Panasonic

Operating Instructions (Overall)

AC Servo Motor & Driver

MINAS A6N series

- Thank you for purchasing this Panasonic product.
- Before operating this product, please read the instructions carefully.
- **Read the the Safety Operating Instructions before using the products (P.6 to 9).**
- Save this manual for future use.
- This product is for industrial equipment. Do not use this product other than this(at general household etc.).

Rev.2.00

Thank you for purchasing Digital AC Servo Motor & Driver, MINAS A6N series. This instruction manual contains information necessary to correctly and safely use the MINAS A6N 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.

Caution

Organization of this manual

1. Before Using the Products

Check of the Driver Model ... Installation

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

2. Preparation

Setup and Wiring

Shows the setting, wiring, and describes how to make wiring and to use the front panel.

3. Setup

Control Mode ... Parameters

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

4. Trial Run

Trial Run and Homing Operation

Shows describes method of trial run and homing 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 Absolute systerm, 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.

Danger	Indicates great possibility of death or serious injury.
Caution	Indicates the possibility of injury or property damage.

- The following indications show things that must be observed.

(Prohibited)	Indicates something that must not be done.
(Mandatory)	Indicates something that must be done.

Danger

Do not subject the Product to water, corrosive or flammable gases, and combustibles.	Failure to observe this instruction could result in fire, electrical shocks, damages and malfunction.
Do not place combustibles near by the motor, driver regenerative resistor and dynamic brake resister..	
Do not use the motor in a place subject to excessive vibration or shock.	Failure to observe this instruction could result in electrical shock, injury or fire.
Do not use cables soaked in water or oil.	Failure to observe this instruction could result in electrical shocks, damages and malfunction.
The installation area should be away from heat generating objects such as a heater and a large wire wound resistor.	Failure to observe this instruction could result in fire and malfunction.
Do not connect the motor directly to the commercial power supply.	
Do not attempt to carry out wiring or manual operation with wet hand.	Failure to observe this instruction could result in electrical shock, injury or fire.
Do not put your hands in the servo driver.	Failure to observe this instruction could result in burn and electrical shocks.

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

Caution

Do not hold the motor cable or motor shaft during the transportation.	Failure to observe this instruction could result in injury.
Do not drop or cause topple over of something during transportation or installation.	Failure to observe this instruction could result in injury and malfunction.
Do not step on the Product nor place the heavy object on them.	Failure to observe this instruction could result in electrical shocks, injury, malfunction and damages.
Do not place any obstacle object around the motor and peripheral, which blocks air passage.	Temperature rise will cause burn injury or fire.
Do not use the equipment under direct sunshine.	Failure to heed these instructions will cause personal injury or fire.
Do not block the heat dissipating holes or put the foreign particles into them.	Failure to observe this instruction could result in electrical shocks and fire.
Do not give strong impact shock to the Product.	Failure to observe this instruction could result in malfunction.
Do not give strong impact shock to the motor shaft.	Failure to observe this instruction could result in a failure of the detector etc.
Do not turn on and off the main power of the driver repeatedly.	Failure to observe this instruction could result in malfunction.
Do not run or stop the motor with the electro-magnetic contactor installed in the main power side.	
Do not make an extreme gain adjustment or change of the drive. **Do not keep the machine running/operating unstably.**	Failure to observe this instruction could result in injury.
Do not use the built-in brake as a "Braking" to stop the moving load.	Failure to observe this instruction could result in injury and malfunction.
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.**	Failure to observe this instruction could result in injury.
Do not attempt to perform modification, dismantle or repair.	Failure to heed this instruction will result in fire, electric shock, personal injury or malfunction.

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

Maintenance and Inspections

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. While power is veing supplied, do not approach the motor and the machine driwen by the motor in case of malfunctioning.
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 charge lamp 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 malfunction of the driver.
4) Do not use benzine, thinner, alcohol, acidic cleaner and alkaline cleaner because they can discolor or damage the exterior case.

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	• Ambient temperature, humidity, speck, dust or foreign object • Abnormal vibration and noise • Main circuit voltage • Odor • Lint or other particles at air holes • Cleanness at front portion of the driver and connector • Damage of the cables • Loose connection or misalignment between the motor and machine or equipment • Pinching of foreign object at the load
Periodic inspection	Annual	• Loose tightening • Trace of overheat • Damage to the terminal block • Loose fasteners on terminal block

Note **Periodic inspection cycle may change when the running conditions of the above change.**

Guideline for Parts Replacement

Parts replacement cycle varies depending on the actual operating conditions. Defective parts should be replaced or repaired when any error have occurred.

Prohibited	**Disassembling for inspection and repair should be carried out only by authorized dealers or service company.**

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	Approx. 2 years	
	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 of battery read P7-6 please.	

Related page • P.7-109“Warranty”

Software Version

<table>
<tr><th>Software version</th><th>Functional change contents</th><th>Available PANATERM</th></tr>
<tr><td>CPU1 Ver1.04
CPU2 Ver1.01</td><td>Initial release</td><td>6.0.0.6
or later</td></tr>
<tr><td>CPU1 Ver1.05
CPU2 Ver1.02</td><td>Function extended edition 1
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<tr><th>Additional function</th><th>Related page</th></tr>
<tr><td>1) Extend the quadrant projection suppression function</td><td>P.3-98, P.5-58</td></tr>
<tr><td>2) Correction function for detection delay of latch position</td><td>P.3-105, P.3-109, P.3-114</td></tr>
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or later</td></tr>
<tr><td>CPU1 Ver1.20
or later
CPU2 Ver1.20
or later</td><td>Function extended edition 2
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<tr><td>1) Slow stop function</td><td>P.3-87, P.6-34</td></tr>
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<tr><td>3) Dynamic brake (DB) operation function by I/O</td><td>P3-82, P3-96</td></tr>
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<tr><td>5) Extend the protection function of motor working range setting</td><td>P6-28</td></tr>
<tr><td>6) Support of electronic gear to single-turn absolute function/infinitely rotatable absolute function</td><td>P5-71, P5-76</td></tr>
<tr><td>7) Pause function of profile operation</td><td>A6N series technical reference RTEX communication specification 6-8-4</td></tr>
<tr><td>8) Extend the RTEX alarm command function</td><td>A6N series technical reference RTEX communication specification 6-6, 6-6-4, 6-6-5</td></tr>
<tr><td>9) Extend the settable range of electronic gear</td><td>P1-10, P3-42</td></tr>
<tr><td>10) Extend the PANATERM command function during the establishment of RTEX communication</td><td>A6N series technical reference RTEX communication specification 4-2-3, 4-3-3, 6-9-3</td></tr>
<tr><td>11) Extend the data of RTEX monitor command</td><td>A6N series technical reference RTEX communication specification 6-9-1, 6-9-6</td></tr>
<tr><td>12) Extend the data of front panel display</td><td>P3-104</td></tr>
<tr><td>13) Extend the profile homing function</td><td>A6N series technical reference RTEX communication specification 7-5-11</td></tr>
<tr><td>14) Extend the data of monitor signal output function</td><td>P3-68</td></tr>
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or later</td></tr>
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Software Version

Software Version

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CPU2 Ver1.21</td><td>Function extended edition 3
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<tr><td>1) Extended range of absolute data</td><td>A6N series technical reference,
RTEX communication specification
7-2-4</td></tr>
<tr><td>2) Expansion of RTEX communication setting</td><td>A6N series technical reference
functional specification 9-1
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RTEX communication specification
2-5-2</td></tr>
<tr><td>3) Addition of RTEX monitor data</td><td>A6N series technical reference
RTEX communication specification
6-7-1, 6-9-1, 6-9-7</td></tr>
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or later</td></tr>
<tr><td>CPU1 Ver1.22
CPU2 Ver1.22</td><td>Function extended edition 4
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<tr><td>1) Expansion of range of display function of serial number</td><td>P.1-4, P.1-11</td></tr>
<tr><td>2) Latch mode with stop function</td><td>P.3-114, P.5-83</td></tr>
<tr><td>3) Extended range of actual position set / command position set</td><td>A6N series technical reference
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</table></td><td>6.0.1.6
or later</td></tr>
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1. Introduction

Outline

MINAS A6N series AC Servo Motor & Drivers are advanced network servo, which correspond 100 Mbps full duplex supper-speed motion network Realtime Express(RTEX), and fulfill all requirements about high speed, high precision, and high performance.

MINAS A6N series equip with upper controller corresponding to RTEX and LAN cable (CAT5e STP over) sold in the open market for connection. They can correspond to maximum number of shafts of 32 (communication cycle is above 0.5 ms) . Especially, quantity of wiring and the system costs on machines with several shafts are saved a lot. Besides, depending on the advantage of synchronism between shaft, maximum cable length between nodes of 100 m, can apply to not only large scale system, but also high-precision CP (Continuous Path) .

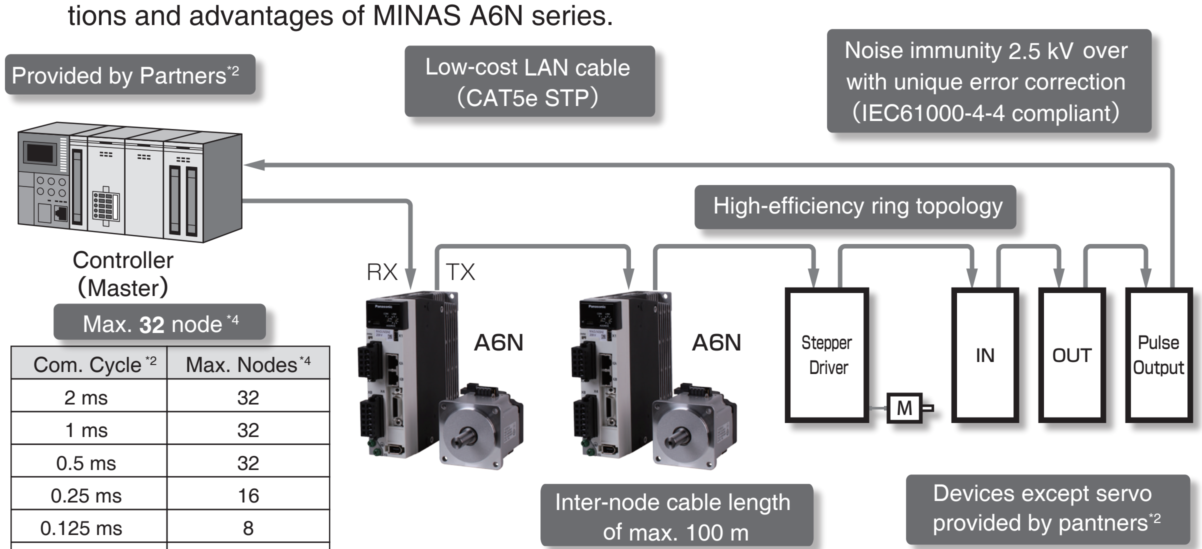
To meet all kinds of requirements, MINAS A6N series are designed to correspond to the mode that can completely control place (Profile or Cyclic) , speed, and torque. The fastest communication cycle is 0.0625 ms, which decreased 25 % of what it use to be. The maximum pulse frequency is 4 Gpps, which is 10 times larger than before. MINAS A6N series accomplish an overwhelming performance improvement over traditional MINAS A5N series.

Moreover, the new product extends to a wide range of outputs from 50 W to 5.0 kW. Equipped with high-resolution 23-bit Absolute encoder, it makes possible more accurate positioning and mechanical drive.

Meanwhile, to simplify the debug settings, it comes standard equipped with the feature of 2DOF(Two-degree-of-freedom) control scheme which became popular in A5 Ⅱ series.

MINAS A6N series equip with autoadjustment function of various setting programs, and make possible some simple adjustment of multifunction. MINAS A6N series have so far improved stability at low-stiffness machines, and high-precision and high-speed operation at high-stiffness machines.

This manual is written as a guide for you so that you can fully correctly make use of all functions and advantages of MINAS A6N series.



Com. Cycle*2	Max. Nodes*4
2 ms	32
1 ms	32
0.5 ms	32
0.25 ms	16
0.125 ms	8
0.0625 ms*3	4

*1 **The specification of the controller and other devices comform to partners please.**
The details refer to URL.
URL：http://industrial.panasonic.com/jp/products/motors-compressors/fa-motors/ac-servo-motors/a5n_rtex.html

*2 The communication cycle and connection of slave devices depend on the controller specificaion.

*3 For communication cycle 0.0625 ms, command update cycle is 0.125 ms only.

*4 Slave nodes.

Note: The setting of parameters of 2DOF control mode in MINAS-A6N series is aviailable and it is different from previous series. When use MINAS-A6N series , please change the setting of parameters again.

1. Introduction

On Opening the Product Package

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

Note

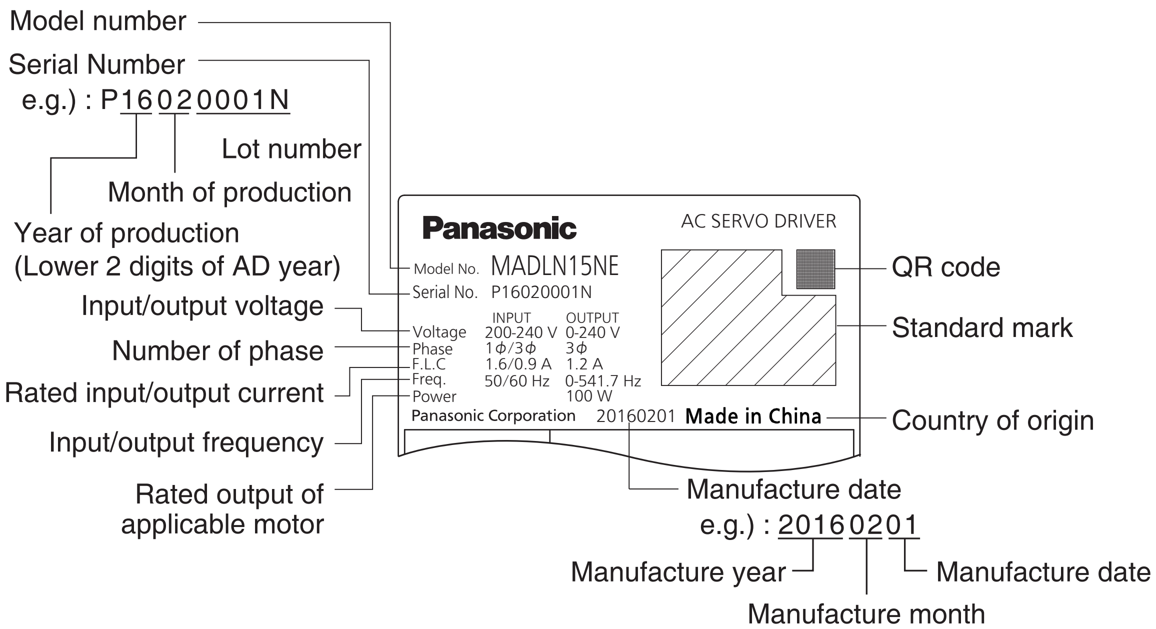
- Neither the short circuit wire of motor connector are included to A, B-frame.
- Neither the plug of XC connentor is not in cluded to C-frame and D-frame.
- Neither the power connector nor motor connector are included to F-frame.

Contact to a dealer if you find any failures.

2. Driver

Check of the Model

Contents of Name Plate



The range of the lot number in serial number is 1 to 33999, but on the nameplate it is written in 4 digits in the following format. In the four digits alphabet, "I" (eye) and "O" (o) are not used.

Lot number value	Display on Nameplate
1 to 9999	0001 to 9999
10000 to 10999	A000 to A999
11000 to 11999	B000 to B999
...	...
17000 to 17999	H000 to H999
18000 to 18999	J000 to J999
...	...
22000 to 22999	N000 to N999
23000 to 23999	P000 to P999
...	...
33000 to 33999	Z000 to Z999

Model Designation

M A D L N 1 5 N E ∗ ∗ ∗

1~3 4 5 6 7 8 9 10~12

Frame-size symbol (1~3)

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

Series (4)

Symbol	Series name
L	A6 series

Safety function (5)

Symbol	Specifications
N	No functional safety
T	Safety torque off *1

Difference of Output (6)

Display the difference of matching motor (or rating of output).

Power supply (7)

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

Interface specifications (8)

Symbol	Specifications
N	RTEX

Driver type (9)

■Rotary specifications

Symbol	Specifications
E	Standard type
F	Multi-function type *1

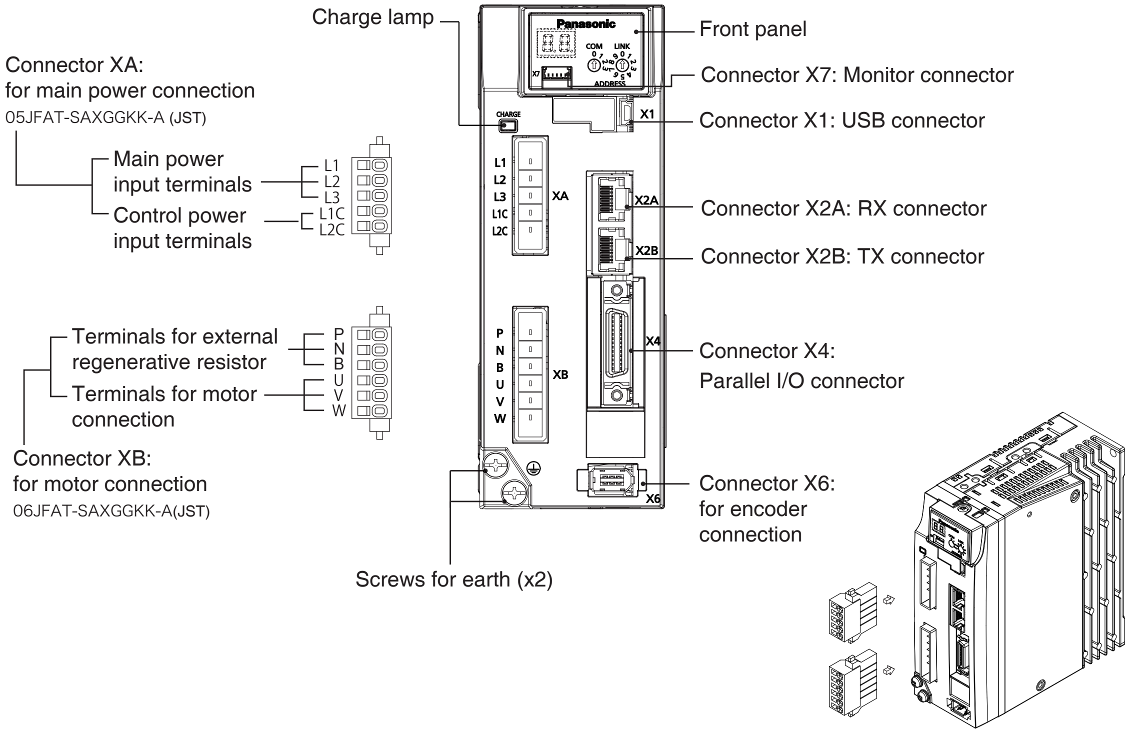
Special specifications (10~12)
(letters and numbers)

*1 For details of Safety torque off and Muti-function type please refer to
Technical reference basic specification (MINAS-A6N series (RTEX communcation) standard type)).

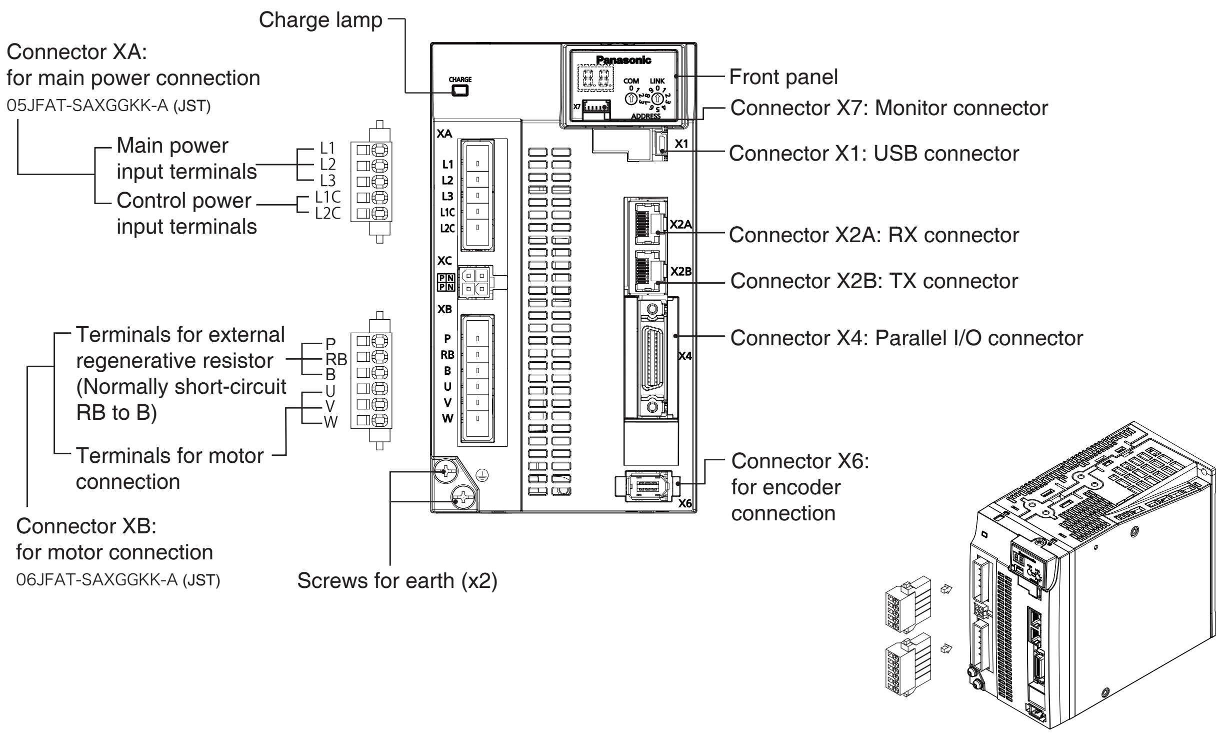
2. Driver

Parts Description

A to B-frame (100 V/200 V)



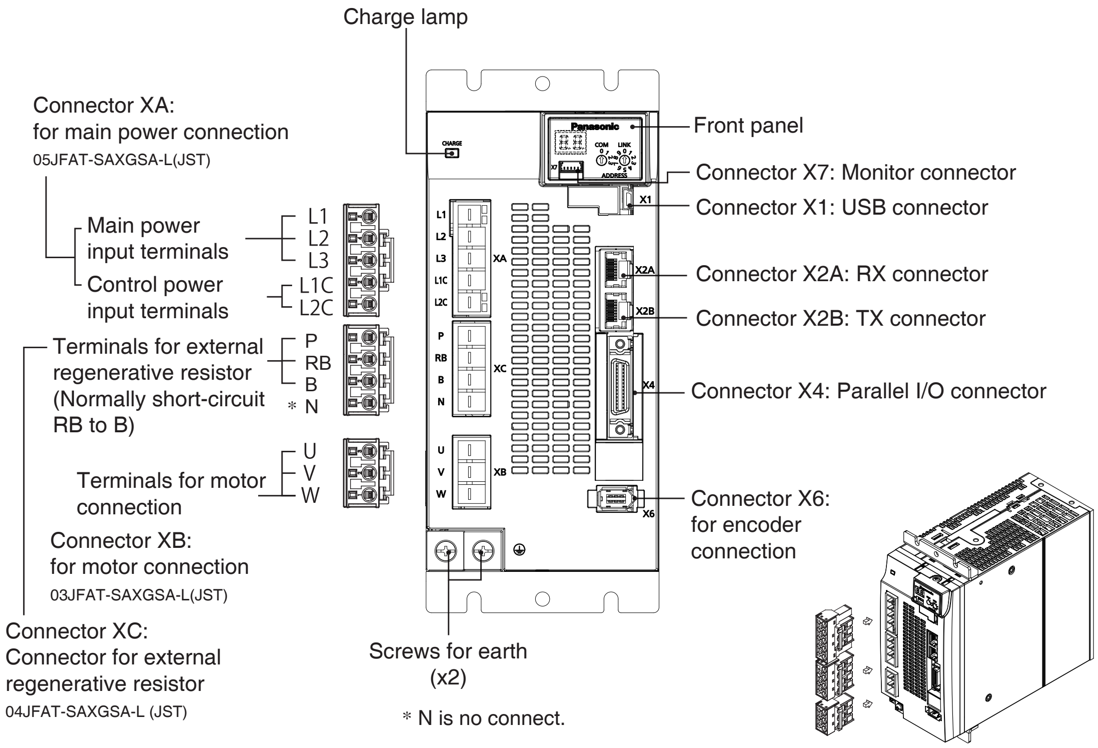
C to D-frame (100 V/200 V)



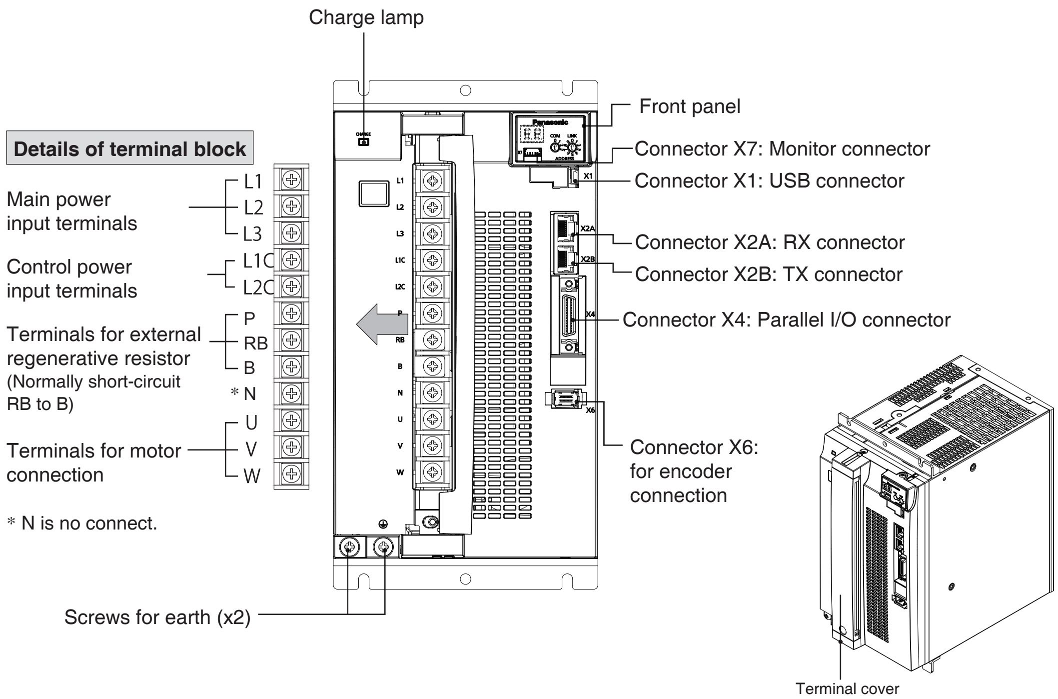
Note

- Connector XA and XB are attached in A to D-frame driver.
- Connector XA, XB and XC are attached in E-frame driver.

E-frame (200 V)



F-frame (200 V)



Related page
• P.1-15 “Check of the Combination of the Driver and the Motor” • P.2-22 “Installation Driver”
• P.2-18 “List of Applicable Peripheral Equipments to Driver” • P.7-32 to 7-37 “Dimensions Driver”

2. Driver

Specifications

Basic Specification	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 240 V +10 % –15 % 50 Hz/60 Hz
			Control circuit	A to F-frame	Single phase, 200 V to 240 V +10 % –15 % 50 Hz/60 Hz
	Withstand voltage				Primary to earth: withstand 1500 VAC, 1 min, [100 V/200 V]
	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*1)
			humidity		Both operating and storage : 20 % to 85 %RH or less (free from condensation*1)
			Altitude		Lower than 1000 m
			Vibration		5.88 m/s^2 or less, 10 Hz to 60 Hz
	Control method				IGBT PWM Sinusoidal wave drive
	Control mode				Semi-closed control Position control: Profile position control [PP], Cyclic position control [CP] Velocity control: Cyclic velocity control [CV] Torque control: Cyclic torque control [CT] - Switch PP/CP/CV/CT mode according to the RTEX communication command.
	Encoder feedback				23-bit (8388608 resolution) absolute encoder, 7-wire serial
	External scale feedback				A/B phase, initialization signal defferential input. (It cannot be used in standard type. It can be used in Multi-function type) Manufacturers supporting serial communication scale*2: · Mitutoyo Corporation · Heidenhain K.K. · Renishaw K.K. · Magnescale Co., Ltd. · Nidec Sankyo Corporation · Fagor Automation S.Coop
	Control signal		Input		Each 8 input can be assigned by the parameter.
			Output		Each 3 output can be assigned by the parameter.
	Analog signal		Output		2 outputs for analog monitors 1 and 2
	Pulse signal		Output		Line driver output for encoder pulses (A/B phase signal) or external scale pulses.
	Communication function		Realtime Express (Abbr. RTEX)		Communication for transmission of a real-time operation command, the parameter setting, or the status monitoring.
			USB		Connect to computers (setup support software PANATERM) for parameter setting or status monitoring. It can also be connected via USB cable and wireless LAN dongle*3.
	Safety terminal				Terminal to support safety function.(It cannot be used in standard type. It can be used in STO specification.)
	Front panel				1. 7-segment LED (double digits) 2. Network status LED (LINK, COM) 3. Rotary switch for node address setting 4. Analog monitor output (Analog monitors 1 and 2)
	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 dynamic brake

Caution

*1 Air containing water vapor will become saturated with water vapor as the temperature falls,causing dew.
*2 For model comparison, please contact us.
*3 May violate the laws and regulations, do not use the wireless LAN dongle outside the permitted countries or areas. For details, please confirm on our website. For permitted countries or areas please confirm on our website.

Related page

• P.2-22 "Installation Driver" • P.2-25 "Installation Motor"

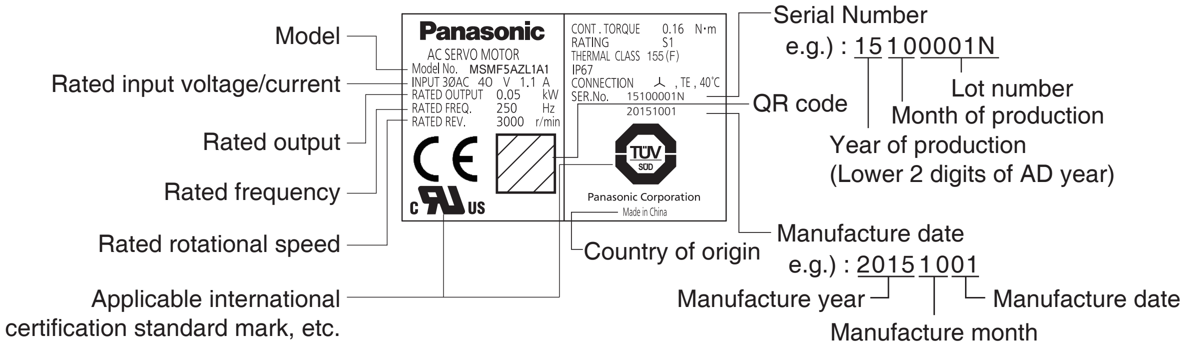
Function	Position control	Control input		Positive direction drive inhibit, negative direction drive inhibit, latch signal, near home position, etc.
		Control output		Positioning completion etc.
		Pulse input	Input mode	Command type by RTEX command
			Smoothing filter	Either a primary delay filter or a FIR type filter can be selected against command input.
		Model-type damping filter		Available (2 filters available)
		2-degree-of-freedom control system		Available
		Load variation suppression function		Available
		Feed forward function		Available (speed/torque)
		Gain 3 switching function		Available
		Friction torque compensation		Available
		Hybrid vibration suppression function		Unavailable(It can be used in Multi-function type)
		Damping control		Available(Up to 3 frequency settings, out of 4 settings in total, can be used simultaneously.)
		Quadrant glitch inhibit function		Available
		Torque limit switching function		Available
		Motor operatable setup function		Available
		Torque saturation protection function		Available
		Single-turn absolute function		Available(The absolute encoder is connected.)
		Continuous rotating absolute encoder function		Available(No hindrance for the motor's normal run. The 23-bit absolute encoder is connected. Encoder resolution (2^{23})/electronic gear ratio/reduction ratio is an integer less than or equal to (2^{31}-1).)
		External scale position information monitor		Unavailable(It can be used in Multi-function type)
		Latch mode with stop function		Available(Servo-on. No hindrance for the motor's normal run. State in which communication cycle is set to 0.5 [ms] and command update cycle to 1.0 [ms]. State in which the electronic gear ratio is set to 1 or larger.)
	Velocity control	Control input		Positive direction drive inhibit, negative direction drive inhibit, latch signal, etc.
		Control output		At speed etc.
		Velocity command input	Input mode	Command type by RTEX command
		Soft start/slowdown function		0 to 10 s / 1000 r/min Acceleration and deceleration can be set separately. S-curve acceleration/deceleration is also available.
		2-degree-of-freedom control system		Available
		Load variation suppression function		Available
		Feed forward function		Available (torque)
		Friction torque compensation		Available
		Hybrid vibration suppression function		Unavailable (It can be used in Multi-function type)
		Torque limit switching function		Available
		Torque saturation protection function		Available
		Single-turn absolute function		Available (The absolute encoder is connected.)
		Continuous rotating absolute encoder function		Available(No hindrance for the motor's normal run. The 23-bit absolute encoder is connected. Encoder resolution (2^{23})/electronic gear ratio/reduction ratio is an integer less than or equal to (2^{31}-1).)
		Damping control		Unavailable
		Model-type damping filter		Unavailable
		Gain 3 switching function		Unavailable
		Quadrant glitch inhibit function		Unavailable
		Motor operatable setup function		Unavailable
		External scale position information monitor		Unavailable(It can be used in Multi-function type)
		Latch mode with stop function		Unavailable

Function	Torque control	Control input		Positive direction drive inhibit, negative direction drive inhibit, latch signal, etc.
		Control output		At speed etc.
		Torque command input	Input mode	Command type by RTEX command
		Speed limit function		Speed limit value cane be set by parameter. (Switched by RTEX command.)
		Single-turn absolute function		Available(The absolute encoder is connected.)
		Continuous rotating absolute encoder function		Available(No hindrance for the motor's normal run. The 23-bit absolute encoder is connected. Encoder resolution (2^{23})/electronic gear ratio/reduction ratio is an integer less than or equal to (2^{31}-1).)
		Damping control		Unavailable
		Model-type damping filter		Unavailable
		Feed forward function		Unavailable
		Load variation suppression function		Unavailable
		Gain 3 switching function		Unavailable
		Friction torque compensation		Unavailable
		Hybrid vibration suppression function		Unavailable (It can be used in Multi-function type)
		Quadrant glitch inhibit function		Unavailable
		2-degree-of-freedom control system		Unavailable
		Torque limit switching function		Unavailable
		Motor operatable setup function		Unavailable
		Torque saturation protection function		Unavailable
		External scale position information monitor		Unavailable
		Latch mode with stop function		Unavailable
	Common	Auto-tuning		Identifies the load inertia real-time and automatically sets up the gain that meets the stiffness setting when the motor is running with controllor and the setup support software PANATERM by internal operation commands.
		Electronic gear ratio		Applicable scaling ratio: 1/1000 to 8000 Although any value of 1 to 2^{30} (numerator) and any value of 1 to 2^{30} (denominator) can be used, resulting value should be within the range shown above.
		Notch filter		Available(5 filters available)
		Gain switching function		Available
		2-step torque filter		Available
		Position comparison output function		Available(No hindrance for the motor's normal run. In the case of incremental encoder, home position return must be completed.)
		Deterioration diagnosis function		Available
		Protective function	Hard error	Overvoltage, undervoltage, overspeed, overload, overheat, overcurrent, encoder failure, etc.
			Soft error	Positional overdeviaition, EEPROM failure, etc.
		Alarm data trace back		Tracing back of alarm data is available

3. Motor

Check of the Model

Contents of Name Plate



The range of the lot number in serial number is 1 to 33999, but on the nameplate it is written in 4 digits in the following format. In the four digits alphabet, "I" (eye) and "O" (o) are not used.

Lot number value	Display on Nameplate
1 to 9999	0001 to 9999
10000 to 10999	A000 to A999
11000 to 11999	B000 to B999
...	...
17000 to 17999	H000 to H999
18000 to 18999	J000 to J999
...	...
22000 to 22999	N000 to N999
23000 to 23999	P000 to P999
...	...
33000 to 33999	Z000 to Z999

Model Designation

M S M F 5 A Z L 1 A 1 *

1~3 | 4 | 5~6 | 7 | 8 | 9 | 10~11 | 12

Type

Symbol	Specifications
MSM	Low inertia (50 W to 5.0 kW)
MQM	Middle inertia (100 W to 400 W)
MDM	Middle inertia (1.0 kW to 5.0 kW)
MGM	Middle inertia (850 W to 4.4 kW)
MHM	High inertia (50 W to 5.0 kW)

Series

Symbol	Series name
F	A6 series

Motor rated output

Symbol	Output
5A	50 W
01	100 W
02	200 W
04	400 W
08	750 W
09	850 W/1.0 kW
10	1.0 kW
13	1.3 kW
15	1.5 kW
18	1.8 kW
20	2.0 kW
24	2.4 kW
29	2.9 kW
30	3.0 kW
40	4.0 kW
44	4.4 kW
50	5.0 kW

Special specifications

Motor structure

Design order

Symbol	Specifications
1	Standard

Rotary encoder specifications

Symbol	Specifications			
	Format	Pulse count	Resolution	Wire count
L	Absolute	23-bit	8388608	7-wire

Voltage specifications

Symbol	Specifications
1	100 V
2	200 V
Z	100/200 V common (50 W only)

Motor structure

MSMF(Below □80)

Symbol		Shaft		Holding brake		Oil seal		Motor I/F	
10 dig	11 dig	Round	Key way Threaded	Without	With	Without	With	Connector type	Leadwire type
A	1	●		●		●		●	
A	2	●		●		●			●
B	1	●			●	●		●	
B	2	●			●	●			●
C	1	●		●			●	●	
C	2	●		●			●		●
D	1	●			●		●	●	
D	2	●			●		●		●
S	1		●	●		●		●	
S	2		●	●		●			●
T	1		●		●	●		●	
T	2		●		●	●			●
U	1		●	●			●	●	
U	2		●	●			●		●
V	1		●		●		●	●	
V	2		●		●		●		●

Note • For details of specific model, refer to the Dimensions of Supplement.

Related page • P.1-15 "Check of the Combination of the Driver and the Motor" • P.7-38 to 7-61 "Dimensions Motor"

Model Designation

Motor structure

MQMF、MHMF(Below □80)

Symbol		Shaft		Holding brake		Oil seal			Motor I/F	
10 dig	11 dig	Round	Key way Threaded	Without	With	Without	With	With (Protective lip)	Connector type	Leadwire type
A	1	●		●		●			●	
A	2	●		●		●				●
B	1	●			●	●			●	
B	2	●			●	●				●
C	1	●		●			●		●	
C	2	●		●			●			●
C	3	●		●	●			●	●	
C	4	●		●	●			●		●
D	1	●			●		●		●	
D	2	●			●		●			●
D	3	●						●	●	
D	4	●						●		●
S	1		●	●		●			●	
S	2		●	●		●				●
T	1		●		●	●			●	
T	2		●		●	●				●
U	1		●	●			●		●	
U	2		●	●			●			●
U	3		●	●				●	●	
U	4		●	●				●		●
V	1		●		●		●		●	
V	2		●		●		●			●
V	3		●		●			●	●	
V	4		●		●			●		●

MSMF、MDMF、MGMF、MHMF(Above □100)

Symbol		Shaft		Holding brake		Oil seal		Motor I/F	
10 dig	11 dig	Round	Key way Threaded	Without	With	With	With (Protective lip)	Connector JN2	Connector JL10
C	5	●		●		●		●	
C	6	●		●		●			●
C	7	●		●			●	●	
C	8	●		●			●		●
D	5	●			●	●		●	
D	6	●			●	●			●
D	7	●			●		●	●	
D	8	●			●		●		●
G	5		●	●		●		●	
G	6		●	●		●			●
G	7		●	●			●	●	
G	8		●	●			●		●
H	5		●		●	●		●	
H	6		●		●	●			●
H	7		●		●		●	●	
H	8		●		●		●		●

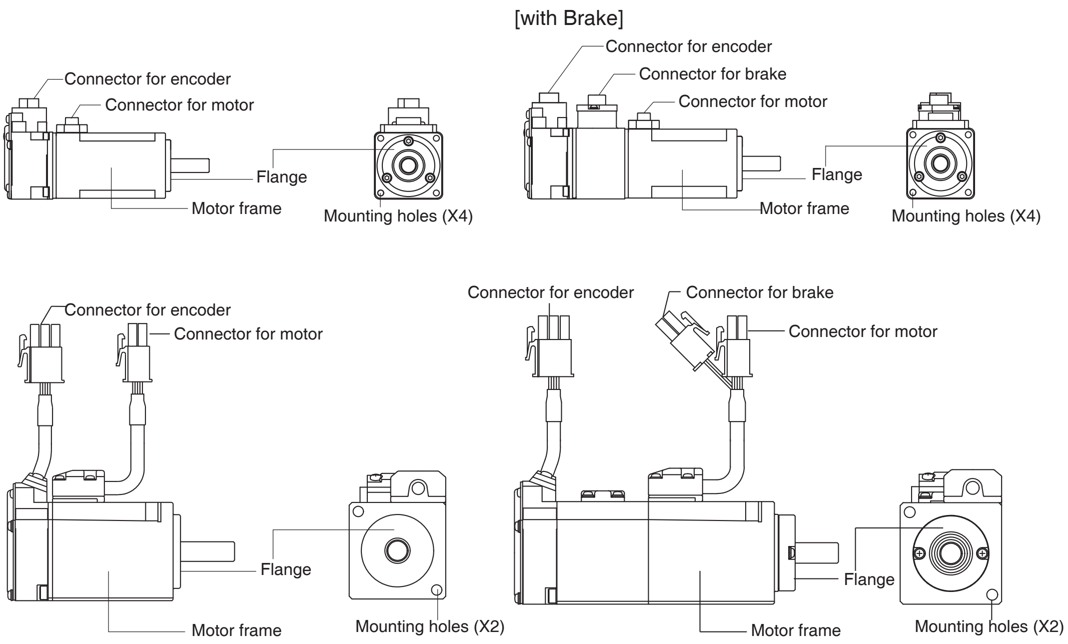
Note • For details of specific model, refer to the Dimensions of Supplement.

Related page • P.1-15 "Check of the Combination of the Driver and the Motor" • P.7-37 to 7-60 "Dimensions Motor"

3. Motor

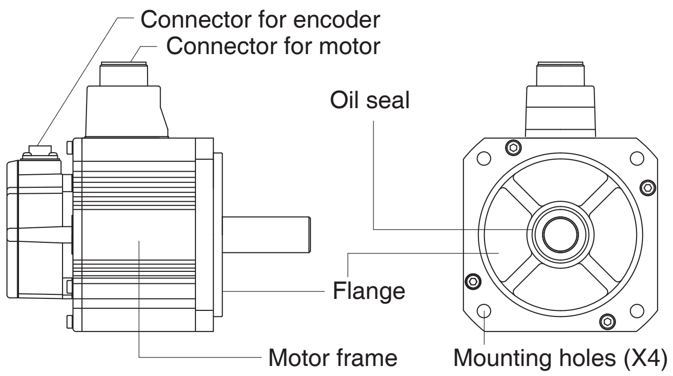
Parts Description

- MSMF 50 W to 1.0 kW(□ 80)
- MHMF 50 W to 1.0 kW(□ 80)
- MQMF 100 W to 400 W



e.g.) : Low inertia type (MSMF series, 50 W), High inertia type (MHMF series, 50 W)

- MSMF 1.0 kW(□ 100) to 5.0 kW
- MDMF 1.0 kW to 5.0 kW
- MGMF 850 W to 4.4 kW
- MHMF 1.0 kW (□ 130) to 5.0 kW



e.g.) : Middle inertia type (MDMF series, 1.0 kW)

Note For details of specific model, refer to the Dimensions of Supplement. (P.7-38 to 7-61)

4. Check of the Combination of the Driver and the Motor

Absolute Specifications, 23-bit

This driver is designed to be used in a combination with the motor which are specified by us. Check the series name of the motor, rated output torque, voltage specifications and encoder specifications.

Remarks **Do not use in other combinations than those listed below.**

Motor					Driver	
Power supply	Type	Rated rotational speed	Model *1	Rated output	Model of type *1	Frame
Single 100 V	MSMF Low inertia	3000 r/min	MSMF5AZL1□□□	50 W	MADL□01N□	A frame
			MSMF011L1□□□	100 W	MADL□11N□	
			MSMF021L1□□□	200 W	MBDL□21N□	B frame
			MSMF041L1□□□	400 W	MCDL□31N□	C frame
Single/ 3-phase, 200 V			MSMF5AZL1□□□	50 W	MADL□05N□	A frame
			MSMF012L1□□□	100 W		
			MSMF022L1□□□	200 W	MADL□15N□	
			MSMF042L1□□□	400 W	MBDL□25N□	B frame
			MSMF082L1□□□	750 W	MCDL□35N□	C frame
			MSMF092L1□□□	1.0 kW	MDDL□45N□	D frame
			MSMF102L1□□□	1.0 kW	MDDL□55N□	D frame
			MSMF152L1□□□	1.5 kW		
3-phase, 200 V			MSMF202L1□□□	2.0 kW	MEDL□83N□	E frame
			MSMF302L1□□□	3.0 kW	MFDL□A3N□	F frame
			MSMF402L1□□□	4.0 kW	MFDL□B3N□	
			MSMF502L1□□□	5.0 kW		
Single 100 V	MQMF Middle inertia	3000 r/min	MQMF011L1□□□	100 W	MADL□11N□	A frame
			MQMF021L1□□□	200 W	MBDL□21N□	B frame
			MQMF041L1□□□	400 W	MCDL□31N□	C frame
Single/ 3-phase, 200 V			MQMF012L1□□□	100 W	MADL□05N□	A frame
			MQMF022L1□□□	200 W	MADL□15N□	
			MQMF042L1□□□	400 W	MBDL□25N□	B frame
Single/ 3-phase, 200 V	MDMF Middle inertia	2000 r/min	MDMF102L1□□□	1.0 kW	MDDL□45N□	D frame
			MDMF152L1□□□	1.5 kW	MDDL□55N□	
3-phase, 200 V			MDMF202L1□□□	2.0 kW	MEDL□83N□	E frame
			MDMF302L1□□□	3.0 kW	MFDL□A3N□	F frame
			MDMF402L1□□□	4.0 kW	MFDL□B3N□	
			MDMF502L1□□□	5.0 kW		
Single/ 3-phase, 200 V	MGMF Middle inertia	1500 r/min	MGMF092L1□□□	850 W	MDDL□45N□	D frame
			MGMF132L1□□□	1.3 kW	MDDL□55N□	
3-phase, 200 V			MGMF182L1□□□	1.8 kW	MEDL□83N□	E frame
			MGMF242L1□□□	2.4 kW	MEDL□93N□	
			MGMF292L1□□□	2.9 kW	MFDL□B3N□	F frame
			MGMF442L1□□□	4.4 kW		
Single 100 V	MHMF High inertia	3000 r/min	MHMF5AZL1□□□	50 W	MADL□01N□	A frame
			MHMF011L1□□□	100 W	MADL□11N□	
			MHMF021L1□□□	200 W	MBDL□21N□	B frame
			MHMF041L1□□□	400 W	MCDL□31N□	C frame
Single/ 3-phase, 200 V			MHMF5AZL1□□□	50 W	MADL□05N□	A frame
			MHMF012L1□□□	100 W		
			MHMF022L1□□□	200 W	MADL□15N□	
			MHMF042L1□□□	400 W	MBDL□25N□	B frame
			MHMF082L1□□□	750 W	MCDL□35N□	C frame
			MHMF092L1□□□	1.0 kW	MDDL□55N□	D frame
			MHMF102L1□□□	1.0 kW	MDDL□45N□	
			MHMF152L1□□□	1.5 kW	MDDL□55N□	
3-phase, 200 V			MHMF202L1□□□	2.0 kW	MEDL□83N□	E frame
			MHMF302L1□□□	3.0 kW	MFDL□A3N□	F frame
			MHMF402L1□□□	4.0 kW	MFDL□B3N□	
			MHMF502L1□□□	5.0 kW		

Note *1 Suffix of "□" in the applicable model represents the structure.

Related page · For details of cable and connector kit, refer to P.7-69 “Options”.

MEMO

2. Preparation

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1.Composition of Peripheral Equipments

A to B-frame (100 V/200 V Type)

Connecting Example of A to B-frame (100 V/200 V Type)

Mains and Residual current device (RCD)
Apply the voltage designated on the nameplate from the power source.

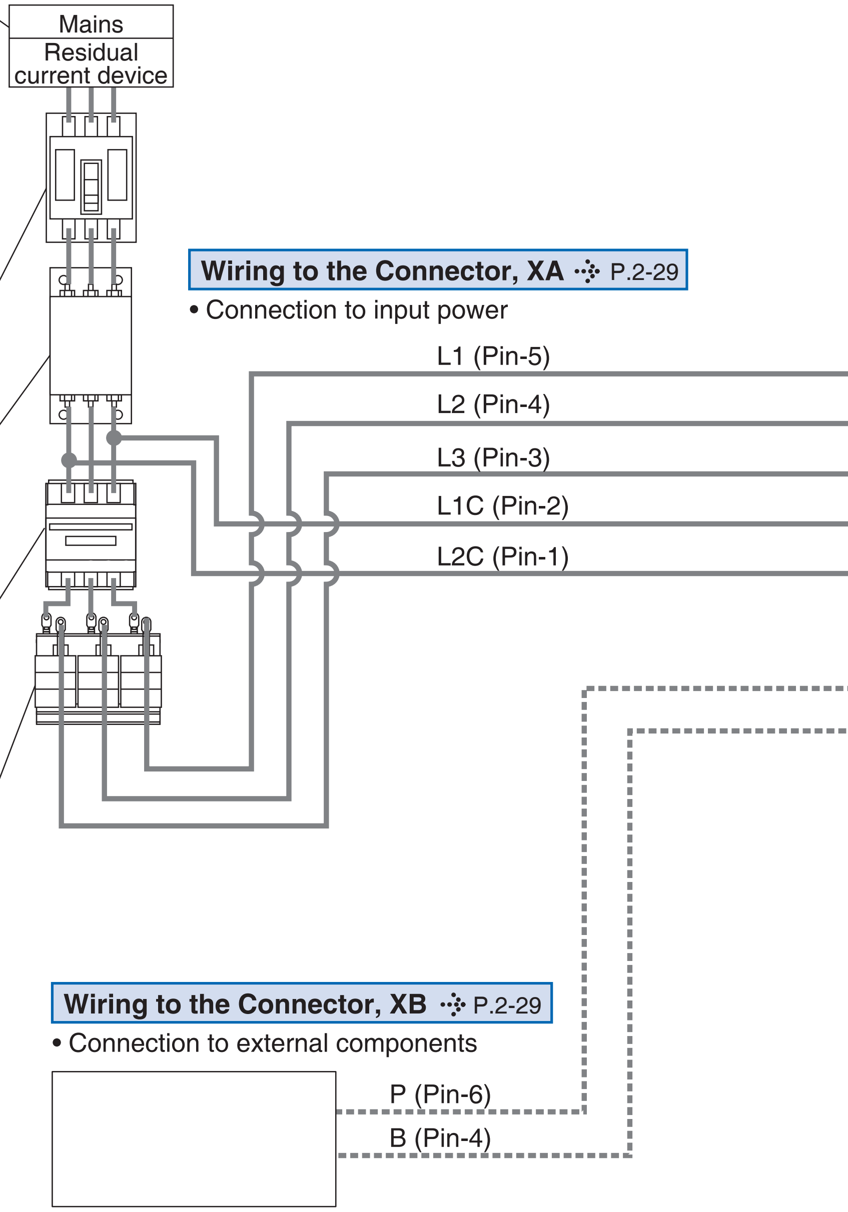
Circuit Breaker (MCCB)
To protect power supply line from overloading, install a wiring circuit breaker rated to the capacity of the power supply.

Noise Filter (NF)
Removes external noise from the power lines. And reduces an effect of the noise generated by the servo driver.

Magnetic Contactor (MC)
Turns on/off the main power of the servo driver.
Use coil surge suppression units together with this.

Note **Do not start or stop the servo motor with this Magnetic Contactor.**

Reactor (L)
Reduces harmonic current of the main power.



Regenerative resistor (optional)

Note

Note that no regenerative resistor is equipped in Frame A and B type.

Remarks

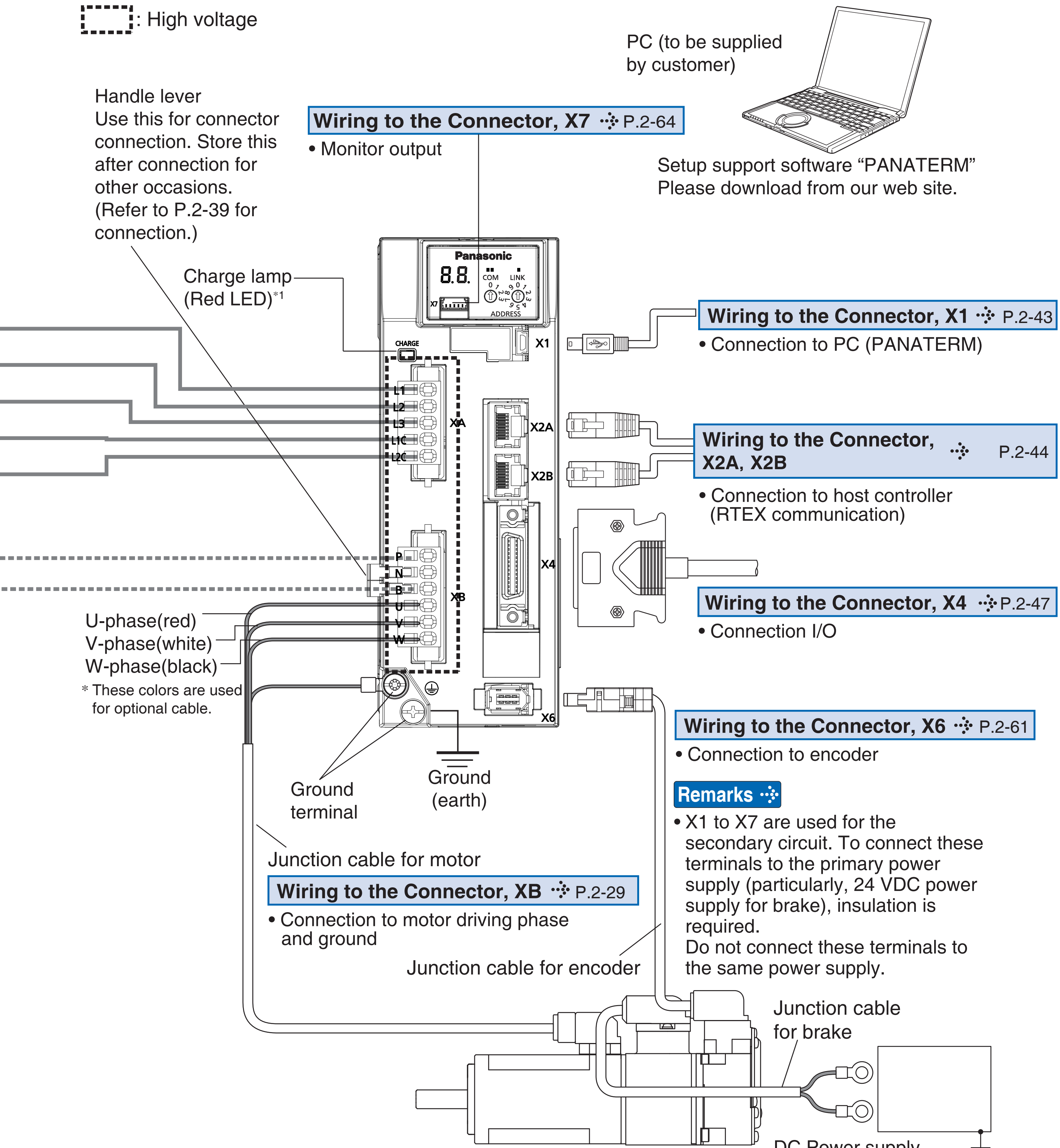
- When you use an external regenerative resistor, **install an external protective apparatus, such as thermal fuse without fail.**
- Mount the regenerative resistor **on incombustible material such as metal.**

Note This overall wiring diagram is a typical one. The pages after P.2-29 that follow show wiring for specific application. The wiring indicated with the broken line shall be provided only when required.

Related page • P.7-69... "Options"

1.Composition of Peripheral Equipments

A to B-frame (100 V/200 V Type)



*1 Do not make displacement, wiring or inspection while the charge lamp is lit - cause of electric shock.

*2 Neither the short circuit wire of motor connector are included to A, B-frame. (Not use.)

Related page
• P.2-29"Wiring of the Main Circuit (A to B-frame, 100 V/200 V Type)" • P.2-40 "Specifications of Motor Connector"

Connecting Example of C to D-frame (100 V/200 V Type)

Mains and Residual current device (RCD)
Apply the voltage designated on the nameplate from the power source.

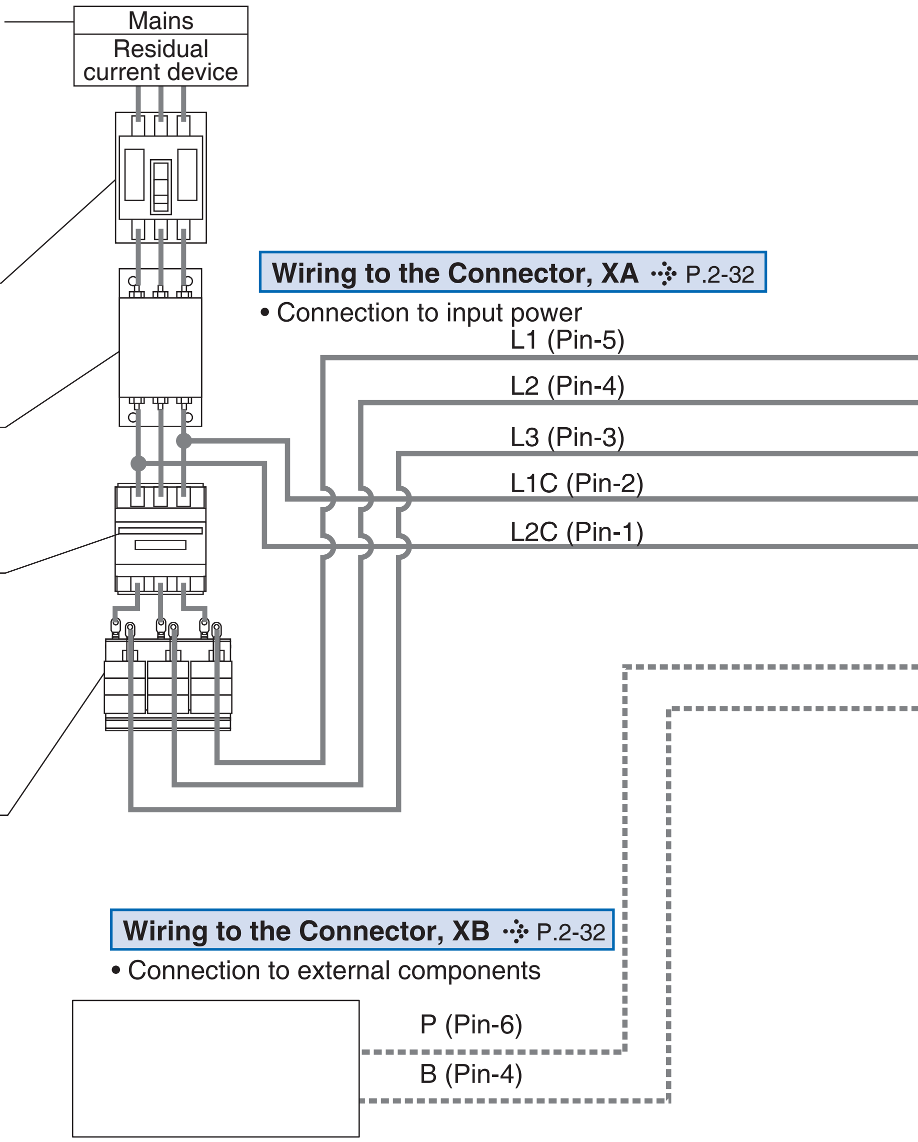
Circuit Breaker (MCCB)
To protect power supply line from overloading, install a wiring circuit breaker rated to the capacity of the power supply.

Noise Filter (NF)
Removes external noise from the power lines. And reduces an effect of the noise generated by the servo driver.

Magnetic Contactor (MC)
Turns on/off the main power of the servo driver.
Use coil surge suppression units together with this.

Note **Do not start or stop the servo motor with this Magnetic Contactor.**

Reactor (L)
Reduces harmonic current of the main power.



Regenerative resistor (optional)

Note

The regenerative resistor is equipped in Frame C and D type, or can use an external regenerative resistor.

Remarks

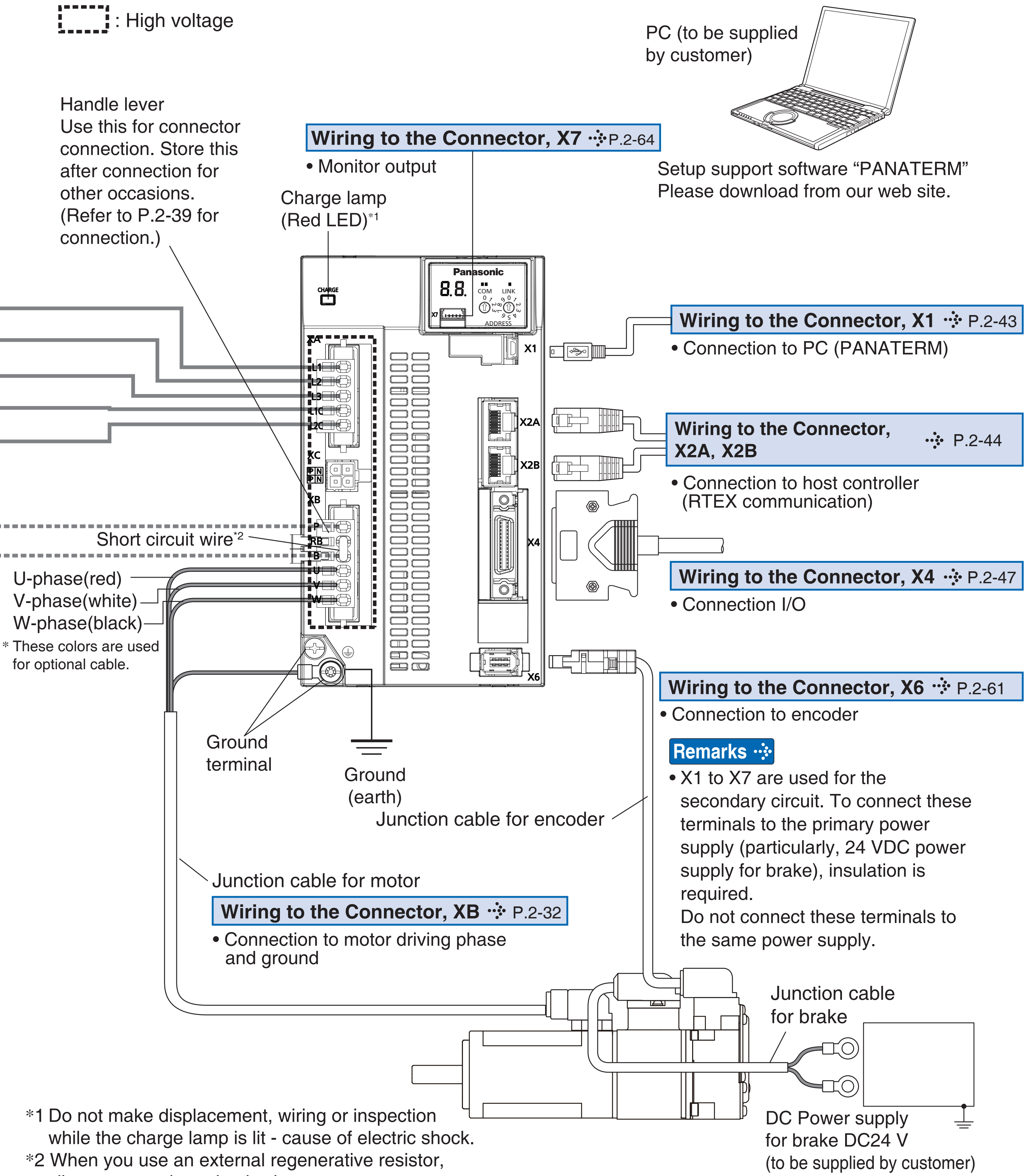
- When you use an external regenerative resistor, **install an external protective apparatus, such as thermal fuse without fail.**
- Mount the regenerative resistor **on incombustible material such as metal.**

Note This overall wiring diagram is a typical one. The pages after P.2-29 that follow show wiring for specific application. The wiring indicated with the broken line shall be provided only when required.

Related page • P.7-69... "Options"

1.Composition of Peripheral Equipments

C to D-frame (100 V/200 V Type)



*1 Do not make displacement, wiring or inspection while the charge lamp is lit - cause of electric shock.
*2 When you use an external regenerative resistor, disconnect a short circuit wire.

Related page
• P.2-32"Wiring of the Main Circuit (C to D-frame, 100 V/200 V Type)" • P.2-40 "Specifications of Motor Connector"

Connecting Example of E-frame (200 V Type)

Mains and Residual current device (RCD)
Apply the voltage designated on the nameplate from the power source.

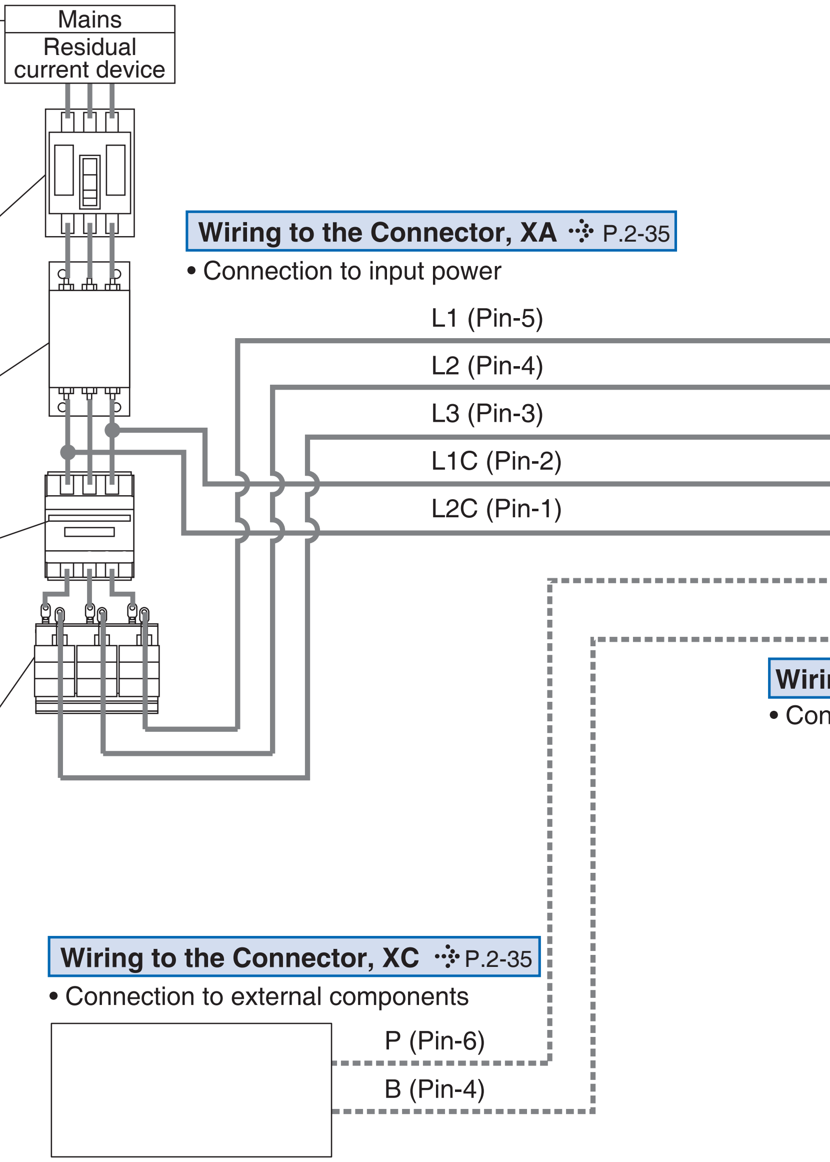
Circuit Breaker (MCCB)
To protect power supply line from overloading, install a wiring circuit breaker rated to the capacity of the power supply.

Noise Filter (NF)
Removes external noise from the power lines. And reduces an effect of the noise generated by the servo driver.

Magnetic Contactor (MC)
Turns on/off the main power of the servo driver.
Use coil surge suppression units together with this.

Note **Do not start or stop the servo motor with this Magnetic Contactor.**

Reactor (L)
Reduces harmonic current of the main power.



Regenerative resistor (optional)

Note

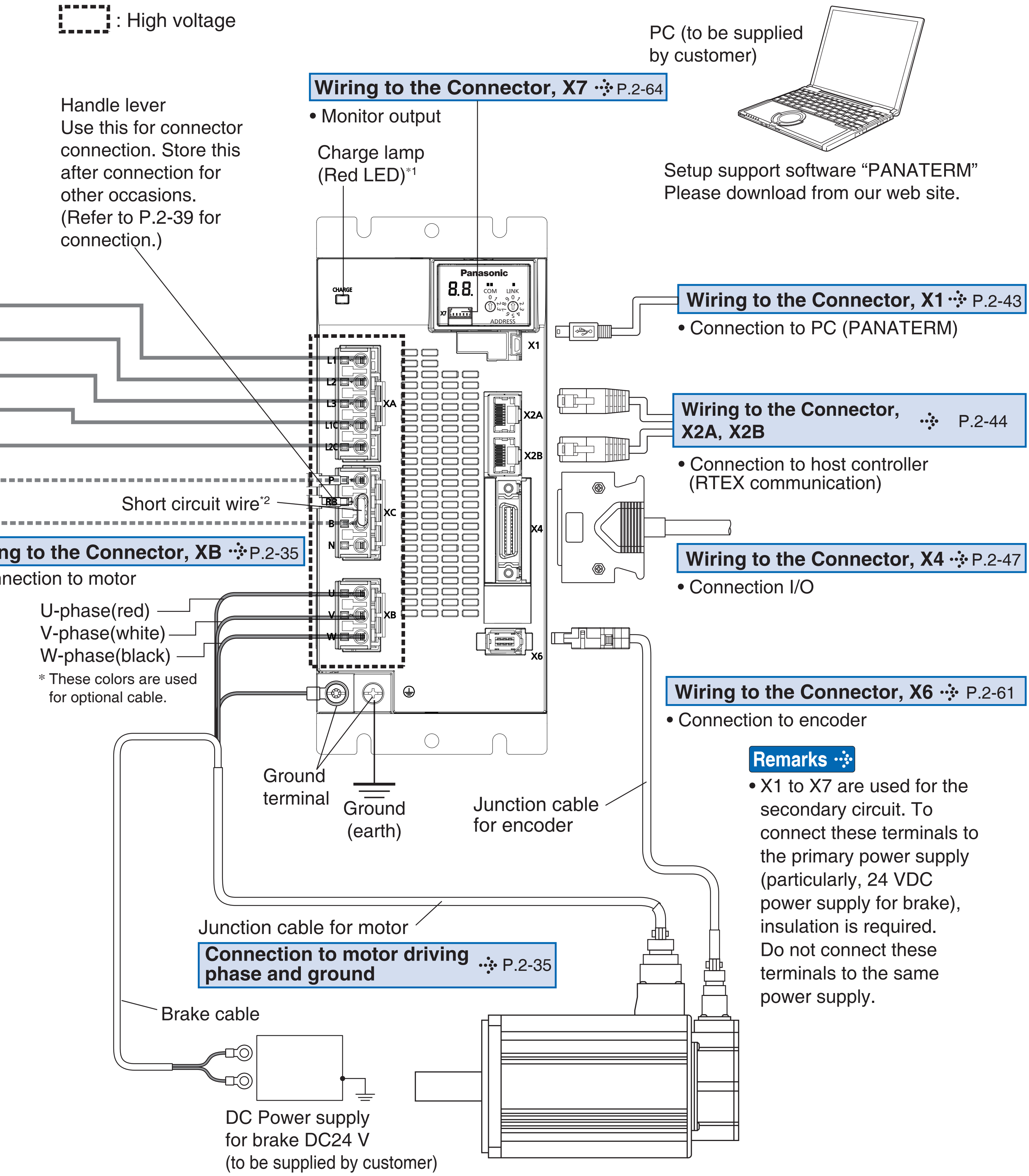
The regenerative resistor is equipped in Frame E type, or can use an external regenerative resistor.

Remarks

- When you use an external regenerative resistor, **install an external protective apparatus, such as thermal fuse without fail.**
- Mount the regenerative resistor **on incombustible material such as metal.**

Note This overall wiring diagram is a typical one. The pages after P.2-29 that follow show wiring for specific application. The wiring indicated with the broken line shall be provided only when required.

Related page • P.7-69... "Options"



Remarks
- X1 to X7 are used for the secondary circuit. To connect these terminals to the primary power supply (particularly, 24 VDC power supply for brake), insulation is required. Do not connect these terminals to the same power supply.

*1 Do not make displacement, wiring or inspection while the charge lamp is lit - cause of electric shock.
*2 When you use an external regenerative resistor, disconnect a short circuit wire.

Related page • P.2-35"Wiring of the Main Circuit (E-frame, 200 V Type)" • P.2-40 "Specifications of Motor Connector"

Connecting Example of F-frame (200 V Type)

Mains and Residual current device (RCD)
Apply the voltage designated on the nameplate from the power source.

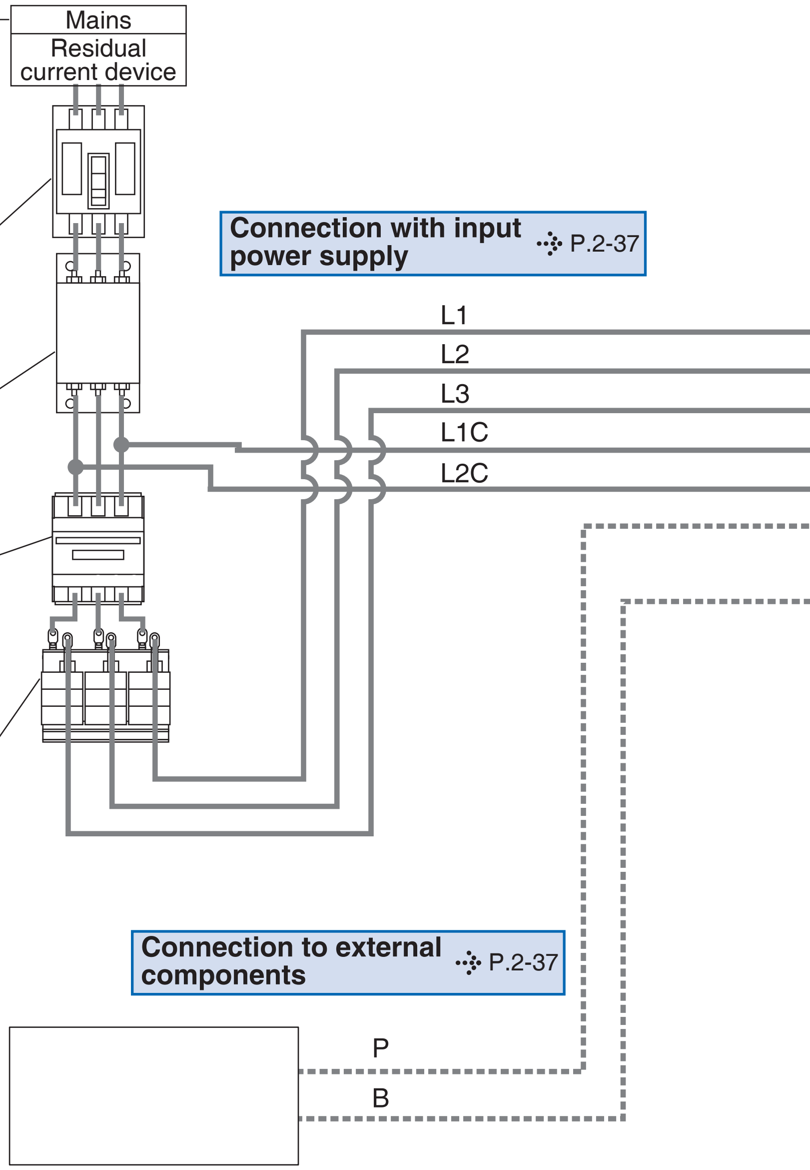
Circuit Breaker (MCCB)
To protect power supply line from overloading, install a wiring circuit breaker rated to the capacity of the power supply.

Noise Filter (NF)
Removes external noise from the power lines. And reduces an effect of the noise generated by the servo driver.

Magnetic Contactor (MC)
Turns on/off the main power of the servo driver.
Use coil surge suppression units together with this.

Note **Do not start or stop the servo motor with this Magnetic Contactor.**

Reactor (L)
Reduces harmonic current of the main power.



Connection with input power supply P.2-37

Connection to external components P.2-37

Regenerative resistor (optional)

Note

The regenerative resistor is equipped in Frame E type, or can use an external regenerative resistor.

Remarks

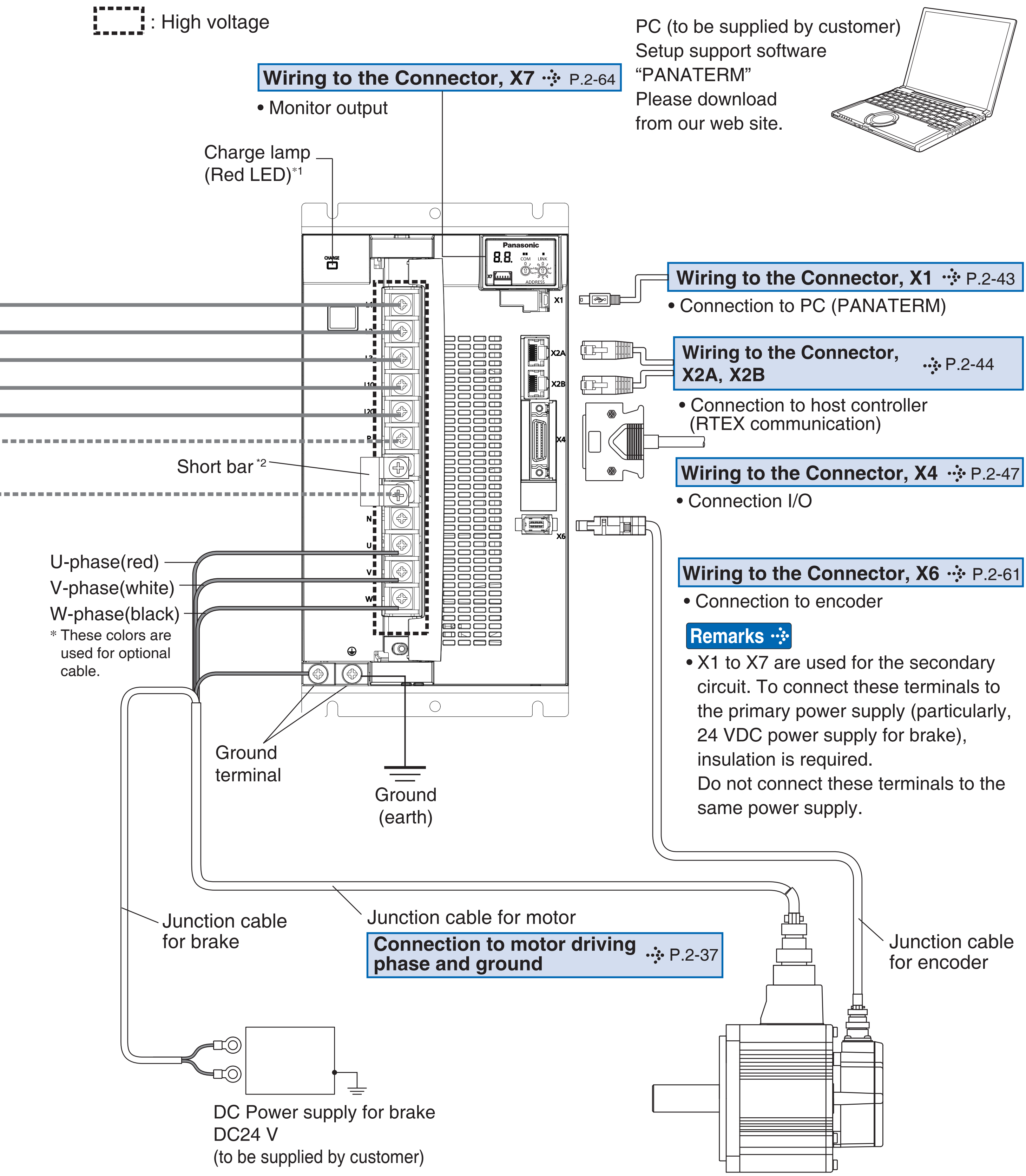
- When you use an external regenerative resistor, **install an external protective apparatus, such as thermal fuse without fail.**
- Mount the regenerative resistor **on incombustible material such as metal.**

Note This overall wiring diagram is a typical one. The pages after P.2-29 that follow show wiring for specific application. The wiring indicated with the broken line shall be provided only when required.

Related page
- P.7-69... “Options”

1.Composition of Peripheral Equipments

F-frame (200 V Type)



*1 Do not make displacement, wiring or inspection while the charge lamp is lit - cause of electric shock.
*2 When you use an external regenerative resistor, disconnect a short circuit wire.

Related page • P.2-37"Wiring of the Main Circuit (F-frame, 200 V Type)" • P.2-40 "Specifications of Motor Connector"

2. Conformance to International Standards

About Confomance to Internationl Standards

EC Directives

The AC servos meet the relevant EC Directives for Low Voltage Equipment so that the machine or equipment comprising our AC servos can meet EC Directives.

EMC Directives

MINAS Servo System conforms to relevant standard under EMC Directives setting up certain model (condition) with certain locating distance and wiring of the servo motor and the driver. And actual working condition often differs from this model condition especially in wiring and grounding. Therefore, in order for the machine to conform to the EMC Directives, especially for noise emission and noise terminal voltage, it is necessary to examine the machine incorporating our servos.

Conformity to UL Standards

(1) Installation environment
Use the driver in an environment of Pollution Degree 2 prescribed in IEC60664-1.
Make sure to install a circuit breaker(MCCB) or fuse which are UL recognized on the power supply.

Use a copper cable with temperature rating of 75 ˚C or higher.

Remarks

(2) Short-Circuit Current Rating(SCCR).

This driver conform to the power source witch is less than the maximum input voltage less than 5000 A symmetrical current.

(3) The NEC (National Electric Code).

The branch circuit of the protection NEC (National Elrctrical Code) and regional standards according to the embodiment.

(4) Over-load protection and over-temperature protection
Drivers
Over-load protective function will be activated when the effective current exceeds 115 % or more than the rated current based on the time characteristics.
Motor over-temperature protection is not provided.
Motor over-load-temperature protection shall be provided at the final installation upon required by the NEC (National Electric Code).

Note For Overload protection time characterstics, refer to P.6-23.

SEMI F47

- The SEMI F47 is the standard for the semiconductor when voltage sag.
- The control voltage of driver is following the SEMI F47 stangard.
  The main voltage of driver is following the SEMI F47 standard for under no load or light load.

Caution
(1) Excluding the single-phase 100 V type .
(2) Please verify the actual compliance of your machine with the SEMI F47 standard for voltage sag immunity.

Conformity to Standards

(A6N Multi-function Type) (A6N Standard Type)

		Driver	Motor
EC Directives	EMC Directives	EN55011 EN61000-6-2 EN61000-6-4 EN61800-3	—
	Low-Voltage Directives	EN61800-5-1 EN50178	EN60034-1 EN60034-5
	Machinery Directives Functional safety *1	ISO13849-1(PL e, Cat.3) EN61508 (SIL 3) EN62061 (SILCL 3) EN61800-5-2 (SIL 3) IEC61326-3-1 IEC60204-1	—
UL Standards		UL508C (File No.E164620)	UL1004-1, UL1004-6 (File No.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 A6N series standard type do not correspond to the functional safety standards.
*2 Information related to the Radio Waves Law (South Korea)
This servo driver is a Class A equipment according to Radio Waves Law in South Korea (commercial broadcast communication equipment). Please use the product after recognizing the following notes.

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)

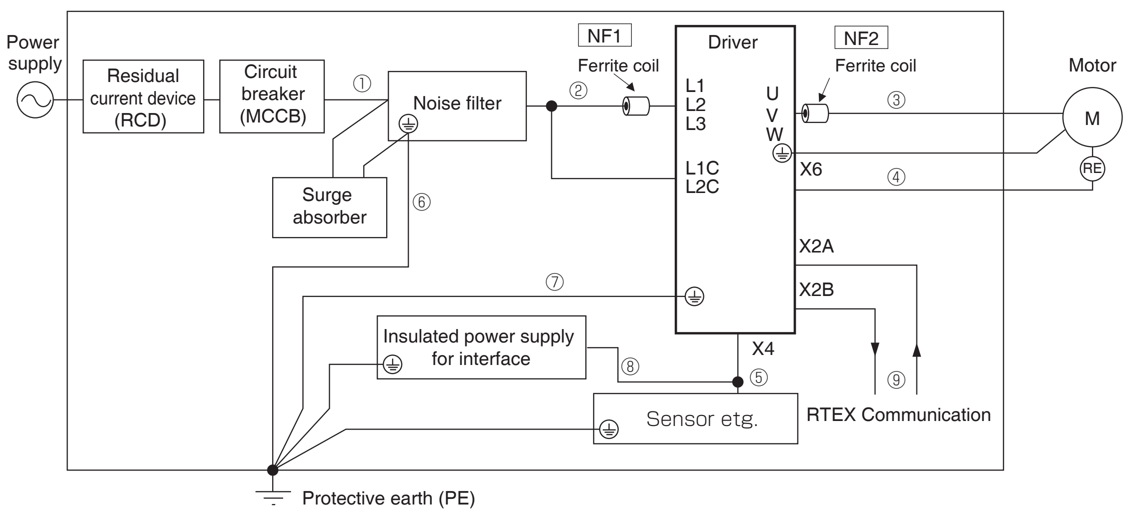
<Refer to English translation>
Class A equipment (commercial broadcast communication equipment)
This servo driver is a Class A equipment electromagnetic radio wave generator not designed for home use. The user and distributor should be aware of this fact.
(Comparison model：Servo Driver)

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

Caution
Use options correctly after reading Operating Instructions of the options to better understand the precautions.
Take care not to apply excessive stress to each optional part.

Installation Environment

Use the servo driver in the environment of Pollution Degree 1 or 2 prescribed in IEC-60664-1 (e.g. Install the driver in control panel with IP54 protection structure.)



• Mandatory requirements to conform to EMC directive

- Install the servo driver on the metallic casing (control board).
- Install noise filter and lightning surge absorber in the power supply line.
- Use braided shield cable (tin plated annealed copper wire) for I/O signal cable and encoder cable.
- Provide the ferrite coil, as shown in the figure, for each cable, power source line and motor line to be connected to the servo driver.
- Shield of cables not shown on the figure should be directly grounded through PE.

Because these conditions for EMC directive are affected by status of connected de vices, wiring, connection and location, compliance should be checked after complet- ing installation.

- **Details of previous chart and cable**

Symbol	Connecting to	Connecting	Cable Name	Length	Memo	Shield	Ferrtie coil
①	Circuit Breaker (MCCB)	Noise filter	Power Line	2 m	Single phase/3-phase	Unattached	Unattached
②	Noise filter	Servo driver	Power Line	2 m	—	Unattached	Attached
③	Servo driver	Servo motor	Motor cable	20 m	—	Unattached	Attached
④	Servo driver	Servo motor	Encoder cable	20 m	—	Attached	Unattached
⑤	Sensor etc.	Servo driver	I/O cable	3 m	—	Attached	Unattached
⑥	Earth	Noise filter	FG Line	1 m	—	Unattached	Unattached
⑦	Earth	Servo driver	FG Line	1 m	—	Unattached	Unattached
⑧	I/O signal power	Servo driver	Power Line	1 m	—	Unattached	Unattached
⑨	RTEX Communcation	Servo driver	Communcation cable	100 m	—	Attached	Unattached

- **The List of Peripheral Equipments refer to P.2-14.**

Caution

Use options correctly after reading Operating Instructions of the options to better understand the precautions.
Take care not to apply excessive stress to each optional part.

2. Conformance to International Standards

Peripheral Equipments

Power Supply

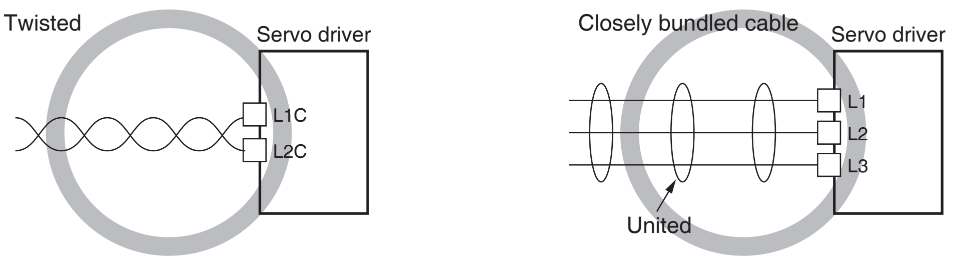
100 V type: (A to C-frame)	Single phase, 100 V	$^{+10\ \%}_{-15\ \%}$	to	120 V	$^{+10\ \%}_{-15\ \%}$	50 Hz/60 Hz
200 V type: (A to D-frame)	Single/3-phase, 200 V	$^{+10\ \%}_{-15\ \%}$	to	240 V	$^{+10\ \%}_{-15\ \%}$	50 Hz/60 Hz
200 V type: (E to F-frame)	3-phase, 200 V	$^{+10\ \%}_{-15\ \%}$	to	240 V	$^{+10\ \%}_{-15\ \%}$	50 Hz/60 Hz

(1) This product is designed to be used in over-voltage category (installation category) III of EN 61800-5-1:2007.

(2) Use an insulated power supply of DC12 to 24 V which has CE marking or complies with EN60950.

Remarks

- Use sheathed (jacketed) cable, twisted cable or closely bundled cable for power cable.



- Power cable and signal wires must be sufficiently isolated from each other.

Circuit Breaker(MCCB)

Install a circuit breaker(MCCB) which complies with IEC Standards and UL recognized (Listed and Ⓤ marked) between power supply and noise filter.
The short-circuit protection circuit on the product is not for protection of branch circuit. The branch circuit should be protected in accordance with NEC and the applicable local regulations in your area.

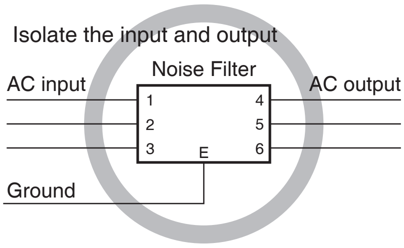
Note

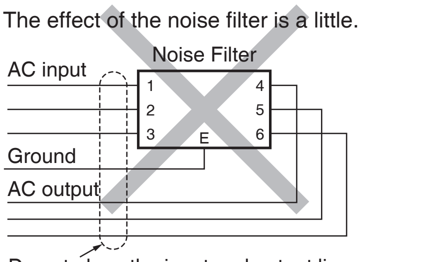
For driver and applicable peripheral equipments, refer to P.2-18 "List of Applicable Peripheral Equipments of Driver".

Noise Filter

Option part No.	Voltage specifications for driver	Manufacturer's part No.	Applicable driver (frame)	Manufacturer
DV0P4170	Single phase 100 V/200 V	SUP-EK5-ER-6	A, B-frame	Okaya Electric Ind.
DV0PM20042	3-phase 200 V	3SUP-HU10-ER-6	A, B-frame	
	Single phase 100 V/200 V 3-phase 200 V		C-frame	
DV0P4220	Single/ 3-phase 200 V	3SUP-HU30-ER-6	D-frame	
DV0PM20043	3-phase 200 V	3SUP-HU50-ER-6	E-frame	
DV0P3410	3-phase 200 V	3SUP-HL50-ER-6B	F-frame	

- Select a noise filter whose capacity is commensurate with the power source capacity (in consideration of the load condition).
- For the detailed specifications of each noise filter, contact the manufacturer.
- When two or more servo drivers are used with a single noise filter at the common power source, consult with the noise filter manufacturer.
- Do not run the input and output wiring on the same passage: noise resistance will drop. (Figure at lower right)
- Isolate the input and output line from each other. (Figure at lower left)





Surge Absorber

Option part No.	Voltage specifications for driver	Manufacturer's part No.	Manufacturer
DV0P1450	3-phase 200 V	R·A·V-781BXZ-4	Okaya Electric Ind.
DV0P4190	Single phase 100 V/200 V	R·A·V-781BWZ-4	

Remarks When performing withstand voltage test of machine and equipment, be sure to remove the surge absorber; otherwise, it will be damaged.

Related page • P.2-18 "List of Applicable Peripheral Equipments of Driver" • P.7-69 "Options"

Ferrite Coil

Symbol*1	Cable Name	Amp. frame symbol	Option part No.	Manufacturer's part No.	Manufacturer	Qty.
NF1	Power cable	(100 V)C (200 V)C, D	DV0P1460	ZCAT3035-1330	TDK Corp.	0
		(100 V)A, B (200 V)A, B, E				1
NF2	Motor cable	(100 V)A, B, C (200 V)A, B, C, D, E				1
		(200 V)F				2

*1 For symbols, refer to the Block Diagram “Installation Environment” (P.2-12).
*2 The number of turns for ferrite coils are 1.

<Attaching ferrite coil>

Signal wire: Wind cables the number of turns required to form the ferrite coil.

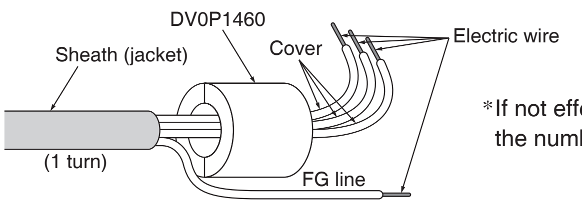
Power wire: If sheathed (jacketed): remove the sheath (jacket) to the length so that wires (L1, L2, L3) can be wound on the ferrite coil (including power line dedicated filter). For effective noise reduction function, L1, L2 and L3 should be wound together.

If not effective, increase the number of signal noise filters (including power line dedicated filters). (See figure below.)

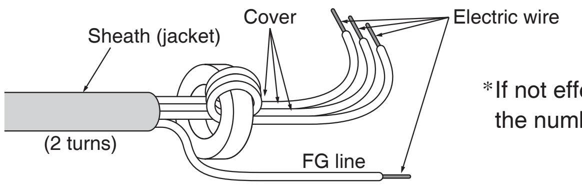
Motor line: When installing the ferrite coil (including motor line dedicated filter) to our optional cable, remove the sheath (jacket) to the length so that wires can be wound on the ferrite coil (including power line dedicated filter). For effective noise reduction function, U, V and W should be wound together.

If not effective, increase the number of ferrite coils (including power line dedicated filters). (See figure below.)

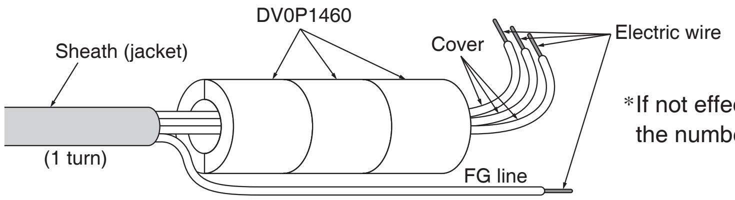
Encoder line: Wind cables the number of turns required to form the ferrite coil.



*If not effective, increase the number of turns.



*If not effective, increase the number of turns.



*If not effective, increase the number of filters.

Residual Current Device

Install a residual current device (RCD) at primary side of the power supply.
Select a RCD of type.B prescribed in IEC60947-2, JISC8201-2-2

Grounding

(1) To prevent electric shock, be sure to connect the ground terminal (⏚) of the driver, and the ground terminal (PE) of the control panel.
(2) The ground terminal (⏚) must not be shared with other equipment. Two ground terminals are provided.

Structure of Control Board

If there is a gap at cable inlet/outlet, mounting hole of operation panel or a door, radio waves will penetrate into or radiate out through the gap. To prevent unfavorable conditions due to radio frequency activities, observe the following control board design and selection instruction.

- The control board should be made of metal which provides electrical continuity.
- The control board should not have electrically-isolated conductor.
- All units installed in the casing should be grounded to the case.

Increasing Noise Resistance of Control I/O Signal

When noise is applied to the control input/output, it causes displacement and malfunctioning of I/O signal.

- X1 to X7 are secondary side circuit which should be isolated from the primary power source (24 VDC control power source, 24 VDC braking power source and 24 VDC for regenerative resistor). Do not connect the secondary side circuit to the primary power source and ground wire. Otherwise, I/O signal will cause error operation.
- Control power source should be completely isolated from external operating power source. Never connect the ground of the control power source to that of external power source.
- The signal line should have shield, the both end of which should be connected to the ground.

Note For driver and applicable peripheral equipments, refer to P.2-18 “List of Applicable Peripheral Equipments of Driver”.

Caution Use options correctly after reading Operating Instructions of the options to better understand the precautions.
Take care not to apply excessive stress to each optional part.

1 Before Using the Products
2 Preparation
3 Setup
4 Trial Run
5 Adjustment
6 When in Trouble
7 Supplement

Peripheral Equipments and Wiring

List of Peripheral Equipments

Driver	Voltage *1	Rated output	Required Power (at the rated load)	Circuit breaker (MCCB) (rated current)	Noise filter	Surge absorber	Noise filter for signal	Rated operating current of magnetic (contactor Contact configuration) *2
MADL□□□□□	Single phase, 100 V	50 W to 100 W	approx. 0.4 kVA	10 A	DV0P4170	DV0P4190	DV0P1460	20 A (3P+1a)
	Single/3-phase, 200 V	50 W to 200 W	approx. 0.5 kVA		DV0P4170 (Single phase) DV0PM20042 (3-phase)	DV0P4190 (Single phase) DV0P1450 (3-phase)		
MBDL□□□□□	Single 100 V	200 W	approx. 0.5 kVA		DV0P4170	DV0P4190		
	Single/3-phase, 200 V	400 W	approx. 0.9 kVA		DV0P4170 (Single phase) DV0PM20042 (3-phase)	DV0P4190 (Single phase) DV0P1450 (3-phase)		
MCDL□□□□□	Single 100 V	400 W	approx. 0.9 kVA	15 A	DV0PM20042	DV0P4190		
	Single/3-phase, 200 V	750 W	approx. 1.8 kVA			DV0P4190 (Single phase) DV0P1450 (3-phase)		
MDDL□□□□□	Single/3-phase, 200 V	0.9 kW	approx. 2.3 kVA	20 A	DV0P4220			30 A (3P+1a)
		1.0 kW	approx. 2.4 kVA					
		1.5 kW	approx. 2.9 kVA					
MEDL□□□□□	3-phase, 200 V	2.0 kW	approx. 3.3 kVA	30 A	DV0PM20043	DV0P1450	DV0P1460	60 A (3P+1a)
		2.4 kW	approx. 4.5 kVA					
MFDL□□□□□	3-phase, 200 V	3.0 kW	approx. 4.5 kVA	50 A	DV0P3410	DV0P1450	DV0P1460	60 A (3P+1a)
		4.0 kW	approx. 6.4 kVA					
		4.5 kW	approx. 6.8 kVA					100 A (3P+1a)
		5.0 kW	approx. 7.8 kVA					

List of Applicable diameter cables

Driver	Voltage *1	Rated output	Required Power (at the rated load)	Diameter and withstand voltage of main circuit cable	Crimp terminal for main circuit terminal block	Diameter and withstand voltage of control power supply cable	Crimp terminal for control power supply terminal block	Diameter and withstand voltage of motor cable *4	Diameter and withstand voltage of brake cable
MADL□□□□□	Single phase, 100 V	50 W to 100 W	approx. 0.4 kVA	0.75 mm²/ AWG18 600 VAC or more	Connection to exclusive connector	0.75 mm²/ AWG18 600 VAC or more	Connection to exclusive connector	0.75 mm²/ AWG18 600 VAC or more	0.28 mm²/ AWG22 to 0.75 mm²/ AWG18 100 VAC or more
	Single/3-phase, 200 V	50 W to 200 W	approx. 0.5 kVA						
MBDL□□□□□	Single phase, 100 V	200 W	approx. 0.5 kVA						
	Single/3-phase, 200 V	400 W	approx. 0.9 kVA						
MCDL□□□□□	Single phase, 100 V	400 W	approx. 0.9 kVA						
	Single/3-phase, 200 V	750 W	approx. 1.8 kVA						
MDDL□□□□□	Single/3-phase, 200 V	0.9 kW	approx. 2.3 kVA	2.0 mm²/ AWG14 600 VAC or more				2.0 mm²/ AWG14 600 VAC or more	0.75 mm²/ AWG18 100 VAC or more
		1.0 kW	approx. 2.4 kVA						
		1.5 kW	approx. 2.9 kVA						

Note When use the external regenerative resistor of the option, use the cable with the same diameter as the main circuit cable.

Related page Noise Filter...P.7-69 Surge Absorber...P.7-71
Ferrite Coil...P.7-72 Motor Connector...P.2-40

Driver	Voltage *1	Rated output	Required Power (at the rated load)	Diameter and withstand voltage of main circuit cable	Crimp terminal for main circuit terminal block	Diameter and withstand voltage of control power supply cable	Crimp terminal for control power supply terminal block	Diameter and withstand voltage of motor cable *4	Diameter and withstand voltage of brake cable
MEDL□□□□□	3-phase, 200 V	2.0 kW	approx. 3.3 kVA	2.0 mm2/ AWG14 600 VAC or more	Connection to exclusive connector	0.75 mm2/ AWG18 600 VAC or more	Connection to exclusive connector	2.0 mm2/ AWG14 600 VAC or more	0.75 mm2/ AWG18 100 VAC or more
		2.4 kW	approx. 4.5 kVA						
MFDL□□□□□	3-phase, 200 V	3.0 kW	approx. 4.5 kVA	3.5 mm2/ AWG12 600 VAC or more	 11 mm以下 φ5.3 Terminal block M5		 11 mm以下 φ5.3 Terminal block M5	3.5 mm2/ AWG12 600 VAC or more	
		4.0 kW	approx. 6.4 kVA						
		4.5 kW	approx. 6.8 kVA						
		5.0 kW	approx. 7.8 kVA						

*1 Select peripheral equipments for single/3phase common specification according to the power source.
*2 For the external dynamic brake resistor, use the magnetic contactor with the same rating as that for the main circuit.
*3 When use the external regenerative resistor of the option (DV0PM20058, DV0PM20059), use the cable with the same diameter as the main circuit cable.
*4 Use thses products to suit a standard.

• About circuit breaker (MCCB) and magnetic contactor

To comply to EC Directives, install a circuit breaker (MCCB) between the power and the noise filter without fail, and the circuit breaker should conform to IEC Standards and UL recognized (Listed and Ⓤ marked).

Suitable for use on a circuit capable of delivering not more than 5,000 Arms symmetrical amperes, below the maximum input voltage of the product.

Remarks Select a circuit breaker (MCCB) and noise filter which match to the capacity of power supply (including a load condition).

• Terminal block and protective ground terminals

- Use a copper conductor cables with temperature rating of 75 ˚C or higher.
- Use the attached exclusive connector for A to E-frame. The Wiring method to connector refer to P.2-39. “Wiring method to Driver Connector”

• Fastening torque list (Terminal block screw/Terminal cover fastening screw)

Driver		Terminal block screw		Terminal cover fastening screw	
Frame	Terminal name	Nominal size	Fastening torque (N•m) Note 1	Nominal size	Fastening torque (N•m) Note 1
F	L1, L2, L3, L1C, L2C, P, RB, B, N, U, V, W	M5	1.8 to 2.0	M3	0.19 to 0.21

• Fastening torque list (Ground terminal screw/Connector to host controller (X4))

Driver frame	Terminal block screw		Connector to host controller (X4)	
	Nominal size	Fastening torque (N•m) Note 1	Nominal size	Fastening torque (N•m) Note 1
A to E	M4	1.0 to 1.2	M2.6	0.3 to 0.35
F	M5	1.8 to 2.0		

Caution Note 1
- Applying fastening torque larger than the maximum value may result in damage to the product.
- Do not turn on power without tightening all terminal block screws properly.
- Do not turn on power without tightening all terminal block screws properly, otherwise, loose contacts may generate heat (smoking, firing).
- To check for looseness, conduct periodic inspection of fastening torque once a year.

Be sure to conduct wiring properly and securely. Insecure or improper wiring may cause the motor running out of control or being damaged from overheating. In addition, pay attention not to allow conductive materials, such as wire chips, entering the driver during the installation and wiring.

Relationship between Wire Diameter and Permissible Current

• When selecting a cable, refer to the following selection guide showing relationship between cable specification and current carrying capacity.

Example: Power supply 3-phase, 200 V, 35 A, ambient temperature 30 °C

Determine the fundamental permissible current according to the cable conductor material (example: stranded copper wire). (For the purpose of this example, the ampere indicated by ◇ is selected from the table right.)

Next, determine the number of conductors. (In this example, the cable contains 4 conductors (3 + ground).) Determine the applicable permissible current using the following formula.

Applicable permissible current

= fundamental permissible current x current reduction coefficient x current correction coefficient

= 37 x 0.7 x 1.414

≒ 36.6 (A)

This permissible value is larger than 35 A to be carried though the cable. Therefore, according to the list of recommended eco-cables, the cable to be selected for the cable with nominal cross section 3.5 mm^2 is a polyethylene-insulated heat-resistant 4-conductor power cable having 13.5 mm finish O.D. (approx. 14.5 mm with shield).

• Fundamental permissible current

	Stranded conductor (nominal cross section: mm^2)	Copper wire (unit: A)
	2 to 3.5 (excl.)	27
◇	**3.5 to 5.5 (excl.)**	**37**
	5.5 to 8 (excl.)	49
	8 to 14 (excl.)	61
	14 to 22 (excl.)	88
	22 to 30 (excl.)	115
	30 to 38 (excl.)	139
	38 to 60 (excl.)	162
	60 to 100 (excl.)	217
	100 to 150 (excl.)	298
	150 to 200 (excl.)	395

<Supplement>

• The current correction coefficient is determined using the following formula:

$\sqrt{(\text{Max. permissible temp.} - \text{ambient temp.}) \div 30}$

Caution

The current correction coefficient is determined according to the cable. Check the specification of the cable used.

• The current reduction coefficient is provided for the case where the cable (4-conductor cable in the case of example), is housed in plastic race/sheath, plastic tube, metal race/sheath, metal tube or flexible conduit.

Caution

Because the neutral conductor is not counted as a wire, the current reduction coefficient for "3 or less" is applied as indicated by (◎) in the table right.

• Current reduction coefficient

	No. of wires in a tube	Coefficient
◎	**Up to 3**	**0.70**
	4	0.63
	5 or 6	0.56
	7 to 15	0.49
	16 to 40	0.43
	41 to 60	0.39
	61 or more	0.34

• Recommended eco-cable

Wire category: 4-conductor polyethylene-insulated power cable with heat-resistant polyethylene sheath (Standard: EM JIS C 3605) Maximum permissible temperature: 90 °C

Conductor			Insulation thickness (mm)	Sheath thickness (mm)	(Reference) Finish O.D. (mm)	Max. conductor resistance (20 °C) (Ω/km)	Test voltage (V/1 min.)	Minimum insulation resistance (MΩ•km)	(Reference) Approx. mass (kg/km)
Nominal cross section (mm^2)	Structure or shape (wires/mm^2)	Outside diameter (mm)							
2	7/0.6	1.8	0.8	1.5	12.0	9.42	1500	2500	170
3.5	7/0.8	2.4	0.8	1.5	13.5	5.30	1500	2500	250
5.5	7/1.0	3.0	1.0	1.5	16.0	3.40	1500	2500	360
8	7/1.2	3.6	1.0	1.5	17.0	2.36	1500	2000	475
14	Circular compression	4.4	1.0	1.5	19.0	1.34	2000	1500	730
22	Circular compression	5.5	1.2	1.6	23	0.849	2000	1500	1100
38	Circular compression	7.3	1.2	1.8	28	0.491	2500	1500	1800
60	Circular compression	9.3	1.5	2.0	35	0.311	2500	1500	2790
100	Circular compression	12.0	2.0	2.4	44	0.187	2500	1500	4630
150	Circular compression	14.7	2.0	2.6	51	0.124	3000	1000	6710
200	Circular compression	17.0	2.5	2.9	60	0.0933	3000	1500	8990

Caution **Shield will increase finish outside diameter by approx. 1 mm.**

Note

• Appropriate cable should be selected to have sufficient allowance for parameters such as operating ambient temperature and current.

• Current reduction coefficient, fundamental permissible current, etc., stated on this page are subject to change due to e.g. standard revision. Consult cable manufacturers for the latest information.

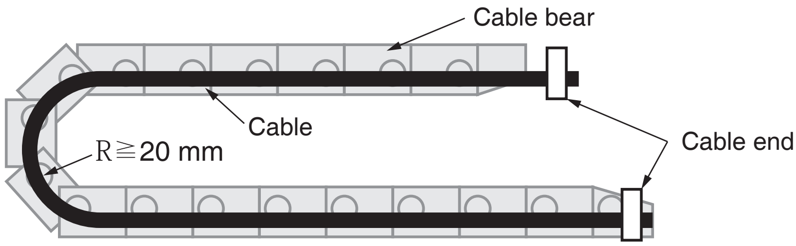
Wiring Precautions on Movable Section

When wiring cable bear, take the following precautions:

• Cable bear wiring

The bend radius of the cable must be 10 times or more its finish outside diameter.
(For finish outside diameter, refer to P.2-20 How to Install, "Relationship between Wire Diameter and Permissible Current" and associated tables.)
Do not fix or bundle wires in the cable bear.
When securing the cable, fix it only at non-movable ends of the cable bear where the cable is free from any stress (e.g. tension). (Avoid tight lock.)

[Recommended cable bear wiring]



Caution Do not keep the cable loosened (too long) or under tension (too short).
Otherwise, the sheath will be cracked by internal wall of the cable bear, tangled by other cable, etc., causing unpredictable troubles.

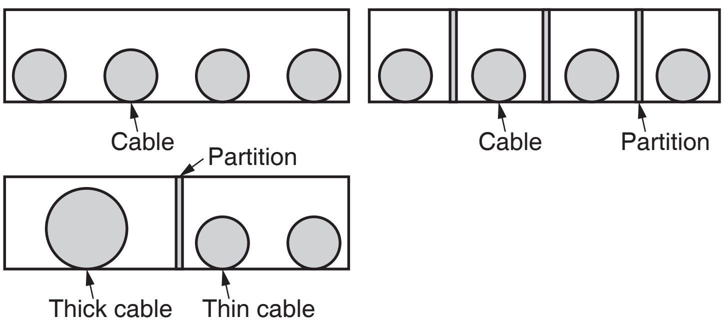
• Cable distortion

Keep the cable free from twists or kinks.
Distorted cable will cause loose connection, lowering performance and reliability.

• Lamination factor of cable in cable bear

Place cables on a flat surface in parallel without bringing them into contact with each other and measure the dimension necessary to cover these cables. Then select a cable bear which is wider than the measured dimension.
The lamination factor of cables should be lower than 60 % (recommended factor is 30 % or below).
Do not run smaller and larger size cables in the same cable bear. Thin cables may break under the pressure of thick cables. If it is necessary to mix cables of different size, isolate them by using suitable separating material such as partition.

[Wiring arrangement in cable bear – example]



4. Installation

Driver

Install the driver properly to avoid a malfunction or an accident.

Installation Place

1) Install the driver in a control panel enclosed in noncombustible material and placed indoor where the product is not subjected to rain or direct sunlight. The products are not waterproof.
2) Where the products are not subjected to corrosive atmospheres such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, sulfur, chloric gas, sulfuric gas, acid, alkaline and salt and so on, and are free from splash of inflammable gas.
3) Where the motor is free from grinding oil, oil mist, iron powder or chips.
4) Well-ventilated and low humidity and dust-free place.
5) Vibration-free place.
6) Do not use benzine, thinner, alcohol, acidic cleaner and alkaline cleaner because they can discolor or damage the exterior case.

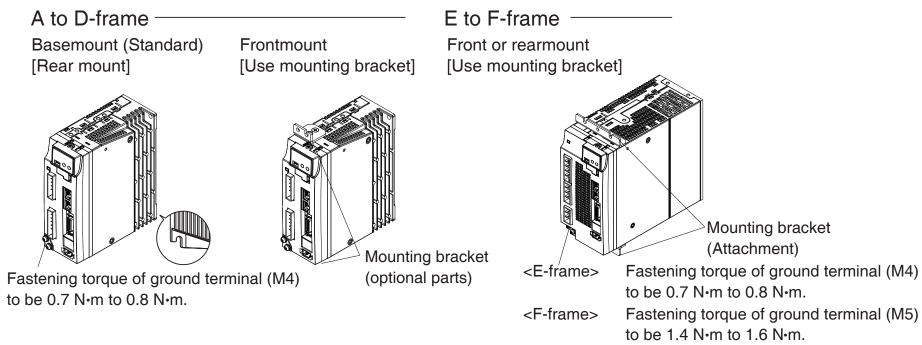
Environmental Conditions

Item	Conditions
Ambient temperature	0 ˚C to 55 ˚C[*1] (free from freezing)
Ambient humidity	20 % to 85 % RH (free from condensation)
Storage temperature[*1]	–20 ˚C to 65 ˚C (Max. temperature guarantee: 80 ˚C for 72 hours free from condensation[*2])
Storage humidity	20 % to 85 % RH (free from condensation[*2])
Vibration	Lower than 5.88 m/s^2 (0.6 G), 10 Hz to 60 Hz
Altitude	Lower than 1000 m

*1 Extreme temperatures are permissible only for short period such as during transportation.
*2 Air containing water vapor will become saturated with water vapor as the temperature falls, causing dew.

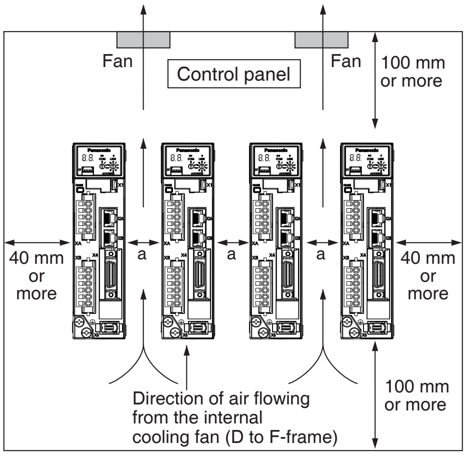
How to Install

1) Rack-mount type. Install in vertical position, and reserve enough space around the servo driver for ventilation.
2) Base mount (rear mount) is standard for A/B/C/D-frame driver.
3) To change the mounting surface of A/B/C/D-frame driver, use the optional mounting bracket. To change the mounting surface of E/F-frame driver, use the mounting bracket.For choosing the correct optional mounting bracket, refer to P.7-101 “Mounting Bracket”.
4) In consideration of strength of the screws and the material of the mounting base, select appropriate fastening torque for the product mounting screws, so that the screws will not be loosened or damaged.
   Example) To tighten a steel screw into a steel base
   A to F-frame: M5 2.7 N·m to 3.3 N·m



Mounting Direction and Spacing

- Reserve enough surrounding space for effective cooling.
- Install fans to provide uniform distribution of temperature in the control panel.
- D to F-frame is provided with a cooling fan at the bottom.
- Observe the environmental conditions of the control panel described in the previous page.
- Check that the ambient temperature of 50 mm around the servo amplifier does not exceed the operating temperature range.
- If the temperature can not be measured beyond a distance of 50 mm, please measure at the midpoint between the obstacle and the servo amplifier .



	a
A to F-frame	10 mm or more

Note It is recommended to use the conductive paint when you make your own mounting bracket, or repaint after peeling off the paint on the machine for installing the products, in order to make noise countermeasure.

Caution on Installation

Caution

- In case the product malfunctions due to external noise disturbance and static electricity (signal disconnection, signal phase loss etc.), it will result in unexpected action very likely. It is highly recommended that you make a fail-safe design and secure the safety in the operative range.
- If stranded wires are used as the cable, bunch the conductors of the cable using a rod terminals or a round terminals. If stranded wires are used as they are, unexpected accidents such as an electric shock and short circuit or injury may result.
- Be sure to install a circurt breaker (MCCB) in the power supply. In addition, be sure to ground the grounding terminal or grounding wire provided. (In order to prevent electric shock and malfunctions, Class D grounding [grounding resistance of 100 Ω or less] is recommended.)
  If the product is grounded insufficiently, not only the driver may not deliver its performance sufficiently, but also safety hazards such as a malfunction due to a electrification or a disturbance may be caused.
- If electric wires are bound and run through metal duct, they cannot carry the rated current due to temperature rise. If they are forced to carry the rated current, they may burn. When determining size of the wire.
- Do not use or store the product in a place subject above to 5.88 m/s^2 or more vibration or shock, foreign materials such as dust, metallic powder and oilmist, liquids such as water, oil and grinding fluid, close to flammable materials, or in an atmosphere of corrosive gas (H_2S, SO_2, NO_2, Cl_2, etc.) or inflammable gas under any circumstance.

Related page
• P.1-8 “Specifications” • P.2-25 “Installation Motor”
• P.7-32 “Dimensions Driver” • P.7-101 “Mounting Bracket”

- Do not use or store the product in a place subject to 5.88 m/s^2 or more vibration or shock, foreign materials such as dust, metallic powder and oilmist, liquids such as water, oil and grinding fluid, close to flammable materials, or in an atmosphere of corrosive gas (H_2S, SO_2, NO_2, Cl_2, etc.) or inflammable gas under any circumstance.
- Be sure to conduct wiring properly and securely. Insecure or improper wiring may cause the motor running out of control or being damaged from overheating. In addition, pay attention not to allow conductive materials, such as wire chips, entering the driver during the installation and wiring.
- Secure the screws and earth screw on the terminal block with the torque specified in the specification in P.2.19.
- Never make an approach to the motor and the machines driven by the motor while power is applied because they may become failure or malfunction.
- Do not use servo-on signal (SRV-ON) as the start/stop signal. Doing so may damage the built-in dynamic brake circuit in the driver.
- Pay attention to the ambient temperature of the amplifier meeting the operating temperature range. The driver will generate heat while the motor is in operation. Using the driver in a sealed control box may cause an abnormal heating of the control box.
- There is a possibility that the motor will be damaged by heat or emit smoke or dust due to a fault in the motor itself or the driver coupled with it. A proper consideration should be given to if the motor is used in a clean room or similar environment. Pay attention please.
- The capacitance of capacitor in the power supply rectifier circuit decreases its capacitance with age.
  To prevent a secondary accident due to malfunction, it should be replaced with new one after 5-year use.
  Replacement should be performed by us or our authorized distributor.
- Before using the product, be sure to read the instruction manual (Safety part).
- If the dynamic brake is applied during operation at a high speed, provide approx. 10-minute dwell period.
  Restarting the motor earlier may cause a broken wire in the dynamic brake making the brake inoperable.

4. Installation

Motor

Install the motor properly to avoid a breakdown or an accident.

Installation Place

Since the conditions of location affect a lot to the motor life, select a place which meets the conditions below.

1) Indoors, where the products are not subjected to rain or direct sun beam. The products are not waterproof.
2) Where the products are not subjected to corrosive atmospheres such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, sulfur, chloric gas, sulfuric gas, acid, alkaline and salt and so on, and are free from splash of inflammable gas.
3) Where the motor is free from grinding oil, oil mist, iron powder or chips.
4) Well-ventilated and humid and dust-free place, far apart from the heat source such as a furnace.
5) Easy-to-access place for inspection and cleaning
6) Vibration-free place.
7) Avoid enclosed place. Motor may gets hot in those enclosure and shorten the motor life.

Environmental Conditions

Item		Conditions
Ambient temperature[*1]		0 ˚C to 40 ˚C (free from freezing)
Ambient humidity		20 % to 85 % RH (free from condensation)
Storage temperature[*2]		–20 ˚C to 65 ˚C (Max. temperature guarantee: 80 ˚C for 72 hours free from condensation[*4])
Storage humidity		20 % to 85 % RH (free from condensation[*4])
Vibration	Motor only	Lower than 5.0 kW Lower than 49 m/s² (5 G) at running, 24.5 m/s² (2.5 G) at stall More than 5.0 kW Lower than 24.5 m/s² (2.5 G) at running, 24.5 m/s² (2.5 G) at stall
Impact	Motor only	Lower than 98 m/s² (10 G)
Enclosure rating	Motor only (Connector type)	IP67 (except rotating portion of output shaft and connecting pin part of the motor connector and the encoder connector)[*3]
	Motor only (Leadwire type)	IP65 (except rotating portion of output shaft and connecting pin part of the motor connector and the encoder connector)[*3]
Altitude		Lower than 1000 m

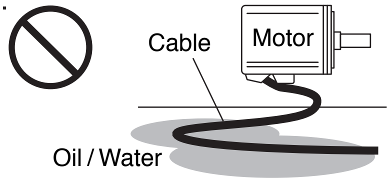
*1 Ambient temperature to be measured at 50 mm away from the motor.
*2 Permissible temperature for short duration such as transportation.
*3 These motors conform to the test conditions specified in EN standards (EN60529, EN60034-5). Do not use these motors in application where water proof performance is required such as continuous wash-down operation.
*4 Air containing water vapor will become saturated with water vapor as the temperature falls, causing dew.

How to Install

You can mount the motor either horizontally or vertically as long as you observe the followings.

1) Horizontal mounting
   - Mount the motor with cable outlet facing downward for water/oil countermeasure.
2) Vertical mounting
   - Use the motor with oil seal when mounting the motor with gear reducer to prevent the reducer oil/grease from entering to the motor.

Oil/Water Protection



1) Do not submerge the motor cable to water or oil.
2) Install the motor with the cable outlet facing downward.
3) Avoid a place where the motor is always subjected to oil or water.
4) Use the motor with an oil seal when used with the gear reducer, so that the oil may not enter to the motor through shaft.

Stress to Cables

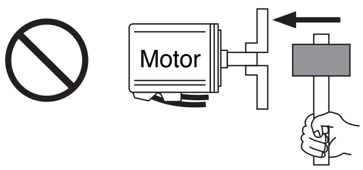
1) Avoid a stress application to the cable outlet and connecting portion by bending or self-weight.
2) Especially in an application where the motor itself travels, fix the junction cable into the bearer so that the stress by bending can be minimized.
3) Take the cable bending radius as large as possible. (When you use our optional cable, Minimum R20 mm)

Permissible Load to Output Shaft

1) Design the mechanical system so that the applied radial load and/or thrust load to the motor shaft at installation and at normal operation can meet the permissible value specified to each model.
2) Pay an extra attention when you use a rigid coupling. (Excess bending load may damage the shaft or deteriorate the bearing life.)
3) Use a flexible coupling with high stiffness designed exclusively for servo application in order to make a radial thrust caused by micro misalignment smaller than the permissible value.

Note For permissible load of each model, refer to P.2-27, “Permissible Load at Output Shaft”.

Notes on Installation



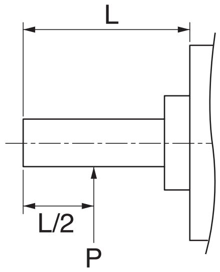
1) Do not apply direct impact to the shaft by hammer while attaching/detaching a coupling to and from the motor shaft.
(Or it may damage the encoder mounted on the other side of the shaft.)
2) Make a full alignment. (incomplete alignment may cause vibration and damage the bearing.)
3) If the motor shaft is not electrically grounded, it may cause electrolytic corrosion to the bearing depending on the condition of the machine and its mounting environment, and may result in the bearing noise. Check and verification by customer is required.

Related page
• P.2-22 “Installation Driver”
• P.2-27 “Permissible Load at Output Shaft” • P.7-38 “Dimensions Motor”

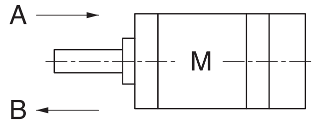
4. Installation

Permissible Load at Output Shaft

Radial load (P) direction



Thrust load (A and B) direction

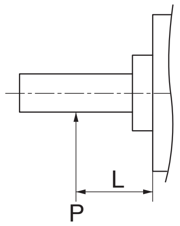


Unit : N (1 kgf=9.8 N)

<table>
<tr><th rowspan="3">Motor series</th><th rowspan="3">Motor output</th><th colspan="3">At assembly</th><th colspan="2">During running</th></tr>
<tr><th rowspan="2">Radial thrust</th><th colspan="2">Thrust load</th><th rowspan="2">Radial thrust</th><th rowspan="2">Thrust load A and B-direction</th></tr>
<tr><th>A-direction</th><th>B-direction</th></tr>
<tr><td rowspan="5">MSMF</td><td>50 W, 100 W</td><td>147</td><td>88</td><td>117.6</td><td>68.6</td><td>58.8</td></tr>
<tr><td>200 W, 400 W</td><td>392</td><td>147</td><td>196</td><td>245</td><td>98</td></tr>
<tr><td>750 W, 1.0 kW(□80)</td><td>686</td><td>294</td><td>392</td><td>392</td><td>147</td></tr>
<tr><td>1.0 kW(□100) to 3.0 kW</td><td rowspan="2">980</td><td rowspan="2">588</td><td rowspan="2">686</td><td>490</td><td>196</td></tr>
<tr><td>4.0 kW, 5.0 kW</td><td>784</td><td>343</td></tr>
<tr><td rowspan="2">MQMF</td><td>100 W</td><td>147</td><td>88</td><td>117.6</td><td>68.6</td><td>58.8</td></tr>
<tr><td>200 W, 400 W</td><td>392</td><td>147</td><td>196</td><td>245</td><td>98</td></tr>
<tr><td rowspan="3">MDMF</td><td>1.0 kW to 2.0 kW</td><td rowspan="2">980</td><td rowspan="2">588</td><td rowspan="2">686</td><td>490</td><td>196</td></tr>
<tr><td>3.0 kW</td><td rowspan="2">784</td><td rowspan="2">343</td></tr>
<tr><td>4.0 kW,5.0 kW</td><td>1666</td><td>784</td><td>980</td></tr>
<tr><td rowspan="4">MGMF</td><td>850 W to 1.8 kW</td><td>980</td><td>588</td><td>686</td><td>686</td><td>196</td></tr>
<tr><td>2.4 kW</td><td rowspan="3">1666</td><td rowspan="3">784</td><td rowspan="3">980</td><td rowspan="2">1176</td><td rowspan="3">490</td></tr>
<tr><td>2.9 kW</td></tr>
<tr><td>4.4 kW</td><td>1470</td></tr>
<tr><td rowspan="6">MHMF</td><td>50 W</td><td rowspan="2">147</td><td rowspan="2">88</td><td rowspan="2">117.6</td><td rowspan="2">68.6</td><td>49</td></tr>
<tr><td>100 W</td><td>58.8</td></tr>
<tr><td>200 W, 400 W</td><td>392</td><td>147</td><td>196</td><td>245</td><td>98</td></tr>
<tr><td>750 W,1.0 kW(□80)</td><td>686</td><td>294</td><td>392</td><td>392</td><td>147</td></tr>
<tr><td>1.0 kW(□130), 1.5kW</td><td>980</td><td>588</td><td>686</td><td>490</td><td>196</td></tr>
<tr><td>2.0 kW to 5.0 kW</td><td>1666</td><td>784</td><td>980</td><td>784</td><td>343</td></tr>
</table>

Note

When the load point varies, calculate the permissible radial load, P (N) from the distance of the load point, L (mm) from the mounting flange based on the formula of the right table, and make it smaller than the calculated result.



Motor series	Motor output	Formula of Load and load point relation
MSMF	50 W	$P=\frac{3533}{L+39}$
	100 W	$P=\frac{4905}{L+59}$
	200 W	$P=\frac{14945}{L+46}$
	400 W	$P=\frac{19723}{L+66.5}$
	750 W	$P=\frac{37044}{L+77}$
	1.0 kW(□80)	$P=\frac{43198}{L+92.7}$
	1.0 kW(□100) to 3.0 kW	$P=\frac{20090}{L+13.5}$
	4.0 kW, 5.0 kW	$P=\frac{36848}{L+14.5}$
MQMF	100 W	$P=\frac{3420}{L+28.8}$
	200 W	$P=\frac{14639}{L+36}$
	400 W	$P=\frac{17579}{L+48}$
MDMF	1.0 kW to 2.0 kW	$P=\frac{19110}{L+11.5}$
	3.0 kW	$P=\frac{34496}{L+11.5}$
	4.0 kW, 5.0 kW	$P=\frac{42336}{L+19}$

Motor series	Motor output	Formula of Load and load point relation
MGMF	850 W to 1.8 kW	$P=\frac{26754}{L+11.5}$
	2.4 kW	$P=\frac{63504}{L+19}$
	2.9 kW	$P=\frac{63504}{L+19}$
	4.4 kW	$P=\frac{79380}{L+19}$
MHMF	50 W	$P=\frac{3240}{L+29}$
	100 W	$P=\frac{4380}{L+43}$
	200 W	$P=\frac{15741}{L+41}$
	400 W	$P=\frac{20176}{L+59}$
	750 W	$P=\frac{36005}{L+66}$
	1.0 kW(□80)	$P=\frac{41101}{L+79}$
	1.0 kW(□130), 1.5kW	$P=\frac{22785}{L+11.5}$
	2.0 kW to 5.0 kW	$P=\frac{46256}{L+19}$

5. Wiring of the Main Circuit

A to B-frame (100 V/200 V Type)

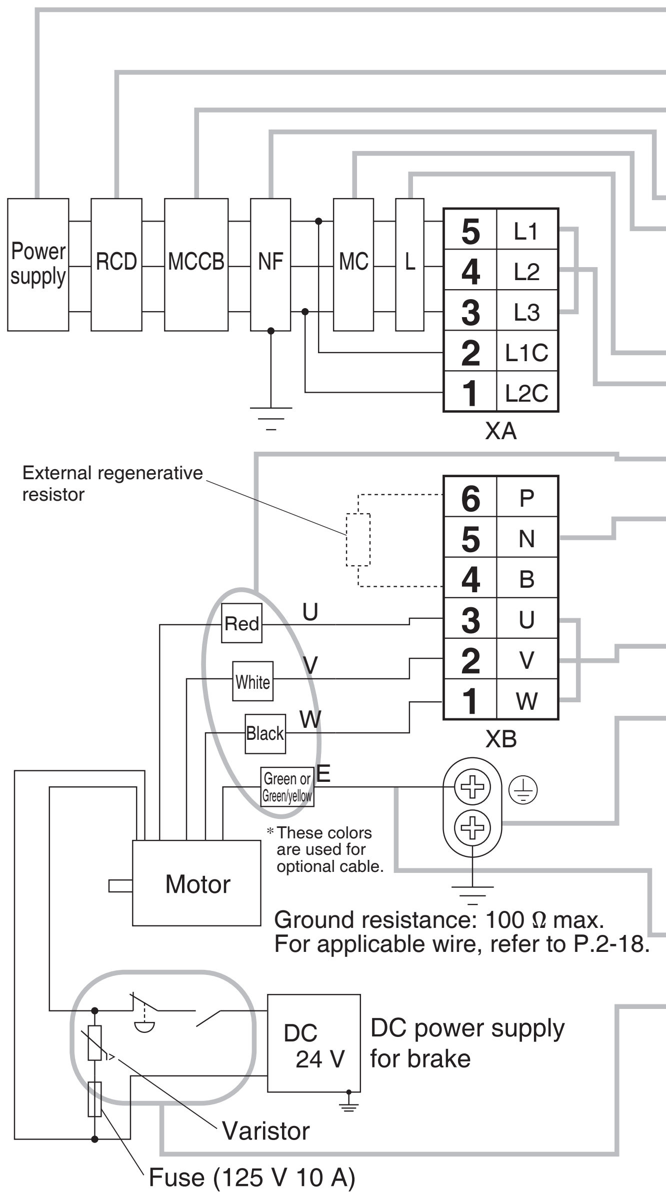
Wiring Sequence

1) Wire connector (XA and XB). (The method of connection refer to P.2-39)
2) Connect the wired connector to the driver.
   Fully insert the connector to the bottom until it is locked.

Caution

- Wiring should be performed by a specialist or an authorized personnel.
- Do not turn on the power until the wiring is completed.
- Never touch the power connector (XA and XB) to which high voltage is applied. There is a risk of electric shock.

Tips on Wiring



- Check the name plate of the driver for power specifications.
- Provide a residual current device. The residual current device to be the one designed for "Inverter" and is equipped with countermeasures for harmonics.
- Provide a circuit breaker (MCCB).
- Make sure to provide a noise filter.
- Provide coil surge suppression units to the coil of the Magnetic Contactor recommended by manufacturer. **Do not start/stop the motor with this Magnetic Contactor.**
- Provide an AC Reactor.
- **Connect L1 and L1C, and L3 and L2C at single phase use (100 V and 200 V), and do not use L2.**
- Match the colors of the motor lead wires to those of the corresponding motor output terminals (U,V,W).
- **Do not connect anything to N.**
- **Avoid shorting and grounding. Do not connect the main power.**
- **Earth-ground this.**
- To prevent electric shock, be sure to connect the ground terminal (⏚) of the driver, and the ground terminal (ground plate) of the control panel.
- The ground terminal (⏚) must not be shared with other equipment. Two ground terminals are provided.
- **Do not connect the earth cable to other inserting slot, nor make them touch.**
- Compose a duplex Brake Control Circuit so that the brake can also be activated by an external immediate stop signal.
- The holding brake has no polarities.
- For the holding brake power supply capacity and how to use the brake, refer to “Built-in Holding Brake” on P.2-65.
- Provide a varistor. Connect a 10 A fuse in series with the varistor.

Note The wiring indicated with the broken line shall be provided only when required.

Related page
• P.2-40 “Specifications of Motor Connector” • P.2-39 “Wiring method to Driver Connector”
• P.7-91 “Connector Kit XA” • P.7-92 “Connector Kit XB” • P.7-104 “External Regenerative Resistor”

• A to B-frame (100 V/200 V Type)

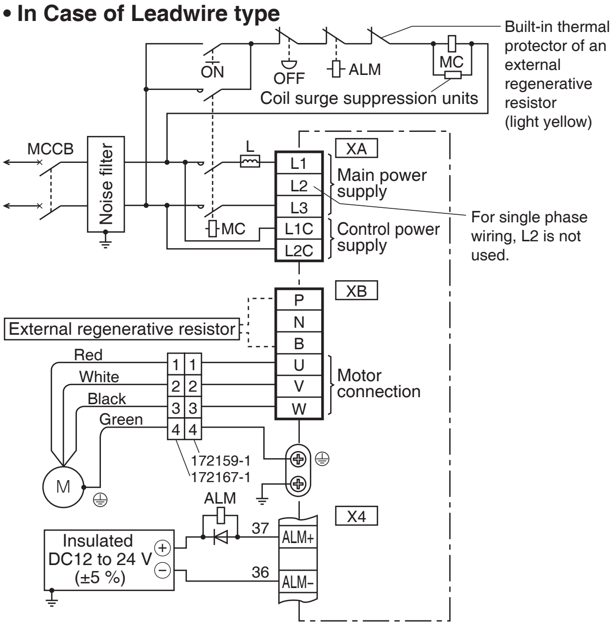
		Name	Symbol	Connector Pin No.	Description
Connector	XA	Main power input terminal	L1	5	100 V type: Single phase AC100 to 120 V $^{+10\,\%}_{-15\,\%}$ 50/60 Hz input. 200 V type: Single phase/3-phase AC200 to 240 V $^{+10\,\%}_{-15\,\%}$ 50/60 Hz input. Use L1 and L3 terminal for single phase input.
			L2	4	
			L3	3	
		Control power input terminal	L1C	2	100 V type: Single phase AC100 to 120 V $^{+10\,\%}_{-15\,\%}$ 50/60 Hz input. 200 V type: Single phase AC200 to 240 V $^{+10\,\%}_{-15\,\%}$ 50/60 Hz input.
			L2C	1	
	XB	Regen resistor connecting terminal	P	6	• When a trip happens due to a regenerative load protection error, connect an external regenerative resistor (prepared by customer) between P and B. Then, specify the external regenerative resistor for the parameter Pr0.16 to 1 or 2. • Do not connect N terminal.
			N	5	
			B	4	
		Motor connecting terminal	U	3	Connect each phase of the motor winding. U: U phase V: V phase W: W phase
			V	2	
			W	1	
Earth terminal			⏚		Earth terminal for grounding. Two terminals are arranged, one of them connect to the ground, and the other is connected with the earth line of the motor.

System Configuration and Wiring

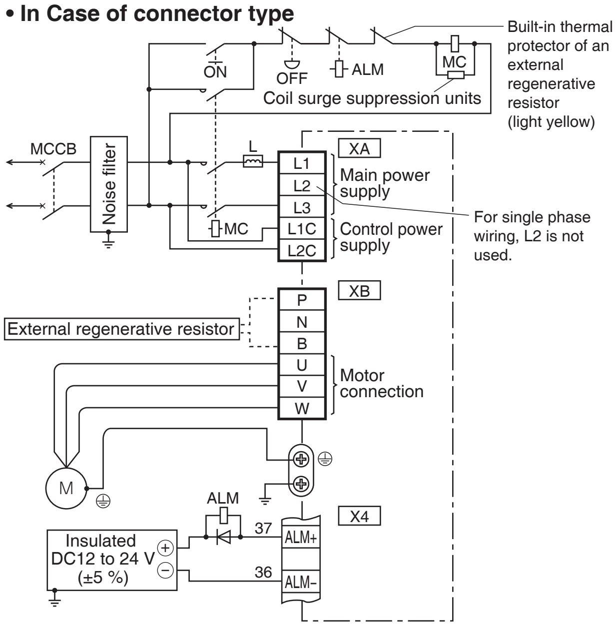
Remarks When the alarm is generated, the main power supply has to be turned off.

Power supply Single phase 100 V/200 V

• In Case of Leadwire type



• In Case of connector type



Note The external regenerative resistor can be built to A, B-frame.

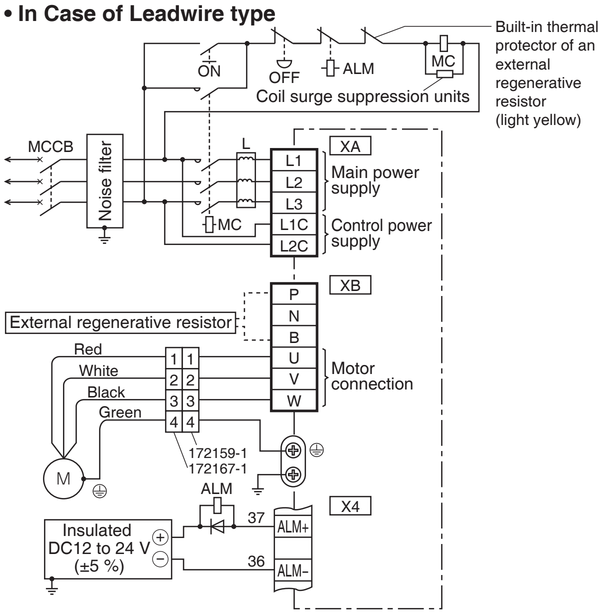
Note The wiring indicated with the broken line shall be provided only when required.

Related page • P.2-40 "Specifications of Motor Connector" • P.2-39 "Wiring method to Driver Connector"

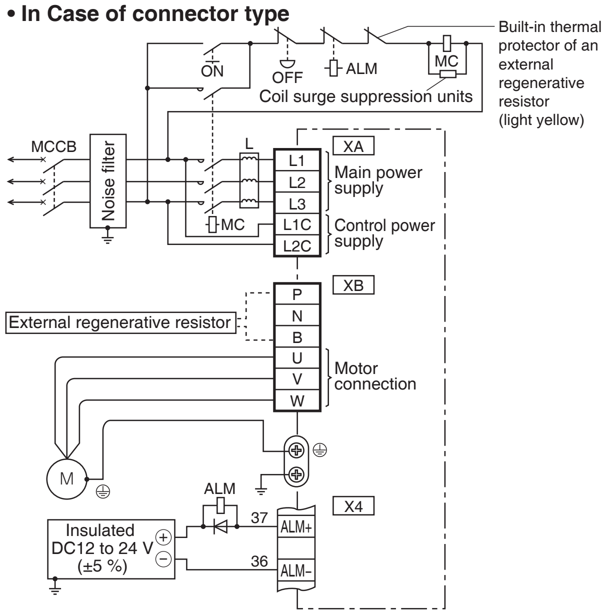
System Configuration and Wiring

Power supply 3-phase 200 V

• In Case of Leadwire type



• In Case of connector type



Note The wiring indicated with the broken line shall be provided only when required.

Related page • P.2-40 “Specifications of Motor Connector” • P.2-39 “Wiring method to Driver Connector”

1 Before Using the Products
2 Preparation
3 Setup
4 Trial Run
5 Adjustment
6 When in Trouble
7 Supplement

5. Wiring of the Main Circuit

C to D-frame (100 V/200 V Type)

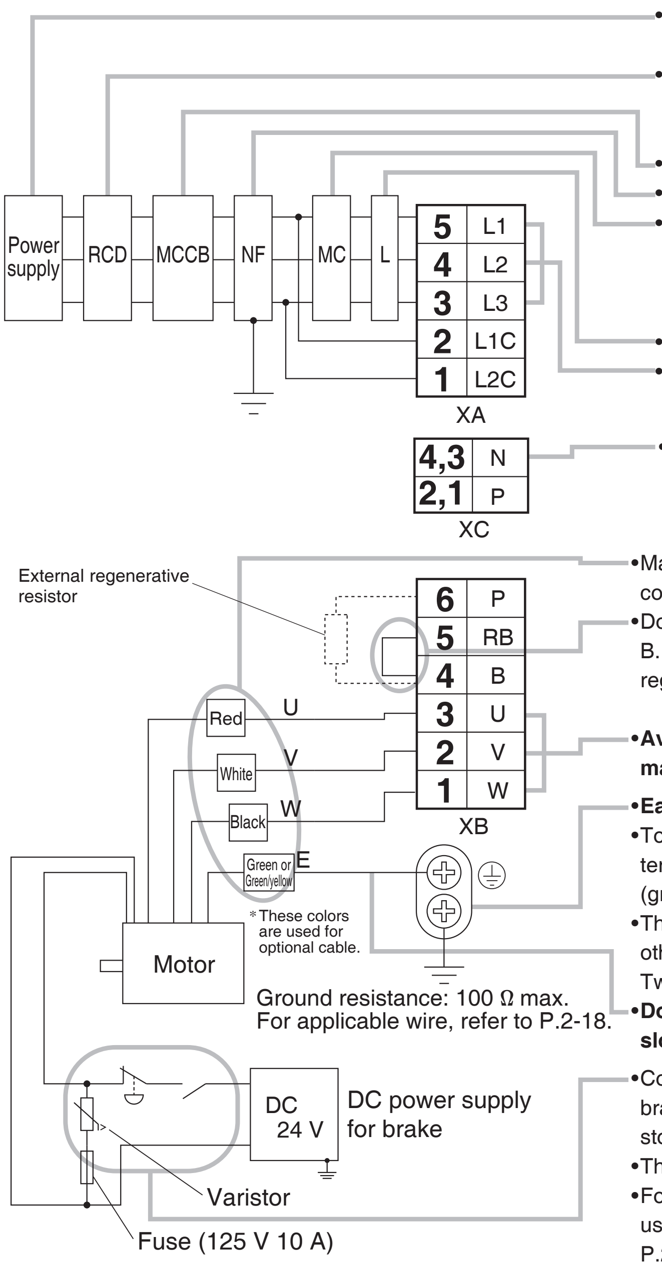
Wiring Sequence

1) Wire connector (XA and XB).(The method of connection refer to P.2-39)
2) Connect the wired connector to the driver.
   Fully insert the connector to the bottom until it is locked.

Caution

- Wiring should be performed by a specialist or an authorized personnel.
- Do not turn on the power until the wiring is completed.
- Never touch the power connector (XA and XB) to which high voltage is applied. There is a risk of electric shock.

Tips on Wiring



- Check the name plate of the driver for power specifications.
- Provide a residual current device. The residual current device to be the one designed for "Inverter" and is equipped with countermeasures for harmonics.
- Provide a circuit breaker (MCCB).
- Make sure to provide a noise filter.
- Provide coil surge suppression units to the coil of the Magnetic Contactor recommended by manufacturer. **Do not start/stop the motor with this Magnetic Contactor.**
- Provide an AC Reactor.
- **Connect L1 and L1C, and L3 and L2C at single phase use (100 V and 200 V), and do not use L2.**
- **Do not connect anything to N.**
- Match the colors of the motor lead wires to those of the corresponding motor output terminals (U,V,W).
- Do not disconnect the shorting cable between RB and B. Disconnect this only when the external regenerative register is used.
- **Avoid shorting and grounding. Do not connect the main power.**
- **Earth-ground this.**
- To prevent electric shock, be sure to connect the ground terminal (⏚) of the driver, and the ground terminal (ground plate) of the control panel.
- The ground terminal (⏚) must not be shared with other equipment. Two ground terminals are provided.
- **Do not connect the earth cable to other inserting slot, nor make them touch.**
- Compose a duplex Brake Control Circuit so that the brake can also be activated by an external immediate stop signal.
- The holding brake has no polarities.
- For the holding brake power supply capacity and how to use the brake, refer to “Built-in Holding Brake” on P.2-65.
- Provide a varistor. Connect a 10 A fuse in series with the varistor.

Note The wiring indicated with the broken line shall be provided only when required.

Related page
• P.2-40 “Specifications of Motor Connector” • P.2-39 “Wiring Method to Driver Connector”
• P.7-91 “Connector Kit XA” • P.7-92 “Connector Kit XB” • P.7-104 “External Regenerative Resistor”

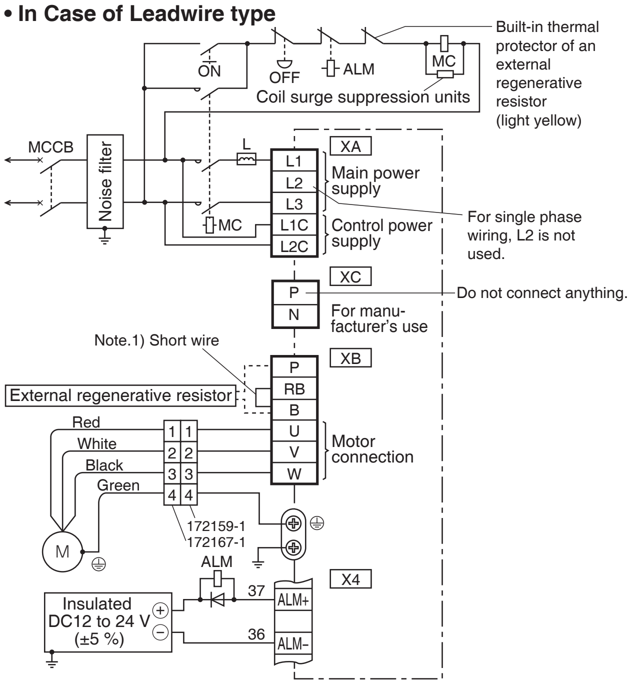
• C to D-frame (100 V/200 V Type)

Name			Symbol	Connector Pin No.	Description
Connetor	XA	Main power input terminal	L1	5	100 V type: Single phase AC100 to 120 V $^{+10\,\%}_{-15\,\%}$ 50/60 Hz input. 200 V type: Single phase/3-phase AC200 to 240 V $^{+10\,\%}_{-15\,\%}$ 50/60 Hz input. Use L1 and L3 terminal for single phase input.
			L2	4	
			L3	3	
		Control power input terminal	L1C	2	100 V type: Single phase AC100 to 120 V $^{+10\,\%}_{-15\,\%}$ 50/60 Hz input. 200 V type: Single phase AC200 to 240 V $^{+10\,\%}_{-15\,\%}$ 50/60 Hz input.
			L2C	1	
	XB	Regen resistor connecting terminal	P	6	Normally, short out the circuit between B and RB. When a trip happens due to a regenerative load protection error, open the circuit between B and RB and connect an external regenerative resistor (prepared by customer) between P and B. Then, specify the external regenerative resistor for the parameter Pr0. 16 set to 1 or 2.
			RB	5	
			B	4	
		Motor connecting terminal	U	3	Connect each phase of the motor winding. U: U phase V: V phase W: W phase
			V	2	
			W	1	
Earth terminal			⏚		Earth terminal for grounding. Two terminals are arranged, one of them connect to the ground, and the other is connected with the earth line of the motor.

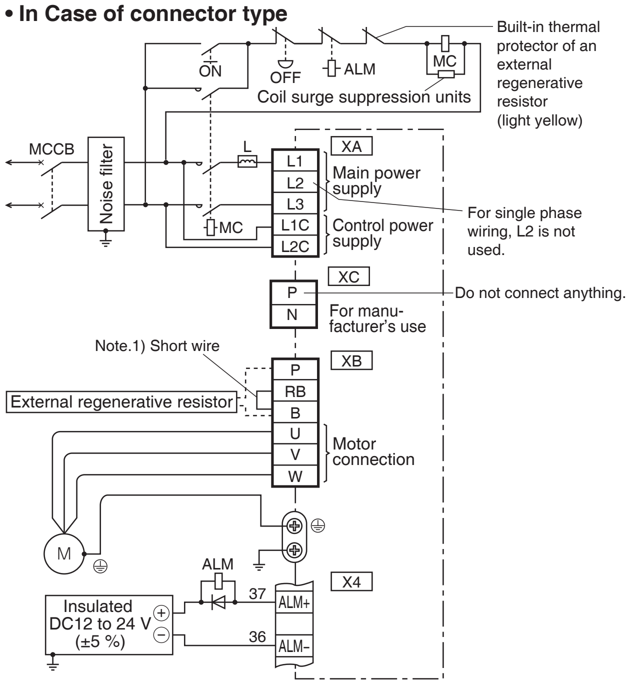
System Configuration and Wiring

Remarks When the alarm is generated, the main power supply has to be turned off.

• In Case of Leadwire type



• In Case of connector type



Note The regenerative resistor is built into C, D-frame.
The external regenerative resistor can be built to C, D-frame.

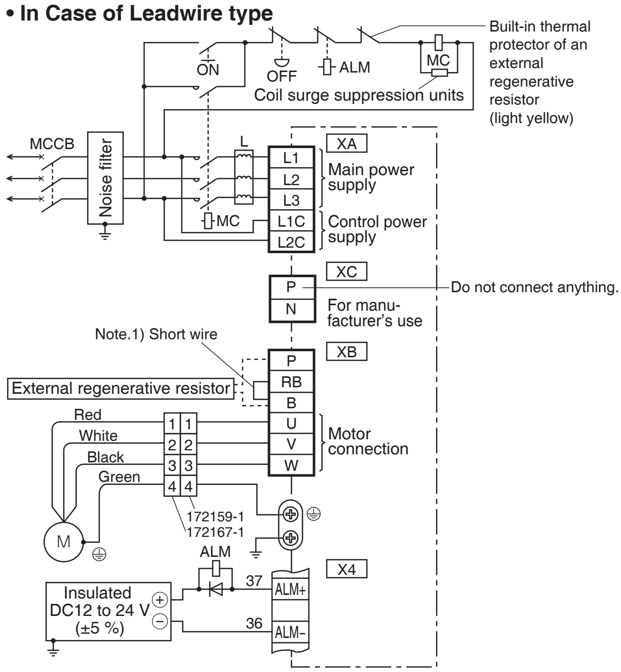
Note The wiring indicated with the broken line shall be provided only when required.

Related page • P.2-40 "Specifications of Motor Connector" • P.2-39 "Wiring Method to Driver Connector"

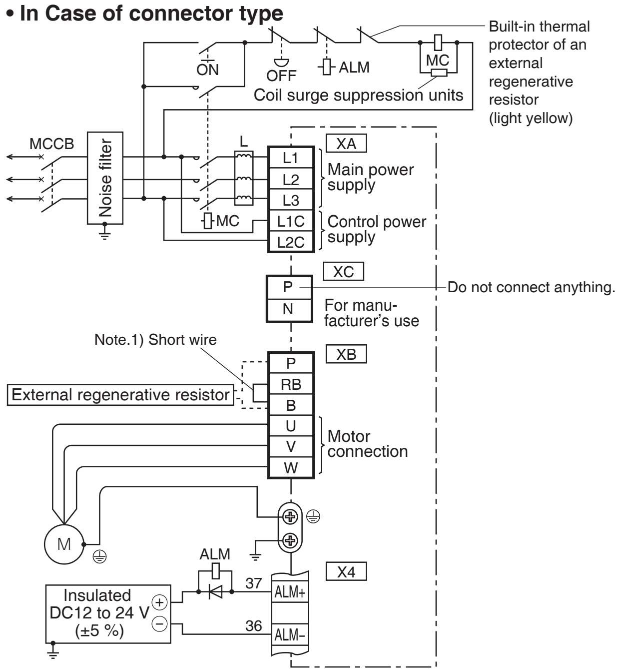
System Configuration and Wiring

Power supply 3-phase

• In Case of Leadwire type



• In Case of connector type



Note The wiring indicated with the broken line shall be provided only when required.

Related page • P.2-40 "Specifications of Motor Connector" • P.2-39 "Wiring Method to Driver Connector"

5. Wiring of the Main Circuit

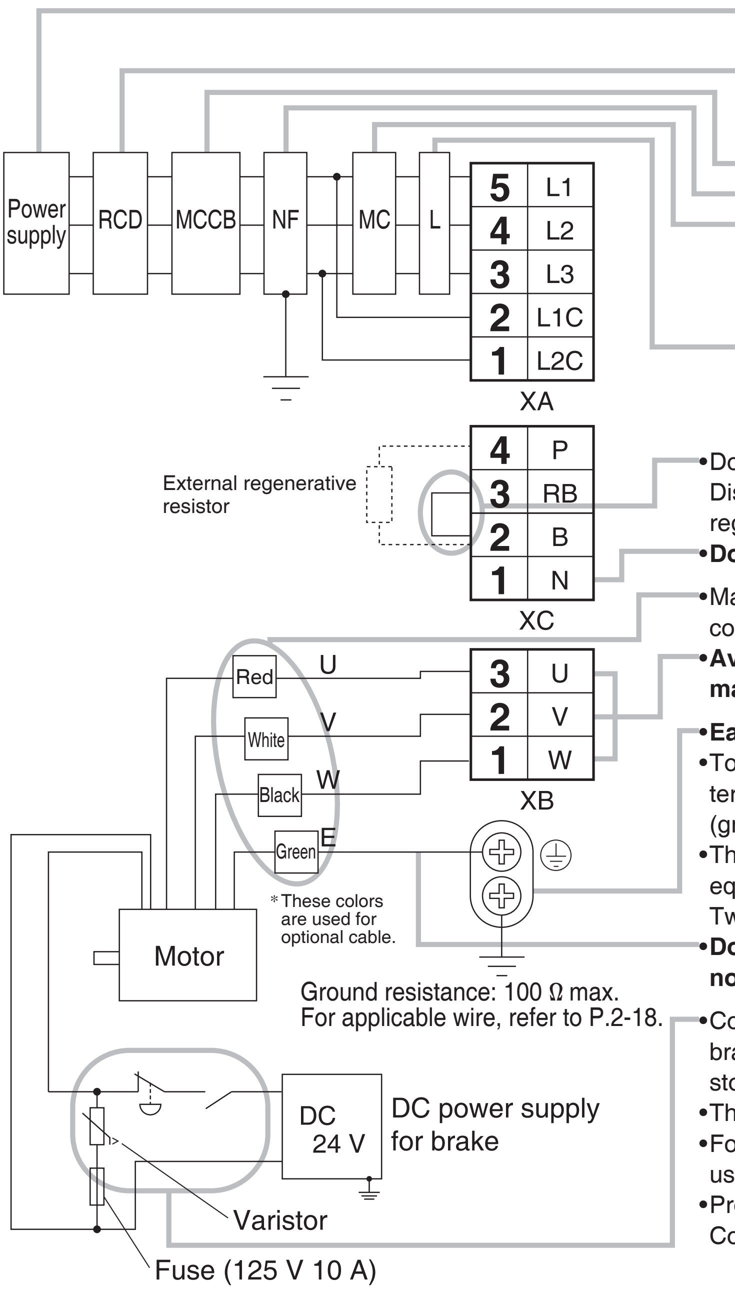
E-frame (200 V Type)

Wiring Sequence

1) Wire connector (XA, XB and XC). (The method of connection refer to P.2-39)
2) Connect the wired connector to the driver.
   Fully insert the connector to the bottom until it is locked.

Caution
- Wiring should be performed by a specialist or an authorized personnel.
- Do not turn on the power until the wiring is completed.
- Never touch the power connector (XA, XB and XC) to which high voltage is applied.
  There is a risk of electric shock.

Tips on Wiring



- Check the name plate of the driver for power specifications.
- Provide a residual current device. The residual current device to be the one designed for "Inverter" and is equipped with countermeasures for harmonics.
- Provide a circuit breaker (NCCB).
- Make sure to provide a noise filter.
- Provide coil surge suppression units to the coil of the Magnetic Contactor recommended by manufacturer. **Do not start/stop the motor with this Magnetic Contactor.**
- Provide an AC Reactor.
- Do not disconnect the shorting cable between RB and B. Disconnect this only when the external regenerative register is used.
- **Do not connect anything to N.**
- Match the colors of the motor lead wires to those of the corresponding motor output terminals (U,V,W).
- **Avoid shorting and grounding. Do not connect the main power.**
- **Earth-ground this.**
- To prevent electric shock, be sure to connect the ground terminal (⏚) of the driver, and the ground terminal (ground plate) of the control panel.
- The ground terminal (⏚) must not be shared with other equipment.
  Two ground terminals are provided.
- **Do not connect the earth cable to other inserting slot, nor make them touch.**
- Compose a duplex Brake Control Circuit so that the brake can also be activated by an external immediate stop signal.
- The holding brake has no polarities.
- For the holding brake power supply capacity and how to use the brake, refer to “Built-in Holding Brake” on P.2-65.
- Provide a varistor.
  Connect a 10 A fuse in series with the varistor.

Note The wiring indicated with the broken line shall be provided only when required.

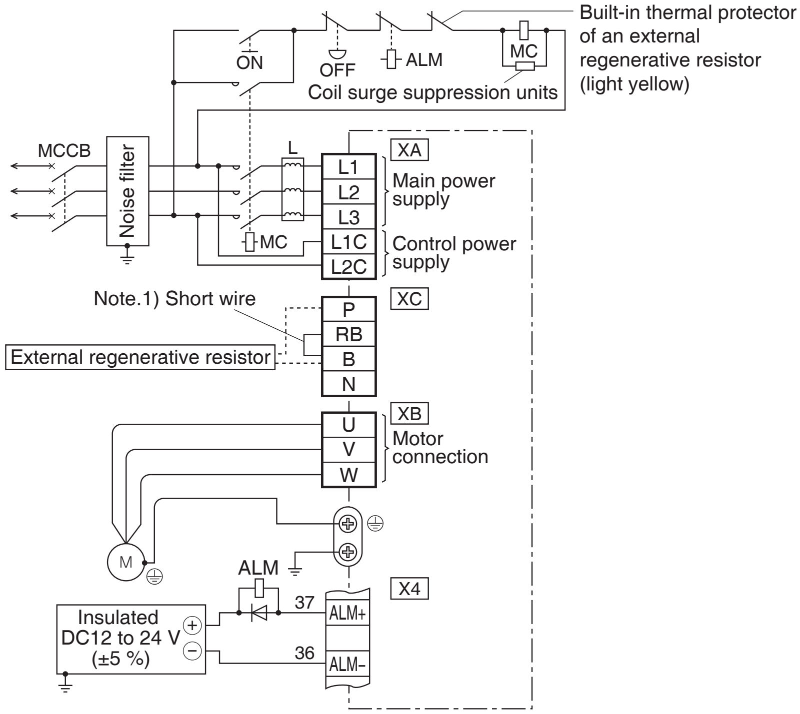
Related page
• P.2-40 “Specifications of Motor Connector” • P.2-39 “Wiring Method to Driver Connector”
• P.7-91 “Connector Kit XA” • P.7-92 “Connector Kit XB” • P.7-104 “External Regenerative Resistor”

• E-frame (200 V Type)

Name			Symbol	Connector Pin No.	Description
Connector	XA	Main power input terminal	L1	5	3-phase AC200 to 240 V $^{+10}_{-15}$ % 50/60 Hz input.
			L2	4	
			L3	3	
		Control power input terminal	L1C	2	Single phase AC200 to 240 V $^{+10}_{-15}$ % 50/60 Hz input.
			L2C	1	
	XC	Regen resistor connecting terminal	P	4	Normally, short out the circuit between RB and B. When a trip happens due to a regenerative load protection error, open the circuit between RB and B and connect an external regenerative resistor (prepared by customer) between P and B. Then, specify the external regenerative resistor for parameter Pr0. 16. Do not connect N terminal.
			RB	3	
			B	2	
			N	1	
	XB	Motor connecting terminal	U	3	Connect each phase of the motor winding. U: U phase V: V phase W: W phase
			V	2	
			W	1	
Earth terminal			⏚		Earth terminal for grounding. Two terminals are arranged, one of them connect to the ground, and the other is connected with the earth line of the motor.

System Configuration and Wiring

Remarks When the alarm is generated, the main power supply has to be turned off.



Note The regenerative resistor is built into E-frame or can use external regenerative resistor.

Note The wiring indicated with the broken line shall be provided only when required.

Related page • P.2-40 “Specifications of Motor Connector” • P.2-39 “Wiring Method to Driver Connector”

5. Wiring of the Main Circuit

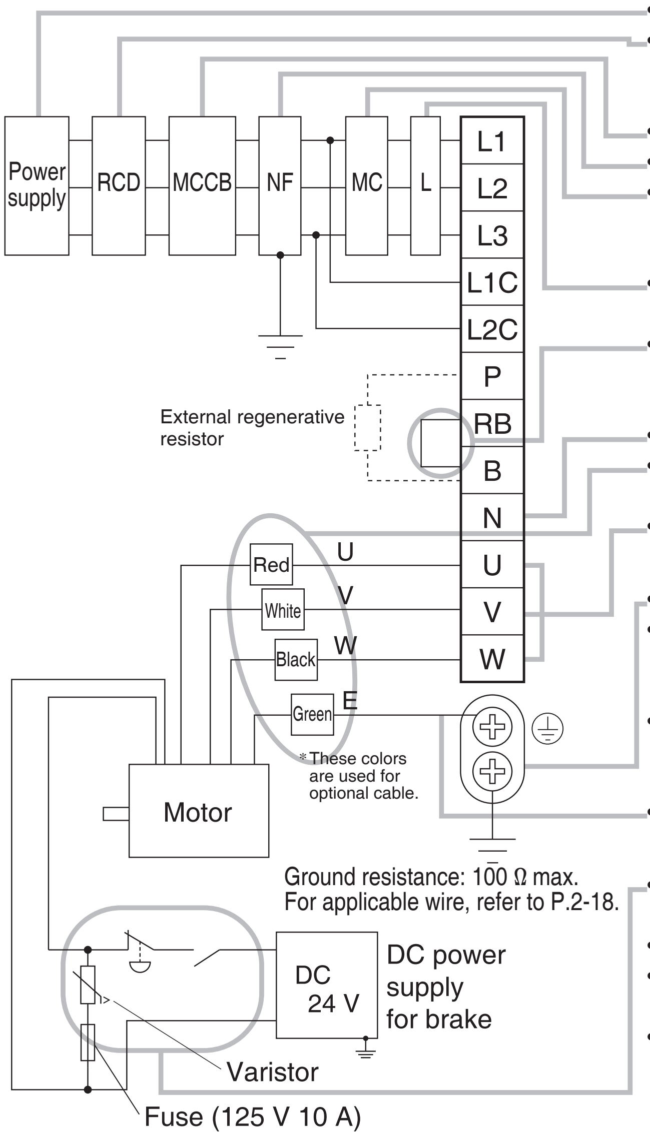
F-frame (200 V Type)

Wiring Sequence

1) Take off the cover fixing screws, and detach the terminal cover.
2) Make wiring
   Use clamp type terminals of round shape with insulation cover for wiring to the terminal block. For cable diameter and size, reter to "List of Applicable Peripheral Equipments of Driver" (P.2-18).
   Tighten the terminal block screw with a torque written on P.2-19.
3) Attach the terminal cover, and fix with screws.
   Tighten the screw securing the cover with a torque written on P.2-19.

Caution
- Wiring should be performed by a specialist or an authorized personnel.
- Do not turn on the power until the wiring is completed.
- Never touch the terminal to which high voltage is applied. There is a risk of electric shock.

Tips on Wiring



- Check the name plate of the driver for power specifications.
- Provide a residual current device. The residual current device to be the one designed for "Inverter" and is equipped with countermeasures for harmonics.
- Provide a circuit breaker (MCCB).
- Make sure to provide a noise filter.
- Provide coil surge suppression units to the coil of the Magnetic Contactor recommended by manufacturer. **Do not start/stop the motor with this Magnetic Contactor.**
- Provide an AC Reactor.
- Do not disconnect the short bar between RB and B. Disconnect this only when an external regenerative register is used.
- **Do not connect anything to N.**
- Match the colors of the motor lead wires to those of the corresponding motor output terminals (U,V,W).
- **Avoid shorting and grounding.**
  Do not connect the main power.
- **Earth-ground this.**
- To prevent electric shock, be sure to connect the ground terminal (⏚) of the driver, and the ground terminal (ground plate) of the control panel.
- The ground terminal (⏚) must not be shared with other equipment.
  Two ground terminals are provided.
- **Do not connect the earth cable to other inserting slot, nor make them touch.**
- Compose a duplex Brake Control Circuit so that the brake can also be activated by an external immediate stop signal.
- The holding brake has no polarities.
- For the holding brake power supply capacity and how to use the brake, refer to "Built-in Holding Brake" on P.2-65.
- Provide a varistor.
  Connect a 10 A fuse in series with the varistor.

Note The wiring indicated with the broken line shall be provided only when required.

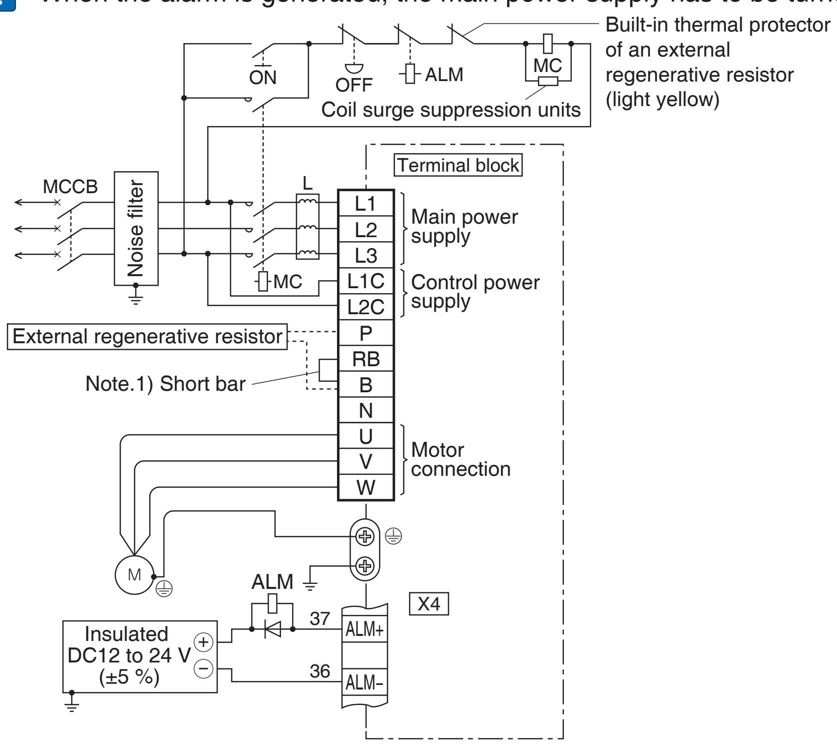
Related page • P.2-40 "Specifications of Motor Connector" • P.7-104 "External Regenerative Resistor"

• F-frame (200 V Type)

Name		Symbol	Terminal No. (Upper to bottom)	Description
Terminal block	Main power input terminal	L1	1	3-phase AC200 to 240 V $^{+10\,\%}_{-15\,\%}$ 50/60 Hz input.
		L2	2	
		L3	3	
	Control power input terminal	L1C	4	Single phase AC200 to 240 V $^{+10\,\%}_{-15\,\%}$ 50/60 Hz input.
		L2C	5	
	Regen resistor connecting terminal	P	6	Normally, short out the circuit between RB and B. When a trip happens due to a regenerative load protection error, open the circuit between RB and B and connect an external regenerative resistor (prepared by customer) between P and B. Then, specify the external regenerative resistor for parameter Pr0. 16. to 1 or 2. Do not connect N terminal.
		RB	7	
		B	8	
		N	9	
	Motor connecting terminal	U	10	Connect each phase of the motor winding. U: U phase V: V phase W: W phase
		V	11	
		W	12	
Earth terminal		⏚		Earth terminal for grounding. Two terminals are arranged, one of them connect to the ground, and the other is connected with the earth line of the motor.

System Configuration and Wiring

Remarks When the alarm is generated, the main power supply has to be turned off.



Note The regenerative resistor is built into E-frame or can use external regenerative resistor.

Note The wiring indicated with the broken line shall be provided only when required.

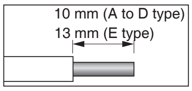
Related page • P.2-40 “Specifications of Motor Connector”

Wiring Method to Driver Connector

• Follow the procedures below for the wiring connection to the Connector XA, XB and XC.

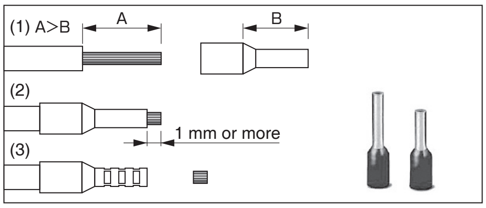
How to Connect

1. Strip the cable.
  • For single wire (Please refer to the length in figure.)
  • For stranded wires (ferrules must be used as illustrated below).



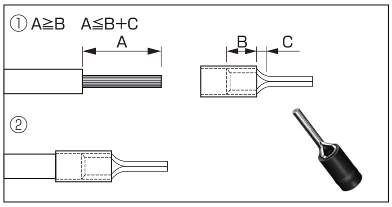
Example: Ferrules with plastic insulating sleeve (AI series, Phoenix Contact, Ltd.)

1) Peel off the sheath so that the conductor portion of the cable will protrude from the tip of the ferrule. (It should protrude 1 mm or more from the ferrule.)
2) Insert the cable into the ferrule and crimp it with an appropriate crimping tool.
3) After crimping, cut off the cable conductor portion protruding from the ferrule. (The allowable protruding length after cutting should be 0 to 0.5 mm.)
  • Part No. of the crimping tool:
    CRIMPFOX U-D66 (1204436)
    Available from Phoenix Contact, Ltd.



Examples: Nylon-insulated ferrule (NTUB series, J.S.T. Mfg. Co., Ltd.)
Vinyl-insulated ferrule (VTUB series, J.S.T. Mfg. Co., Ltd.)

1) Peel off the sheath of the cable conductor portion to the length equal to that of sheath on the ferrule.
2) Insert the cable into the ferrule and crimp it with an appropriate crimping tool.
  • Part No. of the crimping tool: YNT-1614
    Available from J.S.T. Mfg. Co., Ltd



• When peeling off the sheath of the cable, take care not to damage other portions.
• When crimping the ferrule, sufficiently check the status of the ferrule and cable. If the conductors of the cable stick out from the insulation cover or protrude excessively from the tip of the ferrule, accidents such as an electric shock and fire from a short circuit may result.

A to C (100 V/200 V), D (200 V) specifications

<Cables Compatible with Connector>

Conductor Size	AWG18 to 14
Sheath Outline	ϕ 2.1 mm to ϕ 3.8 mm

<Recommended Connector Bar Terminal>

Conductor Size	AWG18
Terminal Model Number	AI0.75-8GY (Phoenix Contact, Ltd.)

E (200 V) specifications

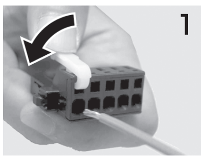
<Cables Compatible with Connector>

Conductor Size	AWG18 to 12
Sheath Outline	ϕ 2.1 mm to ϕ 4.2 mm

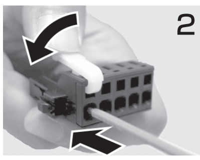
<Recommended Connector Bar Terminal>

Conductor Size	AWG16 to 14
Terminal Model Number	VTUB-2 or NTUB-2 (J.S.T. Mfg. Co., Ltd)

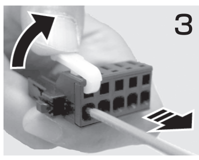
2. Insert the cable to the connector in the following



Attach the handle lever to the handling slot on the upper portion. Press down the lever to push down the spring.



Insert the cable while pressing down the lever, until it hits the insertion slot.



You can wire it by releasing the operating lever. Please pull the wire lightly and make sure that the wire is securely connected.

* You can pull out the cable by pushing down the spring as the above.

* Please be careful that all the strands are inserted into the spring opening.

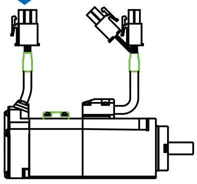
• Take off the connector from the Servo Driver before making connection.
• Insert only one cable into each one of cable insertion slot.
• Please keep the operating lever after use.
• Since the strip length of the electric wire depends on the type of electric wire, please decide the optimum strip length according to the processing condition.

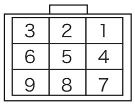
When leadwire type was be used

- **When the motors of <MSMF, MQMF, MHMF> are used, they are connected as shown below.**

Connector: Made by Tyco Electronics k.k, (The figures below show connectors for the motor.)

Connector for encoder





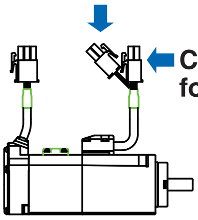
172169-1

PIN No.	Application
1*	BAT+
2*	BAT-
3	FG(SHIELD)
4	PS
5	PS
6	NC
7	E5V
8	E0V
9	NC

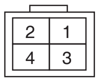
*When use absolute encoder (multi-turn data is not used), do not connect to 1-pin and 2-pin.

Connector for brake

Connector for motor



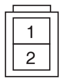
<Connector for motor>



172167-1

PIN No.	Application
1	U-phase
2	V-phase
3	W-phase
4	Ground

<Connector for brake>



172165-1

PIN No.	Application
1	Brake
2	Brake

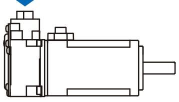
When connector type was be used

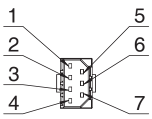
- **When the motors of <MSMF, MQMF, MHMF(50 W to 1.0 kW □80)> are used, they are connected as shown below.**

Connector: Made by Japan Aviation Electronics Industry, Ltd. (The figures below show connectors for the motor.)

* Do not remove the gasket supplied with the junction cable connector. Securely install the gasket in place. Otherwise, the degree of protection of IP67 will not be guaranteed.

Connector for encoder





JN6CR07PM2
JN6CR07PM4

PIN No.	Application
1	FG(SHIELD)
2*	BAT−
3	E0V
4	PS
5*	BAT+
6	E5V
7	PS

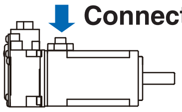
*When use absolute encoder (multi-turn data is not used), do not connect to 2-pin and 5-pin.

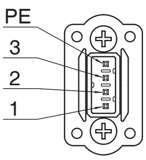
Tightening torque of the screw (M2) 0.19 N·m to 0.21 N·m

*Be sure to use only the screw supplied with the connector, to avoid damage.

MSMF(50 W to 1.0 kW(□80))

Connector for motor





JN8AT04NJ1

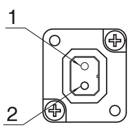
PIN No.	Application
1	U-phase
2	V-phase
3	W-phase
PE	Ground

Tightening torque of the screw (M2) 0.085 N·m to 0.095 N·m (screwed to plastic)

*Be sure to use only the screw supplied with the connector, to avoid damage.

[Motor with brake]

Connector for brake



JN4AT02PJM-R

PIN No.	Application
1	Brake
2	Brake

* Electromagnetic brake is a nonpolar device.

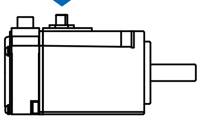
Tightening torque of the screw (M2) 0.19 N·m to 0.21 N·m

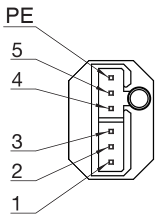
*Be sure to use only the screw supplied with the connector, to avoid damage.

Remarks Do not connect anything to NC.

MHMF(50 W, 100 W)

Connector for motor





JN11AH06NN2

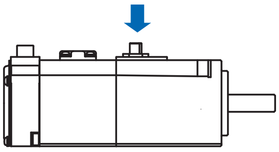
PIN No.	Application
1	U-phase
2	V-phase
3	W-phase
4	NC
5	NC
PE	Ground

Tightening torque of the screw (M2) 0.085 N·m to 0.095 N·m (screwed to plastic)

* Be sure to use only the screw supplied with the connector, to avoid damage.

[Motor with brake]

Connector for motor and brake

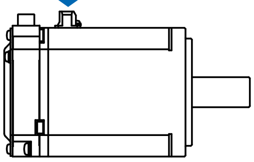


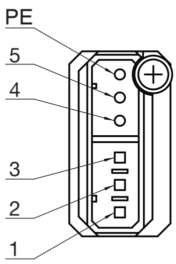
PIN No.	Application
1	U-phase
2	V-phase
3	W-phase
4	Brake
5	Brake
PE	Ground

* Electromagnetic brake is a nonpolar device.

MQMF, MHMF(200 W to 1.0 kW(□80))

Connector for motor





JN11AH06NN1

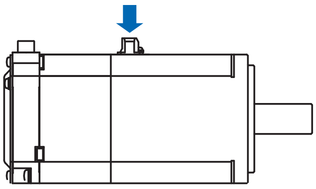
PIN No.	Application
1	U-phase
2	V-phase
3	W-phase
4	NC
5	NC
PE	Ground

Tightening torque of the screw (M2) 0.085 N·m to 0.095 N·m (screwed to plastic)

* Be sure to use only the screw supplied with the connector, to avoid damage.

[Motor with brake]

Connector for motor and brake



PIN No.	Application
1	U-phase
2	V-phase
3	W-phase
4	Brake
5	Brake
PE	Ground

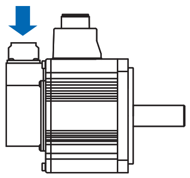
* Electromagnetic brake is a nonpolar device.

Remarks Do not connect anything to NC.

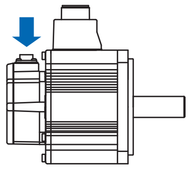
- **When the motors of <MSME(1.0 kW(□100) to 5.0 kW), MDMF, MGMF, MHMF(1.0 kW(□130) to 5.0 kW)> are used, they are connected as shown below.**
  Connector: Made by Japan Aviation Electronics Industry, Ltd. (The figures below show connectors for the motor.)

• Connector for encoder

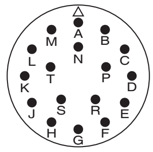
Connector for encoder (Large type) JL10



Connector for encoder (Small type) LN2



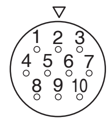
<Encoder connector JL10>



JL10-2A20-29P

PIN No.	Application
A	NC
B	NC
C	NC
D	NC
E	NC
F	NC
G	E0V
H	E5V
J	FG(SHIELD)
K	PS
L	$\overline{PS}$
M	NC
N	NC
P	NC
R	NC
S*	BAT−
T*	BAT+

<Encoder connector JN2>



JN2AS10ML3-R

PIN No.	Application
1	E0V
2	NC
3	PS
4	E5V
5*	BAT−
6*	BAT+
7	$\overline{PS}$
8	NC
9	FG(SHIELD)
10	NC

*When use absolute encoder (multi-turn data is not used), do not connect to 5-pin and 6-pin.

Remarks

Do not connect anything to NC.

*When use absolut encoder(multi-turn data is not used), do not connect to S-pin and T-pin.

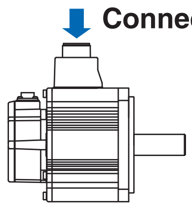
• Connector for motor/brake

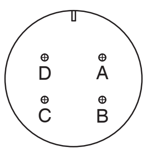
Table of Connector for motor and Connector for brake

Motor model	Motor capacity	200 V	
		with Brake	without Brake
MSMF	1.0 kW(□100) to 2.0 kW	A	C
	3.0 kW to 5.0 kW	B	D
MDMF	1.0 kW to 2.0 kW	A	C
	3.0 kW to 5.0 kW	B	D

Motor model	Motor capacity	200 V	
		with Brake	without Brake
MGMF	850 W to 1.8 kW	A	C
	2.4 kW, 2.9 kW, 4.4 kW	B	D
MHMF	1.0 kW(□130) to 1.5 kW	A	C
	2.0 kW to 5.0 kW	B	D

Connector for motor

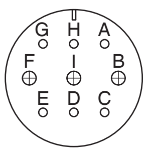




A JL10-2E20-4PE-B

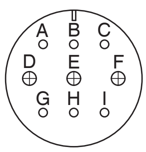
B JL10-2E22-22PE-B

PIN No.	Application
A	U-phase
B	V-phase
C	W-phase
D	Ground



C JL10-2E20-18PE-B

PIN No.	Application
G	with Brake: Brake without Brake: NC
H	with Brake: Brake without Brake: NC
A	NC
F	U-phase
I	V-phase
B	W-phase
E	Ground
D	Ground
C	NC



D JL10-2E24-11PE-B

PIN No.	Application
A	with Brake: Brake without Brake: NC
B	with Brake: Brake without Brake: NC
C	NC
D	U-phase
E	V-phase
F	W-phase
G	Ground
H	Ground
I	NC

Remarks

Do not connect anything to NC.

6. Wiring to the Connector, X1

Connecting Host Computer

This is used for USB connection to a personal computer. It is possible to change the parameter setting and perform monitoring.

Application	Symbol	Connector Pin No.	Description
USB signal terminal	VBUS	1	Use for communication with personal computer.
	D−	2	
	D+	3	
	—	4	Do not connect.
	GND	5	Connected to ground of control circuit.

Caution Use commercially available USB mini-B connector for the driver.

Remarks
- X1 to X7 are used for the secondary circuit. To connect these terminals to the primary power supply (particularly, the 24 VDC power supply for brake), insulation is required.
  Do not connect these terminals to the same power supply.

Connecting to communication cable.

[X2A] RX connector

Name	Symbol	Connector Pin no.	Description
Unused	—	1	Connect to pin 1 on TX connector of sending side node.
Unused	—	2	Connect to pin 2 on TX connector of sending side node.
Network input+	RX+	3	Connect to pin 3 on TX connector of sending side node.
Unused	—	4	Connect to pin 4 on TX connector of sending side node.
Unused	—	5	Connect to pin 5 on TX connector of sending side node.
Network input−	RX−	6	Connect to pin 6 on TX connector of sending side node.
Unused	—	7	Connect to pin 7 on TX connector of sending side node.
Unused	—	8	Connect to pin 8 on TX connector of sending side node.
Frame ground	FG	Shell	Connect to shield of cable.

[X2B] TX connector

Name	Symbol	Connector Pin no.	Description
Unused	—	1	Connect to pin 1 on RX connector of receiving side node.
Unused	—	2	Connect to pin 2 on RX connector of receiving side node.
Network output+	TX+	3	Connect to pin 3 on RX connector of receiving side node.
Unused	—	4	Connect to pin 4 on RX connector of receiving side node.
Unused	—	5	Connect to pin 5 on RX connector of receiving side node.
Network output−	TX−	6	Connect to pin 6 on RX connector of receiving side node.
Unused	—	7	Connect to pin 7 on RX connector of receiving side node.
Unused	—	8	Connect to pin 8 on RX connector of receiving side node.
Frame ground	FG	Shell	Connect to shield of cable.

*Be sure to use shielded twisted pair (STP) compatible with 5e of TIA/EIA-568 or higher category.

Remarks

- X1 to X7 are used for the secondary circuit. To connect these terminals to the primary power supply (particularly, the 24 VDC power supply for brake), insulation is required.
  Do not connect these terminals to the same power supply.

Tips on Wiring

(1) Be sure to use shielded twisted pair (STP) compatible with CAT5e or higher category.
- 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, refer to TIA/E1A568B (see figure below).
- Pins 3 and 6 are for signal wire.
- Connect wire to 3 pin pairs on the connector: 1–2, 4–5 and 7–8.
- When using 2-pair wire in place of 4-pair wire, use pins 1–2 and 3–6 and leave pins 4–5 and 7–8 on connector unconnected.

(2) Legth of communication cable

a . Between 2 nodes: max. 100 m
b. Total length of cables between all nodes in the communication loop: max. 200 m

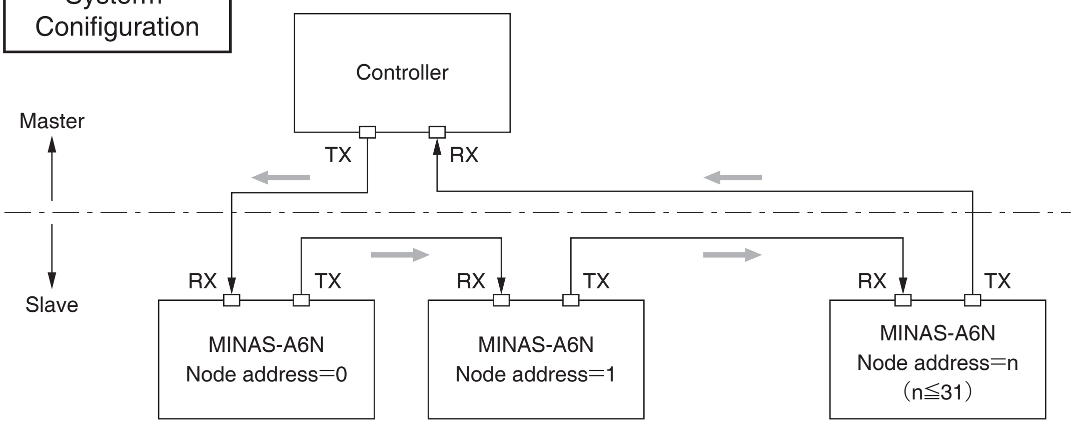
- Both requirements should be met.
- If the requirement b above cannot be met, consult with us.

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-**LBN Category 5e, STP

Systerm Conifiguration

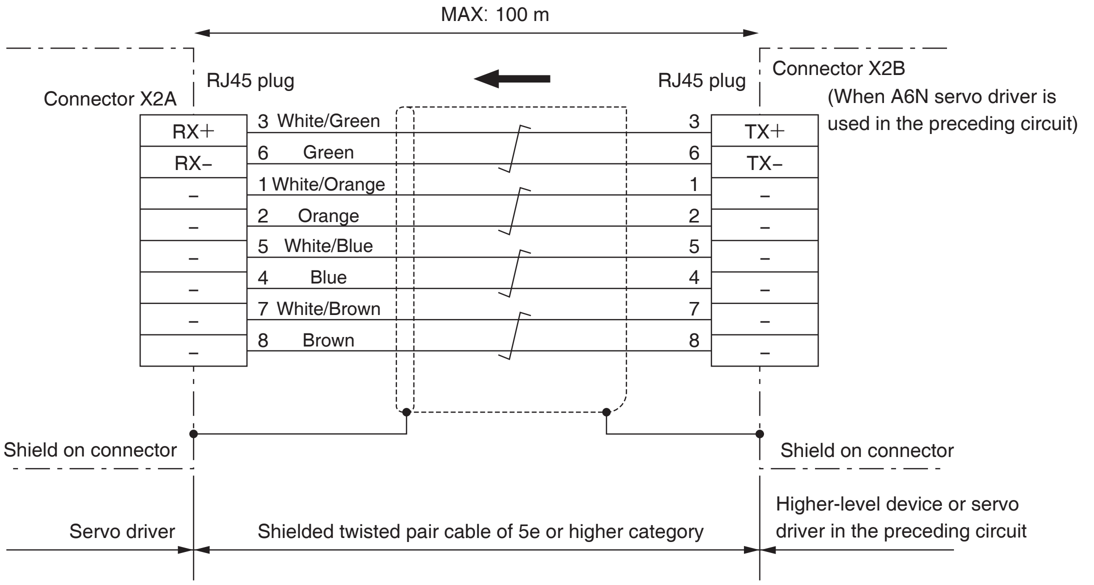


Node address is the ID (MAC-ID) used to identify the slave on the network, and set up with the rotary switch (RSW) on the front panel.
The details of wiring, the node address setting procedure, refer to Reference Specification of the upper controller.

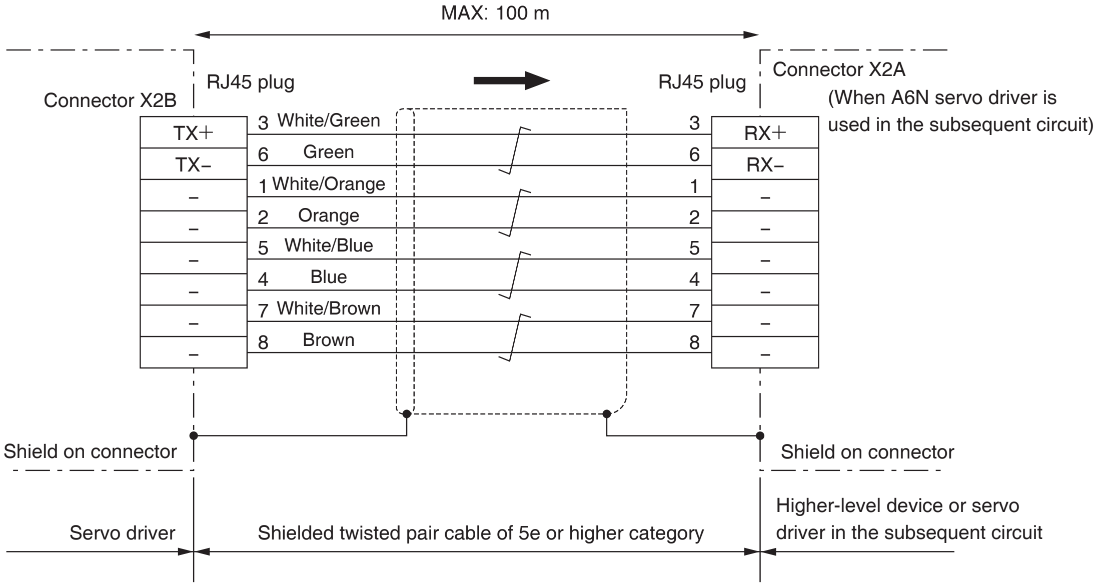
Remarks
- X1 to X7 are used for the secondary circuit. To connect these terminals to the primary power supply (particularly, the 24 VDC power supply for brake), insulation is required.
Do not connect these terminals to the same power supply.

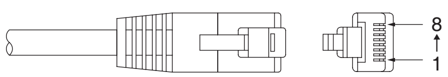
Example of Connecting to Connector X2A, X2B

Connection to X2A



Connection to X2B



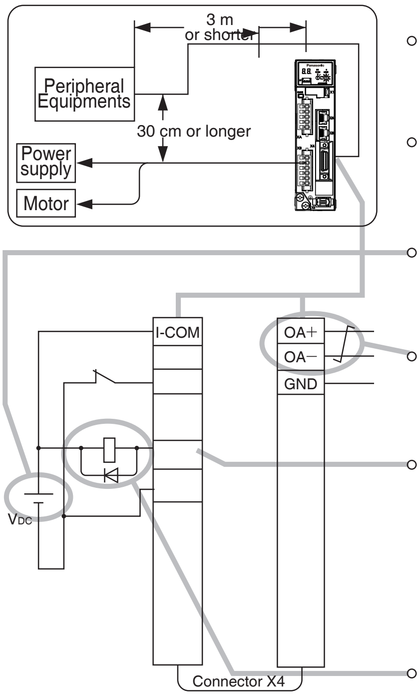


Pin placement of RJ45 plug

8. Wiring to the Connector, X4

Connection to I/O

Tips on Wiring



- Peripheral apparatus such as host controller should be located within 3 m.
- Separate the main circuit at least 30 cm away.
  Do not pass them in the same duct, nor bind them together.
- Power supply for control signals (Vcc) between COM+ and COM– (VDC) should be prepared by customer.
  Vdc:12 to 24 V
- Use shield twisted pair for the wiring of command pulse input and encoder signal output.
- Do not apply more than 24 V to the control signal output terminals, nor run more than current below .
  Rated current: 40 mA
  Maximum current: 50 mA
  Inrush current: 90 mA
- When the relay is directly driven by the control output signals, install a diode in parallel with a relay, and in the direction as the Fig. shows. The driver might be damaged without a diode installment, or by reverse direction.
- Frame ground (FG) and the shell of connector is connected to the earth terminal inside of the driver.

- **Specifications of the Connector, X4**

Connecter to be prepared by customer		Manufacturer
Part name	Part No.	
Connecter (soldering type)	DF02P050F22A1	Japan Aviation Electronics Ind.
Connector cover	DF02P050B22A1	
Connecter (soldering type)	52316-2619	Molex Inc.
Connector cover	54331-0261	
Connecter (soldering type)	10150-3000PE	Sumitomo 3M
Connector cover	10350-52A0-008	

Note
- For details, refer to P.7-69, "Options" of Supplement.

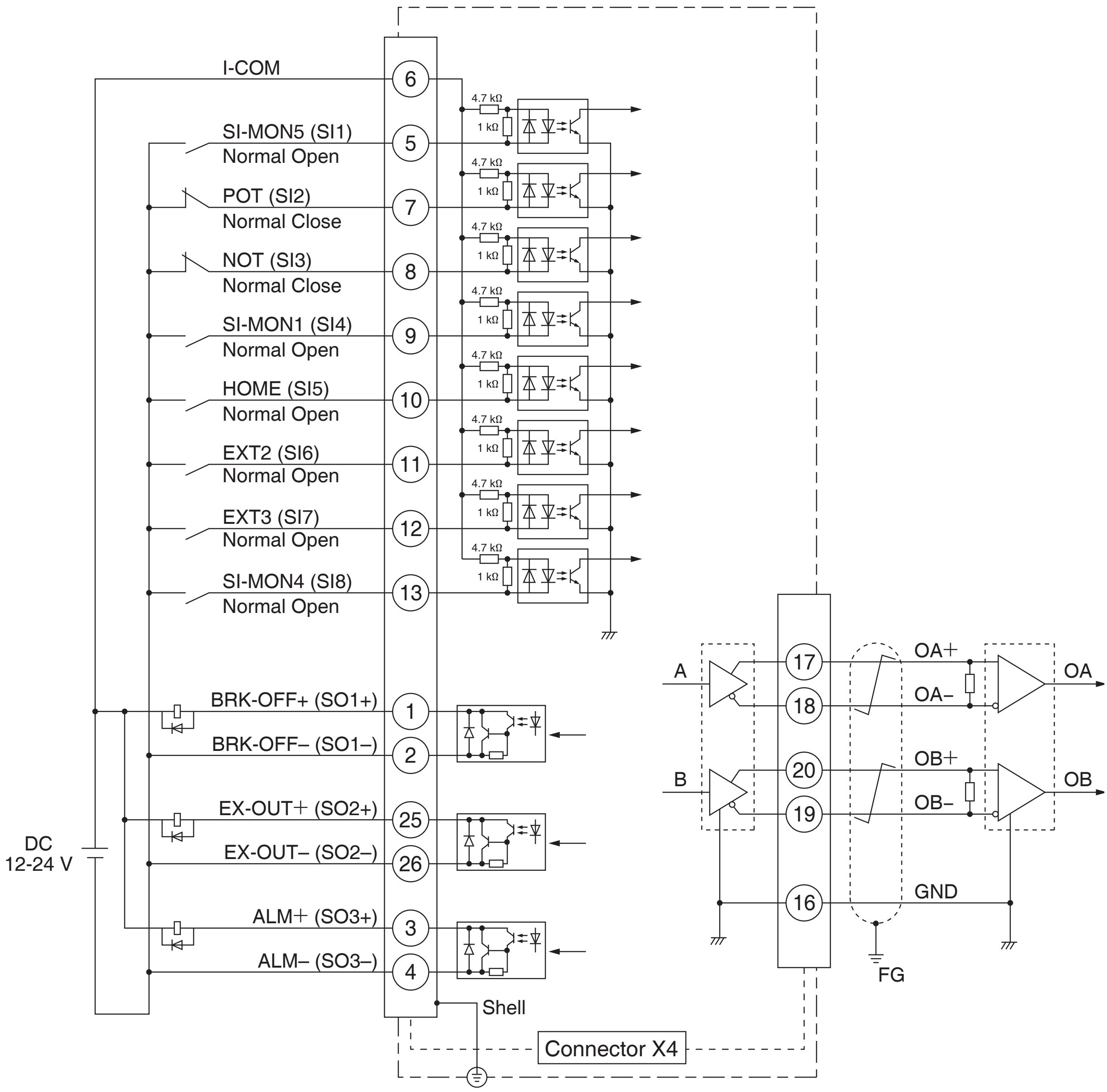
Remarks
- Tightening torque of the screws for connector (X4) for the connection to the I/O controller to be 0.3 N•m to 0.35 N•m. Larger tightening torque than these may damage the connector at the driver side.

Remarks
- X1 to X7 are used for the secondary circuit. To connect these terminals to the primary power supply (particularly, the 24 VDC power supply for brake), insulation is required.
  Do not connect these terminals to the same power supply.

8. Wiring to the Connector, X4

Connecting Example

Example of Connecting to Connector X4



Note The functions of the pins on below can be assigned by parameter (refer to P.3-64...).

Input: 5, 7, 8, 9, 10, 11, 12, 13

Output: 1, 2, 3, 4, 25, 26

* The function of pins on above default factory setting.

8. Wiring to the Connector, X4

Input Signal and Pin No.

Input Signal Source

Pin No.	6	Title of signall	**Input signal source**	Related control mode	
		Symbol	**I-COM**	RTEX communications monitor	

- Connect to the positive or negative terminal of the external DC source (12–24 V).
- Power source is 12 V±5 % to 24 V±5 %.

Absolute Encoder Battery Input

Pin No.	14 15	Title of signal	**Absolute encoder battery input**	Related control mode	
		Symbol	**Pin No.14:BTP-I** **Pin No.15:BTN-I**	RTEX communications monitor	

- Connect the battery for absolute encoder (recommended: ER6V 3.6 V from Toshiba lifestyle), as follows.
  BTP-I: ＋ polarity
  BTN-I: － polarity
- Connect the power for multi-turn data storage to the absolute encoder through BTP-O (pin 3) and BTN-O (pin 4) of encoder connector X6.
- Directly connect the encode connection cable to the battery, or connect to battery connector.

Note

"RTEX communications monitor" in the table is the response of RTEX communication and therefore monitor.
○ No allocation is made to the response (status flag) of RTEX communication and therefore monitor is possible.
– No allocation is made to the response (status flag) of RTEX communication and therefore monitor is impossible.
△ The status flag [Warning] of RTEX communication is turned ON whenever any warning is generated, regardless of setting value of Pr 4.40 or Pr 4.41.
The designation in ( ) in [Sign] column in the table shows the symbol used in RTEX communications.
(Notice that detection conditions of external output signal and RTEX communication signal are not the same.)
For details, refer to Technical Reference of controller.

Control Input Signal

Control input signal SI1to SI8 can be allocation can be changed. The logic can be changed.

Note

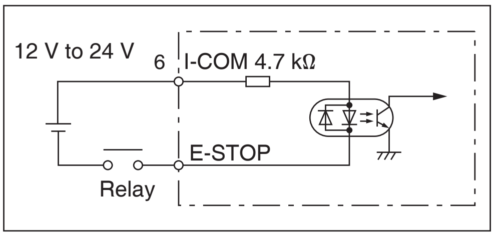
• How to use refer to P.3-64"Pr4.00 SI1 Input selection".

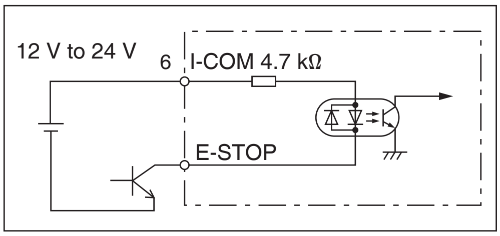
• For details, refer to P.2-54.

• Control Input Circuit

Pin No.	Title of signal	Symbol
5	SI1 Input	SI1
7	SI2 Input	SI2
8	SI3 Input	SI3
9	SI4 Input	SI4
10	SI5 Input	SI5
11	SI6 Input	SI6
12	SI7 Input	SI7
13	SI8 Input	SI8

- Connect to contacts of switches and relays, or open collector output transistors.
- When you use contact inputs, use the switches and relays for micro current to avoid contact failure.
- Make the lower limit voltage of the power supply (12 V to 24 V) as 11.4 V or more in order to secure the primary current for photocouplers.





Related page
•P.3-64 "Details of Parameter"

• Function allocatable to control input

Title of signal	Forced alarm input	Related control mode	P	S	T
Symbol	E-STOP	RTEX communications monitor		○	

• Generates Err 87.0 "Forced alarm input error".

Title of signal	Positive direction over-travel inhibition input	Related control mode	P	S	T
Symbol	POT	RTEX communications monitor		○	

• Positive direction over-travel inhibit input.
• The operation with this input turned ON is set up in Pr5.04 “Setup of over-travel inhibit input”.
• When using setup of over-travel inhibit input by the host controller, set Pr5.04 to 1. and comferm sepesfication of the host controller.
• When using this input, set Pr5.04 “Setup of over-travel inhibit input” to a value other than 1 so that the input is ON when the moving portion of the machine exceeds this signal range toward positive direction.
• If used as a home position reference trigger in a home position return, the input can only be assigned to SI6 with Pr 5.04 set to 1 to disable the drive inhibit input. The signal width should be 1 ms or longer then at the time of closing, and should be 2 ms or longer then at the time of opening. Please keep in mind that it cannot guarantee this value.

Title of signal	Negative direction over-travel inhibition input	Related control mode	P	S	T
Symbol	NOT	RTEX communications monitor		○	

• Positive direction over-travel inhibit input.
• The operation with this input turned ON is set up in Pr5.04 “Setup of over-travel inhibit input”.
• When using setup of over-travel inhibit input by the host controller, set Pr5.04 to 1. and comferm sepesfication of the host controller.
• When using this input, set Pr5.04 “Setup of over-travel inhibit input” to a value other than 1 so that the input is ON when the moving portion of the machine exceeds this signal range toward positive direction.
• If used as a home position reference trigger in a home position return, the input can only be assigned to SI7 with Pr 5.04 set to 1 to disable the drive inhibit input. The signal width should be 1 ms or longer then at the time of closing, and should be 2 ms or longer then at the time of opening. Please keep in mind that it cannot guarantee this value.

Title of signal	Near home input	Related control mode	P	S	T
Symbol	HOME	RTEX communications monitor		○	

• When using the near home sensor during the return to home position operation, input the sensor signal, and External signal input in a home position return.
• If used as a home position reference trigger in a home position return, the input can only be assigned to SI5, respectively.

Related page •P.3-64 “Details of Parameter” •P.6-3 “Protection Function”

Title of signal	External latch input 1	Related control mode	P	S	T
Symbol	EXT1	RTEX communications monitor		○	

Title of signal	External latch input 2	Related control mode	P	S	T
Symbol	EXT2	RTEX communications monitor		○	

Title of signal	External latch input 3	Related control mode	P	S	T
Symbol	EXT3	RTEX communications monitor		○	

- An external input signal is used as a trigger for position latch, Latch mode with stop function and home position return.
- The signal width should be 1 ms or longer then at closing time, and should be 2 ms or longer at opening time. This value is not guarantee value.
- When a contact and rising logical edge setting and b contact and falling logical edge, latch is performed at the timing of change from open (OFF) to closed (ON).
- EXT1, EXT2, and EXT3 can only be assigned to S15, S16, and SI7, respectively.

Positive direction over-travel inhibition input (POT), Negative direction over-travel inhibition input (NOT), Near home input (HOME) used as a trigger or external latch input1 to 3 (EXT1, EXT2, and EXT3) can only be assigned to S15, S16, and SI7, respectively.
The method and condification of assignation, refer to P.3-64 "[Class 4] I/F Monitor setting".
When using this signal to execute a homing operation, the detail of the latch of actual motor position refer to technical reference of controller.

Title of signal	General purpose monitor input 1	Related control mode	P	S	T
Symbol	SI-MON1	RTEX communications monitor		○	

Title of signal	General purpose monitor input 2	Related control mode	P	S	T
Symbol	SI-MON2	RTEX communications monitor		○	

Title of signal	General purpose monitor input 3	Related control mode	P	S	T
Symbol	SI-MON3	RTEX communications monitor		○	

Title of signal	General purpose monitor input 4	Related control mode	P	S	T
Symbol	SI-MON4	RTEX communications monitor		○	

Title of signal	General purpose monitor input 5	Related control mode	P	S	T
Symbol	SI-MON5	RTEX communications monitor		○	

- Used as the general purpose monitor input.
- This input does not affect the operation, and can be used for monitoring through RTEX communications response.
- SI-MON1/EXT1, SI-MON2/EXT2, SI-MON3/EXT3, SI-MON4/EX-SON, and SI-MON5/E-STOP are not to duplicately assign. Duplicate assignment causes the Err33.0 “Input duplicate assignment error 1 protection” or Err33.1 “Input duplicate assignment error 2 protection”.

Title of signal	External servo on input	Related control mode	P	S	T
Symbol	EX-SON	RTEX communications monitor		○	

- External servo on input.
- When both this input and either of RTEX communication servo on command or the setup support tool (PANATERM) servo on command are on, the servo on command for servo control process is turned on.

Title of signal	Dynamic brake (DB) switching input	Related control mode	P	S	T
Symbol	DB-SEL	RTEX communications monitor		○	

- Switches the dynamic brake (DB) ON and OFF after stop (when the main power is off).

Note

Switching is only possible when main power supply Off is detected.
Setting is required for all control modes after setting Pr6.36 “Dynamic brake operation input setup” to 1, in case of using dynamic brake switching input (DB-SEL). In case only one or two control modes are set, either Err33.2 “Input function number error 1” or Err33.3 “Input function number error 2” will occur.

• Default assignment

Pin Name	Pin No.	Applicable parameter	Default parameter setting ( ): decimal notation	Default Setup					
				Position control		Verocity control		Torque control	
				Title of signall	Logic＊1	Title of signall	Logic＊1	Title of signall	Logic＊1
SI1	5	Pr4.00	00323232h (3289650)	SI-MON5	a-contact	SI-MON5	a-contact	SI-MON5	a-contact
SI2	7	Pr4.01	00818181h (8487297)	POT	b-contact	POT	b-contact	POT	b-contact
SI3	8	Pr4.02	00828282h (8553090)	NOT	b-contact	NOT	b-contact	NOT	b-contact
SI4	9	Pr4.03	002E2E2Eh (3026478)	SI-MON1	a-contact	SI-MON1	a-contact	SI-MON1	a-contact
SI5	10	Pr4.04	00222222h (2236962)	HOME	a-contact	HOME	a-contact	HOME	a-contact
SI6	11	Pr4.05	00212121h (2171169)	EXT2	a-contact	EXT2	a-contact	EXT2	a-contact
SI7	12	Pr4.06	002B2B2Bh (2829099)	EXT3	a-contact	EXT3	a-contact	EXT3	a-contact
SI8	13	Pr4.07	00313131h (3223857)	SI-MON4	a-contact	SI-MON4	a-contact	SI-MON4	a-contact

Note

＊1 Operation of a-contact and b-contact:
a-contact: The current in the input circuit is shut down and the photocoupler is turned OFF.
— function disabled (OFF state)
The current flows through the input circuit and the photocoupler is turned ON.
— function enabled (ON state)
b-contact: The current in the input circuit is shut down and the photocoupler is turned OFF.
— function enabled (ON state)
The current flows through the input circuit and the photocoupler is turned ON.
— function disabled (OFF state)
In this manual, the status of the input signal is defined as ON when the signal activates, the specified function and OFF when the signal deactivates.

Output Signals

Control output signal SO1to SO3 can be allocation can be changed. The logic can be changed.

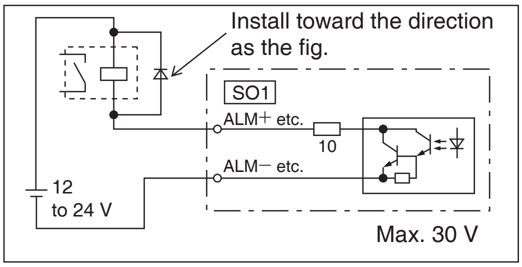
Note

- How to use refer to P.3-66"Pr4.10 SO1 Input selection".
- For details, refer to P.2-58.

• Control output circuit

Pin No.			
Pin No.	1 2	Title of signal	**SO1 output**
		Symbol	**Pin No.1:SO1 +** **Pin No.2:SO1 –**
Pin No.	25 26	Title of signal	**SO2 output**
		Symbol	**Pin No.25:SO2 +** **Pin No.26:SO2 –**
Pin No.	3 4	Title of signal	**SO3 output**
		Symbol	**Pin No.3:SO3 +** **Pin No.4:SO3 –**

- The output circuit is composed of open collector transistor outputs in the Darlington connection, and connect to relays or photocouplers.
- There exists collector to emitter voltage, V_{CE} (SAT) of approx. 1V at transistor-ON, due to the Darlington connection of the output or. Note that normal TTL IC cannot be directly connected since it does not meet VIL.
- The current flowing to each output and input should be rated current 40 mA, maximum current 50 mA, inrush current 90 mA or less.



• Function allocatable to control output

Title of signal	**Servo-Alarm output**	Related control mode*1	P	S	T
Symbol	**ALM** (Alarm)	RTEX communications monitor*2		○	

- This signal shows that the driver is in alarm status..
- Output transistor turns ON when the driver is at normal status, and turns OFF at alarm status.

Title of signal	**Servo-Ready output**	Related control mode*1	P	S	T
Symbol	**S-RDY** (Servo_Ready)	RTEX communications monitor*2		○	

- This signal shows that the driver is ready to be activated.
- The servo becomes ready when all the following

conditions are satisfied, and the output transistor is turned on.
  Control/Main power is established.
  Alarm does not occur.
  RTEX communication is established
  Synchronization between communication and servo is achieved.

Title of signal	External brake release signal	Related control mode*1	P	S	T
Symbol	BRK-OFF	RTEX communications monitor*2	—		

• Outputs the timing signal which activates the holding brake of the motor.
• Turns the output transistor ON at the release timing of the holding brake.
• This output needs to be assigned to every control mode.

Title of signal	Positioning complete	Related control mode*1	P	S	T
Symbol	INP (In_Position)	RTEX communications monitor*2	○		

• Outputs the positioning complete signal. Turns ON the output transistor upon completion of positioning.
• For details, refer to P.3-70.

Title of signal	Speed arrival output	Related control mode*1	P	S	T
Symbol	AT-SPPED	RTEX communications monitor*2	—		

• Outputs the speed arrival signal. Turns ON the output transistor upon arrive of speed.
• For details, refer to P.3-72.

Title of signal	Torque in-limit signal output	Related control mode*1	P	S	T
Symbol	TLC (Torque_Limited)	RTEX communications monitor*2	○		

• Outputs the torque in-limit signal. Turns ON the output transistor upon limit of torque.

Title of signal	Zero-speed detection output signal	Related control mode*1	P	S	T
Symbol	ZSP	RTEX communications monitor*2	—		

• Outputs the zero-speed detection signal. Turns ON the output transistor upon detection of Zero-speed.

Title of signal	Speed coincidence output	Related control mode*1	P	S	T
Symbol	V-COIN	RTEX communications monitor*2	—		

• Outputs the speed coincidence signal. Turns ON the output transistor upon coincidence of speed.
• For details, refer to P.3-72.

Note

*1 With unrelated control mode, the output transistor is always turned off.
*2 "RTEX communications monitor" in the table is the response of RTEX communication and therefore monitor.
○ No allocation is made to the response (status flag) of RTEX communication and therefore monitor is possible.
– No allocation is made to the response (status flag) of RTEX communication and therefore monitor is impossible.
△ The status flag [Warning] of RTEX communication is turned ON whenever any warning is generated, regardless of setting value of Pr 4.40 or Pr 4.41.
The designation in ( ) in [Sign] column in the table shows the symbol used in RTEX communications.
(Notice that detection conditions of external output signal and RTEX communication signal are not the same.)
For details, refer to Technical Reference of controller.

Title of signal	**Positioning complete 2**	Related control mode*1	P	S	T
Symbol	**INP2**	RTEX communications monitor*2	—		

- Outputs the positioning complete signal 2. Turns ON the output transistor upon completion of positioning.
- For details, refer to P.3-74.

Title of signal	**Alarm output 1**	Related control mode*1	P	S	T
Symbol	**WARN1** (Warning)	RTEX communications monitor*2	△		

- Outputs the warning output signal set to Pr4.40 "Warning output select 1". Turns ON the output transistor upon occurrence of warning condition.

Title of signal	**Alarm output 2**	Related control mode*1	P	S	T
Symbol	**WARN2** (Warning)	RTEX communications monitor*2	△		

- Outputs the warning output signal set to Pr4.41 "Warning output select 2". Turns ON the output transistor upon occurrence of warning condition.

Title of signal	**Positional command ON/OFF output**	Related control mode*1	P	S	T
Symbol	**P-CMD** (In_Progress)	RTEX communications monitor*2	○		

- Outputs the Positional command ON/OFF signal 2. Turns on the output transistor when the positioning command (before filter) is other than 0 (with positioning command).

Title of signal	**Speed command ON/OFF output**	Related control mode*1	P	S	T
Symbol	**V-LIMIT**	RTEX communications monitor*2	—		

- Turns on output transistor when the speed command is applied while the speed is controlled. Turns on the output transistor when velocity is limited.

Title of signal	**Alarm clear attribute output**	Related control mode*1	P	S	T
Symbol	**ALM-ATB**	RTEX communications monitor*2	—		

- The signal is output if an alarm has occurred and if it can be cleared, turns on the output transistor when an alarm occurs.

Note

*1 With unrelated control mode, the output transistor is always turned off.

*2 "RTEX communications monitor" in the table is the response of RTEX communication and therefore monitor.

○ No allocation is made to the response (status flag) of RTEX communication and therefore monitor is possible.

– No allocation is made to the response (status flag) of RTEX communication and therefore monitor is impossible.

△ The status flag [Warning] of RTEX communication is turned ON whenever any warning is generated, regardless of setting value of Pr 4.40 or Pr 4.41.

The designation in ( ) in [Sign] column in the table shows the symbol used in RTEX communications.

(Notice that detection conditions of external output signal and RTEX communication signal are not the same.)

For details, refer to Technical Reference of controller.

Title of signal	Velocity command ON/OFF output	Related control mode*1	P	S	T
Symbol	V-CMD	RTEX communications monitor*2	—		

- Turns on output transistor when the velocity command is applied while the velocity is controlled.
- Turns on the output transistor if the velocity command (before filter) is not less than 30 r/min (with velocity command).

Title of signal	RTEX operation output 1	Related control mode*1	P	S	T
Symbol	EX-OUT1	RTEX communications monitor*2	—		

- Outputs signal according to the value of the control bit (EX-OUT1) of RTEX communication.
  0: output transistor is OFF
  1: output transistor is ON
- RTEX communication is not acctive, output transistor is OFF. (Refer to next page Note *3)

Title of signal	RTEX operation output 2	Related control mode*1	P	S	T
Symbol	EX-OUT2	RTEX communications monitor*2	—		

- Outputs signal according to the value of the control bit (EX-OUT2) of RTEX communication.
  0: output transistor is OFF
  1: output transistor is ON
- RTEX communication is not acctive, output transistor is OFF. (Refer to next page Note *3)

Title of signal	Servo on status output	Related control mode*1	P	S	T
Symbol	SRV-ST (Servo_Active)	RTEX communications monitor*2	○		

- Turns on the output transistor during servo on. (Refer to next page Note *4)

Title of signal	Position comparison output	Related control mode*1	P	S	T
Symbol	CMP-OUT	RTEX communications monitor*2	—		

- The output transistor is turned ON or OFF when the actual position passes the position set by the parameter.

Note

*1 With unrelated control mode, the output transistor is always turned off.
*2 "RTEX communications monitor" in the table is the response of RTEX communication and therefore monitor.
○ No allocation is made to the response (status flag) of RTEX communication and therefore monitor is possible.
– No allocation is made to the response (status flag) of RTEX communication and therefore monitor is impossible.
△ The status flag [Warning] of RTEX communication is turned ON whenever any warning is generated, regardless of setting value of Pr 4.40 or Pr 4.41.
The designation in ( ) in [Sign] column in the table shows the symbol used in RTEX communications.
(Notice that detection conditions of external output signal and RTEX communication signal are not the same.)
For details, refer to Technical Reference of controller.

Title of signal	Deterioration diagnosis velocity output	Related control mode*1	P	S	T
Symbol	V-DIAG	RTEX communications monitor*2	—		

- Output transistor turned ON when motor speed is within the range of Pr4.35 “Speed coincidence range” of Pr5.75 “Deterioration diagnosis velocity setting”.
- There is a hysteresis of 10 r/min in the coincidence judgment of deterioration diagnosis velocity.

• Default assignment

Output signal	Applicable parameter	Default parameter setting ( ): decimal notation	Default Setup		
			Position control	Verocity control	Torque control
			Signal	Signal	Signal
SO1 output	Pr4.10	00030303h (197379)	BRK-OFF	BRK-OFF	BRK-OFF
SO2 output	Pr4.11	00101010h (1052688)	EX-OUT1	EX-OUT1	EX-OUT1
SO3 output	Pr4.12	00010101h (65793)	ALM	ALM	ALM

Note

*1 With unrelated control mode, the output transistor is always turned off.

*2 “RTEX communications monitor” in the table is the response of RTEX communication and therefore monitor.
○ No allocation is made to the response (status flag) of RTEX communication and therefore monitor is possible.
– No allocation is made to the response (status flag) of RTEX communication and therefore monitor is impossible.
△ The status flag [Warning] of RTEX communication is turned ON whenever any warning is generated, regardless of setting value of Pr 4.40 or Pr 4.41.
The designation in ( ) in [Sign] column in the table shows the symbol used in RTEX communications.
(Notice that detection conditions of external output signal and RTEX communication signal are not the same.)
For details, refer to Technical Reference of controller.

*3 The following shows the output transistor state for the RTEX operation output 1/2 when RTEX is established, when RTEX communication after reset is not established, and when RTEX is shut down after established. Since operation by the control bit through RTEX communication is not allowed except when RTEX is established, configure the system avoiding problems with safety.

*4 Pr7.24 “RTEX function extended setup 3” bit4 = 1 (Turns on in command receivable state after servo ON.) is not supported.

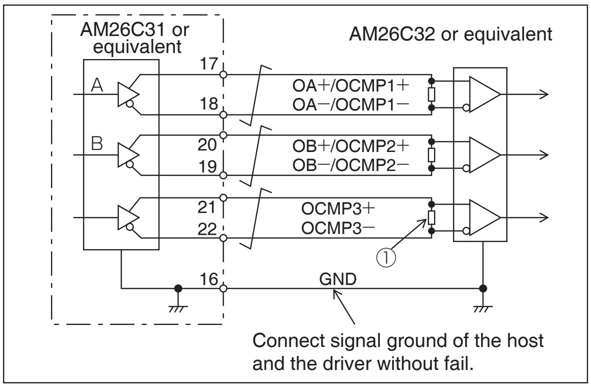
Title of signall	Symbol	Pr.7.24 RTEX function extended setup 3	RTEX control bit	Output transistor state		
				Communication established	Reset	Communication shut down
RTEX operation output1	EX-OUT1	bit0 = 0 (Held)	EX-OUT1 = 0	OFF	OFF	Held
			EX-OUT1 = 1	ON		
		bit0 = 1 (Initialized)	EX-OUT1 = 0	OFF	OFF	OFF
			EX-OUT1 = 1	ON		
RTEX operation output2	EX-OUT2	bit0 = 0 (Held)	EX-OUT2 = 0	OFF	OFF	Held
			EX-OUT2 = 1	ON		
		bit0 = 1 (Initialized)	EX-OUT2 = 0	OFF	OFF	OFF
			EX-OUT2 = 1	ON		

Encoder Output Signal

• Output signal circuit

PO1	Line driver (Differential output) output

- Output the divided encoder outputs (A, B-phase) in differential through each line driver.
- At the host side, receive these in line receiver. Install a terminal resistor (approx. 330 Ω) (right figure (1)) between line receiver inputs without fail.
- These outputs are not insulated.



Pin No.	17 18	Title of signal	A-phase output/Position comparison output 1	Related control mode	P	S	T
		Symbol	Pin No.17:OA + /OCMP1 + Pin No.18:OA − /OCMP1 −	RTEX communications monitor	—		

Pin No.	20 19	Title of signal	B-phase output/Position comparison output 2	Related control mode	P	S	T
		Symbol	Pin No.20:OB + /OCMP2 + Pin No.19:OB − /OCMP2 −	RTEX communications monitor	—		

Pin No.	21 22	Title of signal	Position comparison output 3	Related control mode	P	S	T
		Symbol	Pin No.21:OCMP3 + Pin No.22:OCMP3 −	RTEX communications monitor	—		

- Encoder signal processed with frequency division is outputted by differential line driver signal. (equivalent to RS422)
- Ground for line driver of output circuit is connected to signal ground (GND) and is not insulated.
- Max output frequency is 4 Mpulse/s (after quadrupled)

Pin No.	16	Title of signal	Signal ground	Related control mode	P	S	T
		Symbol	GND	RTEX communications monitor	—		

- Signal ground.

Others

Pin No.	Shell	Title of signal	Frame ground	Related control mode	P	S	T
		Symbol	FG	RTEX communications monitor	—		

• This output is connected to the earth terminal inside of the driver.

Pin No.	23 24	Title of signal	Manufacturer's use	Related control mode	P	S	T
		Symbol	—	RTEX communications monitor	—		

Do not connect anything.

9. Wiring to the Connector, X6

Connection to Encoder

Connect to Encoder connection cable.

Title	Symbol	Connector Pin No.	Description
Encoder power supply output	E5V	1	Encoder power supply
	E0V	2	Ground of encoder power supply
Absolute encoder battery backup output	BTP-0	3	Internally connected to the connector X4,Absolute encoder battery input BTP-I, BTN-I.
	BTN-0	4	
Encoder signal output	PS	5	Encoder signal no-inverting input and output.
	$\overline{\mathrm{PS}}$	6	Encoder signal inverting input and output.
Frame ground	FG	Shell	Connected to the earth terminal in the servo driver.

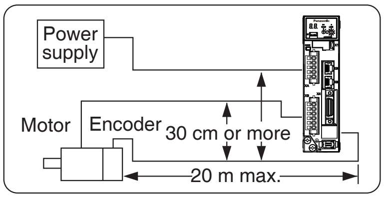
- **Specifications of the Connector, X6**

Cable Connector	Shell kit	Manufacturer
3E206-0100kV	3E206-3200-008	3M Japan co.Ltd

Note
- The details fo the Encoder connection cable and connector, refer to 7"Supplement".

Caution
- Directly connect the encode connection cable to the battery, do not connect to BTP-O and BTN-O.

Tips on Wiring

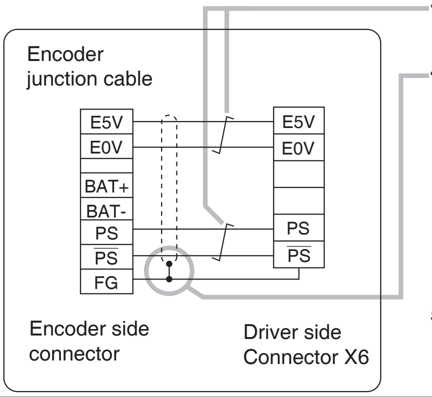


○ Maximum cable length between the driver and the motor to be 20 m. Consult with a dealer or distributor if you want to use the longer cable than 20 m. (Refer to the back cover.)

○ Keep this wiring away from the main circuit by 30 cm or more. Do not guide this wiring through the same duct with the main, nor bind them together.

○ When you make your own encoder junction cable (for connectors, refer to P.7-92, "Options (Connector Kit for Motor /Encoder Connection)" of Supplement.

1) Refer to the Wiring Diagram below.
2) Cable to be : Shielded twisted pair cable with core diameter of 0.18 mm² or larger (AWG24), and with higher bending resistance.
3) Use twisted pair cable for corresponding signal/power wiring.
4) Shielding treatment
   - Shield wall of the driver side : It solders the shell of Connector X6.
   - Shield wall of the motor side :
     manufactured by JAE
     Small type motor (50 W to 750 W): connect to 6 Pin
     Large type motor (850 W to 5.0 kW): connect to 9 Pin
5) Connect nothing to the empty terminals of each connector.



Remarks
- X1 to X7 are used for the secondary circuit. To connect these terminals to the primary power supply (particularly, the 24 VDC power supply for brake), insulation is required.

Do not connect these terminals to the same power supply.

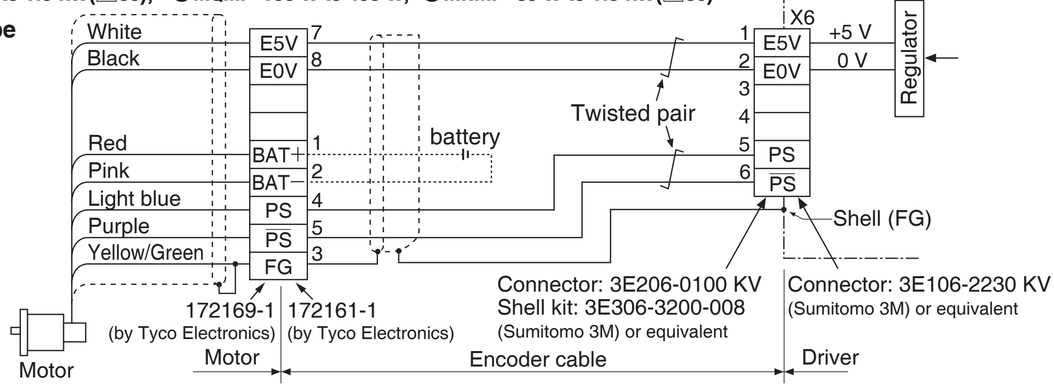
Related page
•P.7-92 “Connector X6 Encoder Connector Kit”

Wiring Diagram Connector X6

• In case of 23-bit absolute encoder (as mutli-turn data was be used)

●MSMF 50 W to 1.0 kW(□80), ●MQMF 100 W to 400 W, ●MHMF 50 W to 1.0 kW(□80)

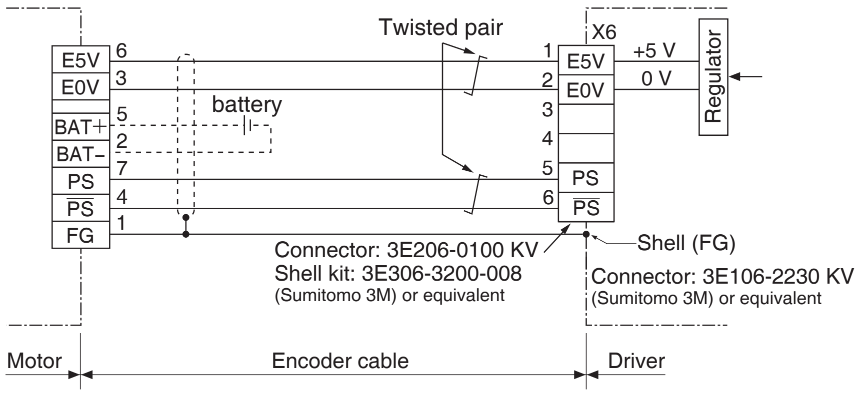
Leadwire type



Remarks
- Connect the battery for absolute encoder across 1P and 2P of the junction connector (the figure above).
- A battery holder and a battery connection cable should be the option cable or prepared by the user.

●MSMF 50 W to 1.0 kW(□80)
●MQMF 100 W to 400 W
●MHMF 50 W to 1.0 kW(□80)

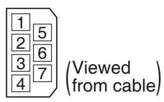
Connector type



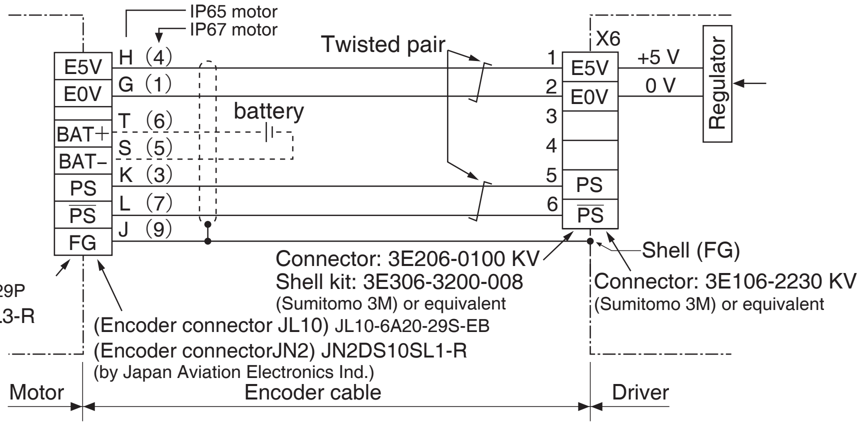
Caution
- Tighten the motor connector mounting screw (M2) with a torque between 0.19 and 0.21 N·m. To avoid damage, be sure to use only the screw supplied with the connector.
- Do not remove the gasket supplied with the junction cable connector. Securely install the gasket in place. Otherwise, the degree of protection of IP67 will not be guaranteed.

Remarks
- Connect the battery for absolute encoder across 5P and 2P of the junction connector (the figure above).
- A battery holder and a battery connection cable should be the option cable or prepared by the user.

[Connector pin assignment]



●MSMF 1.0 kW(□100) to 5.0 kW
●MDMF 1.0 kW to 5.0 kW
●MGMF 850 W to 4.4 kW
●MHMF 1.0 kW(□130) to 7.5 kW



(Encoder connector JL10) JL10-2A20-29P
(Encoder connectorJN2) JN2AS10ML3-R
(by Japan Aviation Electronics Ind.)

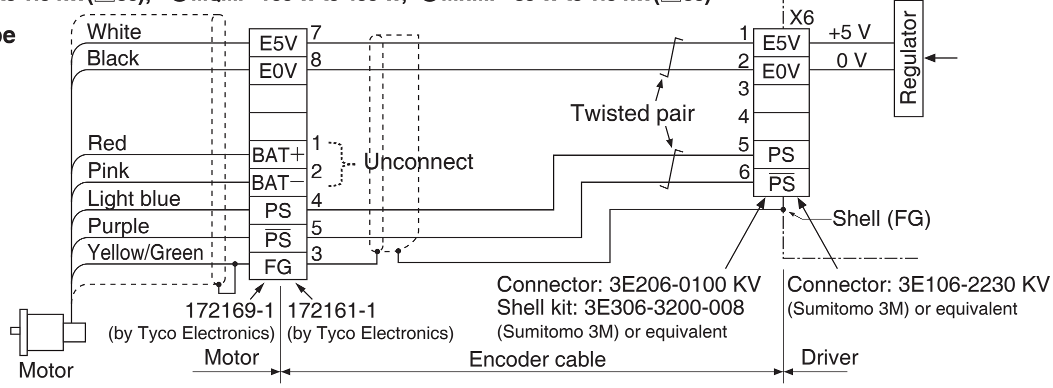
Remarks
- Connect the battery for absolute encoder across 6P and 5P of the junction connector (the figure above).
- A battery holder and a battery connection cable should be the option cable or prepared by the user.

Remarks
- X1 to X7 are used for the secondary circuit. To connect these terminals to the primary power supply (particularly, the 24 VDC power supply for brake), insulation is required.
Do not connect these terminals to the same power supply.

• In case of 23-bit absolute encoder (as single turn data was be used)

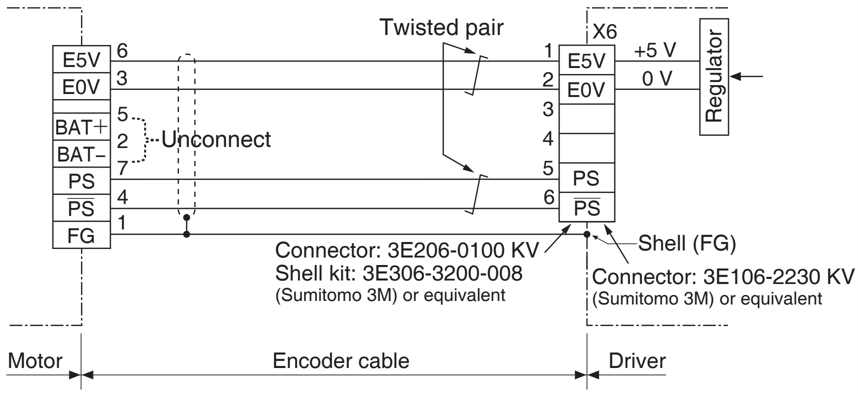
●MSMF 50 W to 1.0 kW(□80), ●MQMF 100 W to 400 W, ●MHMF 50 W to 1.0 kW(□80)

Leadwire type



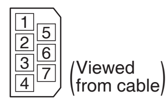
●MSMF 50 W to 1.0 kW(□80)
●MQMF 100 W to 400 W
●MHMF 50 W to 1.0 kW(□80)

Connector type

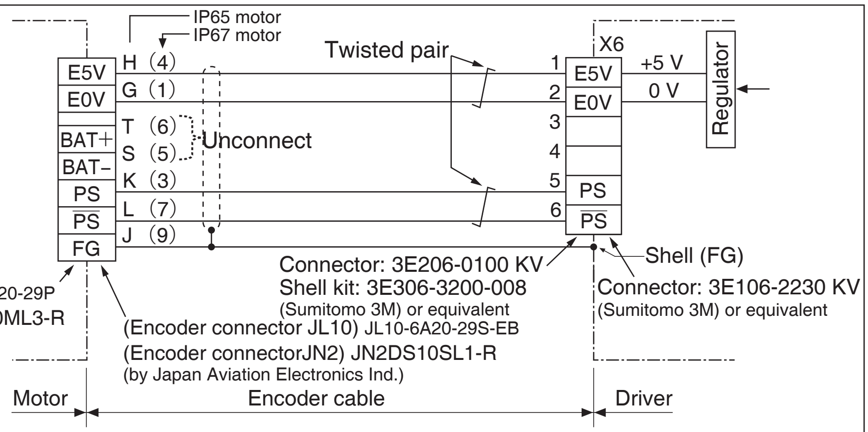


Caution • Tighten the motor connector mounting screw (M2) with a torque between 0.19 and 0.21 N•m. To avoid damage, be sure to use only the screw supplied with the connector.
• Do not remove the gasket supplied with the junction cable connector. Securely install the gasket in place. Otherwise, the degree of protection of IP67 will not be guaranteed.

[Connector pin assignment]



●MSMF 1.0 kW(□100) to 5.0 kW
●MDMF 1.0 kW to 5.0 kW
●MGMF 850 W to 4.4 kW
●MHMF 1.0 kW(□130) to 7.5 kW



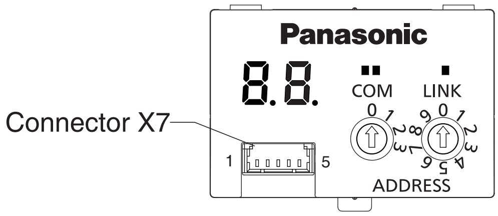
(Encoder connector JL10) JL10-2A20-29P
(Encoder connectorJN2) JN2AS10ML3-R
(by Japan Aviation Electronics Ind.)

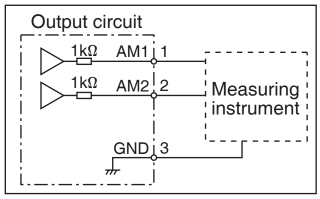
Remarks • X1 to X7 are used for the secondary circuit. To connect these terminals to the primary power supply (particularly, the 24 VDC power supply for brake), insulation is required. Do not connect these terminals to the same power supply.

10. Wiring to the Connector, X7

Monitor Output

The connector X7 of the front panel is for monitor output.
Analogue output: 2 systems
It is possible to switch the output signal by setting parameters.





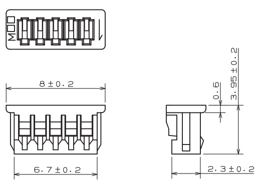
Title	Symbol	Connector Pin No.	Description
Analog monitor output 1	AM1	1	Analog signal output for monitoring
Analog monitor output 2	AM2	2	
Signal ground	GND	3	Connect to signal ground.
NC	—	4	Do not connect.
NC	—	5	Do not connect.

• Relevant parameters of Monitor output

Parameter No.		Title of Parameter	Function
Class	No.		
4	16	Type of analog monitor 1	Select the type of monitor for analog monitor 1.
4	17	Analog monitor 1 output gain	Set up the output gain of analog monitor 1.
4	18	Type of analog monitor 2	Select the type of monitor for analog monitor 2.
4	19	Analog monitor 2 output gain	Set up the output gain of analog monitor 2.
4	21	Analog monitor output setup	Select output format of the analog monitor.

• Specifications of the Connector, X6

Cable Connector		Manufacturer
Part name	Part No.	
Connector	51021-0500	Molex Inc.
Connector Pin	50058-8500	



Remarks

• X1 to X7 are used for the secondary circuit. To connect these terminals to the primary power supply (particularly, the 24 VDC power supply for brake), insulation is required.
Do not connect these terminals to the same power supply.

Related page
•P.3-67 ~ "Details of Parameter"

11. Built-in Holding Brake

Outline

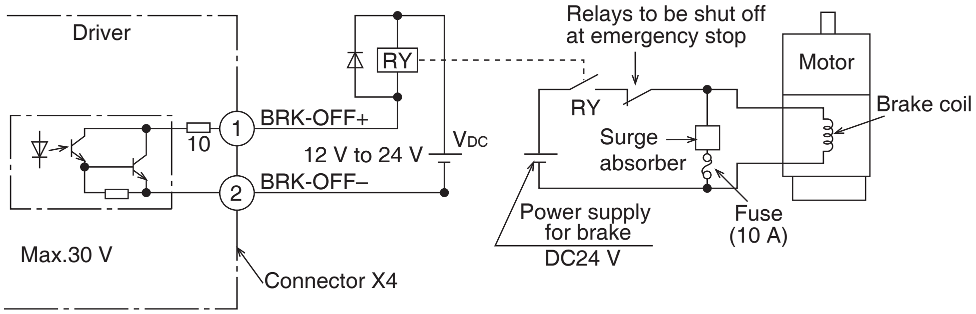
In the applications where the motor drives the vertical axis, this brake would be used to hold and prevent the work (moving load) from falling by gravity while the power to the servo is shut off.

Caution

Use this built-in brake for "Holding" purpose only, that is to hold the stalling status. Never use this for "Brake" purpose to stop the load in motion.

Connecting Example

The following shows the example when the brake is controlled by using the brake release output signal (BRK-OFF) of the driver.



The External brake release signal can be assigned by default setting of SO1(X4:1, 2 Pin).

Note
Caution

1. The brake coil has no polarity.
2. Power supply for the brake to be provided by customer. Do not co-use the power supply for the brake and for the control signals (VDC).
3. Install a surge absorber as the above Fig. shows to suppress surge voltage generated by ON/OFF action of the relay (RY). When you use a diode, note that the time from the brake release to brake engagement is slower than that of the case of using a surge absorber.
4. For a surge absorber, refer to P.7-106, "Recommended Components" of Supplement.
5. Recommended components are specified to measure the brake releasing time.
   Reactance of the cable varies depending on the cable length, and it might generate surge voltage.
   Select a surge absorber so that relay coil voltage (max. rating : 30 V, 50 mA) and terminal voltage may not exceed the rating.
6. The current flowing to SO terminal should be rated current 40 mA, maximum current 50 mA, inrush current 90 mA.

Output Timing of BRK-OFF Signal

- For the brake release timing at power-on, or braking timing at Servo-OFF/Servo-Alarm while the motor is in motion, refer to P.7-62, "Timing Chart".
- With the parameter, Pr4.38 (Setup of mechanical brake action while the motor is in motion), you can set up a time between when the motor enters to a free-run from energized status and when BRK-OFF signal turns off (brake will be engaged), when the Servo-OFF or alarm occurs while the motor is in motion. The details refer to P.3-73.

Note

1. The lining sound of the brake (chattering and etc.) might be generated while running the motor with built-in brake, however this does not affect any functionality.
2. Magnetic flux might be generated through the motor shaft while the brake coil is energized (brake is open). Pay an extra attention when magnetic sensors are used nearby the motor.

11. Built-in Holding Brake

Specifications

Motor series	Motor output	Static friction torque N·m	Rotor inertia x 10^{-4} kg·m²	Engaging time ms	Releasing time ms	Exciting current DC A (at cool-off)	Releasing voltage	Permissible work (J) per one braking	Permissible total work x 10^3 J	Permissible angular acceleration rad/s²
MSMF	50 W, 100 W	0.294 or more	0.002	35 or less	20 or less	0.30	DC1 V or more	39.2	4.9	30000
	200 W, 400 W	1.27 or more	0.018	50 or less	15 or less	0.36		137	44.1	
	750 W	2.45 or more	0.075	70 or less	20 or less	0.42		196	147	
	1.0 kW(□80)	3.80 or more						185	80.0	
	1.0 kW(□100), 1.5 kW, 2.0 kW	8.0 or more	0.175	50 or less	15 or less	0.81	DC2 V or more	600	50	10000
	3.0 kW	12.0 or more		80 or less					900	
	4.0 kW	16.2 or more	1.12	110 or less	50 or less	0.90		1470	2160	
	5.0 kW	22.0 or more						1545	2000	
MQMF	100 W	0.39 or more	0.018	15 or less	20 or less	0.30	DC1 V or more	105	44.1	30000
	200 W, 400 W	1.6 or more	0.075	70 or less		0.36		185	80.0	
MDMF	1.0 kW, 1.5 kW, 2.0 kW	13.7 or more	1.12	100 or less	50 or less	0.79	DC2 V or more	1470	2160	10000
	3.0 kW	22.0 or more		110 or less		0.90		1545	2000	
	4.0 kW	25.0 or more	4.7	80 or less	25 or less	1.29		1800	3000	5440
	5.0 kW	44.1 or more	4.1	150 or less	30 or less				3100	5108
MGMF	850 W, 1.3 kW, 1.8 kW	13.7 or more	1.12	100 or less	50 or less	0.79	DC2 V or more	1470	2160	10000
	2.4 kW, 2.9 kW	25.0 or more	4.7	80 or less	25 or less	1.29		1800	3000	5440
	4.4 kW	44.1 or more	3.93	150 or less	30 or less				3100	5108
MHMF	50 W, 100 W	0.38 or more	0.002	35 or less	20 or less	0.30	DC1 V or more	39.2	4.9	30000
	200 W, 400 W	1.6 or more	0.018	50 or less		0.36		105	44.1	
	750 W, 1.0 kW(□80)	3.8 or more	0.075	70 or less		0.42		185	80.0	
	1.0 kW(□130), 1.5 kW	13.7 or more	1.12	100 or less	50 or less	0.79	DC2 V or more	1470	2160	10000
	2.0 kW, 3.0 kW, 4.0 kW	25 or more	4.7	80 or less	25 or less	1.29		1800	3000	5440
	5.0 kW	44.1 or more	4.1	150 or less	30 or less				3100	5108

- Excitation voltage is DC24 V±2.4(MSMF 50 W to 750W DC24 V±1.2).
- Releasing time values represent the ones with DC-cutoff using a varistor.
- Above values (except static friction torque, releasing voltage and excitation current) represent typical values.
- Backlash of the built-in holding brake is kept ±1˚or smaller at ex-factory point.
- Service life of the number of acceleration/deceleration with the above permissible angular acceleration is more than 10 million times. (Life end is defined as when the brake backlash drastically changes.)

12. Dynamic Brake

Outline

This driver (A to F-frame) is equipped with a dynamic brake for emergency stop.
Pay a special attention to the followings.

Caution

1. Dynamic brake is only for emergency stop.

Do not start/stop the motor by turning on/off the Servo-ON signal (SRV-ON). Otherwise it may damage the dynamic brake circuit of the driver.

The Motor becomes a dynamo when driven externally and short circuit current occurred while dynamic brake is activated may cause smoking or fire.

2. Dynamic brake is a short-duration rating, and designed for only emergency stop. Allow approx. 10 minutes pause when the dynamic brake is activated during high-speed running.
   (E/F-frame(200 V)) built-in dynamic brake resistor is capable of handling up to 3 continuous halts at the rated revolutions with max. permissible inertia. When overheated under more critical operating conditions, the brake will blow out and should be replaced with a new one.)

• You can activate the dynamic brake in the following cases.

1) When the main power is turned off
2) At Servo-OFF
3) When one of the protective function is activated.
4) When over-travel inhibit input (NOT, POT) of connector X4 is activated
   In the above cases from 1) to 4), you can select either activation of the dynamic brake or making the motor free-run during deceleration or after the stop, with parameter.
   Note that when the control power is off, for A to F-frame driver, the dynamic brake will be kept actived.

Related page • P.2-47 “Wiring to the Connector, X4” • P.6-3 “Protective Function”

11. Dynamic Brake

Condition Setting Chart

1) Setup of Driving Condition from Deceleration to after Stop by Main Power-off (Pr5.07)

Sequence at main power-off (Pr5.07)

Setup value of Pr5.07	Driving condition: During deceleration	Driving condition: After stalling, Pr6.36 = 0	Driving condition: After stalling, Pr6.36 = 1	Contents of deviation counter
0	D B	D B	Operation of dynamic brake is subjected to the state of dynamic brake switching input	Clear
1	Free-run	D B		Clear
2	D B	Free-run		Clear
3	Free-run	Free-run		Clear
4	D B	D B		Clear
5	Free-run	D B		Clear
6	D B	Free-run		Clear
7	Free-run	Free-run		Clear
8	Emergency stop	D B		Clear
9	Emergency stop	Free-run		Clear

Torque limit value at emergency stop will be that of Pr5.11 (Setup of torque at emergency stop) when the setup value is 8 or 9.

2) Setup of Driving Condition from Deceleration to after Stop by Servo-OFF (Pr5.06)

Sequence at main Servo-OFF (Pr5.06)

Setup value of Pr5.06	Driving condition: During deceleration	Driving condition: After stalling	Contents of deviation counter
0	D B	D B	Clear
1	Free-run	D B	Clear
2	D B	Free-run	Clear
3	Free-run	Free-run	Clear
4	D B	D B	Clear
5	Free-run	D B	Clear
6	D B	Free-run	Clear
7	Free-run	Free-run	Clear
8	Emergency stop	D B	Clear
9	Emergency stop	Free-run	Clear

Torque limit value at emergency stop will be that of Pr5.11 (Setup of torque at emergency stop) when the setup value is 8 or 9.

Related page •P.3-81, 82 “Details of Parameter”

3) Setup of Driving Condition from Deceleration to after Stop by Activation of Protective Function (Pr5.10)

Sequence at over-travel inhibit input (Pr5.10)

Setup value of Pr5.10	Driving condition: During deceleration	Driving condition: After stalling	Contents of deviation counter
0	D B	D B	Clear
1	Free-run	D B	Clear
2	D B	Free-run	Clear
3	Free-run	Free-run	Clear
4	Engaged A: Emergency stop Engaged B: DB	D B	Clear
5	Engaged A: Emergency stop Engaged B: Free-run	D B	Clear
6	Engaged A: Emergency stop Engaged B: DB	Free-run	Clear
7	Engaged A: Emergency stop Engaged B: Free-run	Free-run	Clear

When setup value is within the range 4 and 7, the protection function that supports immediate stop acts according to operation A and the function that does not support acts according to operation B.
During deceleration to stop, the main power supply must be maintained.
When the protection function acts, content of deviation counter is cleared as the alarm is cleared.

4) Setup of Driving Condition from Deceleration to after Stop by Validation of Over-travel Inhibit Input (Pr5.05)

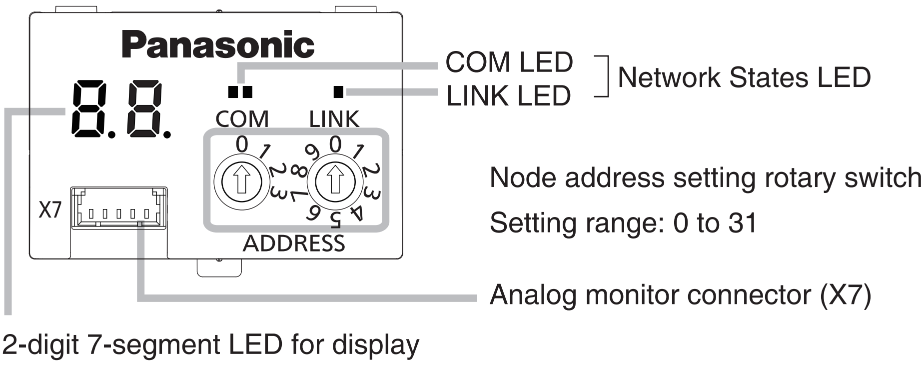
Sequence at over-travel inhibit input (Pr5.05)

Setup value of Pr5.05	Driving condition: During deceleration: Stopping method	Driving condition: During deceleration: Contents of deviation counter	Driving condition: After stalling: Operation after stopping	Driving condition: After stalling: Contents of deviation counter
0	DB	Clear	Torque command to inhibited direction is 0	Hold
1	Free-run	Clear	Torque command to inhibited direction is 0	Hold
2	Emergency stop	Clear	Torque limit and torque command are as usual	Hold

Torque limit value during deceleration will be that of Pr5.11 (Setup of torque at emergency stop) when the setup value is 2.

Related page •P.3-80, 83 "Details of Parameter"

Operation and Display of the Front Panel

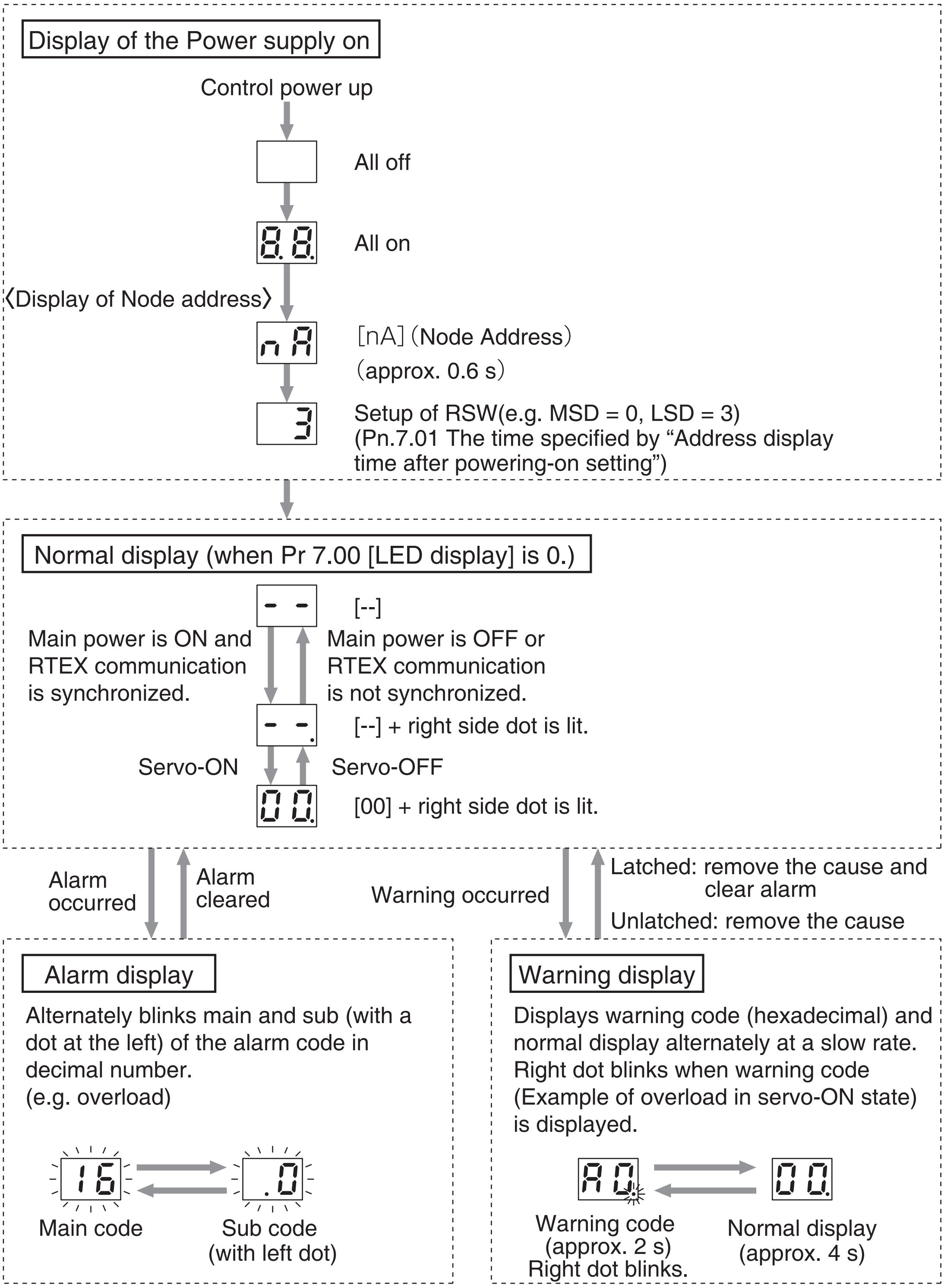


Node Address

- Set the node address (MAC-ID) in a decimal number: high order digit on MSD rotary switch and low order on LSD switch.
  Example: When MAC-ID is 13, MSD = 1, LSD = 3.
- The setting for rotary switch to be using a flat-blade screwdriver (Edge width: less than 2.6 mm, Thickness: less than 0.6 mm).
- Node address (MAC-ID) set with the rotary switch will be loaded once when the control power is turned on. Therefore, a change made after the power up will not be reflected to the control but will become active upon the next power up.
- To avoid unnecessary trouble, after the power supply is turned on ,do not change the values of rotary switch.
- Setup range of the node address (MAC-ID) is 0 to 31. If the setup value exceeds 31, Err 82.0 “COM invalid node-address protection” will be occurred.

Note For details of the connector X7, refer to P.2-64 “Wiring to the Connector, X7”

7-segment LED



Related page
•P.3-104 "Details of Parameter"

The reason of alarm display.

■ General warning

Alarm No.	Alarm	Description
A0	Overload protection	Load factor is 85 % or more the protection level.
A1	Over-regeneration alarm	Regenerative load factor is 85 % or more the protection level.
A2	Battery alarm	Battery voltage is 3.2 V or lower.
A3	Fan alarm	Fan has stopped for 1 sec.
A4	Encoder communication alarm	The number of successive encoder communication errors exceeds the specified value.
A5	Encoder overheat alarm	The encoder detects overheat alarm.
A6	Oscillation detection alarm	Oscillation or vibration is detected.
A7	Lifetime detection alarm	The life expectancy of capacity or fan becomes shorter than the specified time.
AC	Deterioration diagnosis warning	Load characteristic estimates and torque command under constant speed has exceeded the set range.

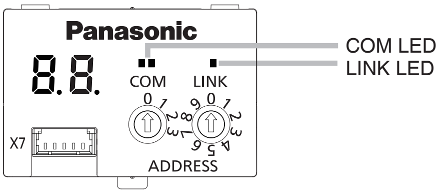
■ Extended warning

Alarm No.	Alarm	Description
C0	RTEX continuous communication error warning	The No. of detected continuous reading errors (CRC error) of the data delivered to the local node reaches the number specified by Pr 7.26 “RTEX continuous error warning setup”.
C1	RTEX accumulated communication error warning	The accumulated number of detected reading errors (CRC error) of the data delivered to the local node reaches the number specified by Pr 7.27 “RTEX accumulated error warning setup”.
C2	RTEX_Update_Counter error warning	Accumulated amount exceeded the times specified by Pr7.28 “RTEX_Update_Counter error warning setup”, so that Update_Counter was not updated.
C3	Main power off warning	When setting of Pr7.14 “Main power off warning detection time” is 10-1999, instantaneous power interruption occurs between L1 and L3 and lasts for a time longer than the setting of Pr7.14.
D2	PANATERM command execution warning	When bit0 of Pr7.99”RTEX function Extended setup 6” is 1 RTEX communication was established, the operation command (such as trial run and FFT) by setup support software (PANATERM) was executed.

Related page •P.6-38 “Warning Function”

Network Status LED

Status indication and description of RTEX network status LED (COM/LINK).



■ LINK LED

Display status	Description
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
Not lit	Initial
Blinking green	Ring Config
Lit green	Network established
Blinking red	RTEX communication-related clearable alarm occurs.
Lit red	RTEX communication-related unclearable alarm occurs.

- While an alarm (e.g. Err.16.0) other than RTEX communication-related occurs, if an alarm relating to RTEX communication occurs, the COM LED blinks red or lights up red according to the above.

However, in this case, be aware that the 7-segment LED indicates the previous alarm, which is not relating to RTEX communication.

- The LINK LED lights up momentarily irrespective of cable connection when the power is turned on or a reset command is issued. This occurs due to internal initialization of a servo driver, not due to an error.
- The state of the bit 4 of Pr.7.23 “RTEX function enhancement setup 2” can change the condition for turning on COM LED.

Related page
•P.3-104 “Details of Parameter”
•P.6-5 “Details of Error Code”

MEMO

3.Setup

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Control Mode and Command Input Mode

MINAS-A6N has 4 command input modes, can be selected based on RTEX communication command controllor.

Pr0.01	Control mode	Command input mode
0	Position Control Mode (Semi - close)	① Profile position control (PP) mode ② Cyclic position control (CP) mode
	Velocity Control Mode (Semi - close)	③ Cyclic velocity control (CV) mode
	Torque Control Mode (Semi - close)	④ Cyclic torque control (CT) mode

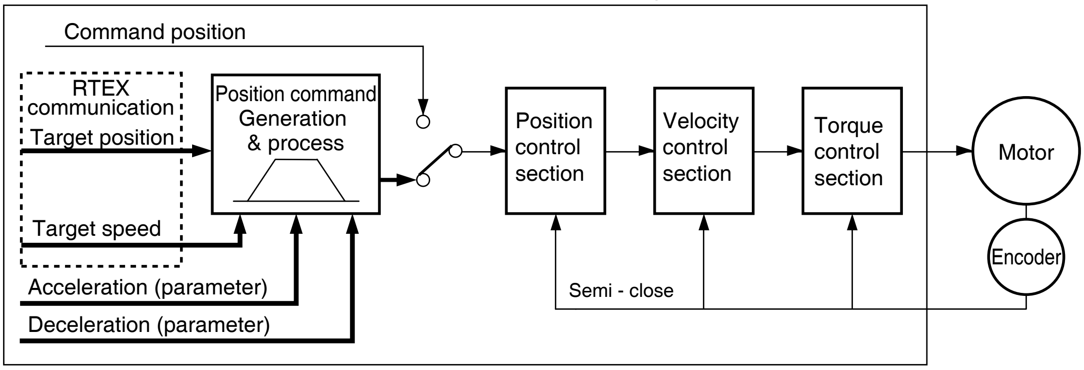
Note

· Because the actual command input mode depends on the controller, please confirm the controller data.

Outline of Command Input Mode

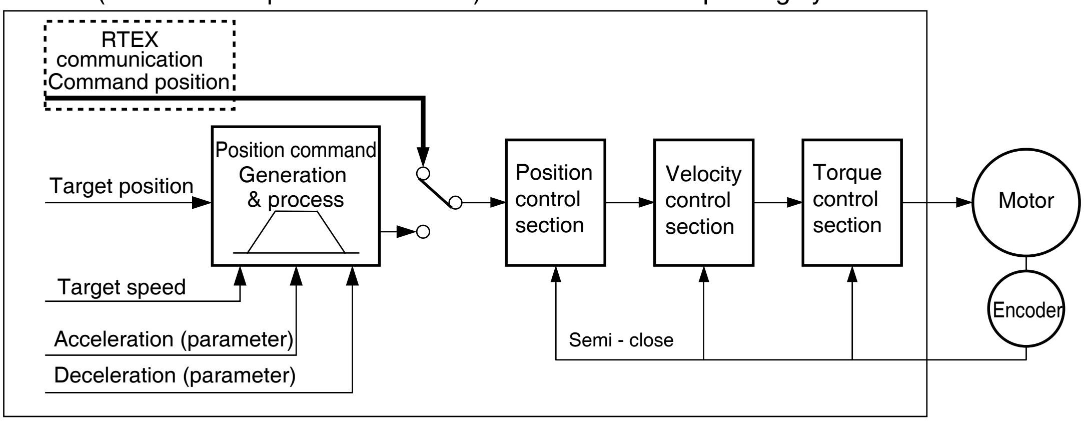
① Profile position control (PP) mode

In this Position Control Mode, the target position, target speed and acceleration/deceleration speed are specified and the servo driver internally generates the position command.



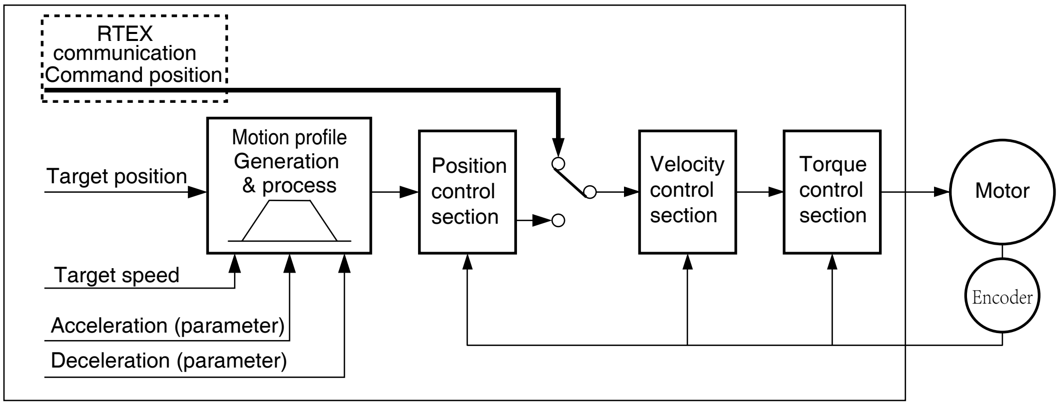
② Cyclic position control (CP) mode

In this Position Control Mode, the host controller generates the position command and updates it (or transmits updated command) at the command updating cycle.



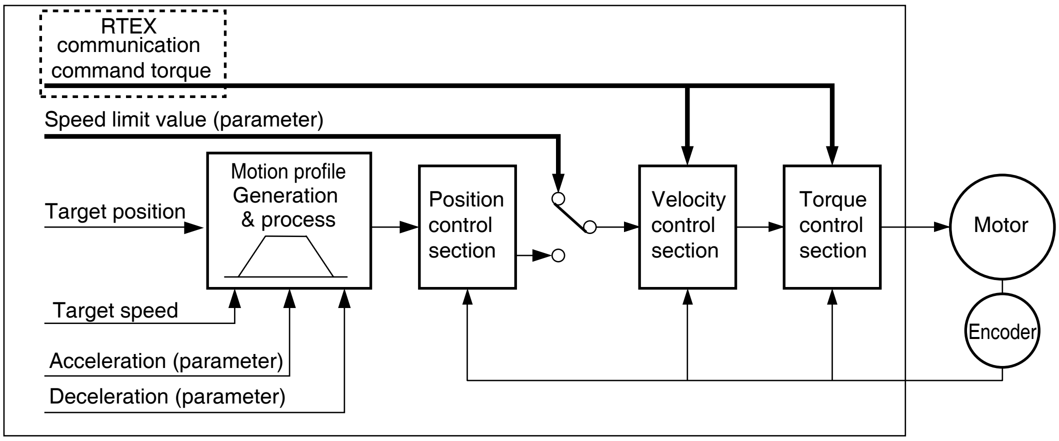
③ Cyclic velocity control (CV) mode

In this Velocity Control Mode, the host controller generates the command velocity and updates it (or transmits updated command) at the communication cycle.



④ Cyclic torque control (CT) mode

In this Torque Control Mode, the host controller generates the command torque and updates it (or transmits updated command) at the communication cycle.



Basic Specifications of Network

<table>
<tr><th>Item</th><th colspan="3">Specifications</th></tr>
<tr><td>Topology</td><td colspan="3">Ring</td></tr>
<tr><td>Physical layer</td><td colspan="3">100BASE-TX（IEEE 802.3）</td></tr>
<tr><td>Baud rate</td><td colspan="3">100 Mbps</td></tr>
<tr><td>Communication cycle (physical data transfer cycle)</td><td colspan="3">0.0625、0.125、0.25、0.5、1.0、2.0 ms
• The cycle at which command or response RTEX frame is transferred.
• The servo driver processes the command and response basically at this cycle.
Exception: when the communication cycle is 0.0625 [ms]</td></tr>
<tr><td rowspan="4">Command update cycle</td><td colspan="3">0.125、0.25、0.5、1.0、2.0、4.0 ms
・The cycle at which the host controller will update the command.
・In response, the servo driver performs the following processes.</td></tr>
<tr><td>Communication cycle 0.0625 ms</td><td colspan="2">• Processes the command and response with a cycle of 0.125 ms.
• Set the command updating cycle to 0.125 ms.</td></tr>
<tr><td rowspan="2">Other communication cycles</td><td>CP</td><td>• Calculates the changes in command position (CPOS) during command updating cycle and generates the movement command.
• If the command updating cycle on the servo driver is different from that on the host controller, operation error will occur.
• Processes commands and responses at a position other than the command position during communication cycle.</td></tr>
<tr><td>PP/CV/CT</td><td>• Processes commands and responses at the communication cycle, regardless of the command updating cycle.</td></tr>
<tr><td>Slaves to be connected (axes)</td><td colspan="3">Max. 4 when communication cycle time is 0.0625 ms
Max. 8 when communication cycle time is 0.125 ms
Max. 16 when communication cycle time is 0.250 ms
Max. 32 when communication cycle time is 0.5, 1.0 or 2.0 ms
（Notes）•Number of axes when all connected axes are in 16-byte mode.When in the 32-byte mode, the number of axes connected is one half that of axes connected in the 16-byte mode because the number of transmit-receive data blocks is twice that required in the 16-byte mode.
•These figures depend on the arithmetic processing power of the host device.
•For the use with the same communication system as the MINAS-A5N series, set the communication cycle to the same cycle (0.5 ms or 1.0 ms) as A5N.</td></tr>
<tr><td>Data size</td><td colspan="3">16-byte mode: Transmit/receive
32-byte mode: Transmit/receive</td></tr>
</table>

Mode Reference Table

(1)16 byte mode

○ :Compatible、–:Not compatible

Commu-nication cycle [ms]	Command update cycle [ms]																							
	0.125				0.25				0.5				1.0				2.0				4.0			
	PP	CP	CV	CT	PP	CP	CV	CT	PP	CP	CV	CT	PP	CP	CV	CT	PP	CP	CV	CT	PP	CP	CV	CT
0.0625	—	○	○	○	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0.125	—	○	○	○	—	○	○	○	—	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—
0.25					—	○	○	○	—	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—
0.5									○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—
1.0													○	○	○	○	○	○	○	○	—	—	—	—
2.0																	○	○	○	○	○	○	○	○

(2)32 byte mode ◯ :Compatible、–:Not compatible

Communication cycle [ms]	Command update cycle [ms]																							
	0.125				0.25				0.5				1.0				2.0				4.0			
	PP	CP	CV	CT	PP	CP	CV	CT	PP	CP	CV	CT	PP	CP	CV	CT	PP	CP	CV	CT	PP	CP	CV	CT
0.0625	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0.125	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0.25					—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0.5									◯	◯	◯	◯	◯	◯	◯	◯	—	—	—	—	—	—	—	—
1.0													◯	◯	◯	◯	◯	◯	◯	◯	—	—	—	—
2.0																	◯	◯	◯	◯	◯	◯	◯	◯

● **Related Parameters**

Parameter No.	Title	Range	Function
Pr0.01	Control mode setup	0 to 6	You can set up the control mode to be used. 0：semi-closed control
Pr7.20	RTEX communication cycle setup	–1 to 12	Set up the RTEX communication cycle. — 1：Enable the setup by Pr7.91, 3：0.5 ms, 6：1.0 ms
Pr7.21	RTEX command updating cycle setup	1 to 2	Set up the ratio of RTEX communication cycle to command updating cycle. Setting = command updating cycle/communication cycle
Pr7.22	RTEX function extended setup 1	–32768 to 32767	・bit 0： specifies the data size of RTEX communication. 0：16-byte mode, 1：32-byte mode ・bit 1： specifies the inter-axis sync mode when 2 or more axes are used with TMG_CNT. Set this parameter to 0 when not using TMG_CNT.
Pr7.91	RTEX communication cycle expansion setting	0～2000000	Set the communication cycle of RTEX communication in a unit of ns.Do not set other value than 62500(0.0625 ms)、125000(0.125 ms)、250000(0.25 ms)、500000(0.5 ms)、1000000(1.0 ms)、2000000(2.0 ms). Set to other value, Err93.5 “Parameter setting error protection 4” is generated.

Example of Mode Setup

Communication cycle of 0.5 ms, command updating cycle 1.0 ms, semi-closed control, 16-byte mode and interaxis semi-synchronous mode.

・Pr0.01 = 0（Semi-closed control） ・Pr7.20 = 3（Communication cycle 0.5 ms）
・Pr7.21 = 2（Command updating cycle 1.0 ms = 0.5 ms ×2）
・Pr7.22 = 0（(16-byte mode and interaxis semi-synchronous mode）

In this example setting, PP/CP/CV/CT control mode switch can be used.

Caution PP/CP/CV/CT control mode selection is necessary by specifying command code.

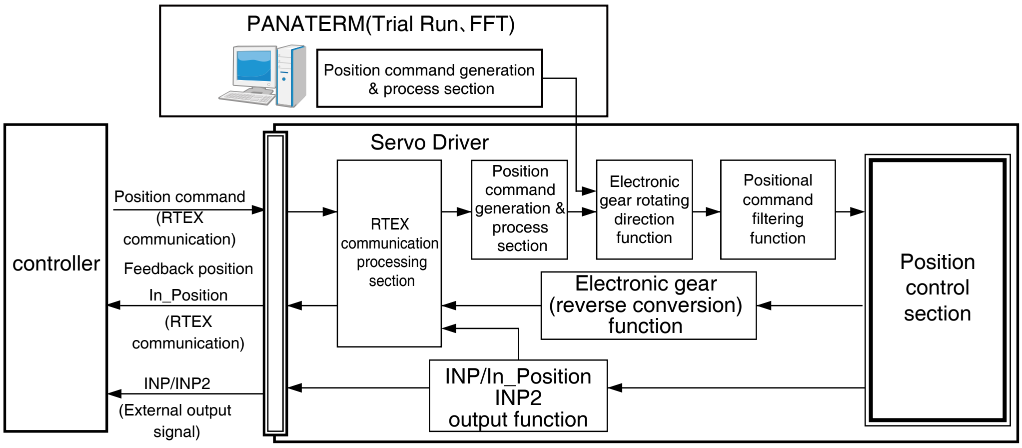
> If the combination of Pr7.20 “RTEX communication cycle setup”, Pr7.91 “RTEX communication cycle expansion setting”, Pr7.21 “RTEX command updating cycle setup” and electronic gear ratio is are not suitable, Err93.5 “Parameter setting error protection 4” is generated.
> Make sure to set the same cycle as the upper equipment for the RTEX communication cycle (Pr7.20, Pr7.91) and RTEX command updating cycle (Pr7.21).
> Also, make sure to set the same setting as the upper equipment for the extended RTEX function (Pr7.22).
> Otherwise, the operation cannot be guaranteed.

2.Outline of Control Mode

Position Control Mode

Outline

Control the position based on the positional command of RTEX communication command from the host controller. Below describes the Basic Settings necessary for position control.
As Position Control Modes, profile position control (PP) and Cyclic position control (CP) are available. In the former, target position, a target velocity, and acceleration/deceleration are specified and a position command is generated in a servo driver; and in the latter, a position command is generated in an upper controller and a command position is updated at specified intervals, Positional command is input based on the command of RTEX communication.



Function

① Electronic gear function

The electronic gear is a function to receive a position command from an upper controller, and multiplies it by an electronic gear ratio specified by a parameter to produce a position command to a position control section. By using this function, the number of revolutions and travel of the motor per command can be set to the desired value.
Setup by the number of pulses per motor revolution of reproduced pulse（Pr0.08）or electronic gear setting for conmmand（Pr0.09, Pr0.10）.

● Relevant parameters

Panameter No.	Title	Range	Function
Pr0.08	Command pulse counts per one motor revolution	0 to 8388608	Specifies the number of command pulses equivalent to one revolution of a motor. If this value is 0, Pn0.09 “Numerator of electronic gear ratio” and Pn0.10 “Denominator of electronic gear ratio” are valid.
Pr0.09	Numerator of electronic gear	0 to 1073741824	Set the numerator of electronic gear ratio.
Pr0.10	Denominator of electronic gear	1 to 1073741824	Set the denominator of electronic gear ratio.

Note

For Details of Parameter,refer to P.3-42 “Details of Parameter”.

Caution

In case that communication cycle is 250us or less, please fix the value as 1/1. When electronic gear ratio is not 1/1 in case that communication cycle is 250us or less, Err93.5（Parameter setup error protection 4）can be occur.

Related page
・P.3-12 “ Block Diagram of Control Mode ”　・P.2-48 “ Wiring to the Connector，X4 ”

② Positional command filtering function

To make the positional command divided or multiplied by the electronic gear smooth, set the command filter.

● **Relevant parameters**

Panameter No.	Title	Range	Unit	Function
Pr2.22	Command smoothing filter	0 to 10000	0.1 ms	Sets the time constant of first order lag filter for the position command. With the two-degree-of-freedom control, it functions as the command response filter.
Pr2.23	Command FIR filter	0 to 10000	0.1 ms	Sets the time constant of FIR filter for the position command..

Note For Details of Parameter,refer to P.3-59, 60 “ Details of Parameter ” .

③ Pulse regeneration function

The information on the amount of movement can be sent to the host controller in the form of A- and B-phase pulses from the servo driver. The resolution of information, B phase logic and output source (encoder and external scale) can be set up by using parameters.
Z phase signal is not compatible with pulse regeneration.

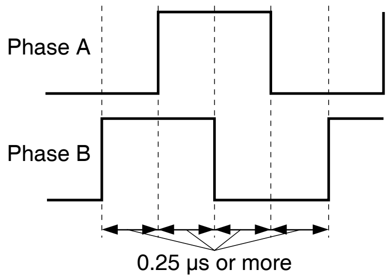
● **Relevant parameters**

Panameter No.	Title	Range	Unit	Function
Pr0.11	Output pulse counts per one motor revolution	1 to 2097152	pulse/r	Set the resolution of pulse output by the number of output pulses per revolution of OA and OB, respectively.
Pr0.12	Reversal of pulse output logic/output source selection	0 to 3	—	Set the B-phase logic and the output source of the pulse output. By inverting the B-phase pulse by this parameter, it is possible to reverse the phase relationship between the B-phase pulses to the A-phase pulse.
Pr4.47	Pulse output selection	0 to 1	—	Select the signal to be output from the pulse regeneration output terminal or position comparison output terminal. 0：Encoder output signal 1：Position comparison output signal
Pr5.03	Denominator of pulse output division	0 to 8388608	—	For application where the number of output pulses is not an integer, this parameter can be set to a value other than 0 and the dividing ratio can be set by using Pr. 0.11 as numerator and Pr. 5.03 as denominator. .
Pr5.33	Pulse regenerative output limit setup	0 to 1	—	Enable/disable detection of Err28.0 “Pulse regenerative limit protection”.

Note For Details of Parameter, refer to P.3-44, 75, 78, 86 “ Details of Parameter ”.

■ Command on pulse regeneration function

Maximum frequency of regenerated pulse output is 4 Mpps (after multiplied by 4), If the movement speed exceeds this frequency, the regeneration will not function correctly. That is, correct pulse is not returned to the host controller, causing positional deviation.



By enabling Pr5.33 “Pulse regenerative output limit setup”, Err28.0 “Pulse regenerative limit protection” can be generated upon reaching the pulse regeneration limit. Because this error is generated when the output limit of the pulse regeneration is detected, it is not generated at the maximum frequency. However, detection error may occur if the frequency instantaneously jumps up due to motor velocity change (irregular rotation).

④ Positioning complete output function

Positioning completion status can be checked also in positioning completion (In_Position) of RTEX communication status.

the absolute value of the positional deviation parameter is equal to or below the positioning complete range by the parameter, the output is 1. Presence and absence of positional command can be specified as one of judgment conditions.

● Relevant parameters

Panameter No.	Title	Range	Unit	Function
Pr4.31	Positioning complete range	0 to 2097152	Command unit	Set the threshold of positional deviation with respect to the output of positioning complete signal.
Pr4.32	Positioning complete output setup	0 to 10	—	Select the condition to output the positioning complete signal.
Pr4.33	INP hold time	0 to 30000	1 ms	Set up the hold time when Pr 4.32 “Positioning complete output setup” = 3,8. Becomes positioning detection delay time if Pr4.32 “Positioning complete output setup” is 4,5,9,10..

Note For Details of Parameter,refer to P.3-70, 71 “ Details of Parameter ”.

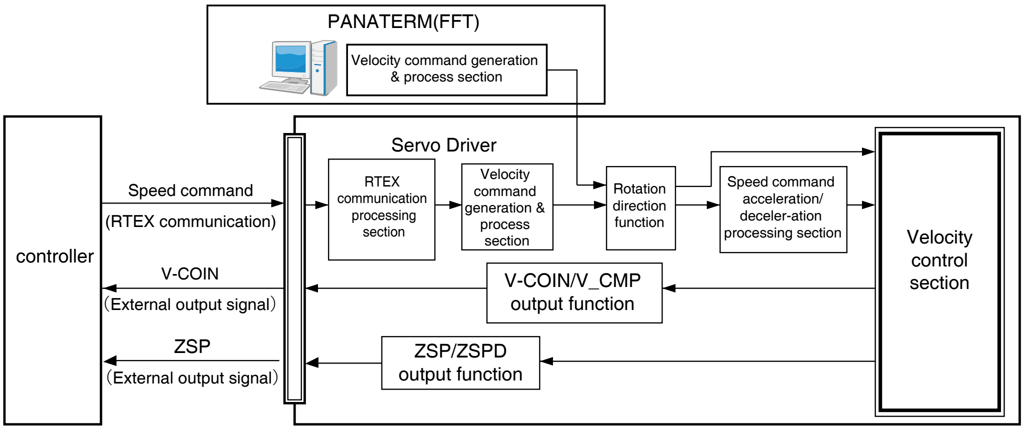
2.Outline of Control Mode

Velocity Control Mode

Outline

This function controls the velocity according to the velocity command RTEX communication command sent from the host controller. Below describes the basic set up of the velocity controls.

Available Velocity Control Mode is the cyclic Velocity Control Mode (CV control mode) which updates the command velocity through RTEX communication command.



Function

① Velocity command acceleration/deceleration setting function

This function controls the velocity by adding acceleration or deceleration command in the driver to the input velocity command.

Using this function, it is possible to can use the soft start when inputting stepwise velocity command or when using internal velocity setup. Also, it is possible to use S shaped acceleration/deceleration function to minimize shock due to change in velocity.

● **Relevant parameters**

Parameter No.	Title	Range	Unit	Function
Pr3.12	Acceleration time setup	0 to 10000	ms/ (1000 r/min)	Set up acceleration processing time in response to the velocity command input.
Pr3.13	Deceleration time setup	0 to 10000	ms/ (1000 r/min)	Set up deceleration processing time in response to the velocity command input.
Pr3.14	Sigmoid acceleration/ deceleration time setup	0 to 1000	ms	Set S-curve time for acceleration/ deceleration process when the velocity command is applied.

Caution When the position loop is external to the driver, do not use the acceleration/deceleration time setting. Set these values to 0.

Note For Details of Parameter, refer to P.3-62 “ Details of Parameter ”.

Related page · P.3-12“ Block Diagram of Control ” · P.2-48 “ Wiring to the Connector, X4 ”

② Speed coincidence output (V-COIN)

This signal is output when the motor speed is equal to the velocity specified by the velocity command. The motor speed is judged to be coincident with the specified speed when the difference from the velocity command before/after acceleration/deceleration is within the range specified by Pr 4.35 “Speed coincident range”.

● **Relevant parameters**

Panameter No.	Title	Range	Unit	Function
Pr4.35	Speed coincidence range	10 to 20000	r/min	Set the speed coincidence (V-COIN) output detection timing.

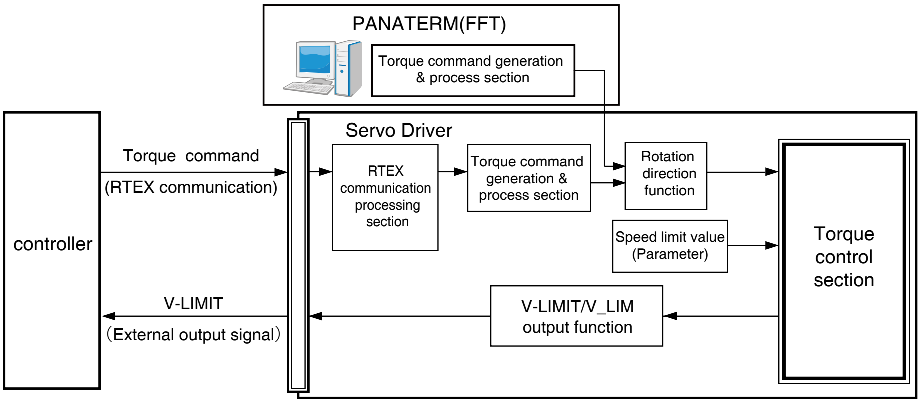
Note

For Details of Parameter,refer to P.3-72 “ Details of Parameter ”.

Outline

This function performs torque control based on torque command of RTEX communication command sent from the host controller. Below describes Basic Setting of torque control to be used. In addition to the torque command, the speed limit command is required to maintain the motor at a speed below the limited value.

Available Torque Control Mode is the cyclic Torque Control Mode (CT control mode) which updates the command torque during communication cycle. The mode is selected by RTEX communication command.



Function

① Speed limit function

The speed limit is one of the protective functions used during torque control.
This function regulates the motor speed so that it does not exceed the speed limit while the torque is controlled.

Caution

While the speed limit is used to control the motor, the torque command applied to the motor is not directly proportional to the analog torque command. Torque command should have the following result.: the motor speed is equal to the speed limit.

The default speed limit value is 0, Be sure it is set higer than the maximum operating speed.

The speed limit is disabled when the motor operates in the reverse direction to the torque command given by the host controller due to gravity and other disturbances.If this behavior is a problem, by setting the rate at which the motor is stopped to Pr5.13“Over-speed level setup” or Pr6.15“2nd over-speed level setup”, to stop the motor by generating Err26.0“Over-speed protection” or Err26.1“2nd over-speed protection”.

For details of over-speed protection, refer to setup of P6-22(Pr5.13[over-speed level setup] and Pr6.15[2nd over-speed level]).

● Relevant parameters

Panameter No.	Title	range	unit	Function
Pr3.17	Selection of speed limit	0 to 1	—	Set up the selection method of the speed limit used for torque controlling.
Pr3.21	Speed limit value 1	0 to 20000	r/min	Set up the speed limit used for torque controlling.
Pr3.22	Speed limit value 2	0 to 20000	r/min	When Pr 3.17 Selection of speed limit is set to 1, the speed limit selected with SL_SW1 of RTEX communication command is set.

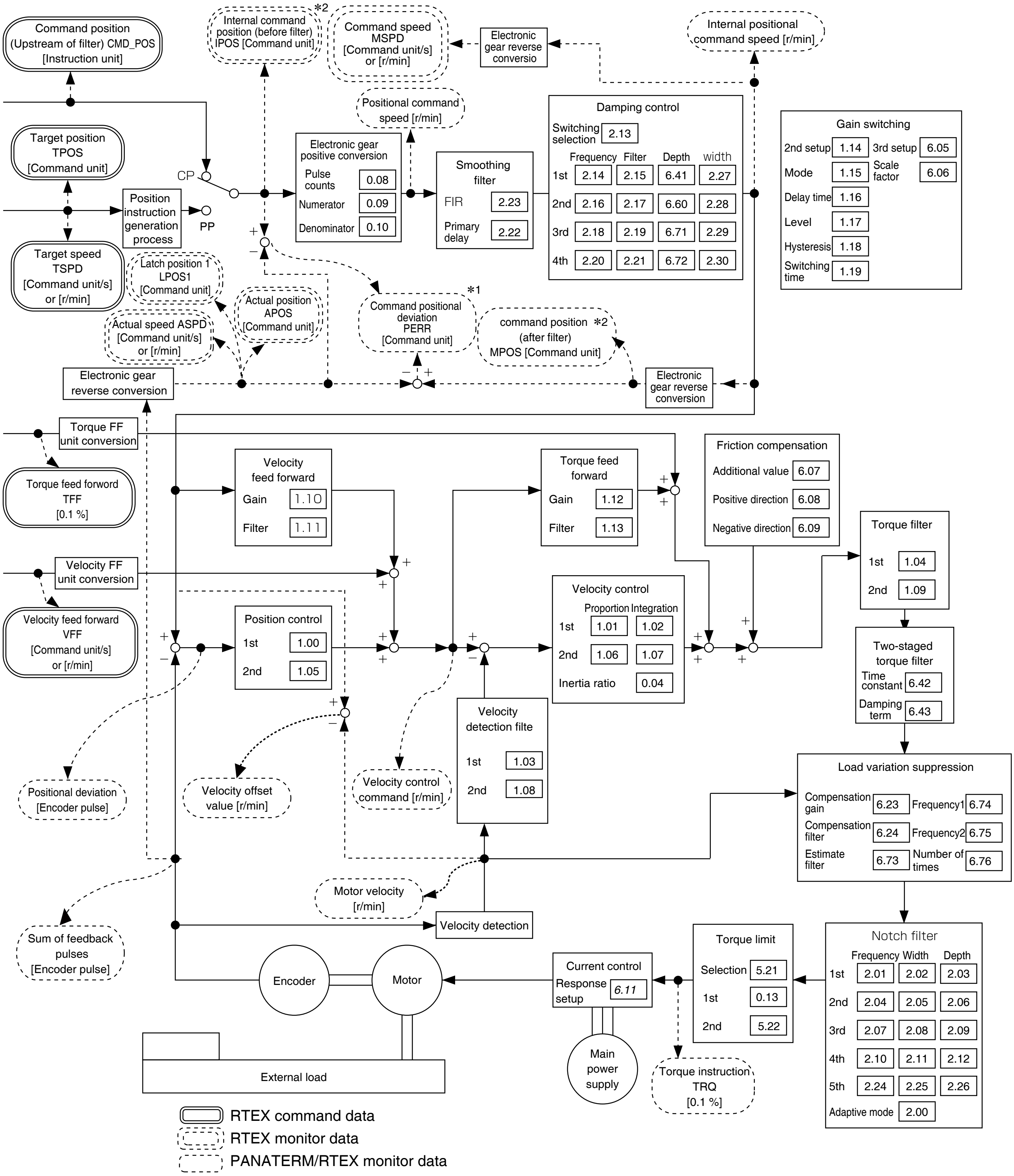
Note

For Details of Parameter, refer to P.3-63 “ Details of Parameter ”.

Block Diagram of Control Mode

Position Mode

- Profile position control mode (PP)
- Cyclic position control mode (CP)



*1 The computation reference for the command positional deviation [command unit] can be changed by bit14 for Pr7.23 " RTEX function extended setup 2".

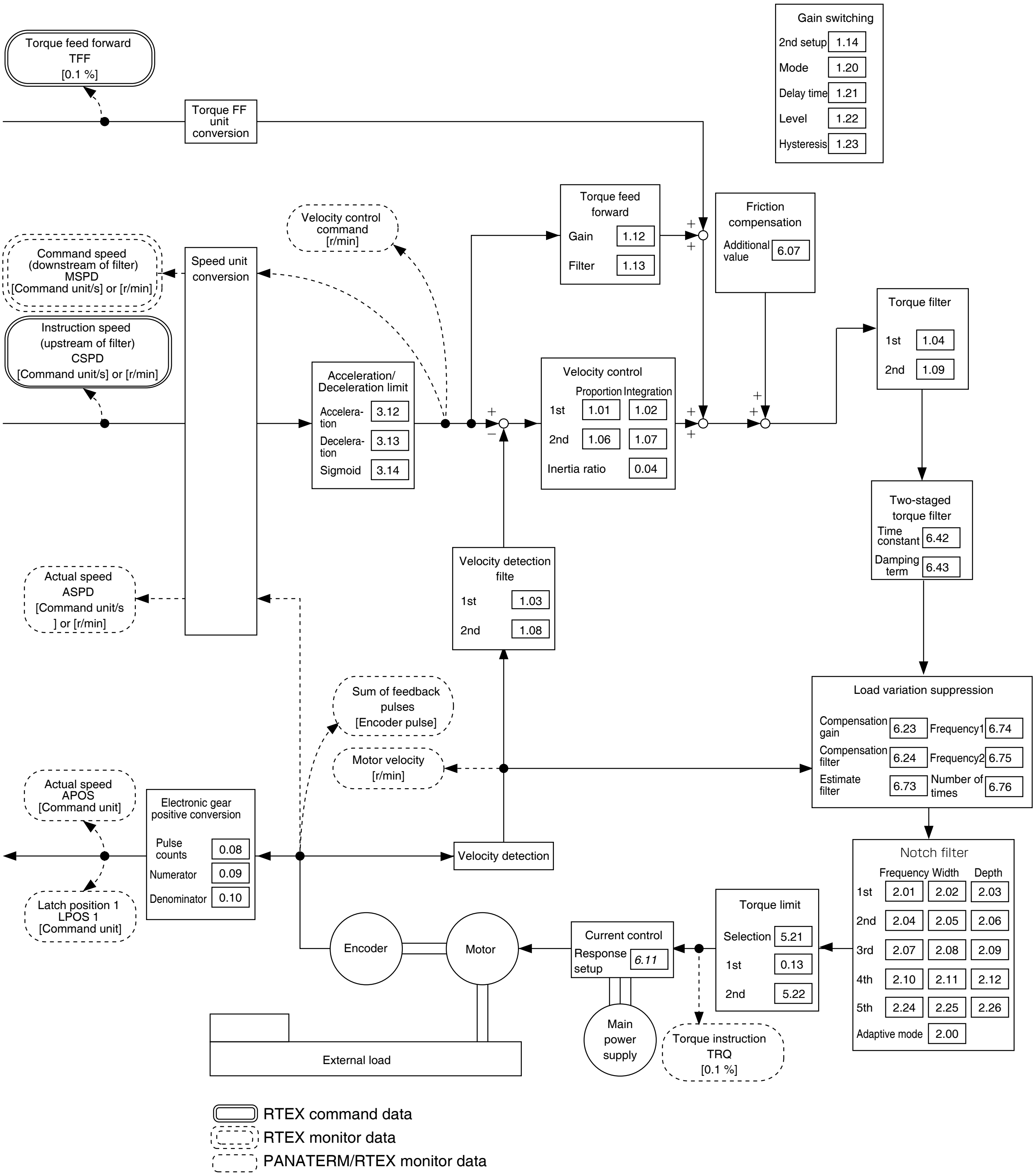
*2 The position command on PANATERM can be switched depending on the setting of the bit3 "Command pulse accumulation value" of Pr7.99 "RTEX function extended setup 6".

*3 When performing trial run function, Z phase search, Frequency characteristic analysis (position loop characteristic) Sfrom the PANATERM, the driver switches to position control mode internally.

Related page ・P.2-47 "Wiring to the Connector, X4" ・P.2-48 " Wiring to the Connector, X4" ・P.3-17 "List of Parameters "

Velocity Mode

●Cyclic velocity control mode (CV)

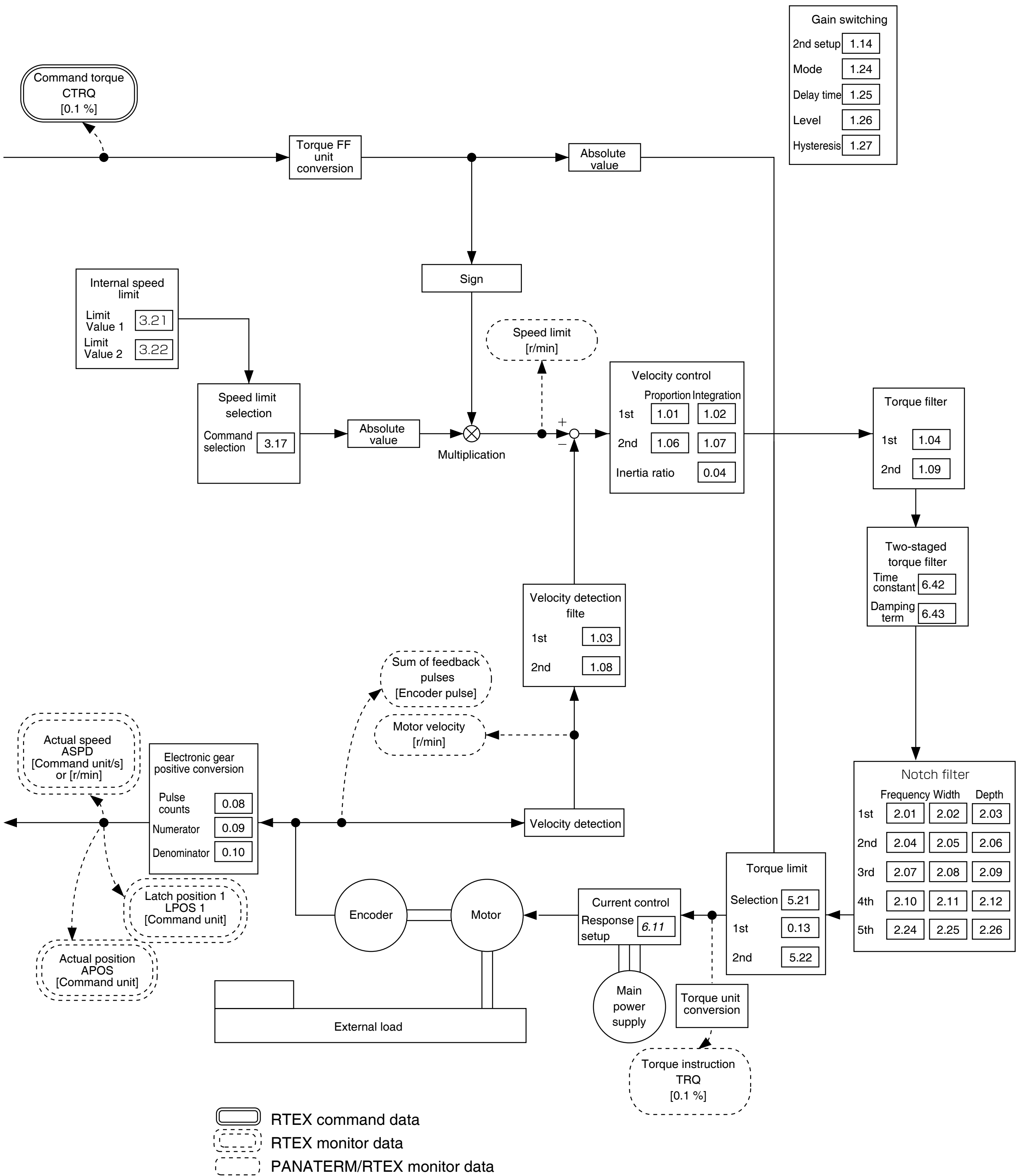


*1 When performing Frequency characteristic analysis (speed close loop characteristic, Torque speed(Vertical)) from the PANATERM, the driver switches to velocity control mode internally.

Related page ・P.2-48 " Wiring to the Connector, X4 "

Torque Control Mode

●Cyclic torque control mode (CT)



*1 When performing Frequency characteristic analysis (Torque speed (normal)) from the PANATERM, the driver switches to torque control mode internally.

Related page ・P.2-48 “ Wiring to the Connector, X4 ”

Outline of Parameter

This driver is equipped with various parameters to set up its characteristics and functions. This section describes the function and purpose of each parameter. Read and comprehend very well so that you can adjust this driver in optimum condition for your running requirements.

Setup of Parameter

● The parameters reference and setup by three methods in the following.
① RTEX communication
② combination of the setup support software, "PANATERM" and PC.
③ Application "Panasonic Motor Setup App" of iPhone and Android.

Setup of PC

The personal computer and connector X1 of MINAS A6N can be connected by commercial USB cable.After downloading and installing the support software PANATERM from our homepage, you can do the following operation easily.

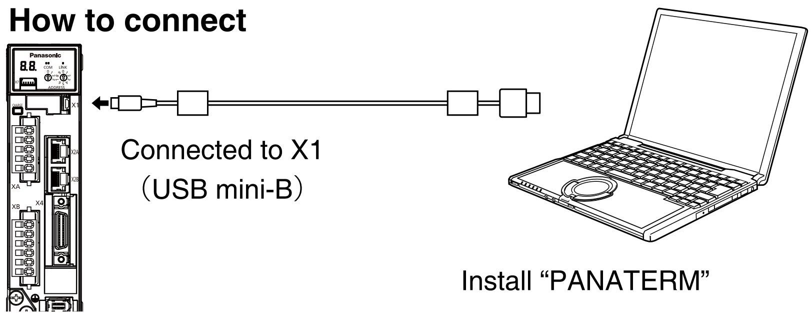
■ Outline of setup support software" PANATERM"

The following can be operated by "PANATERM" .

①Setup and storage of parameters, and writing to the memory (EEPROM).
②Monitoring of I/O, pulse input and load factor.
③Display of the present alarm and reference of the error history.
④Data measurement of the wave-form graphic and bringing of the stored data.
⑤Normal auto-gain tuning.
⑥Frequency characteristic analysis of the machine system.
⑦JOG function and Z phase search.
⑧Troubleshooting（Motor does not run, life diagnosis）.

Note Because there is no CD-ROM version of the product, so please download from homepage.

■ How to connect



■ For USB cable

Using a commercially USB cable with ferrite core. The connector of driver is USB mini-B. The connector on the side of the personal computer, personal computer for use in accordance with the specifications.
When using the cable without ferrite core, Both ends of the cable is attached to the ferrite core（DV0P1460）.
If use to option product " WIFI LAN Dongle (DV0PM20105) " , can be connectted by WIFI. the details refer to homepage of our company.

Related page ・P.7-9 " Outline of Setup Support Software "PANATERM" " ・P.3-39 " Details of Parameter "
Note ・For the application" Panasonic Motor Setup App "of iPhone and Android terminal,check on our homepage.

Class of Parameter

For MINAS A6N, Parameters are classified into 11 categories.

Parametr No. Class	No. *1	Title	content	page
0	00 to 18	Basic Setting	Parameter of Basic Setting	P.3-39
1	00 to 78	Gain adjustmeng	Parameter of Gain adjustmeng	P.3-47
2	00 to 37	Damping Control function	Parameter of Damping Control	P.3-54
3	04 to 29	Velocity・Torque control	Parameter of Velocity and Torque	P.3-62
4	00 to 57	I/O monitor setting	Parameter of Interface monitor	P.3-64
5	03 to 78	Enhancing setting	Parameter of Enhancing setting	P.3-78
6	02 to 98	Special setting	Parameter of Special setting	P.3-91
7	00 to 110	Special setting 2		P.3-104
8	00 to 19	Special setting 3		P.3-117
9	00 to 50	For manufacturer's use	Parameter of manufacturer's use	P.3-120
14 *2	00 to 29	For manufacturer's use		
15	00 to 35	For manufacturer's use		

Note

* 1 Input double figures for No..
* 2 There is class 14 before Ver.1.05.

The sign of mode is the following.

Sign	Contor mode
P	Position control
S	Velocity control
T	Torque control

・Parameter has attribute. Attribute indicates when the changed parameter is made valid. Details refer to P.3-38,

【Class 0】 Basic Setting

Parametr No. Class	No.	Title	Range	Default A,B type	Default C type	Default D,E,F type	Unit	Attribute	Related control mode P	S	T	Detail page
0	00	Rotational direction setup	0 to 1	1			–	C	○	○	○	3-39
0	01	Control mode setup	0 to 6	0			–	R	○	○	○	
0	02	Real-time auto-gain tuning setup	0 to 6	1			–	B	○	○	○	3-40
0	03	Selection of machine stiffness at real-time auto-gain tuning	0 to 31	13		11	–	B	○	○	○	3-41
0	04	Inertia ratio	0 to 10000	250			%	B	○	○	○	3-42
0	08	Command pulse counts per one motor revolution	0 to 2^{23}	0			pulse	C	○	○	○	
0	09	Numerator of electronic gear	0 to 2^{30}	1			–	C	○	○	○	
0	10	Denominator of electronic gear	1 to 2^{30}	1			–	C	○	○	○	
0	11	Output pulse counts per one motor revolution	1 to 2097152	2500			pulse/r	R	○	○	○	3-44
0	12	Reversal of pulse output logic/ output source selection	0 to 3	0			–	R	○	○	○	
0	13	1st torque limit	0 to 500	500＊1			%	B	○	○	○	3-45
0	14	Position deviation excess setup	0 to 2^{30}	83886080			command unit	A	○			
0	15	Absolute encoder setup	0 to 4	1			–	C	○	○	○	
0	16	External regenerative resistor setup	0 to 3	3	0		–	C	○	○	○	3-46
0	17	Load factor of external regenerative resistor selection	0 to 4	0			–	C	○	○	○	
0	18	For manufacturer's use	–	0			–	–				

【Class 1】 Gain Adjustment

Parametr No. Class	No.	Title	Range	Default A,B type	Default C type	Default D,E,F type	Unit	Attribute	Related control mode P	S	T	Detail page
1	00	1st gain of position loop	0 to 30000	480		320	0.1 /s*	B	○			3-47
1	01	1st gain of velocity loop	1 to 32767	270		180	0.1 Hz*	B	○	○	○	
1	02	1st time constant of velocity loop integration	1 to 10000	210		310	0.1 ms*	B	○	○	○	
1	03	1st filter of velocity detection	0 to 5	0			–	B	○	○	○	

※ “ Related control mode ” is thant P：Position control、S：Velocity control、T：Torque control.

※ For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

＊1 Default value is diffrent according to the combination of the drive and motor .Refer to P.3-121 “ Torque limit Setup ”.

Parametr No. Class	No.	Title	Range	Default A,B type	Default C type	Default D,E,F type	Unit	Attribute	Related control mode P	S	T	Detail page
1	04	1st time constant of torque filter	0 to 2500	84		126	0.01 ms	B	○	○	○	3-47
1	05	2nd gain of position loop	0 to 30000	480		320	0.1 /s*	B	○			3-48
1	06	2nd gain of velocity loop	1 to 32767	270		180	0.1 Hz*	B	○	○	○	
1	07	2nd time constant of velocity loop integration	1 to 10000	210		310	0.1 ms*	B	○	○	○	
1	08	2nd filter of velocity detection	0 to 5	0			–	B	○	○	○	
1	09	2nd time constant of torque filter	0 to 2500	84		126	0.01 ms*	B	○	○	○	
1	10	Velocity feed forward gain	0 to 4000	1000			0.10 %*	B	○			
1	11	Velocity feed forward filter	0 to 6400	0			0.01 ms*	B	○			
1	12	Torque feed forward gain	0 to 2000	1000			0.10 %*	B	○	○		
1	13	Torque feed forward filter	0 to 6400	0			0.01 ms*	B	○	○		
1	14	2nd gain setup	0 to 1	1			–	B	○	○	○	3-49
1	15	Mode of position control switching	0 to 10	0			–	B	○			
1	16	Delay time of position control switching	0 to 10000	10			0.1 ms*	B	○			3-50
1	17	Level of position control switching	0 to 20000	0			–	B	○			
1	18	Hysteresis at position control switching	0 to 20000	0			–	B	○			
1	19	Position gain switching time	0 to 10000	10			0.1 ms*	B	○			3-51
1	20	Mode of velocity control switching	0 to 5	0			–	B		○		
1	21	Delay time of velocity control switching	0 to 10000	0			0.1 ms*	B		○		3-52
1	22	Level of velocity control switching	0 to 20000	0			–	B		○		
1	23	Hysteresis at velocity control switching	0 to 20000	0			–	B		○		
1	24	Mode of torque control switching	0 to 3	0			–	B			○	
1	25	Delay time of torque control switching	0 to 10000	0			0.1 ms*	B			○	3-53
1	26	Level of torque control switching	0 to 20000	0			–	B			○	
1	27	Hysteresis at torque control switching	0 to 20000	0			–	B			○	

※ “ Related control mode ”is thant P：Position control、S：Velocity control、T：Torque control.
※ For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Caution Parameter with for “ Unit ”,set to parameter by setup support software “ PANATERM ”,please pay attention to the setting of the number of units have changed.

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
1	28	For manufacturer's use	–	0			–	–				3-53
1	29	For manufacturer's use	–	0			–	–				
1	30	For manufacturer's use	–	0			–	–				
1	31	For manufacturer's use	–	0			–	–				
1	32	For manufacturer's use	–	0			–	–				
1	33	For manufacturer's use	–	0			–	–				
1	34	For manufacturer's use	–	0			–	–				
1	35	For manufacturer's use	–	0			–	–				
1	36	For manufacturer's use	–	0			–	–				
1	37	For manufacturer's use	–	0			–	–				
1	38	For manufacturer's use	–	0			–	–				
1	39	For manufacturer's use	–	0			–	–				
1	40	For manufacturer's use	–	0			–	–				
1	41	For manufacturer's use	–	0			–	–				
1	42	For manufacturer's use	–	0			–	–				
1	43	For manufacturer's use	–	0			–	–				
1	44	For manufacturer's use	–	0			–	–				
1	45	For manufacturer's use	–	0			–	–				
1	46	For manufacturer's use	–	0			–	–				
1	47	For manufacturer's use	–	0			–	–				
1	48	For manufacturer's use	–	0			–	–				
1	49	For manufacturer's use	–	0			–	–				
1	50	For manufacturer's use	–	0			–	–				
1	51	For manufacturer's use	–	0			–	–				

※ " Related control mode "is thant P：Position control、S：Velocity control、T：Torque control.
※ For " Attribute ",refer to P.3-38 " Details of Attribute " .

Caution Parameter with for " Unit ",set to parameter by setup support software " PANATERM ",please pay attention to the setting of the number of units have changed.

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
1	52	For manufacturer's use	–	0			–	–				3-53
1	53	For manufacturer's use	–	0			–	–				
1	54	For manufacturer's use	–	0			–	–				
1	55	For manufacturer's use	–	0			–	–				
1	56	For manufacturer's use	–	0			–	–				
1	57	For manufacturer's use	–	0			–	–				
1	58	For manufacturer's use	–	0			–	–				
1	59	For manufacturer's use	–	0			–	–				
1	60	For manufacturer's use	–	0			–	–				
1	61	For manufacturer's use	–	0			–	–				
1	62	For manufacturer's use	–	0			–	–				
1	63	For manufacturer's use	–	0			–	–				
1	64	For manufacturer's use	–	0			–	–				
1	65	For manufacturer's use	–	0			–	–				
1	66	For manufacturer's use	–	0			–	–				
1	67	For manufacturer's use	–	0			–	–				
1	68	For manufacturer's use	–	0			–	–				
1	69	For manufacturer's use	–	0			–	–				
1	70	For manufacturer's use	–	0			–	–				
1	71	For manufacturer's use	–	0			–	–				
1	72	For manufacturer's use	–	0			–	–				
1	73	For manufacturer's use	–	0			–	–				
1	74	For manufacturer's use	–	0			–	–				
1	75	For manufacturer's use	–	0			–	–				

※ “ Related control mode ”is thant P：Position control、S：Velocity control、T：Torque control.

※ For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Caution Parameter with for “ Unit ”,set to parameter by setup support software “ PANATERM ”,please pay attention to the setting of the number of units have changed.

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
1	76	For manufacturer's use	–	0			–	–				
1	77	For manufacturer's use	–	0			–	–				3-53
1	78	For manufacturer's use	–	0			–	–				

【Class 2】 Damping Control Function

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
2	00	Adaptive filter mode setup	0 to 6	0			–	B	○	○		
2	01	1st notch frequency	50 to 5000	5000			Hz	B	○	○	○	3-54
2	02	1st notchwidth selection	0 to 20	2			–	B	○	○	○	
2	03	1st notch depth selection	0 to 99	0			–	B	○	○	○	
2	04	2nd notch frequency	50 to 5000	5000			Hz	B	○	○	○	
2	05	2nd notch width selection	0 to 20	2			–	B	○	○	○	
2	06	2nd notch depth selection	0 to 99	0			–	B	○	○	○	3-55
2	07	3rd notch frequency	50 to 5000	5000			Hz	B	○	○	○	
2	08	3rd notch width selection	0 to 20	2			–	B	○	○	○	
2	09	3rd notch depth selection	0 to 99	0			–	B	○	○	○	
2	10	4th notch frequency	50 to 5000	5000			Hz	B	○	○	○	
2	11	4th notch width selection	0 to 20	2			–	B	○	○	○	3-56
2	12	4th notch depth selection	0 to 99	0			–	B	○	○	○	
2	13	Selection of damping filter switching	0 to 6	0			–	B	○			3-57
2	14	1st damping frequency	0 to 3000	0			0.1 Hz*	B	○			
2	15	1st damping filter setup	0 to 1500	0			0.1 Hz*	B	○			3-58
2	16	2nd damping frequency	0 to 3000	0			0.1 Hz*	B	○			
2	17	2nd damping filter setup	0 to 1500	0			0.1 Hz*	B	○			

※ " Related control mode "is thant P：Position control、S：Velocity control、T：Torque control.
※ For " Attribute ",refer to P.3-38 " Details of Attribute ".

Caution Parameter with for " Unit ",set to parameter by setup support software " PANATERM ",please pay attention to the setting of the number of units have changed.

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
2	18	3rd damping frequency	0 to 3000	0			0.1 Hz*	B	○			3-58
2	19	3rd damping filter setup	0 to 1500	0			0.1 Hz*	B	○			
2	20	4th damping frequency	0 to 3000	0			0.1 Hz*	B	○			
2	21	4th damping filter setup	0 to 1500	0			0.1 Hz*	B	○			
2	22	Command smoothing filter	0 to 10000	92		139	0.1 ms*	B	○	○		3-59
2	23	Command FIR filter	0 to 10000	10			0.1 ms*	B	○			3-60
2	24	5th notch frequency	50 to 5000	5000			Hz	B	○	○	○	
2	25	5th notch width selection	0 to 20	2			–	B	○	○	○	
2	26	5th notch depth selection	0 to 99	0			–	B	○	○	○	
2	27	1st damping width setting	0 to 1000	0			–	B	○			
2	28	2nd damping width setting	0 to 1000	0			–	B	○			3-61
2	29	3rd damping width setting	0 to 1000	0			–	B	○			
2	30	4th damping width setting	0 to 1000	0			–	B	○			
2	31	For manufacturer's use	–	0			–	–				
2	32	For manufacturer's use	–	0			–	–				
2	33	For manufacturer's use	–	0			–	–				
2	34	For manufacturer's use	–	0			–	–				
2	35	For manufacturer's use	–	0			–	–				
2	36	For manufacturer's use	–	0			–	–				
2	37	For manufacturer's use	–	0			–	–				

【Class 3】 Velocity/ Torque

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
3	04	For manufacturer's use	–	0			–	–				3-62

※ " Related control mode "is thant P：Position control、S：Velocity control、T：Torque control.

※ For " Attribute ",refer to P.3-38 " Details of Attribute ".

Caution Parameter with for " Unit ",set to parameter by setup support software " PANATERM ",please pay attention to the setting of the number of units have changed.

Parametr No. Class	No.	Title	Range	Default A,B type	Default C type	Default D,E,F type	Unit	Attribute	Related control mode P	S	T	Detail page
3	05	For manufacturer's use	–	0			–	–				3-62
3	12	Acceleration time setup	0 to 10000	0			ms/ (1000 r/min)	B		○		
3	13	Deceleration time setup	0 to 10000	0			ms/ (1000 r/min)	B		○		
3	14	Sigmoid acceleration/ deceleration time setup	0 to 1000	0			ms	B		○		
3	17	Selection of speed limit	0 to 1	0			–	B			○	3-63
3	21	Speed limit value 1	0 to 20000	0			r/min	B			○	
3	22	Speed limit value 2	0 to 20000	0			r/min	B			○	
3	23	For manufacturer's use	–	0			–	–				
3	24	For manufacturer's use	–	0			–	–				
3	25	For manufacturer's use	–	10000			–	–				
3	26	For manufacturer's use	–	0			–	–				
3	27	For manufacturer's use	–	0			–	–				
3	28	For manufacturer's use	–	16000			–	–				
3	29	For manufacturer's use	–	0			–	–				

【Class 4】 I/F Monitor Setting

Parametr No. Class	No.	Title	Range	Default A,B type	Default C type	Default D,E,F type	Unit	Attribute	Related control mode P	S	T	Detail page
4	00	SI1 input selection	0 to 00FFFFFFh	3289650			–	C	○	○	○	3-64
4	01	SI2 input selection	0 to 00FFFFFFh	8487297			–	C	○	○	○	3-65
4	02	SI3 input selection	0 to 00FFFFFFh	8553090			–	C	○	○	○	
4	03	SI4 input selection	0 to 00FFFFFFh	3026478			–	C	○	○	○	
4	04	SI5 input selection	0 to 00FFFFFFh	2236962			–	C	○	○	○	
4	05	SI6 input selection	0 to 00FFFFFFh	2171169			–	C	○	○	○	
4	06	SI7 input selection	0 to 00FFFFFFh	2829099			–	C	○	○	○	

※ " Related control mode "is thant P：Position control、S：Velocity control、T：Torque control.

※ For " Attribute ",refer to P.3-38 " Details of Attribute ".

Caution Parameter with for " Unit ",set to parameter by setup support software " PANATERM ",please pay attention to the setting of the number of units have changed.

Parametr No. Class	Parametr No. No.	Title	Range	Default (A,B type / C type / D,E,F type)	Unit	Attribute	Related control mode P	Related control mode S	Related control mode T	Detail page
4	07	SI8 input selection	0 to 00FFFFFFh	3223857	–	C	○	○	○	3-65
4	10	SO1 output selection	0 to 00FFFFFFh	197379	–	C	○	○	○	3-66
4	11	SO2 output selection	0 to 00FFFFFFh	1052688	–	C	○	○	○	3-67
4	12	SO3 output selection	0 to 00FFFFFFh	65793	–	C	○	○	○	
4	16	Type of analog monitor 1	0 to 28	0	–	A	○	○	○	
4	17	Analog monitor 1 output gain	0 to 214748364	0	–	A	○	○	○	
4	18	Type of analog monitor 2	0 to 28	4	–	A	○	○	○	
4	19	Analog monitor 2 output gain	0 to 214748364	0	–	A	○	○	○	
4	21	Analog monitor output setup	0 to 2	0	–	A	○	○	○	3-68
4	22	For manufacturer's use	–	0	–	–				3-70
4	23	For manufacturer's use	–	0	–	–				
4	24	For manufacturer's use	–	0	–	–				
4	31	Positioning complete range	0 to 2097152	8400	command unit	A	○			
4	32	Positioning complete output setup	0 to 10	0	–	A	○			
4	33	INP hold time	0 to 30000	0	1 ms	A	○			3-71
4	34	Zero-speed	10 to 20000	50	r/min	A	○	○	○	
4	35	Speed coincidence range	10 to 20000	50	r/min	A		○	○	3-72
4	36	At-speed (Speed arrival)	10 to 20000	1000	r/min	A		○	○	
4	37	Mechanical brake action at stalling setup	0 to 10000	0	1 ms	B	○	○	○	3-73
4	38	Mechanical brake action at running setup	0 to 32000	0	1 ms	B	○	○	○	
4	39	Brake release speed setup	30 to 3000	30	r/min	B	○	○	○	
4	40	Selection of alarm output 1	0 to 40	0	–	A	○	○	○	3-74
4	41	Selection of alarm output 2	0 to 40	0	–	A	○	○	○	
4	42	2nd Positioning complete (In-position) range	0 to 2097152	8400	command unit	A	○			3-75

※ " Related control mode "is thant P：Position control、S：Velocity control、T：Torque control.

※ For " Attribute ",refer to P.3-38 " Details of Attribute ".

Caution Parameter with for " Unit ",set to parameter by setup support software " PANATERM ",please pay attention to the setting of the number of units have changed.

Parametr No. Class	No.	Title	Range	Default (A,B type / C type / D,E,F type)	Unit	Attribute	Related control mode P	S	T	Detail page
4	44	Position comparison output pulse width setting	0 to 32767	0	0.1 ms	R	○	○	○	
4	45	Position comparison output polarity selection	0 to 7	0	–	R	○	○	○	3-75
4	47	Pluse output selection	0 to 1	0	–	R	○	○	○	
4	48	Position comparison value 1	-2147483648 to 2147483647	0	command unit	A	○	○	○	
4	49	Position comparison value 2	-2147483648 to 2147483647	0	command	A	○	○	○	
4	50	Position comparison value 3	-2147483648 to 2147483647	0	unit	A	○	○	○	
4	51	Position comparison value 4	-2147483648 to 2147483647	0	command unit	A	○	○	○	
4	52	Position comparison value 5	-2147483648 to 2147483647	0	command unit	A	○	○	○	3-76
4	53	Position comparison value 6	-2147483648 to 2147483647	0	command unit	A	○	○	○	
4	54	Position comparison value 7	-2147483648 to 2147483647	0	command unit	A	○	○	○	
4	55	Position comparison value 8	-2147483648 to 2147483647	0	command unit	A	○	○	○	
4	56	Position comparison output delay compensation amount	-32768 to32767	0	0.1 us	R	○	○	○	
4	57	Position comparison output assignment setting	-2147483648 to 2147483647	0	–	R	○	○	○	3-77

【Class 5】 Enhancing Setting

Parametr No. Class	No.	Title	Range	Default (A,B type / C type / D,E,F type)	Unit	Attribute	Related control mode P	S	T	Detail page
5	03	Denominator of pulse output division	0 to 8388608	0	–	R	○	○	○	3-78
5	04	Over-travel inhibit input setup	0 to 2	1	–	C	○	○	○	3-79
5	05	Sequence at over-travel inhibit	0 to 2	0	–	C	○	○	○	3-80
5	06	Sequence at Servo-off	0 to 9	0	–	B	○	○	○	3-81
5	07	Sequence at main power off	0 to 9	0	–	B	○	○	○	
5	08	LV trip selection at main power off	0 to 3	1	–	B	○	○	○	3-82
5	09	Detection time of main power off	70 to 2000	70	1 ms	C	○	○	○	

※ “ Related control mode ”is thant P：Position control、S：Velocity control、T：Torque control.
※ For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Caution

Parameter with for “ Unit ”,set to parameter by setup support software “ PANATERM ”,please pay attention to the setting of the number of units have changed.

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
5	10	Sequence at alarm	0 to 7	0			–	B	○	○	○	3-83
5	11	Torque setup for emergency stop	0 to 500	0			%	B	○	○	○	3-84
5	12	Over-load level setup	0 to 500	0			%	A	○	○	○	
5	13	Over-speed level setup	0 to 20000	0			r/min	A	○	○	○	
5	14	Motor working range setup	0 to 1000	10			0.1 rot*	A	○			
5	15	Control input signal reading setup	0 to 3	0			–	C	○	○	○	
5	20	Position setup unit select	0 to 1	0			–	C	○			3-85
5	21	Selection of torque limit	0 to 4	1			–	B	○	○		
5	22	2nd torque limit	0 to 500	500*1			%	B	○	○		
5	23	Torque limit switching setup 1	0 to 4000	0			ms/100 %	B	○	○		
5	24	Torque limit switching setup 2	0 to 4000	0			ms/100 %	B	○	○		
5	25	Positive direction torque limit	0 to 500	500*1			%	B	○	○		3-86
5	26	Negative direction torque limit	0 to 500	500*1			%	B	○	○		
5	29	For manufacturer's use	–	2			–	–				
5	31	USB axis address	0 to 127	1			–	C	○	○	○	
5	33	Pulse regenerative output limit setup	0 to 1	0			–	C	○	○	○	
5	34	For manufacturer's use	–	4			–	–				
5	36	For manufacturer's use	–	0			–	–				
5	45	Quadrant glitch positive-direction compensation value	−1000 to 1000	0			0.1 %	B	○			
5	46	Quadrant glitch negative-direction compensation value	−1000 to1000	0			0.1 %	B	○			3-87
5	47	Quadrant glitch compensation delay time	0 to 1000	0			ms	B	○			
5	48	Quadrant glitch compensation filter setting L	0 to 6400	0			0.01 ms	B	○			
5	49	Quadrant glitch compensation filter setting H	0 to 10000	0			0.1 ms	B	○			

※ " Related control mode "is thant P：Position control、S：Velocity control、T：Torque control.

※ For " Attribute ",refer to P.3-38 " Details of Attribute ".

＊1 Default setting is different based on the combination of drive and motor. Refer to P.3-121 " Torque limit setting ".

Caution Parameter with for " Unit ",set to parameter by setup support software " PANATERM ",please pay attention to the setting of the number of units have changed.

【Class 5】 Enhancing Setting

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
5	50	For manufacturer’s use	–	0			–	–				
5	51	For manufacturer’s use	–	0			–	–				
5	52	For manufacturer’s use	–	0			–	–				
5	53	For manufacturer’s use	–	0			–	–				3-87
5	54	For manufacturer’s use	–	0			–	–				
5	55	For manufacturer’s use	–	0			–	–				
5	56	Slow stop deceleration time setting	0 to 10000	0			ms/(1000 r/min)	B	○	○	○	
5	57	Slow stop S-shape acceleration and deceleration setting	0 to 1000	0			ms	B	○	○	○	
5	66	Deterioration diagnosis convergence judgment time	0 to 10000	0			0.1s	A	○	○	○	
5	67	Deterioration diagnosis inertia ratio upper limit	0 to 10000	0			%	A	○	○	○	
5	68	Deterioration diagnosis inertia ratio lower limit	0 to 10000	0			%	A	○	○	○	3-88
5	69	Deterioration diagnosis unbalanced load upper limit	-1000 to 1000	0			0.1 %	A	○	○	○	
5	70	Deterioration diagnosis unbalanced load lower limit	-1000 to 1000	0			0.1 %	A	○	○	○	
5	71	Deterioration diagnosis dynamic friction upper limit	-1000 to 1000	0			0.1 %	A	○	○	○	
5	72	Deterioration diagnosis dynamic friction lower limit	-1000 to 1000	0			0.1 %	A	○	○	○	
5	73	Deterioration diagnosis viscous friction upper limit	0 to 10000	0			0.1 %/(1000 r/min)	A	○	○	○	
5	74	Deterioration diagnosis viscous friction lower limit	0 to 10000	0			0.1 %/(1000 r/min)	A	○	○	○	
5	75	Deterioration diagnosis velocity setting	-20000 to 20000	0			r/min	A	○	○	○	3-89
5	76	Deterioration diagnosis torque average time	0 to 10000	0			ms	A	○	○	○	
5	77	Deterioration diagnosis torque upper limit	-1000 to 1000	0			0.1 %	A	○	○	○	
5	78	Deterioration diagnosis torque lower limit	-1000 to 1000	0			0.1 %	A	○	○	○	3-90

※ “ Related control mode ”is thant P : Position control、S : Velocity control、T : Torque control.

※ For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Caution

Parameter with for “ Unit ”,set to parameter by setup support software “ PANATERM ”,please pay attention to the setting of the number of units have changed.

【Class 6】 Special Setting

Parametr No. Class	No.	Title	Range	Default A,B type	Default C type	Default D,E,F type	Unit	Attribute	Related control mode P	S	T	Detail page
6	02	Velocity deviation excess setup	0 to 20000	0			r/min	A	○			3-91
6	05	Position 3rd gain valid time	0 to 10000	0			0.1 ms*	B	○			
6	06	Position 3rd gain scale factor	50 to 1000	100			%	B	○			
6	07	Torque command additional value	−100 to 100	0			%	B	○	○		
6	08	Positive direction torque compensation value	−100 to 100	0			%	B	○			
6	09	Negative direction torque compensation value	−100 to 100	0			%	B	○			
6	10	Function expansion setup	−32768 to 32767	16			–	B	○	○	○	3-92
6	11	Current response setup	10 to 100	100			%	B	○	○	○	
6	14	Emergency stop time at alarm	0 to 1000	200			ms	B	○	○	○	3-93
6	15	2nd over-speed level setup	0 to 20000	0			r/min	B	○	○	○	
6	18	Power-up wait time	0 to 100	0			0.1 s*	R	○	○	○	
6	19	For manufacturer's use	–	0			–	–				
6	20	For manufacturer's use	–	0			–	–				
6	21	For manufacturer's use	–	0			–	–				
6	22	For manufacturer's use	–	0			–	–				
6	23	Load change compensation gain	−100 to 100	0			%	B	○	○		
6	24	Load change compensation filter	10 to 2500	53			0.01 ms*	B	○	○		3-94
6	27	Warning latch state setup	0 to 3	0			–	C	○	○	○	
6	30	For manufacturer's use	–	0			–	–				
6	31	Real time auto tuning estimation speed	0 to 3	1			–	B	○	○	○	
6	32	Real time auto tuning custom setup	−32768 to 32767	0			–	B	○	○	○	3-95
6	34	For manufacturer's use	–	0			–	–				3-96

※ " Related control mode "is thant P：Position control、S：Velocity control、T：Torque control.
※ For " Attribute ",refer to P.3-38 " Details of Attribute ".

Caution Parameter with for " Unit ",set to parameter by setup support software " PANATERM ",please pay attention to the setting of the number of units have changed.

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
6	35	For manufacturer's use	–	10			–	–				3-96
6	36	Dynamic brake operation input setup	0 to 1	0			–	R	○	○	○	
6	37	Oscillation detecting level	0 to 1000	0			0.1 %*	B	○	○	○	3-97
6	38	Warning mask setup	–32768 to 32767	4			–	C	○	○	○	
6	39	Warning mask setup 2	–32768 to 32767	0			–	C	○	○	○	
6	41	1st damping depth	0 to 1000	0			–	B	○			
6	42	Two-stage torque filter time constant	0 to 2500	0			0.01 ms*	B	○	○	○	
6	43	Two-stage torque filter attenuation term	0 to 1000	0			–	B	○	○	○	
6	47	Function expansion setup 2	–32768 to 32767	1			–	R	○	○	○	3-98
6	48	Adjust filter	0 to 2000	A type:11 B,C type:12		17	0.1 ms*	B	○	○		
6	49	Command response/ Adjust filter attenuation term	0 to 99	15			–	B	○			
6	50	Viscous friction compensation gain	0 to 10000	0			0.1 %/ (10000 r/min)	B	○	○		3-99
6	51	Immediate cessation completion wait time	0 to 10000	0			ms	B	○	○	○	
6	52	For manufacturer's use	–	0			–	–				
6	53	For manufacturer's use	–	0			–	–				
6	54	For manufacturer's use	–	0			–	–				
6	57	Torque saturation anomaly detection time	0 to 5000	0			ms	B	○	○		3-100
6	58	For manufacturer's use	–	0			–	–				
6	59	For manufacturer's use	–	0			–	–				
6	60	2nd damping depth	0 to 1000	0			—	B	○			3-101
6	61	1st resonance frequency	0 to 3000	0			0.1 Hz*	B	○			
6	62	1st resonance attenuation ratio	0 to 1000	0			–	B	○			
6	63	1st anti-resonance frequency	0 to 3000	0			0.1 Hz*	B	○			

※ " Related control mode "is thant P：Position control、S：Velocity control、T：Torque control.

※ For " Attribute ",refer to P.3-38 " Details of Attribute ".

Caution Parameter with for " Unit ",set to parameter by setup support software " PANATERM ",please pay attention to the setting of the number of units have changed.

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
6	64	1st anti-resonance attenuation ratio	0 to 1000	0			–	B	○			3-101
6	65	1st response frequency	0 to 3000	0			0.1 Hz*	B	○			
6	66	2nd resonance frequency	0 to 3000	0			0.1 Hz*	B	○			
6	67	2nd resonance attenuation ratio	0 to 1000	0			–	B	○			
6	68	2nd anti-resonance frequency	0 to 3000	0			0.1 Hz*	B	○			
6	69	2nd anti-resonance attenuation ratio	0 to 1000	0			–	B	○			3-102
6	70	2nd response frequency	0 to 3000	0			0.1 Hz*	B	○			
6	71	3rd damping depth	0 to 1000	0			–	B	○			
6	72	4th damping depth	0 to 1000	0			–	B	○			
6	73	Load estimation filter	0 to 2500	0			0.01 ms*	B	○	○		
6	74	Torque compensation frequency 1	0 to 5000	0			0.1 Hz*	B	○	○		
6	75	Torque compensation frequency 2	0 to 5000	0			0.1 Hz*	B	○	○		
6	76	Load estimation count	0 to 8	0			–	B	○	○		3-103
6	87	For manufacturer's use	–	0			–	–				
6	88	Absolute encoder multi-turn data upper-limit value	0 to 65534	0			–	C	○	○	○	
6	97	Function expansion setup 3	-2147483648 to 2147483647	0			–	B	○	○	○	
6	98	Function expansion setup 4	-2147483648 to 2147483647	0			–	R	○	○	○	

【Class 7】 Special Setting 2

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
7	00	Display on LED	0 to 32767	0			–	A	○	○	○	3-104
7	01	Display time setup upon power-up	−1 to 1000	0			100 ms*	R	○	○	○	
7	03	Output setup during torque limit	0 to 1	0			–	A			○	

※ " Related control mode " is thant P：Position control、S：Velocity control、T：Torque control. ※ For " Attribute ",refer to P.3-38 " Details of Attribute ".

Caution Parameter with for " Unit ",set to parameter by setup support software " PANATERM ",please pay attention to the setting of the number of units have changed.

【Class 7】 Special Setting 2

Parametr No. Class	No.	Title	Range	Default (A,B type / C type / D,E,F type)	Unit	Attribute	Related control mode P	S	T	Detail page
7	04	For manufacturer's use	–	0	–	–				
7	05	For manufacturer's use	–	0	–	–				
7	06	For manufacturer's use	–	0	–	–				
7	07	For manufacturer's use	–	0	–	–				3-105
7	08	For manufacturer's use	–	0	–	–				
7	09	Correction time of latch delay 1	-2000 to 2000	360	25 ns	B	○	○	○	
7	10	Software limit function	0 to 3	0	–	A	○			
7	11	Positive side software limit value	–1073741823 to 1073741823	500000	command unit	A	○			
7	12	Negative side software limit value	–1073741823 to 1073741823	–500000	command unit	A	○			
7	13	Absolute home position offset	–1073741823 to 1073741823	0	command unit	C	○	○	○	3-106
7	14	Main power off warning detection time	0 to 2000	0	1 ms	C	○	○	○	
7	15	Positioning adjacent range	0 to 1073741823	10	command unit	A	○			
7	16	Torque saturation error protection frequency	0 to 30000	0	time	B	○	○		
7	20	RTEX communication cycle setup	–1 to 12	3	–	R	○	○	○	3-107
7	21	RTEX command updating cycle setup	1 to 2	2	–	R	○	○	○	
7	22	RTEX function extended setup 1	–32768 to 32767	0	–	R	○	○	○	3-108
7	23	RTEX function extended setup 2	–32768 to 32767	18	–	B	○	○	○	
7	24	RTEX function extended setup 3	–32768 to 32767	0	–	C	○	○	○	3-110
7	25	RTEX speed unit setup	0 to 1	0	–	C	○	○	○	
7	26	RTEX continuous error warning setup	0 to 32767	0	time	A	○	○	○	
7	27	RTEX accumulated error warning setup	0 to 32767	0	time	A	○	○	○	3-111
7	28	RTEX_Update_Counter error warning setup	0 to 32767	0	time	A	○	○	○	
7	29	RTEX monitor select 1	0 to 32767	0	–	A	○	○	○	

※ " Related control mode "is thant P：Position control、S：Velocity control、T：Torque control.
※ For " Attribute ",refer to P.3-38 " Details of Attribute ".

Caution Parameter with for " Unit ",set to parameter by setup support software " PANATERM ",please pay attention to the setting of the number of units have changed.

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
7	30	RTEX monitor select 2	0 to 32767	0			–	A	○	○	○	3-111
7	31	RTEX monitor select 3	0 to 32767	0			–	A	○	○	○	3-112
7	32	RTEX monitor select 4	0 to 32767	0			–	A	○	○	○	
7	33	RTEX monitor select 5	0 to 32767	0			–	A	○	○	○	
7	34	RTEX monitor select 6	0 to 32767	0			–	A	○	○	○	
7	35	RTEX command setting 1	0 to 2	0			–	C	○	○	○	
7	36	RTEX command setting 2	0 to 2	0			–	C	○	○	○	
7	37	RTEX command setting 3	0 to 2	0			–	C	○	○	○	3-113
7	38	RTEX_Update_Counter error protection setup	0 to 32767	0			time	A	○	○	○	
7	39	For manufacturer's use	–	0			–	–				
7	40	For manufacturer's use	–	0			–	–				
7	41	RTEX function extended setup 5	–32768 to 32767	0			–	R	○	○	○	
7	43	For manufacturer's use	–	0			–	–				
7	52	For manufacturer's use	–	0			–	–				
7	78	Signal reading setting for latch trigger with stop function	0 to 3	0			–	C	○			3-114
7	87	For manufacturer's use	–	0			–	–				
7	91	RTEX communication cycle expansion setting	0 to 2000000	500000			ns	R	○	○	○	
7	92	Correction time of latch delay 2	-2000 to 2000	0			25 ns	B	○	○	○	
7	93	Home position return limit speed	0 to 20000	0			r/min	C	○	○	○	
7	95	Number of RTEX continuous communication error protection 1 detections	0 to 17	4			time	R	○	○	○	3-115
7	96	Number of RTEX continuous communication error protection 2 detections	0 to 17	12			time	R	○	○	○	
7	97	Number of RTEX communication timeout error protection detections	0 to 17	4			time	R	○	○	○	
7	98	Number of RTEX cyclic data error protection 1/2 detections	0 to 17	4			time	R	○	○	○	
7	99	RTEX function extended setup 6	–32768 to 32767	0			–	B	○	○	○	

※ " Related control mode "is thant P：Position control、S：Velocity control、T：Torque control.

※ For " Attribute ",refer to P.3-38 " Details of Attribute ".

Caution Parameter with for " Unit ",set to parameter by setup support software " PANATERM ",please pay attention to the setting of the number of units have changed.

Parametr No. Class	No.	Title	Range	Default A,B type	Default C type	Default D,E,F type	Unit	Attribute	Related control mode P	S	T	Detail page
7	100	For manufacturer's use	–	0			–	–				3-116
7	108	RTEX communication synchronization setup	0 to 7	7			–	R	○	○	○	
7	109	For manufacturer's use	–	0			–	–				
7	110	For manufacturer's use	–	0			–	–				

【Class 8】 Special Setting 3

Parametr No. Class	No.	Title	Range	Default A,B type	Default C type	Default D,E,F type	Unit	Attribute	Related control mode P	S	T	Detail page
8	00	For manufacturer's use	–	0			–	–				3-117
8	01	Profile linear acceleration constant	1 to 429496	100			10000 command unit/s^2	B	○			
8	02	For manufacturer's use	–	0			–	–				
8	03	For manufacturer's use	–	0			–	–				
8	04	Profile linear deceleration constant	1 to 429496	100			10000 command unit/s^2	B	○			
8	05	For manufacturer's use	–	0			–	–				
8	10	Amount of travel after profile position latch detection	–1073741823 to 1073741823	0			command unit	B	○			
8	12	Profile return to home position mode setup	0 to 1	0			–	B	○			3-118
8	13	Profile home position return velocity 1	0 to 2147483647	50			command unit/s or r/min	B	○			
8	14	Profile home position return velocity 2	0 to 2147483647	5			command unit/s or r/min	B	○			
8	15	For manufacturer's use	–	0			–	–				3-119
8	19	For manufacturer's use	–	0			–	–				

※ " Related control mode "is thant P : Position control、S : Velocity control、T : Torque control.
※ For " Attribute ",refer to P.3-38 " Details of Attribute ".

Caution Parameter with for " Unit ",set to parameter by setup support software " PANATERM ",please pay attention to the setting of the number of units have changed.

【Class 9】 For Manufacturer's Use

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
9	00	For manufacturer's use	–	1			–	–				3-120
9	01	For manufacturer's use	–	0			–	–				
9	02	For manufacturer's use	–	0			–	–				
9	03	For manufacturer's use	–	0			–	–				
9	04	For manufacturer's use	–	0			–	–				
9	05	For manufacturer's use	–	0			–	–				
9	06	For manufacturer's use	–	0			–	–				
9	07	For manufacturer's use	–	0			–	–				
9	08	For manufacturer's use	–	0			–	–				
9	09	For manufacturer's use	–	0			–	–				
9	10	For manufacturer's use	–	0			–	–				
9	11	For manufacturer's use	–	1			–	–				
9	12	For manufacturer's use	–	80			–	–				
9	13	For manufacturer's use	–	50			–	–				
9	14	For manufacturer's use	–	10			–	–				
9	17	For manufacturer's use	–	0			–	–				
9	18	For manufacturer's use	–	0			–	–				
9	19	For manufacturer's use	–	0			–	–				
9	20	For manufacturer's use	–	0			–	–				
9	21	For manufacturer's use	–	0			–	–				
9	22	For manufacturer's use	–	200			–	–				
9	23	For manufacturer's use	–	50			–	–				
9	24	For manufacturer's use	–	100			–	–				

※ " Related control mode "is thant P：Position control、S：Velocity control、T：Torque control.
※ For " Attribute ",refer to P.3-38 " Details of Attribute ".
※ There is class 14 before software Ver.1.05.

Caution Parameter with for " Unit ",set to parameter by setup support software " PANATERM ",please pay attention to the setting of the number of units have changed.

【Class 9】 For Manufacturer's Use

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
9	25	For manufacturer's use	–	40			–	–				3-120
9	26	For manufacturer's use	–	40			–	–				
9	27	For manufacturer's use	–	1000			–	–				
9	28	For manufacturer's use	–	1			–	–				
9	29	For manufacturer's use	–	0			–	–				
9	30	For manufacturer's use	–	0			–	–				
9	31	For manufacturer's use	–	0			–	–				
9	32	For manufacturer's use	–	0			–	–				
9	33	For manufacturer's use	–	100			–	–				
9	34	For manufacturer's use	–	0			–	–				
9	35	For manufacturer's use	–	0			–	–				
9	48	For manufacturer's use	–	0			–	–				
9	49	For manufacturer's use	–	0			–	–				
9	50	For manufacturer's use	–	0			–	–				

【Class 14】 For Manufacturer's Use

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
14	00	For manufacturer's use	–	0			–	–				3-120
14	01	For manufacturer's use	–	0			–	–				
14	02	For manufacturer's use	–	0			–	–				
14	03	For manufacturer's use	–	0			–	–				
14	04	For manufacturer's use	–	0			–	–				

※ " Related control mode "is thant P：Position control、S：Velocity control、T：Torque control.

※ For " Attribute ",refer to P.3-38 " Details of Attribute ".

※ There is class 14 before software Ver.1.05.

Caution Parameter with for " Unit ",set to parameter by setup support software " PANATERM ",please pay attention to the setting of the number of units have changed.

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
14	05	For manufacturer's use	–	0			–	–				3-120
14	06	For manufacturer's use	–	0			–	–				
14	07	For manufacturer's use	–	0			–	–				
14	08	For manufacturer's use	–	0			–	–				
14	09	For manufacturer's use	–	0			–	–				
14	10	For manufacturer's use	–	0			–	–				
14	11	For manufacturer's use	–	0			–	–				
14	12	For manufacturer's use	–	0			–	–				
14	13	For manufacturer's use	–	0			–	–				
14	14	For manufacturer's use	–	0			–	–				
14	15	For manufacturer's use	–	0			–	–				
14	16	For manufacturer's use	–	0			–	–				
14	17	For manufacturer's use	–	0			–	–				
14	18	For manufacturer's use	–	0			–	–				
14	19	For manufacturer's use	–	0			–	–				
14	20	For manufacturer's use	–	0			–	–				
14	21	For manufacturer's use	–	0			–	–				
14	22	For manufacturer's use	–	0			–	–				
14	23	For manufacturer's use	–	0			–	–				
14	24	For manufacturer's use	–	0			–	–				
14	25	For manufacturer's use	–	0			–	–				
14	26	For manufacturer's use	–	0			–	–				
14	27	For manufacturer's use	–	0			–	–				

※ " Related control mode "is thant P：Position control、S：Velocity control、T：Torque control.

※ For " Attribute ",refer to P.3-38 " Details of Attribute ".

※ There is class 14 before software Ver.1.05.

Caution Parameter with for " Unit ",set to parameter by setup support software " PANATERM ",please pay attention to the setting of the number of units have changed.

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
14	28	For manufacturer's use	–	0			–	–				3-120
14	29	For manufacturer's use	–	0			–	–				

【Class 15】 For Manufacturer's Use

Parametr No.		Title	Range	Default			Unit	Attribute	Related control mode			Detail page
Class	No.			A,B type	C type	D,E,F type			P	S	T	
15	00	For manufacturer's use	–	0			–	–				3-120
15	16	For manufacturer's use	–	2			–	–				
15	17	For manufacturer's use	–	4			–	–				
15	30	For manufacturer's use	–	0			–	–				
15	31	For manufacturer's use	–	5			–	–				
15	33	For manufacturer's use	–	0			–	–				
15	34	For manufacturer's use	–	0			–	–				
15	35	For manufacturer's use	–	1			–	–				

※ " Related control mode "is thant P：Position control、S：Velocity control、T：Torque control.

※ For " Attribute ",refer to P.3-38 " Details of Attribute ".

Caution Parameter with for " Unit ",set to parameter by setup support software " PANATERM ",please pay attention to the setting of the number of units have changed.

Detail of Attribute

The attribute of a parameter indicates the point at which the modified parameter setting becomes effective.

A : Always effective

B : Do not change while the motor is operating or command is transferred.

C : Parameter with Attribute C of reset command is valid by by operating valid model, or operating the same an Attribute R.

R : After EEPROM writing, can be valid by restarting the power supply or restarting the command soft start mode.

Caution

- After change parameter, turn off power or start softreset of reset command, Lost value that is changed.
  In order to change the value to EEPROM was carried out.
- For writing EEPROM, operating by parameter command or PANATERM.
  Check to controller data and Instruction manual of PANATERM.

＜ Attribute C parameter validation mode ＞

Operating by reset command of RTEX communication from controllor. For reset command,refer to controllor data.Use this mode when validating the changed parameter of attribute C after establishing communication without turning off control power or resetting (software reset) servo driver.
it is not necessary to write this parameter to EEPROM before executing the command .

- When this command is received in servo-on status, it causes the command error (0045h).While processing the command, keep servo-off status. When servo is turned on (Servo_On = 1) during processing of this command, Err. 27.7 “Position information initialization error protection” will occur.
- After execution of the command, all position information including actual position is initialized.This means that return to home is not completed (provided not in absolute mode) and latch is not completed.After successful completion of the command, repeat the return to home. Status and output signals during command execution are as shown below.

Status/output signal	Before execution	Executing	After execution
Position information	Current position information	Initialization	Information on the current position with reference to initialized position ＊1
Return to home status	Current status	Undefined	•Unfinished while incrementing •Finished in absolute mode
Latch status	Current status	Undefined	Unfinished
Busy (non-cyclic status)	0	1	0
Other status	Current status	Undefined	Current status
Output signal	Current status	Undefined	Current status

＊1 Information on position after initialization
<Incremental mode> All position information = 0
<Absolute mode> All position information = Value of absolute encoder (scale)/ electronic gear ratio + Pr.7.13 “Absolute home position offset”

Caution **While executing the command, do not run PANATERM.**

[Class 0] Basic Setting

Default: [ ]

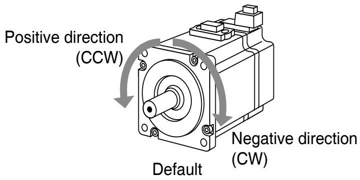
- A parameter is designated as follows:

Pr0.00
Class ── ── No.

- Definition of symbols under “Related mode” -
  P: position control, S: velocity control, T: torque control.
- For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Pr0.00	Rotational direction setup	Range	Unit	Attribute	Default	Related control code
		0 to 1	—	C	1	P S T

Setup the relationship between the direction of command and direction of motor rotation.
0: Motor turns CW in response to positive direction command (CW when viewed from load side shaft end)
1: Motor turns CCW in response to positive direction command (CCW when viewed from load side shaft end)
This parameter is set in accordance with the specification of the controller.
If change the parameters, in the case of Pr 7.23(RTEX function extended setup 2) bit 3 must be changed.Be sure to check the host controller.



Setup value	Command direction	Motor rotational direction	Positive direction drive inhibit input	Negative direction drive inhibit input
0	Positive direction	CW	Valid	—
	Negative direction	CCW	—	Valid
[1]	Positive direction	CCW	Valid	—
	Negative direction	CW	—	Valid

Pr0.01	Control mode setup	Range	Unit	Attribute	Default	Related control code
		0 to 6	—	R	0	P S T

You can set up the control mode to be used.

Note

Setup value	Content
[0]	Semi-closed control (Position（PP/CP）/Velocity（CV）/Torque（CT）control can be selected)
1	For manufacturer’s use
2	
3	
4	
5	
6	

For details of Control Mode and Command Input Mode,refer to P.3-2 ～ 3-14.

Note

・A parameter is designated as follows: Class Pr0.00 No.
・For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page

・P.2-47 ～ “ Wiring to the Connector，X4 ”

Default: [ ]

Pr0.02	Real-time auto-gain tuning setup	Range	Unit	Attribute	Default	Related control code
		0 to 6	—	B	1	P S T

You can set up the action mode of the real-time auto-gain tuning.
Refer to P.5-4 Adjustment " Real-Time Auto-Gain Tuning ".

Setup value	Mode	Varying degree of load inertia in motion
0	Invalid	Real-time auto-gain tuning function is disabled.
[1]	Standard	Basic mode. Do not use unbalanced load, friction compensation or gain switching.
2	Positioning *1	Main application is positioning. It is recommended to use this mode on equipment without unbalanced horizontal axis, ball screw driving equipment with low friction, etc.
3	Vertical axis *2	With additional features to the positioning mode - use this mode to positively and effectively compensate for unbalanced load to the vertical axis or minimize variations in setting time.
4	Friction compensation *3	With additional features to the vertical axis mode - use this mode to positively and effectively reduce positioning setting time when the belt driving axis has high friction.
5	Load characteristic measurement	Estimate the load characteristics without changing current parameter setting. This mode requires use of the setup support software.
6	Customize *4	Functions of real-time auto-gain tuning can be customized to meet the requirements of the specific application by combining desired functions according to the Pr6.32 "Real-time auto-gain tuning custom setting".

*1 Velocity and torque controls are the same as in the standard mode.
*2 Torque control is the same as in the standard mode.
*3 Velocity control is the same as in the vertical axis mode. Torque control is the same as in the standard mode.
*4 Certain function(s) is not available in a specific control mode. Refer to description in Pr6.32.

Two-degree-of-freedom control mode: standard type

For Two-degree-of-freedom control mode, refer to Pr6.47 (P.3-98).
Set up the action mode of the real-time auto-gain tuning.

Setup value	Mode	Varying degree of load inertia in motion
0	Invalid	Real-time auto-gain tuning function is disabled.
[1]	Standard	Stability-first mode. Do not use unbalanced load compensation, friction compensation or gain switching
2	Quick response mode 1	Positioning-first mode. Use this mode for equipment with horizontal axis, low friction ball screw driving and without unbalanced load.
3	Quick response mode 2	In addition to the features provided with the Quick response mode 1, use this mode to compensate unbalanced load, to apply third gain to reduce variation in positioning settling time.
4	Quick response mode 3 *1	In addition to the features provided with the Quick response mode 2, use this mode to shorten positioning settling time when the load has high friction.
5	Load characteristic measurement	Estimate load characteristics without changing basic gain setting or friction compensation setting with the help of the setup support software.
6	Fit gain mode	To be used for fine adjustment of rigidity setting after completion of fit gain.

*1 Velocity control is the same as in the quick response mode 2. Value of parameters, Pr6.08 Forward torque compensation value, Pr6.09 Backward torque compensation value and Pr6.50 Viscous friction compensation gain will be updated but not reflected on operation.

(continued)

Default: [ ]

Two-degree-of-freedom control mode: synchronous type

For Two-degree-of-freedom control mode, refer to Pr6.47 (P.3-98).

Set up the action mode of the real-time auto-gain tuning.

Setup value	Mode	Varying degree of load inertia in motion
0	Invalid	Real-time auto-gain tuning function is disabled.
[1]	Synchronous	Synchronous control mode. Do not use this mode for unbalanced load or friction compensate. Use this mode first when maintaining command response filter, then switch to another mode as necessary.
2	Synchronous friction compensation	With dynamic friction compensation/viscous friction compensation in addition to those of synchronous mode. Use this mode when the load has a large friction.
3	Stiffness setting	Use this mode when modifying gain filter setting according to stiffness table without making inertia ratio assumption, unbalanced load compensation or friction compensation. When handling a load with larger inertia variations, first estimate inertia in an appropriate mode, e.g. sync mode, and then switch to this mode.
4	Load characteristics update	Use this mode when applying only inertia ratio, dynamic friction compensation and viscous friction compensation among load characteristics while holding gain filter setting.
5	Load characteristic measurement	Estimate load characteristics without changing basic gain setting or friction compensation setting with the help of the setup support software.
6	Load fluctuation response mode	Use this mode when you wish to make robust adjustments for fluctuating loads.

Pr0.03	Selection of machine stiffness at real-time auto-gain tuning	Range	Unit	Attribute	Default	Related control code		
		0 to 31	—	B	A,B,C-frame: 13 D to F-frame: 11	P	S	T

You can set up the response while the real-time auto-gain tuning is valid.

low ← machine stiffness → high
low ← servo gain → high
0, 1 - - - - - - - 11 - - 13 - - - - - - - - - - - - 30, 31
low ← response → high

Caution

· Higher the setup value, higher the velocity response and servo stiffness will be obtained. However, when increasing the value, check the resulting operation to avoid oscillation or vibration.

· Control gain is updated while the motor is stopped. If the motor cannot be stopped due to excessively low gain or continuous application of one-way direction command, any change made to Pr0.03 “Selection of machine stiffness at real-time auto-gain tuning” is not used for update. If the changed stiffness setting is made valid after the motor stopped, abnormal sound or oscillation will be generated. To prevent this problem, stop the motor after changing the stiffness setting and check that the changed setting is enabled.

Note

· A parameter is designated as follows: Class Pr0.00 No.

· For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page

· P.2-47 ～ “ Wiring to the Connector，X4 ”

Default: [ ]

Pr0.04	Inertia ratio	Range	Unit	Attribute	Default	Related control code
		0 to 10000	%	B	250	P S T

Set 1st inertia ratio.
You can set up the ratio of the load inertia against the rotor (of the motor) inertia.

Pr0.04 = (load inertia/ rotor inertia) × 100 [%]

The inertia ratio will be estimated at all time while the real-time auto-gain tuning is valid, and its result will be saved to EEPROM every 30 min.

Caution If the inertia ratio is correctly set, the setup unit of Pr1.01 and Pr1.06 becomes (Hz). When the inertia ratio of Pr0.04 is larger than the actual, the setup unit of the velocity loop gain becomes larger, and when the inertia ratio of Pr0.04 is smaller than the actual, the setup unit of the velocity loop gain becomes smaller.。

Note The inertia ratio will be set automatically in real-time automatic gain tuning.When change by Manual Gain Tuning,Refer to P.5-8 Adjustment " Invalidation of Real-Time Auto-Gain Tuning ",Please start to set from automatic Gain Adjustment. invalidation.

Pr0.08	Command pulse counts per one motor revolution	Range	Unit	Attribute	Default	Related control code
		0 to 2^{23}	pulse	C	0	P S T

Set the command pulses that causes single turn of the motor shaft.
When this setting is 0, Pr0.09 1st numerator of electronic gear and Pr0.10 Denominator of electronic gear become valid.

Note **Parameters determined according to the combination of the controller.**
To set according to the instructions of the upper controller.

Pr0.09	Numerator of electronic gear	Range	Unit	Attribute	Default	Related control code
		0 to 2^{30}	—	C	1	P S T
Pr0.10	**Denominator of electronic gear**	**Range**	**Unit**	**Attribute**	**Default**	**Related control code**
		1 to 2^{30}	—	C	1	P S T

Set to Numerator and Denominator of electronic gear.
This setup is enabled when Pr0.08 " command pulse counts per one motor revolution " = 0.

Note **Parameters determined according to the combination of the controller.**
To set according to the instructions of the upper controller.

Caution Electronic gear ratio is in the range of 1 to 1000 times. When electronic gear ratio exceeds the set range of electronic gear ratio, Err93.0（Parameter setup error protection ）will Occur.

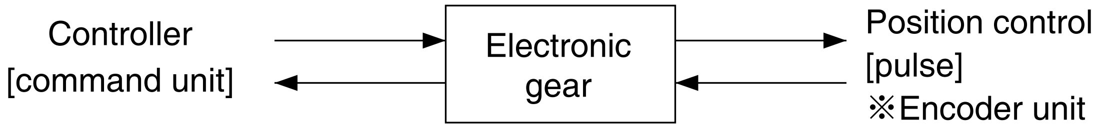
Note
・A parameter is designated as follows: Class Pr0.00 No.
・For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page ・P.3-121" List of Torque Limit " ・P.2-47 ～ " Wiring to the Connector, X4 " ・P.6-3 " Protective Function "

Default: [ ]

■ Command unit

The command unit is position command unit of electronic gear input from controller.



■ Interrelationship between Pr0.08, Pr0.09 and Pr0.10 during position control

Pr0.08	Pr0.09	Pr0.10	electronic gear operation
1～8388608	— (No influence)	— (No influence)	Position command input → encoder resolution / 【Pr0.08 setting value】 → Position command ＊ With independent setting of Pr0.09, 0.10 , this operation is processed according to setup value of Pr0.08.
0	0	1～1073741824	Position command input → encoder resolution / 【Pr0.10 setting value】 → Position command ＊ When Pr0.08 and 0.09=0,this operation is processed according to setup value of Pr0.10.
	1～1073741824	1～1073741824	Position command input → 【Pr0.09 setting value】 / 【Pr0.10 setting value】 → Position command ＊ When Pr0.08 and 0.09≠0,this operation is processed according to setup value of Pr0.09 and Pr0.10.

■ Pr0.08=0, Pr0.09≠0

Position command of division and multiplication (F)is setting Pr0.10、Pr0.09 such asencoder resolution (2^{23}).

F = f×Pr0.09/Pr0.10 = 2^{23} (8388608)

F : Position command (Internal command pulse counts per one motor revolution)

f : command pulse counts per one motor revolution (pulse counts per one motor revolution by customer)

Setting example

Encoder resolution	2^{23} (8388608)
The input pulse counts per one motor revolution (f) is 5000	Pr0.09 8388608
	Pr0.10 5000

Default: [ ]

Pr0.11	Output pulse counts per one motor revolution	Range	Unit	Attribute	Default	Related control code
		1 to 2097152	pulse/r	R	2500	P S T

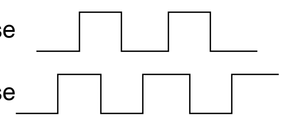
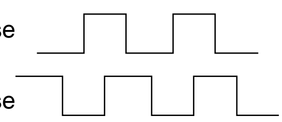
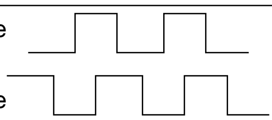
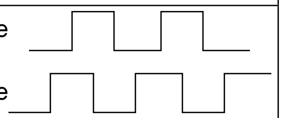
You can set up the output pulse counts per one motor revolution for each OA and OB .Therefore,The pulse count of the controller by 4 times is as follows.
command pulse resolution per one motor revolution = Pr0.11 Value×4

Caution For details of setup, refer to description in Pr5.03.

Pr0.12	Reversal of pulse output logic/ output source selection	Range	Unit	Attribute	Default	Related control code
		0 to 3	—	R	0	P S T

You can set up the B-phase logic and the output source of the pulse output. With this parameter, you can reverse the phase relation between the A-phase pulse and the B-phase pulse by reversing the B-phase logic.

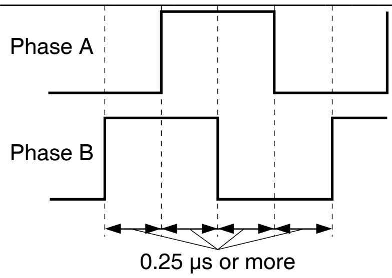
< Output Source selection/Reversal of pulse output logic >

Pr0.12	B-phase logic	Output source	CCW direction rotation	CW direction rotation
【0】	Non-reversal	Encoder	A-phase B-phase 	A-phase B-phase 
1	Reversal	Encoder	A-phase B-phase 	A-phase B-phase 

Caution Setup value 2 and 3 are for manufacturer's use.

■ Pulse regeneration function

Maximum frequency of regenerated pulse output is 4 Mpps (after multiplied by 4), If the movement speed exceeds this frequency, the regeneration will not function correctly. That is, correct pulse is not returned to the host controller, causing positional deviation.



By enabling Pr5.33 "Pulse regenerative output limit setup", Err28.0 "Pulse regenerative limit protection" can be generated upon reaching the pulse regeneration limit. Because this error is generated when the output limit of the pulse regeneration is detected, it is not generated at the maximum frequency. However, detection error may occur if the frequency instantaneously jumps up due to motor velocity change (irregular rotation).

Default: [ ]

Pr0.13	1st torque limit	Range	Unit	Attribute	Default	Related control code		
		0 to 500	%	B	500	P	S	T

You can set up the limit value of the motor output torque.

Note For details of torque limit value, refer to P.3-121.

Pr0.14	Position deviation excess setup	Range	Unit	Attribute	Default	Related control code		
		0 to 2^{30}	Command unit	A	83886080	P		

・ Set excess range of positional deviation by the command unit (default).
・ Setup unit can be changed to encoder unit through Pr5.20 (position setup unit selection). If the unit is changed, set up with the encoder pulse counts at the position control.
・ Err24.0 (Error detection of position deviation excess) becomes invalid when you set up this to 0.

Note For description of “command unit” and “encoder unit”, refer to P.3-85 “Pr5.20”.

Pr0.15	Absolute encoder setup	Range	Unit	Attribute	Default	Related control code		
		0 to 4	—	C	1	P	S	T

You can set up the using method of absolute encoder.

Setup value	Function
0	Used as absolute system .
【1】	Used as incremental system . （Can not detect the following protection function. Err40.0 “ Absolute system down error protection ” Err41.0 “ Absolute counter over error protection ” Err42.0 “ Absolute over-speed error protection ” Err45.0 “ Multi-turn counter error protection ”）
2	Used as absolute system (absolute mode), but multirotation counter over is ignored.
3	Use as absolute System (absolute mode),Do not use multiple rotation counter.(a single-turn absolute mode).
4	Used as an absolute system(absolute mode);however,any value can be set for the upper limit of the multi-turn counter. (continuous rotating absolute encoder mode)

Note
・ A parameter is designated as follows: Class Pr0.00 No.
・ For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page
・ P.2-47 ～ “ Wiring to the Connector，X4 ”

Default: [ ]

Pr0.16	External regenerative resistor setup	Range	Unit	Attribute	Default	Related control code
		0 to 3	—	C	A,B-frame: 3 C to F-frame: 0	P S T

With this parameter, you can select either to use the built-in regenerative resistor of the driver, or to separate this built-in regenerative resistor and externally install the regenerative resistor (between B1 and B2 of Connector XB in case of A to D-frame, between B1 and B2 of Connector XC in case of E-frame(200 V), between B1 and B2 of terminal block in case of F-frame(200 V)).
A, B-frame driver is not provided with built-in resister.

Setup value	Regenerative resistor to be used	Function
[0] (C to F-frame)	Built-in resistor	Regenerative processing circuit will be activated and regenerative resistor overload protection will be triggered according to the built-in resistor (approx. 1 % duty).
1	External resistor	The driver trips due to regenerative overload protection (Err18.0), when regenerative processing circuit is activated and its active ratio exceeds 10 %.
2	External resistor	Regenerative processing circuit is activated, but no regenerative over-load protection is triggered.
[3] (A, B-frame)	No resistor	Both regenerative processing circuit and regenerative protection are not activated, and built-in capacitor handles all regenerative power.

Remarks

Install an external protection such as thermal fuse when you use the external regenerative resistor.
Otherwise, the regenerative resistor might be heated up abnormally and result in burnout, regardless of validation or invalidation of regenerative over-load protection.

Caution

When you use the built-in regenerative resistor, Do not set up other value than 0. Do not touch the external regenerative resistor.
External regenerative resistor gets very hot, and might cause burning.

Pr0.17	Load factor of external regenerative resistor selection	Range	Unit	Attribute	Default	Related control code
		0 to 4	—	C	0	P S T

When selecting the external regenerative resistor (Pr0.16 = 1, 2), select the computing method of load factor of regenerative resistor.
Pleses fixed to 0.

Setup value	Function
[0]	Regenerative load factor is 100 % when duty factor of external regenerative resistor is 10 %.
1 to 4	For manufacturer's use (do not setup)

Pr0.18	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Note

- A parameter is designated as follows: Class Pr0.00 No.
- For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page

- P.2-47 ~ “ Wiring to the Connector, X4 ”

4. Details of Parameter

[Class 1] Gain Adjustment

Default: [ ]

Pr1.00	1st gain of position loop	Range	Unit	Attribute	Default	Related control code
		0 to 30000	0.1 /s	B	A to C-frame: 480 D to F-frame: 320	P

You can determine the response of the positional control system.
Higher the gain of position loop you set, faster the positioning time you can obtain.
Note that too high setup may cause oscillation

Pr1.01	1st gain of velocity loop	Range	Unit	Attribute	Default	Related control code
		1 to 32767	0.1 Hz	B	A to C-frame: 270 D to F-frame: 180	P S T

You can determine the response of the velocity loop.
In order to increase the response of overall servo system by setting high position loop gain, you need higher setup of this velocity loop gain as well. However, too high setup may cause oscillation.

Caution When the inertia ratio of Pr0.04 is set correctly, the setup unit of Pr1.01 becomes (Hz).

Pr1.02	1st time constant of velocity loop integration	Range	Unit	Attribute	Default	Related control code
		1 to 10000	0.1 ms	B	A to C-frame: 210 D to F-frame: 310	P S T

You can set up the integration time constant of velocity loop.
Smaller the setup, faster you can dog-in deviation at stall to 0.
The integration will be maintained by setting to "9999".
The integration effect will be lost by setting to "10000".

Pr1.03	1st filter of speed detection	Range	Unit	Attribute	Default	Related control code
		0 to 5	—	B	0	P S T

You can set up the time constant of the low pass filter (LPF) after the speed detection, in 6 steps(0 to 5).
Higher the setup, larger the time constant you can obtain so that you can decrease the motor noise, however, response becomes slow. Use with a default value of 0 in normal operation.

Pr1.04	1st time constant of torque filter	Range	Unit	Attribute	Default	Related control code
		0 to 2500	0.01 ms	B	A to C-frame: 84 D to F-frame: 126	P S T

You can set up the time constant of the 1st delay filter inserted in the torque command portion. You might expect suppression of oscillation caused by distortion resonance.

Caution · To Panasonic MINAS users: A4 and higher series.
Parameter settings shown in this manual may differ from those applied to your product (s).

Note · For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page · P.2-47 ～ “ Wiring to the Connector, X4 ”.

1 Before Using the Products
2 Preparation
3 Setup
4 Trial Run
5 Adjustment
6 When in Trouble
7 Supplement

Default: [ ]

Parameter	Name	Range	Unit	Attribute	Default	Related control code
Pr1.05	2nd gain of position loop	0 to 30000	0.1 /s	B	A to C-frame: 480 D to F-frame: 320	P
Pr1.06	2nd gain of velocity loop	1 to 32767	0.1 Hz	B	A to C-frame: 270 D to F-frame: 180	P S T
Pr1.07	2nd time constant of velocity loop integration	1 to 10000	0.1 ms	B	A to C-frame: 210 D to F-frame: 310	P S T
Pr1.08	2nd filter of speed detection	0 to 5	—	B	0	P S T
Pr1.09	2nd time constant of torque filter	0 to 2500	0.01 ms	B	A to C-frame: 84 D to F-frame: 126	P S T

Position loop, velocity loop, speed detection filter and torque command filter have their 2 pairs of gain or time constant (1st and 2nd).

Related page For details of switching the 1st and the 2nd gain or the time constant, refer to P.5-36 "Gain Switching Function" of Adjustment.
The function and the content of each parameter is as same as that of the 1st gain and time constant.

Parameter	Name	Range	Unit	Attribute	Default	Related control code
Pr1.10	Velocity feed forward gain	0 to 4000	0.10 %	B	1000	P
Pr1.11	Velocity feed forward filter	0 to 6400	0.01 ms	B	0	P

- Multiply the velocity control command calculated according to the internal positional command by the ratio of Pr1.10 and add the result to the speed command resulting from the positional control process.
- Set the time constant of 1st delay filter which affects the input of velocity feed forward by Pr1.11.

Related page The details of velocity feed forward function refers to P.5-49 “ Feed Forward Function ” .

Parameter	Name	Range	Unit	Attribute	Default	Related control code
Pr1.12	Torque feed forward gain	0 to 2000	0.1 %	B	1000	P S
Pr1.13	Torque feed forward filter	0 to 6400	0.01 ms	B	0	P S

- Multiply the torque command calculated according to the velocity control command by the ratio of Pr1.12 and add the result to the torque command resulting from the velocity control process.
- Positional deviation at a constant acceleration/deceleration can be minimized close to 0 by increasing the torque forward gain. This means that positional deviation can be maintained at near 0 over entire operation range while driving in trapezoidal speed pattern under ideal condition where disturbance torque is not active.
- Set up the time constant of 1st delay filter which affects the input of torque feed forward by Pr1.13.
- The torque feed forward will become effective as the torque feed forward gain is gradually increased with the torque feed forward filter is set at approx. 50 (0.5 ms).

Related page The details of torque feed forward function refers to P.5-49 “ Feed Forward Function ” .

Default: [ ]

Pr1.14	2nd gain setup	Range	Unit	Attribute	Default	Related control code
		0 to 1	—	B	1	P S T

Arrange this parameter when performing optimum adjustment by using the gain switching function.

Setup value	Gain selection/switching
0	1st gain is fixed at a value. By using controller bit Gain_SW with RTEX communication, change the velocity loop operation from PI to P. Gain_SW = 0 →PI operation Gain_SW = 1 →P operation
【1】	Enable gain switching of 1st gain (Pr1.00-Pr1.04) and 2nd gain (Pr1.05-Pr1.09).

Related page For switching condition of the 1st and the 2nd, refer to P.5-36 "Gain Switching Function" of Adjustment.

Pr1.15	Mode of position control switching	Range	Unit	Attribute	Default	Related control code
		0 to 10	—	B	0	P

Set up the triggering condition of gain switching for position control.

Setup value	Switching condition	Gain switching condition
[0]	Fixed to 1st gain	Fixed to the 1st gain (Pr1.00 to Pr1.04).
1	Fixed to 2nd gain	Fixed to the 2nd gain (Pr1.05 to Pr1.09).
2	RTEX communication gain switching command	• 1st gain when gain switching command (Gain_SW) with RTEX communication is 0,2nd gain when Gain_SW is 1.
3	Torque command is large	• Shift to the 2nd gain when the absolute value of the torque command exceeded (level + hysteresis) (%) previously with the 1st gain. • Return to the 1st gain when the absolute value of the torque command was kept below (level - hysteresis) (%) previously during delay time with the 2nd gain.
5	Speed command is large	• Shift to the 2nd gain when the absolute value of the speed command exceeded (level + hysteresis) (r/min) previously with the 1st gain. • Return to the 1st gain when the absolute value of the speed command was kept below (level - hysteresis) (r/min) previously during delay time with the 2nd gain.
6	Position deviation is large	• Shift to the 2nd gain when the absolute value of the positional deviation exceeded (level + hysteresis) (pulse) previously with the 1st gain. • Return to the 1st gain when the absolute value of the positional deviation was kept below (level - hysteresis) (pulse) previously over delay time with the 2nd gain. * Unit of level and hysteresis (pulse) is set as the encoder resolution for positional control and external scale resolution for full-closed control.
7	Position command exists	• Shift to the 2nd gain when the positional command was not 0 previously with the 1st gain. • Return to the 1st gain when the positional command was kept 0 previously during delay time with the 2nd gain.
8	Not in positioning complete	• Shift to the 2nd gain when the positioning was not completed previously with the 1st gain. • Return to the 1st gain when the positioning was kept in completed condition previously during delay time with the 2nd gain.
9	Actual speed is large	• Shift to the 2nd gain when the absolute value of the actual speed exceeded (level + hysteresis) (r/min) previously with the 1st gain. • Return to the 1st gain when the absolute value of the actual speed was kept below (level - hysteresis) (r/min) previously during delay time with the 2nd gain.
10	Position command exists +Actual speed	• Shift to the 2nd gain when the positional command was not 0 previously with the 1st gain. • Return to the 1st gain when the positional command was kept at 0 during the delay time and the absolute value of actual speed was kept below (level - hysteresis) (r/min) previously with the 2nd gain.

Related page The switching condition of 1st gain and 2nd gain refer to P.5-36 Adjustment “ Gain Swiching Function ” .

Default: [ ]

Pr1.16	Delay time of position control switching	Range	Unit	Attribute	Default	Related control code
		0 to 10000	0.1 ms	B	10	P

For position controlling : When shifting from the 2nd gain to the 1st gain with Pr1.15 Position control switching mode set at 3, 5 to 10, set up the delay time from trigger detection to the switching operation.

Related page: The switching condition of 1st gain and 2nd gain refer to P.5-36 Adjustment " Gain Switching Function " .

Pr1.17	Level of position control switching	Range	Unit	Attribute	Default	Related control code
		0 to 20000	Mode-dependent	B	0	P

For position controlling: Set up triggering level when Pr1.15 Position control switching mode is set at 3, 5, 6, 9 or 10.
Unit of setting varies with switching mode.

Caution: Set the level equal to or higher than the hysteresis.

Related page: The switching condition of 1st gain and 2nd gain refer to P.5-36 Adjustment " Gain Switching Function " .

Pr1.18	Hysteresis at position control switching	Range	Unit	Attribute	Default	Related control code
		0 to 20000	Mode-dependent	B	0	P

For position controlling: Set up triggering hysteresis when Pr1.15 Position control switching mode is set at 3, 5, 6, 9 or 10.
Unit of setting varies with switching mode.

Caution: When level < hysteresis, the hysteresis is internally adjusted so that it is equal to level.

Related page: The switching condition of 1st gain and 2nd gain refer to P.5-36 Adjustment " Gain Switching Function " .

Default: [ ]

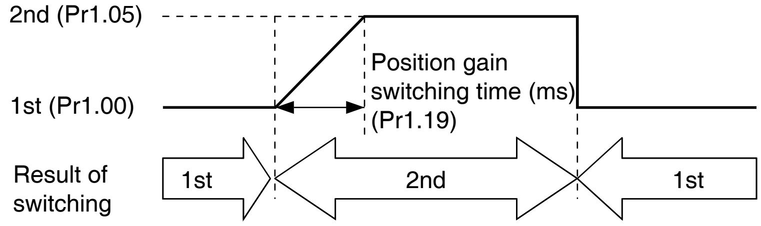
Pr1.19	Position gain switching time	Range	Unit	Attribute	Default	Related control code
		0 to 10000	0.1 ms	B	10	P

For position controlling: If the difference between Pr1.00 1st gain of position loop and Pr1.05 2nd gain of poison loop is large, the increasing rate of position loop gain can be limited by this parameter.
The position loop gain will increase over the time set.

<Position gain switching time>
When using position control and full-closed control, gain of position loop rapidly changes, causing torque change and vibration. By adjusting Pr1.19 Position gain switching time, increasing rate of the poison loop gain can be decreased and vibration level can be reduced.

Caution Setting of this parameter does not affect the gain switching time when the gain of position loop is switched to lower level (gain is switched immediately).

Example: 1st (Pr1.00) > 2nd (Pr1.05)



1st（Pr1.00）＞2nd（Pr1.05）,When Switching from 1st to 2nd,Gain changes slowly.

Related page The switching condition of 1st gain and 2nd gain refer to P.5-36 Adjustment " Gain Switching Function " .

Pr1.20	Mode of velocity control switching	Range	Unit	Attribute	Default	Related control code
		0 to 5	—	B	0	S

For velocity controlling: Set the condition to trigger gain switching.

Setup value	Switching condition	Gain switching condition
[0]	Fixed to the 1st gain.	Fixed to the 1st gain (Pr1.00 to Pr1.04).
1	Fixed to the 2nd gain.	Fixed to the 2nd gain (Pr1.05 to Pr1.09).
2	RTEX communication gain switching command	• 1st gain when gain switching command（Gain_SW）with RTEX communication is 0,2nd gain when Gain_SW is 1.
3	Torque command	• Shift to the 2nd gain when the absolute value of the torque command exceeded (level + hysteresis) (%) previously with the 1st gain. • Return to the 1st gain when the absolute value of the torque command was kept below (level - hysteresis) (%) previously during delay time with the 2nd gain.
4	Speed command variation is larger.	• Shift to the 2nd gain when the absolute value of the speed command variations exceeded (level + hysteresis) (10 r/min/s) previously with the 1st gain. • Return to the 1st gain when the absolute value of the speed command variations was kept below (level - hysteresis) (10 r/min/s) during delay time previously with the 2nd gain. * The 1st gain is fixed while the velocity control is not applied.
5	Speed command is large	• Shift to the 2nd gain when the absolute value of the speed command exceeded (level + hysteresis) (r/min) previously with the 1st gain. • Return to the 1st gain when the absolute value of the speed command was kept below (level - hysteresis) (r/min) previously during delay time with the 2nd gain.

Related page The switching condition of 1st gain and 2nd gain refer to P.5-36 Adjustment " Gain switching Function " .
Switching Level and Timing refer to P.5-36 Adjustment " Setup of Gain Switching Condition " .

Default: [ ]

Pr1.21	Delay time of velocity control switching	Range	Unit	Attribute	Default	Related control code
		0 to 10000	0.1 ms	B	0	S

For velocity controlling: When shifting from the 2nd gain to the 1st gain with Pr1.20 Velocity control switching mode set at 3 to 5, set the delay time from trigger detection to the switching operation.

Related page: The switching condition of 1st gain and 2nd gain refer to P.5-36 Adjustment “ Gain Switching Function ” .

Pr1.22	Level of velocity control switching	Range	Unit	Attribute	Default	Related control code
		0 to 20000	Mode-dependent	B	0	S

For velocity controlling: Set up triggering level when Pr1.20 Velocity control gain switching mode is set at 3 to 5.

Caution: Unit of setting varies with switching mode.
Set the level equal to or higher than the hysteresis.

Related page: The switching condition of 1st gain and 2nd gain refer to P.5-36 Adjustment “ Gain Switching Function ” .

Pr1.23	Hysteresis at velocity control switching	Range	Unit	Attribute	Default	Related control code
		0 to 20000	Mode-dependent	B	0	S

For velocity controlling: Set up triggering hysteresis when Pr1.20 Velocity control gain switching mode is set at 3 to 5.

Caution: Unit of setting varies with switching mode.
When level < hysteresis, the hysteresis is internally adjusted so that it is equal to level.

Related page: The switching condition of 1st gain and 2nd gain refer to P.5-36 Adjustment “ Gain Switching Function ” .

Pr1.24	Mode of torque control switching	Range	Unit	Attribute	Default	Related control code
		0 to 3	—	B	0	T

For torque controlling: Set the condition to trigger gain switching.

Setup value	Switching condition	Gain switching condition
[0]	Fixed to the 1st gain.	Fixed to the 1st gain (Pr1.00 to Pr1.04).
1	Fixed to the 2nd gain.	Fixed to the 2nd gain (Pr1.05 to Pr1.09).
2	RTEX communication gain switching command	• 1st gain when gain switching command (Gain_SW) with RTEX communication is 0,2nd gain when Gain_SW is 1.
3	Torque command is large	• Shift to the 2nd gain when the absolute value of the torque command exceeded (level + hysteresis) (%) previously with the 1st gain. • Return to the 1st gain when the absolute value of the torque command was kept below (level - hysteresis) (%) previously during delay time with the 2nd gain.

Related page: The switching condition of 1st gain and 2nd gain refer to P.5-36 Adjustment “ Gain Switching Function ” .

Note
· A parameter is designated as follows: Class Pr0.00 No.
· For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page
· P.2-47 ～ “ Wiring to the Connector, X4 ”

Default: [ ]

Pr1.25	Delay time of torque control switching	Range	Unit	Attribute	Default	Related control code
		0 to 10000	0.1 ms	B	0	T

For torque controlling : When shifting from the 2nd gain to the 1st gain with Pr1.24 Torque control switching mode set at 3, set up the delay time from trigger detection to the switching operation.

Related page: The switching condition of 1st gain and 2nd gain refer to P.5-36 Adjustment " Gain Switching Function " .

Pr1.26	Level of torque control switching	Range	Unit	Attribute	Default	Related control code
		0 to 20000	Mode-dependent	B	0	T

For torque controlling: Set up triggering level when Pr1.24 Torque control gain switching mode is set at 3.
Unit varies depending on the setup of mode of control switching.

Caution: Set the level equal to or higher than the hysteresis.

Related page: The switching condition of 1st gain and 2nd gain refer to P.5-36 Adjustment " Gain Switching Function " .

Pr1.27	Hysteresis at torque control switching	Range	Unit	Attribute	Default	Related control code
		0 to 20000	Mode-dependent	B	0	T

For torque controlling: Set up triggering hysteresis when Pr1.24 Torque control gain switching mode is set at 3.
Unit of setting varies with switching mode.

Caution: When level < hysteresis, the hysteresis is internally adjusted so that it is equal to level.

Related page: The switching condition of 1st gain and 2nd gain refer to P.5-36 Adjustment " Gain Switching Function " .

From Pr1.28 toPr1.78 are all parameters for manufacturer's use.Please do not change the default parameters.

Default: [ ]

Pr2.00	Adaptive filter mode setup	Range	Unit	Attribute	Default	Related control code
		0 to 6	—	B	0	P S

Set up the resonance frequency to be estimated by the adaptive filter and specify the operation after estimation.

Setup value	Content	
[0]	Adaptive filter: invalid	Parameters related to the 3rd and 4th notch filter hold the current value.
1	Adaptive filter: 1 filter is valid	One adaptive filter is enabled. Parameters related to the 3rd notch filter will be updated based on adaptive performance.
2	Adaptive filter: 2 filters are valid	Two adaptive filters are enabled. Parameters related to the 3rd and 4th notch filters will be updated based on adaptive performance.
3	Resonance frequency measurement mode	Measure the resonance frequency. Result of measurement can be checked with PANATERM. Parameters related to the 3rd and 4th notch filter hold the current value.
4	Clear result of adaptation	Parameters related to the 3rd and 4th notch filter are disabled and results of adaptive operation are cleared.
5	High-precision adaptive filter	Two adaptive filters are enabled. Parameters related to the 3rd and 4th notch filters will be updated based on the results of adaptive performance. Use of this setup value is recommended when using 2 adaptive filters.
6	For manufacturer's use	PANATERM’s fit gain function used internally. Do not use this setup value in the normal condition.

Related page

The details of Adaptive filter refers to P.5-28 Adjustment “ Adaptive Filter ” .

Pr2.01	1st notch frequency	Range	Unit	Attribute	Default	Related control code
		50 to 5000	Hz	B	5000	P S T

Set the center frequency of the 1st notch filter.

Caution

The notch filter function will be invalidated by setting up this parameter to "5000".

Pr2.02	1st notch width selection	Range	Unit	Attribute	Default	Related control code
		0 to 20	—	B	2	P S T

Set the width of notch at the center frequency of the 1st notch filter.

Caution

Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.

Pr2.03	1st notch depth selection	Range	Unit	Attribute	Default	Related control code
		0 to 99	—	B	0	P S T

Set the depth of notch at the center frequency of the 1st notch filter.

Caution

Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.

Note

· A parameter is designated as follows: Class Pr0.00 No.

· For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page

· When using the notch filter, refer to P.5-39 Adjustment “ Suppression of Machine Resonance ” .
· P.2-47 ～ “ Wiring to the Connector, X4 ”

Default: [ ]

Pr2.04	2nd notch frequency	Range	Unit	Attribute	Default	Related control code
		50 to 5000	Hz	B	5000	P S T

Set the center frequency of the 2nd notch filter.

Caution: The notch filter function will be invalidated by setting up this parameter to "5000".

Pr2.05	2nd notch width selection	Range	Unit	Attribute	Default	Related control code
		0 to 20	—	B	2	P S T

Set the width of notch at the center frequency of the 2nd notch filter.

Caution: Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.

Pr2.06	2nd notch depth selection	Range	Unit	Attribute	Default	Related control code
		0 to 99	—	B	0	P S T

Set the depth of notch at the center frequency of the 2nd notch filter.

Caution: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.

Pr2.07	3rd notch frequency	Range	Unit	Attribute	Default	Related control code
		50 to 5000	Hz	B	5000	P S T

Set the depth of notch at the center frequency of the 3th notch filter.

Caution: In no resonance point is found, the frequency is set to 5000.Notch frequency is automatically set to the 1st resonance frequency estimated by the adaptive filter.No resonance point was found, set to 5000 .

Pr2.08	3rd notch width selection	Range	Unit	Attribute	Default	Related control code
		0 to 20	—	B	2	P S T

Set the width of notch at the center frequency of the 3rd notch filter.

Caution: Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.
When the applicable filter function is used, parameter value is automatically set.

Pr2.09	3rd notch depth selection	Range	Unit	Attribute	Default	Related control code
		0 to 99	—	B	0	P S T

Set the depth of notch at the center frequency of the 3rd notch filter.

Caution: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.
When the applicable filter function is used, parameter value is automatically set.

Note
- A parameter is designated as follows: Class Pr0.00 No.
- For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page
- P.2-47 ～ “ Wiring to the Connector，X4 ”

Default: [ ]

Pr2.10	4th notch frequency	Range	Unit	Attribute	Default	Related control code
		50 to 5000	Hz	B	5000	P S T

Set the depth of notch at the center frequency of the 4th notch filter.

Caution: In no resonance point is found, the frequency is set to 5000.Notch frequency is automatically set to the 2nd resonance frequency estimated by the adaptive filter.No resonance point was found, set to 5000.

Pr2.11	4th notch width selection	Range	Unit	Attribute	Default	Related control code
		0 to 20	—	B	2	P S T

Set the width of notch at the center frequency of the 4th notch filter.

Caution: Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.
When the applicable filter function is used, parameter value is automatically set.

Pr2.12	4th notch depth selection	Range	Unit	Attribute	Default	Related control code
		0 to 99	—	B	0	P S T

Set the depth of notch at the center frequency of the 4th notch filter.

Caution: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.
When the applicable filter function is used, parameter value is automatically set.

Note

· A parameter is designated as follows: Class Pr0.00 No.

· For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

· When using the notch filter, refer to P.5-39 Adjustment " Suppression of Machine Resonance " .

· P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

Pr2.13	Selection of damping filter switching	Range	Unit	Attribute	Default	Related control code
		0 to 6	—	B	0	P

Among 4 filters select the filters to be used for Damping Control.

• When setup value is 0: Up to 2 filters can be used simultaneously.

Setup value	1st damping	2nd damping	3rd damping	4th damping
【0】	○	○		
1	For manufacturer's use			
2	For manufacturer's use			

• With setup value 3: Select the filter with command direction.

Setup value	Position command direction	1st damping	2nd damping	3rd damping	4th damping
3	Positive direction	○		○	
	Negative direction		○		○

Contents of setup values 4 to 6 will differ with enabled/disabled switching of two degree-of-freedom control mode.

• Position control (Two degree-of-freedom control mode disabled).

Setup value	1st damping	2nd damping	3rd damping	4th damping
4	○	○	○	
6	Same action as set value 0.			

• Position control (Two degree-of-freedom control mode enabled).

Setup value	1st model	2nd model
4	○	○
5	For manufacturer's use	

Setup value	Position command direction	1st model	2nd model
6	Positive direction	○	
	Negative direction		○

Caution

• Switching of Damping Controls will be done on the rising edge of the command whose number of pulses/0.125 ms has been changed from 0 while the positioning complete signal is being output.
When the damping frequency is increased or disabled, and positioning complete range is large, and pulses are stored in the filter at that time (the area represented by the value of position command before filter subtracted by the value of position command after filter and integrated with the time). Note that since these pulses will be discharged at a higher rate upon switching to return back to the original position, the motor may run at a speed higher than the command speed for a short time.

Note

· A parameter is designated as follows: Class Pr0.00 No.
· For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

· When using the notch filter, refer to P.5-39 Adjustment " Suppression of Machine Resonance " .
· P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

Parameter	Name	Range	Unit	Attribute	Default	Related control code
Pr2.14	1st damping frequency	0 to 3000	0.1 Hz	B	0	P
Pr2.16	2nd damping frequency	0 to 3000	0.1 Hz	B	0	P
Pr2.18	3rd damping frequency	0 to 3000	0.1 Hz	B	0	P
Pr2.20	4th damping frequency	0 to 3000	0.1 Hz	B	0	P

You can set up the 1st to 4th damping frequency of the Damping Control which suppress vibration at the load edge.
The driver measures vibration at load edge. Setup unit is 0.1[Hz].
The setup frequency is 0.5 to 300.0[Hz]. Setup of 0 to 0.4 Hz becomes invalid.

Related page Refer to P.5-39, "Suppression of Machine Resonance" as well before using this parameter.

Parameter	Name	Range	Unit	Attribute	Default	Related control code
Pr2.15	1st damping filter setup	0 to 1500	0.1 Hz	B	0	P
Pr2.17	2nd damping filter setup	0 to 1500	0.1 Hz	B	0	P
Pr2.19	3rd damping filter setup	0 to 1500	0.1 Hz	B	0	P
Pr2.21	4th damping filter setup	0 to 1500	0.1 Hz	B	0	P

If torque saturation occurs with damping frequency (1st- 4th) enabled, decrease the setup value, or if the operation is slow, increase it. Usually set it to 0.

Caution The maximum setup value is internally limited to the corresponding damping frequency or 3000 - damping frequency, whichever is smaller..

Related page Refer to P.5-43 " Damping Control " as well before using this parameter.。

Note
・A parameter is designated as follows: Class Pr0.00 No.
・For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page ・P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

		Range	Unit	Attribute	Default	Related control code			
Pr2.22	**Command smoothing filter**	0 to 10000	0.1 ms	B	A to C-frame: 92 D to F-frame: 139	P	S		

[Position Control Mode]

- With previous control (Pr6.47 bit0 = 0)
  Set the time constant of the 1st delay filter in response to the positional command.
- In the two-degree-of-freedom control mode (Pr6.47 bit0 = 1)
  Time constant of the command response filter
  The maximum value is limited by 2000 (= 200.0 ms).*

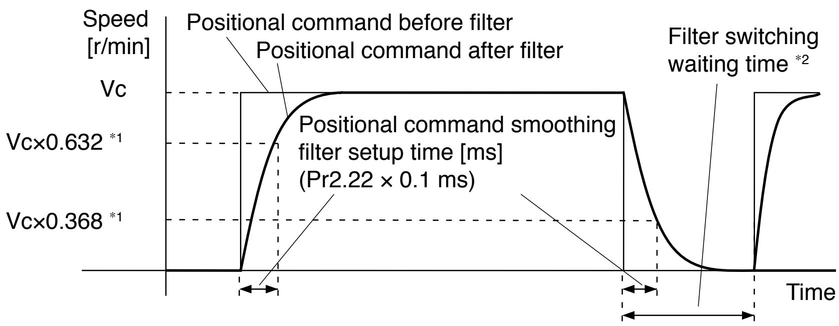
[Speed control mode]

- With previous control (Pr6.47 bit0 = 0)
  This setting is ignored.
- In the two-degree-of-freedom control mode (Pr6.47 bit0 = 1)
  Time constant of the command response filter
  The maximum value is limited by 640 (= 64.0 ms).*

Related page For Two-degree-of-freedom control mode, refer to Pr6.47 (P.3-98).

* The value of the parameter is not limited but the value to be applied to driver is limited. Set attenuation term in Pr6.49 [Set attenuation term of command filter/adjustment filter].

When a square wave command for the target speed Vc is applied, set up the time constant of the 1st delay filter as shown in the figure below.



*1 Actual filter time constant (setup value × 0.1 ms) has the maximum absolute error of 0.4 ms for a time constant below 100 ms and the maximum relative error of 0.2 % for a time constant 20 ms or more.

*2 Switching of Pr2.22 Positional command smoothing filter is performed on the rising edge of the command with the number of command pulses/0.125 ms is changed from 0 to a value other than 0 while the positioning complete is being output.
If the filter time constant is decreased and positioning complete range is increased, and a many number of plusses are accumulated in the filter (the area equivalent of “value of positional command filter - value of positional command after filter” integrated over the time), at the time of switching, these pulses are discharged at a higher rate, causing the motor to return to the previous position - the motor runs at a speed higher than the command speed for a short time.

*3 Even if Pr2.22 Positional command smoothing filter is changed, it is not applied immediately. If the switching as described in *2 occurs during this delay time, the change of Pr2.22 will be suspended.

Note

・A parameter is designated as follows: Class Pr0.00 No.

・For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page ・P.2-47 ～ “ Wiring of connector, X4 ”　・P.6-3 “ Protective Function ”

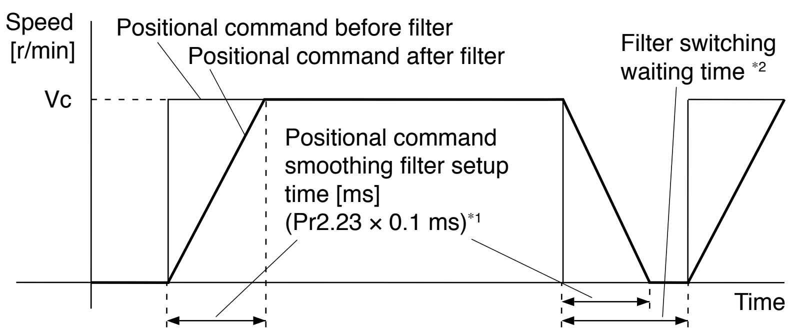
1 Before Using the Products
2 Preparation
3 Setup
4 Trial Run
5 Adjustment
6 When in Trouble
7 Supplement

Default: [ ]

Pr2.23	Command FIR filter	Range	Unit	Attribute	Default	Related control code
		0 to 10000	0.1 ms	B	10	P

• Set up the time constant of FIR filter in response to the command.

When a square wave command for the target speed Vc is applied, set up the time constant of the 1st delay filter as shown in the figure below.



*1 The actual average travel time (setup value × 0.1 ms) has the maximum absolute error of 0.2 ms for a time constant below 10 ms and the maximum relative error of 1.6 % for a time constant 10 ms or more.

*2 When changing Pr2.23 Command FIR filter, stop the command pulse and wait until the filter switching wait time has elapsed. The filter switching wait time is the setup value × 0.1 ms + 0.25 ms when the setup time is 10 ms, and setup value × 0.1 ms × 1.05 when the setup time is 10 ms or more. If Pr2.23 is changed while the command pulse is being input, the change is not reflected until the command pulse-less state has continued for the filter switching wait time.

*3 Even if Pr2.23 Command FIR filter is changed, it is not applied immediately. If the switching as described in *2 occurs during this delay time, the change of Pr2.23 will be suspended.

Pr2.24	5th notch frequency	Range	Unit	Attribute	Default	Related control code
		50 to 5000	Hz	B	5000	P S T

Set the center frequency of the 5th notch filter.

Caution: The notch filter function will be invalidated by setting up this parameter to "5000".

Pr2.25	5th notch width selection	Range	Unit	Attribute	Default	Related control code
		0 to 20	—	B	2	P S T

Set the width of notch at the center frequency of the 5th notch filter.

Caution: Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.

Pr2.26	5th notch depth selection	Range	Unit	Attribute	Default	Related control code
		0 to 99	—	B	0	P S T

Set the depth of notch at the center frequency of the 5th notch filter.

Caution: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.

Pr2.27	1st vibration control width setting	Range	Unit	Attribute	Default	Related control code
		0 to 1000	—	B	0	P

To conduct fine tuning of 1st vibration suppression control function.

Default: [ ]

		Range	Unit	Attribute	Default	Related control code
Pr2.28	2nd vibration control width setting	0 to 1000	—	B	0	P

To conduct fine tuning of 2nd vibration suppression control function.

		Range	Unit	Attribute	Default	Related control code
Pr2.29	3rd vibration control width setting	0 to 1000	—	B	0	P

To conduct fine tuning of 3rd vibration suppression control function.

		Range	Unit	Attribute	Default	Related control code
Pr2.30	4th vibration control width setting	0 to 1000	—	B	0	P

To conduct fine tuning of 4th vibration suppression control function..

		Range	Unit	Attribute	Default	Related control code
Pr2.31	For manufacturer's use	—	—	—	0	
Pr2.32	For manufacturer's use	—	—	—	0	
Pr2.33	For manufacturer's use	—	—	—	0	
Pr2.34	For manufacturer's use	—	—	—	0	
Pr2.35	For manufacturer's use	—	—	—	0	
Pr2.36	For manufacturer's use	—	—	—	0	
Pr2.37	For manufacturer's use	—	—	—	0	

Pleses fixed to 0.

Note

・A parameter is designated as follows: Class Pr0.00 No.
・For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page

・P.2-47 ～ “ Wiring to the Connector, X4 ”

Default: [ ]

Pr3.04	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr3.05	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

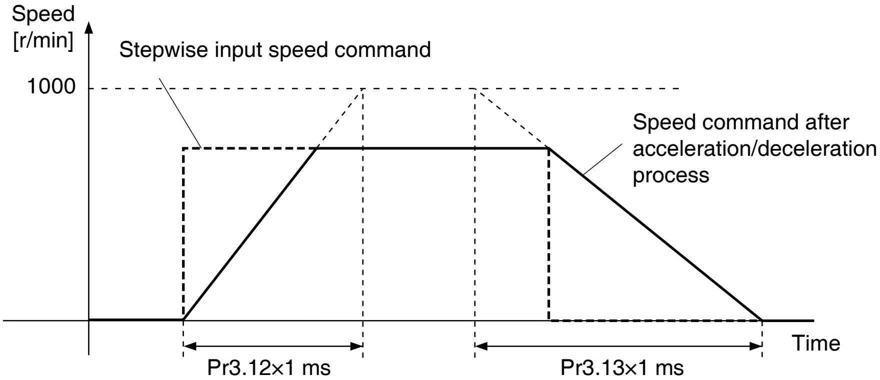
Pr3.12	Acceleration time setup	Range	Unit	Attribute	Default	Related control code
		0 to 10000	ms/ (1000 r/min)	B	0	S

Pr3.13	Deceleration time setup	Range	Unit	Attribute	Default	Related control code
		0 to 10000	ms/ (1000 r/min)	B	0	S

Set up acceleration/deceleration processing time in response to the speed command input. Set the time required for the speed command (stepwise input) to reach 1000 r/min to Pr3.12 Acceleration time setup. Also set the time required for the speed command to reach from 1000 r/min to 0 r/min, to Pr3.13 Deceleration time setup.
Assuming that the target value of the speed command is Vc(r/min), the time required for acceleration/deceleration can be computed from the formula shown below.

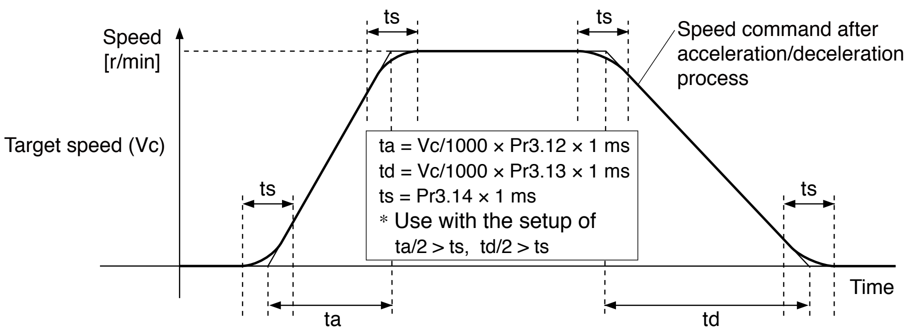
Acceleration time (ms) = Vc/1000 × Pr3.12 × 1 ms

Deceleration time (ms) = Vc/1000 × Pr3.13 × 1 ms



Pr3.14	Sigmoid acceleration / deceleration time setup	Range	Unit	Attribute	Default	Related control code
		0 to 1000	ms	B	0	S

Set S-curve time for acceleration/deceleration process when the speed command is applied. According to Pr3.12 Acceleration time setup and Pr3.13 Deceleration time setup, set up sigmoid time with time width centering the inflection point of acceleration/deceleration.



Note The determination of the speed command acceleration or deceleration, deceleration and differential speed command and a speed command of the currently selected, and then the speed command in the same direction acceleration and deceleration, deceleration is determined in the opposite direction.

Default: [ ]

Pr3.17	Selection of speed limit	Range	Unit	Attribute	Default	Related control code
		0 to 1	—	B	0	T

You can select the input of the torque command and the speed limit.

Setup value	SL_SW = 0	SL_SW = 1
[0]	Pr3.21	
1	Pr3.21	Pr3.22

When set to 1,can select with the value of RTEX communication command SL_SW.

Pr3.21	Speed limit value 1	Range	Unit	Attribute	Default	Related control code
		0 to 20000	r/min	B	0	T

Set up the speed limit used for torque controlling.
During the torque controlling, the speed set by the speed limit value cannot be exceeded.
But,it is limited by setting value of Pr5.13 and Pr6.15, min value of motor max velocity×1.2 .

Pr3.22	Speed limit value 2	Range	Unit	Attribute	Default	Related control code
		0 to 20000	r/min	B	0	T

Pr3.17 " Selection of speed limit " =1, set to velocity limit value when RTEX communication command SL_SW is 1.
But,it is limited by setting value of Pr5.13 and Pr6.15, min value of motor max velocity×1.2 .

Pr3.23	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr3.24	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr3.26	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr3.27	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr3.29	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Pr3.25	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	10000	

Pleses fixed to 10000.

Pr3.28	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	16000	

Pleses fixed to 16000.

Default: [ ]

Pr4.00	SI1 input selection	Range	Unit	Attribute	Default	Related control code
		0 to 00FFFFFFh (0 to 16777215)	—	C	00323232h (3289650)	P S T

Assign functions to SI1 inputs.
These parameters are presented in hexadecimals.
Afther change to decimal, input the parametre.
Hexadecimal presentation is followed by a specific control mode designation.
0 0 – – – – * * h : position/full-closed control
0 0 – – * * – – h : velocity control
0 0 * * – – – – h : torque control
Replace * * with the function number.
For the function number see the table below. Logical setup is also a function number.

Title	Symbol	Setup value	
		a-contact	b-contact
Invalid	–	00h	Do not setup.
Positive direction over-travel inhibition input	POT	01h	81h
Negative direction over-travel inhibition input	NOT	02h	82h
External servo ON input	EX-SON	03h	83h
Forced alarm input	E-STOP	14h	94h
Dynamic brake switching inpu	DB-SEL	16h	Do not setup.
External latch input 1	EXT1	20h	A0h
External latch input 2	EXT2	21h	A1h
Near home input	HOME	22h	A2h
External latch input 3	EXT3	2Bh	ABh
General purpose monitor input 1	SI-MON1	2Eh	AEh
General purpose monitor input 2	SI-MON2	2Fh	AFh
General purpose monitor input 3	SI-MON3	30h	B0h
General purpose monitor input 4	SI-MON4	31h	B1h
General purpose monitor input 5	SI-MON5	32h	B2h

Note

For input pin assignment with default setting, refer to P.2-50 Control input.

< Example of change >

To change the default setting “Negative direction over-travel inhabitation input” (in all modes) for b-contact to for a-contact, set the input to 00020202h, Parameter input value is “ 131586 ” for converting to 10 decimal number.

※ For easier setting, use the USB communication (PANATERM) .

Caution

・Do not setup to a value other than that specified in the table.
・The same signal can’t be assigned to multiple pins. Otherwise, duplicated assignment will cause Err 33.0 “Input multiple assignment error 1 protection” or Err 33.1 “Input multiple assignment error 2 protection”.
・EXT1 can be allocated only to SI5, EXT2 only to SI6 and EXT3 only to SI7. Wrong allocation will cause Err 33.8 “Latch input allocation error protection”.
・When using HOME/POT/NOT as the home reference trigger in the return to home position operation, HOME can be allocated only to SI5, POT only to SI6 and NOT only to SI7.
The Err33.8 “Latch input allocation error protection” occurs if HOME is assigned to S16 and S17, POT is assigned to S15 and S17, and NOT is assigned to S15 and S16.
・When using POT/NOT as the home reference trigger in the return to home position operation, set Pr 5.04 to 1 and disable over-travel inhibit input. If Pr 5.04 is not 1, Err 38.2 “Drive inhibit input protection 3” will occur.
・When latch correction pins (SI5/SI6/SI7) are used, configuration is required for all the control modes. If configuration is made only for 1 or 2 modes, the Err33.8 “Latch input allocation error protection” occurs.
・Disabled control input pin does not affect the operation and RTEX communication response.
・A signal used in multiple control modes should be assigned to the same pin and the logic should be matched. If not assigned to the same pin, the Err33.0 “Input duplicate assignment error 1 protection” or Err33.1 “Input duplicate assignment error 2 protection” occurs. In case that the logics do not match, Err33.2 “Input function number error 1 protection” or Err33.3 “Input function number error 2 protection” will occur.

Default: [ ]

Parameter	Name	Range	Unit	Attribute	Default	Related control code
Pr4.01	SI2 input selection	0 to 00FFFFFFh (0 to 16777215)	—	C	00818181h (8487297)	P S T
Pr4.02	SI3 input selection	0 to 00FFFFFFh (0 to 16777215)	—	C	00828282h (8553090)	P S T
Pr4.03	SI4 input selection	0 to 00FFFFFFh (0 to 16777215)	—	C	002E2E2Eh (3026478)	P S T
Pr4.04	SI5 input selection	0 to 00FFFFFFh (0 to 16777215)	—	C	00222222h (2236962)	P S T
Pr4.05	SI6 input selection	0 to 00FFFFFFh (0 to 16777215)	—	C	00212121h (2171169)	P S T
Pr4.06	SI7 input selection	0 to 00FFFFFFh (0 to 16777215)	—	C	002B2B2Bh (2829099)	P S T
Pr4.07	SI8 input selection	0 to 00FFFFFFh (0 to 16777215)	—	C	00313131h (3223857)	P S T

Assign functions to SI2 to SI8 inputs.。
After the set value in hexadecimal is determined, Convert to 10 decimal numbers and then enter.
Setup procedure is the same as described for Pr4.00.

Note For input pin assignment with default setting, also refer to P.2-50 Control input single.

Safety precautions

The over-travel inhibit input (POT, NOT) and forced alarm input (E-STOP) should normally be set to b-contact, which stops when wire is broken. If a-contact is specified, be sure that there is no safety hazard.

Note For return to the origin operation by using this signal and latch of the actual position by signal input, check to content of the controllor.

Note
· A parameter is designated as follows: Class Pr0.00 No.
· For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page
· P.2-47 ～ " Wiring to the Connector，X4 "

Default: [ ]

Pr4.10	SO1 output selection	Range	Unit	Attribute	Default	Related control code
		0 to 00FFFFFFh (0 to 16777215)	—	C	00030303h (197379)	P S T

Assign functions to SO1 outputs.
These parameters are presented in hexadecimals.
Afther change to decimal, input the parametre.
Hexadecimal presentation is followed by a specific control mode designation.
0 0 – – – – * * h : position/full-closed control
0 0 – – * * – – h : velocity control
0 0 * * – – – – h : torque control
Replace * * with the function number.
For the function number see the table below. Logical setup is also a function number.

Title	Symbol: External output	Symbol: RTEX communication Status	setup value
Invalid	–	–	00h
Alarm output	ALM	Alarm	01h
Servo-Ready output	S-RDY	Servo_Ready	02h
External brake release signal	BRK-OFF	–	03h
Positioning complete output	INP	In_Position	04h
At-velocity output	AT-SPPED	–	05h
Torque in-limit signal output	TLC	Torque_Limited	06h
Zero-speed detection output signal	ZSP	–	07h
Speed coincidence output	V-COIN	–	08h
Alarm output1	WARN1	Warning	09h
Alarm output2	WARN2	Warning	0Ah
Positional command ON/OFF output	P-CMD	In_Progress	0Bh
Positioning complete 2	INP2	–	0Ch
Speed in-limit output	V-LIMIT	–	0Dh
Alarm clear attribute output	ALM-ATB	–	0Eh
Velocity command ON/OFF output	V-CMD	–	0Fh
RTEX operation output 1	EX-OUT1	–	10h
RTEX operation output 2	EX-OUT2	–	11h
Servo on status output	SRV-ST	Servo_Active	12h
Position comparison output	CMP-OUT	—	14h
Deterioration diagnosis velocity output	V-DIAG	—	15h

Note The details of each of the output logic signal refer to P.2-54 " Output Signal " .

< Example of change >
To change the default setting "External brake release signal" (in all modes) to "Alarm output 1", set the input to 00090909h, The input value of the parameter is a "592137" that is converted to a decimal number.
※ For easier setting, use PANATERM.

- Same function can be assigned to 2 or more output signals.
- Control output pin set to invalid always has the output transistor turned OFF.
- Do not change the setup value shown in the table.

Note
· A parameter is designated as follows: Class Pr0.00 No.
· For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page
· P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

		Range	Unit	Attribute	Default	Related control code
Pr4.11	SO2 output selection	0 to 00FFFFFFh (0 to 16777215)	—	C	00101010h (1052688)	P S T
Pr4.12	SO3 output selection	0 to 00FFFFFFh (0 to 16777215)	—	C	00010101h (65793)	P S T

Assign functions to SO2 ,SO3 outputs.
These parameters are presented in hexadecimals.
Setup procedure is the same as described for Pr4.10.

		Range	Unit	Attribute	Default	Related control code
Pr4.16	Type of analog monitor 1	0 to 28	—	A	0	P S T

Select the type of monitor for analog monitor 1. *See the table shown on the next page.
Default " Mortor velocity "

		Range	Unit	Attribute	Default	Related control code
Pr4.17	Analog monitor 1 output gain	0 to 214748364	—	A	0	P S T

Set up the output gain of analog monitor 1.
Default : For Pr4.16 = 0 Motor speed, 1 V is output at the motor speed [r/min] = 500 r/min setup value.

		Range	Unit	Attribute	Default	Related control code
Pr4.18	Type of analog monitor 2	0 to 28	—	A	4	P S T

Select the type of monitor for analog monitor 2. *See the table shown on the next page
Default : " torque command "

		Range	Unit	Attribute	Default	Related control code
Pr4.19	Analog monitor 2 output gain	0 to 214748364	—	A	0	P S T

Set up the output gain of analog monitor 2.
Default : For Pr4.18 = 3 Torque command, 1 V is output at the torque command [%] = 33 % setup value.

Default: [ ]

Pr4.21	Analog monitor output setup	Range	Unit	Attribute	Default	Related control code
		0 to 2	—	A	0	P S T

Select output format of the analog monitor.

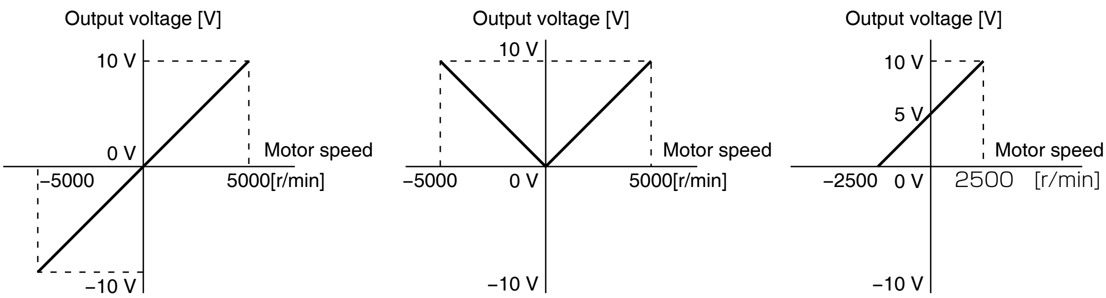
Setup value	Output format	
[0]	Signed data output	–10 V to 10 V
1	Absolute value data output	0 V to 10 V
2	Data output with offset	0 V to 10 V (5 V at center)

The figure below shows output specification when Pr 4.21 is 0, 1 or 2.

Pr 4.21 = 0,
signed data output
(output range –10 to 10 V)

Pr 4.21 = 1,
absolute value data output
(output range 0 to 10 V)

Pr 4.21 = 2,
data output with offset
(output range 0 to 10 V)



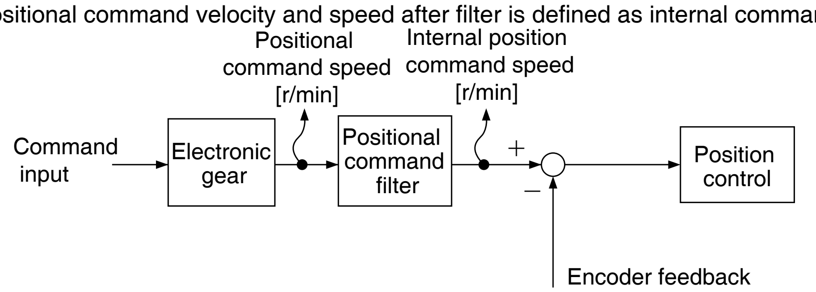
• When monitor type is motor speed, and conversion gain is 500 (1 V = 500 r/min).

Pr4.16/Pr4.18	Type of monitor	Unit		Output gain for setting Pr4.17/Pr4.19 = 0
0	Motor speed	r/min		500
1	Positional command speed *2	r/min		500
2	Internal positional command speed *2	r/min		500
3	Velocity control command	r/min		500
4	Torque command	%		33
5	Command positional deviation *3	pulse(Command unit)		3000
6	Encoder positional deviation *3	pulse (Encoder unit)		3000
7	Reservation	–		–
8	Reservation	–		–
9	Voltage across PN	V		80
10	Regenerative load factor	%*7		33
11	Overload factor	%		33
12	Positive direction torque limit	%		33
13	Negative direction torque limit	%		33
14	Speed limit value	r/min		500
15	Inertia ratio	%		500
16	Reservation	—		—
17	Reservation	—		—
18	Reservation	—		—
19	Encoder temperature	℃		10
20	Driver temperature	℃		10
21	Encoder single-turn data *1	pulse (Encoder unit)		110000
22	Reservation	—		—
23	Command input state*4	—		—
24	Gain selection state*4	—		—
25	Positioning complete state	0 : Positioning not completed	1 : Positioning completed	＊6
26	Alarm triggered state	0 : Alarm not happened	1 : Alarm happened	＊6
27	Motor power consumption	W		100
28 *5	Motor power electrical energy*5	Wh		100

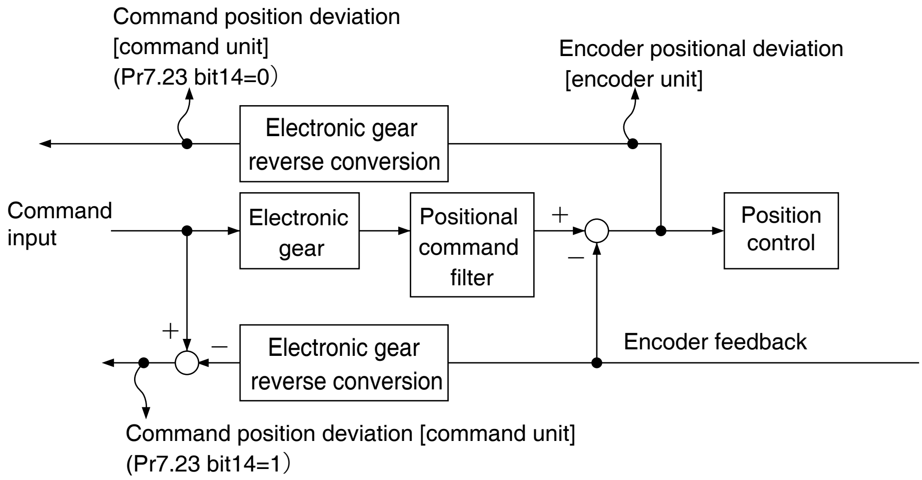
Default: [ ]

＊1 The direction of monitor data is basically as defined in Pr 0.00 "Rotational direction setup",However, the direction of encoder rotational data is defined positive when it turns CCW.

＊2 For the command pulse input, the speed before the positional command filter (smoothing, FIR filter) is defined as positional command velocity and speed after filter is defined as internal command velocity.



＊3 The RTEX communication type (MINAS-A6N series) can set the calculation method (standard) for command position deviation.
Switchover is accomplished according to the setting for the command position deviation output switching (bit 14) of Pr7.23 "RTEX function extended setup 2".
Pr7.23 bit14=0: Deviation with respect to command input after positional command filter
Pr7.23 bit14=1: Deviation with respect to command input before positional command filter



＊4 For monitor types No.23 and 24, digital signals are monitored using an analog monitor. Therefore, the output gain is as follows irrespective of the settings for Pr4.17 "Analog monitor 1 output gain" and Pr4.19 "Analog monitor 2 output gain".
＜ Analog output setup ＞

Pr4.16 /Pr4.18	Monitor type		Output voltage 0[V]	Output voltage +5[V]
23	Travel command status	Profile position control (PP)	In process of profiling	Under suspension of profiling
		Cyclic position control (CP)	Command update interval Travel command ≠0	Command update interval Travel command = 0
		Cyclic velocity control (CV)	Velocity command ≠ 0	Velocity command = 0
		Cyclic torque control (CT)	Torque command ≠ 0	Torque command = 0
24	Gain selection status		2nd gain(Including 3rd gain)	1st gain

＊5 The amount of motor power consumption per 30 minutes is output. The value is updated after the elapse of 30 minutes.
＊6 Regardless of the setting for Pr4.17 and Pr4.19, output gain shall be 0 V at unit 0 and 5 V at unit 1.
＊7 For CPU ver1.04/ver1.05 and ver1.20, unit is different.

Note
・ For description of "command unit" and "encoder unit" refer to P.3-85 "Pr5.20".
・ For command input mode (PP, CP, CV, CT) ,refer to P.3-2 and P.3-3.

Default: [ ]

Pr4.22	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr4.23	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr4.24	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Pr4.31	Positioning complete (In-position) range	Range	Unit	Attribute	Default	Related control code
		0 to 2097152	Command unit	A	8400	P

Set up the timing of positional deviation at which the positioning complete signal (INP1) is output. The command unit is used as the default unit but can be replaced by the encoder unit by using Pr5.20. Positioning unit selection. Note that when the encoder unit is used, unit of Pr0.14 Positional deviation excess setup is also changed.

positional deviation value can switch the command before and after the position command filter by setting to Pr 7.23 bit14.

Caution Using this setup value as Detection threshold data of Positioning complete (In_Position) on RTEX communication Status. but However, it has nothing to do with the Pr5.20 value, usually the command unit.

Pr4.32	Positioning complete (In-position) output setup	Range	Unit	Attribute	Default	Related control code
		0 to10	—	A	0	P

Select the condition to output the positioning complete signal (INP).

Setup value	Action of positioning complete signal
[0]	The signal will turn on when the positional deviation is smaller than Pr4.31 (Positioning complete range)
1, 6	The signal will turn on when there is no position command and the positional deviation is smaller than Pr4.31 (Positioning complete range).
2, 7	The signal will turn on when there is no position command, the zero-speed detection signal is ON and the positional deviation is smaller than Pr4.31 (Positioning complete range).
3, 8	The signal will turn on when there is no position command and the positional deviation is smaller than Pr4.31 (Positioning complete range). Then holds "ON" status until the next position command is entered.Subsequently, ON state is maintained until Pr4.33 INP hold time has elapsed. After the hold time, INP output will be turned ON/OFF according to the coming positional command or condition of the positional deviation.
4, 9	When the positioning judgment delay time set by Pr4.33 INP hold time passes after transition from “with position command” to “without position command”, positioning complete judgment sequence starts. If there is no position command and the positional deviation is smaller than Pr4.31 Positioning complete (in position) range, the signal will turn on.
5, 10	When the positioning judgment delay time set by Pr4.33 INP hold time passes after transition from “with position command” to “without position command”, and within positioning complete range, positioning complete judgment sequence starts. If there is no position command and the positional deviation is smaller than Pr4.31 Positioning complete range, the signal will turn on.

Caution This setting value is also used in the condition for detecting positioning completion (In_Position) of RTEX communication status.

Note
- A parameter is designated as follows: Class Pr0.00 No.
- For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page
- P.2-47 ~ “ Wiring to the Connector, X4 ”

Default: [ ]

Pr4.33	INP hold time	Range	Unit	Attribute	Default	Related control code
		0 to 30000	1 ms	A	0	P

Set up the hold time when Pr4.32 Positioning complete output setup = 3 , 8

Setup value	State of positioning complete signal
[0]	The hold time is maintained definitely, keeping ON state until the next positional command is received.
1 to 30000	ON state is maintained for setup time (ms) but switched to OFF state as the positional command is received during hold time.

＊ Becomes positioning detection delay time if Pr4.32 “Positioning complete output setup” is 4,5,9,10.

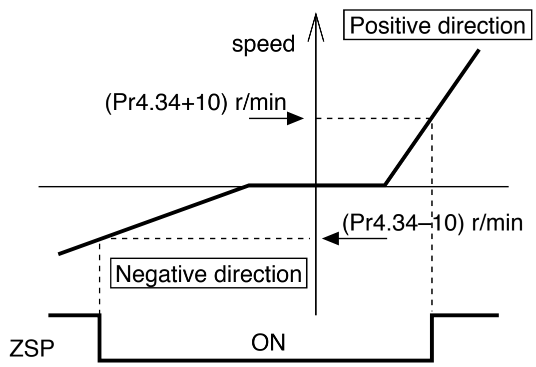
Setup value	State of positioning complete signal
[0]	Positioning detection delay time becomes 0, and positioning completion decision is started immediately upon a change from “With position command” to “Without position command”
1 to 30000	Positioning decision start time is delayed by a setting value [ms]. If a position command is received during the delay time, the delay time is reset. When the position command becomes 0, the delay time starts to be measured starting from 0.

Caution This setting value is also used in the condition for detecting positioning completion (In_Position) of RTEX communication status.

Pr4.34	Zero-speed	Range	Unit	Attribute	Default	Related control code
		10 to 20000	r/min	A	50	P S T

Set the detection threshold of zerospeed (ZSP)by the rotating speed .
The zero-speed detection signal will be detected when the motor speed falls below the setup speed of this parameter, Pr4.34.

- The setup of Pr4.34 is valid for both Positive and Negative direction regardless of the motor rotating direction.
- There is hysteresis of 10 [r/min].



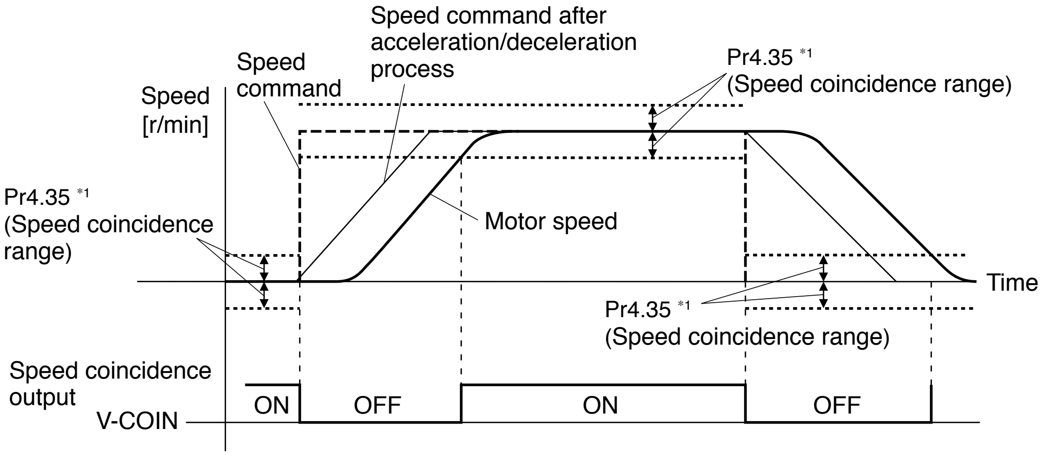
Note
・A parameter is designated as follows: Class Pr0.00 No.
・For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page
・P.2-47 ～ “ Wiring to the Connector，X4 ”

Default: [ ]

Pr4.35	Speed coincidence range	Range	Unit	Attribute	Default	Related control code
		10 to 20000	r/min	A	50	S T

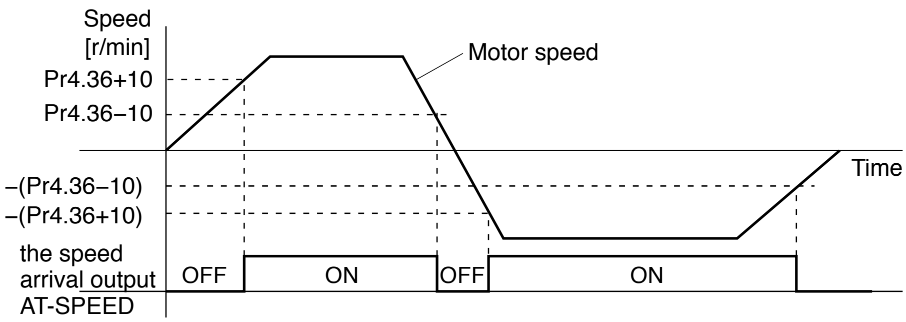
Set the speed coincidence (V-COIN) output detection timing.
Output the speed coincidence (V-COIN) when the difference between the speed command and the motor speed is equal to or smaller than the speed specified by this parameter.



*1 Because the speed coincidence detection is associated with 10 r/min hysteresis, actual detection range is as shown below.
Speed coincidence output OFF → ON timing (Pr4.35 – 10) r/min
Speed coincidence output ON → OFF timing (Pr4.35 + 10) r/min

Pr4.36	At-speed (Speed arrival)	Range	Unit	Attribute	Default	Related control code
		10 to 20000	r/min	A	1000	S T

Set the detection timing of the speed arrival output (AT-SPEED).
When the motor speed exceeds this setup value, the speed arrival output (AT-SPEED) is output. Detection is associated with 10 r/min hysteresis.



Note
· A parameter is designated as follows: Class Pr0.00 No.
· For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

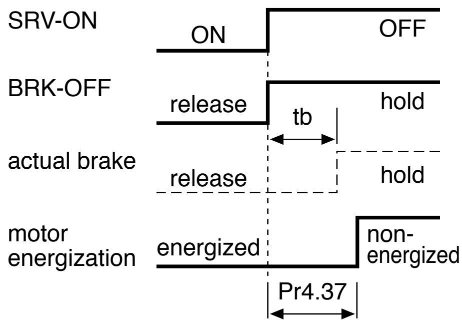
Related page
· P.2-47 ～ “ Wiring to the Connector, X4 ”

Default: [ ]

Pr4.37	Mechanical brake action at stalling setup	Range	Unit	Attribute	Default	Related control code
		0 to 32000	1 ms	B	0	P S T

You can set up the time from when the brake release signal (BRK-OFF) turns off to when the motor is de-energized (Servo-free), when the motor turns to Servo-OFF while the motor is at stall.

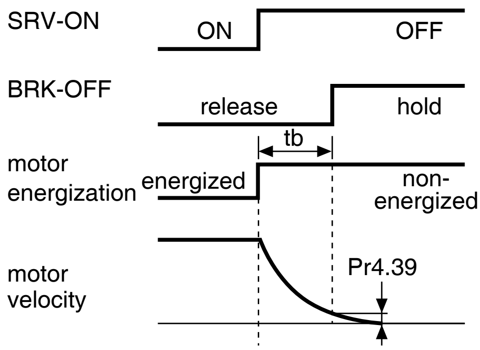
- Set up to prevent a micro-travel/ drop of the motor (work) due to the action delay time (tb) of the brake
- After setting up Pr4.37 ≥ tb, then compose the sequence so as the driver turns to Servo-OFF after the brake is actually activated.



Pr4.38	Mechanical brake action at running setup	Range	Unit	Attribute	Default	Related control code
		0 to 32000	1 ms	B	0	P S T

When the motor turns to Servo-OFF, you can set up the time from when servo on signal (SRV-ON) truns on to the brake release signal (BRK-OFF) turns off.

- Set up to prevent the brake deterioration due to the motor running.
- At Servo-OFF during the motor is running, tb of the right fig. will be a shorter one of either Pr4.38 setup time, or time lapse till the motor speed falls below Pr4.39 setup speed.



Pr4.39	Brake release speed setup	Range	Unit	Attribute	Default	Related control code
		30 to 3000	r/min	B	30	P S T

Set up the speed timing of brake output checking during operation.

Note

· A parameter is designated as follows: Class Pr0.00 No.

· For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

· P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

		Range	Unit	Attribute	Default	Related control code
Pr4.40	**Selection of alarm output 1**	0 to 40	—	A	0	P S T
Pr4.41	**Selection of alarm output 2**	0 to 40	—	A	0	P S T

Select the type of alarm issued as the alarm output 1 or 2.

Setup value	Alarm	Content
[0]	—	OR output of all alarms.
1	Overload protection	Load factor is 85 % or more the protection level.
2	Over-regeneration alarm	Regenerative load factor is 85 % or more the protection level.
3	Battery alarm	Battery voltage is 3.2 V or lower.
4	Fan alarm	Fan has stopped for 1 sec.
5	Encoder communication alarm	The number of successive encoder communication errors exceeds the specified value.
6	Encoder overheat alarm	The encoder detects overheat alarm.
7	Oscillation detection alarm	Oscillation or vibration is detected.
8	Lifetime detection alarm	Life expectancy of capacitor or fan becomes short.
9	For manufacturer's use	—
10	For manufacturer's use	—
11	RTEX continuous communication error warning	The No. of detected continuous reading errors (CRC error) of the data delivered to the local node reaches the number specified by Pr 7.26 “RTEX continuous error warning setup”.
12	RTEX accumulated communication error warning	The accumulated number of detected reading errors (CRC error) of the data delivered to the local node reaches the number specified by Pr 7.27 “RTEX accumulated error warning setup”.
13	RTEX_Update_Counter error warning	Accumulated amount exceeded the times specified by Pr7.28 “RTEX_Update_Counter error warning setup”, so that Update_ Counter was not updated.
14	Main power off warning	When setting of Pr7.14 “Main power off warning detection time” is 10-1999, instantaneous power interruption occurs between L1 and L3 and lasts for a time longer than the setting of Pr7.14.
15～21	For manufacturer's use	—
22	Deterioration diagnosis warning	Load characteristic estimates and torque command under constant speed has exceeded the set range.
23～29	For manufacturer's use	—
30	PANATERM command execution warning	In this state of Pr7.99 ”RTEX function extended setup 6” bit0 is 1,When RTEX communication was established, the operation command (such as trial run and FFT) by setup support software (PANATERM) was executed.
31～40	For manufacturer's use	—

Related page For detailed description of alarm types, refer to P.6-40.

Pr4.42	2nd Positioning complete (In-position) range	Range	Unit	Attribute	Default	Related control code
		0 to 2097152	Command unit	A	8400	P

The INP2 turns ON whenever the positional deviation is lower than the value set up in this parameter, without being affected by Pr4.32 Positioning complete output setup. (Presence/ absence of positional command is not related to this judgment.)

Caution The command unit is used as the default unit but can be replaced by the encoder unit by using Pr5.20. Positioning unit selection. Note that when the encoder unit is used, unit of Pr0.14 Positional deviation excess setup is also changed.

Note For description of “command unit” and “encoder unit”, refer to P.3-85 “Pr5.20”.

Pr4.44	Position comparison output pulse width setting	Range	Unit	Attribute	Default	Related control code
		0 to 32767	0.1 ms	R	0	P S T

Sets the signal width of position comparison output.
No signal will be output when 0.

Pr4.45	Position comparison output polarity selection	Range	Unit	Attribute	Default	Related control code
		0 to 7	—	R	0	P S T

Sets position comparison output polarity by each bit of the output terminal.

・Set bits*1 *2

bit	Designation
bit0	SO1,OCMP1
bit1	SO2,OCMP2
bit2	SO3,OCMP3

・Set value for each bit

Setup value	Designation
0	The output photocoupler is turned ON for SO1 to 3 and is set to L level for OCMP1 to 3, respectively, during pulse output.
1	The output photocoupler is turned OFF for SO1 to 3 and is set to H level for OCMP1 to 3, respectively, during pulse output.

Basically, use this function as 0.

Pr4.47	Pulse output select	Range	Unit	Attribute	Default	Related control code
		0 to 1	—	R	0	P S T

Selects signal outputted from pulse regeneration output / position comparison output terminal.*2

0：Encoder output Signal (OA,OB)　　1：Position comparison output signal (OCMP1 to 3)

*1 When general output (SO1 to SO3) is used as position comparision output(CMP-OUT),assign position comparision to Pr4.10 to Pr4.12 for all control modes.

*2 When encoder output signal(OA,OB) is used as position comparision output(OCMP1 to 3),set Pr4.47 to 1.

Default: [ ]

Pr4.48	Position comparison value 1	Range	Unit	Attribute	Default	Related control code
		-2147483648 to 2147483647	Command unit	A	0	P S T

Sets comparison value for position compare 1.

Pr4.49	Position comparison value 2	Range	Unit	Attribute	Default	Related control code
		-2147483648 to 2147483647	Command unit	A	0	P S T

Sets comparison value for position compare 2.

Pr4.50	Position comparison value 3	Range	Unit	Attribute	Default	Related control code
		-2147483648 to 2147483647	Command unit	A	0	P S T

Sets comparison value for position compare 3.

Pr4.51	Position comparison value 4	Range	Unit	Attribute	Default	Related control code
		-2147483648 to 2147483647	Command unit	A	0	P S T

Sets comparison value for position compare 4.

Pr4.52	Position comparison value 5	Range	Unit	Attribute	Default	Related control code
		-2147483648 to 2147483647	Command unit	A	0	P S T

Sets comparison value for position compare 5.

Pr4.53	Position comparison value 6	Range	Unit	Attribute	Default	Related control code
		-2147483648 to 2147483647	Command unit	A	0	P S T

Sets comparison value for position compare 6.

Pr4.54	Position comparison value 7	Range	Unit	Attribute	Default	Related control code
		-2147483648 to 2147483647	Command unit	A	0	P S T

Sets comparison value for position compare 7.

Pr4.55	Position comparison value 8	Range	Unit	Attribute	Default	Related control code
		-2147483648 to 2147483647	Command unit	A	0	P S T

Sets comparison value for position compare 8.

Pr4.56	Position comparison output delay compensation amount	Range	Unit	Attribute	Default	Related control code
		-32768 to 32767	0.1 us	R	0	P S T

Compensates position compare output delay caused by the circuit.

Note

・A parameter is designated as follows: Class Pr0.00 No.

・For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

・P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

Pr4.57	Position comparison output assignment setting	Range	Unit	Attribute	Default	Related control code
		-2147483648 to 2147483647	—	R	0	P S T

Sets output terminal corresponding to position compare 1 to 8 by bit.
Multiple position comparison values can be set by one single output terminal.

・Set bits

bit	Designation
bit0 to bit3	Position com 1
bit4 to bit7	Position com 2
bit8 to bit11	Position com 3
bit12 to bit15	Position com 4
bit16 to bit19	Position com 5
bit20 to bit23	Position com 6
bit24 to bit27	Position com 7
bit28 to bit31	Position com 8

・Set value for each bit *1 *2

Setup value	Designation
0000b	Invalid output
0001b	Assigned to SO1 or OCMP1
0010b	Assigned to SO2 or OCMP2
0011b	Assigned to SO3 or OCMP3
Others	For manufacturer's use (do not set)

*1 When general output (SO1 to SO3) is used as position comparision output(CMP-OUT),assign position comparision to Pr4.10 to Pr4.12 for all control modes.

*2 When encoder output signal(OA,OB) is used as position comparision output(OCMP1 to 3),set Pr4.47 to 1.

Note

・A parameter is designated as follows: Class Pr0.00 No.

・For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

・P.2-47 ~ " Wiring to the Connector, X4 "

Default: [ ]

Pr5.03	Denominator of pulse output division	Range	Unit	Attribute	Default	Related control code
		0 to 8388608	—	R	0	P S T

For application where the number of output pulses is not an integer, this parameter can be set to a value other than 0 and the dividing ratio can be set by using Pr. 0.11 as numerator and Pr. 5.03 as denominator.

Pulse output resolution per revolution
= (Pr0.11 setting value ／ Pr5.03 setting value) × encoder resolution × $\frac{1}{4}$

〈The table below shows combination of Pr0.11 "Output pulse counts per one motor revolution" and Pr5.03 "Denominator of pulse output division".〉

<table>
<tr><th>Pr0.11</th><th>Pr5.03</th><th>Pulse regeneration output operation</th></tr>
<tr><td rowspan="2">1 to 2097152</td><td>【0】</td><td>When the output source is encoder
Encoder feedback pulse [pulse] → $\frac{\text{【Pr0.11settingvalue】×4}}{\text{Encoder resolution}}$ → Output pulse [pulse]
＊ When Pr 5.03 = 0, the above process is made according to Pr 0.11 setup value. The number of pulses of reproduced pulse output OA and OB are the number of pulses set in Pr 0.11. The resolution of pulse output per one revolution is equal to or less the encoder resolution.</td></tr>
<tr><td>1 to 8388608</td><td>Encoder feedback pulse [pulse] → $\frac{\text{【Pr0.11 setting value】}}{\text{【Pr5.03 setting value】}}$ → Output pulse [pulse]
＊ If Pr 5.03 is not equal to 0, then the above process is performed based on setup value of Pr 0.11 and Pr 5.03. This process enables the system to be compatible with application where the number of pulses per motor revolution of reproduced pulse output OA and OB are not an integral. However, the resolution of output pulse is equal to the resolution of encoder pulse at the best.</td></tr>
</table>

Note

・A parameter is designated as follows: Class Pr0.00 No.

・For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

・P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

Pr5.04	Over-travel inhibit input setup	Range	Unit	Attribute	Default	Related control code
		0 to 2	—	C	1	P S T

Set up the operation of the over-travel inhibition (POT, NOT) inputs.

Set the parameter according to the specification of upper controller.

Normally it should be set to 1 (disabled) because the operation is controlled by an upper controller.

For details, check to materials of controller.

setup value	Operation
0	POT → inhibits CW drive, NOT → inhibits CCW drive. When POT is input during CW driving, stops the drive according to Pr 5.05“Sequence at over-travel inhibit”. The similar function NOT is applied in reverse direction.
【1】	POT and NOT are disabled, having no effect on operation.*1
2	POT or NOT input activates Err 38.0 Run-inhibition input protection.

Caution

The Pr5.04 “Over-travel inhibit input setup” and Pr5.05 “Sequence at over-travel inhibit” settings are temporarily invalid during profile home position return.

If profile home position return function is used without using the over-travel inhibit input, Do not assign over-travel inhibit input (POT/NOT) to general purpose input. The setting is not invalidated only by setting the Pr5.04 to 1.

For details of profile home position return function, check to materials of controller.

*1 In the state that SI6 assigned to POT, SI7 assigned to NOT,when Pr5.04 “Over-travel inhibit input setup” is set to a value other than 1(invalid),Err38.2 “Drive inhibit input protection 3” occurs.

Note

・A parameter is designated as follows: Class Pr0.00 No.

・For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page

・P.2-47 ～ “ Wiring to the Connector, X4 ”

1 Before Using the Products
2 Preparation
3 Setup
4 Trial Run
5 Adjustment
6 When in Trouble
7 Supplement

Default: [ ]

Pr5.05	Sequence at over-travel inhibit	Range	Unit	Attribute	Default	Related control mode
		0 to 2	—	R	0	P S T

When Pr5.04 Over-travel inhibition = 0, specify the status during deceleration and stop after application of the over-travel inhibition (POT, NOT).

<Details of Pr5.05 (Sequence at over-travel inhibit)>

Pr5.04	Pr5.05	During deceleration*6		After stalling (Approx. 30 r/min or below)	
		Stopping method	Deviation	Operation after stopping	Deviation
0	Common	•Forcibly controls the position. *1 •Forcibly stops position command generation. *1*9	—	Control mode depends on the command. *2	–
	[0]	Dynamic brake action*7	Clear *3	Torque command=0 towards inhibited direction	Hold
	1	Free run (DB OFF)	Clear *3	Torque command=0 towards inhibited direction	Hold
	2	•Emergency stop *5*8*9 •Torque limit=Pr 5.11	Clear *3	Torque limit and torque command are as usual.	Hold

*1 During deceleration, the system is forced to perform position control, forcibly stopping the internal position command generating process.

*2 Stop a command in over-travel inhibit direction with the over-travel inhibit input set to ON. If a command is issued in over-travel inhibit direction, the command is neglected. If the bit 9 of the parameter for RTEX function extended setup 2 (Pr7.23) is set to 1 at this time, a command error is returned.

*3 During deviation clearing, the process that lets the internal command position to follow the feedback position is activated. At the instantaneous stopping and at the end of deceleration, position deviations accumulated during deceleration are cleared.

*4 When setting value of Pr 5.04 “Over-travel inhibit input setup” is 2, Err 38.0 “Over-travel inhibit input protect” occurs when POT or NOT is turned on. Therefore, the system operates according to Pr 5.10 “Sequence at alarm” but not to this setting. Pr 5.10 “Sequence at alarm” has always priority if any other error occurs.

*5 Emergency stop refers to a controlled immediate stop with servo-on.
The torque command value is limited during this process by Pr 5.11 “Torque setup for emergency stop”.

*6 Deceleration period is the time required for the running motor to speed down to 30 r/min. Once the motor speed drops below 30 r/min, it is treated as in stop state regardless of its speed.

*7 Stopping method is Free run (DB OFF) in dynamic brake non-compatible models.

*8 The set value of Pr 6.14 “Emergency stop time at alarm” is invalid.

*9 When the slow stop function is valid by bit10 and bit 15 of Pr 6.10 “Function expansion setup”, can not emergency stop,but slow stop.Details refer to Technical Refarence for basic specification of RTEX 6-3-7.

Caution

The Pr5.04 “Over-travel inhibit input setup” and Pr5.05 “Sequence at over-travel inhibit” settings are temporarily invalid during profile home position return.

If profile home position return function is used without using the over-travel inhibit input, Do not assign over-travel inhibit input (POT/NOT) to general purpose input. The setting is not invalidated only by setting the Pr5.04 to 1.

For details of profile home position return function, check to materials of controller.

Note

・A parameter is designated as follows: Class Pr0.00 No.

・For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page

・P.2-47 ～ “ Wiring to the Connector, X4 ”　・P.6-3 “ Protective Function ”

Default: [ ]

Pr5.06	Sequence at Servo-Off	Range	Unit	Attribute	Default	Related control mode
		0 to 9	—	R	0	P S T F

Specify the status during deceleration and after stop, after servo-off.

•Details of Pr 5.06 “Sequence at Servo-off”

Setup value	During deceleration[*4]		After stalling (Approx. 30 r/min or below)	
	Stopping method	Deviation	Operation after stopping	Deviation
Common	•Forcibly controls the position. [*1] •Forcibly stops position command generation. [*1*7]	—	•Forcibly controls the position. [*1] •Forcibly stops position command generation. [*1*7]	–
[0],4	Dynamic brake action [*6]	Clear [*2]	Dynamic brake action [*6]	Clear [*2]
1,5	Free-run (DB OFF)	Clear [*2]	Dynamic brake action [*6]	Clear [*2]
2,6	Dynamic brake action [*6]	Clear [*2]	Free-run (DB OFF)	Clear [*2]
3,7	Free-run (DB OFF)	Clear [*2]	Free-run (DB OFF)	Clear [*2]
8	•Emergency stop [*3*6*7] •Torque limit =Pr 5.11	Clear [*2]	Dynamic brake action [*6]	Clear [*2]
9	•Emergency stop [*3*6*7] •Torque limit =Pr 5.11	Clear [*2]	Dynamic Brake (DB) action	Clear [*2]

*1 During deceleration sequence or at the stop (servo OFF), the system has to control the position and to stop the generation of internal position command..

*2 During deviation clearing process, the system causes the internal command position to follow up the feedback position. When executing the interpolation feed system command after servo ON, re-set the command coordinate of the host controller. The motor may operate sharply.

*3 Emergency stop refers to a controlled immediate stop with servo-on. The torque command value is limited during this process by Pr 5.11 “Torque setup for emergency stop”.

*4 Deceleration period is the time required for the running motor to speed down to 30 r/min. Once the motor speed drops below 30 r/min, it is treated as in stop state regardless of its speed.

*5 Stopping method is Free run (DB OFF) in dynamic brake non-compatible models.

*6 The set value of Pr 6.14 “Emergency stop time at alarm” is invalid.

*7 When the slow stop function is valid by bit10 and bit 15 of Pr 6.10 “Function expansion setup”, can not emergency stop,but slow stop.Details refer to Technical Refarence for basic specification of RTEX 6-3-7.

Caution If an error occurs during servo-off, follow Pr5.10 Sequence at alarm. If the main power is turned off during servo-off, follow Pr5.07 Sequence during main power interruption.

Related page Refer to P.7-66, "Timing Chart"-Servo-ON/OFF action while the motor is at stall" of Preparation as well.

Note
· A parameter is designated as follows: Class Pr0.00 No.
· For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page
· P.2-47 ～ “ Wiring to the Connector, X4 ” · P.6-3 “ Protective Function ”

Default: [ ]

Pr5.07	Sequence at main power OFF	Range	Unit	Attribute	Default	Related control code
		0 to 9	—	B	0	P S T

Specify the status during deceleration after main power interrupt or after stoppage.
The relationship between the setup value of Pr5.06 and the operation and process at deviation counters is the same as that for Pr5.07 (sequence at main power OFF).

Caution If an error occurs with the main power supply turned off, Pr5.10 Sequence at alarm is applied to the operation.
When the main power supply is turned off with servo-on state, Err13.1 Main power undervoltage error occurs if Pr5.08 LV trip selection with main power off = 1, and the operation follows Pr5.10 Sequence at alarm.
Dynamic brake operation input will be possible when Pr6.36 “Dynamic brake operation input setup” is effective d
when main power supply is OFF. In the output signal assignment of Pr4.02 “SI3 input selection,” when connected to COM- by a connection setting, dynamic brake installed inside the amplifier will be released, and when COM- is opened, the dynamic brake installed inside the amplifier will activate.
This input will become invalid for Servo-ON, during trips, safety state or when the main power supply is switched ON and will follow the normal sequence setting.

Pr5.08	LV trip selection at main power OFF	Range	Unit	Attribute	Default	Related control code
		0 to 3	—	B	1	P S T

To select whether to trip LV or Servo Off, in case of main power supply alarm.
In addition, also sets conditions for detection of main power supply off warning, in case the main power supply cut-off condition persists more than the time set in Pr 7.14.

	Setup value	Action of main power low voltage protection
bit 0	0	Servo Off in accordance with setting of Pr 5.07 and resumes Servo On when power supply reclosed
	1	Detects Err 13.1 Main power supply low voltage protection.
bit 1	0	Main power supply Off warning detects only on Servo On conditions.
	1	Main power supply off warning always detected.

Caution This parameter is invalid when Pr5.09 (Detection time of main power OFF)=2000. Err13.1 (Main power under-voltage protection) is triggered when setup of Pr5.09 is long and P-N voltage of the main converter falls below the specified value before detecting the main power shutoff, regardless of the Pr5.08 setup.

Pr5.09	Detection time of main power off	Range	Unit	Attribute	Default	Related control code
		70 to 2000	1 ms	C	70	P S T

You can set up the time to detect the shutoff while the main power is kept shut off continuously.
The main power off detection is invalid when you set up this to 2000.

Note
- A parameter is designated as follows: Class Pr0.00 No.
- For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page
- P.2-47 ~ “ Wiring to the Connector, X4 ”

Pr5.10	Sequence at alarm	Range	Unit		Default	Related control mode
		0 to 7	—		0	P S T

Specify the status during deceleration and after stop, after occurrence of alarm.

•Details of Pr 5.10 "Sequence at alarm"

Setup value	During deceleration[*4]			After stalling (Approx. 30 r/min or below)	
	Stopping method		Deviation	Operation after stopping	Deviation
Common	•Forcibly controls the position. [*1] •Forcibly stops position command generation. [*1*6]		—	•Forcibly controls the position. [*1] •Forcibly stops position command generation. [*1*6]	—
[0]	Dynamic Brake (DB) action[*5]		Clear [*2]	Dynamic Brake (DB) action[*5]	Clear [*2]
1	Free-run (DB OFF)		Clear [*2]	Dynamic Brake (DB) action[*5]	Clear [*2]
2	Dynamic Brake (DB) action[*5]		Clear [*2]	Free-run (DB OFF)	Clear [*2]
3	Free-run (DB OFF)		Clear [*2]	Free-run (DB OFF)	Clear [*2]
4	Action A [*3]	•Emergency stop [*3*6] •Torque limit =Pr 5.11	Clear [*2]	Dynamic Brake (DB) action[*5]	Clear [*2]
	Action B [*3]	Dynamic Brake (DB) action[*5]	Clear [*2]		
5	Action A [*3]	•Emergency stop [*3*6] •Torque limit =Pr 5.11	Clear [*2]	Dynamic Brake (DB) action[*5]	Clear [*2]
	Action B [*3]	Free-run (DB OFF)	Clear [*2]		
6	Action A [*3]	•Emergency stop [*3*6] •Torque limit =Pr 5.11	Clear [*2]	Free-run (DB OFF)	Clear [*2]
	Action B [*3]	Dynamic Brake (DB) action[*5]	Clear [*2]		
7	Action A [*3]	•Emergency stop [*3*6] •Torque limit =Pr 5.11	Clear [*2]	Free-run (DB OFF)	Clear [*2]
	Action B [*3]	Free-run (DB OFF)	Clear [*2]		

*1 During deceleration sequence or at the stop (during alarm or servo OFF), the system must control the position and stop the generation of internal position command.

*2 During deviation clearing process, the system causes the internal command position to follow up the feedback position. When executing the interpolation feed system command after servo ON, first re-set the command coordinate of the host controller. The motor may operate sharply.

*3 Action of A/B: When an alarm requiring emergency stop occurs, the action A is selected when the setup value in the table is set within the range 4 to 7, causing emergency stop of operation. When an alarm not requiring emergency stop occurs, it triggers dynamic braking (DB) specified by action B, or free-running.
Hold the main circuit power until deceleration stop is completed.For the alarm requiring emergency stop, refer to Section 6-4 "Protective function list".

*4 Deceleration period is the time required for the running motor to speed down to 30 r/min. Once the motor speed drops below 30 r/min, and changes its status after stoppage, it is treated as in stop state regardless of its speed.

*5 Stopping method is Free run (DB OFF) in dynamic brake non-compatible models.

*6 When the slow stop function is valid by bit10 and bit 15 of Pr 6.10 "Function expansion setup", can not emergency stop,but slow stop.Details refer to Technical Refarence for basic specification of RTEX Functional Specification 6-3-7.

Note

· A parameter is designated as follows: Class Pr0.00 No.

· For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

· P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

Pr5.11	Torque setup for emergency stop	Range	Unit	Attribute	Default	Related control code
		0 to 500	%	B	0	P S T

Set up the torque limit at emergency stop.

Note When setup value is 0, the torque limit for normal operation is applied.

Pr5.12	Over-load level setup	Range	Unit	Attribute	Default	Related control code
		0 to 500	%	A	0	P S T

- You can set up the over-load level of effective torque. The overload level becomes 115[%] by setting up this to 0.
- Use this with 0 setup in normal operation. Set up other value only when you need to lower the over-load level.
- The setup value of this parameter is limited by 115[%] of the motor rating.

Related page The over-load protection time characteristics are described on P.6-23.

Pr5.13	Over-speed level setup	Range	Unit	Attribute	Default	Related control code
		0 to 20000	r/min	B	0	P S T

- Set up the detection level of Err.26.0 Over-speed protection. When the setting value is 0, the over-speed level of applicable motor is set.
- The internal value is limited to the over-speed level of applicable motor.

Pr5.14	Motor working range setup	Range	Unit	Attribute	Default	Related control code
		0 to 1000	0.1 revolution	A	10	P

Sets the allowable motor operating range corresponding to the position command input range.
Err34.0 “Allowable motor operating range abnormal protection” will be triggered when the set value is exceeded.
Protection function will be invalid in case the set value is 0.
will be invalid under the conditions indicated in Precaution of 6-2.

Related page P.6-28“Allowable Motor Operating Range Setting Function(Err34.0)”

Pr5.15	Control input signal reading setup	Range	Unit	Attribute	Default	Related control code
		0 to 3	—	C	0	P S T

Select reading cycle of the control input signal.

Setup value	Reading cycle of the signal.
[0]	0.25 ms
1	0.5 ms
2	1 ms
3	2 ms

However,When using POT/NOT/HOME as the origin reference trigger and an external latch input 1/2/3 (EXT1/2/3).
(Note) MINAS-A5N series different read cycle.

Note
- A parameter is designated as follows: Class Pr0.00 No.
- For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page
- P.2-47 ~ “ Wiring to the Connector, X4”
- P.6-3 “ Protective Function ”

Default: [ ]

Pr5.20	Position setup unit select	Range	Unit	Attribute	Default	Related control code
		0 to 1	—	C	0	P

Specify the unit to determine the range of positioning complete and excessive positional deviation.

Setup value	Unit
[0]	Command unit
1	Encoder unit

Positioning complete detection threshold of RTEX communication status is always in terms of command unit regardless of the setting of this parameter.

Related page P.3-6 " Outline of Mode/Position Control Mode/Function/ ① Electronic gear function "

Pr5.21	Selection of torque limit	Range	Unit	Attribute	Default	Related control code
		0 to 4	—	B	1	P S

You can set up the torque limiting method.

Setup value of RTEX communication command TL-SW (torque limit switching command) as follows. But, for torque control, switching function is invalid, Pr0.13 (1st torque limit) is fixed.

For RTEX communication command,check to content of contorllor.

setup value	TL_SW = 0		TL_SW = 1	
	Negative direction	Positive direction	Negative direction	Positive direction
0, [1]	Pr0.13			
2	Pr5.22	Pr0.13	Pr5.22	Pr0.13
3	Pr0.13		Pr5.22	
4	Pr5.22	Pr0.13	Pr5.26	Pr5.25

Pr5.22	2nd torque limit	Range	Unit	Attribute	Default	Related control code
		0 to 500	%	B	500	P S

You can set up the 2nd limit value of the motor output torque.

Pr5.23	Torque limit switching setup 1	Range	Unit	Attribute	Default	Related control code
		0 to 4000	ms/100 %	B	0	P S

Specify the rate of change (slope) from 1st to 2nd during torque limit switching.

Pr5.24	Torque limit switching setup 2	Range	Unit	Attribute	Default	Related control code
		0 to 4000	ms/100 %	B	0	P S

Specify the rate of change (slope) from 2nd to 1st during torque limit switching.

Note

· A parameter is designated as follows: Class Pr0.00 No.

· For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page · P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

Pr5.25	External input positive direction torque limit	Range	Unit	Attribute	Default	Related control code
		0 to 500	%	C	500	P S

Set up positive direction torque limit when TL-SW=1 with Pr5.21 Selection of torque limit set at 4.
The value of parameter is limited to the maximum torque of the applicable motor.

Pr5.26	External input negative direction torque limit	Range	Unit	Attribute	Default	Related control code
		0 to 500	%	C	500	P S

Set up negative direction torque limit when TL-SW=1 with Pr5.21 Selection of torque limit set at 4.
The value of parameter is limited to the maximum torque of the applicable motor.

Pr5.29	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	2	

Pleses fixed to 2.

Pr5.31	USB axis address	Range	Unit	Attribute	Default	Related control code
		0 to 127	—	C	1	P S T

Set up the axis number for USB communication.

Pr5.33	Pulse regenerative output limit setup	Range	Unit	Attribute	Default	Related control code
		0 to 1	—	C	0	P S T

Enable/disable detection of Err28.0 Pulse regenerative limit protection.
0 : Invalid 1 : Valid

Pr5.34	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	4	

Pleses fixed to 4.

Pr5.36	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Pr5.45	Quadrant projection positive direction compensation value	Range	Unit	Attribute	Default	Related control code
		-1000 to 1000	0.1 %	B	0	P

To set positive direction high-precision torque compensation value for quadrant projection.

Note

・A parameter is designated as follows: Class Pr0.00 No.
・For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

・P.2-47 ～ " Wiring to the Connector, X4"

1 Before Using the Products
2 Preparation
3 Setup
4 Trial Run
5 Adjustment
6 When in Trouble
7 Supplement

Default: [ ]

Pr5.46	Quadrant projection negative direction compensation value	Range	Unit	Attribute	Default	Related control code
		-1000 to 1000	0.1 %	B	0	P

To set negative direction high-precision torque compensation value for quadrant projection.

Pr5.47	Quadrant projection compensation delay time	Range	Unit	Attribute	Default	Related control code
		0 to 1000	ms	B	0	P

To set compensation timing delay time for quadrant projection.

Pr5.48	Quadrant projection compensation filter setting L	Range	Unit	Attribute	Default	Related control code
		0 to 6400	0.01 ms	B	0	P

To set compensation value LPF time constant for quadrant projection.

Pr5.49	Quadrant projection compensation filter setting H	Range	Unit	Attribute	Default	Related control code
		0 to10000	0.1 ms	B	0	P

To set compensation value HPF time constant for quadrant projection.

Pr5.50	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr5.51	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr5.52	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr5.53	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr5.54	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr5.55	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Pr5.56	Slow stop deceleration time setting	Range	Unit	Attribute	Default	Related control code
		0 to 10000	ms/1000 r/min	B	0	P S T

Sets deceleration time for immediate stop deceleration stop deceleration processing.
This parameter will become valid when Pr6.10 "Function enhancement setting" bit 15 = 1.

Note

・A parameter is designated as follows: Class Pr0.00 No.
・For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

・P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

Pr5.57	Slow stop S-shape acceleration and deceleration setting	Range	Unit	Attribute	Default	Related control code
		0 to 10000	ms	B	0	P S T

Sets the S-shape time for immediate stop deceleration stop deceleration processing.
This parameter will become valid when Pr6.10 “Function enhancement setting” bit 15 = 1.

Pr5.66	Deterioration diagnosis convergence judgment time	Range	Unit	Attribute	Default	Related control code
		0 to 10000	0.1 s	A	0	P S T

Sets time for deemed convergence of real-time auto tuning load characteristics estimate when deterioration diagnosis warning function is valid (Pr6.97 bit 1 = 1).

Pr5.67	Deterioration diagnosis inertia ratio uppe limit	Range	Unit	Attribute	Default	Related control code
		0 to 10000	%	A	0	P S T

Sets the upper limit values for inertia ratio estimate in deterioration diagnosis judgment of load characteristics estimate after completion of convergence, when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1).

Pr5.68	Deterioration diagnosis inertia ratio lower limit	Range	Unit	Attribute	Default	Related control code
		0 to 10000	%	A	0	P S T

Sets the lower limit values for inertia ratio estimate in deterioration diagnosis judgment of load characteristics estimate after completion of convergence, when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1).

Pr5.69	Deterioration diagnosis unbalanced load upper limit	Range	Unit	Attribute	Default	Related control code
		-1000 to 1000	0.1 %	A	0	P S T

Sets the upper limit values for unbalanced load estimate in deterioration diagnosis judgment of load characteristics estimate after completion of convergence, when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1).

Pr5.70	Deterioration diagnosis unbalanced load lower limit	Range	Unit	Attribute	Default	Related control code
		-1000 to 1000	0.1 %	A	0	P S T

Sets the lower limit values for unbalanced load estimate in deterioration diagnosis judgment of load characteristics estimate after completion of convergence, when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1).

Pr5.71	Deterioration diagnosis dynamic friction upper limit	Range	Unit	Attribute	Default	Related control code
		-1000 to 1000	0.1 %	A	0	P S T

Sets the upper limit values for dynamic friction estimate in deterioration diagnosis judgment of load characteristics estimate after completion of convergence, when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1).

Note

- A parameter is designated as follows: Class Pr0.00 No.
- For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page

- P.2-47 ～ “ Wiring to the Connector, X4 ”

Default: [ ]

Pr5.72	Deterioration diagnosis dynamic friction lower limit	Range	Unit	Attribute	Default	Related control code
		-1000 to 1000	0.1 %	A	0	P S T

Sets the lower limit values for dynamic friction estimate in deterioration diagnosis judgment of load characteristics estimate after completion of convergence, when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1).

Pr5.73	Deterioration diagnosis viscous friction upper limit	Range	Unit	Attribute	Default	Related control code
		0 to 10000	0.1 %/ 10000 r/min	A	0	P S T

Sets the upper limit values for viscous friction coefficient estimate in deterioration diagnosis judgment of load characteristics estimate after completion of convergence, when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1).

Pr5.74	Deterioration diagnosis viscous friction lower limit	Range	Unit	Attribute	Default	Related control code
		0 to 10000	0.1 %/ 10000 r/min	A	0	P S T

Sets the upper and lower limit values for viscous friction coefficient estimate in deterioration diagnosis judgment of load characteristics estimate after completion of convergence, when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1).

Pr5.75	Deterioration diagnosis velocity setting	Range	Unit	Attribute	Default	Related control code
		-20000 to 20000	r/min	A	0	P S T

Outputs deterioration diagnosis velocity output (V-DIAG) when the motor velocity is in the range of Pr5.75±Pr4.35 (velocity coinciding width), when deterioration diagnosis warning is valid (Pr6.97 bit 1 =1).

Pr5.76	Deterioration diagnosis torque average time	Range	Unit	Attribute	Default	Related control code
		0 to 10000	ms	A	0	P S T

Sets time required to compute the torque command average (weighted frequency) when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1) and diagnosis velocity output (V-DIAG) is ON.

Pr5.77	Deterioration diagnosis torque upper limit	Range	Unit	Attribute	Default	Related control code
		-1000 to 1000	0.1 %	A	0	P S T

Sets the upper limit values for torque command average value when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1) and deterioration diagnosis velocity output (V-DIAG) is ON.

Note

・A parameter is designated as follows: Class Pr0.00 No.

・For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

・P.2-47 ～ " Wiring to the Connector , X4 "

Default: [ ]

Pr5.78	Deterioration diagnosis torque lower limit	Range	Unit	Attribute	Default	Related control code			
		-1000 to 1000	0.1 %	A	0	P	S	T	

Sets the lower limit values for torque command average value when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1) and deterioration diagnosis velocity output (V-DIAG) is ON.

Note

· A parameter is designated as follows: Class Pr0.00 No.

· For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

· P.2-47 ～ " Wiring to the Connector, X4 "

4. Details of Parameter

[Class 6] Special Setting

Pr6.02	Velocity deviation excess setup	Range	Unit	Attribute	Default	Related control code
		0 to 20000	r/min	A	0	P

When the speed deviation (difference between internal positional command and actual speed) exceeds this value, Err24.2 Speed over deviation protection occurs.
This protection is not detected when the setup value is 0.

Pr6.05	Position 3rd gain valid time	Range	Unit	Attribute	Default	Related control code
		0 to 10000	0.1 ms	B	0	P

Pr6.06	Position 3rd gain scale factor	Range	Unit	Attribute	Default	Related control code
		50 to 1000	%	B	100	P

- Set up the time at which 3rd gain becomes valid, and Set up the 3rd gain by a multiplying factor of the 1st gain.
- 3rd gain = 1st gain × Pr6.06/100
- When not using this parameter, set Pr6.05 to 0 and Pr6.06 to 100.
- This is valid for only position control.

Related page P.5-54 “ 3rd Gain Switching Function ”

Pr6.07	Torque command additional value	Range	Unit	Attribute	Default	Related control code
		−100 to 100	%	B	0	P S

- Set up the offset load compensation value usually added to the torque command in a control mode except for the Torque Control Mode.
- Update this parameter when the vertical axis mode for real time auto-tuning is valid.

Pr6.08	Positive direction torque compensation value	Range	Unit	Attribute	Default	Related control code
		−100 to 100	%	B	0	P

Pr6.09	Negative direction torque compensation value	Range	Unit	Attribute	Default	Related control code
		−100 to 100	%	B	0	P

- Set up the dynamic friction compensation value to be added to the torque command when negative direction and positive direction positional command is fed.
- Update this parameter when the friction compensation mode for real time auto-tuning is valid.

Related page P.5-4 “ Real-Time Auto-Gain Tuning ” 、 P.5-56 “ Friction Torque Compensation ”

Note

· A parameter is designated as follows: Class Pr0.00 No.

· For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page · P.2-47 ～ “ Wiring to the Connector，X4 ”

Pr6.10	Function expansion setup	Range	Unit	Attribute	Default	Related control code
		-32768 to 32767	—	B	16	P S T

Set up the function in unit of bit.

	Function	Setup value	
		[0]	1
bit 0	Not used	Fixed to 0.	
bit 1	Load fluctuation control funtion	Invalid	Valid
bit 2	Load change stabilization setting	Invalid	Valid
bit 3	For manufacturer's use	Fixed to 0.	
bit 4	Current response improvement	Invalid	Valid
bit 5	For manufacturer's use	Fixed to 0.	
bit 6	Not used	Fixed to 0.	
bit 7	For manufacturer's use	Fixed to 0.	
bit 8	Not used	Fixed to 0.	
bit 9	For manufacturer's use	Fixed to 0.	
bit 10	Positional deviation of falling prevention function during alarm	Invalid	Valid
bit 11	Encoder overheat abnormality protectiondetection	Invalid	Valid *1
bit 12	Not used	Fixed to 0.	
bit 13	For manufacturer's use	0 Fixed to 0.	
bit 14	Load variation suppression functionautomatic adjustment setting	Invalid	Valid *2
bit 15	Slow stop function.	Invalid	Valid

※ The least significant bit is considered as bit0.

*1 When the encoder overheat alarm is generated, Err15.1 "Encoder overheat abnormality protection" is generated together.

*2 When bit14 to 1, it will be bit1 and 2 also 1.

Pr6.11	Current response setup	Range	Unit	Attribute	Default	Related control code
		10 to 100	%	B	100	P S T

Fine tune the current response with respect to default setup (100 %).

Note

· A parameter is designated as follows: Class Pr0.00 No.

· For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

· P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

Pr6.14	Emergency stop time at alarm	Range	Unit	Attribute	Default	Related control code
		0 to 1000	1 ms	B	200	P S T

Set up the time allowed to complete emergency stop in an alarm condition. Exceeding this time puts the system in alarm state.
When setup value is 0, immediate stop is disabled and the immediate alarm stop is enabled.
In case the slow stop function is to be used, set it to a length sufficiently longer than the maximum deceleration time, as the motor velocity will have a delay from the deceleration and stop command.
※ Please refer to P.6-34 " Slow Stop Function " of this item for maximum deceleration time.

Related page P.6-32 " Emergency Stop upon Occurrence of Alarm "

Pr6.15	2nd over-speed level setup	Range	Unit	Attribute	Default	Related control code
		0 to 20000	r/min	B	0	P S T

When the motor speed exceeds this setup time during emergency stop sequence in an alarm condition, Err26.1 "2nd overspeed protection" will be activated.
When setting value is 0, the internal value of over-speed leve is used.

Related page P.6-32 " Emergency Stop upon Occurrence of Alarm "

Pr6.18	Power-up wait time	Range	Unit	Attribute	Default	Related control code
		0 to 100	0.1 s	R	0	P S T

Set up the standard initialization time (1.5 s + α) after power-up.

Related page P.7-62 " Time Chart / Power ON "

Pr6.19	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr6.20	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr6.21	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr6.22	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Please fixed to 0.

Pr6.23	Load fluctuation compensating gain	Range	Unit	Attribute	Default	Related control code
		−100 to 100	%	B	0	P S

Sets the compensation gain for the load fluctuation.

Note
・A parameter is designated as follows: Class Pr0.00 No.
・For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page ・P.2-47 ～ " Wiring to the Connector，X4 "

Default: [ ]

Pr6.24	Load fluctuation compensating filter	Range	Unit	Attribute	Default	Related control code
		10 to 2500	0.01 ms	B	53	P S

Sets the filter time constant for the load fluctuation.

Pr6.27	Alarm latch time selection	Range	Unit	Attribute	Default	Related control code
		0 to 3	—	C	0	P S T

Setup to latch warning state.

General warning and Extended warning can be specified.

bit0 Extended warning 0：unlatched 1:latched

bit1 General warning 0：unlatched 1:latched

Related page P.6-38 “ Warning Functions ” 、P.6-40 “ List of Warning Code ”

Pr6.30	For manufacturer’s use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Please fixed to 0.

Pr6.31	Real time auto tuning estimation speed	Range	Unit	Attribute	Default	Related control code
		0 to 3	—	B	1	P S T

Set up the load characteristics estimation speed with the real time auto tuning being valid. A higher setup value assures faster response to a change in load characteristics but increases variations in disturbance estimation. Result of estimation is saved to EEPROM every 30 minutes.

Setup value	Mode	Description
0	No change	Stop estimation of load characteristics.
[1]	Almost constant	Response to changes in load characteristics in every minute.
2	Slower change	Response to changes in load characteristics in every second.
3 *	Faster change	Obtain best suitable estimation in response to changes in load characteristics.

＊ If the automatic oscillation detection is enabled by USB communication(PANATERM), the setup value 3 is used.

Note

・A parameter is designated as follows: Class Pr0.00 No.

・For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page ・P.2-47 ～ “ Wiring to the Connector, X4 ”

Default: [ ]

Pr6.32	Real time auto tuning custom setup	Range	Unit	Attribute	Default	Related control code
		–32768 to 32767	—	B	0	P S T

When the operation mode of real time auto tuning is set to the customize (Pr0.02 = 6), set the automatic adjusting function as shown below.
When the two-degree-of-freedom control mode is set , use with Pr6.32 = 0.

<table>
<tr><th>Bit</th><th>Content</th><th>Description</th></tr>
<tr><td>1 to 0</td><td>Load characteristics estimation *</td><td>Enable/disable the load characteristics estimation function.
<table><tr><th>Setup value</th><th>Function</th></tr><tr><td>[0]</td><td>Disable</td></tr><tr><td>1</td><td>Enable</td></tr></table>
* If the load characteristics estimation is disabled, the current setup cannot be changed even if the inertia ratio is updated according to the estimated value. When the torque compensation is updated by the estimated value, it is cleared to 0 (invalid).</td></tr>
<tr><td>3 to 2</td><td>Inertia ratio update</td><td>Set up update to be made based on result of the load characteristics estimation of Pr0.04 Inertia ratio.
<table><tr><th>Setup value</th><th>Function</th></tr><tr><td>[0]</td><td>Use the current setup.</td></tr><tr><td>1</td><td>Update by the estimated value.</td></tr></table></td></tr>
<tr><td>6 to 4</td><td>Torque compensation</td><td>Set up the update to be made according to the results of load characteristics estimation of Pr6.07 Torque command additional value, Pr6.08 positive direction torque compensation value and Pr6.09 negative direction torque compensation value.
<table><tr><th rowspan="2">Setup value</th><th rowspan="2">Function</th><th colspan="3">Compensation setup</th></tr>
<tr><th>Pr6.07</th><th>Pr6.08</th><th>Pr6.09</th></tr>
<tr><td>[0]</td><td>Use current setup</td><td></td><td></td><td></td></tr>
<tr><td>1</td><td>Disable torque compensation</td><td>0 clear</td><td>0 clear</td><td>0 clear</td></tr>
<tr><td>2</td><td>Vertical axis mode</td><td>Update</td><td>0 clear</td><td>0 clear</td></tr>
<tr><td>3</td><td>Friction compensation (low)</td><td>Update</td><td>Low</td><td>Low</td></tr>
<tr><td>4</td><td>Friction compensation (middle)</td><td>Update</td><td>Middle</td><td>Middle</td></tr>
<tr><td>5</td><td>Friction compensation (high)</td><td>Update</td><td>High</td><td>High</td></tr></table></td></tr>
<tr><td>7</td><td>Stiffness setup</td><td>Enable/disable the basic gain setup to be made according to Pr0.03 Real time auto tuning mechanical stiffness selection.
<table><tr><th>Setup value</th><th>Function</th></tr><tr><td>[0]</td><td>Disable</td></tr><tr><td>1</td><td>Enable</td></tr></table></td></tr>
<tr><td>8</td><td>Fixed parameter setup</td><td>Enable/disable the change of parameter that is normally set at a fixed value.
<table><tr><th>Setup value</th><th>Function</th></tr><tr><td>[0]</td><td>Use the current setup.</td></tr><tr><td>1</td><td>Set to a fixed value.</td></tr></table></td></tr>
</table>

(continued)

Default: [ ]

10 to 9	Gain switching setup	Select the gain switching related parameter to be used when the real time auto tuning is enabled. <table><tr><th>Setup value</th><th>Function</th></tr><tr><td>[0]</td><td>Use the current setup.</td></tr><tr><td>1</td><td>Disable gain switching.</td></tr><tr><td>2</td><td>Enable gain switching.</td></tr></table>

Caution This parameter should be setup bit by bit. To prevent setting error, use of the setup support software is recommended when editing parameter.
Do not change this parameter while the motor is running. Updated parameters will be effective when the motor stops after the result of load characteristics measurement is confirmed.

<Setup procedure of bitwise parameter>

When setting parameter to a value other than 0, calculate the setup value of Pr6.32 in the following procedure.

1) Identify the LSB of the setup.
   Example: LSB of the torque compensation function is 4.
2) Multiply the setup value by power of 2 (LSB).
   Example: To set the torque compensation function to friction compensation (middle):
   $2^4 \times 4 = 64$.
3) Perform steps 1) and 2) for every setups, sum up the values which are to be Pr6.32 setup value.
   Example: Load characteristics measurement = enable, inertia ratio update = enable, torque compensation = friction compensation (middle), stiffness setup = enable, fixed parameter = set to a fixed value, gain switching setup = enable, then,
   $2^0 \times 1 + 2^2 \times 1 + 2^4 \times 4 + 2^7 \times 1 + 2^8 \times 1 + 2^9 \times 2 = 1477$

Related page P.5-4 " Real-Time Auto-Gain Turing "

Pr6.34	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Please fixed to 0.

Pr6.35	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	10	

Please fixed to 10.

Pr6.36	Dynamic brake operation input	Range	Unit	Attribute	Default	Related control code
		0 to 1	—	R	0	P S T

Sets between enabling and disabling dynamic brake (DB) operation input by I/O.
Note) This function is available only when the main power is turned off.
0: Disabled 1: Enabled

Note
- A parameter is designated as follows: Class Pr0.00 No.
- For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page ・P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

Pr6.37	Oscillation detecting level	Range	Unit	Attribute	Default	Related control code
		0 to 1000	0.1 %	B	0	P S T

Set up the oscillation detecting level.
If the effective value of the torque vibration, which is calculated from the motor vibration, is the set value, or higher, in this case oscillation detection warning will be issued. If the setting value is 0, then oscillation detection warning is disabled.

Pr6.38	Alarm mask setup	Range	Unit	Attribute	Default	Related control code
		–32768 to 32767	—	C	4	P S T

Pr6.39	Alarm mask setup 2	Range	Unit	Attribute	Default	Related control code
		–32768 to 32767	—	C	0	P S T

Set up the alarm detection mask. Placing 1 to the corresponding bit position disables detection of the alarm condition.

Related page P.6-38 “ Warning Functions ” 、 P.6-40 “ List of Warning Code ”

Pr6.41	1st damping depth	Range	Unit	Attribute	Default	Related control code
		0 to 1000	—	B	0	P

Specifies a depth corresponding to the 1st damping frequency.
The depth is maximum if the setting value is 0. As the setting value increases, the depth decreases. As the depth increases, the damping effect increases, but the delay also increases. As the depth decreases, the delay decreases, but the damping effect also decreases.
Use the parameter to fine adjust the damping effect and delay.

Pr6.42	Two-stage torque filter time constant	Range	Unit	Attribute	Default	Related control code
		0 to 2500	0.01 ms	B	0	P S T

Pr6.43	Two-stage torque filter attenuation term	Range	Unit	Attribute	Default	Related control code
		0 to 1000	—	B	0	P S T

- Sets Two-stage torque filter time constant.and attenuation term of Two-stage torque filter.
- The setup value of Pr6.42 is invalid if 0 is specified.
- The filter degree of the Two-stage torque filter is changed according to the setting value of attenuation term .
- attenuation term 0～49：Operates as the 1st filter.
- attenuation term 50 to 1000：Operates as a 2nd filter and becomes a 2nd filter with $\zeta = 1.0$ if setting value is 1000. As the setting value is decreased, the filter becomes vibrational. Use with a setting value 1000 basically.

[When used for the secondary filter as Pr6.43 ≧ 50]
The time constants that can be used are 5～159 (0.05～1.59 ms).
(Equivalent to 100 to 3000 Hz in frequency)
Setting values 1～4 works as 5 (3000 Hz), and 159～2500 works as 159 (100 Hz).

Related page P.5-63 “ Two-stage Torque Filter ”

Default: [ ]

Pr6.47 *	Function expansion settings 2	Range	Unit	Attribute	Default	Related control code
		-32768 to 32767	—	R	1	P S T

Set up the function in unit of bit.

	Function	Setup value	
		0	1
bit 0	Two-degree-of-freedom control mode	Invalid	Valid
bit 1	Not used	Fixed to 0	
bit 2	Encoder communication error/ Alarm judgment setting	Standard specification	Relaxation specification
bit 3	Selection of real-time auto-tuning of two-degree-of-freedom control *1	Standard type	Synchronous type
bit 4 to 7	Not used	Fixed to 0	
bit 8-13	For manufacturer's use	Fixed to 0	
bit 14	Quadrant projection suppression function	Invalid	Valid
bit 15	For manufacturer's use	Fixed to 0	

- The least significant bit is considered as bit0.
- When use Cyclic torque control, bit0=0(Two-degree-of-freedom control is Invalid).
- Regarding bit3 (two-degree-of-freedom control real-time auto tuning selection), the function is available only when bit0 is set to 1: Enabled.

*1 For details of the type, refer to P.5-11 Real time auto tuning (two-degree-of-freedom control, standard type) and P.5-19 Real time auto tuning (two-degree-of-freedom control, synchronous type).

Pr6.48	Adjust filter	Range	Unit	Attribute	Default	Related control code
		0 to 2000	0.1 ms	B	Size A:11 Size B,C:12 Size D to F:17	P S

Set time constant of adjustment filter for two-degree-of-freedom control (position and speed).

Pr6.49	Adjust/Torque command attenuation term	Range	Unit	Attribute	Default	Related control code
		0 to 99	—	B	15	P

Set attenuation term of the command filter and adjustment filter for two-degree-of-freedom control (position and speed).
Decimal notation: 1st digit sets command filter and 2nd digit sets adjustment filter.

value of digit	Content
0 to 4	Without attenuation term (functions as 1st filter).
5 to 9	The 2nd filter (attenuation term ▯ is 1.0, 0.86, 0.71, 0.50 and 0.35, in that order).

But,when Pr2.13(Selection of damping filter switching) is set up 4,The 2nd filter attenuation term fixxed 1.0.
Example: To set command filter ζ = 1.0, adjustment filter 1 _ = 0.71:

Setup value = 75 1st digit = 5 (ζ = 1.0), 2nd digit = 7 (ζ = 0.71)

Pr2.22 Command smoothing filter is applied as time constant of command filter.

Note

- A parameter is designated as follows: Class Pr0.00 No.
- For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page

- P.2-47 〜 “ Wiring to the Connector, X4 ”

Default: [ ]

Pr6.50	Viscous friction compensation gain	Range	Unit	Attribute	Default	Related control code			
		0 to 10000	0.1 %/(10000 r/min)	B	0	P	S		

Command velocity is multiplied by this setting and the result is added to the torque command as compensation value.
The unit is [Rated torque 0.1 %/(10000 r/min)].

Pr6.51	Immediate cessation completion wait time	Range	Unit	Attribute	Default	Related control code			
		0 to 10000	ms	B	0	P	S	T	

When immediate stop alarm is occurs, turn off brake release output (BRK-OFF) and set the time during which the current flows through the motor.

Pr6.52	For manufacturer's use	Range	Unit	Attribute	Default	Related control code			
		—	—	—	0				

Please fixed to 0.

Pr6.53	For manufacturer's use	Range	Unit	Attribute	Default	Related control code			
		—	—	—	0				

Please fixed to 0.

Pr6.54	For manufacturer's use	Range	Unit	Attribute	Default	Related control code			
		—	—	—	0				

Please fixed to 0.

Note

· A parameter is designated as follows: Class Pr0.00 No.

· For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

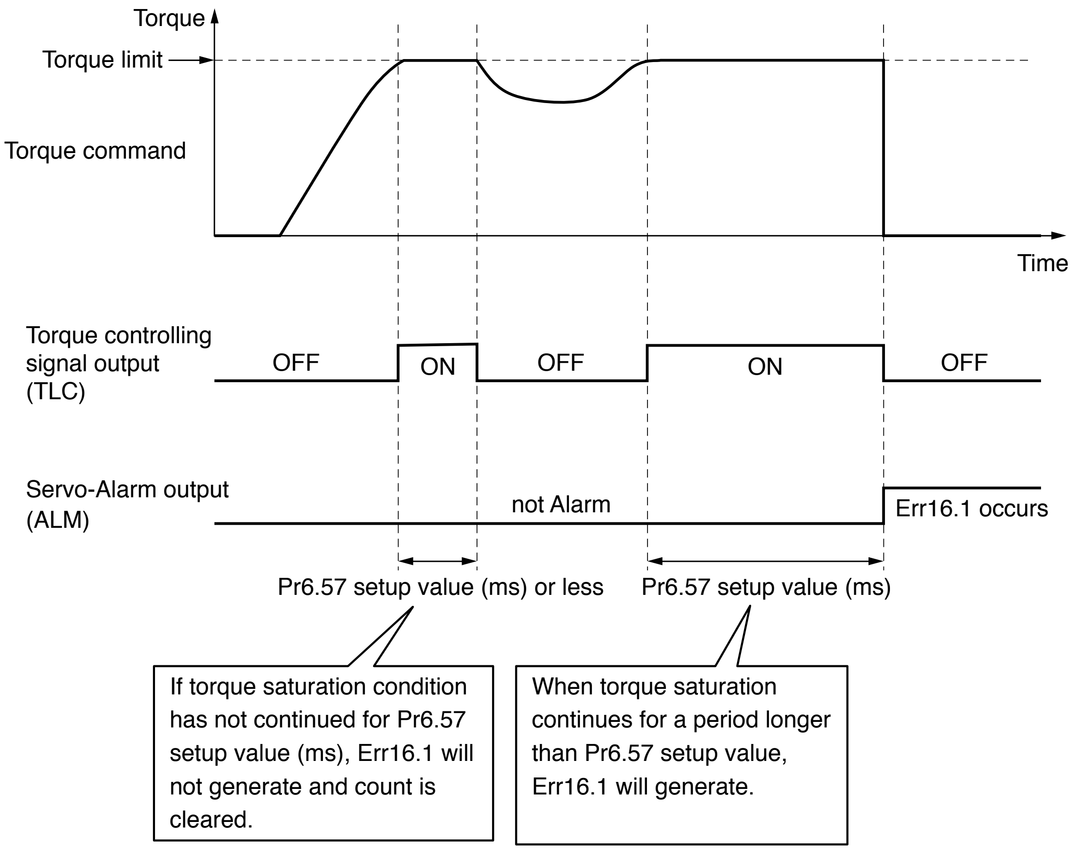
· P.2-47 ~ " Wiring to the Connector, X4 "

Default: [ ]

Pr6.57	Torque saturation anomaly detection time	Range	Unit	Attribute	Default	Related control code
		0 to 5000	ms	B	0	P S

Set torque saturation error protection detect time.
When torque saturation still continues after the preset time, Err16.1 Torque saturation error protection occurs.
When the setup value is 0, the setting value of Pr7.16 is Valid .Set both Pr6.57 and Pr7.16 to 0 to make this function disabled..
Count cycle is different from the MINAS-A5N series.In the case of the same setting, the time until Err16.1 occurs, A6N is longer than A5N.

- For example, if setting is 5000, Err16.1 will generate when torque saturation continues longer than 5 sec.
- During torque controlling, this function is disabled and Err16.1 will not generate.
- During immediate stop alarm, this function is disabled and Err16.1 is not generated.



Pr6.58	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr6.59	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Please fixed to 0.

Note

- A parameter is designated as follows: Class Pr0.00 No.
- For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

- P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

Pr6.60	2nd damping filter depth	Range	Unit	Attribute	Default	Related control code
		0 to 1000	-	B	0	P

Sets the damping depth of the 2nd resonance oppression notch filter.

Pr6.61	1st resonance frequency	Range	Unit	Attribute	Default	Related control code
		0 to 3000	0.1 Hz	B	0	P

Sets the resonance frequency for the load of model 1 type vibration control filter.

Pr6.62	1st resonance damping ratio	Range	Unit	Attribute	Default	Related control code
		0 to 1000	-	B	0	P

Sets the resonance damping ratio of the 1st model type resonance oppression notch filter.

Pr6.63	1st antiresonance frequency	Range	Unit	Attribute	Default	Related control code
		0 to 3000	0.1 Hz	B	0	P

Sets the antiresonance frequency of the 1st model type resonance oppression notch filter.

Pr6.64	1st antiresonance damping ratio	Range	Unit	Attribute	Default	Related control code
		0 to 1000	-	B	0	P

Sets the antiresonance damping ratio of the 1st model type resonance oppression notch filter.

Pr6.65	1st response frequency	Range	Unit	Attribute	Default	Related control code
		0 to 3000	0.1 Hz	B	0	P

Sets the response frequency of the 1st model type resonance oppression notch filter.

Pr6.66	2nd resonance frequency	Range	Unit	Attribute	Default	Related control code
		0 to 3000	0.1 Hz	B	0	P

Sets the resonance damping ratio of the 2nd model type resonance oppression notch filter.

Pr6.67	2nd resonance damping ratio	Range	Unit	Attribute	Default	Related control code
		0 to 1000	-	B	0	P

Sets the resonance damping ratio of the 2nd model type resonance oppression notch filter.

Pr6.68	2nd antiresonance frequency	Range	Unit	Attribute	Default	Related control code
		0 to 3000	0.1 Hz	B	0	P

Sets the antiresonance frequency of the 2nd model type resonance oppression notch filter.

Note

· A parameter is designated as follows: Class Pr0.00 No.

· For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

· P.2-47 ～ " Wiring to the Connector，X4 "

Default: [ ]

Pr6.69	2nd antiresonance damping ratio	Range	Unit	Attribute	Default	Related control code
		0 to 1000	-	B	0	P

Sets the antiresonance damping ratio of the 2nd model type resonance oppression notch filter.

Pr6.70	2nd response frequency	Range	Unit	Attribute	Default	Related control code
		0 to 3000	0.1 Hz	B	0	P

Sets the damping depth of the 3rd resonance oppression notch filter.

Pr6.71	3rd damping filter depth	Range	Unit	Attribute	Default	Related control code
		0 to1000	-	B	0	P

Sets the damping depth of the 3rd resonance oppression notch filter.

Pr6.72	4th damping filter depth	Range	Unit	Attribute	Default	Related control code
		0 to1000	-	B	0	P

Sets the damping depth of the 4th resonance oppression notch filter..

Pr6.73	Load estimation filter	Range	Unit	Attribute	Default	Related control code
		0 to 2500	0.01 ms	B	0	P S

Set the filter time constant(T2) for load estimation.

Pr6.74	Torque compensation frequency 1	Range	Unit	Attribute	Default	Related control code
		0 to5000	0.1 Hz	B	0	P S

Sets the filtering frequency 1 (F1)for the output of velocity control.
Pr6.74(Torque compensating frequency 1) and Pr6.75(Torque compensating frequency 2) are inzhe following range,Ttorque compensating is valid.
(Pr6.75×32) ≥ Pr6.74 > Pr6.75 ≥ 1.0 Hz

Pr6.75	Torque compensating frequency 2	Range	Unit	Attribute	Default	Related control code
		0 to 5000	0.1 Hz	B	0	P S

Sets the filtering frequency 2(F2) for the output of velocity control.
Pr6.74(Torque compensating frequency 1) and Pr6.75(Torque compensating frequency 2) are inzhe following range,Ttorque compensating is valid.
(Pr6.75×32) ≥ Pr6.74 > Pr6.75 ≥ 1.0 Hz

Note

- A parameter is designated as follows: Class Pr0.00 No.
- For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page

- P.2-47 ～ “ Wiring to the Connector, X4 ”

Default: [ ]

Pr6.76	Number of load estimation	Range	Unit	Attribute	Default	Related control code
		0 to 8	-	B	0	P S

Sets the number (N)for the load estimation.

Pr6.87	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Please fixed to 0.

Pr6.88	Absolute multi-rotation data upper limit	Range	Unit	Attribute	Default	Related control code
		0 to 65534	-	C	0	P S T

Sets the upper limit value for absolute multi-rotation data.
Multi rotation data will change to 0 when this set value has been exceeded.
Inversely, it will change to the set value in case it goes lower than 0.

Internal value will be set to 65535 in case Pr0.15 is set to 0 or 2 (absolute mode).

For actual position of absolute encoder, refer to " technical reference-Realtime Express (RTEX) Communication Specification-MINAS-A6N series (RTEX communication type) ".

Pr6.97	Function expansion setting 3	Range	Unit	Attribute	Default	Related control code
		-2147483648 to 2147483647	-	B	0	P S T

	function	Setup value 0	Setup value 1
bit0	Quadrant projection compensation function enhancement	Invalid	valid
bit1	Deterioration diagnosis warning function	Invalid	valid
bit2	Expansion of Allowable motor operating range abnormal protection	Invalid	valid
bit3-31	Not used	fixed to 0.	

＊ 1 To set the compensation amount of quadrant projection by inversion direction when the direction of the velocity has changed, set Pr6.97 bit0 to 1.

Pr6.98	Function expansion setting 4	Range	Unit	Attribute	Default	Related control code
		-2147483648 to 2147483647	-	R	0	P S T

Sets various function in bit units:
bit 0 to 4 : For manufacture's use. Please set fixed to 0
bit 5 to 31: Not used. Please set fixed to 0
*bit 0 is the least significant bit.

Note

・A parameter is designated as follows: Class Pr0.00 No.
・For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

・P.2-47 ～ " Wiring to the Connector, X4 "

[Class 7] Special Setting 2

Default: [ ]

Pr7.00	Display on LED	Range	Unit	Attribute	Default	Related control code
		0 to 32767	—	A	0	P S T

Select the type of data display on 7 segment LED of pannel.

setup value	Information on display	Remarks
【0】	Normal display	" -- " servo OFF、" 00 " servo ON
1	Mechanical angle	Range: 0 to FFF hex. 0: zero position of 1 revolution data of encoder. Data increments as motor turn CCW. When the displayed value exceeds [FF], the count is reset to [0] and restarted.
2	Electrical angle	Display range: 0 to FF hex. 0: the position where U phase induced voltage reaches the positive peak. Data increments as motor turn CCW. When the displayed value exceeds [FF], the count is reset to [0] and restarted
3	RTEX Accumulated communication 1 error counts	Display range: 0 to FF hex. Max counts: FFFF hex. Only the least significant byte is displayed. When the displayed value exceeds [FF], the count is reset to [00] and restarted. *Will be cleared upon turning OFF of the control power source.
5	Encoder Accumulated communication error counts	
4	Node address value	Displays the value set on rotary switch (node address) and read upon power-up, in decimal number. After power-up, the value cannot be changed from the rotary switch.
10	Overload load rate	Displayed by 0 to FF [hex]. Indicates the ratio [%] against rated load. Will indicate "nA" (not Available) in case the load ratio is larger than FF [hex].
Other	To be used by the manufacturer but not by the user.	–

Pr7.01	Display time setup upon power-up	Range	Unit	Attribute	Default	Related control code
		–1 to 1000	100 ms	R	0	P S T

Sets node address display time upon turning ON of control power.
When the setting value is 0 to 6, it is processed in 600ms.
When the setting value is -1, a node address is shown from control power-on until the RTEX communication is established (communication and servo synchronization).

Related page P.2-70 " How to Use the Front Panel "

Pr7.03	Output setup during torque limit	Range	Unit	Attribute	Default	Related control code
		0 to 1	—	A	0	T

Set up judgment condition of output while torque is limited by torque control.

setup value	Content
【0】	Turn ON at torque limit including torque command value
1	Turn ON at torque limit excluding torque command value

Note

- A parameter is designated as follows: Class Pr0.00 No.
- For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

- P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

Pr7.04	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr7.05	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr7.06	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr7.07	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr7.08	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Please fixed to 0.

Pr7.09	Correction time of latch delay 1	Range	Unit	Attribute	Default	Related control code
		-2000 to 2000	25 ns	B	360	P S T

Set the correction time for delay of the latch trigger signal detection.
This parameter can be switched by Pr7.24 bit5.
bit5=0 : The correction time is reflected in both the latch signal rising edge detection and the latch signal falling edge detection.
bit5=1 : The correction time is reflected in the latch signal rising edge detection.
(Note)Signal state of edge detection means the following
The rising edge detection means the photocoupler is turned ON.
The falling edge detection means the photocoupler is turned OFF.

Pr7.10	Software limit function	Range	Unit	Attribute	Default	Related control code
		0 to 3	—	A	0	P

Specifies whether to enable/disable soft limit function during profile position control (PP).When selecting enable, set the software limit value through Pr 7.11 "Positive side software limit value" and Pr 7.12 "Negative side software limit value".

setup value	Positive software limit	Negative software limit
[0]	valid	valid
1	Invalid	valid
2	valid	Invalid
3	Invalid	valid

Caution

Limit signals made invalid in this setting (P_SOT/N_SOL): RTEX communication status is 0 and 0 when return to home position is not completed.

Note

- A parameter is designated as follows: Class Pr0.00 No.
- For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

- P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

Pr7.11	Positive side software limit value	Range	Unit	Attribute	Default	Related control code
		–1073741823 to 1073741823	Command unit	A	500000	P

Pr7.12	Negative side software limit value	Range	Unit	Attribute	Default	Related control code
		–1073741823 to 1073741823	Command unit	A	–500000	P

Set up software limit on positive and negative direction. When the limit is exceeded, RTEX communication status P_SOT/N_SOT will be turned ON (=1).
For operation, check to Materials of controllor.

Note

・Positive side software limit value must be larger than negative side software limit value.
・When home return is not completed, P_SOT/N_SOT is not on.

Pr7.13	Absolute home position offset	Range	Unit	Attribute	Default	Related control code
		–1073741823 to 1073741823	Command unit	C	0	P S T

Set up the offset value on encoder position when using absolute encoder and mechanical coordinate system position.

Pr7.14	Main power off warning detection time	Range	Unit	Attribute	Default	Related control code
		0 to 2000	1 ms	C	0	P S T

Specifies a time to wait until a main power off warning is detected when main power shut-off continues.
RTEX communication status AC_OFF becomes 1 when main power off is detected.

setup value	Content
0 to 9、2000	Warning detection is disabled
10 to 1999	Unit is [1 ms]

Caution

Set this parameter so that Pr.7.14 becomes smaller than Pr.5.09 in order for the warning detection is performed before shut-down detection. If the voltage between P and N of the main power convertor is decreased to below a specified value before the warning is detected because the setting value is long, the main power low voltage error (Err13.0) occurs before the warning.

Pr7.15	Positioning adjacent range	Range	Unit	Attribute	Default	Related control code
		0 to 1073741823	Command unit	A	10	P

The NEAR of the RTEX communication status becomes 1 when the difference between the internal target position and command position is smaller than a specified value during profile position control (PP).

Note

・A parameter is designated as follows: Class Pr0.00 No.
・For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

・P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

Pr7.16	Torque saturation error protection frequency	Range	Unit	Attribute	Default	Related control code
		0 to 30000	time	B	0	P S

If torque saturated is continued during a preset frequency, Err 16.1 “Torque saturation protection” will be activated.
If the setup value is 0, this function is disabled and an alarm will not be activated.
This parameter is enabled when the value set for Pr6.57 is 0.

Related page P.6-27 “ Torque Saturation Protection（Err16.1）”

Pr7.20	RTEX communication cycle setup	Range	Unit	Attribute	Default	Related control code
		-1 to 12	—	R	3	P S T

Set up the RTEX communication cycle.

setup value	Content	setup value	Content
-1	Setup by Pr7.91 is enabled.	【3】	0.5 [ms]
0	For manufacturer’s use (is not allowed to set)	4, 5	For manufacturer’s use (is not allowed to set)
1	For manufacturer’s use (is not allowed to set)	6	1.0 [ms]
2	For manufacturer’s use (is not allowed to set)	7 to 12	For manufacturer’s use (is not allowed to set)

Pr7.21	RTEX command updating cycle setup	Range	Unit	Attribute	Default	Related control code
		1 to 2	—	R	2	P S T

Setup the ratio of RTEX communication cycle and command update cycle.

setup value	Content
1	1 [time]
【2】	2 [times]

Note For parameter Pr7.33 to Pr7.38 that is determined according to using the controller.Please setup according to the instruction manual.

Default: [ ]

Pr7.22	RTEX function extended setup 1	Range	Unit	Attribute	Default	Related control code
		–32768 to 32767	—	R	0	P S T

bit0 : Set up RTEX communication data size.

setup value	Content
[0]	16-byte mode
1	32-byte mode

bit1 : Specifies synchronization mode among multiple axes using TMG_CNT.

setup value	Content
[0]	Semi synchronization among axes
1	Full synchronization among axes

bit2 : For manufacturer's use Pleses fixed to 0. .
bit3 : Not used Pleses fixed to 0.
bit4 : External scale position information monitoring function under semi-closed control .
0 : Invalid 1 : Valid
※ When communication cycle is below 0.25[ms], (PP/CP/CV/CT) except NOP command is invalid.
bit5:Command pulse saturation function selection.

setup value	Content
[0]	Invalid
1	Valid

bit6 : Return to origin operation velocity restriction function activation.

setup value	Content
[0]	Invalid
1	Valid

bit7-10 : Not used Pleses fixed to 0.
bit11-13 : For manufacture use Pleses fixed to 0.
bit14-15 : Not used Pleses fixed to 0.
※ Please set the value that matches the controller sepecification.If it dose not match,it is not possible to make sure the action is normal.

Pr7.23	RTEX function extended setup 2	Range	Unit	Attribute	Default	Related control code
		–32768 to 32767	—	B	18	P S T

bit0 : Parameter writing through RTEX communication.

setup value	Content
[0]	Enable
1	Disable

bit1 : Alarm code sub number setup.

setup value	Content
0	Fixed to 0
[1]	Sub number enabled

(continued)

Default: [ ]

bit2：RTEX status response condition setup with function of POT/NOT disabled (Pr.5.04 = 1).

setup value	Content
[0]	Status enabled
1	Fixed to 0

bit3：RTEX status bit arrangement setup of POT/NOT.

setup value	Content
[0]	POT is bit 1, NOT is bit 0
1	NOT is bit 1, POT is bit 0

bit4：Set up [COM] LED display mode.

setup value	Content
0	Mode 1
[1]	Mode 2

bit5：Non-cyclic command start mode setting.

setup value	Content
[0]	When standard command is changed
1	When command code and command parameter are changed.

bit6：Set up P0T/N0T RTEX status logic.

setup value	Content
[0]	No inversion
1	Inversion

bit7：PSL/NSL RTEX status logic setting.

setup value	Content
[0]	No inversion
1	Inversion

bit8：RTEX status selection between In_Progress and AC_OFF

setup value	Content
[0]	In_Progress
1	AC_OFF

bit9：Selects whether to return a command error in over-travel inhibit direction when a command is received after a deceleration stop caused by over-travel inhibit input.

setup value	Content
[0]	Command error is not returned
1	Command error is returned

bit10 to 13: Not used　Pleses fixed to 0. .

bit14: Command positional deviation [Command unit] output setting.

setup value	Content
[0]	Internal command position (after filter) [Command unit] − Actual position[Command unit]
1	Internal command position (before filter) [Command unit] − Actual position [Command unit]

bit15：Not used　Pleses fixed to 0.

Default: [ ]

Pr7.24	RTEX function extended setup 3	Range	Unit	Attribute	Default	Related control code
		–32768 to 32767	—	C	0	P S T

bit0：Specifies output status of EX-OUT1 during communication shut-down after RTEX communication is established..

setup value	Content
[0]	Hold
1	Initialized (Output when EX-OUT1 is 0.)

bit1：Specifies output status of EX-OUT2 during communication shut-down after RTEX communication is established.

setup value	Content
[0]	Hold
1	Initialized (Output when EX-OUT2 is 0.)

bit2：For manufacturer's use　Pleses fixed to 0. .

bit3：Setting condition for In_Position (positioning complete signal) of RTEX communication.

setup value	Content
[0]	Unit is set up by Pr5.20
1	Command unit

bit4：Setting condition for Servo_Active (servo-on state signal) of RTEX Communication .

setup value	Content
[0]	Same as before
1	Turns on in command receivable state after servo ON.

bit5：The correction function for detection delay of latch position.

setup value	Content
[0]	The correction time of both the latch signal rising edge detection and the latch signal falling edge detection is set by Pr7.09
1	The correction time of the latch signal rising edge detection is set by Pr7.09, the correction time of the latch signal falling edge detection is set by Pr7.92.

bit7 : Select the state of the internal value of TFF from RTEX communication (Fall prevention in Servo-ON)

setup value	Content
[0]	Clear
1	Hold the internal value

※ The internal value is cleared at the timing of Servo-OFF, deceleration to stop due to over-travel inhibit input, stop and in safety state.

※ When setup value is 1,please set TFF value,no less than the value of Pr5.11"Torque setup for emergency stop".

bit8 to 10：For manufacturer's use　Pleses fixed to 0. .

bit11 to 15：Not used　Pleses fixed to 0. .

Note For parameter Pr7.33 to Pr7.38 that is determined according to using the controller.Please setup according to the instruction manual.

Default: [ ]

		Range	Unit	Attribute	Default	Related control code
Pr7.25	**RTEX speed unit setup**	0 to 1	—	C	0	P S T

Set up the unit of speed data used in RTEX communication.
Set up the unit both for both command data such as command speed and for response data such as actual speed.

setup value	Content
[0]	r/min
1	Command unit/s

		Range	Unit	Attribute	Default	Related control code
Pr7.26	**RTEX continuous error warning setup**	0 to 32767	times	A	0	P S T

Generates WngC0h (RTEX continuous communication error warning) when the No. of continuous errors reaches the setting of this parameter.
When the setting value is 0, this function is disabled and no warning is issued.

		Range	Unit	Attribute	Default	Related control code
Pr7.27	**RTEX accumulated error warning setup**	0 to 32767	times	A	0	P S T

Generates WngC1h (RTEX accumulated communication error warning) when the No. of accumulated errors reaches the setting of this parameter.
When the setting value is 0, this function is disabled and no warning is generated.

		Range	Unit	Attribute	Default	Related control code
Pr7.28	**RTEX_Update_Counter error warning setup**	0 to 32767	times	A	0	P S T

If Update_Counter is accumulated exceeding the setting value of this parameter and correct update fails, WngC2h (RTEX_Update_
Counter error warning) is issued.
When the setting value is 0 or 1, this function is disabled and no warning is generated.

		Range	Unit	Attribute	Default	Related control code
Pr7.29	**RTEX monitor select 1**	0 to 32767	times	A	0	P S T

Select the monitor type of Response data 1.
If the setup value is 0, the actual position (APOS) is monitored.

		Range	Unit	Attribute	Default	Related control code
Pr7.30	**RTEX monitor select 2**	0 to 32767	—	A	0	P S T

Select the monitor type of Response data 2 when non-cyclic command = 0h.
If the setup value is 0, the actual speed (ASPD) is monitored.

Note For parameter Pr7.33 to Pr7.38 that is determined according to using the controller.Please setup according to the instruction manual.

Default: [ ]

Pr7.31	RTEX monitor select 3	Range	Unit	Attribute	Default	Related control code
		0 to 32767	—	A	0	P S T

Select the monitor type of Response data 3 when non-cyclic command = 0h.
If the setup value is 0, torque (TRQ) is monitored.

Pr7.32	RTEX monitor select 4	Range	Unit	Attribute	Default	Related control code
		0 to 32767	—	A	0	P S T

Selects a monitor type of Sub Response Data1 in 32-byte mode when sub command is 0h.
If the setup value is 0, 0 is returned.

Pr7.33	RTEX monitor select 5	Range	Unit	Attribute	Default	Related control code
		0 to 32767	—	A	0	P S T

Selects a monitor type of Sub Response Data2 in 32-byte mode.
If the setup value is 0, 0 is returned.

Pr7.34	RTEX monitor select 6	Range	Unit	Attribute	Default	Related control code
		0 to 32767	—	A	0	P S T

Selects a monitor type of Sub Response Data3 in 32-byte mode.
If the setup value is 0, 0 is returned.

Pr7.35	RTEX command setting 1	Range	Unit	Attribute	Default	Related control code
		0 to 2	—	C	0	P S T

Specifies the Command_Data3 of non-cyclic command. However, this setting is invalid for non-cyclic command using Command_Data3 area.

setup value	Content
[0]	Invalid
1	Velocity feedforward [Command unit/s] or [r/min]
2	Torque feedforward [0.1 %]

Pr7.36	RTEX command setting 2	Range	Unit	Attribute	Default	Related control code
		0 to 2	—	C	0	P S T

Specifies Sub_Command_Data2 of sub command.

setup value	Content
[0]	Invalid
1	Velocity feedforward [Command unit/s] or [r/min]
2	Torque feedforward [0.1 %]

Note
- A parameter is designated as follows: Class Pr0.00 No.
- For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page
- P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

Pr7.37	RTEX command setting 3	Range	Unit	Attribute	Default	Related control code
		0 to 2	—	C	0	P S T

Specifies Sub_Command_Data3 of sub command.

setup value	Content
[0]	Invalid
1	Velocity feedforward [Command unit/s] or [r/min]
2	Torque feedforward [0.1 %]

Pr7.38	RTEX_Update_Counter error protection setup	Range	Unit	Attribute	Default	Related control code
		0 to 32767	times	A	0	P S T

If the Update_Counter exceeds the setup value for this parameter and is not updated correctly, Err 86.2 “RTEX_Update_Counter error protection” will be activated.
If the setup value is 0 or 1, this function will be disabled and an alarm will not be activated..

Pr7.39	For manufacturer’s use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Pr7.40	For manufacturer’s use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Pr7.41	RTEX function extended setup 5	Range	Unit	Attribute	Default	Related control code
		–32768 to 32767	—	R	0	P S T

bit0 to 6: Not used Pleses fixed to 0.
bit7：Run inhibit input detection setting when returning to origin of Z phase
0：Invalid、1：Valid

Pr7.43	For manufacturer’s use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Pr7.52	For manufacturer’s use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Note

・A parameter is designated as follows: Class Pr0.00 No.
・For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page

・P.2-47 ～ “ Wiring to the Connector，X4 ”

Default: [ ]

Pr7.78	Signal reading setting for latch trigger with stop function	Range	Unit	Attribute	Default	Related control code
		0 to 3	—	C	0	P

The number of readings from latch trigger signal input until internal logic confirmation by driver with Latch mode with stop function is selected.
0:0.1875 ms (3 readings)
1:0.0625 ms (1 reading)
2:0.125 ms (2 readings)
3:0.1875 ms (3 readings)

Pr7.87	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Pr7.91	RTEX communication cycle expansion setting	Range	Unit	Attribute	Default	Related control code
		0 to 2000000	ns	R	500000	P S T

Set the RTEX communication cycle at the time of Pr7.20=-1.
Only 62500, 125000, 250000, 500000, 1000000 or 2000000 can be set. If other value is set, Err93.5 "parameter setting error protection 4" occurs.

Pr7.92	Correction time of latch delay 2	Range	Unit	Attribute	Default	Related control code
		-2000 to 2000	25 ns	B	0	P S T

Set the correction time for delay of the latch trigger signal detection.
This parameter can be switched by Pr7.24 bit5.
bit5=0 : Invalid
bit5=1 : The correction time is reflected in the latch signal falling edge detection.

Pr7.93	Home position return limit speed	Range	Unit	Attribute	Default	Related control code
		0 to 20000	r/min	C	0	P S T

Set the limit speed for home position return operation.
If a value smaller than the internal minimum speed is set, the internal minimum speed is applied as limit speed.
If a value greater than the motor maximum speed is set, the motor maximum speed is applied as limit speed.
(Note)The value is converted into command unit/s during internal computation.
The converted value is limited within the following range.
0000001h to 7FFFFFFFh(1 to 2147483647).
If 0 is set for this parameter, 1 is internally set for control.

Note
・A parameter is designated as follows: Class Pr0.00 No.
・For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page
・P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

Pr7.95	Number of RTEX continuous communication error protection 1 detections	Range	Unit	Attribute	Default	Related control code
		0 to 17	times	R	4	P S T

Set the number of RTEX continuous communication error protection 1 detections.
If a continuous CRC error occurs exceeding the number of times set for this parameter, Err83.0 “RTEX continuous communication error protection 1” occurs.
If 0 or 1 is set for this parameter, 2 is internally set.

Pr7.96	Number of RTEX continuous communication error protection 2 detections	Range	Unit	Attribute	Default	Related control code
		0 to 17	times	R	12	P S T

Set the number of RTEX continuous communication error protection 2 detections.
If an interrupt omission, CRC error, MAC-ID error, C/R error or cyclic data error occurs exceeding the number of times set for this parameter, Err83.1 “RTEX continuous communication error protection 2” occurs.
If 0 or 1 is set for this parameter, 2 is internally set.

Pr7.97	Number of RTEX communication timeout error protection detections	Range	Unit	Attribute	Default	Related control code
		0 to 17	times	R	4	P S T

Set the number of times for RTEX communication timeout error protection detection.
If 0 or 1 is set for this parameter, 2 is internally set.

Pr7.98	Number of RTEX cyclic data error protection 1/2 detections	Range	Unit	Attribute	Default	Related control code
		0 to 17	times	R	4	P S T

Set the number of times for RTEX cyclic data error protection 1/2 detection.
If a continuous cyclic error occurs exceeding the number of times set for this parameter, Err86.0 or Err86.1 “RTEX cyclic data error protection 1 or 2” occurs.
If 0 or 1 is set for this parameter, 2 is internally set.

Pr7.99	RTEX function extended setup 6	Range	Unit	Attribute	Default	Related control code
		-32768 to 32767	—	B	0	P S T

	Content	setup value	
bit0	Activation of operation command (trial run, FFT, etc.) execution by USB communication (PANATERM) when TEX communication established.	0 Invalid	1 Valid
bit1 to 2	For manufacturer’s use		
bit3	Command pulse aggregate value [command units] output setting.	0 Before filter	1 After filter
bit4 to 6	For manufacturer’s use		
bit7	RTEX monitor command regenerative load factor unit switching	0 [%]	1 [0.1%]
bit8 to 15	For manufacturer’s use		

Note

· A parameter is designated as follows: Class Pr0.00 No.
· For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page

· P.2-47 ～ “ Wiring to the Connector, X4 ”

Default: [ ]

Pr7.100	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Pr7.108	RTEX communication synchronization setting	Range	Unit	Attribute	Default	Related control code
		0 to 7	—	R	7	P S T

Setup value	Content
0	Extended settings ※ Err96.4 is detected when a delay occurs in transmission/reception processing by the amplifier due to unstable transmission timing from the host device and so forth. If delay cannot be tolerated, please use this setting.
1 to 6	For manufacturer's use
7	Normal setting

Pr7.109	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Pr7.110	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Note
· A parameter is designated as follows: Class Pr0.00 No.
· For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page
· P.2-47 ～ " Wiring to the Connector, X4 "

4. Details of Parameter

[Class 8] Special Setting 3

Default: [ ]

Pr8.00	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Pr8.01	Profile linear acceleration constant	Range	Unit	Attribute	Default	Related control code
		1 to 429496	10000 Command unit/s^2	B	100	P

Specifies acceleration during profile position control (PP).
Be sure to set before starting operation.

Note **Parameters are determined according to using the controller.**
Please setup according to the instruction manual.

Pr8.02	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pr8.03	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Pr8.04	Profile linear deceleration constant	Range	Unit	Attribute	Default	Related control code
		1 to 429496	10000 Command unit/s^2	B	100	P

Specifies deceleration during profile position control (PP).
Be sure to set before starting operation.

Note **Parameters are determined according to using the controller.**
Please setup according to the instruction manual.

Pr8.05	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Pr8.10	Amount of travel after profile position latch detection	Range	Unit	Attribute	Default	Related control code
		−1073741823 to 1073741823	Command unit	B	0	P

Specifies the amount of travel during profile position latch positioning after a latch trigger signal input position is detected.

Note **Parameters are determined according to using the controller.**
Please setup according to the instruction manual.

Note
· A parameter is designated as follows: Class Pr0.00 No.
· For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page
· P.2-47 ～ " Wiring to the Connector, X4 "

Default: [ ]

Pr8.12	Profile return to home position mode setup	Range	Unit	Attribute	Default	Related control code
		0 to 1	—	B	0	P

Specifies a direction in which latch trigger signal is detected during profile home position return.

setup value	Content
[0]	Positive direction
1	Negative direction

Caution: For profile homing 2 or 4, select 0 setting. Setting to 1 also causes homing in positive direction.

Note: **Parameters are determined according to using the controller.**
Please setup according to the instruction manual.

Pr8.13	Profile home position return velocity 1	Range	Unit	Attribute	Default	Related control code
		0 to 2147483647	10000 Command unit/s^2	B	50	P

Specifies a velocity for high-speed operation during profile home position return.
Unit is specified with Pr7.25 “RTEX speed unit setup”.
Maximum velocity is internally limited using the motor maximum speed

Caution: When velocity setting is in r/min, it is converted to command unit/s through internal computation and the equivalent value is limited within the range as shown below:
00000001h to 7FFFFFFFh(1 to 2147483647)
If setting value is 0, control is performed with an assumption that the setting value is 1.

Note: **Parameters are determined according to using the controller.**
Please setup according to the instruction manual.

Pr8.14	Profile home position return velocity 2	Range	Unit	Attribute	Default	Related control code
		0 to 2147483647	10000 Command unit/s^2	B	5	P

Specifies a velocity for low-speed operation during profile home position return.
Specify a minimum speed to decrease detection error.
Unit is specified with Pr7.25 “RTEX speed unit setup”.
Maximum velocity is internally limited using the motor maximum speed.

Caution: When velocity setting is in r/min, it is converted to command unit/s through internal computation and the equivalent value is limited within the range as shown below:
00000001h to 7FFFFFFFh(1 to 2147483647)
If setting value is 0, control is performed with an assumption that the setting value is 1.

Note: **Parameters are determined according to using the controller.**
Please setup according to the instruction manual.

Note
- A parameter is designated as follows: Class Pr0.00 No.
- For “ Attribute ”,refer to P.3-38 “ Details of Attribute ”.

Related page
- P.2-47 ～ “ Wiring to the Connector, X4 ”

Default: [ ]

Pr8.15	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0. 。

Pr8.19	For manufacturer's use	Range	Unit	Attribute	Default	Related control code
		—	—	—	0	

Pleses fixed to 0.

Note

・A parameter is designated as follows: Class Pr0.00 No.

・For " Attribute ",refer to P.3-38 " Details of Attribute ".

Related page

・P.2-47 ~ " Wiring to the Connector, X4 "

3 Setup

4. Details of Parameter

[Class 9] For Manufacturer's Use ＊[1]

Parameters are all manufacturer's use.Please do not change the default parameters.

＊1 There are of parameters of Class 9 after the software version 1.21.

3 Setup

4. Details of Parameter

[Class 14] For Manufacturer's Use ＊[1]

Parameters are all manufacturer's use.Please do not change the default parameters.

＊1 There are of parameters of Class 14 before the software version 1.05.

3 Setup

4. Details of Parameter

[Class 15] For Manufacturer's Use

Parameters are all manufacturer's use.Please do not change the default parameters.

Torque Limit Setup

Torque limit setup range is 0 to 300 and default is 300 except the combinations of the motor and the driver listed in the table below.

Frame	Model No.	Applicable motor	value of torque limit
A	MADL□ 01□□	MHMF5AZL1□□	350
	MADL□ 11□□	MQMF011L1□□	350
		MHMF011L1□□	350
	MADL□ 05□□	MHMF5AZL1□□	350
		MQMF012L1□□	350
		MHMF012L1□□	350
	MADL□ 15□□	MQMF022L1□□	350
		MHMF022L1□□	350
B	MBDL□ 21□□	MQMF021L1□□	350
		MHMF021L1□□	350
	MBDL□ 25□□	MQMF042L1□□	350
		MHMF042L1□□	350

Frame	Model No.	Applicable motor	value of torque limit
C	MCDL□ 31□□	MQMF041L1□□	350
		MHMF041L1□□	350
	MCDL□ 35□□	MHMF082L1□□	350
D	MDDL □ 45 □	MGMF092L1□□	264
	MDDL □ 55 □	MHMF092L1□□	350
		MGMF132L1□□	281
E	MEDL □ 83 □	MGMF182L1 □□	251
	MEDL □ 93 □	MGMF242L1 □□	296
F	MFDL □ B3 □	MGMF292L1 □□	245
		MGMF442L1 □□	250

Caution

- The above limit applies to Pr0.13 (1st torque limit), Pr5.22 (2nd torque limit), Pr5.11 (Torque setup for emergency stop), Pr5.25 (External input positive direction torque limit) and Pr5.26(External input negative direction torque limit).

When you change the motor model, above max. value may change as well. Check and reset the setup values of Pr0.13, Pr5.22, Pr5.11, Pr5.25 and Pr5.26.

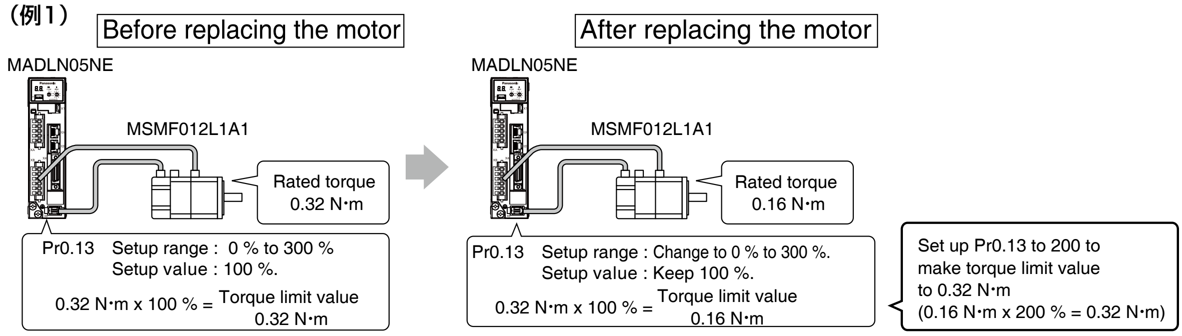
Cautions on Replacing the Motor

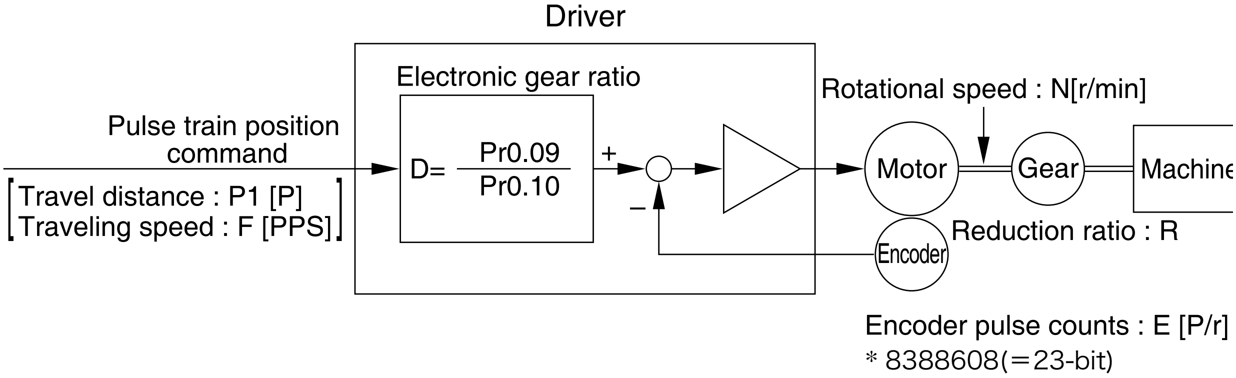
As stated previously, torque limit setup range might change when you replace the combination of the motor and the driver. Pay attention to the followings.

1. When the motor torque is limited,

When you replace the motor series or to the different wattage motor, you need to reset the torque limit setup because the rated toque of the motor is different from the previous motor. (see e.g.1)

(例1)





Example of ball screw drive by servo motor

Here we take a ball screw drive as an example of machine.
A travel distance of a ball screw M [mm] corresponding to travel command P1 [P], can be described by the following formula (1) by making the lead of ball screw as L [mm]

M = P1 x (D/E) x (1/R) x L .... (1)

therefore, position resolution (travel distance ΔM per one command pulse) will be described by the formula (2)

ΔM = (D/E) x (1/R) x L .... (2)

modifying the above formula (2), electronic gear ratio can be found in the formula (3).

D = (ΔM x E x R) x L .... (3)

Actual traveling velocity of ball screw, V[mm/s] can be described by the formula (4) and the motor rotational speed, N at that time can be described by the formula (5).

V = F x (D/E) x (1/R) x L .... (4)

N = F x (D/E) x 60 .... (5)

modifying the above formula (5), electronic gear ratio can be found in the formula (6).

D = (N x E)/ (F x 60) .... (6)

Note

1) Make a position resolution, Δ M as approx. 1/5 to 1/10 of the machine positioning accuracy, $\Delta\varepsilon$, considering a mechanical error.
2) Set up Pr0.09 and Pr0.10 to any values between 1 to 2^{30}.
3) The desired setting can be determined by selecting value of numerator and denominator of electronic gear. However, an excessively high division or multiplication ratio cannot guarantee the operation. The ratio should be in a range between 1/1000 and 1000. Excessively high multiplication ratio will cause Err27.2 (command pulse multiplication error protection) due to varying command pulse input or noises, even if the other settings are within the specified range.
4)

2^n	Decimal	2^n	Decimal
2^0	1	2^{12}	4096
2^1	2	2^{13}	8192
2^2	4	2^{14}	16384
2^3	8	2^{15}	32768
2^4	16	2^{16}	65536
2^5	32	2^{17}	131072
2^6	64	2^{18}	262144
2^7	128	2^{19}	524288
2^8	256	2^{20}	1048576
2^9	512	2^{21}	2097152
2^{10}	1024	2^{22}	4194304
2^{11}	2048	2^{23}	8388608

	Electronic gear ratio $D = \dfrac{\Delta M \times E \times R}{L}$	$D = \dfrac{Pr0.09}{Pr0.10}$
Lead of ball screw, L =10 mm Gear reduction ratio, R = 1 Position resolution, ΔM =0.005 mm Encoder, 23-bit (E= 2^{23} P/r)	$\dfrac{0.0005\times 2^{23}\times 1}{10} = \dfrac{5\times 2^{23}}{10\times 10^{4}} = \dfrac{41943040}{100000}$	Pr0.09 = 41943040 Pr0.10 = 100000

	Motor rotational speed (r/min), $N = F \times \dfrac{D}{E} \times 60$	
Lead of ball screw, L =20 mm Gear reduction ratio, R = 1 Position resolution, ΔM = 0.0005 mm Line driver pulse input, 500 kpps Encoder, 23-bit	$500000\times \dfrac{0.0005\times 2^{23}\times 1}{20} \times \dfrac{1}{2^{23}} \times 60$ $=750$	
Ditto To make it to 2000 r/min.	Electronic gear ratio $D = \dfrac{N \times E}{F \times 60}$	$D = \dfrac{Pr0.09}{Pr0.10}$
	$D = \dfrac{2000\times 2^{23}}{500000\times 60} = \dfrac{\cancel{2000}\times 2^{23}}{\cancel{2000}\times 500\times 30} = \dfrac{8388608}{15000}$	Pr0.09 = 8388608 Pr0.10 = 15000
	Travel distance per command pulse (mm) (Position resolution) $\Delta M = \dfrac{D}{E} \times \dfrac{1}{R} \times L$	
	$\dfrac{2000\times 2^{23}}{500000\times 60} \times \dfrac{1}{2^{23}} \times \dfrac{1}{1} \times 20 = 0.00133$ mm	

Related page • P.3-39 “Details of Parameter”

MEMO

4.Trial Run

1.Trial Run

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1.Trial Run

Inspection Before Trial Run

(1) Please make sure of the situation before trial run.

● Wiring

- Is power input (L1、L2、L3、L1C、L2C) miswiring ?
- Is the earth wire connected to the ground terminal?
- Motor connection terminals (U、V、W) of the motor and the phase coincidence?
- Is power input (L1、L2、L3、L1C、L2C) and motor connection terminals (U、V、W) short?
- Is the ground of motor connected to the ground terminal of Servo Driver?
- If you use an external resistor ,is the short line removed?
- Loose connection?
- Whether or not a force is exerted or pulling force on the cable wire?
- Is I/O connector X4 pin added to the voltage over DC24 V?

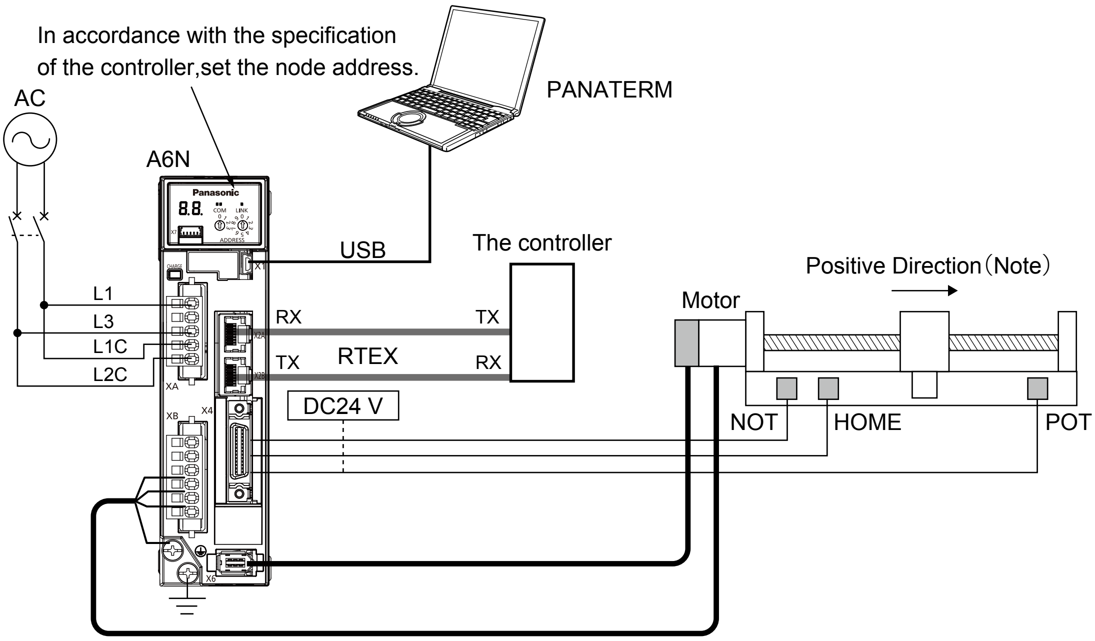
● **power supply and voltage**

- Rated voltage or Within this range?

● **Motor**

- Is the mounting portion of the motor or the shaft coupling loosened?
- Can motor and its equipment moving?
- In the case of the brake, is the brake released?

● **Wiring Example**



Note：Set the CCW or CW in positive direction by the Pr0.00.

Note Wiring details please refer to P.2-2 ~ " Composition of Peripheral Equipments".

1.Trial Run

Setting of Servo Driver

(2) The servo driver is set.

Many of the settings, depending on the controller interface.
In addition, according to the controller, there is an automatic parameter setting.
According to the controller specifications, the relevant settings please.

● **A list of setting for trial run**

	Class	Setting		Dependent on the controller
①	Node address	Node address is setting by rotary switch of front panel.		○
②	The parameters of motor rotational direction	Pr0.00	Rotational direction setup	○
③	The parameters of control mode and command input	Pr0.01	Control mode setup	○
		Pr7.25	RTEX speed unit setup	○
		Pr8.01	Profile linear acceleration constant	
		Pr8.04	Profile linear deceleration constant	
④	The parameters of absolute encoder	Pr0.15	Absolute encoder setup	○
⑤	The parameters of input/output single	Pr4.00～4.07	SI1 ～ 8 input selection	○
		Pr4.10～4.12	SO1 ～ 3 output selection	○
⑥	The parameters of Command unit	Pr0.08	Command pulse counts per one motor revolution	○
		Pr0.09	Numerator of electronic gear	○
		Pr0.10	Denominator of electronic gear	○
⑦	The parameters of communication cycle	Pr7.20	RTEX communication cycle setup	○
		Pr7.21	RTEX command updating cycle setup	○
		Pr7.91	RTEX communication cycle expansion setting	○
⑧	The parameters of communication data size and the synchronization mode	Pr7.22	RTEX function extended setup 1	○
⑨	The parameters of limite single status and the activation mode of non-cyclic command	Pr7.23	RTEX function extended setup 2	○
⑩	The parameters of Protective function	Pr0.13	1st torque limit	
		Pr0.14	Position deviation excess setup	
		Pr3.17	Selection of speed limit	
		Pr3.21	Speed limit value 1	
		Pr3.22	Speed limit value 2	
		Pr5.04	Over-travel inhibit input setup	○
		Pr5.05	Sequence at over-travel inhibit	
		Pr5.13	Over-speed level setup	
		Pr5.14	Motor working range setup	
		Pr5.20	Position setup unit select	
		Pr5.21	Selection of torque limit	○
⑪	The parameters of the two-degrees-of-freedom control	Pr6.47	Function expansion setup 2	○

Caution

· Protection function related parameters also exist other of the above parameters.
Please set the parameters according to the conditions of use and settings,
Please refer to Chapter 6 of the protection function.

① Node address is setted by rotary switch of front panel

Due to the controller,The existence of “ can not set 0 ” and “ In order to connected network by node address ” etc.
Be sure to confirm the controller specifications.

Related page
please refer to P.2-70 “ Operation and Display of the Front Panel ”

② The setting of rotational direction

Please set the positive direction by Pr0.00.

③ The setting of control mode

If semi - close control mode, set Pr0.01 to 0.
When the speed control,please set the unit of velocity by Pr7.25.
When the profile position control,please set The acceleration and deceleration by Pr8.01 and Pr8.04.

④ The setting of absolute encoder

When using absolute encoder,please set the method of use by Pr0.15.

⑤ The input/output signal is assigned in accordance with the need to change

Input single........ Pr4.00 to 4.07
Output single........ Pr4.10 to 4.12

⑥ The setting of Command pulse counts per one motor revolution and electronic gear.

Please set to electronic gear by Pr0.08, 0.09, 0.10 .
For example, When the command pulses is 10000 per one motor revolution,
please set to Pr0.08 = 0、Pr0.09 = 0、Pr0.10 = 10000.
In addition, Be sure to adjust the position instruction FIR filter (Pr2.23), please smooth the position of the electronic gear after the command.
At this point, please confirm the effect of the filter to adjust by the PANATERM waveform display "position command speed" (before filtering) and "internal position command speed" (after filtering),

Related page
P.4-7 “ Setup of Motor Rotational Speed and Input Pulse Frequency ”

⑦ The seeting of communication cycle and command updata cycle ratio

Depending on the specification of the controller,please set to the command updata cycle and communication cycle appropriately by Pr7.20,Pr7.21,Pr7.91.

[Example]

Command update cycle	communication cycle	Parameter setting			Remarks
		Pr7.20	Pr7.21	Pr7.91	
4.000 ms	2.000 ms	–1	2	2000000	
2.000 ms	2.000 ms	–1	1	2000000	
2.000 ms	1.000 ms	–1	2	1000000	
1.000 ms	1.000 ms	–1	1	1000000	Pr7.02=6、Pr7.21=1 also apply
1.000 ms	0.500 ms	–1	2	500000	Pr7.02=3、Pr7.21=2 also apply
0.500 ms	0.500 ms	–1	1	500000	Pr7.02=3、Pr7.21=1 also apply
0.500 ms	0.250 ms	–1	2	250000	
0.250 ms	0.250 ms	–1	1	250000	
0.250 ms	0.125 ms	–1	2	125000	
0.125 ms	0.125 ms	–1	1	125000	
0.125 ms	0.0625 ms	–1	2	62500	

⑧ The setting of communication data size and the synchronization mode

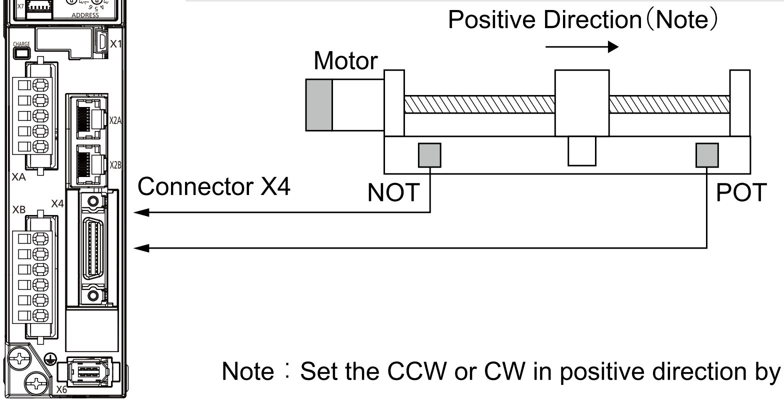
Depending on the specification of the controller,please set to Pr7.22.

⑨ The setting of limite single status

RTEX communication on the byte 3 on the limit signal (POT,NOT) state, according to the controller specification set Pr7.23.

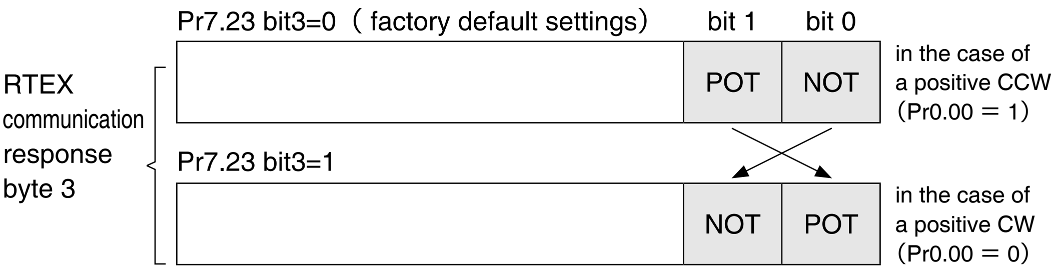
Class	No.	Attribute	Title	Range	Function
7	23	B	RTEX function extended setup 2	−32768 to 32767	[bit2] RTEX status response condition setup with function of POT/NOT disabled (Pr.5.04 = 1). 0：RTEX status enabled（response) 1：RTEX status disable [bit3] RTEX status bit arrangement setup of POT/NOT 0：POT is bit 1, NOT is bit 0 1：NOT is bit 1, POT is bit 0 Select according to controller specifications [bit6] Set up POT/NOT RTEX status logic 0：No inversion（Active 1) 1：Inversion（Active 0)

According to the parameters set in the positive direction, the change of wiring.



Note：Set the CCW or CW in positive direction by the Pr0.00.

According to the controller used, In order to have interchangeability with the old product A4N, CW as a positive direction, the need to change the Pr7.23 bit3 .（Below）Be sure to confirm the controller specifications.



After Parameter settings, Write EEPROM by PANATERM ,please turn on the power again.

⑩ The setting of Protective function

Please set the protection function in accordance with the conditions of use .

On the control of the input, because the controller is usually used, so that the control of the servo is invalid by setting Pr5.04 to 1.

Torque control, be sure to change the speed limit value of Pr3.21 and Pr3.22 is higher than the maximum running speed. Because the factory set value is 0, so do not change will not move.

Related page P.6-42 "Setup of Gain Pre-adjustment Protection"

1.Trial Run

Trial Run

⑪ **The setting of the two-degrees-of-freedom control**

When cyclic Torque control, To set the bit0 of Pr 6.47 to 0, 2 degree of freedom control is disabled.

(3) Complete the following steps to start trial run.

Switch off the power supply after confirming the correct wiring (Turn on sequence according to controller specification)
▼
If the LINK LED and COM LED of the front panel for the green light, RTEX communication normal action.
▼
According to the controller, servo ON, start

4 Trial Run

1.Trial Run

Trial Run by PANATERM

Trial Run function by PANATERM,under the conditions of the controller can be recognized Before the RTEX communication is established (the power supply of the controller is not connected, the RTEX communication cable is not connected, etc.).

RTEX communication state, trial run is compatible by PANATERM,please set bit0 of Pr7.99 to1.

For PANATERM settings, refer to PANATERM's "manual for PANATERM" of "HELP".

Caution

- The current position of the motor is the position of the servo ON as 0 command unit position.

  Please after read the trial run operation of the relevant precautions of the PANATERM "HELP" "PANATERM operating manual", Try to operate.
- Trial run function by PANATERM,the acceleration of action [command unit/s^2] is limited fro 10,000 to 327,670,000. Set up under the acceleration equation to be within this range.

  ● Position control

  Acceleration [command unit/s^2] =

  Velocity [r/min] / 60×Encoder resolution [pulse/r] /electronic gear ratio/ Acceleration and deceleration time [s]

Note Please refer to P.6-42 . Setup of Gain Pre-adjustment Protection"

1.Trial Run

Setup of Motor Rotational Speed and Input Pulse Frequency

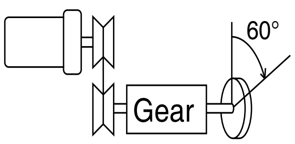
Input pulse frequency (pps)	Motor rotational speed (r/min)	electronic gear 23bit	Pr0.08 Command pulse counts per one motor revolution
2 M	3000	$\frac{2^{23}}{\boxed{40000}}$	40000
500 K	3000	$\frac{2^{23}}{\boxed{10000}}$	10000
250 K	3000	$\frac{2^{23}}{\boxed{5000}}$	5000
100 K	3000	$\frac{2^{23}}{\boxed{2000}}$	2000
500 K	1500	$\frac{2^{23}}{\boxed{20000}}$	20000

Note When setting Pr0.08, and encoder resolution is automatically set up as numerators.

Caution

- Max. input pulse frequency varies depending on input terminals.
- The desired setting can be determined by selecting value of numerator and denominator of electronic gear. However, an excessively high division or multiplication ratio cannot guarantee the operation. The ratio should be in a range between 1/1000 and 8000. Excessively high multiplication ratio will cause Err27.2 (command pulse multiplication error protection) due to varying command pulse input or noises, even if the other settings are within the specified range.

With load of total reduction ratio 18/365, output shaft rotates 60°.



Pulley ratio : $\frac{18}{60}$

Gear ratio : $\frac{12}{73}$

Total reduction ratio : $\frac{18}{365}$

When setting the command division and multiplication ratio as numerator/denominator, express it as Pr0.09/Pr0.10 with Pr0.08 = 0.

	Encoder 23bit
$\frac{\boxed{\text{Pr0.09}}}{\boxed{\text{Pr0.10}}}$	$\frac{\boxed{9568256}}{\boxed{3375}}$
Command pulse	To rotate the output shaft by 60°, enter the command of 10000 pulses from the host controller.
How to determine parameter	$\frac{365}{18} \times \frac{1 \times 2^{23}}{10000} \times \frac{60°}{360°} = \frac{\boxed{9568256}}{\boxed{3375}}$

2^n	Decimal figure	2^n	Decimal figure
2^0	1	2^{12}	4096
2^1	2	2^{13}	8192
2^2	4	2^{14}	16384
2^3	8	2^{15}	32768
2^4	16	2^{16}	65536
2^5	32	2^{17}	131072
2^6	64	2^{18}	262144
2^7	128	2^{19}	524288
2^8	256	2^{20}	1048576
2^9	512	2^{21}	2097152
2^{10}	1024	2^{22}	4194304
2^{11}	2048	2^{23}	8388608

Note Refer to P.3-122 "Position Resolution or Relation of Moving Velocity and Command Division/Multiplication)" of Supplement.

1 Before Using the Products
2 Preparation
3 Setup
4 Trial Run
5 Adjustment
6 When In Trouble
7 Supplement

2.Homing Operation

Outline of Homing Operation

When position and using in incremental mode, homing is required before positioning.

With MINAS-A6N, the following return-to-home sequences can be used.

Title	Contents
Cyclic homing	The host controller controls the return-to-home sequence in cyclic position control (CP) mode.
Profile homing	The servo driver controls the return-to-home sequence in profile position control (PP) mode

Caution Velocity(CV)/torque control(CT)mode can not use homing opration(absolute encoder multi circle data cleared except). Once you switch to the Cyclic position control (CP) mode or the Profile position control (PP) mode for the homing operation, then, return to the original control mode.

Note Please refer to P.3-2 to 3-3 for command input（PP, CP, CV, CT）.

Cyclic Homing

Homing of cyclic position control mode, dependent on controller specifications.

Following the used controller.

Profile Homing

Homing for profile position control mode, please set the following parameters.

● Related parameter

Parameter No.	Title	Range	Unit	Function
Pr8.01	Profile linear acceleration constant	1 to 429496	10000 command unit/s^2	Set acceleration for profile position control (PP). Be sure to set this parameter before starting operation.
Pr8.04	Profile linear deceleration constant	1 to 429496	10000 command unit/s^2	Set deceleration for profile position control (PP). Be sure to set this parameter before starting operation.
Pr8.12	Profile return to home position mode setup	0 to 1	—	Select the polarity of latch trigger signal to be detected during profile homing operation.
Pr8.13	Profile home position return velocity 1	0 to 2147483647	Command unit/s or r/min	Set the velocity for high velocity operation during profile homing.
Pr8.14	Profile home position return velocity 2	0 to 2147483647	Command unit/s or r/min	Set the velocity for low velocity operation during profile homing.
Pr7.25	RTEX speed unit setup	0 to 1	—	Set up the unit of speed data used in RTEX communication. Set up the unit both for both command data such as command speed and for response data such as actual speed.

Related page P.3-111,117,118 "Details of Panaterm"

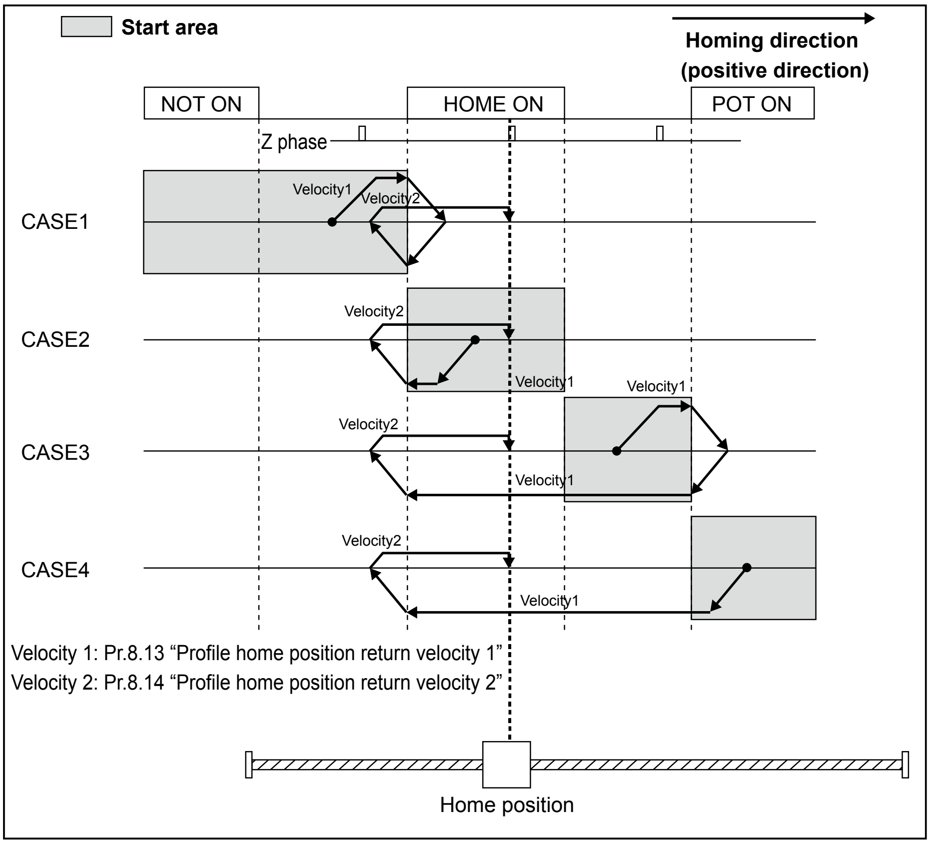
2.Homing Operation

Profile Homing Operation

The Profile homing action example is as follows.
For specific startup methods, please confirm controller specifications.

① Profile homing 1 (HOME + Z phase)

This return-to-home process uses Z phase from HOME sensor as the trigger signal.
In this system, the position of the first Z phase after the HOME sensor in homing direction detected the rising edge is denoted as the home position.
As the unit stops at the home position, the position information is initialized so that the position is set to 0.
Direction of homing (positive/negative) can be set according to Pr8.12 “Profile return to home position mode setup”.
Change to operation with start area. there is 4 cases as the following.
Example: Pr.8.12 = 0 (Homing direction = positive direction trigger signal detection)



Example: Pr8.12 = 0 (Positive direction trigger signal detection)—homing is started at a position more negative than HOME sensor.

1)The host controller sets the command code to normal command (10h) of PP control.
This does not start the profile operation.
Parameters related to acceleration/deceleration (Pr8.01/Pr8.04) and homing(Pr8.12/Pr8.14) should be set before starting operation

2)With normal command (10h) condition, set Type_Code to 31h.
Set target position (TPOS) and target speed (TSPD) to 0 because they are not used.
Set Latch_Sel1 to 0. For Monitor_Sel, select data to be returned to Monitor_Data.
This does not directly start profile operation.

3)Change command code 10h to 17h.

4)The servo driver starts profile operation as command code 10h changes to 17h, accelerates operation (starts operation) according to Pr8.01 “Profile linear acceleration constant” to reach Pr8.13 “Profile home position return velocity 1”. Note that upon starting the profile operation, Homing_Complete is set to 0.

5)The host controller checks that command code echo is 17h, Type_Code echo is 31h and status In_Progress is 1, and no command error has been generated, and homing operation has started. If command error is detected, the controller should take appropriate countermeasure according to the error code.

6)When POT is detected before HOME sensor detection, start deceleration according to Pr8.04 “Profile linear deceleration constant” to stop.

7)At the stop position, start movement in the direction opposite to the homing at the speed specified by Pr8.13.

8)When HOME sensor turns on and then OFF edge is detected, start deceleration at the rate specified by Pr8.04.

9)At the stop position, start movement in the homing direction, accelerating according to Pr8.14 “Profile home position return velocity 2”, re-entering HOME sensor area and stop upon detecting the 1st Z phase.

▪ Actually, detected position is determined by repositioning.

10)Initialize the position information so that the detected Z phase becomes 0 and Homing_ Complete becomes 1, and profile homing is finished.

■ Precautions

- If Z phase is close to a point where HOME changes, the 1st Z phase may not be detected as home due to reading delay of HOME sensor. Place Z phase far away from the point where HOME sensor changes the output.
- Sensors (HOME, POT, NOT) should be so arranged that once they detect something, nothing will pass through them until deceleration and stop complete.
- During profile homing 1 (HOME + Z phase), Pr5.04 “Over-travel inhibit input setup” and Pr5.05 “Sequence at over-travel inhibit” are temporarily disabled. When POT/NOT is detected, reverse operation will automatically start after deceleration and stop.
  When using this function without using the over-travel inhibit input, do not allocate POT/NOT to general purpose input. Simply setting Pr5.04 to 1 will not disable the function.
- If an error occurs during homing, e.g. the sensor cannot detect the home during reverse operation due to the over-travel inhibit input and detects the over-travel inhibit input ON of reverse side, or, if both of over-travel inhibit inputs are ON state, Err94.2 “Homing error protection” will occur, canceling homing process.

② Profile homing 2 (HOME)

This homing sequence uses HOME sensor as the trigger signal.

Home position is defined as the point where HOME sensor detects the rising edge in return-to-home direction.After stopping at the home position, initialize the position information so that this position is set at 0.

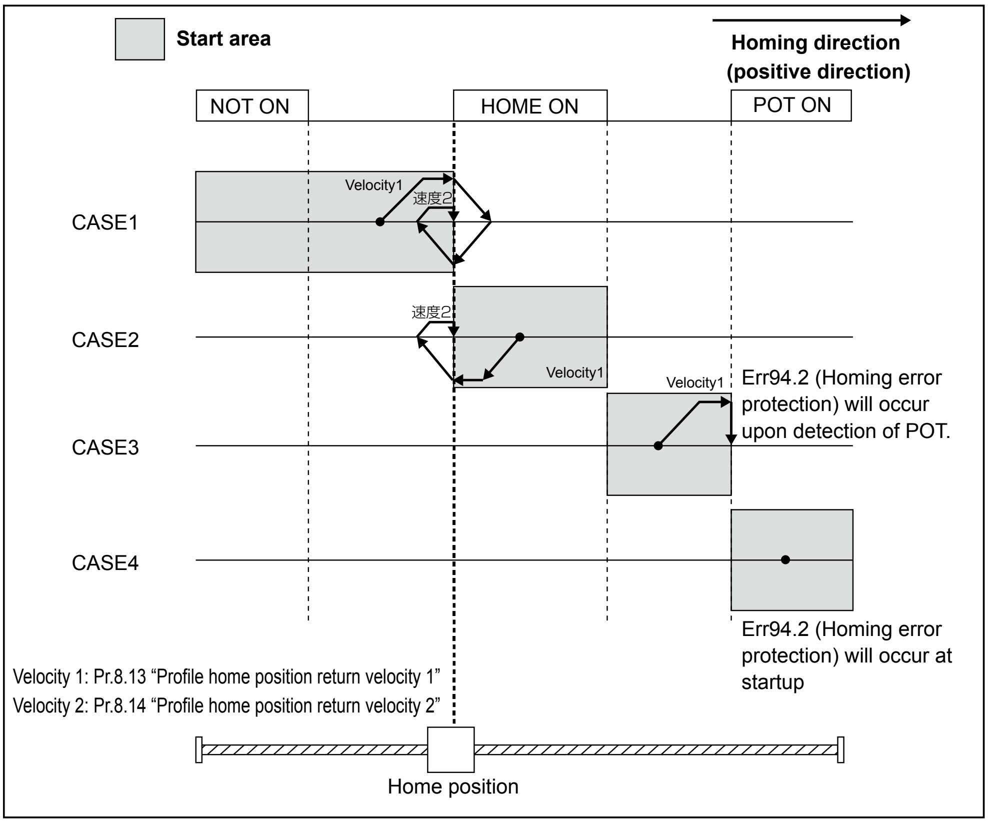
Only positive homing direction is supported.

Set Pr8.12 “Profile return to home position mode setup” to 0.

Setting Pr8.12 to 1 also causes homing in positive directio.

There are 4 cases in the following figure as a result of the changes in the region during the start area.

■ Example: Pr8.12 = 0 (Homing direction = positive direction trigger signal detection)



Example: Pr8.12 = 0 (Positive direction trigger signal detection)—homing is started at a position more negative than HOME sensor.

1)The host controller sets the command code to normal command (10h) of PP control.
This does not start the profile operation.
Parameters related to acceleration/deceleration (Pr8.01/Pr8.04) and homing (Pr8.12 to Pr8.14) should be set before starting operation.

2)With normal command (10h) condition, set Type_Code to 32h.
Set target position (TPOS) and target speed (TSPD) to 0 because they are not used.
Set Latch_Sel1 to 0. For Monitor_Sel, select data to be returned to Monitor_Data.
This does not directly start profile operation.

3)Change command code 10h to 17h.
4)The servo driver starts profile operation as command code 10h changes to 17h, accelerates operation (starts operation) according to Pr8.01 “Profile linear acceleration constant” to reach Pr8.13 “Profile home position return velocity 1”. Note that upon starting the profile operation, Homing_Complete is set to 0.
5)The host controller checks that command code echo is 17h, Type_Code echo is 32h and status In_Progress is 1, and no command error has been generated, and homing operation has started. If command error is detected, the controller should take appropriate countermeasure according to the error code.
6)When HOME sensor turns on, start deceleration according to Pr8.04 “Profile linear deceleration constant” to stop.
7)At the stop position, start movement in the direction opposite to the homing at the speed specified by Pr8.13.
8)When HOME sensor turns on and then OFF edge is detected, start deceleration at the rate specified by Pr8.04.
9)At the stop position, start movement in the homing direction, accelerating according to Pr8.14 “Profile home position return velocity 2”, and stop at the position where HOME sensor ON (rising edge) is detected.
▪ Actually, detected position is determined by repositioning.
10)Initialize the position information so that the detected HOME sensor rising edge is at 0 and Homing_Complete becomes 1, and profile homing is finished.

■ **Precautions**

- Set Pr8.14 “Profile home position return velocity 2” to the lowest possible velocity. Higher velocity may cause error due to delay in reading.
- HOME sensors should be so arranged that once they detect something, nothing will pass through them until deceleration and stop complete.
- Other non-cyclic commands except for homing commands may be executed during operation (until Homing_Ccomplete becomes 1) while maintaining profile operation. However, do not change the operation mode (Type_Code, Latch_Sel1 of profile command), otherwise, Err91.1 “RTEX command error protection” and command error (0104h) will occur.
- If there is an Err 94.2 (Origin reset exceotion protection) in POT/NOT in the same direction as the origin reset direction in profile origin reset 2(HOME), cancel the home reset processing. When the driver disable input function is not used, do not driver the input of the prohibited input at the general purpose input. Only Pr5.04=1 is invalid.

③ Profile homing 3 (Z phase)

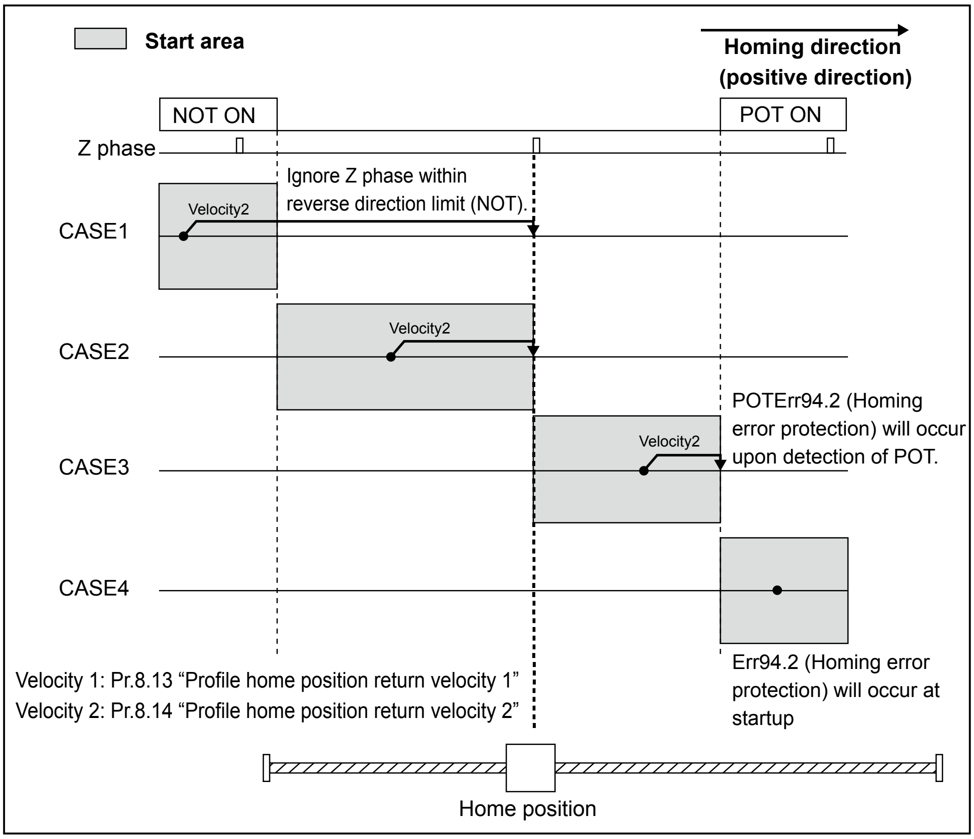
This homing sequence uses Z phase as the trigger signal.

Define the 1st Z phase position in the homing direction as the home position.Stop at the home and initialize the position information to set this position at 0.

Direction of homing can be set to either positive or negative through the setting of Pr8.12 “Profile return to home position mode setup”.

There are 4 cases in the following figure as a result of the changes in the region during the start area.

■ Example: Pr.8.12 = 0 (Homing direction = positive direction trigger signal detection)



Example: Pr8.12 = 0 (Positive direction trigger signal detection)—homing is started at a position more negative than Z phase.

1)The host controller sets the command code to normal command (10h) of PP control.
This does not start the profile operation.
Parameters related to acceleration/deceleration (Pr8.01/Pr8.04) and homing (Pr8.12 to Pr8.14) should be set before starting operation.

2)With normal command (10h) condition, set Type_Code to 33h.
Set target position (TPOS) and target speed (TSPD) to 0 because they are not used.
Set Latch_Sel1 to 0. For Monitor_Sel, select data to be returned to Monitor_Data.
This does not directly start profile operation.

3)Change command code 10h to 17h.

4)The servo driver starts profile operation as command code 10h changes to 17h, accelerates operation (starts operation) according to Pr8.01 “Profile linear acceleration constant” to reach Pr8.14 “Profile home position return velocity 2”. Note that upon starting the profile operation, Homing_Complete is set to 0.

5)The host controller checks that command code echo is 17h, Type_Code echo is 33h and status In_Progress is 1, and no command error has been generated, and homing operation has started. If command error is detected, the controller should take appropriate countermeasure according to the error code.

6)Stop at the position where the 1st Z phase is detected.

- Actually, detected position is determined by repositioning.

7)Initialize the position information to set the detected Z phase position to 0, and set Homing_Complete to 1 to finish profile homing sequence.

■ **Precautions**

- When the detected direction of drive inhibit input and the direction of homing are the same, Err94.2 “Homing error protection” will occur, disabling reversal of movement direction.
- When the detected direction of drive inhibit input is opposite to the homing direction, Z phase is not detected or ignored.
- During profile homing 3 (Z phase), when the detected POT/NOT and the direction of homing are the same direction, Err94.2 “Homing error protection” will occur and cancel homing process.

  When using this function without using the over-travel inhibit input, do not allocate POT/NOT to general purpose input. Simply setting Pr5.04 to 1 will not disable the function.
- Other non-cyclic commands except for homing commands may be executed during operation (until Homing_Complete becomes 1) while maintaining profile operation. However, do not change the operation mode (Type_Code, Latch_Sel1 of profile command), otherwise, Err91.1 “RTEX command error protection” and command error (0104h) will occur.
- When the Z-phase width is great, there may be the wrong detection evaluating that the amount of deceleration travel is smaller than the Z-phase width.

  Adjust the amount of deceleration travel using Pr8.04 “Profile linear deceleration constant” to allow for a margin that provides a sufficiently greater amount than the Z-phase width.
- .When there is more than one Z phase, this home position return method may not be able to detect a desired Z phase.

  Therefore, have one Z phase or use the home position return method that combines the use of the HOME sensor (Type_Code=31h)

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④ Profile homing 4 (POT/NOT + HOME)

This homing sequence uses HOME sensor as the trigger signal.

Home position is defined as the point where HOME sensor detects the rising edge in return-to-home direction.

After stopping at the home position, initialize the position information so that this position is set at 0.

Note that only positive homing direction is supported, negative homing direction is not supported.

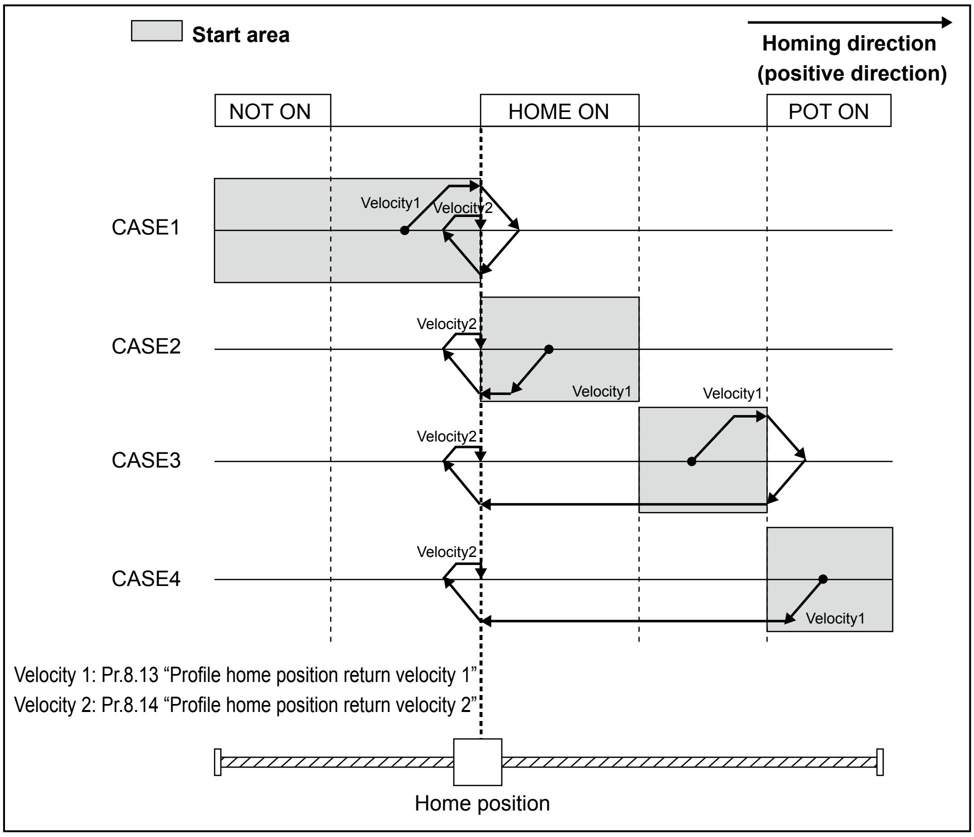
Set Pr8.12 “Profile return to home position mode setup” to 0.

Setting Pr8.12 to 1 also causes homing in positive direction.

If POT/NOT is detected in the same direction of the direction of home position return, reversal operation automatically starts after a deceleration to stop, and then home position return processing continues.

There are 4 cases in the following figure as a result of the changes in the region during the start area.

■ Example: Pr8.12 = 0 (Homing direction = positive direction trigger signal detection)



Example: Pr8.12 = 0 (Positive direction trigger signal detection)—homing is started at a position more negative than HOME sensor.

1)The host controller sets the command code to normal command (10h) of PP control.
This does not start the profile operation.
Parameters related to acceleration/deceleration (Pr8.01/Pr8.04) and homing (Pr8.12 to Pr8.14) should be set before starting operation.

2)With normal command (10h) condition, set Type_Code to 34h.
Set target position (TPOS) and target speed (TSPD) to 0 because they are not used.
Set Latch_Sel1 to 0. For Monitor_Sel, select data to be returned to Monitor_Data.
This does not directly start profile operation.

3)Change command code 10h to 17h.

4)The servo driver starts profile operation as command code 10h changes to 17h, accelerates operation (starts operation) according to Pr8.01 “Profile linear acceleration constant” to reach Pr8.13 “Profile home position return velocity 1”. Note that upon starting the profile operation, Homing_Complete is set to 0.

5)The host controller checks that command code echo is 17h, Type_Code echo is 34h and status In_Progress is 1, and no command error has been generated, and homing operation has started. If command error is detected, the controller should take appropriate countermeasure according to the error code

6)When HOME sensor turns on, start deceleration according to Pr8.04 “Profile linear deceleration constant” to stop.

7)At the stop position, start movement in the direction opposite to the homing at the speed specified by Pr8.13.

8)When HOME sensor turns on and then OFF edge is detected, start deceleration at the rate specified by Pr8.04.

9)At the stop position, start movement in the homing direction, accelerating according to Pr8.14 “Profile home position return velocity 2”, and stop at the position where HOME sensor ON (rising edge) is detected.

▪ Actually, detected position is determined by repositioning.

10)Initialize the position information so that the detected HOME sensor rising edge is at 0 and Homing_Complete becomes 1, and profile homing is finished.

■ **Precautions**

- Set Pr8.14 “Profile home position return velocity 2” to the lowest possible velocity. Higher velocity may cause error due to delay in reading.
- HOME sensors should be so arranged that once they detect something, nothing will pass through them until deceleration and stop complete.
- During profile home position return 4 (POT/NOT +HOME), the setup of Pr5.04 “Over-travel inhibit input setup” and Pr5.05 “Sequence at over-travel inhibit” is temporarily invalid. During POT/NOT detection, reversal operation is automatically started after a deceleration to stop.
  When using this function without using the over-travel inhibit input, do not allocate POT/NOT to general purpose input. Simply setting Pr5.04 to 1 will not disable the function.
- If an error, such as the detection of drive disable input ON on the reverse side while failing to detect the home position during reversal operation with the drive disable setup or the drive disable input turned ON on both sides, is detected during home position return, Err94.2 “Home position return error protection” occurs and home position return processing is cancelled.
- Other non-cyclic commands except for homing commands may be executed during operation (until Homing_Ccomplete becomes 1) while maintaining profile operation. However, do not change the operation mode (Type_Code, Latch_Sel1 of profile command), otherwise, Err91.1 “RTEX command error protection” and command error (0104h) will occur.

⑤ Profile homing 6 (POT/NOT + Z phase)

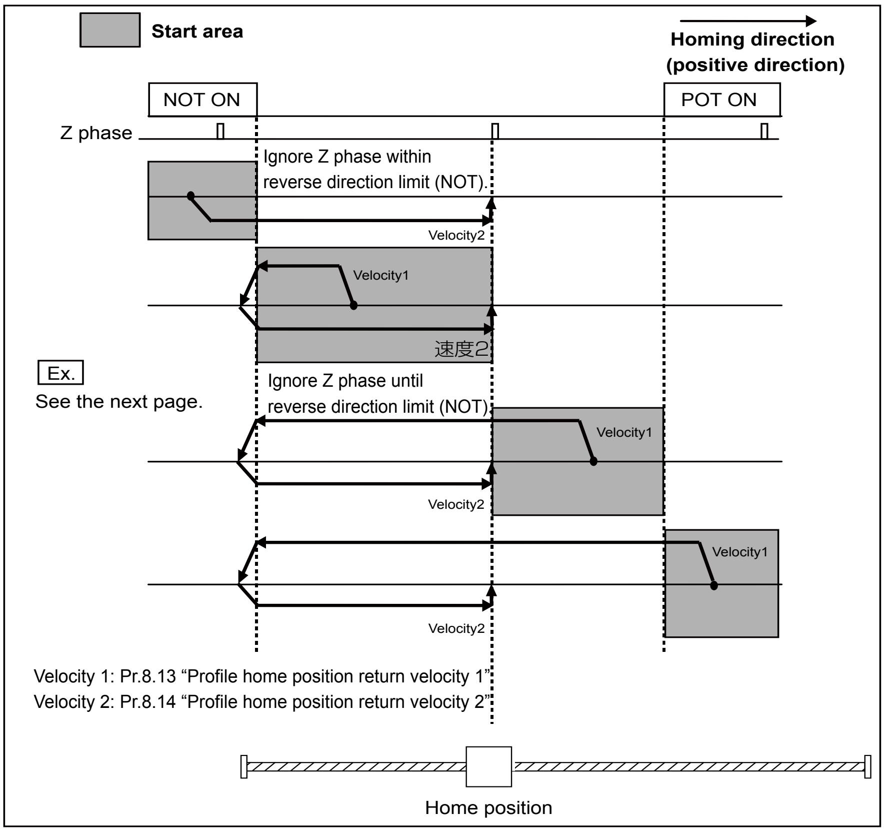
This homing sequence uses Z phase as the trigger signal.

The first Z phase position where the limit sensor is no longer detected, after reversal of operation by limit sensor detection in the return to origin direction, shall become the origin.

After stopping at the home position, initialize the position information so that this position is set at 0.

Direction of homing (positive/negative) can be set according to Pr8.12 “Profile return to home position mode setup”.

■ Example: Pr8.12 = 0 (Homing direction = positive direction trigger signal detection)



Example: Pr8.12 = 0 (Positive direction trigger signal detection)—homing is started at a position more negative than HOME sensor.

1)The host controller sets the command code to normal command (10h) of PP control.
This does not start the profile operation.
Parameters related to acceleration/deceleration (Pr8.01/Pr8.04) and homing (Pr8.12 to Pr8.14) should be set before starting operation

2)With normal command (10h) condition, set Type_Code to 36h.
Set target position (TPOS) and target speed (TSPD) to 0 because they are not used.
Set Latch_Sel1 to 0. For Monitor_Sel, select data to be returned to Monitor_Data.
This does not directly start profile operation

3)Change command code 10h to 17h.

4)The servo driver will start profile operation in the reverse direction of return to origin direction when the command code is changed from 10h to 17h, and will commence acceleration (operation start) under Pr8.01 “Profile linear acceleration constant” to reach Pr8.13 “Profile home position return velocity 1” Homing_Complete is once set to 0, as of the time of start..

5)The host controller checks that command code echo is 17h, Type_Code echo is 36h and status In_Progress is 1, and no command error has been generated, and homing operation has started. If command error is detected, the controller should take appropriate countermeasure according to the error code

6)When NOT sensor turns on, start deceleration according to Pr8.04 “Profile linear deceleration con stant” to stop.

7)After stopping, begin operation under the velocity of Pr8.14 “Profile home position return velocity 2” in the return to origin direction.

8)Stop at the position where the 1st Z phase is detected.

- Actually, detected position is determined by repositioning.

9)Initialize the position information to set the detected Z phase position to 0, and set Homing_Complete to 1 to finish profile homing sequence..

■ Precautions

- During profile home position return 6 (POT/NOT + Z phase), the setup of Pr5.04 “Over-travel inhibit input setup” and Pr5.05 “Sequence at over-travel inhibit” is temporarily invalid. During POT/NOT detection, reversal operation is automatically started after a deceleration to stop.
- If an error, such as the detection of drive disable input ON on the reverse side while failing to detect the home position during reversal operation with the drive disable setup or the drive disable input turned ON on both sides, is detected during home position return, Err94.2 “Home position return error protection” occurs and home position return processing is cancelled.
- Other non-cyclic commands except for homing commands may be executed during operation (until Homing_Ccomplete becomes 1) while maintaining profile operation. However, do not change the operation mode (Type_Code, Latch_Sel1 of profile command), otherwise, Err91.1 “RTEX command error protection” and command error (0104h) will occur.
- When the Z-phase width is great, there may be the wrong detection evaluating that the amount of deceleration travel is smaller than the Z-phase width.
  Adjust the amount of deceleration travel using Pr8.04 “Profile linear deceleration constant” to allow for a margin that provides a sufficiently greater amount than the Z-phase width.
- When there is more than one Z phase, this home position return method may not be able to detect a desired Z phase.
  Therefore, have one Z phase or use the home position return method that combines the use of the HOME sensor (Type_Code=31h)

5. Adjustment

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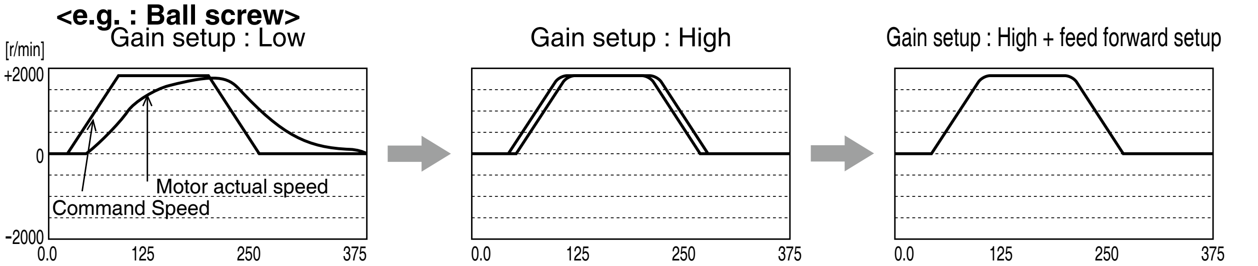
1. Gain Adjustment

Outline

Purpose

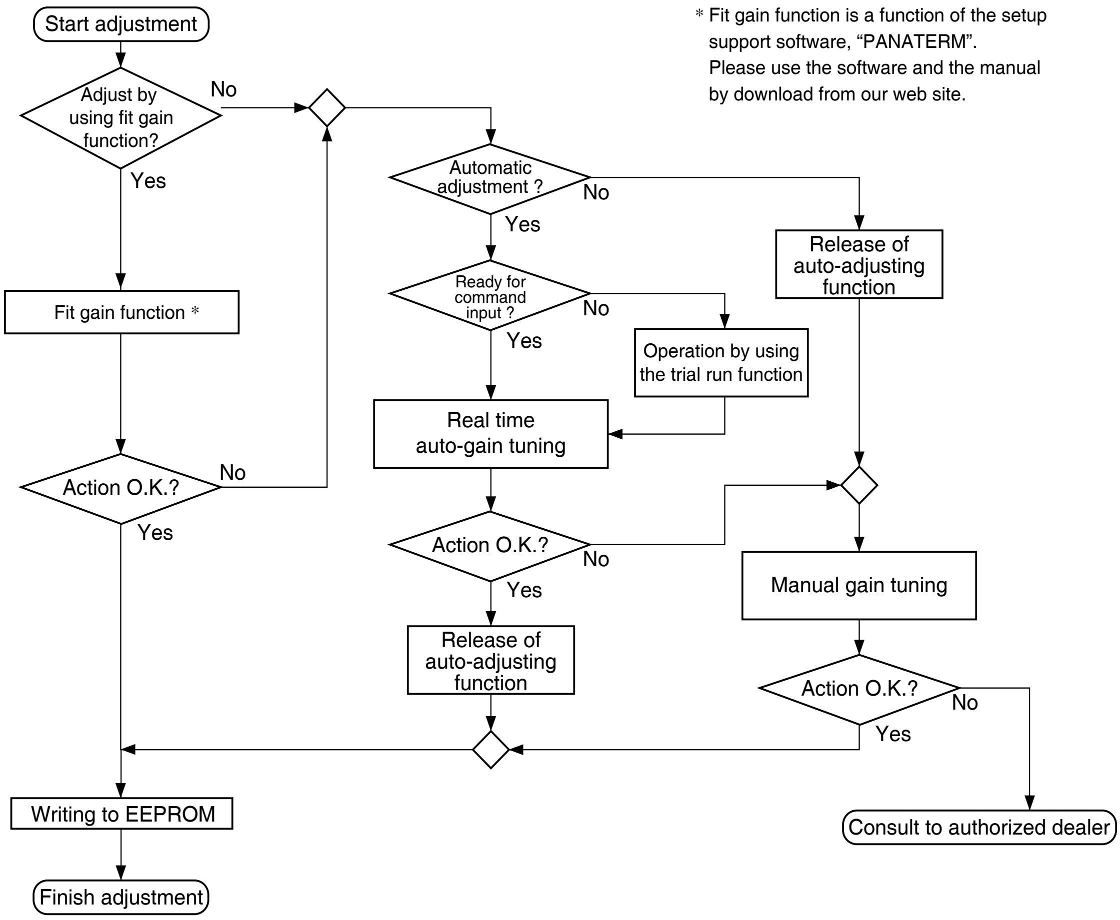
t is required for the servo driver to run the motor in least time delay and as faithful as possible against the commands from the host controller. You can make a gain adjustment so that you can run the motor as closely as possible to the commands and obtain the optimum performance of the machine.

<e.g. : Ball screw>



Gain setup : Low		Gain setup : High		Gain setup : High + feed forward setup	
Position loop gain	: 200 [0.1 /s]	Position loop gain	: 1000 [0.1 /s]	Position loop gain	: 1000 [0.1 /s]
Velocity loop gain	: 1000 [0.1 Hz]	Velocity loop gain	: 500 [0.1 Hz]	Velocity loop gain	: 500 [0.1 Hz]
Time constant of V-loop integration	: 500 [0.1 ms]	Time constant of V-loop integration	: 500 [0.1 ms]	Time constant of V-loop integration	: 500 [0.1 ms]
Velocity loop feed forward	: 0 [0.10 %]	Velocity loop feed forward	: 0 [0.10 %]	Velocity loop feed forward	: 500 [0.10 %]
Inertia ratio	: 100 [%]	Inertia ratio	: 100 [%]	Inertia ratio	: 100 [%]

Procedures



* Fit gain function is a function of the setup support software, “PANATERM”. Please use the software and the manual by download from our web site.

Note For safety operation, first adjust the gain by referring to P.6-42 Setup of Gain Pre-adjustment Protection.

Type

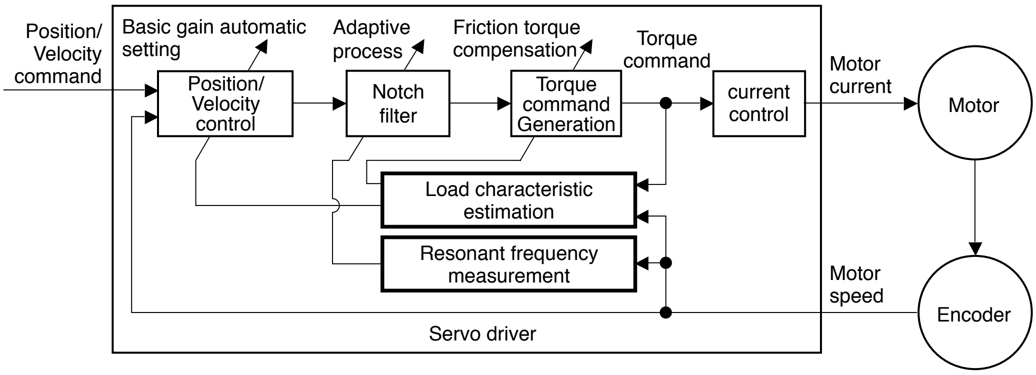
Function			Explanation	Pages to refer
Automatic adjustment	Real-time auto-gain tuning		Estimates the load inertia of the machine in real time, and automatically sets up the optimum gain corresponding to this result.	P.5-4
	Two-degree-of-freedom control mode		In the two-degree-of-freedom control mode, command response and servo rigidity can be independently set with improved responsiveness. This mode has enhanced position and speed control functions.	P.5-10
	Adaptive filter		Reduces the resonance vibration point by automatically setting up the notch filter coefficient which removes the resonance component from the torque command while estimating the resonance frequency from the vibrating component which appears in the motor speed in actual operating condition.	P.5-28
Manual adjustment	Manual gain tuning (basic)		Execute the manual adjustment or fine-tuning when real-time auto-gain tuning cannot be activated due to the limitation of operation or load condition, or when you want to obtain an optimum response and stability under these conditions.	P.5-31
		Basic procedure	Adjustment in position control mode	P.5-32
			Adjustment in velocity control mode	P.5-35
			Adjustment in torque control mode	P.5-35
		Gain switching function	You can expect to reduce vibration at stopping and settling time and to improve command compliance by switching the gains by internal data or external signals.	P.5-36
		Suppression of machine resonance	When the machine stiffness is low, vibration or noise may be generated due to the distorted axis, hence you cannot set the higher gain. You can suppress the resonance with two kinds of filter.	P.5-39
	Manual gain tuning (application)		You can obtain the higher performance while you are not satisfied with the performance obtained with the basic adjustment, using the following application functions.	P.5-43
		Damping control	Damping control	
			Model-type damping filter	P.5-45
		Feed forward function	Velocity feed forward function improves responsiveness during position control.Torque feed forward improves the response of velocity control system.	P.5-49
		Load variation suppression function	Function which obtains both reducing motor speed variation and improving stability by changing estimated disturbance torque and load fluctuation.	P.5-51
		3rd gain switching function	By using this function in addition to the normal gain switching function, the gain can be changed at the moment of stop to further shorten the positioning time.	P.5-54
		Friction torque compensation	Offset load compensation and dynamic friction compensation are used to reduce effects of mechanical friction.	P.5-56
		Qudrant projecttion suppression function	Control configuration can be switched to suppress quadrant projection occurring during arc interpolation of 2 or more axes.	P.5-58
		Two-degree-of-freedom control mode	In the two-degree-of-freedom control mode, command response and servo rigidity can be independently set with improved responsiveness. This mode has enhanced position and speed control functions.	P.5-60
		Two-stage torque filter	In addition to 1st and 2nd torque filters (Pr1.04 and Pr1.09), another torque filter can be set.	P.5-63

Remarks

- Pay extra attention to safety, when oscillation (abnormal noise and vibration) occurs, shut off the main power, or turn to Servo-OFF.

Outline

The system estimates the load characteristics in real time, and automatically performs basic gain setting and friction compensation by referring to stiffness parameter.



Applicable Range

Real time auto-gain tuning is applicable to all control modes.

	Real-time auto-tuning condition
Control Mode	Specific real-time auto-tuning mode is selected according to the currently active control mode. For details, refer to the description of Pr0.02 Real-time auto-tuning setup.
Others	• Should be in servo-on condition • Parameters except control parameters such as torque limit settings are correctly set, assuring that the motor can run smoothly.

Caution

•After the power is turned on, estimate value following may become quicker regardless of Pr6.31 “Real-time auto tuning estimation speed” until operation data effective for the estimation of load characteristics is sufficiently accumulated.

•When real-time auto-gain tuning is effective, an estimate value may become abnormal due to disturbance. If you want to obtain stable operation from when the power is turned on, it is recommended to disable the real-time auto-gain tuning.

Real-time auto-gain tuning may not be executed properly under the conditions described in the table below. Under these conditions, change the load condition or operation pattern, or start manual gain tuning (refer to P.5-31).

	Conditions which obstruct real-time auto-gain tuning action
Load inertia	• The load is too small or large compared to the rotor inertia. (less than 3 times or more than 20 times). • The load inertia changes too quickly.
Load	• The machine stiffness is extremely low. • Nonlinear characteristics such as backlash exist.
Action pattern	• The motor is running continuously at low speed of (100 [r/min] or lower. • Acceleration/deceleration is slow (2000 [r/min] per 1[s] or low). • Acceleration/deceleration torque is smaller than unbalanced weighted/ viscous friction torque. • When the speed condition of 100 [r/min] or more and acceleration/ deceleration condition of 2000 [r/min] per 1 [s] are not maintained for 50 [ms].

How to Operate

1) Bring the motor to stall (Servo-OFF).
2) Set up Pr0.02 (Setup of real-time auto-gain tuning mode) to 1-6.
   Default is set to 1.

Setup value	Real-time auto-gain tuning
0	Invalid
1	Standard
2	Positioning *1
3	Vertical axis *2
4	Friction compensation *3
5	Load characteristic measurement
6	Customize *4

*1 Velocity and torque controls are the same as in the standard mode.
*2 Torque control is the same as in the standard mode.
*3 Velocity control is the same as in the vertical axis mode. Torque control is the same as in the standard mode.
*4 Certain function(s) is not available in a specific control mode. Refer to description in Pr6.32.

   Control parameter is automatically set according to Pr0.03 Real-time auto-tuning stiffness setup. For details, refer to P.5-6 and 5-7.
3) Turn on servo, and start the machine.

   Estimation of load characteristics starts.
4) When the load characteristics are determined, Pr0.04 Inertia ratio is updated.
   In a specific mode, the following parameters are changed:
   Pr6.07 Torque command additional value
   Pr6.08 Positive direction torque compensation value
   Pr6.09 Negative direction torque compensation value
5) When value of Pr0.03 Real-time auto-tuning stiffness setup is increased, the motor responsiveness will be improved.
   Determine the most appropriate stiffness in relation to the positioning setup time and vibration condition.
6) To save the result to memory, write the data to EEPROM.

Caution If power is turned off within 30 minutes after the end of tuning process, the result of the real-time auto-tuning is not saved. If the result is not saved, manually write parameters to EEPROM and then turn off power.

Note
- While the auto-tuning is valid, parameters that are to be automatically adjusted cannot be changed.

Related page
• P.3-39... "Details of Parameter"

Parameters Set/Changed by Real-time Auto-gain Tuning

• Parameters which are updated

The real-time auto-tuning function updates the following parameters according to Pr0.02 Real-time auto-tuning setup and Pr6.32 Real-time auto-tuning custom setup and by using the load characteristic estimate values.

Class	No.	Title	Function
0	04	Inertia ratio	Updates this parameter when the real-time auto-tuning inertia ratio update is enabled.
6	07	Torque command additional value	Update this parameter when the vertical axis mode for real time auto-tuning is valid.
6	08	Positive direction torque compensation value	Update this parameter when the friction compensation mode for real time auto-tuning is valid.
6	09	Negative direction torque compensation value	Update this parameter when the friction compensation mode for real time auto-tuning is valid.

• Parameters which are updated to setup value corresponding to stiffness setup

The real-time auto-tuning function updates the following basic gain setup parameters according to Pr0.03 Real-time auto-tuning stiffness setup.

Class	No.	Title	Function
1	00	1st gain of position loop	When stiffness setup is valid, updates the parameter based on the setup value. Refer to P.5-9 Basic gain parameter setup table.
1	01	1st gain of velocity loop	
1	02	1st time constant of velocity loop integration	
1	04	1st time constant of torque filter	
1	05	2nd gain of position loop	
1	06	2nd gain of velocity loop	
1	07	2nd time constant of velocity loop integration	
1	09	2nd time constant of torque filter	

• Parameters which are set to fixed value

Real-time auto-tuning function sets the following parameters to the fixed value.

Class	No.	Title	Setup value when fixed parameter setup is valid.
1	03	1st filter of speed detection	0
1	08	2nd filter of speed detection	
1	10	Velocity feed forward gain	300 (30 %)
1	11	Velocity feed forward filter	50 (0.5 ms)
1	12	Torque feed forward gain	0
1	13	Torque feed forward filter	

Related page •P.3-42 “Pr0.04” •P.3-47 ～ “Pr1.00 ～” •P.3-91 “Pr6.07 ～”

● Parameters which are set in response to gain switching setup

The real-time auto-tuning function sets the following parameters as the gain is switched.

Class	No.	Title	Function
1	14	2nd gain setup	Sets to 1 if the current setting is not aintained.
1	15	Mode of position control switching	Sets to 10 to enable the gain switching. Sets to 0 to disable the gain switching.
1	16	Delay time of position control switching	Sets to 50 if the current setting is not aintained.
1	17	Level of position control switching	
1	18	Hysteresis at position control switching	Sets to 33 if the current setting is not aintained.
1	19	Position gain switching time	
1	20	Mode of velocity control switching	Sets to 0 if the current setting is not aintained.
1	21	Delay time of velocity control switching	
1	22	Level of velocity control switching	
1	23	Hysteresis at velocity control switching	
1	24	Mode of torque control switching	
1	25	Delay time of torque control switching	
1	26	Level of torque control switching	
1	27	Hysteresis at torque control switching	

● Parameters which are set in response to load variation suppression function

The following settings and parameters are set automatic for enable/disable state of Pr 6.10 “Function expansion setup” load variation suppression function automatic adjustment.

Class	No.	Title	Function
6	10	Function expansion setup	When set to Pr6.10 bit14=1in case of stiffness setting is enabled.load fluctuation suppression funtion will become enabled(bit1=1). When set to Pr6.10 bit14=0,it is disabled(bit1=0).
6	23	Load fluctuation compensation gain	When set to Pr6.10 bit4=1 in case of stiffness setting is enabled,sets to 90%. When set to Pr6.10 bit14=0,set to 0%.
6	24	Load fluctuation compensating filter	When set to Pr6.10 bit14=1 in case of stiffness setting is enabled.updates to match rigidity. When set to Pr6.10 bit14=0,value is held.
6	73	load estimation filter	When set to Pr6.10 bit14=1 in case of stiffness setting is enabled.ses to 0.13 ms.When set to Pr6.10 bit14=0,set to 0 ms.
6	74	Torque compensating frequency 1	Regardless value of the Pr6.10 bit14,sets to 0.
6	75	Torque compensating frequency 2	Regardless value of the Pr6.10 bit14,sets to 0.
6	76	Load estimate numbers	When set to Pr6.10 bit14=1 in case of stiffness setting is enabled,sets to 4. When set to Pr6.10 bit14=0,set to 0.

Related page •P.3-49 ～ “Pr1.14 ～” •P.3-92 ～ “Pr6.10 ～”

1 Before Using the Products
2 Preparation
3 Setup
4 Trial Run
5 Adjustment
6 When in Trouble
7 Supplement

Caution

(1) Immediately after the first servo-on upon start up; or after increasing Pr0.03 Real-time auto-tuning stiffness setup, abnormal sound or oscillation may be generated until the load characteristics estimation is stabilized. If such abnormality lasts or repeats for 3 or more reciprocating operations, take the following countermeasures.
   1) Lower the setup of Pr0.03 (Selection of machine stiffness at real-time auto-gain tuning).
   2) Set Pr0.02 Real-time auto-tuning setup to 0 to disable the real-time auto-tuning.
   3) Set Pr0.04 Inertial ratio to the calculational value of the equipment and set Pr6.07 Torque command addition value, Pr6.08 Positive direction compensation value and Pr6.09 Negative direction compensation value to 0.
   4) Disabale load variation suppression function. (bit1=0 after Pr 6.10 bit14=0)

(2) When abnormal noise and oscillation occur, Pr0.04 (Inertia ratio) or Pr6.07 (Torque command additional value), Pr6.08(Positive direction torque compensation value), Pr6.09(Negative direction torque compensation value) might have changed to extreme values. Take the same measures as the above (1) -3) in these cases.

(3) Among the results of real-time auto-gain tuning, Pr0.04 (Inertia ratio) and Pr6.07 (Torque command additional value), Pr6.08(Positive direction torque compensation value), Pr6.09(Negative direction torque compensation value) will be written to EEPROM every 30 minutes. When you turn on the power again, the auto-gain tuning will be executed using the latest data as initial values.

(4) Because the control gain is updated while the motor stops, changed setting value of Pr0.03 “Real-time auto-tuning stiffness setup” may not be reflected if the motor cannot stop due to excessively low gain or application of a command that directs the motor to turn in the same direction continuously. If the changed stiffness setting value is reflected after motor stops, it may generate abnormal sound or oscillate.
After changing stiffness, stop the motor and check to see that the new stiffness setting is made effective.

Invalidation of Real-Time Auto-Gain Tuning

You can stop the automatic calculation of Pr0.04 (Inertial ratio) and invalidate the real-time auto-gain tuning by setting up Pr0.02 (Real-time auto-gain tuning setup) to 0.
Since the estimation result of Pr0.04 “Inertia ratio” remains, and if this parameter becomes clearly abnormal value, manually set to the appropriate value which is obtained from suitable formula or calculation.

Caution If power is turned off within 30 minutes after the end of tuning process, the result of the real-time auto-tuning is not saved. If the result is not saved, manually write parameters to EEPROM and then turn off power.

Basic Gain Parameter Setup Table

Stiffness	1st gain				2nd gain				load variation suppression function
	Pr1.00	Pr1.01	Pr1.02	Pr1.04	Pr1.05	Pr1.06	Pr1.07 *2	Pr1.09	Pr6.24
	Gain of position loop [0.1 /s]	Gain of velocity loop [0.1 Hz]	Time constant of velocity loop integration [0.1 ms]	Time constant of torque filter [0.01 ms]	Gain of position loop [0.1 /s]	Gain of velocity loop [0.1 Hz]	Time constant of velocity loop integration [0.1 ms]	Time constant of torque filter [0.01 ms]	Load fluctuation compensation filter [0.01 ms]
0	20	15	3700	1500	25	15	10000	1500	2500
1	25	20	2800	1100	30	20	10000	1100	2500
2	30	25	2200	900	40	25	10000	900	2500
3	40	30	1900	800	45	30	10000	800	2500
4	45	35	1600	600	55	35	10000	600	2500
5	55	45	1200	500	70	45	10000	500	2500
6	75	60	900	400	95	60	10000	400	2500
7	95	75	700	300	120	75	10000	300	2120
8	115	90	600	300	140	90	10000	300	1770
9	140	110	500	200	175	110	10000	200	1450
10	175	140	400	200	220	140	10000	200	1140
11 *1	320	180	310	126	380	180	10000	126	880
12	390	220	250	103	460	220	10000	103	720
13 *1	480	270	210	84	570	270	10000	84	590
14	630	350	160	65	730	350	10000	65	450
15	720	400	140	57	840	400	10000	57	400
16	900	500	120	45	1050	500	10000	45	320
17	1080	600	110	38	1260	600	10000	38	270
18	1350	750	90	30	1570	750	10000	30	210
19	1620	900	80	25	1880	900	10000	25	180
20	2060	1150	70	20	2410	1150	10000	20	140
21	2510	1400	60	16	2930	1400	10000	16	110
22	3050	1700	50	13	3560	1700	10000	13	90
23	3770	2100	40	11	4400	2100	10000	11	80
24	4490	2500	40	9	5240	2500	10000	9	60
25	5000	2800	35	8	5900	2800	10000	8	60
26	5600	3100	30	7	6500	3100	10000	7	50
27	6100	3400	30	7	7100	3400	10000	7	50
28	6600	3700	25	6	7700	3700	10000	6	40
29	7200	4000	25	6	8400	4000	10000	6	40
30	8100	4500	20	5	9400	4500	10000	5	40
31	9000	5000	20	5	10500	5000	10000	5	40

*1 Default stiffness setting: 13 for frames A, B and C, 11 for frames D, E, F.

*2 In the vertical axis mode or friction compensation mode (Pr0.02 = 3, 4), Pr1.07 keeps 9999 (hold) until load characteristics estimation completes.

Note • For details of parameter, refer to P.3-39... “Details of Parameter”.

2. Real-Time Auto-Gain Tuning

Two-degree-of-freedom Control Mode – Standard Type

Outline

The Two-degree-of-freedom control mode has two types: standard type and synchronization type.
Standard type : This is a standard mode. Use this mode normally.
Synchronization type : Use this mode for locus control of multiple axes of an articulated robot, etc.
This item is an auto tuning function exclusive for the standard type.
Load characteristic of a machine is estimated on a real-time basis, and using the results, basic gain settings and friction compensation are automatically specified in accordance of hardness parameters.

Applicable Range

	Real-time auto-tuning condition
Control Mode	Position Control, Velocity control or Full-closed control Pr6.47 bit0=1 and bit3=0: Two-degree-of-freedom control mode Standard type.
Others	•Should be in servo-on condition. •Input signals such as command input disable signals, and parameters except control parameters such as torque limit settings are correctly set, assuring that the motor can run smoothly.

Caution

・After the power is turned on, estimate value following may become quicker regardless of Pr6.31 "Real-time auto tuning estimation speed" until operation data effective for the estimation of load characteristics is sufficiently accumulated.
・When real-time auto-gain tuning is effective, an estimate value may become abnormal due to disturbance. If you want to obtain stable operation from when the power is turned on, it is recommended to disable the real-time auto-gain tuning

Real-time auto-gain tuning may not be executed properly under the conditions described below.Under these conditions, change the load conditions or operation patterns, or start manual gain tuning (refer to P.5-35 and subsequent).

	Conditions which obstruct real-time auto-gain tuning
Load condition	•The load mass is too small or large with reference to the rotor mass (smaller than three times or 20 times or larger). •The load mass varies. •The mechanical stiffness is extremely low. •Any non-linear characteristic exists such as backlash.
Action pattern	•Continuous use at a low speed of less than 100 [mm/s] •The acceleration is low at 2000 [mm/s] per 1 [s]. •A speed at 100 [mm/s] or higher or a acceleration/deceleration of 2000 [mm/s] per 1 [s] does not continue for 50 [ms] or longer. •The acceleration/deceleration torque is small with reference to the uneven load/ viscous friction torque.

How to Operate

When Pr 0.02 “Real-time auto-gain tuning setup” is set to a value other than 0, control parameter is automatically set according to Pr0.03 “Selection of machine stiffness at real-time auto-gain tuning” or Pr6.10 “Function expansion setup” bit14, the control parameters are automatically set .

When the servo is ON, enter operation command after about 100ms. When the load characteristic is correctly estimated, Pr 0.04 “Inertia ratio” is updated. With certain mode settings, Pr 6.07 “Torque command addition value”, Pr 6.08 “Positive direction compensation value”, Pr6.09 “Negative direction torque compensation value”, and Pr6.50 “Viscous friction compensation gain” will be changed.

When value of Pr0.03 “Selection of machine stiffness at real-time auto-gain tuning” is increased,

the motor responsiveness will be improved. Determine the most appropriate stiffness in relation to the positioning setup time and vibration condition.

Note

- While the auto-tuning is valid, parameters that are to be automatically adjusted cannot be changed.

Related page

- P.3-39... “Details of Parameter”

Parameters Set/Changed by Real-time Auto-gain Tuning

● **Configure the real-time auto tuning operation by setting the following parameters.**

<table>
<tr><th>Class</th><th>No.</th><th>Title</th><th colspan="3">Function</th></tr>
<tr><td rowspan="10">0</td><td rowspan="10">02</td><td rowspan="10">Real-time auto-gain tuning setup</td><td colspan="3">Specifies the operation mode of real-time auto tuning.</td></tr>
<tr><td>Setting</td><td>Mode</td><td>Description</td></tr>
<tr><td>0</td><td>Invalid</td><td>The real-time auto tuning function is disabled.</td></tr>
<tr><td>1</td><td>Standard response mode</td><td>The mode for the optimum stability.No uneven load or friction compensation takes place and no gain switching is used.</td></tr>
<tr><td>2</td><td>High response mode 1</td><td>The mode for the optimum positioning. Used for a ball screw-driven device,etc. with no uneven load and little friction, as in a horizontal axis.</td></tr>
<tr><td>3</td><td>High response mode 2</td><td>In addition to the high responce mode 1,compensation against biased load and application of 3rd gain are made to reduce variations in settling time of positioning.</td></tr>
<tr><td>4</td><td>High response mode 3 *1</td><td>In addition to the high responce mode 2, settling time of positioning is reduced for a load where frictions are high.</td></tr>
<tr><td>5</td><td>Load characteristic measurement</td><td>Basic gain settings and friction compensation settings are not changed and load characteristic estimation only is made. This is used in combination with set-up support software(PANATERM).</td></tr>
<tr><td>6</td><td>Fit-gain mode</td><td>Use this mode to fine-adjust the stiffness setting after fit-gain has been completed.</td></tr>
<tr><td colspan="3">*1: In velocity control, it is the same as high response mode 2.In addition, Parameters of Pr6.08 “Positive direction torque compensation value”, Pr6.09 “Negative direction torque compensation value” and Pr6.50 “Viscous friction compensation gain” are updated, but not reflected in the operation.</td></tr>
<tr><td>0</td><td>03</td><td>Selection of machine stiffness at real-time auto-gain tuning</td><td colspan="3">Specifies the response for enabled real-time auto tuning. A larger setting increases the speed response and servo stiffness but invites more vibration. Gradually increase the setting while monitoring the operation.</td></tr>
</table>

Note

- While the auto-tuning is valid, parameters that are to be automatically adjusted cannot be changed.

Related page

- P.3-39... “Details of Parameter”

Parameters Set/Changed by Real-time Auto-gain Tuning

<table>
<tr><th>Class</th><th>No.</th><th>Title</th><th>Function</th></tr>
<tr><td>6</td><td>10</td><td>Function expansion setup</td><td>The automatic adjustment of load change inhibit function is enabled with bit14=1.</td></tr>
<tr><td>6</td><td>31</td><td>Real time auto tuning estimation speed</td><td>Specifies the load characteristics estimation speed for enabled real-time auto tuning. A larger setting allows faster follow-up to the variation in the load characteristics but also increases estimation fluctuation due to disturbance. The result of estimation is stored in the EEPROM every 30 minutes.
<table>
<tr><th>Setting</th><th>Mode</th><th>Description</th></tr>
<tr><td>0</td><td>No change</td><td>Terminates estimation of load characteristic.</td></tr>
<tr><td>1</td><td>Little change</td><td>Responded against change of load characteristic on the order of minutes.</td></tr>
<tr><td>2</td><td>Gradual change</td><td>Responded against change of load characteristic on the order of seconds.</td></tr>
<tr><td>3
*</td><td>Steep change</td><td>Appropriate estimation is made against change of load characteristic.</td></tr>
</table>
* If oscillation automatic detection is made valid from set-up support software (PANATERM), this setting is ignored and operation is based on settings of setting value 3.</td></tr>
<tr><td>6</td><td>32</td><td>Real time auto tuning custom setup</td><td>Not available in two-degrees-of-freedom control mode. Always set to 0.</td></tr>
</table>

Parameters Set/Changed by Real-time Auto-gain Tuning

● Parameters which are updated

The real-time auto-tuning function updates the following parameters according to Pr0.02 Real-time auto-tuning setup by using the load characteristic estimate values.

Class	No.	Title	Function
0	04	Inertia ratio	Updates this parameter when the real-time auto-tuning is enabled (Pr0.02 = 1 to 4).
6	07	Torque command additional value	Updates this parameter when the real-time auto-tuning is in the quick response mode 2, 3 (Pr0.02 = 3, 4).
6	08	Positive direction torque compensation value	Updates this parameter when the real-time auto-tuning is in the quick response mode 3 (Pr0.02 = 4).
6	09	Negative direction torque compensation value	
6	50	Viscous friction compensation gain	

● Parameters which are updated to setup value corresponding to stiffness setup

The real-time auto-tuning function updates the following basic gain setup parameters according to Pr0.03 Real-time auto-tuning stiffness setup.Dtails refer to basic gain parameter setup table.

Class	No.	Title	Function
1	00	1st gain of position loop	When real-time auto-tuning is valid (Pr0.02 = 1 to 4,6), updates the setup value according to the stiffness. Refer to P.5-10 Basic gain parameter setup table.
1	01	1st gain of velocity loop	
1	02	1st time constant of velocity loop integration	
1	04	1st time constant of torque filter	
1	05	2nd gain of position loop	
1	06	2nd gain of velocity loop	
1	07	2nd time constant of velocity loop integration	
1	09	2nd time constant of torque filter	
2	22	Command smoothing filter	When real-time auto tuning is valid (Pr0.02=1 to 4), updates the parameter based on the setup value. ∗ In velocity control, 1st filter is fixed.
6	48	Adjust filter	When real-time auto tuning is valid (Pr0.02=1 to 4,6), updates the parameter based on the setup value. ∗ In velocity control, 1st filter is fixed.

● Parameters which are set to fixed value

Real-time auto-tuning function sets the following parameters to fixed value.

Class	No.	Title	Setup value
1	03	1st filter of speed detection	0
1	08	2nd filter of speed detection	
1	10	Velocity feed forward gain	1000 (100 %)

Related page • P.3-39 to P.3-123... "Details of Parameter"

Class	No.	Title	Setting
1	11	Velocity feed forward filter	0
1	12	Torque feed forward gain	1000 (100 %)
1	13	Torque feed forward filter	0
6	10	Function expansion setup 2	bit4=1
6	49	command response/Adjust filter attenuation term	15

● Parameters which are set in respons to gain switching setup

The real-time automatic tuning sets the following parameters depending on Pr0.02 "Real-time auto-gain tuning setup".

Class	No.	Title	Function
1	14	2nd gain setup	Sets to 1 if real-time auto-tuning is valid (Pr0.02 = 1 to 4).
1	15	Mode of position control switching	Sets to 0 when in standard response mode (Pr0.02 = 1); when in quick response mode 1 to 3 (Pr0.02 = 2 to 4).
1	16	Delay time of position control switching	Sets to 10 if real-time auto-tuning is valid (Pr0.02 = 1 to 4).
1	17	Level of position control switching	Sets to 0 if real-time auto-tuning is valid (Pr0.02 = 1 to 4).
1	18	Hysteresis at position control switching	
1	19	Position gain switching time	Sets to 10 if real-time auto-tuning is valid (Pr0.02 = 1 to 4).
1	20	Mode of velocity control switching	Sets to 0 if real-time auto-tuning is valid (Pr0.02 = 1 to 4).
1	21	Delay time of velocity control switching	
1	22	Level of velocity control switching	Sets to 10 if real-time auto-tuning is valid (Pr0.02 = 1 to 4).
1	23	Hysteresis at velocity control switching	Sets to 0 if real-time auto-tuning is valid (Pr0.02 = 1 to 4).
1	24	Mode of torque control switching	
1	25	Delay time of torque control switching	Sets to 10 if real-time auto-tuning is valid (Pr0.02 = 1 to 4).
1	26	Level of torque control switching	Sets to 0 if real-time auto-tuning is valid (Pr0.02 = 1 to 4).
1	27	Hysteresis at torque control switching	
6	05	Position 3rd gain valid time	Sets to 0 (invalid) when in standard response mode or high speed response mode 1 (Pr0.02 = 1, 2).When in high speed response mode 2 or 3 (Pr0.02 = 3, 4), sets to Pr2.22 × 20 (max. value is limited to 10000).
6	06	Position 3rd gain scale factor	When in standard mode or high speed response mode 1, (Pr0.02 = 1, 2), sets to 100 (100 %). When in high speed response mode 2 or 3, (Pr0.02 = 3, 4), sets to 200 (200 %).

Related page • P.3-39 to P.3-123... "Details of Parameter""

● Parameters which are set in response to load variation suppression function

When Pr0.02 “Real-time auto-gain tuning setup” = 1 to 4 or 6,the following settings and parameters are set automatic for enable/disable state of Pr 6.10 “Function expansion setup” load variation suppression function automatic adjustment.

Class	No.	Title	Function
6	10	Function extension setting	When set to Pr 6.10 bit14=1, load variation suppression function will become enabled (bit1 = 1). When set to Pr 6.10 bit14=0,it is disabled(bit1 = 0).
6	23	Load variation compensation gain	When set to Pr 6.10 bit14=1 in case of stiffness setting is enabled, sets to 90 %. When set to Pr 6.10 bit14=0, set to 0 %.
6	24	Load variation compensation filter	When set to Pr 6.10 bit14=1 in case of stiffness setting is enabled, updates to match rigidity. When set to Pr 6.10 bit14=0, value is held.
6	73	Load estimation filter	When set to Pr 6.10 bit14=1 in case of stiffness setting is enabled, sets to 0.13 ms. When set to Pr 6.10 bit14=0, set to 0 ms.
6	74	Torque compensation frequency 1	Regardless value of the Pr 6.10 bit 14, sets to 0.
6	75	Torque compensation frequency 2	Regardless value of the Pr 6.10 bit 14, sets to 0.
6	76	Load estimation numbers	When set to Pr 6.10 bit14=1 in case of stiffness setting is enabled, sets to 4. When set to Pr 6.10 bit14=0, set to 0.

Caution

(1) Immediately after the first servo-on upon start up; or after increasing Pr0.03 Real-time auto-tuning stiffness setup, abnormal sound or oscillation may be generated until the load characteristics estimation is stabilized. If such abnormality lasts or repeats for 3 or more reciprocating operations, take the following countermeasures.
   1) Lower the setup of Pr0.03 (Selection of machine stiffness at real-time auto-gain tuning).
   2) Set Pr0.02 Real-time auto-tuning setup to 0 to disable the real-time auto-tuning.
   3) Set Pr0.04 Inertial ratio to the calculational value of the equipment and set Pr6.07 (Torque command addition value), Pr6.08 (Positive direction compensation value), Pr6.09 (Negative direction compensation value) and Pr6.50 (Viscous friction compensation gain) to 0.
   4) Disabale load variation suppression function. (bit1=0 after Pr 6.10 bit14=0)

(2) When abnormal noise and oscillation occur, Pr0.04 (Inertia ratio) or Pr6.07 (Torque command additional value), Pr6.08 (Positive direction torque compensation value), Pr6.09 (Negative direction compensation value), Pr6.50 (Viscous friction compensa tion gain) might have changed extreme value.Take the same measures as the above in these cases.

(3) The results of real-time automatic gain tuning, such as Pr0.04 “Inertia ratio”, Pr6.07 “Torque command additional value”, Pr6.08 “Positive direction torque compensation value”, Pr6.09 “Negative direction torque compensation value”, and Pr6.50 “Viscous friction compensation gain” are written in EEPROM in every 30 minutes. Upon re starting of power, auto tuning is performed using the data for initial values.

(4) Because the control gain is updated while the motor stops, changed setting value of Pr0.03 “Real-time auto-tuning stiffness setup” may not be reflected if the motor cannot stop due to excessively low gain or application of a command that directs the motor to turn in the same direction continuously. If the changed stiffness setting value is reflected after motor stops, it may generate abnormal sound or oscillate.
After changing stiffness, stop the motor and check to see that the new stiffness setting is made effective.

Invalidation of Real-Time Auto-Gain Tuning

You can stop the automatic calculation of Pr0.04 (Inertial ratio) and invalidate the real-time auto-gain tuning by setting up Pr0.02 (Real-time auto-gain tuning setup) to 0.
Because the estimation result of Pr0.04 Inertia ratio is recorded, if this parameter becomes abnormal value, manually set to the appropriate value which is obtained from suitable formula or calculation.

Caution If power is turned off within 30 minutes after the end of tuning process, the result of the real-time auto-tuning is not saved. If the result is not saved, manually write parameters to EEPROM and then turn off power.

Basic Gain Parameter Setup Table

Stiffness	1st gain/2nd gain				Command response		Adjustment filter	load variation suppression function
	Pr1.00 Pr1.05	Pr1.01 Pr1.06	Pr1.02 Pr1.07	Pr1.04 Pr1.09	Pr2.22		Pr6.48*1	Pr6.24
	Position loop [0.1 /s]	Velocity loop [0.1 Hz]	Velocity loop integration [0.1 ms]	Torque [0.01 ms]	Time constant [0.1 ms] Standard response mode	Time constant [0.1 ms] Quick response mode 1 to 3	Time constant [0.1 ms]	Load fluctuation compensation filter [0.01 ms]
0	20	15	3700	1500	1919	764	155	2500
1	25	20	2800	1100	1487	595	115	2500
2	30	25	2200	900	1214	486	94	2500
3	40	30	1900	800	960	384	84	2500
4	45	35	1600	600	838	335	64	2500
5	55	45	1200	500	668	267	54	2500
6	75	60	900	400	496	198	44	2500
7	95	75	700	300	394	158	34	2120
8	115	90	600	300	327	131	34	1770
9	140	110	500	200	268	107	24	1450
10	175	140	400	200	212	85	23	1140
11	320	180	310	126	139	55	16	880
12	390	220	250	103	113	45	13	720
13	480	270	210	84	92	37	11	590
14	630	350	160	65	71	28	9	450
15	720	400	140	57	62	25	8	400
16	900	500	120	45	50	20	7	320
17	1080	600	110	38	41	17	6	270
18	1350	750	90	30	33	13	5	210
19	1620	900	80	25	28	11	5	180
20	2060	1150	70	20	22	9	4	140
21	2510	1400	60	16	18	7	4	110
22	3050	1700	50	13	15	6	3	90
23	3770	2100	40	11	12	5	3	80
24	4490	2500	40	9	10	4	3	60
25	5000	2800	35	8	9	4	2	60
26	5600	3100	30	7	8	3	2	50
27	6100	3400	30	7	7	3	2	50
28	6600	3700	25	6	7	3	2	40
29	7200	4000	25	6	6	2	2	40
30	8100	4500	20	5	6	2	2	40
31	9000	5000	20	5	5	2	2	40

*1 The value of Pr6.48 Adjustment filter has additional value 1 for B to F frames.

Note

• P.3-39 to P.3-123... “Details of Parameter”

2. Real-Time Auto-Gain Tuning

Two-degree-of-freedom Control Mode – Synchronous Type

Outline

The Two-degree-of-freedom control mode has two types: standard type and synchronization type.

Standard type : This is a standard mode. Use this mode normally.

Synchronization type: Use this mode for locus control of multiple axes of an articulated robot, etc.

This item is an auto tuning function exclusive for the synchronization type.

Load characteristic of a machine is estimated on a real-time basis, and using the results, basic gain settings and load fluctuation compensation are automatically specified in accordance of hardness parameters.

Applicable Range

	Conditions for real-time auto tuning
Control Mode	Position Control Pr6.47 bit0=1 and bit3=1: Two-degree-of-freedom control mode Synchronization type
Others	•Should be in servo-on condition. •Input signals such as command input disable signals, and parameters except control parameters such as torque limit settings are correctly set, assuring that the motor can run smoothly.

Caution

•After the power is turned on, estimate value following may become quicker regardless of Pr6.31 “Real-time auto tuning estimation speed” until operation data effective for the estimation of load characteristics is sufficiently accumulated.

•When real-time auto-gain tuning is effective, an estimate value may become abnormal due to disturbance. If you want to obtain stable operation from when the power is turned on, it is recommended to disable the real-time auto-gain tuning.

Real-time auto-gain tuning may not be executed properly under the conditions described below.Under these conditions, change the load conditions or operation patterns, or start manual gain tuning (refer to P.5-35 and subsequent).

	Conditions which obstruct real-time auto-gain tuning
Load condition	•The load mass is too small or large with reference to the rotor mass (smaller than three times or 20 times or larger). •The load mass varies. •The mechanical stiffness is extremely low. •Any non-linear characteristic exists such as backlash.
Action pattern	•Continuous use at a low speed of less than 100 [mm/s] •The acceleration is low at 2000 [mm/s] per 1 [s]. •A speed at 100 [mm/s] or higher or a acceleration/deceleration of 2000 [mm/s] per 1 [s] does not continue for 50 [ms] or longer. •The acceleration/deceleration torque is small with reference to the uneven load/ viscous friction torque.

How to Operate

When Pr0.02 “Real-time auto-gain tuning setup” is set to a value other than 0, control parameter is automatically set according to Pr0.03 “Selection of machine stiffness at real-time auto-gain tuning” or Pr6.10 “Function expansion setup” bit14, the control parameters are automatically set .
Enter an operation command when about 100 ms has elapsed after the servo was turned ON.
When the load characteristic is correctly estimated, Pr0.04 “Inertia ratio” is updated. With certain mode settings, Pr6.07 “Torque command additional value”, Pr6.08 “Positive direction torque compensation value”, Pr6.09 “Negative direction torque compensation value”, and Pr6.50 “Viscous friction compensation gain” will also be changed.
When the value of Pr0.03 “Selection of machine stiffness at real-time auto-gain tuning” is in creased, the motor responsiveness will be improved. Determine the most appropriate stiffness in relation to the positioning setup time and vibration condition.

Parameters Controlling Operation of Real-time Auto Tuning

● **Configure the real-time auto tuning operation by setting the following parameters.**

<table>
<tr><th>Class</th><th>No.</th><th>Title</th><th colspan="3">Function</th></tr>
<tr><td rowspan="9">0</td><td rowspan="9">02</td><td rowspan="9">Real-time auto-gain tuning setup</td><td colspan="3">Specifies the operation mode of real-time auto tuning.</td></tr>
<tr><td>Setting</td><td>Mode</td><td>Description</td></tr>
<tr><td>0</td><td>Invalid</td><td>The real-time auto tuning function is disabled.</td></tr>
<tr><td>1</td><td>Synchronization</td><td>Mode for synchronization control.Offset load compensation and friction compensation are not performed. The command filter will be maintained. Use this mode first. If there is any problem, use the other mode.</td></tr>
<tr><td>2</td><td>Synchronous friction compensation</td><td>In addition to the synchronization mode, dynamic friction/viscous friction compensation is applied. Use this mode for a load with large friction.</td></tr>
<tr><td>3</td><td>Stiffness setup</td><td>Inertia ratio estimation, offset load compensation, and friction compensation are not performed, and only the gain filter setup corresponding to the stiffness table is updated.
For a load with large inertia variations, estimate the inertia in the synchronization mode, etc., and then use this mode.</td></tr>
<tr><td>4</td><td>Load characteristic update</td><td>In the gain filter setup, only the inertia ratio and dynamic friction/viscous friction compensation are applied among load characteristics.</td></tr>
<tr><td>5</td><td>Load characteristic measurement</td><td>Basic gain settings and friction compensation settings are not changed and load characteristic estimation only is made. This is used in combination with set-up support software (PANATERM).</td></tr>
<tr><td>6</td><td>Load change support mode</td><td>Use this mode to make robust adjustments in load change.</td></tr>
<tr><td>0</td><td>03</td><td>Selection of machine stiffness at real-time auto-gain tuning</td><td colspan="3">Specifies the response for enabled real-time auto tuning.
A larger setting increases the speed response and servo stiffness but invites more vibration.
Gradually increase the setting while monitoring the operation.</td></tr>
<tr><td>6</td><td>10</td><td>Function expansion setup</td><td colspan="3">The automatic adjustment of load change inhibit function is enabled with bit14=1.</td></tr>
</table>

Parameters Controlling Operation of Real-time Auto Tuning

<table>
<tr><th>Class</th><th>No.</th><th>Title</th><th>Function</th></tr>
<tr><td>6</td><td>31</td><td>Real time auto tuning estimation speed</td><td>Specifies the load characteristics estimation speed for enabled real-time auto tuning. A larger setting allows faster follow-up to the variation in the load characteristics but also increases estimation fluctuation due to disturbance. The result of estimation is stored in the EEPROM every 30 minutes.
<table>
<tr><th>Setting</th><th>Mode</th><th>Description</th></tr>
<tr><td>0</td><td>No change</td><td>Terminates estimation of load characteristic.</td></tr>
<tr><td>1</td><td>Little change</td><td>Responded against change of load characteristic on the order of minutes.</td></tr>
<tr><td>2</td><td>Gradual change</td><td>Responded against change of load characteristic on the order of seconds.</td></tr>
<tr><td>3 *</td><td>Steep change</td><td>Appropriate estimation is made against change of load characteristic.</td></tr>
</table>
* If oscillation automatic detection is made valid from set-up support software (PANATERM), this setting is ignored and operation is based on settings of setting value 3.</td></tr>
<tr><td>6</td><td>32</td><td>Real time auto tuning custom setup</td><td>Not available in two-degrees-of-freedom control mode. Always set to 0.</td></tr>
</table>

Parameters Changed by Real-time Auto-tuning

● Parameters which are updated

The real-time auto-tuning function updates the following parameters according to Pr0.02 “Real-time auto-gain tuning setup” by using the load characteristic estimate value.

<table>
<tr><th>Class</th><th>No.</th><th>Title</th><th>Function</th></tr>
<tr><td>0</td><td>04</td><td>Inertia ratio</td><td>In the synchronous mode (Pr0.02 = 1), synchronous friction compensation mode (Pr0.02 = 2) and load characteristic update mode (Pr0.02 = 4), this parameter will be updated.</td></tr>
<tr><td>6</td><td>08</td><td>Positive direction torque compensation value</td><td rowspan="3">In the synchronous friction compensation mode (Pr0.02 = 2) and load characteristic update mode (Pr0.02 = 4), this parameter will be updated.</td></tr>
<tr><td>6</td><td>09</td><td>Negative direction torque compensation value</td></tr>
<tr><td>6</td><td>50</td><td>Viscous friction compensation gain</td></tr>
</table>

● Parameters which are updated to setup value corresponding to stiffness setup

The real-time auto tuning function updates the following basic gain setup parameters according to Pr0.03 “Selection of machine stiffness at real-time auto-gain tuning”.

<table>
<tr><th>Class</th><th>No.</th><th>Title</th><th>Function</th></tr>
<tr><td>1</td><td>00</td><td>1st gain of position loop</td><td rowspan="9">In the case of the synchronization mode, synchronous friction compensation mode, stiffness setup mode, or load change support mode (Pr0.02=1 to 3, 6), updates the parameter based on the setup value.</td></tr>
<tr><td>1</td><td>01</td><td>1st gain of velocity loop</td></tr>
<tr><td>1</td><td>02</td><td>1st time constant of velocity loop integration</td></tr>
<tr><td>1</td><td>04</td><td>1st time constant of torque filter</td></tr>
<tr><td>1</td><td>05</td><td>2nd gain of position loop</td></tr>
<tr><td>1</td><td>06</td><td>2nd gain of velocity loop</td></tr>
<tr><td>1</td><td>07</td><td>2nd time constant of velocity loop integration</td></tr>
<tr><td>1</td><td>09</td><td>2nd time constant of torque filter</td></tr>
<tr><td>6</td><td>48</td><td>Adjust filter</td></tr>
</table>

● **Parameters which are set to fixed value**

The real-time auto-tuning function sets the following parameters to fixed values or uses the current setup values.

Class	No.	Title	Function
1	03	1st filter of speed detection	0
1	08	2nd filter of speed detection	
1	10	Velocity feed forward gain	1000 (100 %)
1	11	Velocity feed forward filter	0
1	12	Torque feed forward gain	1000 (100 %)
1	13	Torque feed forward filter	0
2	22	Command smoothing filter	Holds the current setup value. *1
6	07	Torque command additional value	0
6	10	Function expansion setup	bit4=1
6	49	Adjust/Torque command attenuation term	Ten digits set as 1 and ones digit is kept as is.

*1 If noise generates, change the setting to appropriate value (e.g. 3 ms = setup value: 30).

● **Parameters which are set in respons to gain switching setup**

The real-time auto-tuning function sets the following parameters according to Pr0.02 Real-time auto-tuning setup, or uses current setup values.

Class	No.	Title	Function
1	14	2nd gain setup	Sets to 1 if the case of the synchronization mode, synchronous friction compensation mode, stiffness setup mode, or load change support mode (Pr0.02=1 to 3, 6).
1	15	Mode of position control switching	Sets to 10 if the case of the synchronization mode, synchronous friction compensation mode, stiffness setup mode, or load change support mode (Pr0.02=1 to 3, 6).
1	16	Delay time of position control switching	Sets to 0 if the case of the synchronization mode, synchronous friction compensation mode, stiffness setup mode, or load change support mode (Pr0.02=1 to 3, 6).
1	17	Level of position control switching	Sets to 0 if the case of the synchronization mode, synchronous friction compensation mode, stiffness setup mode, or load change support mode (Pr0.02=1 to 3, 6).
1	18	Hysteresis at position control switching	
1	19	Position gain switching time	Sets to 10 if the case of the synchronization mode, synchronous friction compensation mode, stiffness setup mode, or load change support mode (Pr0.02=1 to 3, 6).
1	20	Mode of velocity control switching	Sets to 0 if the case of the synchronization mode, synchronous friction compensation mode, stiffness setup mode, or load change support mode (Pr0.02=1 to 3, 6).
1	21	Delay time of velocity control switching	
1	22	Level of velocity control switching	
1	23	Hysteresis at velocity control switching	
1	24	Mode of torque control switching	
1	25	Delay time of torque control switching	
1	26	Level of torque control switching	
1	27	Hysteresis at torque control switching	
6	05	Position 3rd gain valid time	When the real-time auto-tuning remains valid (Pr0.02 = 1 to 4,6), uses the current setup value.
6	06	Position 3rd gain scale factor	

● Parameters which are automatic set by Load variation suppression function

In case Pr 0.02 “Real-time auto-gain tuning setup” = 1 to 4, the following settings and parameters are set automatic for enable/disable state of Pr 6.10 “Function expansion setup” load variation suppression function automatic adjustment.

Class	No.	Title	Function
6	10	Function extension setup	When set to Pr 6.10 bit0=1, load variation suppression function will become enabled (bit1 = 1). When set to Pr 6.10 bit14=0,it is disabled(bit1 = 0).
6	23	Load change compensation gain	When set to Pr 6.10 bit14=1, sets to 90 %. When set to Pr 6.10 bit14=0, set to 0 %
6	24	Load change compensation filter	When set to Pr 6.10 bit14=1, updates to match rigidity. When set to Pr 6.10 bit14=0, value is held.
6	73	Load estimation filter	When set to Pr6.10 bit14=1 in case of stiffnesssetting is enabled.ses to 0.13 ms.When set toPr6.10 bit14=0,set to 0 ms.
6	74	Torque compensation frequency 1	Regardless value of the Pr6.10 bit14,sets to 0.
6	75	Torque compensation frequency 2	Regardless value of the Pr6.10 bit14,sets to 0.
6	76	Load estimation count	When set to Pr6.10 bit14=1 in case of stiffnesssetting is enabled,sets to 4. When set to Pr6.10 bit14=0,set to 0.

In case Pr 0.02 “Real-time auto-gain tuning setup” = 6 (load fluctuation response mode), the setting will be changed to the following.

Class	No.	Title	Function
6	10	Function extension setup	Load fluctuation suppression function always become enabled (bit1 = 1, bit2=1, bit14=1).
6	23	Load change compensation gain	Sets to 100 %.
6	24	Load change compensation filter	Updates to match rigidity.
6	73	Load estimation filter	Sets to 0.13 ms.
6	74	Torque compensation frequency 1	Updates to match rigidity.
6	75	Torque compensation frequency 2	Updates to match rigidity.
6	76	Load estimation count	Sets to 4.

Caution

(1) Immediately after the first servo-on upon start up; or after increasing Pr0.03 “Selection of machine stiffness at real-time auto-gain tuning”, abnormal sound or oscillation may be generated until the load characteristics estimation is stabilized. It is not an abnormality if the load characteristic estimation is stabilized soon. If oscillation or abnormal sound lasts or repeats for 3 or more reciprocating operations, however, take the following counter-measures.
   1) Lower the setting value of Pr0.03 “Selection of machine stiffness at real-time auto-gain tuning”.
   2) Set Pr0.02 “Real-time auto-gain tuning setup” to 0 to disable the real-time auto-tuning.
   3) Set Pr 0.04 “Inertial ratio” to the calculational value of the equipment and set Pr6.07 “Torque command additional value”, Pr6.08 “Positive direction torque compensation value”, Pr6.09 “Negative direction torque compensation value”, and Pr6.50 “Viscous friction compensation gain” to 0.
   4) Disabling the load variation suppression function. (Pr6.10 bit14 = 0 and it was after bit1 = 0)

(2) When abnormal noise and oscillation occurs, Pr0.04 “Inertia ratio”, Pr6.07 “Torque command additional value”, Pr6.08 “Positive direction torque compensation value”, Pr6.09 “Negative direction torque compensation value”, and Pr6.50 “Viscous friction compensation gain” might have changed to extreme values. Take the same measures as described in step 3) above in these cases.

(3) Among the results of real-time auto-gain tuning, Pr0.04 “Inertia ratio”, Pr6.07 “Torque command additional value”, Pr6.08 “Positive direction torque compensation value”, Pr6.09 “Negative direction torque compensation value”, and Pr6.50 “Viscous friction compensation gain” will be written to EEPROM every 30 minutes. When you turn on the power again, auto-tuning will be executed using the latest data as initial values. If power is turned off within 30 minutes after the end of the tuning process, the result of the real-time auto-gain tuning is not saved.

(4) The control gain is updated when the motor is stopped. Therefore, if the motor is not stopped because gain is excessively low or commands are given continually in one direction, the change in the set value for Pr0.03 “Selection of machine stiffness at real-time auto-gain tuning” may not be reflected. In this case, abnormal sound or oscillation may be generated depending on the stiffness setting that is reflected after the motor stops.
   After the stiffness setting is changed, be sure to stop the motor once and check that the stiffness setting has been reflected before performing the next operation.

.

Invalidation of Real-Time Auto-Gain Tuning

You can stop the automatic calculation of Pr0.04 (Inertial ratio) and invalidate the real-time auto-gain tuning by setting up Pr0.02 (Real-time auto-gain tuning setup) to 0.
Because the estimation result of Pr0.04 Inertia ratio is recorded, if this parameter becomes abnormal value, manually set to the appropriate value which is obtained from suitable formula or calculation.

Caution If power is turned off within 30 minutes after the end of tuning process, the result of the real-time auto-tuning is not saved. If the result is not saved, manually write parameters to EEPROM and then turn off power.

Basic Gain Parameter Setup Table

Stiffness	1st gain/2nd gain				Adjustment filter	load variation suppression function	For load variation support mode (Pr0.02 = 6) only			
	Pr1.00 Pr1.05	Pr1.01 Pr1.06	Pr1.02 Pr1.07	Pr1.04 Pr1.09	Pr6.48*1	Pr6.24	Pr1.00 Pr1.05	Pr6.24	Pr6.74	Pr6.75
	Position loop [0.1 /s]	Velocity loop [0.1 Hz]	Velocity loop integration [0.1 ms]	Torque [0.01 ms]	Time constant [0.1 ms]	Load fiuctuation compensation filter [0.01 ms]	Position loop [0.1 /s]	Load fiuctuation compensation filter [0.01 ms]	Torque compensation ferquecy1 [0.1 Hz]	Torque compensation ferquecy2 [0.1 Hz]
0	20	15	3700	1500	155	2500	15	1300	25	10
1	25	20	2800	1100	115	2500	20	990	34	10
2	30	25	2200	900	94	2500	25	800	42	12
3	40	30	1900	800	84	2500	30	660	51	15
4	45	35	1600	600	64	2500	35	570	59	17
5	55	45	1200	500	54	2500	45	440	76	22
6	75	60	900	400	44	2500	60	330	104	30
7	95	75	700	300	34	2120	75	270	129	37
8	115	90	600	300	34	1770	90	220	153	44
9	140	110	500	200	24	1450	110	180	184	53
10	175	140	400	200	23	1140	140	140	231	66
11	320	180	310	126	16	880	180	110	290	83
12	390	220	250	103	13	720	220	90	346	99
13	480	270	210	84	11	590	270	70	413	118
14	630	350	160	65	9	450	350	60	512	146
15	720	400	140	57	8	400	400	50	570	163
16	900	500	120	45	7	320	500	40	678	194
17	1080	600	110	38	6	270	600	40	678	194
18	1350	750	90	30	5	210	750	40	678	194
19	1620	900	80	25	5	180	900	40	678	194
20	2060	1150	70	20	4	140	1150	40	678	194
21	2510	1400	60	16	4	110	1400	40	678	194
22	3050	1700	50	13	3	90	1700	40	678	194
23	3770	2100	40	11	3	80	2100	40	678	194
24	4490	2500	40	9	3	60	2500	40	678	194
25	5000	2800	35	8	2	60	2800	40	678	194
26	5600	3100	30	7	2	50	3100	40	678	194
27	6100	3400	30	7	2	50	3400	40	678	194
28	6600	3700	25	6	2	40	3700	40	678	194
29	7200	4000	25	6	2	40	4000	40	678	194
30	8100	4500	20	5	2	40	4500	40	678	194
31	9000	5000	20	5	2	40	5000	40	678	194

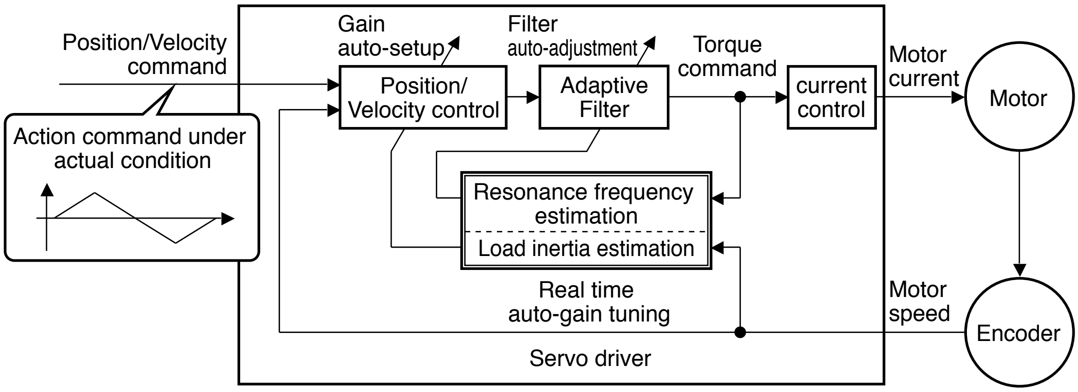
*1 The value of Pr6.48 Adjustment filter has additional value 1 for B to F frames.

3. Adaptive Filter

Adaptive Filter

Outline

This function estimates the resonance frequency from the vibrating component which appears on the motor velocity, and removes the resonance component from the torque command with adaptive filter, thus reduces the resonance vibration.



Applicable Range

This function works under the following condition.

	Conditions under which the Adaptive filter is activated
Control Mode	• Applies to other control modes than torque control.
Others	• Should be servo-on status. • Elements other than control parameters, such as deviation counter clear command inhibit and torque limit are appropriately set, enabling the motor to run normally.

Caution

In the following condition, normal operation may not be expected - manually set the notch filter to prevent resonance.

	Conditions which obstruct adaptive filter action
Resonance point	• Resonance frequency is lower than 3 times. • Resonance peak is low, or control gain is low where the motor speed is not affected by this. • Multiple resonance of 3 or more points exist.
Load	• Motor velocity variation with high harmonic component is generated due to non-linear factors such as backlash.
Command pattern	• Acceleration/deceleration is rapid such as 30000[r/min] per 1[s].

How to Operate

Enter the action command with Pr2.00 Adaptive filter mode set to a value other than 0.
If the resonance point affects the motor speed, parameters of 3rd notch filter and/or 4th notch filters are automatically set according to the number of adaptive filters.

Set the operation of the adaptive filter to the following parameter.When changing mode, set to 0(Invalid) or 4(Clear) temporarily.

Class	No.	Title	Setup value	Function
2	00	Adaptive filter mode setup	0	**[Adaptive filter: invalid]** The adaptive filter is disabled. Parameters related to the 3rd and 4th notch filter hold the current value.
			1	**[Adaptive filter: 1 filter is valid]** One adaptive filter is enabled. Parameters related to the 3rd notch filter will be updated based on adaptive performance.
			2	**[Adaptive filter: 2 filters are valid]** Two adaptive filters are enabled. Parameters related to the 3rd and 4th notch filters will be updated based on adaptive performance.
			3	**[Resonance frequency measurement mode]** Measure the resonance frequency. Result of measurement can be checked with PANATERM. Parameters related to the 3rd and 4th notch filter hold the current value.
			4	**[Clear result of adaptation]** Parameters related to the 3rd and 4th notch filter are disabled and results of adaptive operation are cleared.
			5	**[High-precision adaptive filter]** Two adaptive filters are enabled. Parameters related to the 3rd and 4th notch filters will be updated based on the results of adaptive performance. Use of this setup value is recommended when using 2 adaptive filters.
			6	**[For manufacturer's use]** PANATERM's fit gain function used internally. Do not use this setup value in the normal condition.

At the same time, the following parameters are automatically set.

Class	No.	Title	Function
2	07	3rd notch frequency	In no resonance point is found, the frequency is set to 5000.
2	08	3rd notch width selection	Automatically set when the adaptive filter is active.
2	09	3rd notch depth selection	
2	10	4th notch frequency	Notch frequency is automatically set to the 2nd resonance frequency estimated by the adaptive filter. In no resonance point is found, the frequency is set to 5000.
2	11	4th notch width selection	Automatically set when 2 adaptive filters are active.
2	12	4th notch depth selection	

Related page
• P.3-54 ... “Details of Parameter”
• P.5-39 ... “Manual Gain Tuning(Basic) Suppression of Mechine Resonance”

Caution

(1) Immediately after the first servo-on at start up; or after increasing stiffness setting with the real-time auto-tuning enabled, abnormal sound or oscillation may be generated until the adaptive filter stabilizes. If such abnormality lasts or repeats for 3 or more reciprocating operations, take the following countermeasures.
   1) Write the parameters which have given the normal operation into EEPROM.
   2) Lower the setting value of Pr0.03 “Selection of machine stiffness at real-time auto-gain tuning”.
   3) Invalidate the adaptive filter by setting Pr2.00 “Adaptive filter mode setup” to 0.
   4) Set up the notch filter manually.

(2) Abnormal sound or oscillation may excessively change the setup value of 3rd and 4th notch filters. If such change occurs, disable the adaptive filter as described in step 3) above, change setup value of Pr 2.07 “3rd notch frequency” and Pr 2.10 “4th notch frequency” to 5000 (disable), and then enable the adaptive filter again.

③ The 3rd filters (Pr 2.07 to Pr 2.09) and 4th notch filters (Pr 2.10 to Pr 2.12) are written to EEPROM every 30minutes. Upon power up, these data are used as default values during adaptive process.

Related page • P.3-39 ... “Details of Parameter”

4. Manual Gain Tuning (Basic)

Outline

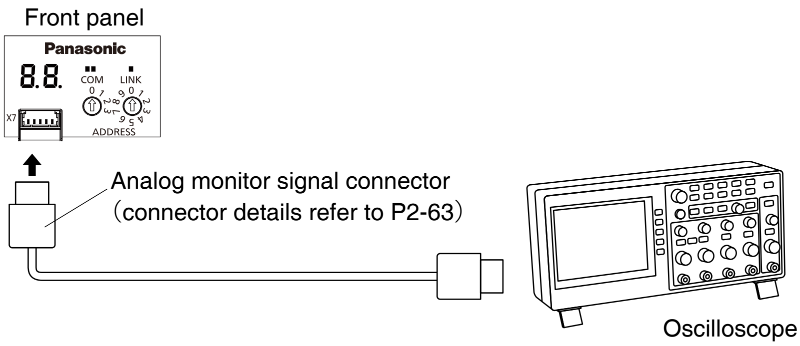
On the MINAS A6N series have the auto tuning gain function, when the constraints of load conditions such as auto gain tuning gain adjustment can not be performed, the best response to the individual, or the load is that if you want to achieve stability and need to be readjusted.
In this case, the control mode is divided into every function of this manual gain tuning method are described.

In the Prior Manual Adjustment

Which is installed in a personal computer, a communication USB (PANATERM) using waveform graphic function waveform observation and the analog voltage waveform to measure and monitor function, can be quickly adjusted.

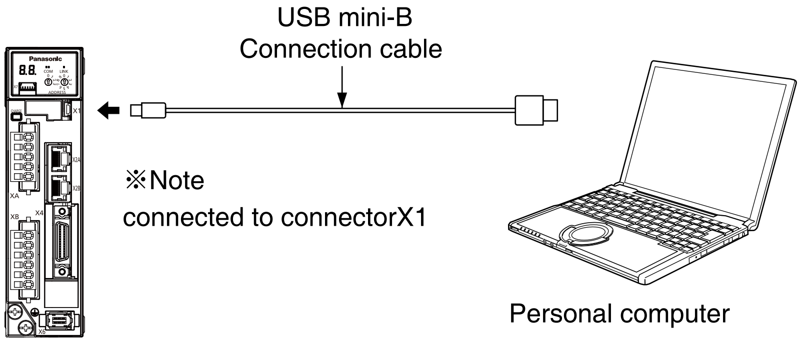
1. Analog monitor output

The actual motor speed, torque, speed, speed difference, an analog voltage pulse can be measured by using an oscilloscope.
Set to type of output single and output voltage level by the setting of Pr4.16 ～ Pr4.21.



2. Waveform graphic function of “PANATERM”

For command of motor, the motion of motor(motor speed, torque command and the error pulse) as the waveform on the display of the personal computer. Refer to P.7-9 “Outline of Setup Support Software “PANATERM” ” .



Caution Setup support software “PANATERM” download from our web site.

Related page •P.3-39...“Details of Parameter” •P.7-9 “Outline of Setup Surport Software “PANATERM” ”

position control of MINAS-A6N series as shown in P.3-12 position mode control block diagram.

Here, in the case of not using the position control mode switching function to gain the basic procedure to gain adjustment. The following procedure is adjusted.

① Initial setup of the parameters

The following parameters return to factory setting value.

（unit is a unit recorded in P.3-17 ～ 21）

Panaterm No. (Pr□□)	Title of parameter	value	
		A~C type	D~H type
0.02	Setup of real time auto-gain tuning mode	0	
0.04	Inertia ratio	100	
1.00	1st gain of position loop	480	320
1.01	1st gain of velocity loop	270	180
1.02	1st gain of velocity loop	210	310
1.03	1st filter of velocity detection	0	
1.04	1st time constant of torque filter time	84	126
1.14	2nd gain setup	0	

Panaterm No. (Pr□□)	Title of parameter	value
2.00	Adaptive filter setup mode	0
2.01	1st notch frequency	5000
2.02	1st notch width selection	2
2.03	1st notch depth selection	0
2.04	2nd notch frequency	5000
2.05	2nd notch width selection	2
2.06	2nd notch depth selection	0
2.07	3st notch frequency	5000
2.08	3st notch width selection	2
2.09	3st notch depth selection	0
2.10	4st notch frequency	5000
2.11	4st notch width selection	2
2.12	4st notch depth selection	0

- Even if the factory setting value above table also happen vibration,please reduce 1st velocity gain gain Pr1.01 and 1st position loop gain Pr1.00 to 50.

②Setup of inertia ratio

Please set to inertia ratio（Pr0.04）.

- When using the automatic gain adjustment function to determine the inertia ratio（Pr0.04）,use the original setting value of Pr0.04.
- Please input the calculater value when the inertia ratio is already known by the calculation of the load etc.

③Check to motor action

Operating motor,please check to whether there is abnormal.

- Check to it by the above analog monitor and waveform graphic functions of “PANATERM” etc.
- If there is no exception when stop（servo lock）and action,action by step ④.

④Velocity loop gain adjustment

Caution

Please increase 1st velocity loop gain（Pr1.01）to 100 [0.1 Hz].

- Increase 1st position loop gain(Pr1.00) to she same value.

  Please change parameter when motor stops.
- Check to whether there is abnormal,if there is no exception to continue step ⑤.
- When the vibration or oscillation occurs, if 1st velocity loop gain(Pr1.01) down to about 80 %,1st position loop gain (Pr1.00) reduces to the same value,continue step ⑤.

⑤ Setup of torque filter time constant value

Please set to torque filter time constant(Pr1.04) as the following equation.
(Cutoff frequency of torque filter [Hz])×4 ≧ (Cutoff frequency of velocity loop[Hz])
If the action sound is loud,please increase by 10 [0.01 ms].
If you want to response as soon as possible,please each reduce by 10 [0.01 ms], increase 1st velocity loop gain（Pr1.04）.

- cutoff frequency of torque filter can be calculated by the following formula.
  cutoff frequency[Hz] = 1/(2π×Pr1.04[0.01 ms]×0.00001)
- When the inertia ratio(Pr0.04) is set correctly,the value of 1st velocity loop gain(Pr1.01) is cutoff frequency [Hz].

⑥ Setup of 1st velocity detection filter

If you want to response as soon as possible,please reduce 1st velocity detection filter（Pr1.03）,increase 1st velocity loop gain（Pr1.01）.Please usually use 0.

⑦ Setup of 1st position loop gain

Please set 1st positon loop gain（Pr1.00）to 1st velocity loop gain（Pr1.01）×1.5.

- When Motor action, check to positioning settling time by Analog monitor output and waveform detection function of “PANATERM” ect, then make fine adjustment.
- If increase the value,the positioning settling time can be accelerated, but please be careful that if the value is too large, the oscillation or vibration can occur. If the vibration or oscillation occurs,please reduce 1st position loop gain(Pr1.00) to 80%.
- If want to shorten the positioning settling time,please continue step ⑧.

Caution Please change parameter when motor stops.

⑧ Setup of 1st velocity loop integration time constant

Please reduce integration time constant of 1st velocity loop（Pr1.02）from the following initial value.

- Initial value : Pr1.02 [0.1 ms] = 1500000/(2π×Pr1.01[0.1 Hz])
- Descent range : ....Pr1.02 [0.1 ms] ≧ 300 100 one by one
  300 ＞ Pr1.02 [0.1 ms] ≧ 150.........50 one by one
  Pr1.02 [0.1 ms] ＜ 150 ....10 one by one
- If reduce 1st velocity loop integration time constant, the deviation of positioning setting can be close to 0 quickly, but it is possible that the time for the first time to reach the setting width becomes slow.
  In this case, using the gain switching function, can improve this phenomenonby setting 2nd velocity loop integration time constant（Pr.1A）to 1000（invalid）.
- Want to further reduce the positioning settling time, please go back to step ④ to adjust 1st velocity loop gain.
  When if increase 1st velocity loop gain,the vibration or oscillation occurs, after set ⑨ notch filter, go back to step ④ to adjust 1st velocity loop gain.

Related page • P.3-39 ... “Details of Parameter” • P.3-12 ... “Block Diagram of Control Mode”

⑨ **Setup of notch filter**

Please determine the vibration frequency of torque command by analog monitor output wavegraphic function or FFT of "PANATERM" .

- Please refer to P.5-25 for the measurement of frequency characteristics of "PANATERM".
- For the measured vibration frequency, please carry out countermeasure of (A) ~ (C).
- After carring out countermeasure, because even if increase 1st velocity loop gain(Pr1.01) the oscillation or vibration will converge,so please go to back step ④ to check again. Compared to before and after, continue to adjust by increase the value of 1st velocity loop gain.

(A) The vibration frequency is above 1.5 kHz

Please increase 1st torque filter time constant (Pr1.04) .

- Take the formuka recorded in ⑤ as target, Until the allowable vibration value is increased.
- If 1st torque filter time constant (Pr1.04) is set too large, low frequency vibration may exacerbate. At this poin please reduce 1st velocity loop gain (Pr1.01) .

(B) The vibration frequency is 600 Hz ~ 1500 Hz

Please set vibration frequency in 1st notch frequency(Pr2.01).

- If the vibration does not decrease, please fine adjust the value of 1st notch frequency(Pr2.01).
- resonance peak can be measured by FFT of "PANATERM".To reduce the resonance peak so as to set up the notch filter. In the case of multiple resonance peak, please set vibration frequency to 2nd ~ 4th notch frequency (Pr2.04, 2.07, 2.10) .
  In the event of more than 600 Hz vibration, please increase 1st torque filter time constant (Pr1.04) .

(C) The vibration frequency is 400 ~ 600 Hz

Determine the resonance frequency by FFT of "PANATERM", please set the resonance frequency to 1st notch frequency (Pr2.01) .

- After set the value of 1st notch frequency (Pr2.01), detemine frequency characteristic again, check to resonance peak reduction related matters.
- If the resonance peak does not decrease, adjust 1st notch frequency (Pr2.01)、1st notch width selection(Pr2.02)、1st notch depth selection(Pr2.03) to decrease resonance peak.
- When resonance peak is in the low frequency, for the vibration that is lower than the anti resonance frequency, reduce to the value of 1st velocity loop gain (Pr1.01) .
- When the resonance frequency is 350 ~ 450 Hz, increse to 1st velocity loop gain (Pr1.01) , if the vibration occurs, please set to the notch filter . The vibration may be decreased.
- If the vibration does not decrease, The notch filter is disabled.
  At this point, the 1st velocity loop gain(Pr1.01) reaches the upper limit.

Related page • P.3-39 ... "Details of Parameter" • P.3-12 ... "Block Diagram of Control Mode"

4. Manual Gain Tuning (Basic)

Adjustment in Velocity Control Mode

Velocity control of MINAS-A6N series is described in Block Diagram of P.3-13 of Velocity Control Mode.
Adjustment in velocity control is almost same as that in position control described in "Adjustment in Position Control Mode", and make adjustments of parameters per the procedures except the gain setup of position loop gain (Pr1.00).

5 Adjustment

4. Manual Gain Tuning (Basic)

Adjustment in Torque Control Mode

Torque control of MINAS-A6N series is described in P.3-14, "Block Diagram" of Torque Control Mode.
This torque control is based on velocity control while making Pr3.21 [Speed limit value 1], Pr3.22 [Speed limit value 2] input as a speed limit. Here we explain the setup of speed limiting value.

■ Setup of speed limiting value

The torque command selection (Pr3.17) specifies the setup method.		
Pr3.17 = 0	Set up by using speed limit value 1 (Pr3.21)	
Pr3.17 = 1	SL_SW = 0 …speed limit value 1 (Pr3.21)	
	SL_SW = 1…Set up by using speed limit value 2 (Pr3.22)	
RTEX Communication command SL_SW (speed limit switch command)		

- When the motor speed approaches to the speed limiting value, torque control following the analog torque command shifts to velocity control based on the speed limiting value.
- In order to stabilize the movement under the speed limiting, you are required to set up the parameters according to the above-mentioned "Adjustment in Velocity Control Mode".
- When the speed limiting value is too low or the velocity loop gain is too low, or when the time constant of the velocity loop integration is 10000 (invalid), the input to the torque limiting portion of the above fig. becomes small and the output torque may not be generated as the analog torque command.

Related page •P.2-47 "Wiring to the Connector,X4"

Gain Switching Function

Outline

By selecting appropriate gain based on internal data or external signal, the following effects can be obtained.

- Decrease the gain at the time of stoppage (servo lock) to reduce vibration.
- Increase the gain at the time of stoppage (setting) to shorten the settling time.
- Increase the gain during operation to improve command compliance.
- Based on condition of the equipment, change the gain with external signal.

Relevant Parameters

A6N series is which can use gain switching function of position,Velocity and torque control mode.

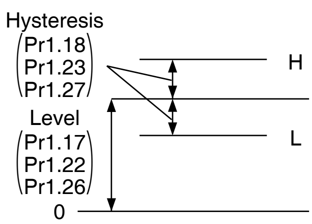
Class	No.	Parameter name	Function
1	05～09	setting value of 2nd gain	Set the 2nd gain value of the gain switching function.
1	14	2nd gain setup	Using the gain switching function Valid/ Invalid.
1	15～19	The condition setup of mode of position control switching	Set up the triggering condition of gain switching for position control.
1	20～23	The condition setup of mode of velocity control switching	For velocity controlling: Set the condition to trigger gain switching.
1	24～27	The condition setup of mode of torque control switching	For torque controlling: Set the condition to trigger gain switching.

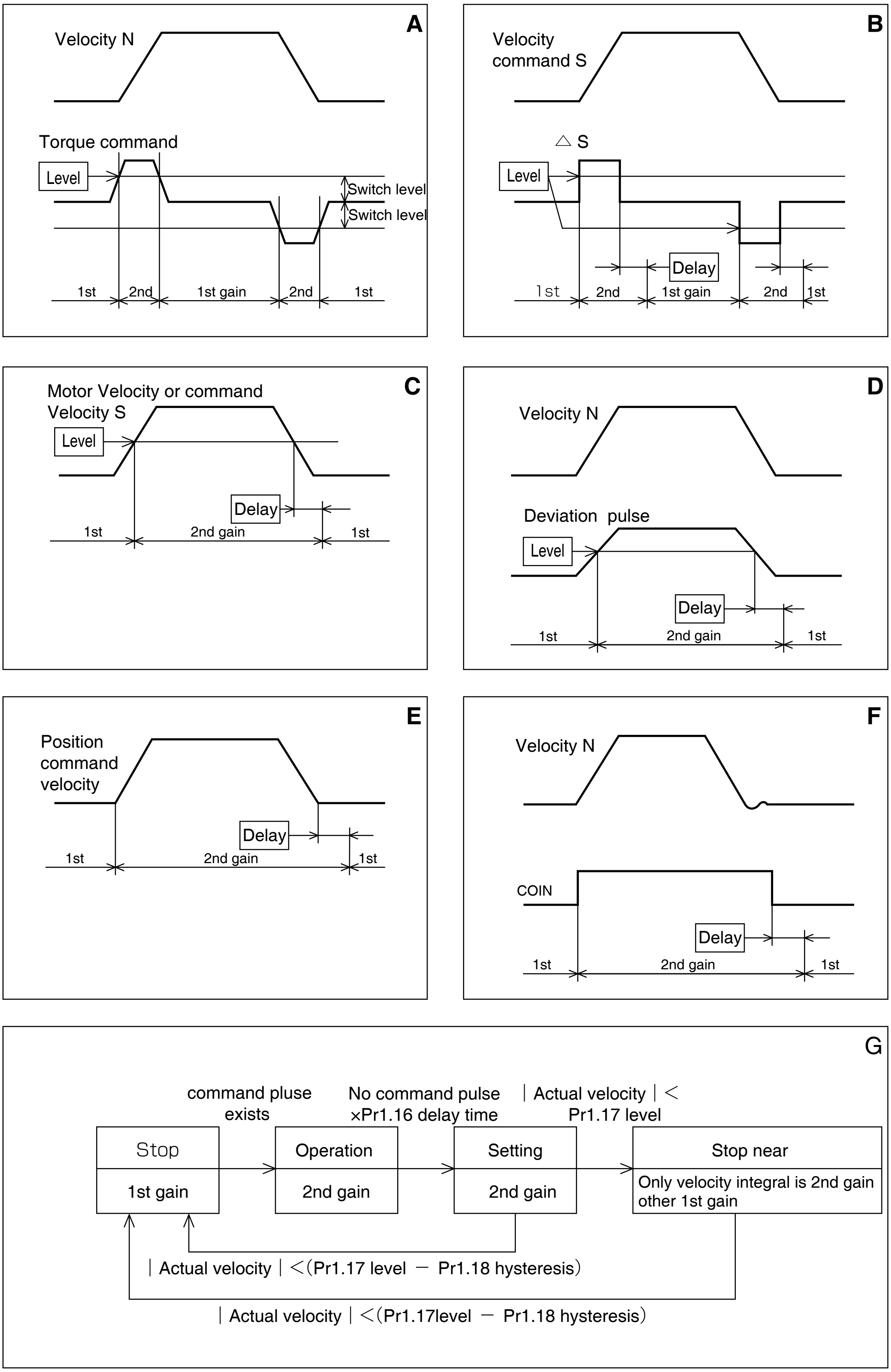
Setup of Gain Switching Condition

The choice of the gain switching mode, the operation conditions of the equipment shall be used to fit mode.
(Depending on switching mode, the ssetting time becomes large.)
Refer to graph A to G of P.5-37,set each of gain switching mode by parameter.
Parameter units refer to the following table.

Gain switching mode				P.5-37 graph	Paramter unit								
parameter setting value			Switching condition to 2nd gain		Position			Velocity			torque		
Position	Velocity	Torque			Delay time*1	Level	Hysteresis *2	Delay time*1	Level	Hysteresis *2	Delay time*1	Level	Hysteresis *2
Pr1.15	Pr1.20	Pr1.24			Pr1.16	Pr1.17	Pr1.18	Pr1.21	Pr1.22	Pr1.23	Pr1.25	Pr1.26	Pr1.27
0	0	0	Fixed to 1st gain	–	Invalid*6			Invalid*6			Invalid*6		
1	1	1	Fixed to 2nd gain	–	Invalid*6			Invalid*6			Invalid*6		
2	2	2	RTEX communication gain switching command	–	Invalid*6			Invalid*6			Invalid*6		
3	3	3	Torque command	A	[0.1 ms]	[%]	[%]	[0.1 ms]	[%]	[%]	[0.1 ms]	[%]	[%]
–*7	4	–	The Velocity change command	B	Invalid*7			Invalid	[10 (r/min)/s]*4	[10 (r/min)/s]*4	Invalid		
5	5	–	Velocity command	C	[0.1 ms]	[r/min]	[r/min]	[0.1 ms]	[r/min]	[r/min]	Invalid		
6	–	–	Position deviation	D	[0.1 ms]	[pulse]*3	[pulse]*3	Invalid			Invalid		
7	–	–	Position command exists	E	[0.1 ms]	Invalid		Invalid			Invalid		
8	–	–	Not in positioning complete	F	[0.1 ms]	Invalid		Invalid			Invalid		
9	–	–	Actual speed	C	[0.1 ms]	[r/min]	[r/min]	Invalid			Invalid		
10	–	–	Position command exists + Actual speed	G	[0.1 ms]	[r/min]*5	[r/min]*5	Invalid			Invalid		

*1 Delay time (Pr1.16, 1.12 and 1.25) will be valid only when returning from 2nd to 1st gain.
*2 Hysteresis (Pr1.18, 1.23 and 1.27) is defined as the fig. below shows.
*3 Designate with either the encoder resolution resolution depending on the control mode.
*4 When you make it a condition that there is speed variation of 10 r/min in 1s, set up the value to 1.
*5 When Pr1.15=10, the meanings of delay time, level and hysteresis are different from the normal. (refer to Fig. G)
*6 Gain switching mode 0, 1, 2 do not use parameter of delay time,level and hysteresis.
*7 When gain swithching mode set to 4 under Position control,1st gain is fixed.

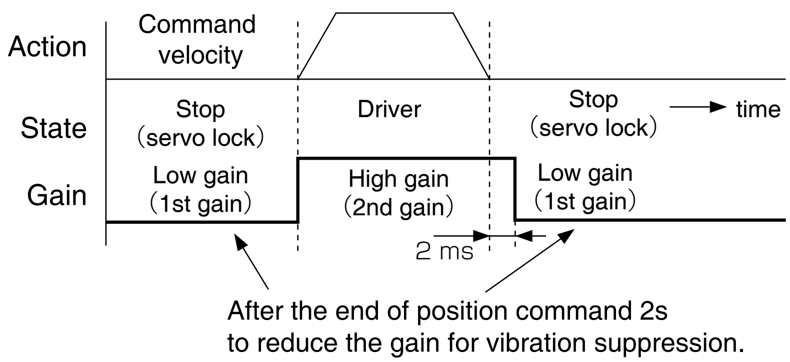




Caution In the figure, the hysteresis (Pr 1.18, 1.23, 1.27) does not reflect the deviation of gain switching timing.

Usage Example of Gain Switching Function

When the sound is loud by motor stops（servo lock）,examples of noise reduction by switching to low gain after motor stops.
Refer to the base gain parameter setting list（P.5-9）for adjustment.



< The parameter setting flow >

parameter No.	Title	Manual adjustment by no gain switching.	Set Pr1.05～Pr1.09（2nd gain）and Pr1.00～Pr1.04（1st gain）is the same value.	Pr1.14～P1.19 setup（Gain switching conndition）	When Stop adjust Pr1.01 and Pr1.04 of（1st gain）,reduce noise.
1.00	1st gain of position loop	630	630	630	630
1.01	1st gain of velocity loop	350	350	350	270
1.02	1st time constant of velocity loop integration	160	160	160	160
1.03	1st filter of velocity detection	0	0	0	0
1.04	1st time constant of torque filter	65	65	65	84
1.10	Velocity feed forward gain	300	300	300	300
1.11	Velocity feed forward filter	50	50	50	50
1.05	2nd gain of position loop		630	630	630
1.06	2nd gain of velocity loop		350	350	350
1.07	2nd time constant of velocity loop integration		160	160	160
1.08	2nd filter of velocity detection		0	0	0
1.09	2nd time constant of torque filter		65	65	65
1.14	2nd gain setup	0	0	1	1
1.15	Mode of position control switching			7	7
1.16	Delay time of position control switching			20	20
1.17	Level of position control switching			0	0
1.18	Hysteresis at position control switching			0	0
1.19	Position gain switching time			0	0

Related page • P.3-39 ... “Details of Parameter”

4. Manual Gain Tuning (Basic)

Suppression of Machine Resonance

In case of a low machine stiffness, you cannot set up a higher gain because vibration and noise occur due to oscillation caused by axis distortion or other causes. By suppressing the resonance peak at the notch filter, higher gain can be obtained or the level of vibration can be lowered.

1. Torque command filter (Pr1.04 and Pr1.09)

Sets up the filter time constant so as to damp the frequency at vicinity of resonance frequency. You can obtain the cut off frequency of the torque command filter in the following formula.
Cut off frequency (Hz) fc = 1 / (2π x parameter setup value x 0.00001)

2. Notch filter (Pr2.00, 2.07 to Pr2.12)

• Adaptive filter

MINAS-A6N series feature the adaptive filter. With this filter you can control vibration of the load which resonance points vary by machine by machine and normal notch filter or torque filter cannot respond. Enter the action command with Pr2.00 Adaptive filter mode set to a value other than 0.

If the resonance point affects the motor speed, parameters of 3rd notch filter and/or 4th notch filters are automatically set according to the number of adaptive filters.

Pr2.00	Adaptive filter mode	1: Adaptive filter is valid 2: 2 adaptive filters are valid.
Pr2.07	3rd notch frequency	In no resonance point is found, the frequency is set to 5000.
Pr2.08	3rd notch width selection	Automatically set when the adaptive filter is active.
Pr2.09	3rd notch depth selection	
Pr2.10	4th notch frequency	Notch frequency is automatically set to the 2nd resonance frequency estimated by the adaptive filter. In no resonance point is found, the frequency is set to 5000.
Pr2.11	4th notch width selection	Automatically set when 2 adaptive filters are active.
Pr2.12	4th notch depth selection	

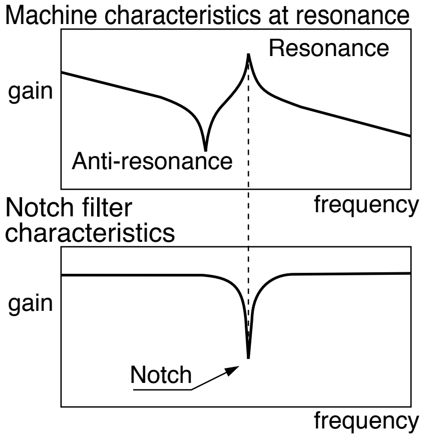
• Notch filter (Pr2.01 to 2.12,Pr2.24 to 2.26)

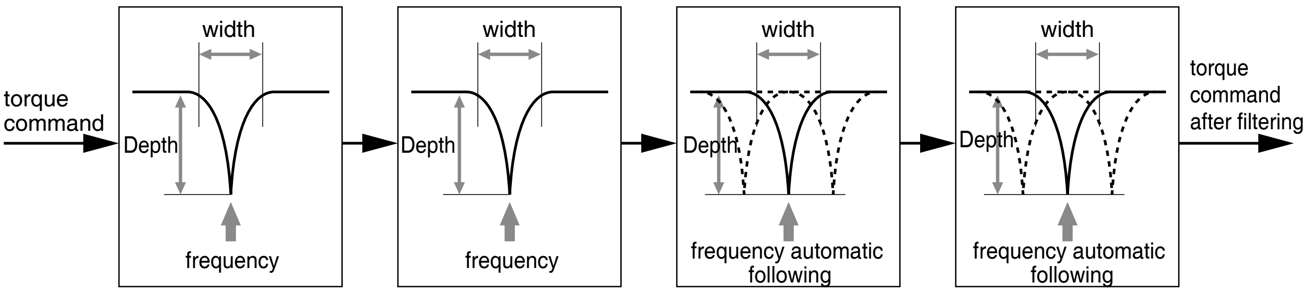
MINAS-A6N series feature 5 normal notch filters. You can adjust frequency and width and depth.

Pr2.01	1st notch frequency	Set the center frequency of the 1st notch filter. *1
Pr2.02	1st notch width selection	Set the width of notch at the center frequency of the 1st notch filter.
Pr2.03	1st notch depth selection	Set the depth of notch at the center frequency of the 1st notch filter.
Pr2.04	2nd notch frequency	Set the center frequency of the 2nd notch filter. *1
Pr2.05	2nd notch width selection	Set the width of notch at the center frequency of the 2nd notch filter.
Pr2.06	2nd notch depth selection	Set the depth of notch at the center frequency of the 2nd notch filter.
Pr2.07	3rd notch frequency	Set the center frequency of the 3rd notch filter. *1
Pr2.08	3rd notch width selection	Set the width of notch at the center frequency of the 3rd notch filter.
Pr2.09	3rd notch depth selection	Set the depth of notch at the center frequency of the 3rd notch filter.
Pr2.10	4th notch frequency	Set the center frequency of the 4th notch filter. *1
Pr2.11	4th notch width selection	Set the width of notch at the center frequency of the 4th notch filter.
Pr2.12	4th notch depth selection	Set the depth of notch at the center frequency of the 4th notch filter.

Pr2.24	5th notch frequency	Set the center frequency of the 5th notch filter. *1
Pr2.25	5th notch width selection	Set the width of notch at the center frequency of the 5th notch filter.
Pr2.26	5th notch depth selection	Set the depth of notch at the center frequency of the 5th notch filter.

*1 The notch filter function will be invalidated by setting up this parameter to "5000".



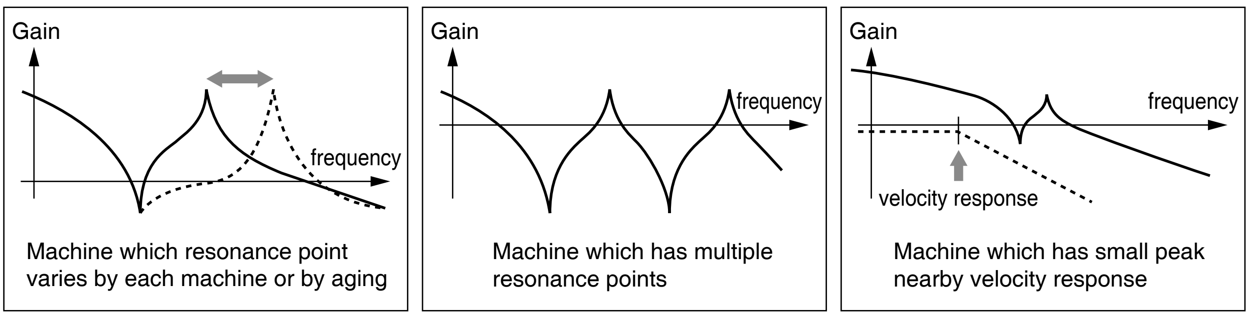


1st notch filter **2nd notch filter** **3th notch filter** **4th notch filter**

Adaptive filter can be operated with Pr2.00 “ Adaptive filter mode setup ”.
Suppress resonance point instantaneously.（frequency、width、depth…automatic following）

frequency、width、depth can manual adjuste

Example of application machine



daptive filter enabled **Adaptive filter and notch filter enabled** **Depth adjustment enabled**

Related page • P.3-39 to P.3-123... “Details of Parameter”

Notch Width and Depth

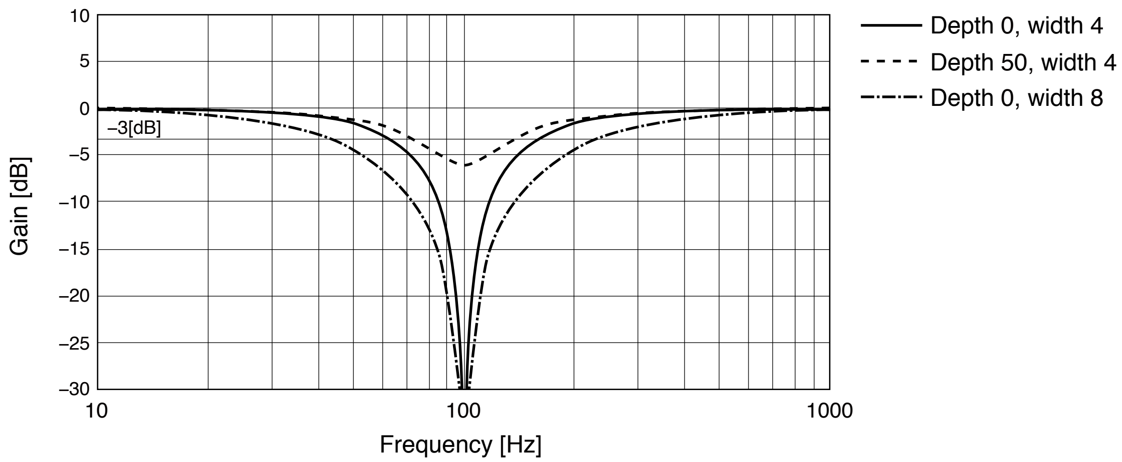
The width of the notch filter is the ratio of the width of –3dB attenuation frequency band with respect to the notch frequency at its center when depth is 0, and the value is as shown in the table below.

The notch filter depth where the input at the center frequency is completely shut with setup value 0 but fully received with setup value 100. The table below shows this value in dB on the right.

Notch width	Band width/center frequency A6 series
0	0.5
1	0.59
2	0.71
3	0.84
4	1
5	1.19
6	1.41
7	1.68
8	2
9	2.38
10	2.83
11	3.36
12	4
13	4.76
14	5.66
15	6.73
16	8
17	9.51
18	11.31
19	13.45
20	16

Notch depth	I/O ratio	[dB]
0	0	–∞
1	0.01	–40
2	0.02	–34
3	0.03	–30.5
4	0.04	–28
5	0.05	–26
6	0.06	–24.4
7	0.07	–23.1
8	0.08	–21.9
9	0.09	–20.9
10	0.1	–20
15	0.15	–16.5
20	0.2	–14
25	0.25	–12
30	0.3	–10.5
35	0.35	–9.1
40	0.4	–8
45	0.45	–6.9
50	0.5	–6
60	0.6	–4.4
70	0.7	–3.1
80	0.8	–1.9
90	0.9	–0.9
100	1	0

Notch filter frequency characteristics



How to Check the Resonance Frequency of the Machine

After using setup support software “PANATERM”,frequency characteristics of load can be determined.

“The method of Determination”

(1) Start up the Setup Support Software, "PANATERM" and bring the frequency characteristics measurement screen.

(2) Set up the parameters and measurement conditions. (Following values are standard.)

- Set up Pr1.01 (1st gain of velocity loop) to 25 or so. (to lower the gain and make it easy to identify the resonance frequency)
- Set up the amplitude to 50 (r/min) or so. (not to saturate the torque)
- Make the offset to 100 (r/min) or so. (to increase the speed detecting data and to avoid the measurement error in the vicinity of speed-zero)
- Polarity is made positive direction with "+" and negative direction with "–".
- Setup the sampling rate to 0. (setup range to be 0 to 7.)
- Check to “Auto servo on”.

(3) Execute the frequency characteristic analysis.

Remarks

- Make sure that the revolution does not exceed the travel limit before the measurement.
  Standard revolutions are,
  Offset (r/min) × 0.017 × (sampling rate +1)
  Larger the offset, better measurement result you can obtain, however, revolutions may be increased.
- Set up Pr2.00 (Setup of adaptive filter mode) to 0 while you make measurement.
- When the RTEX communication has been established, can not determine by PANATERM. In the case of communication is not established (the power is not input, RTEX communication cable is not connected etc) , can be carried out.
  For example, If you want to measure after the RTEX communication is established, once the RTEX communication cable is pulled out from driver, need to determine after alarm is cleared.

Note

- When you set a larger value of offset than the amplitude setup and make the motor run to the one direction at all time, you can obtain a better measurement result.
- Set up a smaller sampling rate when you measure a high frequency band, and a larger sampling rate when you measure a low frequency band in order to obtain a better measurement result.
- When you set a larger amplitude, you can obtain a better measurement result, but noise will be larger. Start a measurement from 50 [r/min] and gradually increase it.
- On servo on station, when determinating by external input, do not select check with “Auto servo on”.
- For details, refer to “Help” “Panaterm Operation Manual” of PANATERM.

Relation of Gain Adjustment and Machine Stiffness

In order to enhance the machine stiffness,

(1) Install the base of the machine firmly, and assemble them without looseness.

(2) Use a coupling designed exclusively for servo application with high stiffness.

(3) Use a wider timing belt. Belt tension to be within the permissible load to the motor shaft.

(4) Use a gear reducer with small backlash.

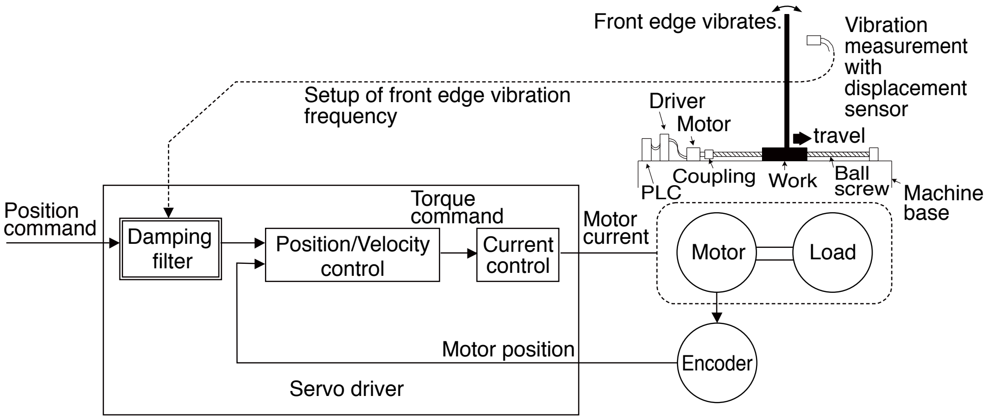
- Inherent vibration (resonance frequency) of the machine system has a large effect to the gain adjustment of the servo.
  You cannot setup a higher response of the servo system to the machine with a low resonance frequency (machine stiffness is low).

5. Manual Gain Tuning (Application)

Damping Control

Outline

This function reduces the vibration at the top or on whole of the equipment by removing the vibration frequency components specified by the positional command. Up to 3 frequency settings, out of 4 settings in total, can be used simultaneously.



Applicable Range

This function can only be applicable when the following conditions are satisfied.

	Conditions under which the damping control is activated
Control mode	• Position control mode or Full-closed control mode.

Caution

This function does not work properly or no effect is obtained under the following conditions.

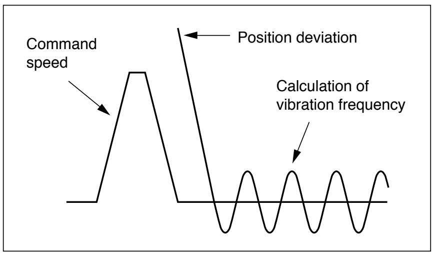
	Conditions which obstruct the damping control effect
Load condition	• Vibration is triggered by other factors than command (such as disturbance). • Ratio of resonance frequency and anti-resonance frequency is large. • Vibration frequency is out of the range of 0.5-300.0 [Hz].

How to Use

(1) Setup of damping frequency (1st: Pr2.14, 2nd: Pr2.16, 3rd: Pr2.18, 4th: Pr2.20))

Measure the vibration frequency at the top of the equipment. When you can use such instrument as a laser displacement meter to directly measure the top end vibration, read out the vibration frequency from the measured waveform in unit of 0.1[Hz] and set it to the parameter.

If no measuring device is available, measure the frequency based on the residual vibration of the position deviation waveform measured using the vibration frequency monitor or the waveform graphic function of the setup support software (PANATERM).



How to Use

(2) Setup of damping depth(Pr6.41) （＊ **Only 1st damping filter setup is valid.**）

First set it to 0, and increase the setting value little by little if settling time needs to be decreased. As the setting value increases, the settling time can be decreased, but the damping effect is also decreased. Make an adjustment while checking the statuses of the settling time and vibration.

(3) Setup of damping filter (Pr 2.15, Pr 2.17, Pr 2.19, Pr 2.21)。

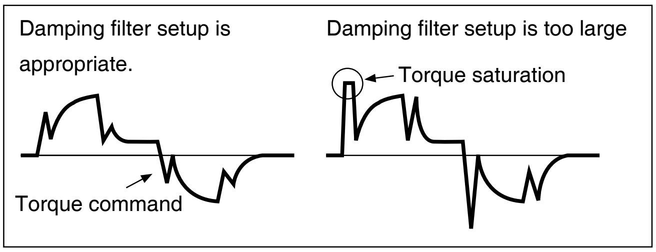
First, set to 0 and check the torque waveform during operation.

Although you can reduce the settling time by specifying a larger value, the torque ripple increases at the command changing point as shown in the following figure.Set up a value within the range where no torque saturation occurs under the actual condition. If torque saturation occurs, the vibration suppression effect will be lost.

The damping filter setting value is limited by the following formula.

Caution

10.0[Hz] − damping frequency ≦ damping filter setup ≦ damping frequency



(4) Setup of damping filter switching selection（Pr2.13）

In accordance with the state of the device,from 1st damping filter to 4th damping filter can be switched.

Pr2.13	1st	2nd	3rd	4th
0	○	○		

Pr2.13	Position conmmand direction	1st	2nd	3rd	4th
3	positive direction	○		○	
	negative direction		○		○

Do not set Pr2.13 to1 or 2. Not to be used.

•Two-degree-of-freedom control mode disabled(Only position control)

Pr2.13	1st	2nd	3rd	4th
4	○	○	○	
5、6	Same action as set value 0			

Caution

Damping control switching setting is performed at the rising edge of the command that causes the number of command pluses per command detection period (0.166 ms) (at upstream of position command filter) changes from 0 to any other value while the positioning complete is being output.

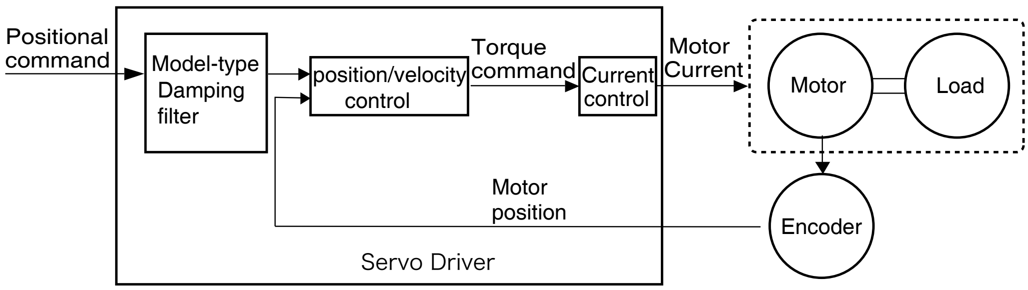
Especially, at higher damping frequency, or if it becomes disabled, and wider positioning complete range is set up, and if large pulse (area is equivalent of time integration of the value of position command at upstream of the filter minus the value of position command at downstream of filter) remains in the filter during switching, it is rapidly discharged upon switching and returns to original position, and the motor will move at a speed higher than normal command velocity.

5. Manual Gain Tuning (Application)

Model-type Damping Filter

Outline

This function reduces vibration at the edge or over the entire equipment by removing the vibration frequency components specified by the positional command.
The model-type damping filter can also remove resonance frequency components as well as anti-resonance frequency components, enhancing the effect of a conventional damping filter to generate smooth torque commands and offering a better damping effect.
In addition, the removal of anti-resonance frequency components and resonance frequency components can increase the responsiveness of the command response filter, which improves the settling time.
However, unlike a conventional damping filter, the model-type damping filter can not obtain vibration components from the position sensor for the measurement of anti-resonance frequency components and resonance frequency components, which thus requires frequency characteristics analysis and the setting of optimum parameter values.



Applicable Range

This function can only be applicable when the following conditions are satisfied.

	Conditions under which the Model type resonance oppression notch filter is activated
Control mode	• Two-degree-of-freedom control with position control.

Caution

This function does not work properly or no effect is obtained under the following conditions.

	Conditions which obstruct the Model type resonance oppression notch filter effect
Load condition	• Vibration is triggered by other factors than command (such as disturbance). • Resonance frequency and antiresonance frequency is out of the range of 5.0-300.0 [Hz].

In addition, Previous damping filter is used under the following conditions.

	Conditions of the previous damping filter
Parameter setting	• Resonance frequency and antiresonance frequency is the relation. 300.0[Hz] ≧ Resonance frequency >antiresonance frequency ≧ 5.0[Hz] • response frequency and antiresonance frequency is the relation. 300.0[Hz] ≧ antiresonance frequency*4 ≧ Resonance frequency ≧ antiresonance frequency ≧ 5.0[Hz] • By setting value of Pr2.13[Selection of damping filter switching] is equalto 4,it is effctive to make the 1st and the 2nd model type resonance oppression notch filter,in addition the 1st and the 2nd response frequency/antiresonance frequency ratio is out of the range of 8.(At this moment,the 2nd model type resonance oppression notch filter become the previous damping filter.)

When the damping filter works in a conventional manner, the three parameters of anti-esonance frequency, anti-resonance attenuation ratio and response frequency will be used for damping frequency, damping depth and damping filter setting.To completely disable this function, all of the five parameters of resonance frequency, resonance attenuation ratio, anti-resonance frequency, anti-resonance attenuation ratio and response frequency should be set to 0.

How to Use

The determination of resonance frequency and anti-resonance frequency is the frequency characteristic analysis.Need to set the appropriate parameters.
Model-type damping filter is setted by Pr2.13.
Contents of setup values 4 to 6 will differ with enabled/disabled switching of two degree-of-freedom control mode.
Two degree-of-freedom control mode disabled,set the value as 0.

Pr2.13	1st model type damping	2nd model type damping
4	Enabled	Enabled
5	for manufacturer's use (do not set this)	

When set to 6:To be switched by command direction.

Pr2.13	Position command direction	1st model type damping	2nd model type damping
6	Positive direction	Enabled	Enabled
	Negative direction	Disabled	Enabled

Set up the model-type damping filter using the following parameters.

Class	No.	Parameter name	Function
6	61	1st resonance frequency	Defines the resonance frequency of the model-type damping filter's load. The unit is [0.1 Hz].
6	62	1st resonance damping ratio	Defines the resonance attenuation ratio of the model-type damping filter's load. The attenuation ratio can be set as the setup value multiplied by 0.001. The value of 1000 results in an attenuation of 1 (no peak). The smaller the setup value, the smaller the attenuation ratio (higher resonance peak).
6	63	1st anti-resonance frequency	Defines the anti-resonance frequency of the model-type damping filter's load. The unit is [0.1 Hz].
6	64	1st anti-resonance damping ratio	Defines the anti-resonance attenuation ratio of the model-type damping filter's load. The attenuation ratio can be set as the setup value multiplied by 0.001. The value of 1000 results in an attenuation of 1 (no peak). The smaller the setup value, the smaller the attenuation ratio (higher resonance peak).
6	65	1st response frequency	Defines the response frequency of the model-type damping filter's load. The unit is [0.1 Hz].
6	66	2nd resonance frequency	Defines the 2nd resonance frequency of the model-type damping filter's load. The unit is [0.1 Hz].
6	67	2nd resonance damping ratio	Defines the 2nd resonance attenuation ratio of the model-type damping filter's load. The attenuation ratio can be set as the setup value multiplied by 0.001. The value of 1000 results in an attenuation of 1 (no peak). The smaller the setup value, the smaller the attenuation ratio (higher resonance peak).
6	68	2nd anti-resonance frequency	Defines the 2nd anti-resonance frequency of the model-type damping filter's load. The unit is [0.1 Hz].
6	69	2nd anti-resonance damping ratio	Defines the 2nd anti-resonance attenuation ratio of the model-type damping filter's load. The attenuation ratio can be set as the setup value multiplied by 0.001. The value of 1000 results in an attenuation of 1 (no peak). The smaller the setup value, the smaller the attenuation ratio (higher resonance peak).
6	70	2nd response frequency	Defines the 2nd response frequency of the model-type damping filter's load. The unit is [0.1 Hz].

How to Use

1) As preparation, measure the resonance frequency and anti-resonance frequency using the frequency characteristic analysis function of PANATERM in torque velocity mode.

   Ex.) The figure below shows the measurement result with a belt device. Ignoring small resonances, the resonance frequency at the gain peak and the anti-resonance frequency at the gain valley are as follows:

   1st resonance frequency = 130 [Hz], 1st anti-resonance frequency = 44 [Hz]

   2nd resonance frequency = 285 [Hz], 2nd anti-resonance frequency=180 [Hz]

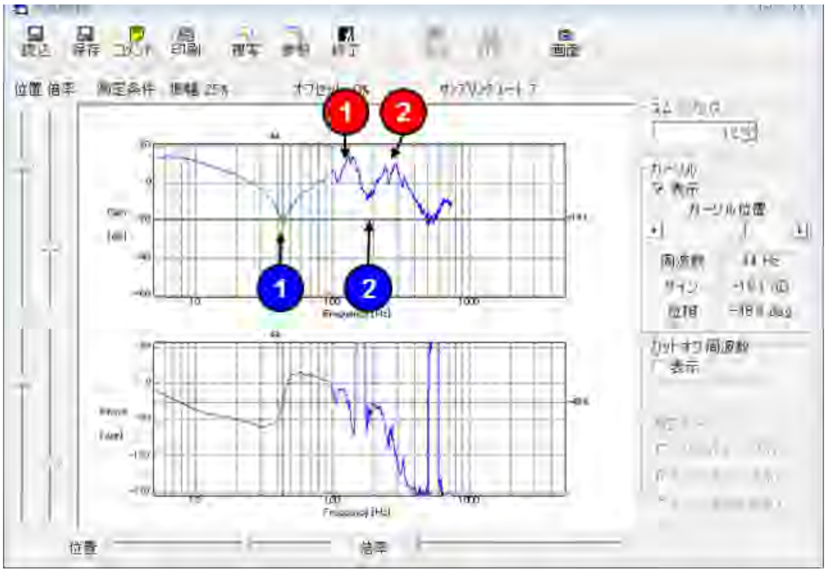
2) The resonance attenuation ratio and anti-resonance attenuation ratio should have initial values of around 50 (0.050).

3) The response frequency should start with the same value as the anti-resonance frequency.

4) Specify a value of 4 to 6 in Pr. 2.13 “Damping filter switching selection” to enable model-type damping control.

5) Activate the motor and fine tune the parameters in the following sequence so that vibration components including command position deviation become small.
   (1) Anti-resonance frequency
   (2) Anti-resonance attenuation ratio
   (3) Resonance frequency
   (4) Resonance attenuation ratio

6) Once the setting where vibration is minimized was found, increase the setup value of response frequency. The response frequency increases from one to four times the anti-resonance frequency, and the higher the frequency, the smaller the delay due to damping control. However, the damping effect decreases gradually, so a balanced setting should be chosen.



Example of frequency characteristic measurement with setup support software PANATERM

5. Manual Gain Tuning (Application)

Feed Forward Function

Outline

When position control is used, positional deviation can be further reduced when compared with deviation where control is made only by feedback, and response is also improved, by calculating the velocity control command necessary for operation based on the internal positional command, and by adding velocity feed forward to the speed command calculated by comparison with position feedback.
The response time of the velocity control system is also improved by calculating torque command necessary for operation based on the velocity control command and by adding torque feed forward calculated by comparison with velocity feedback to the torque command.

Related Parameter

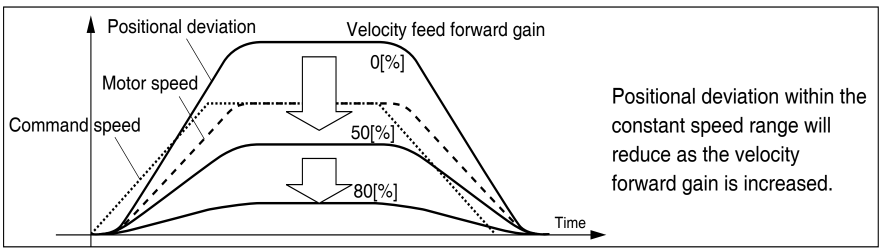
For A6N series, the velocity feed forward and torque feed forward can be used.

Class	No.	Title	Function
1	10	Velocity feed forward gain	Multiply the velocity control command calculated according to the internal positional command by the ratio of this parameter and add the result to the speed command resulting from the positional control process.
1	11	Velocity feed forward filter	Set the time constant of 1st delay filter which affects the input of velocity feed forward.
1	12	Torque feed forward gain	Multiply the torque command calculated according to the velocity control command by the ratio of this parameter and add the result to the torque command resulting from the velocity control process.
1	13	Torque feed forward filter	Set up the time constant of 1st delay filter which affects the input of torque feed forward.

Usage Example of Velocity Feed Forward

When velocity feed forward filter is set to 50（0.5 ms）,After check to waveform graphic functions of "PANATERM", the velocity feed forward gain is gradually increased with the velocity feed forward filter set at approx. 50.The velocity feed forward will become effective.The positional deviation during operation at a constant velocity is reduced as shown in the equation below in proportion to the value of velocity feed forward gain.

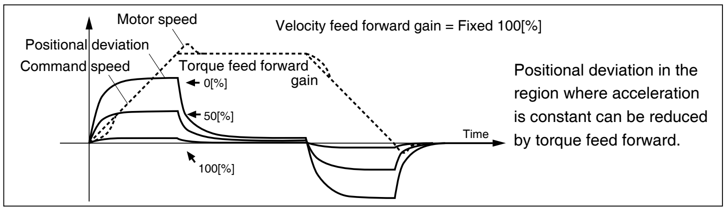
Positional deviation [unit of command] = command speed [unit of command/s] / positional loop gain [1/s] × (100 - velocity feed forward gain [%]) / 100



With the gain set at 100 %, calculatory positional deviation is 0, but significant overshoot occurs during acceleration/deceleration.
If the updating cycle of the positional command input is longer than the driver control cycle, or the pulse frequency varies, the operating noise may increase while the velocity feed forward is active. If this is the case, use positional command filter (1st delay or FIR smoothing), or increase the velocity forward filter setup value.

Usage Example of Torque Feed Forward

To use the torque feed forward, correctly set the inertia ratio. Use the value that was determined at the start of the real time auto tuning, or set the inertia ratio that can be calculated from the machine specification to Pr 0.04 "Inertia ratio".
When torque feed forward filter is set to 50（0.5 ms）,After check to waveform graphic functions of "PANATERM", the torque feed forward gain is gradually increased with the torque feed forward filter set at approx. 50.The velocity feed forward will become effective.
Positional deviation at a constant acceleration/deceleration can be minimized close to 0 by increasing the torque forward gain. This means that positional deviation can be maintained at near 0 over entire operation range while driving in trapezoidal speed pattern under ideal condition where disturbance torque is not active.
Because there is always a disturbance torque actually, the positional deviation is not 0.
In addition,as the velocity feed forward,if the time constant of the torque feed forward filter is increased,noise will be reduced,but the positional deviation of the acceleration change point will increase.



Caution

- Feed forward given through RTEX communication should be filtered at the host device.
- If the control mode is changed from other than torque control mode to torque control mode while the motor is in operation, torque feed forward may be applied even if in torque control mode.

Related page

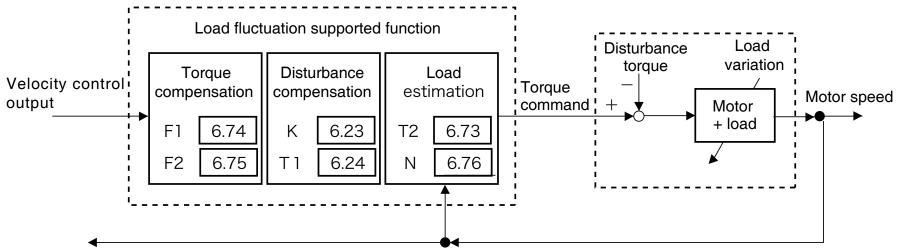
• P.3-39... “Details of Parameter”

5. Manual Gain Tuning (Application)

Load Variation Suppression Function

Outline

This function uses the disturbance torque determined by the disturbance observer to reduce effect of disturbance torque and vibration.
This is effective when real-time auto tuning cannot handle load variation sufficiently.



Applicable Range

This function can be applicable only when the following conditions are satisfied.

	Conditions under which the load variation suppression function is activated
Control mode	• Should be either position control, or velocity control,
Others	• Should be in servo-on condition • Parameters except for controls such as torque limit setup, are correctly set, assuring that the motor can run smoothly.

Caution

Effect may not be expected in the following condition.

	Conditions which load variation suppression function action
Load	• The rigidity is low (the anti-resonance point is at low frequency range of 10 Hz or below). •The load shows a clear non-linear trend with friction and backlash.

Related Parameter

Class	No.	Title	Function
6	10	Function expansion setup	Enables or disables the load variation suppression function. bit1 0: Disables the load variation suppression function 1: Enables the load variation suppression function bit2 0:Disables the load variation stabilization setting 1: Enables the load variation stabilization setting bit14 0: Disables the load variation suppression function automatic adjustment 1: Enables the load variation suppression function automatic adjustment * The least significant bit is bit0
6	23	Load variation compensation gain	Defines the compensation gain against load variation.
6	24	Load variation compensation filter	Defines the filter time constant against load variation.
6	73	Load estimation filter	Defines the filter time (T2) constant for load estimation.
6	74	Torque compensating frequency 1	Defines the filter frequency 1 (F1) against the velocity control output. Torque compensation is enabled when the relation between Pr. 6.74 "Torque compensation frequency 1" and Pr. 6.75 "Torque compensation frequency 2" satisfies the following formula. (Pr. 6.75 x 32) ≥ Pr. 6.74 > Pr. 6.75 ≥ 1.0 Hz
6	75	Torque compensating frequency 2	Defines the filter frequency 2 (F2) against the velocity control output. Torque compensation is enabled when the relation between Pr. 6.74 "Torque compensation frequency 1" and Pr. 6.75 "Torque compensation frequency 2" satisfies the following formula. (Pr. 6.75 x 32) ≥ Pr. 6.74 > Pr. 6.75 ≥ 1.0 Hz
6	76	Load estimation count	Defines the load estimation count.

How to Use

There are two methods below for adjusting the load variation suppression function.

■ When there is no load inertia variation (disturbance suppression setting)

1) Make normal gain adjustment in advance.
 Use real-time auto tuning (Pr 0.02=1) with the load variation suppression function automatic adjustment disabled (Pr 6.10 bit14=0), and set stiffness (Pr 0.03) as high as possible.
2) Set bit14 to 1 in Pr 6.10 “Function expansion setting” to enable the load variation suppression function automatic adjustment, and check disturbance suppression effect with the motor rotate.

How to Use

*Before enabling or disabling the load variation suppression function, turn off the servo first.

*If this change causes the motor to oscillate or generates an abnormal sound, return to Step [1] and decrease the servo rigidity by one or two levels before repeating the subsequent steps.

3) If further aims to adjust, set bit14 to 0 in Pr 6.10 to disable the automatic adjustment of load variation suppression function.

4) Specify a small value as possible in Pr 6.24 “Load variation compensation filter.”
Decreasing the filter setup value within the range that does not produce any significant abnormal sound or torque command variation will improve disturbance suppression performance and reduce motor velocity variation and encoder position deviation.

*When an abnormal sound at high frequency (1 kHz or above) is generated, increase the value in Pr 6.76 “Load estimation count.”

*When vibration at low frequency (10 Hz or below) is produced after operation stops, increase the value in Pr 6.23 “Load variation compensation gain”.

*No change is required for Pr 6.73 “Load estimation filter” in normal cases, but you can set the optimum point by fine-tuning within the range between around 0.00 and 0.20 ms.

■ When there is load inertia variation (load variation stabilization setting)

1) Turn ON the control power in two-degree-of-freedom position control (synchronization type) (Pr 0.01=0, Pr 6.47 bit0=1 bit3=1).
2) Set the command response filter (Pr 2.22) to 10ms.
3) Set real-time auto tuning to load variation support mode(Pr0.02=6), and operate the motor in a pattern as large as possible load variation occurs in this state.
4) Set the stiffness setting (Pr 0.03) as large as possible.
5) Set the command response filter to appropriate value to continue to derease while checking response of the motor.
(*In case of need to the multi-axis trajectory control, change all axes Pr 2.22 to the same value and adjust.)

5. Manual Gain Tuning (Application)

3rd Gain Switching Function

Outline

In addition to the normal gain switching function described on P.5-15, 3rd gain switching function can be set to increase the gain just before stopping. The higher gain shortens positioning adjusting time.

Applicable Range

This function can be applicable only when the following conditions are satisfied.

	Conditions under which the 3rd gain switching function is activated
Control mode	• Should be position control.
Others	• Should be in servo-on condition • Parameters except for controls such as torque limit setup, are correctly set, assuring that the motor can run smoothly.

Related Parameter

Class	No.	Title	Function
6	05	Position 3rd gain valid time	Set up the time at which 3rd gain becomes valid.
6	06	Position 3rd gain scale factor	Set up the 3rd gain by a multiplying factor of the 1st gain: 3rd gain = 1st gain × Pr6.06/100

Related page • P.3-39... "Details of Parameter"

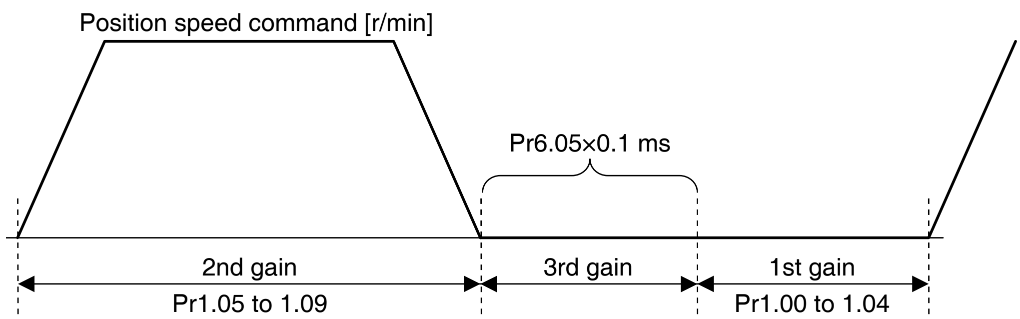
How to Use

While in the condition under which the normal gain switching functions, set the 3rd gain application time to Pr6.05 Position 3rd gain enable time, and set the 3rd gain (scale factor with reference to 1st gain) to Pr6.06 Position 3rd gain magnification ratio.

- Each upgrade 5 % from 100 %,please check to positioning waveform by the waveform graphic function of “PANATERM”.
- If 3rd gain is not used, set Pr6.05 to 0 and Pr6.06 to 100.
- The 3rd gain is enabled only for position control or full closed control.
- During the 3rd gain period, only position loop gain/speed proportional gain becomes 3rd gain, during other periods, 1st gain setting is used.
- When the 2nd gain switching condition is established during 3rd gain period, 2nd gain is used.
- During transition from 2nd gain to 3rd gain, Pr1.19 Position gain switching time is applied.

Caution When the gain is switched from 2nd to 1st by the change in parameter, the 3rd gain period appears.

Example)
Pr1.15 Position control switching mode = 7 switching condition: with positional command:



[3rd gain period]
Position loop gain = Pr1.00 × Pr6.06/100
Speed proportional gain = Pr1.01 × Pr6.06/100
Time constant of velocity integration, speed detection filter and torque filter directly use the 1st gain value.

5. Manual Gain Tuning (Application)

Friction Torque Compensation

Outline

To reduce effect of friction represented by mechanical system, 3 types of friction torque compensation can be applied:ooffset load compensation that cancels constant offset torque, the dynamic friction compensation that varies direction as the operating direction varies and viscous friction torque correction amount that is varied by the command speed.

Applicable Range

This function can be applicable only when the following conditions are satisfied.

	Conditions under which the Friction torque compensation is activated
Control mode	• Specific to individual functions. Refer to "Related parameters" shown below.
Others	• Should be in servo-on condition • Parameters except for controls such as torque limit setup, are correctly set, assuring that the motor can run smoothly.

Related Parameter

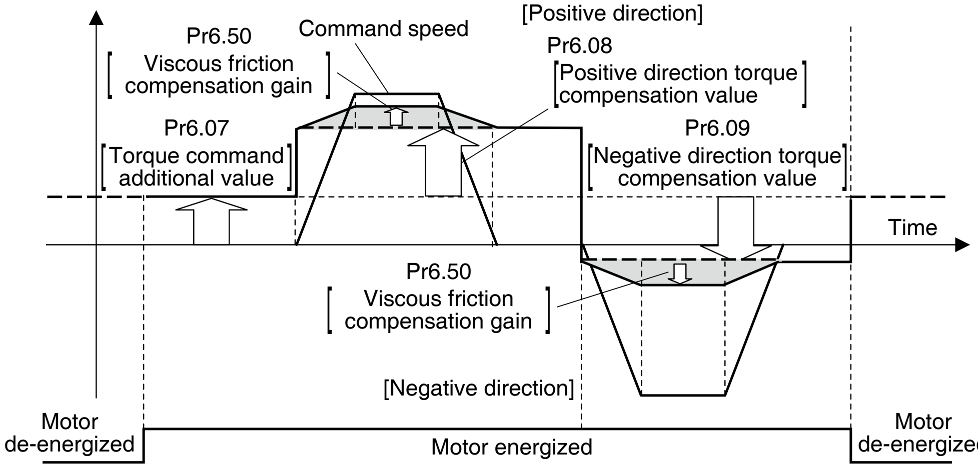
Combine the following 4 parameters to setup appropriate friction torque compensation.

Class	No.	Title	Function
6	7	Torque command additional value	Set up the offset load compensation value usually added to the torque command in a control mode except for the torque control mode.
6	8	Positive direction torque compensation value	Set up the dynamic friction compensation value to be added to the torque command when forward positional command is fed.
6	9	Negative direction torque compensation value	Set up the dynamic friction compensation value to be added to the torque command when negative direction positional command is fed.
6	50	Viscous friction compensating gain	When the 2 degree of freedom control mode is active, the product of the instruction speed and the setting value is used as the friction torque compensation and the torque command is added to the torque. By setting the value of the viscous friction coefficient estimation of real-time auto-tuning,it can improve the feedback scale position deviation of the settling area.

Related page • P.3-39... "Details of Parameter"

How to Use

The friction torque compensation will be added in response to the entered positional command direction as shown below.



- Pr6.07 [Torque command additional value] reduces variations in positioning operation (performance is affected by direction of movement). These variations occur when constant offset torque resulting from weight on vertical axis is applied to the motor.
- Certain loads such as belt driven shaft requires high dynamic friction torque, which lengthens positioning setting time or varies positioning accuracy. These problems can be minimized by setting the friction torque of every rotating direction into individual parameters. Pr6.08 [Positive direction torque compensation value] and Pr6.09 [Negative direction torque compensation value] can be used for this purpose.
- The sum of the value of the compensation torque and friction compensation.
- Each upgrade 1 % from 0 %,please check to positioning waveform by the waveform graphic function of “PANATERM”.

Caution **some control modes impose limit on application.**

- For torque control: Offset load compensation and dynamic friction compensation are set at 0 regardless of parameter setting.
- For velocity control : Offset load compensation per Pr6.07 is enabled. operation is enabled with servo on, if change parameter setting,reflected in the operation immediately.Dynamic friction compensation is set at 0 regardless of parameter setting. Pr6.08/09”positive / negative direction torque value ”of The dynamic friction compensation is invalid.
- For position control: Previous offset load compensation and dynamic friction compensation values are maintained until the first positional command is applied where the offset load compensation value is updated according to Pr6.07. The dynamic friction compensation value is updated to parameters Pr.6.08 and Pr6.09 depending on command direction.

5. Manual Gain Tuning (Application)

Quadrant Projection Suppression Function

Outline

Control configuration can be switched to suppress quadrant projection occurring during arc interpolation of 2 or more axes. To be used in conjunction with load fluctuation suppression function.

Applicable range

This function can be applicable only when the following conditions are satisfied.

	Conditions under which the Hybrid vibration damping function is activated
Control mode	• Should be position control mode
Others	• Should be in servo-on condition • Elements other than control parameters, such as prohibition of deviation counter clear command input and torque limit, etc. are set appropriately, in a state where there are no obstructions in normal motor revolutions.

Caution

There are cases where effects cannot be observed under the following conditions.

	Conditions which obstruct disturbance observer action
Load	• When rigidity is low (anti-resonance point exists in the low frequency range of 10 Hz or lower). • When non-linearity of load is strong from existence of backlash, etc. • When action patterns are changed.

Related Parameter

Class	No.	Title	Function
5	45	Quadrant projection positive direction compensation amount	Sets amount of compensation to be added to torque command when the position command is in positive direction and quadrant projection compensation function is enabled.
5	46	Quadrant projection negative direction compensation amount	Sets amount of compensation to be added to torque command when the position command is in negative direction and quadrant projection compensation function is enabled.
5	47	Quadrant projection compensation delay time	Sets the length of delay time for switching of amount of compensation after position command has been reversed, when quadrant projection compensation function is enabled.
5	48	Quadrant projection compensation filter setting L	Sets time constant for low-pass filter on the amount of compensation on torque command when quadrant projection compensation function is enabled.
5	49	Quadrant projection compensation filter setting H	Sets time constant for high-pass filter on the amount of compensation on torque command when quadrant projection compensation function is enabled.

Related Parameter

Class	No.	Title	Function
6	47	Function expansion setting 2	bit14: Enables/disables quadrant projection compensation function. (0: disabled, 1: enabled)
6	97	Function expansion setting 3	bit 0 : Enables/disables quadrant projection compensation function. (0: disabled, 1: enabled) * Please set to 1 to set the amount of quadrant projection compensation for each reversed direction when traveling direction is reversed.

How to Use

Load fluctuation suppression function is adjusted through disturbance suppression setting to measure quadrant projection.
If the level is unsatisfactory, fine adjustment can be conducted using the quadrant projection suppression function.

1) Reclose control power supply after enabling quadrant projection suppression function (Pr 6.47 bit14 = 1)
2) Set initial values to: Pr 5.47 = 0, Pr 5.48 = Pr 1.04, Pr 5.49 =0.
3) Measure the magnitude of quadrant projection and conduct fine adjustments to Pr 5.45 and Pr 5.46 of each axis.

* In case of delay in quadrant projection from travelling direction reversing timing, try changing Pr 5.47 and Pr5.48.
* To set the amount of quadrant projection compensation to the revised direction when the traveling direction is reversed, try chanting Pr6.97 bit 0 to 1 and changing Pr 5.49.

5. Manual Gain Tuning (Application)

Two-degree-of-freedom Control Mode (Position Control Mode)

Outline

In the two-degree-of-freedom control mode, command response and servo rigidity can be independently set with improved responsiveness. This mode has enhanced position control functions.
Either of the standard type or synchronization type of the two-degree-of-freedom control can be used

Applicable Range

This function can be applicable only when the following condition are satisfied.

	Conditions under which the Two-degree-of-freedom control mode is activated.
Control Mode	Position control
Others	• Should be servo-on condition. • Factors other than control parameters such as torque limit should be properly setup, allowing motor to operate normally.

Related Parameter

First, set Pr6.47 ”Function expansion settings 2” to 1 and write the setting to EEPROM. Reset the control power supply to enable the two-degree-of-freedom control mode. Adjust the gain by using the real-time auto-tuning (refer to P.5-10). If further improvement is necessary, manually fine tune the following parameters while checking the response.

Class	No.	Title	Function
6	47	Function expansion settings 2	Set up various functions bit by bit. bit 0 Two-degree-of-freedom control mode 0: Invalid 1: Valid bit 3 Two-degree-of-freedom control real-time auto-tuning select 0: Standard type 1: Synchronous type * The least significant bit is represented by bit0. *For bit3 (two-degree-of-freedom control real time auto tuning select): this is made usable when bit0 is at 1 (valid).
2	22	Command smoothing filter	While the two-degree-of-freedom control real-time auto-tuning is selected, time constant of command filter is applied with the maximum value limited to 2000 (= 200.0 ms). (The value of the parameter is not limited but the value to be applied to driver is limited. Set attenuation term in Pr6.49 [Set attenuation term of command filter/adjustment filter].) Decreasing the value of this parameter makes command response fast and large, resulting smooth command response.

(continued)

Class	No.	Title	Function
6	48	Adjust filter	Sets time constant of adjustment filter. When the torque filter setting is changed, set the parameter to a value close to real-time auto-tuning setting. Fine adjustment by checking positional deviation of the encoder near setting point may improve overshoot or oscillatory waveform.
6	49	Adjust/ Torque command attenuation term	Sets attenuation term of command filter and adjustment filter. Decimal notation: 1st digit sets command filter and 2nd digit sets adjustment filter. Value of digit 0 to 4: Without attenuation term (functions as 1st filter). Value of digit 5 to 9: The 2nd filter (attenuation term ζ is 1.0, 0.86, 0.71, 0.50 and 0.35, in that order). but,Pr2.13 (Selection of damping filter switching) is 4(model type damping filter two effective), the damping ratio is fixed to 1.0 during the secondary filter selection. <Example> To set command filter ζ = 1.0, adjustment filter 1 ζ = 0.71: Setup value = 75 1st digit = 5 (ζ = 1.0), 2nd digit = 7 (ζ = 0.71) Pr2.22 Command smoothing filter is applied as time constant of command filter.
6	50	Viscous friction compensation gain	Adds the result of command speed multiplied by this setup value to torque command as viscous friction torque correction value. By setting the estimate value of viscous friction coefficient of real-time auto-tuning, encoder positional deviation near the setting point may be improved.

5. Manual Gain Tuning (Application)

Two-degree-of-freedom Control Mode (Velocity Control Mode)

Outline

In the two-degree-of-freedom control mode, command response and servo rigidity can be independently set with improved responsiveness. This mode has enhanced speed control functions.
Only the standard type of two-degree-of-freedom control is available.

Applicable Range

This function can be applicable only when the following condition are satisfied.

	Conditions under which the Two-degree-of-freedom control mode is activated.
Control Mode	Speed control
Others	• Should be servo-on condition. • Factors other than control parameters such as torque limit should be properly setup, allowing motor to operate normally.

Related Parameter

First, set Pr6.47 Function expansion setup 2 to 1 and write the setting to EEPROM. Reset the control power supply to enable the two-degree-of-freedom control mode. Adjust the gain by using the real-time auto-tuning (refer to P.5-10). If further improvement is necessary, manually fine tune the following parameters while checking the response.

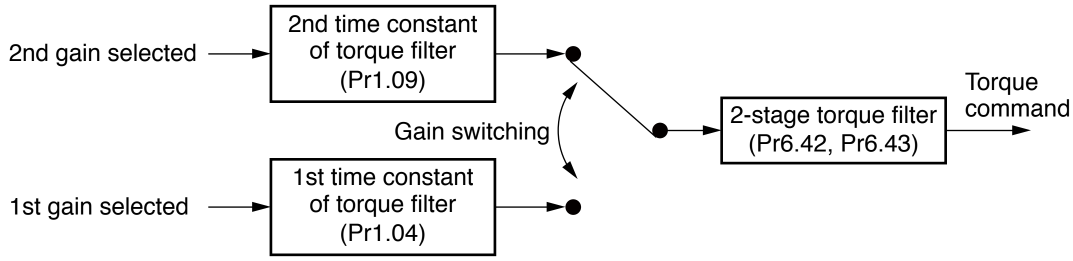
Class	No.	Title	Function
6	47	Function expansion settings 2	Set up various functions bit by bit. bit 0 Two-degree-of-freedom control mode 0: Invalid 1: Valid bit 3 Two-degree-of-freedom control real-time auto-tuning select 0: Standard type 1: Synchronous type * The least significant bit is represented by bit0. *For bit3 (two-degree-of-freedom control real time auto tuning select): this is made usable when bit0 is at 1 (valid).
2	22	Command smoothing filter	While the two-degree-of-freedom control real-time auto-tuning is selected, time constant of command filter is applied with the maximum value limited to 640 (= 64.0 ms). (The value of the parameter is not limited but the value to be applied to driver is limited.) Decreasing the value of this parameter makes command response fast and large, resulting smooth command response.
6	48	Adjust filter	To set the time constant of adjustment filter. When the torque filter setting is changed, set the adjustment filter to a near value while referring to setting of real-time auto-tuning. In addition, by finely adjusting the adjustment filter while monitoring the encoder position deviation in the vicinity of steady state, overshoot or vibration waveforms may be sometimes improved.

5. Manual Gain Tuning (Application)

Two-stage Torque Filter

Outline

In addition to existing 1st and 2nd torque filter (Pr1.04 and Pr1.09), the 3rd torque filter can be set. This 2-stage torque filter will effectively suppress oscillating component in high frequency range.



Applicable Range

This function can be applicable only when the following condition are satisfied.

	2-stage torque filter operating condition
Control Mode	Can be used in any control mode.
Others	• Should be servo-on condition. • Parameters except for controls such as torque limit setup, are correctly set, assuring that the motor can run smoothly.

Caution

- Excessively high setup value makes control unstable and may cause oscillation.
- Set to an appropriate value by checking condition of the device.
- Changing Pr6.43 2-stage torque filter attenuation term during operation may cause oscillation. Stop operation before changing the term.

Related page • P.3-47,3-48,3-94... "Details of Parameter"

Related Parameter

Class	No.	Title	Function
6	42	Two-stage torque filter time constant	[Setting range: 0 to 2500] Sets time constant of 2-stage torque filter. Setup value 0: invalid [When using in 2nd filter with Pr6.43 ≥ 50] Compatible time constant range is 5 to 159 (0.05 ms to 1.59 ms) (corresponding frequency range: 100 Hz to 3000 Hz) Setup values 1 to 4 function as 5 (3000 Hz) and 159 to 2500 as 159 (100 Hz).
6	43	Two-stage torque filter Attenuation term	[Setting range: 0 to 1000] Set the attenuation term of 2-stage torque filter. This setup value is used to switchover between 1st and 2nd filter of 2-stage filter. 0 to 49: Operates as 1st filter. 50 to 1000: Operates as 2nd filter with ζ = 1.0 when setup value is 1000. Standard value is 1000; smaller setup value will cause oscillation.

How to Operate

When high frequency oscillation cannot be completely prevented by 1st and 2nd torque filter, setup the 2-stage torque filter. Set Pr6.43 2-stage torque filter attenuation term to 1000 (ζ = 1.0) and adjust Pr6.42 2-stage torque filter time constant.

6. Application Functions

Torque Limit Switching Function

Outline

This function changes the torque limit value according to the operation direction or torque limit switching command (TI_SW) of RTEX communication.

Applicable Range

This function can be applicable only when the following condition are satisfied.

	Conditions under which the Torque limit switching function is activated
Control Mode	• Position control, velocity control
Others	• Should be in servo-on condition • Parameters except for controls are correctly set, assuring that the motor can run smoothly.

Related Parameter

<table>
<tr><th>Class</th><th>No.</th><th>Title</th><th>Function</th></tr>
<tr><td>0</td><td>13</td><td>1st torque limit</td><td>You can set up the 1st limit value of the motor output torque.</td></tr>
<tr><td>5</td><td>21</td><td>Selection of torque limit</td><td>You can set up the torque limiting method.
<table>
<tr><td rowspan="2">Setup value</td><td colspan="2">TL_SW = 0</td><td colspan="2">TL_SW = 1</td></tr>
<tr><td>Negative direction</td><td>Positive direction</td><td>Negative direction</td><td>Positive direction</td></tr>
<tr><td>1</td><td colspan="4">Pr0.13</td></tr>
<tr><td>2</td><td>Pr5.22</td><td>Pr0.13</td><td>Pr5.22</td><td>Pr0.13</td></tr>
<tr><td>3</td><td colspan="2">Pr0.13</td><td colspan="2">Pr5.22</td></tr>
<tr><td>4</td><td>Pr5.22</td><td>Pr0.13</td><td>Pr5.26</td><td>Pr5.25</td></tr>
</table>
If 0 is set for this parameter, 1 is internally set.</td></tr>
<tr><td>5</td><td>22</td><td>2nd torque limit</td><td>You can set up the 2nd limit value of the motor output torque.</td></tr>
<tr><td>5</td><td>23</td><td>Torque limit switching setup 1</td><td>Set the rate of change (gradient) from value 1 to value 2 during torque limit change.</td></tr>
<tr><td>5</td><td>24</td><td>Torque limit switching setup 2</td><td>Set the rate of change (gradient) from value 2 to value 1 during torque limit change.</td></tr>
<tr><td>5</td><td>25</td><td>Positive direction torque limit</td><td>Set up positive direction torque limit upon receiving torque limit switching.</td></tr>
<tr><td>5</td><td>26</td><td>Negative direction torque limit</td><td>Set up negative direction torque limit upon receiving torque limit switching.</td></tr>
</table>

Content

•The torque limit switching mode is shown in the table below:

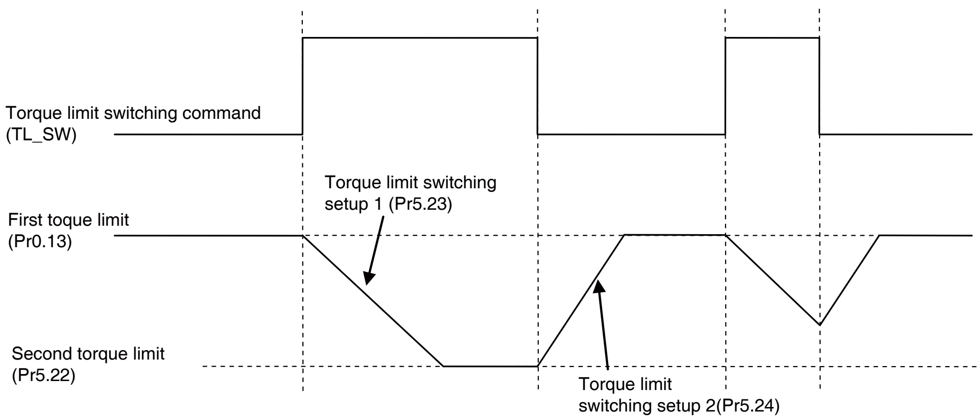
<table>
<tr><th>Pr5.21</th><th>Torque limit switching command (TL_SW)</th><th>Torque limit switching setting (Change rate setting) (Pr5.23、Pr5.24)</th><th>Positive direction torque</th><th>Negative direction torque limit</th></tr>
<tr><td>1</td><td>—</td><td>—</td><td colspan="2">Pr0.13</td></tr>
<tr><td>2</td><td>—</td><td>—</td><td>Pr0.13</td><td>Pr5.22</td></tr>
<tr><td rowspan="2">3</td><td>OFF</td><td rowspan="2">Effective</td><td colspan="2">Pr0.13</td></tr>
<tr><td>ON</td><td colspan="2">Pr5.22</td></tr>
<tr><td rowspan="2">4</td><td>OFF</td><td rowspan="2">—</td><td>Pr0.13</td><td>Pr5.22</td></tr>
<tr><td>ON</td><td>Pr5.25</td><td>Pr5.26</td></tr>
</table>

•Setting of change rate at the time of torque limit switching

When the motor is used with Pr5.21 “Selection of torque limit” = 3, an gradient is able to be provided to the change when the torque limit is switched. This function is invalid in other set tings.

The change rate (gradient) set by Pr5.23 “Torque limit switching setup 1” is applied when the first torque limit is switched to the second torque limit and the change rate (gradient) set by Pr5.24 “Torque limit switching setup 2” is applied when the second torque limit is switched to the first torque limit. The sign of the change rate (gradient) is automatically switched in the driver in accordance with the magnitude relationship between the first torque limit and the second torque limit.

Setting Pr5.23 “Torque limit switching setup 1” or Pr5.24 “Torque limit switching setup 2” to 0 instantaneously switches the torque limit.



Note) When the first torque limit (Pr0.13) and the second torque limit (Pr5.22) is changed from the setup support software PANATERM or RTEX communication, the change rate setting is ignored and the torque limit value after the change is immediately applied. The change rate setting becomes effective only at the time of switching by the torque limit switching command (TL_SW).

6. Application Functions

Position Comparison Output Function

Outline

This function enables a general-purpose output or encoder output terminal to output a pulse signal when the actual position passes the position set for the parameter.

Specification

Trigger output	**I/F**	3-outputs□Photocoupler (Open collector) or 3-outputs□Line driver
	Logic	Parameter set (Polarity can be set for each output)
	Pulse width	Parameter set 0.1 to 3276.7 ms (in 0.1 ms units)
	Delay compensation	Available
Compare source	**Encoder (comms)**	Available
	External scale (comms)	Unavailable
	External scale (A, B phase)	Unavailable
Compare value	**Set quantity**	8 points
	Set range	32-bit with sign

Applicable Range

This function is available only when the following conditions are satisfied:

	Conditions where position comparison output function are valid
Control Mode	・Available in all control modes
Others	・RTEX communication has been established ・Home position return has been completed. (The status flag bit2"Homing_Complete" of RTEX communication is 1) ・The elements other than control parameters are correctly set, assuring that the motor can run smoothly.

1 Before Using the Products
2 Preparation
3 Setup
4 Trial Run
5 Adjustment
6 When in Trouble
7 Supplement

Related parameters

Class	No.	Title	Function
4	44	Position comparison output pulse width setting	Sets pulse width of position comparison output No pulse output when 0 (zero)
4	45	Position comparison output polarity select	Set the polarity of position comparison output by each bit of output terminal. •Setup bits [*1] [*2] bit0: SO1 , OCMP1 bit1: SO2 , OCMP2 bit2: SO3 , OCMP3 •Setup values 0: The output photocoupler is turned ON for SO1 to 3 and is set to L level for OCMP1 to 3, respectively, during pulse output. 1: The output photocoupler is turned OFF for SO1 to 3 and is set to H level for OCMP1 to 3, respectively, during pulse output. Basically, use this function as 0.
4	47	Pulse output select	Select the signal to be outputted from the pulse output terminal or position comparison output terminal. [*2] 0: Encoder output signal(OA, OB) 1: Position comparison output signal(OCMP1 to 3)
4	48	Position comparison output polarity select 1	Sets position compare 1 comparison value
4	49	Position comparison output polarity select 2	Sets position compare 2 comparison value
4	50	Position comparison output polarity select 3	Sets position compare 3 comparison value
4	51	Position comparison output polarity select 4	Sets position compare 4 comparison value
4	52	Position comparison output polarity select 5	Sets position compare 5 comparison value
4	53	Position comparison output polarity select 6	Sets position compare 6 comparison value
4	54	Position comparison output polarity select 7	Sets position compare 7 comparison value
4	55	Position comparison output polarity select 8	Sets position compare 8 comparison value
4	56	Position comparison output delay compensation amount	Compensates circuit delay of position comparison

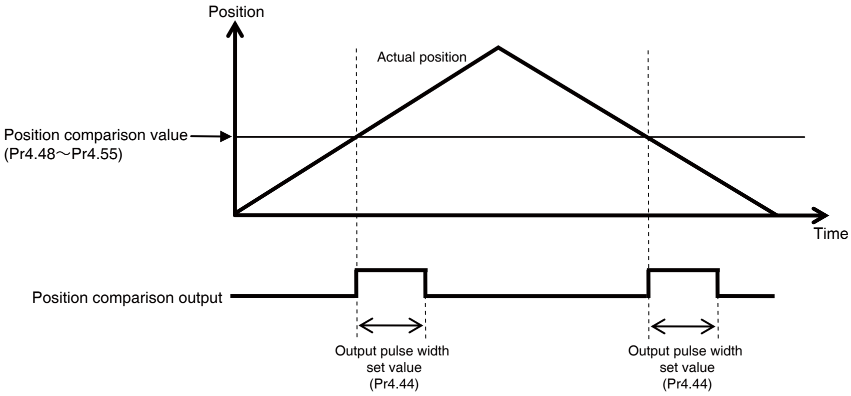
Class	No.	Title	Function
4	57	Position comparison output assignment setting	Sets output terminal corresponding to position compare 1 to 8 by bit. Multiple position comparison values can be set by one single output terminal ・Set bits bit0 to 3 : Position compare 1 bit4 to 7 : Position compare 2 bit8 to 11 : Position compare 3 bit12 to 15 : Position compare 4 bit16 to 19 : Position compare 5 bit20 to 23 : Position compare 6 bit24 to 27 : Position compare 7 bit28 to 31 : Position compare 8 ・Set value[*1 *2] 0000b : Output disabled 0001b : Allocated to SO1 or OCMP1 0010b : Allocated to SO2 or OCMP2 0011b : Allocated to SO3 or OCMP3 Other than above : For manufacturer's use (Do not set.)

*1 When general-purpose outputs (SO1 to SO3) are used as position comparison outputs, allocate Pr4.10 to Pr4.12 to the position comparison output (CMP-OUT) for all control modes.

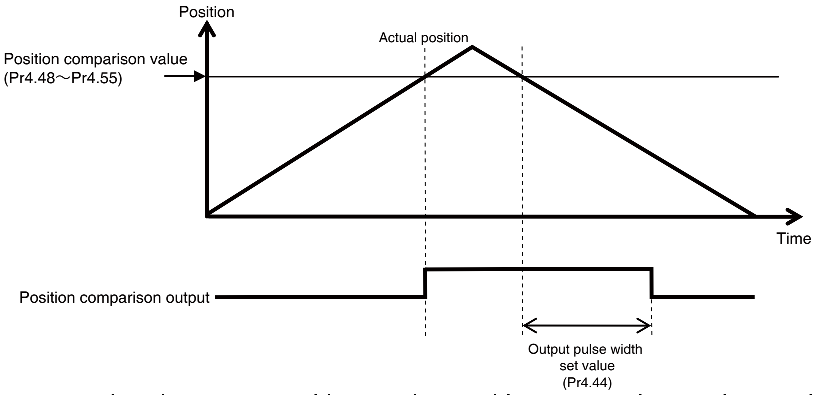
*2 When the encoder output signals (OCMP1 to OCMP3) are used as position comparison outputs, set Pr4.47 to "1".

Operation

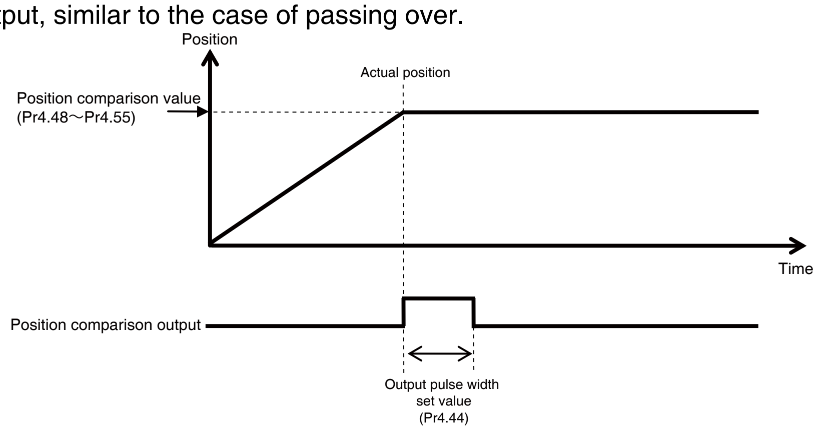
•A time width pulse set in Pr4.44 “Position comparison output pulse width setting” will be output, when the actual position of the encoder passes over the position comparison value (Pr4.48 to Pr4.55),



・Regardless of the direction of encoder position travel, a pulse will be output when the magnitude correlation changes as it passes over the position comparison value.
・Multiple position comparison value can be set to one position comparison output.
・When the operation direction has been reversed, or when the external scale position has passed the position comparison value, a state where pulse output is ON will continue from the time of the most recent passing until the output pulse width set value is reached.



• When stopped at the same position as the position comparison value, a single pulse will be output, similar to the case of passing over.



・The position comparison output function sends outputs while automatically compensating, based on the previous motor speed, the errors caused by the time of delay of encoder serial communication, etc. In addition, the amount of correction can also be adjusted with the setup of the amount of position comparison output delay correction (Pr4.56).

6. Application Functions

Single-turn Absolute Function

Outline

This function uses the absolute encoder as an absolute system only for single-turn absolute position data without connecting the battery power.
The movable range of the motor is limited by single-turn data of the absolute encoder.

Applicable Range

This function can be applicable only when the following condition are satisfied.

	Operating conditions for the single-turn absolute function
Control Mode	• Position control, velocity control, torque control
Others	• The absolute encoder must be connected.

Caution

•This function is enabled by setting Pr0.15 “Absolute encoder setup” to 3.
•If the motor (encoder) position exceeds the motor working range (single-turn data of the encoder), Err34.1 “Single-turn absolute working range error protection” occurs.
•When Err34.1 “Single-turn absolute working range error protection” has been activated, the motor is decelerated and stopped according to Pr5.10 “Sequence at alarm”.
•If the command position for RTEX communication is set to the outside of the motor working range, a command error is returned.
•When this function is enabled, multi-turn data for the absolute encoder is not used. Thus, alarms related to multi-turn data (Err40.0 “Absolute system down error protection”, Err41.0 “Absolute counter over error protection”, Err42.0 “Absolute over-speed error protection”, and Err45.0 “Absolute multi-turn counter error protection”) and battery alarms are not detected.

Related Parameter

Class	No.	Title	Function
0	15	Absolute encoder setup	Select the use method of the absolute encoder. *2) 0: Use as an absolute system (absolute mode). 1: Use as an incremental system (incremental mode). 2: Use as an absolute system (absolute mode), however ignore the multi-turn counter over. 3: Use as an absolute system, however not use the multi-turn counter (single-turn absolute mode). 4: Used as an absolute system (absolute mode), however any upper limit value can be set for the multi-turn counter, and ignore the multi-turn counter over. (continuous rotating absolute mode)
7	13	Absolute home position offset	When using an absolute encoder , set up the offset value on the encoder position and mechanical coordinate system position.

Input Range of the Command Position for RTEX Communication

The following shows the input range of the command position when the single-turn absolute function is enabled.
Note that the value below is the input range when the electronic gear ratio is 1/1 and the ab solute home position offset is 0.

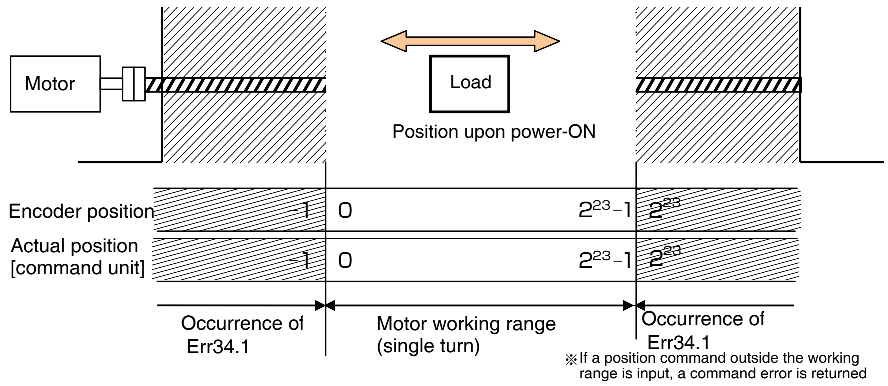
For the input range when the electronic gear ratio and absolute home position offset are set, refer to the operation example).

method	Pluse	Position command input range
Absolute encoder	23bit	0 ～ 2^{23}-1（8388607）

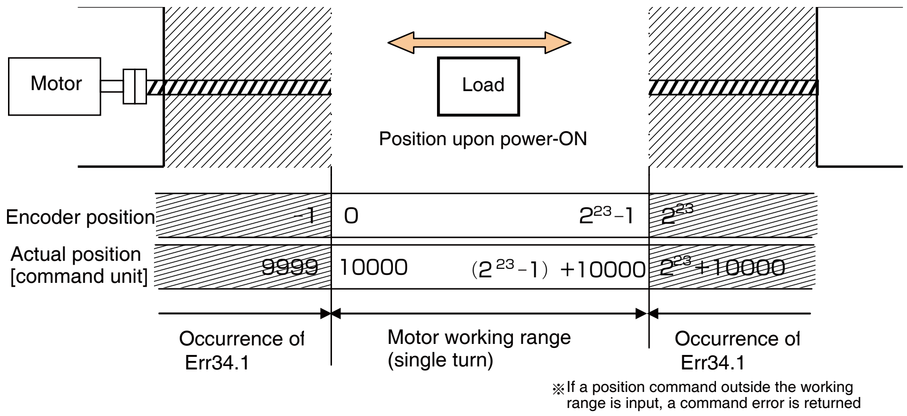
Operation Example

When using a 23 bit absolute encoder, the effective range of a single turn is as follows.

i) CCW = Positive direction, electronic gear ratio (Pr0.09/Pr0.10) = 1/1, Pr7.13 “Absolute home position offset” = 0



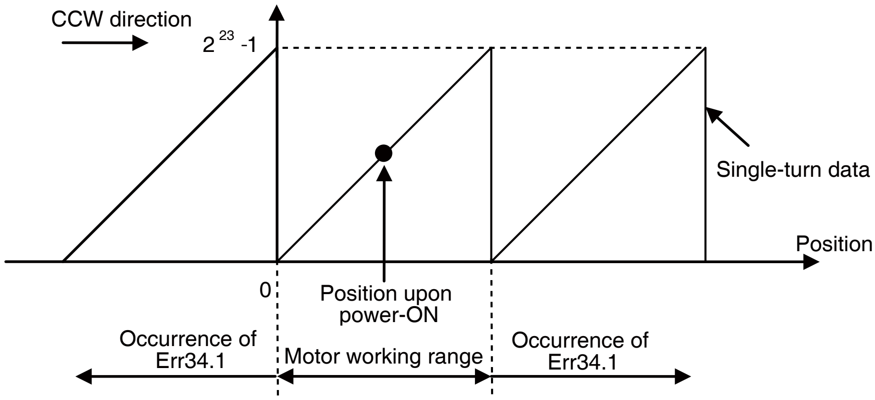
ii) CCW = Normal direction, electronic gear ratio (Pr0.09/Pr0.10) = 1/1, Pr.7.13 “Absolute home position offset” = 10000



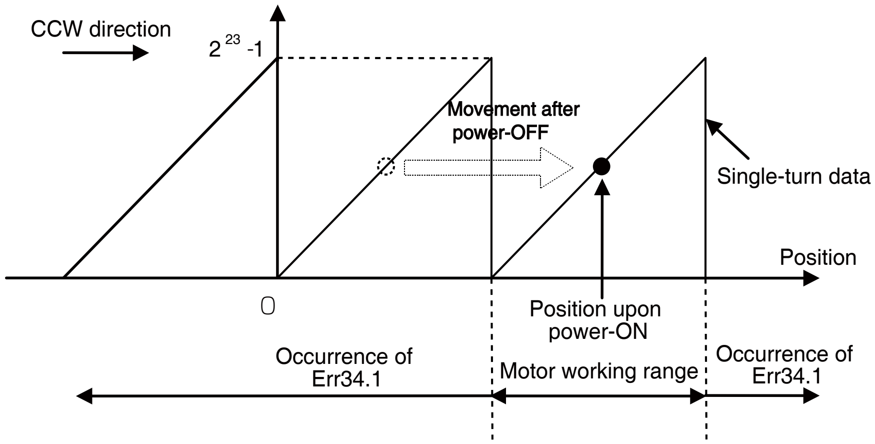
Cautions on the Motor Position Upon Power-ON

The motor working range is determined depending on the motor position upon power-ON. (Operation example with a 23bit absolute encoder)

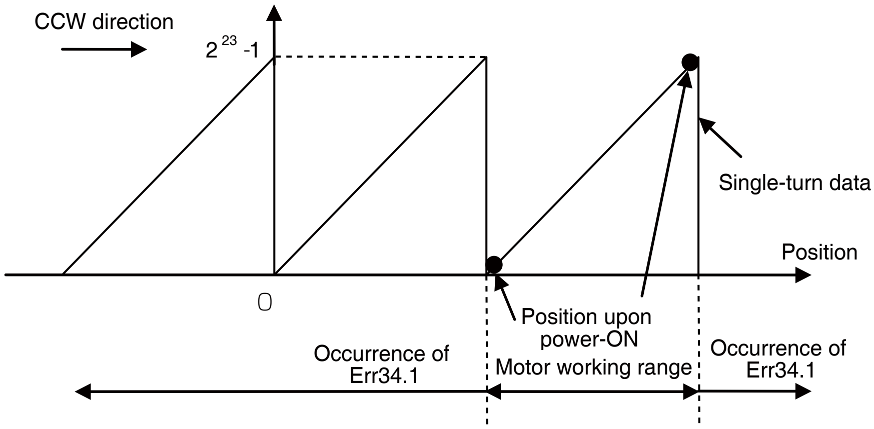
i) When the power-ON position is as shown in the figure below, the motor working range is the single-turn data range from the power-ON position.



ii) When the power is turned off at the position in Figure i) and then turned on again after the motor is moved to the position in the figure below, the motor working range will be changed.



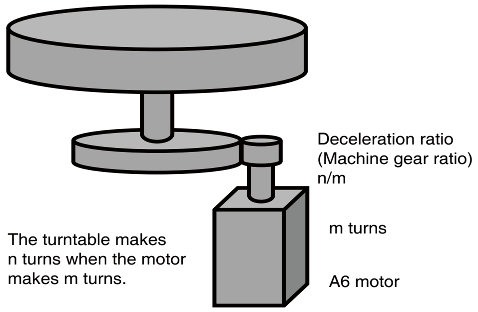
iii) If the power is turned on when the power-ON position is near the limit of the motor working range, the motor working range is exceeded if the motor operates even if only slightly, causing Err34.1 “Single-turn absolute working range error protection”



Continuous Rotating Absolute Encoder Function

Outline

This function allows you to set any upper limit value for absolute encoder multi-turn data.
With this function, it is possible to determine the turn angle (position) of a turntable and such other applications, even in the case of continuous turn in one direction.
In addition, because this is an absolute encoder, the home position return after the power is re-powered on is unnecessary.



Applicable Range

This function can be applicable only when the following condition.

	Operating conditions for continuous rotating absolute encoder function
Control Mode	• Position control, velocity control, torque control
Others	• The encoder is a 23bit resolution absolute encoder. • The following equation holds and the solution is an integer: Command position per turn of turntable = Encoder resolution (2^{23})/ electronic gear ratio/reduction ratio is an integer less than or equal to (2^{31}-1). • The elements other than control parameters are correctly set, assuring that the motor can run smoothly.

Related Parameter

Class	No.	Title	Function
0	15	Absolute encoder setup	Select the use method of the absolute encoder. 0: Use as an absolute system (absolute mode). 1: Use as an incremental system (incremental mode). 2: Use as an absolute system (absolute mode), however ignore the multi-turn counter over. 3: Use as an absolute system, however not use the multi-turn counter (single-turn absolute mode). 4: Used as an absolute system (absolute mode), however any upper limit value can be set for the multi-turn counter, and ignore the multi-turn counter over. (continuous rotating absolute mode)
6	88	Absolute encoder multi-turn data upper-limit value	Set the upper-limit value for absolute encoder multi-turn data. When the multi-turn data is more than the value set for this parameter, the multi-turn data changes to 0. When the multi-turn data falls below 0, multi-turn data will change to the set value. When set to Pr0.15 = 0 or 2(absolute mode), the upper limit of the absolute rotation data becomes 65535, regardless of this setting. This setting will become invalid when Pr0.15 is set to 3. When Pr0.15 is set to 4, Pr6.88=0 makes a motion equivalent to that of Pr6.88=1.
7	13	Absolute home position offset	When using an absolute encoder, set up the offset value on the encoder position and mechanical coordinate system position.

Caution

•This function is available when Pr0.15 “Absolute encoder setup” is set to “4” with control power cycle or RTEX reset command,attribute C parameter is enabled.

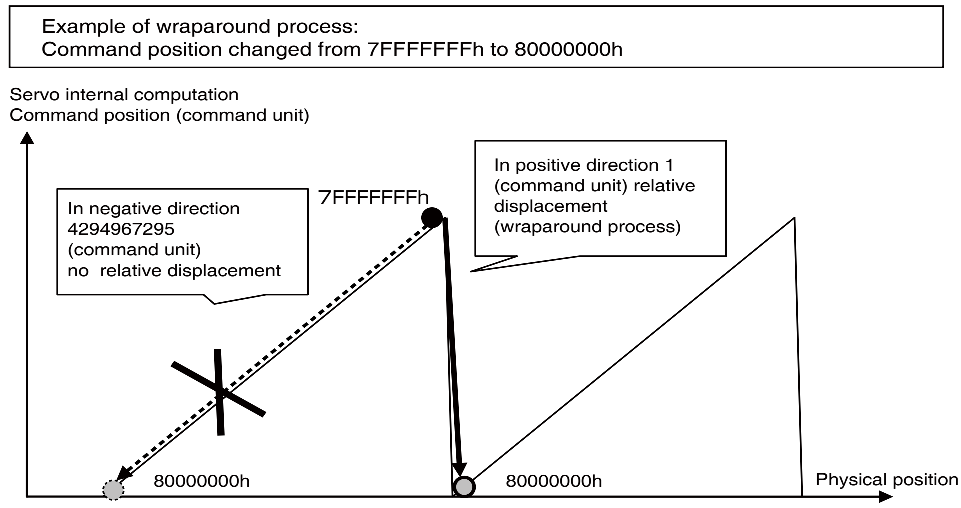
•Set Pr6.88 “Absolute encoder multi-turn data upper-limit value” to “(m-1)”.
“m” corresponds to the denominator of the deceleration ratio.

•The command of return to the origin by RTEX conmmunication can be used only for multi-revolution data clear.

•The actual position wraps around at the position at which multi-turn data wraps around.
Give a position command so that the position will agree with this actual position.
If a variation of command position during communication cycle has exceeded the following values, wraparound process starts.

Absolute encoder setup	Wraparound threshold [command unit]	
	lower limit	upper limit
Infinitely rotatable absolute encoder mode	0	$(2^{23}\times$Pr6.88setting value)-1
Other than infinitely rotatable absolute encoder mode	80000000h	7FFFFFFFh

Caution

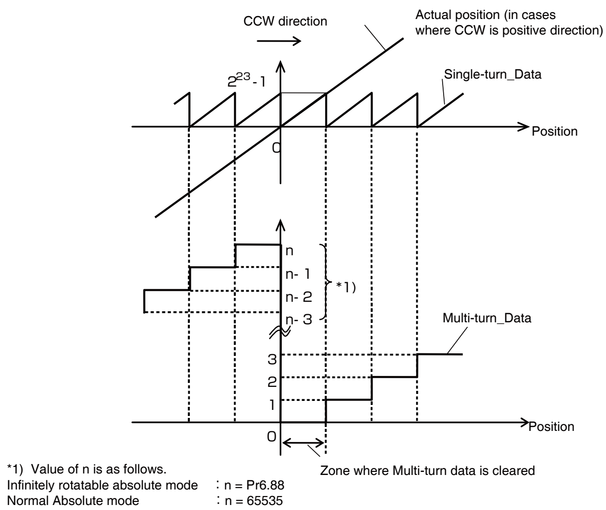


•Set Pr6.88 “Absolute encoder multi-turn data upper-limit value” while not allowing the RTEX actual position and command position to exceed 2^{31}.
When ((Pr6.88+1)× Encoder’s resolution performance) – 1 exceeds 2^{31}, Err93.8 “Parameter setting fault protection 6” is generated.
The actual position is based on Pr0.00 “Rotational direction setup” and Pr7.13 “Absolute home position offset” and so on.
The servo driver set up actual position based on the following formulas.

Parameter Pr.0.00 (Rotational direction setup)	pluse	Actual_position*1
When set to 1 (CCW is positive direction)	23bit	APOS =((M×2^{23}+S)×Electronic gear reverse conversion function)+OFS
When set to 0 (CW is positive direction)	23bit	APOS =((M×2^{23}+S)×Electronic gear reverse conversion function)+OFS

APOS：Actual_Position
M：Multi-turn_Data
S：Single-turn_Data
OFS : Pr7.13
“Absolute home position offset”

*1 When electronic gear is 1:1, effective bit length of multi-turn data is 9bit.
When electronic gear is 2:1, effective bit length of multi-turn data is 10bit.
When setting to electronic gear, APOS converge to the signed 32bit width.



Caution

•When this function is used for the first time, or Pr6.88 is changed to an arbitrary value and power is re-input, Err92.3 “Inconsistency fault protection of multiple rotation data’s upper limit values” is always generated. However, it is not a fault.
Once the driver control power is re-powered on, the error will not occur from the next time.

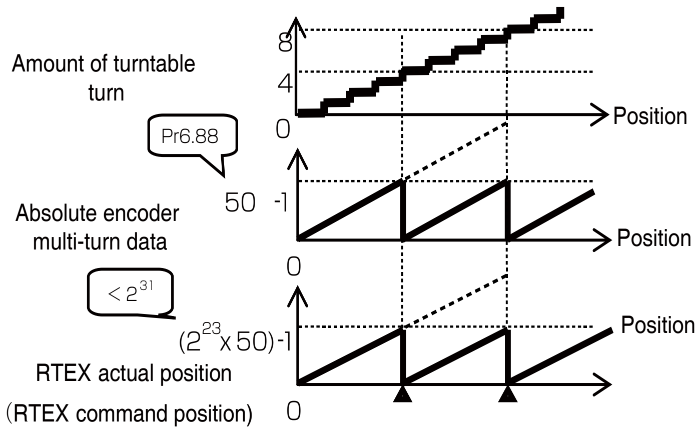
•Refer to Section P.7-3 for structure of absolute system.

•Set Pr7.13 “Absolute home position offset” between “0” to “((Pr6.88 set value +1)* encoder resolution)-1”.
When wrong valuse is set, the servo amplifiers shows Err93.8 “Parameter setting error protection 6”.

Operation Example

The operation is as follows in the case of the deceleration ratio (m = 50, n = 4) where the turntable makes 4 turns when the motor makes 50 turns.

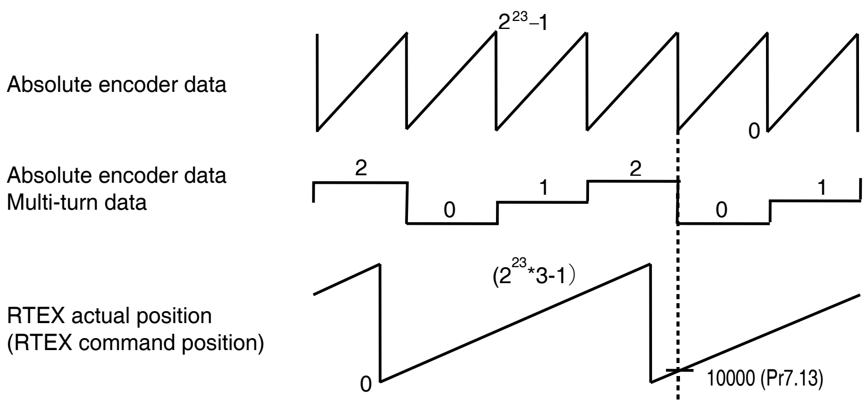
① Set Pr0.15=4 and Pr6.88=49, and write to EEPROM.
② Re-power on the driver control power (or execute the attribute C enable command).
③ The upper-limit value of the multi-turn data on the encoder side is automatically updated when the driver is started up
④ Err.92.3 “Multi-turn data upper-limit value disagreement error protection” occurs.
⑤ Re-power on the driver control power
⑥ The multi-turn data upper-limit value is enabled and the RTEX actual position is generated as shown in the figure below.
⑦ The host device reads the RTEX actual position, and the RTEX command position is initialized.
⑧ Because the RTEX actual position wraps around at 223 x 50 - 1, allow for operation with the RTEX command position wrapped around in agreement with this.
※ Because the multi-turn data upper-limit value is retained with the battery power supply connected to the encoder, follow the steps from (6) above when you turn on the driver control power at the next and subsequent operations.



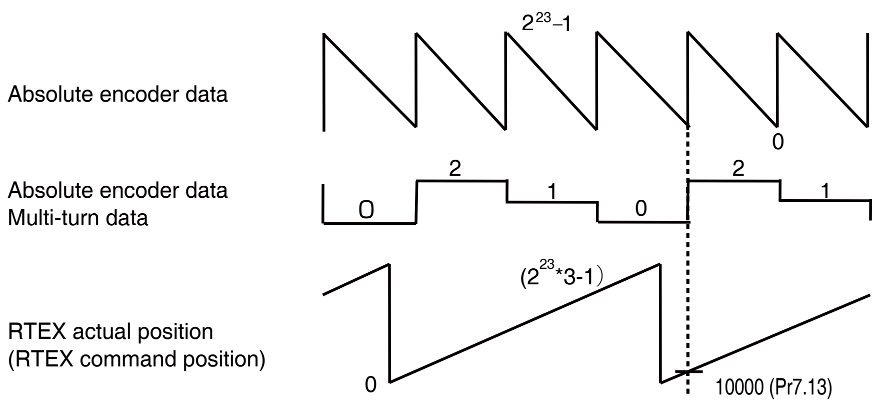
Absolute Home Position Offset

When 23bit absolute encoder is used, the absolute home position offset is as shown below.

i) CCW = Positive direction, electronic gear ratio (Pr0.09/Pr0.10) = 1/1, Pr6.88 “Absolute encoder multi-turn data upper-limit value” = 2, Pr7.13 “Absolute home position offset” = 10000



ii) CW = Positive direction, electronic gear ratio (Pr0.09/Pr0.10) = 1/1, Pr6.88 “Absolute encoder multi-turn data upper-limit value” = 2, Pr7.13 “Absolute home position offset” = 10000



Deterioration Diagnosis Warning Function

Outline

This is a function to check the changes in motor and connected equipment characteristics to output deterioration diagnosis warning.

Applicable Range

This function can be applicable only in the following condition.

	Operating conditions for Deterioration Diagnosis Warning Function
Control Mode	• Available in all control modes
Others	• Pr6.97 “Function expansion setup 3” bit1 “Deterioration Diagnosis Warning Function” is 1(valid).

Related Parameters

Class	No.	Title	Function
5	66	Deterioration diagnosis convergence judgment time	Sets the time required to deem that real-time auto tuning load characteristics estimate has converged when Deterioration Diagnosis Warning Function is activated (Pr6.97 bit 1 = 1). When the set value is 0, it will be set automatically inside the driver in accordance with Pr6.31 (real-time auto tuning convergence velocity). * When Pr6.31 (real-time auto tuning convergence velocity) = 0, the deterioration diagnosis warning judgment for load characteristics estimate will be invalid.
5	67	Deterioration diagnosis inertia ratio upper limit value	Sets the upper and lower limit values for inertia ratio estimate in deterioration diagnosis judgment when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1) and load characteristics estimate convergence has been completed. * The set resolution shall be in units of 0.2 %.
5	68	Deterioration diagnosis inertia ratio lower limit value	
5	69	Deterioration diagnosis unbalanced load upper limit value	Sets the upper and lower limit values for unbalanced load estimate in deterioration diagnosis judgment when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1) and load characteristics estimate convergence has been completed. * The set resolution shall be in units of 0.2 %.
5	70	Deterioration diagnosis unbalanced load lower limit value	
5	71	Deterioration diagnosis dynamic friction upper limit value	Sets the upper and lower limit values for dynamic friction estimate in deterioration diagnosis judgment when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1) and load characteristics estimate convergence has been completed. * The set resolution shall be in units of 0.2 %.
5	72	Deterioration diagnosis dynamic friction lower limit value	

Class	No.	Title	Function
5	73	Deterioration diagnosis viscous friction upper limit value	Sets the upper and lower limit values for viscous friction coefficient estimate in deterioration diagnosis judgment when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1) and load characteristics estimate convergence has been completed. * The set resolution shall be in units of 0.2 %.
5	74	Deterioration diagnosis viscous friction lower limit value	
5	75	Deterioration diagnosis velocity setting	Outputs deterioration diagnosis velocity output (V-DIAG) when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1) and the motor velocity is within the range of Pr5.75 ± Pr4.35 (velocity coinciding width). * Deterioration diagnosis velocity output has a 10 [r/min] hysteresis.
5	76	Deterioration diagnosis torque average time	Sets time required to calculate the torque command average value when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1) and diagnosis velocity output (V-DIAG) is ON. * Time from diagnosis velocity output (V-DIAG) ON to the start judgment for upper and lower value of torque command average value is also a part of the set time for this parameter. * If the setting value is 0, the torque command average value is not calculated.
5	77	Deterioration diagnosis torque upper limit value	Sets the upper and lower limit values of torque command average value when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1) and deterioration diagnosis velocity output (V-DIAG) is ON.
5	78	Deterioration diagnosis torque lower limit value	
6	97	Function expansion setting 3	bit 1 to set the Deterioration Diagnosis Warning Function to valid or invalid 0: invalid, 1: valid

Precautions

- When the upper limit value is set to the maximum value, the upper limit judgment will become invalid.
- When the lower limit value is set to the minimum value, the lower limit judgment will become invalid.
- In case upper limit value ≤ lower limit value, then both the upper limit and lower limit judgment will become invalid

Contents

- The following Deterioration Diagnosis Warning Functions can be used by setting bit 1 of Pr6.97 (Function expansion setting 3) to 1.

Contents

・The following Deterioration Diagnosis Warning Functions can be used by setting bit 1 of Pr6.97 (Function expansion setting 3) to 1.
- Inertia ratio(4-1-1)
- Unbalanced load(4-1-2)
- Dynamic friction(4-1-3)
- Viscous friction coefficient(4-1-4)
- Torque command average(2)

(1) Deterioration diagnosis warning for load characteristic estimates

・Deterioration diagnosis warning judgment for four load characteristics estimates (inertia ratio, unbalanced load, dynamic friction, and viscous friction coefficient) can be used in case real-time auto tuning load characteristics estimate is valid.

・The abovementioned deterioration diagnosis warning judgment will become effective when the required operational conditions for load characteristics estimate has continued in total for Pr5.66 (deterioration diagnosis convergence judgment time) or more, and the load characteristics estimate has converged. Once it has become effective, it will remain in effect until Pr6.97 bit 1 is set to 0 (invalid) or the real-time auto tuning load characteristics estimate is invalidated.

・For each load characteristics estimate value, its upper and lower limit value can be set by the parameters as indicated in the following table. In case the load characteristic estimates has exceeded the upper or lower limit values for changes in load characteristics estimate, it generates deterioration diagnostic warning number AC.

	(4-1-1)	(4-1-2)	(4-1-3)	(4-1-4)
	Inertia ratio	**Unbalanced load**	**Dynamic friction**	**Viscous fric**
Upper limit value	Pr5.67	Pr5.69	Pr5.71	Pr5.73
Lower limit value	Pr5.68	Pr5.70	Pr5.72	Pr5.74

※Set resolution for the upper and lower limit of friction torque estimates (unbalanced load, dynamic friction, and viscous friction coefficient) shall be in units of 0.2 %.

※In case Pr6.31 (real-time auto-tuning convergence velocity) is set to 0 and is estimate stopped from the start or before the load characteristics estimate results has been confirmed, deterioration diagnosis warning judgment will become invalid even if real-time auto tuning load characteristics estimate is valid.

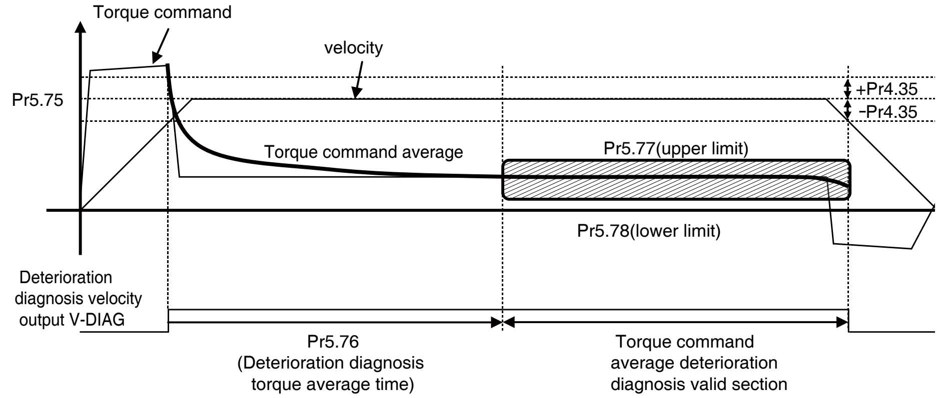
(2)Deterioration diagnosis warning for constant velocity torque command average value

・Deterioration diagnosis velocity output (V-DIAG) is ON when the motor velocity is within the range of Pr4.35 (Velocity coinciding width) of Pr5.75 (deterioration diagnosis set velocity).

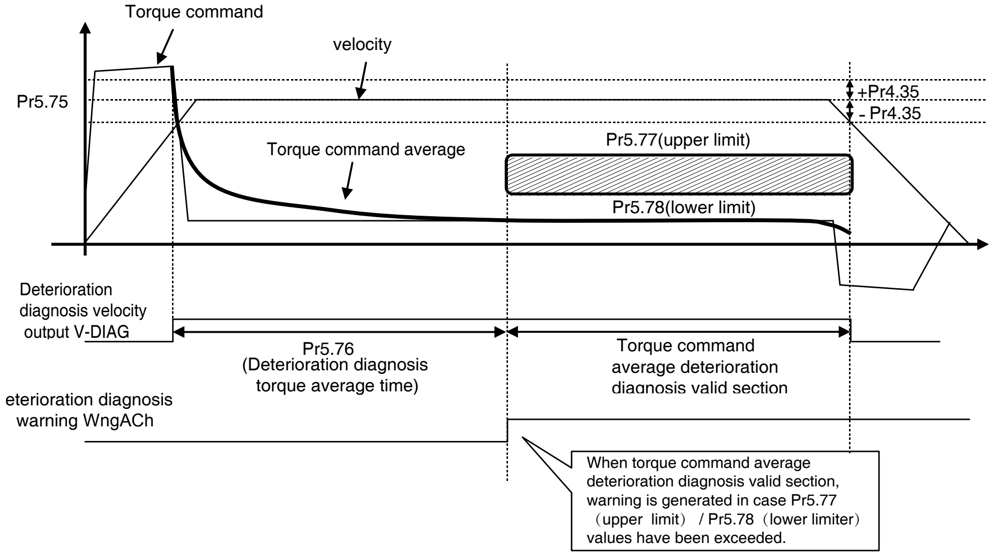
・When deterioration diagnosis velocity output (V-DIAG) is turned ON, torque command average calculation will start and after lapse of the set time of Pr5.76, deterioration diagnosis judgment by torque command average will become effective. This will continue while deterioration diagnosis velocity output (V-DIAG) remains ON, however will return to invalid condition when the output is turned OFF.

・The upper limit and lower limit values for torque command average can be set by parameters Pr5.77 and 5.78 respectively. Deterioration diagnostic warning number AC is generated in case these upper or lower limit values have been exceeded for changes in the load characteristic estimates.

i) Legond for torque command average deterioration diagnosis warning not cccured.



ii) Legond for torque command average deterioration diagnosis warning cccured.



6. Application Functions

Latch Mode with Stop Function

Outline

This is the function to stop at the latched position with the input timing of latch trigger signal with stop function (hereafter referred to as the trigger signal), without initialization of position information.
When this function is started, the motor is controlled according to the command position from the host device until the trigger signal is input, and it stops at the latch position while neglecting the command position from the host device when the trigger signal is input.
With this function, the position command filter is disabled in order to shorten the command output cycle to the stop position from the time when the trigger signal is input until it stops at the latch position.
For other details, refer to technical document RTEX Communication Specification (Section 6-5-5).

Applicable Range

This function can be applicable only in the following condition.

	Operating conditions for Latch Mode with Stop Function
Control Mode	• Position control
Others	• The software version shall be function extended version 4 or later. • Should be in servo-on condition • Parameters except for controls are correctly set, assuring that the motor can run smoothly. • The communication cycle shall be set to 0.5 ms and command update cycle to 1.0 ms. • The electronic gear ratio shall be set to 1 or larger.

Related Parameters

Class	No.	Title	Function
7	78	Signal reading setting for latch trigger with stop function	The number of readings from latch trigger signal input until internal logic confirmation by amplifier with Latch Mode with Stop Function is selected. 0:0.1875 ms (3 readings) 1:0.0625 ms (1 reading) 2:0.125 ms (2 readings) 3:0.1875 ms (3 readings)

*1) For parameter attribute, refer to Section 9-1 of RTEX Communication Specification.

Caution

- Latch Mode with Stop Function does not start up with the following settings, but returns command error(005Fh).
  - With settings other than cyclic position control (CP),
  - With settings other than command update cycle 1.0 ms and communication cycle 0.5 ms,
  - With electronic gear ratio setting smaller than 1.
- To start up Latch Mode with Stop Function, set the trigger signal as the external latch input and assign it any one from SI5 to SI7 available.
  Command error (0058h) is returned if it is started without assignment of the trigger signal.
- While Latch Mode with Stop Function is executed, set up so that the value of multiplying the command position of the host device and actual position of the motor by the electronic gear ratio is between -2,147,483,648 and 2,147,483,647.
- Err91.3 “RTEX command error protection 2” is generated if cancellation of latch mode with stop function is executed between input of the trigger signal and completion of operation.
  If this may be a problem, cancel without detection of the trigger signal, such as stopping the motor.
- The amount of delay for the latch trigger signal detection may vary depending on the environment of use or aging deterioration.
  Set up the correction period for amount of delay as necessary if latch precision is required.
  For details, refer to Section 6-5-4-4 of technical document RTEX Communication Specification.

6. When in Trouble

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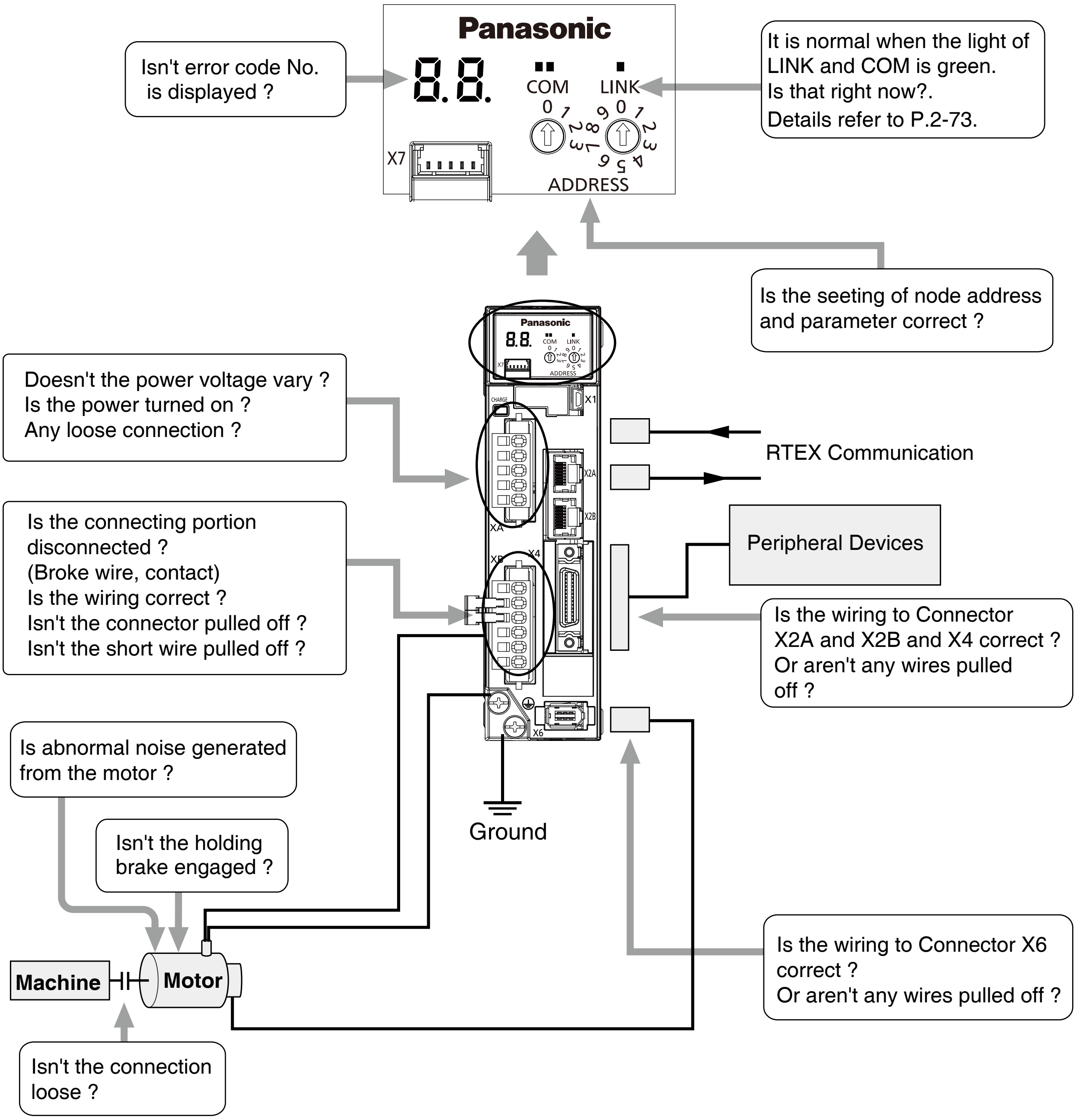
1. When in Trouble

What to Check ?



Related page
· P.2-70 ... "How to Use the Front Panel"
· P.2-47 "Wiring to the Connector, X4"
· P.7-9 "Outline of Setup Support Software "PANATERM"

1. When in Trouble

Protective Function (What is Error Code ?)

● Various protective functions are equipped in the driver. When these are triggered, according to the P.7-62 " Timing Chart" (when abnormal),the motor will stall due to error, the driver will turn the Servo-Alarm output (ALM) to off (open).

● Error status and their measures

· During the error status, the error code No. will be displayed on the front panel LED, and you cannot turn Servo-ON.

Alarm Displayed

The main code and the sub code（+ Left dot）of alarm code is using 10 - ary exchange flashing display.

（An example of Overload protection）

Main code　　　Sub code
（+Left dot）

· Alarm status can be cleared by RTEX communication or USB communication.
（Attribute/Can be cleared only）

· When overload protection is triggered, you can clear it by Alarm clear input (A-CLR) in 10sec or longer after the error occurs. RTEX communication under the clear alarm is accepted as command, but can be cleared after the state cleared.In addition,You can clear the Overload protection time characteristics (refer to P.6-19) by turning off the control power supply between L1C and L2C of the driver.

· Be sure to clear the alarm during stop after removing the cause of the error and securing safety.

Related page
· P.2-70 ... "How to Use the Front Panel"
· P.2-47 "Wiring to the Connector, X4"
· P.7-9 "Outline of Setup Support Software "PANATERM"

1 Before Using the Products
2 Preparation
3 Setup
4 Trial Run
5 Adjustment
6 When in Trouble
7 Supplement

1. When in Trouble

List of Error Code

Error code Main	Sub	Protective function	Attribute: History	can be cleared	Immediate stop	Detail page
11	0	Under voltage protection of control power supply		○		6-5
12	0	Over-voltage protection	○	○		
13	0	Main power supply under-voltage protection (between P and N)		○		6-6
	1	Main power supply under-voltage protection (AC interception detection)		○	○	
14	0	Over-current protection	○			
	1	IPM error protection	○			
15	0	Over-heat protection	○		○	6-7
	1	Encoders abnormal overheat protection	○		○	
16	0	Over-load protection	○	○		
	1	Torque saturation error protection	○	○		6-8
18	0	Over-regeneration load protection	○		○	
	1	Regeneration Tr error protection	○			
21	0	Encoder communication disconnect error protection	○			
	1	Encoder communication error protection	○			
23	0	Encoder communication data error protection	○			6-9
24	0	Position deviation excess protection	○	○	○	
	1	Speed deviation excess protection	○	○	○	
26	0	Over-speed protection	○	○	○	
	1	2nd over-speed protection	○	○		
27	1	Absolute clear abnormal protection	○			6-10
	4	Command error protection	○		○	
	5	Command generation error protection	○		○	
	6	Operation command contention protection	○	○		
	7	Position information initialization error protection	○			6-11
28	0	Limit of pulse replay error protection	○	○	○	
29	1	counter overflow protection 1	○			
	2	Counter overflow error protection 2	○			
33	0	IF overlaps allocation error 1 protection	○			6-12
	1	IF overlaps allocation error 2 protection	○			
	2	IF input function number error 1 protection	○			
	3	IF input function number error 2 protection	○			
	4	IF output function number error 1 protection	○			
	5	IF output function number error 2 protection	○			
	8	Latch input allocation error protection	○			
34	0	Motor working range setup error protection	○	○		6-13
	1	One revolution absolute working range error	○	○		
36	0 to 1	EEPROM parameter error protection				
37	0 to 2	EEPROM check code error protection				
38	0	Drive prohibition input protection1		○		6-14
	1	Drive prohibition input protection2		○		
	2	Drive prohibition input protection3	○			

Error code Main	Sub	Protective function	Attribute: History	can be cleared	Immediate stop	Detail page
40	0	Absolute system down error protection	○	○		6-14
41	0	Absolute counter over error protection	○			
42	0	Absolute over-speed error protection	○	○		6-15
44	0	Absolute single turn counter error protection	○			
45	0	Absolute multi-turn counter error protection	○			
47	0	Absolute status error protection	○			
70	0	U-phase current detector error protection	○			
	1	W-phase current detector error protection	○			
72	0	Thermal protector error protection	○			
80	3	PLL incomplete error protection	○	○		6-16
82	0	RTEX node addressing error protection	○			
83	0	RTEX communication error protection 1	○	○	○	6-17
	1	RTEX communication error protection 2	○	○	○	
84	0	RTEX time out error protection	○	○	○	
	3	RTEX communication synchronization error protection	○			
	5	RTEX communication cycle error protection	○	○	○	6-18
86	0	RTEX cyclic data error protection 1	○	○	○	
	1	RTEX cyclic data error protection 2	○	○	○	
	2	RTEX update counter error protection	○		○	
87	0	Compulsory alarm input protection		○	○	
90	2	Multi-axis synchronization establishment error protection	○			
91	1	RTEX command error protection	○	○		6-19
	3	RTEX command error protection 2	○	○		
92	0	Encoder data recovery abnormal protection	○			6-20
	3	Multi-turn data upper-limit value disagreement error protection	○			
93	0	Parameter setup error protection 1	○			
	5	Parameter setup error protection 4	○			
	8	Parameter setup error protection 6	○			
94	2	Home position return error protection	○	○		
	3	Home position return error protection2	○	○		6-21
95	0 to 4	Motor automatic recognition error protection				
96	2	Control unit error protection 1	○			
	3	Control unit error protection 2	○			
	4	Control unit error protection 3	○			
	5	Control unit error protection 4	○			
	6	Control unit error protection 5	○			
	7	Control unit error protection 6	○			
98	1	RTEX hardware error protection 1	○			6-22
	2	RTEX hardware error protection 2	○			
	3	RTEX hardware error protection 3	○			
Other number		Other error protection	—	—	—	

Note 〈The meaning of the attribute〉

History...The error will be stored in the error history.

Can be cleared...To cancel the error, use the alarm clear input (A-CLR).
If the alarm clear input is not effective, turn off power, remove the cause of the error and then turn on power again.

Immediate stop...Instantaneous controlled stop upon occurrence of an error.
(Setting of "Pr.5.10 Sequence at alarm" is also required.)

1. When in Trouble

Detail of Error Code

Error code No. Main	Error code No. Sub	Protective function	Causes	Measures
11	0	**Under voltage protection of control power supply**	Voltage between P and N of converting unit of control power supply has fallen down and dropped below specified value. 100 V version: approx. 70 VDC (approx. 50 VAC) 200 V version: approx. 140 VDC (approx. 100 VAC) 1) Low power supply voltage. Occurrence of momentary power failure. 2) Power capacity shortage…Due to rush current at the main power-on, power supply voltage has fallen down. 3) Servo driver failure (circuit failure)	100 V, 200 V product Measure L1C-L2C line voltage of connector and terminal block 1) Increase the capacity of power supply voltage. Change the power supply. 2) Increase the power capacity. 3) Replace with new servo driver.
12	0	**Over-voltage protection**	Power supply voltage has exceeded the permissible input voltage. = Voltage between P and N of the converter portion of the control power supply has exceeded the specified value. Source voltage is high. Voltage surge due to the phase-advancing capacitor or UPS (Uninterruptible Power Supply) have occurred. 100 V version: approx. 200 VDC (approx. 140 VAC) 200 V version: approx. 400 VDC (approx. 280 VAC) 1) Disconnection of the regeneration discharge resistor 2)External regeneration resistor is not appropriate and could not absorb the regenerative energy. 3) Failure of servo driver (failure of the circuit) 4) External regeneration discharge resistor is not appropriate and could not absorb the regeneration energy.	Measure the voltage between lines of connector (L1, L2 and L3). Enter correct voltage. Remove a phase advancing capacitor. 1) Measure the resistance of the external resistor connected between terminal P - B of the driver. Replace the external resistor if the value is ∞. 2) Change the specified regeneration resistance value to wattage. 3) Change to the one with specified resistance and wattage. 4) Check that Pr0.16.

Caution · Confirmation work is that checking the charge lamp is turned off after the power supply turn off.

Related page · P.2-2"Composition of Peripheral Equipments" · P.3-79"Details of Parameter"

Error code No. Main	Sub	Protective function	Causes	Measures
13	0	**Main power supply under-voltage protection (PN)**	Instantaneous power failure has occurred between L1 and L3 for longer period than the preset time with Pr5.09 (Main power off detecting time) while Pr5.08 (LV trip selection at the main power-off) is set to 1. Or the voltage between P and N of the converter portion of the main power supply has fallen below the specified value during Servo-ON. 100 V version: approx. 80 VDC (approx. 55 VAC) 200 V version: approx. 110 VDC (approx. 75 VAC)	Measure the voltage between lines of connector (L1, L2 and L3).
	1	**Main power supply under-voltage protection (AC)**	1) Power supply voltage is low. Instantaneous power failure has occurred 2) Instantaneous power failure has occurred. 3) Lack of power capacity...Power supply voltage has fallen down due to inrush current at the main power-on. 4) Phase lack...3-phase input driver has been operated with single phase input. 5) Failure of servo driver (failure of the circuit)	1) Increase the power capacity. Change the power supply. Remove the causes of the shutdown of the magnetic contactor or the main power supply, then re-enter the power. 2) Set up the longer time to Pr5.09 (Main power off detecting time). Set up each phase of the power correctly. 3) Increase the power capacity. For the capacity, refer to P.2-18, "List of Applicable Peripheral Equipments to Driver" of Preparation. 4) Connect each phase of the power supply (L1, L2 and L3) correctly. For single phase, 100 V and 200 V driver, use L1 and L3. 5) Replace the driver with a new one.
14	0	* **Over-current protection**	Current through the converter portion has exceeded the specified value. 1) Failure of servo driver (failure of the circuit, IGBT or other components) 2) Short of the motor wire (U, V and W) 3) Earth fault of the motor wire 4) Burnout of the motor 5) Poor contact of the motor wire. 6) Welding of contact of dynamic braking relay due to frequent servo ON/OFF operations. 7) Timing of pulse input is same as or earlier than Servo-ON. 8) Blowout of thermal fuse due to overheating dynamic brake circuit. (Only F)	1) Turn to Servo-ON, while disconnecting the motor. If error occurs immediately, replace with a new driver. 2) Check that the motor wire (U, V and W) is not shorted, and check the branched out wire out of the connector. Make a correct wiring connection. 3) Measure the insulation resistance between motor wires, U, V and W and earth wire. In case of poor insulation, replace the motor. 4) Check the balance of resister between each motor line, and if unbalance is found, replace the motor. 5) Check the loose connectors. If they are, or pulled out, fix them securely. 6) Replace the servo driver. Do not use Servo-ON/Servo-OFF as a means of staring/stopping the operation. 7) Enter the pulses 100 ms or longer after Servo-ON. 8) Replace the driver.
	1	* **IPM error protection** [IPM: Intelligent Power Module]		

Caution · Confirmation work is that checking the charge lamp is turned off after the power supply turn off.

Note · When protective function marked with * in the protective function table is activated, it cannot be disabled by the alarm clear input (USB conmmunication(PANATERM) or RTEX alarm clear commond). To return to the normal operation, turn off power, and then turn on power again,or use soft reset commond by RTEX conmmunication.

Error code No. Main	Error code No. Sub	Protective function	Causes	Measures
15	0	* Over-heat protection	Temperature of the heat sink or power device has been risen over the specified temperature. 1) Ambient temperature has risen over the specified temperature. 2) Over-load	1) Improve the ambient temperature and cooling condition. 2) Increase the capacity of the driver and motor. Set up longer acceleration/ deceleration time. Lower the load.
	1	Encoders abnormal Over-heat protection	When encoder overheating prtection detection is valid by the setting value of bit 11 Pr6.10,(Invaild initial set value) The temperature of encoder has exceeded an encoder overheat abnormal level. 1) The ambient temperature of servomotor is high. 2) Overload	1) Improve the ambient temperature of servomotor and the cooling condition. 2) Increase capacity of servo driver and motor.Set up longer acceleration/ deceleration time.Reduce the load..
16	0	Over-load protection	Torque command value has exceeded the over-load level set with Pr 5.12 "Over-load level setup" and resulted in overload protection according to the time characteristics (described later). 1) Load was heavy and actual torque has exceeded the rated torque and kept running for a long time. 2) Oscillation and hunching action due to poor adjustment of gain. Motor vibration, abnormal noise. Inertia ratio (Pr 0.04) setup error. 3) Miswiring, disconnection of the motor. 4) Machine has collided or the load has gotten heavy. Machine has been distorted. 5) Electromagnetic brake has been kept engaged. 6) While wiring multiple axes, miswiring has occurred by connecting the motor cable to other axis. 7) P5.12 "Over-load level setup" is too low. • The over-load protection time characteristics are described on P.6-23.	Check that the torque (current) does not oscillates nor fluctuate up and down very much on the graphic screen of the network. Check the over-load alarm display and load factor with the network. 1) Increase the capacity of the servo driver and motor. Set up longer acceleration/ deceleration time. Lower the load. 2) Make a re-adjustment of gain. 3) Make a wiring as per the wiring diagram. Replace the cables. 4) Remove the cause of distortion. Lower the load. 5) Measure the voltage between brake terminals. Release the brake. 6) Make a correct wiring by matching the correct motor and encoder wires. 7) Set Pr5.12 "Over-load level setup" to 0 (Set the maximum value allowed for the motor).

Caution · Confirmation work is that checking the charge lamp is turned off after the power supply turn off.

Note · When protective function marked with * in the protective function table is activated, it cannot be disabled by the alarm clear input (USB conmmunication(PANATERM) or RTEX alarm clear commond). To return to the normal operation, turn off power, and then turn on power again,or use soft reset commond by RTEX conmmunication.

Error code No. Main	Sub	Protective function	Causes	Measures
16	1	Torque saturation anomaly protection	Torque saturated has continued for the period set to Pr 7.16 "Torque saturation error protection frequency" or Pr6.57 "Torque saturation anomaly detection time".	• Check the operating state of the driver. • Take the same measure as done against Err16.0.
18	0	* Over-regeneration load protection	Regenerative energy has exceeded the capacity of regenerative resistor. 1) Due to the regenerative energy during deceleration caused by a large load inertia, converter voltage has risen, and the voltage is risen further due to the lack of capacity of absorbing this energy of the regeneration discharge resistor. 2) Regenerative energy has not been absorbed in the specified time due to a high motor rotational speed. 3) Active limit of the external regenerative resistor has been limited to 10 % duty. **Caution** Install an external protection such as thermal fuse without fail when you set up Pr0.16 to 2. Otherwise, regenerative resistor loses the protection and it may be heated up extremely and may burn out.	Check the load factor of the regenerative resistor from the front panel or via communication. Do not use in the continuous regenerative brake application. 1) Check the running pattern (velocity monitor). Check the load factor of the regenerative resistor and over-regeneration warning display. Increase the capacity of the driver and the motor, and loosen the deceleration time. Use the external regenerative resistor. 2) Check the running pattern (speed monitor). Check the load factor of the regenerative resistor. Increase the capacity of the driver and the motor, and loosen the deceleration time. Lower the motor rotational speed. Use an external regenerative resistor. 3) Set up Pr0.16 to 2.
	1	* Regenerative transistor error protection	Regenerative driver transistor on the servo driver is defective.	Replace the driver.
21	0	* Encoder communication disconnection error protection	Communication between the encoder and the driver has been interrupted in certain times, and disconnection detecting function has been triggered.	Make a wiring connection of the encoder as per the wiring diagram. Correct the miswiring of the connector pins.
	1	* Encoder communication error protection	Communication error has occurred in data from the encoder. Mainly data error due to noise. Encoder cables are connected, but communication data has some errors.	• Secure the power supply for the encoder of DC4.90 V to 5.25 V)...pay an attention especially when the encoder cables are long. • Separate the encoder cable and the motor cable if they are bound together. • Connect the shield to FG.

Caution · Confirmation work is that checking the charge lamp is turned off after the power supply turn off.

Note · When protective function marked with * in the protective function table is activated, it cannot be disabled by the alarm clear input (USB conmmunication(PANATERM) or RTEX alarm clear commond). To return to the normal operation, turn off power, and then turn on power again,or use soft reset commond by RTEX conmmunication.

Error code No. Main	Sub	Protective function	Causes	Measures
23	0	* Encoder communication data error protection	Data communication between the encoder is normal, but contents of data are not correct. Mainly data error due to noise. Encoder cables are connected, but communication data has some errors.	• Secure the power supply for the encoder of DC4.90 V to 5.25 V)...pay an attention especially when the encoder cables are long. • Separate the encoder cable and the motor cable if they are bound together. • Connect the shield to FG.
24	0	**Position deviation excess protection**	Deviation pulses have exceeded the setup of Pr0.14. 1) The motor movement has not followed the command. 2) Setup value of Pr0.14 (Position deviation excess setup) is small.	1) Check that the motor follows to the position command pulses. Check that the output toque has not saturated in torque monitor. Make a gain adjustment. Set up maximum value to Pr0.13 “1st torqur limit” and Pr5.22 “2nd torqur limit” . Make a encoder wiring as per the wiring diagram. Set up the longer acceleration/deceleration time. Lower the load and speed. 2) Set up a larger value to Pr0.14.
	1	**Speed deviation excess protection**	The difference between the internal positional command speed and actual speed (speed deviation) exceeds the setup vale of Pr6.02. Note) If the internal positional command speed is forcibly set to 0 due to instantaneous stop caused by the command pulse inhibit input (INH) or CW/CCW over-travel inhibit input, the speed deviation rapidly increases at this moment. Pr6.02 setup value should have sufficient margin because the speed deviation also largely increases on the rising edge of the internal positional command speed.	• Increase the setup value of Pr6.02. • Lengthen the acceleration/deceleration time of internal positional command speed, or improve the follow-up characteristic by adjusting the gain. • Disable the excess speed deviation detection (Pr6.02 = 0).
26	0	**Over-speed protection**	The motor rotational speed has exceeded the setup value of Pr5.13.	• Do not give an excessive speed command. • Check the command pulse input frequency and division/multiplication ratio. • Make a gain adjustment when an overshoot has occurred due to a poor gain adjustment. • Make a wiring connection of the encoder as per the wiring diagram.
	1	**2nd Over-speed protection**	The motor rotational speed has exceeded the setup value of Pr6.15.	

Note

• When protective function marked with * in the protective function table is activated, it cannot be disabled by the alarm clear input (USB conmmunication(PANATERM) or RTEX alarm clear commond). To return to the normal operation, turn off power, and then turn on power again,or use soft reset commond by RTEX conmmunication.

Error code No. Main	Sub	Protective function	Causes	Measures
27	1	＊ **Absolute clear protection**	Multi-turn clear of absolute encoder is made through USB communication (setup support software PANATERM).	・ Check if multi-turn clear of absolute encoder has been made through USB communication(setup support software PANATERM).
			Caution Checking is for the purpose of safety and not the cause of error. Multi-turn clearing through RTEX communication does not cause an alarm. However, be sure to reset the control power.	
	4	＊ **Command error protection**	Position command variation (value after electronic gear) exceeds the specified value.	・Check whether the position command was significantly changed due to cyclic position control (CP). ・ Check electronic gear ratio. ・ Check whether Update_Counter is changed in the correct cycle. ・ In case of changes from servo-off to servo-on,check whether the position command was initialized by the actual position when Servo_Active is 0. ・ Check whether parameter settings related to the communication cycle or the command update cycle are consistent with the specifications of the host controller
	5	＊ **Command generation error protection**	Position command generation process exceeded the computation range	・ Make sure that the electronic gear ratio and velocity control conform to limit requirements.
	6	**Operation commands contention protection**	・When Pr7.99 bit0 = 0, RTEX communications established during trial run of FFT operating on the amplifier alone. ・When Pr7.99 bit0 = 1, servo ON command by RTEX communications received during trial run of FET operating on the amplifier alone	・Check that RTEX has not been established during FFT trial run when Pr7.99 bit0 = 0. ・Check that servo ON command by RTEX communication has not been sent from a host unit during FFT trial run when Pr7.99 bit0 =1.

Note

- When protective function marked with * in the protective function table is activated, it cannot be disabled by the alarm clear input (USB conmmunication(PANATERM) or RTEX alarm clear commond). To return to the normal operation, turn off power, and then turn on power again,or use soft reset commond by RTEX conmmunication.

Error code No. Main	Sub	Protective function	Causes	Measures
27	7	* **Position information initialization error protection**	・During validation mode of attribute C parameter of reset command of RTEX communication, servo was turned ON. ・Cancellation of the homing command was executed from the host device during homing command (Type_Code: 11h to 1Dh) between home position detection and completion of return to home position. Note: It is not supported in versions corresponding to function extended edition 2 or earlier.	・Check to see that the servo is OFF during validation mode of attribute C parameter of reset command of RTEX communication. ・Check if homing command is canceled near the home position signal.
28	0	**Limit of pulse replay protection**	The output frequency of pulse regeneration has exceeded the limit.	・Check the setup value of Pr0.11 “Output pulse counts per one motor revolution” and Pr5.03 “Denominator of pulse output division”. ・To disable the detection, set Pr5.33 “Pulse regenerative output limit setup” to 0.
29	1	* Counter overflow protection 1	The calculated value of the absolute encoder position [in pulse units] or the electric gear ratio exceeded 32 bits in position information initialization that was performed after turning on the control power in absolute mode, after executing the attribute C parameter enabling mode, when clearing absolute encoder multi-turn via PANATERM or RTEX, when PANATERM operation (trial run, frequency characteristic analysis, Z phase search, or fit gain) is completed, or when pin assignment is made by PANATERM.	・Confirm the operating range of absolute encoder (absolute external scale) position and review the electronic gear ratio.
	2	* **Counter overflow protection 2**	Position deviation in unit of pulse has reached$\pm 2^{30}$-1 (1073741823) or more. Or, position deviation in unit of command has exceeded$\pm 2^{30}$ (1073741824).	・Check that the motor runs as per the position command pulses. ・Check that the output toque has not saturated in torque monitor. ・Make a gain adjustment. ・Set up maximum value to torque limit setting. ・Make a wiring connection of the encoder as per the wiring diagram.

Error code No. Main	Sub	Protective function	Causes	Measures
33	0	* Input duplicated allocation error 1 protection	Input signals (SI1, SI2, SI3, SI4) are assigned with two functions	・ Allocate correct function to each connector pin.
	1	* IInput duplicated allocation error 2 protection	Input signals (SI5, SI6, SI7, SI8) are assigned with two functions.	
	2	* IInput function number error 1 protection	Input signals (SI1, SI2, SI3, SI4) are assigned with undefined number. Or, logical setup is not correct.	
	3	* Input function number error 2 protection	Input signals (SI5, SI6, SI7, SI8) are assigned with undefined number. Or, logical setup is not correct..	
	4	* Output function number error 1 protection	Output signals (SO1) are assigned with undefined number.	
	5	* Output function number error 2 protection	Output signals (SO2,SO3) are assigned with undefined number.	
	8	* Latch input allocation error protection	Error has occurred during function assignment of latch correction pins (SI5, SI6, and SI7). • EXT1 must be allocated to SI5. EXT2 to SI6 and EXT3 to SI7: but these are assigned to other pins. • HOME is allocated to SI6 or SI7; POT is allocated to SI5 or SI7; NOT is allocated to SI5 or SI6. • Function not allocated to one or more control modes.	

Note

- When protective function marked with * in the protective function table is activated, it cannot be disabled by the alarm clear input (USB conmmunication(PANATERM) or RTEX alarm clear commond). To return to the normal operation, turn off power, and then turn on power again,or use soft reset commond by RTEX conmmunication.

Error code No. Main	Sub	Protective function	Causes	Measures
34	0	**Motor working range setup error protection**	When a position command within the specified input range is given, the motor operates outside its working range specified in Pr 5.14 “Motor working range etup”. 1) Gain is not appropriate. 2) Pr 5.14 setup value is low. 3) Conditions of compulsory Err34.0 occurring have met in the case of Pr6.97 “Function expansion setting 3” bit2=1. Note: It is not supported in versions corresponding to function extended edition 1 or earlier.	1) Check the gain (balance between position loop gain and velocity loop gain) and inertia ratio. 2) Increase the setup value of Pr 5.14. Or, Set Pr 5.14 to 0 to disable the protective function. 3)Revise the setting conditions or action conditions.(Refer tp Note of P6-24.)
	1	**One revolution absolute working range error**	At the time of absolute encoder is used, When Pr0.15 “Absolute encoder setup”=3, the motor (encoder) position crossed motor working range (encoder 1 revolution data).	・The working range of an absolute encoder (absolute scale) position including absolute home position offset is checked. ・A motor (encoder) position is returned in motor working range (inside of encoder 1 revolution data).
36	0 1	**＊ EEPROM parameter error protection**	Data in parameter storage area has been damaged when reading the data from EEPROM at power-on.	・Set up all parameters again. ・If the error persists, replace the driver (it may be a failure.) Return the product to the dealer or manufacturer.
37	0 1 2	**＊ EEPROM check code error protection**	Data for writing confirmation to EEPROM has been damaged when reading the data from EEPROM at power-on.	Replace the driver. (it may be a failure). Return the product to a dealer or manufacturer.

Note

- When protective function marked with * in the protective function table is activated, it cannot be disabled by the alarm clear input (USB conmmunication(PANATERM) or RTEX alarm clear commond). To return to the normal operation, turn off power, and then turn on power again,or use soft reset commond by RTEX conmmunication.

Error code No. Main	Sub	Protective function	Causes	Measures
38	0	**Over-travel inhibit input protection 1**	With Pr 5.04, over-travel inhibit input setup = 0, both positive and negative over-travel inhibit inputs (POT/NOT) have been ON. With Pr 5.04 = 2, positive or negative over-travel inhibit input has turned ON.	・ Check that there are not any errors in switches, wires or power supply which are connected to positive direction/ negative direction over-travel inhibit input. Check that the rising time of the control power supply (12 to 24 VDC) is not slow.
	1	**Over-travel inhibit input protection 2**	RTEX communication is OFF with Pr 5.04 = 0, and POT or NOT is ON, and then operation command (e.g. trial run, FFT) is given through USB communication (setup support software PANATERM). Or, POT or NOT is turned ON while the system is operating according to the command given through USB communication(setup support software PANATERM).	・ Check that there are not any errors in switches, wires or power supply which are connected to positive direction/ negative direction over-travel inhibit input. Check that the rising time of the control power supply (12 to 24 VDC) is not slow.
	2	**＊ Over-travel inhibit input protection 3**	With POT allocated to SI6 or NOT to SI7, Pr 5.04 “Over-travel inhibit input setup” is set to a value other than 1 (disabled).	・ When POT is allocated to SI6 or NOT allocated to SI7, make sure that Pr 5.04 “Over-travel inhibit input setup” is set to 1 (disabled).
40	0	**Absolute system down error protection**	Voltage of the built-in capacitor has fallen below the specified value because the power supply or battery for the absolute encoder has been down.	After connecting the power supply for the battery, clear the absolute encoder. ・ If you use the incremental system Pr 0.15 "sets the absolute encoder " is set to 1.
			Caution Once this error occurs, the alarm cannot be cleared until the absolute encoder is reset. Please refer to P.7-8 “Setup (Initialization) of Absolute Encoder”	
41	0	**＊ Absolute counter over error protection**	Multi-turn counter of the encoder has exceeded the specified value.	・ Set Pr 0.15 “Absolute encoder setup” to the appropriate value. ・ Limit the travel from the machine origin within 32767 revolutions.

Note

- When protective function marked with * in the protective function table is activated, it cannot be disabled by the alarm clear input (USB conmmunication(PANATERM) or RTEX alarm clear commond). To return to the normal operation, turn off power, and then turn on power again,or use soft reset commond by RTEX conmmunication.

Error code No. Main	Sub	Protective function	Causes	Measures
42	0	**Absolute overspeed error protection**	1) During a power failure, when only battery power is supplied, the motor rotational speed has exceeded the specified value. 2) During normal operation, for some reason, the power of encoder has been shut down, and the rotational speed has exceeded the specified value.	1) Check the driving from outside in a power outage and the rotational speed at the time, and operate to make it below specified value. 2) Because the mode was switched to a power failure mode during normal activity ・Check the encoder-side power supply voltage (5 V±5 %). ・ Check the connection of connector X6. ・ If you use the incremental system Pr 0.15 "sets the absolute encoder " is set to 1.
			Caution Once this error occurs, the alarm cannot be cleared until the absolute encoder is reset. Please refer to P.7-8 “Setup (Initialization) of Absolute Encoder”	
44	0	**＊ Single turn counter error protectio**	Single turn counter error was detected.	Replace the motor.
45	0	**＊ multi-turn counter error protection**	Multi turn counter error has been detected.	Replace the motor. ・ If you use the incremental system Pr 0.15 "sets the absolute encoder " is set to 1.
47	0	**＊ Absolute status error protection**	Encoder has been running at faster speed than the specified value at power on.	Arrange so as the motor does not run at power-on.
70	0	**U-phase current detector error protection**	U-phase current offset error is detected.	・Turn off the power once, then re-enter. ・If error repeats, this might be a failure. Stop using the products, and replace the motor and the driver. Return the products to the dealer or manufacturer.
	1	**W-phase current detector error protection**	W-phase current offset error is detected.	
72	0	**Thermal protector error**	Thermal protector error is detected.	

Note

- When protective function marked with * in the protective function table is activated, it cannot be disabled by the alarm clear input (USB conmmunication(PANATERM) or RTEX alarm clear commond). To return to the normal operation, turn off power, and then turn on power again,or use soft reset commond by RTEX conmmunication.

Error code No. Main	Error code No. Sub	Protective function	Causes	Measures
80	**3**	**PLL incomplete error protection**	Phase lock between communication and servo (PLL lock) could not be completed even after 1s of starting synchronization process.	・Check that communication cycle set in Pr7.20 “RTEX communication cycle setup” and Pr7.91 “RTEX communication cycle enhancement setting” match the transmission cycle from the host unit. ・ Check that the synchronization mode among multiple axis in Pr7.22 “RTEX function extended setup 1” bit1 matches the setting of the host unit. ・ Check that there are no problems in the processing of the host side units. ・ Check that there are no abnormalities in the transmission cycle of RTEX communication data from the host unit. ・ Design the accuracy of RTEX communication data transmission cycle from the host device within ±0.05 %. ・ If the communication cycle is 250 us or less, Update_Counter must be varied correctly even when the command update cycle equals the communicate cycle. Please check if there is a problem in Update_Counter. ・ Shut down and reclose the power supply. ・ It may be a failure if indication continues to be displayed and error persists. Terminate use and replace the motor and the servo driver. ・ Return to the supplier store for investigation (repairs).
82	**0**	＊ **RTEX node addressing error protection**	On power up of the control power, node address setting rotary switch on the servo drive has been set to a value outside the valid value.。	・ Check the setting of the node address setting switc. ・ Set node address setting switch to a value within the range of 0 and 31 and then turn on control power to the servo driver。

Error code No. Main	Error code No. Sub	Protective function	Causes	Measures
83	0	RTEX continues communication error protection 1	Error (CRC error) detection for the read of receive data sent to the node itself continued for the number of times set for Pr7.95 "Number of RTEX continuous communication error protection 1 detections"	· Check the communication cable for excessive noise. · Check the communication cable for length, layout arrangement and connections, · Communication cable must be category 5-e or higher (6 or higher grade is recommended) shielded twisted pair cable (STPC) specified by TIA/EIA-568. · Replace the cable with the one recommended as above, if not a recommended one. · Attach the ferrite core to the cable if effective. · Increase the value set for Pr7.95 or Pr7.96.
	1	RTEX continues communication error protection 2	Error detection for the read of receive data sent to the node itself continued for the number of times set for Pr7.96 "Number of RTEX continuous communication error protection 2 detections".	
			Caution: This alarm assumes an error if CRC error, receiving failure, or cyclic data error occurs.	
84	0	RTEX communication timeout error protection 2	The condition, in which the receive interrupt startup signal was not output from the RTEX communication IC with no reception of communication data, continued for the number of times set for Pr7.97 "Number of RTEX communication timeout error protection detections"	· If the frequency of occurrence is changed by the exchange of communication cable, there is a possibility of a connection failure of the connector. Please change the manufacturer of the connector plug. · Check to see that the cable is disconnected or broken. · Check that the upstream node is ready for transmission (power is ON, not reset). · Make sure that the host device can transmit the signal at the correct timing and speed. · The communication cycle set by Pr 7.20 "RTEX communication cycle setup" and Pr7.91 "RTEX communication cycle expansion setting" must match the transmission cycle of the host device. · Increase the value set for Pr7.97. · If one or more requirements are not met, take the corrective action by referring to description of Err 83.0.
	3	* RTEX ommunication synchronization error protection	An error occurred in the communication-servo synchronization processing.	· Turn off the power once, then re-enter. · If error repeats, this might be a failure. Stop using the products, and replace the motor and the driver. · Return the products to the dealer or manufacturer.

Error code No. Main	Sub	Protective function	Causes	Measures
84	5	**RTEX ommunication cyclic error protection**	The receive interrupt startup signal was output from the RTEX communication IC, but the communication got out of sync with the servo with an error in output cycle.	· Make sure that the host device can transmit the signal at the correct timing and speed. · The communication cycle set by Pr 7.20 “RTEX communication cycle settup” and Pr7.91 “RTEX communication cycle expansion setting” must match the transmission cycle of the host device. · If one or more requirements are not met, take the corrective action by referring to description of Err 83.0.
86	0	**RTEX cyclic data error protection 1**	The condition, in which there is an error in cyclic command area data (C/R, MAC-ID) or there is an error in Sub_Chk during 32-byte mode, continued for the number of times set for Pr7.98 “Number of RTEX cyclic data error protection 1/2 detections”.	· Check the data in the cyclic command field (at location as described on the left column). · Check process performed on the host device. · Increase the value set for Pr7.98.
	1	**RTEX cyclic data error protection 2**	The condition, in which there is an error in the cyclic command code, continued for the number of times set for Pr7.98 “Number of RTEX cyclic data error protection 1/2 detections”.	
	2	*** RTEX_ Update_ Counter error protection**	The setup value for Pr 7.38 “RTEX_ Update_Counter error protection setup” has been exceeded and the Update_ Counter has not been updated correctly.	· Check for any trouble in the process performed on the host device. · Please check whether there is any problem in a cycle setup of the host device, and a cycle setup of the driver. · Increase the setup value for Pr 7.38. · Please repeal this alarm when the ratio of the communication cycle to the cycle which a command updates is 1:1 and you do not use Update_Counter.
87	0	**Forced alarm input protection**	Forced alarm input (E-STOP) is applied.	· Check the wiring of forced alarm input (E-STOP).
90	2	*** RTEX multi-axis synchronization establishment error protection**	Communication error occurred or communication was lost during transition to synchronization establishment in full synchronization mode.	· Take the same measure as done against Err83.0 or Err84.0.

Error code No. Main	Sub	Protective function	Causes	Measures
91	1	**RTEX command error protection**	・ Disagreement in the combination of communication cycle, 16/32 byte mode, semi-closed/full-closed and control mode ・ The control mode is changed within a period shorter than 2 ms. ・ Control mode was changed during profile position latch positioning/profile home position return (Type_Code = 12h, 13h, 31h, 32h, 33h,34h,36h). ・ Control mode was changed while non-cyclic command (Busy = 1) was processed. ・ Home position return command (4h) was executed during profile position latch positioning/profile home position return (Type_Code = 12h, 13h, 31h, 32h, 33h,34h,36h). ・ Initialization mode (Type_Code = 1•h, 31h) for home position return command (4h) was performed during profile positioning/profile continuous rotation (Type_Code = 10h, 11h, 20h). ・ Type_Code was changed during profile position control (pp). ・ Type_Code = 1•h/2•h for home position return command (4th) was performed at the time of speed control (CV)/ torque control (CT). ・ the control mode is except NOP, and the external scale position information monitoring facility at the semi-closed control is effective, and the communication cycle is 0.0625ms or less at 16 byte modes. ・ During the two-degrees-of-freedom control mode (standard type), the control mode was switched to other than position/speed control . ・ During the two-degrees-of-freedom control mode (sync type), the control mode was switched to other than position control .	・ Check the process of upper device for any problem.
	3	**RTEX command error protection 2**	・Cancellation of Latch mode with stop function was executed by the host device for Latch mode with stop function (Type_ Code: F1h) of homing command between trigger signal detection and completion of the operation. Note: It is not supported in versions corresponding to function extended edition 3 or earlier.	・Check if cancellation of Latch mode with stop function is executed near the trigger signal.

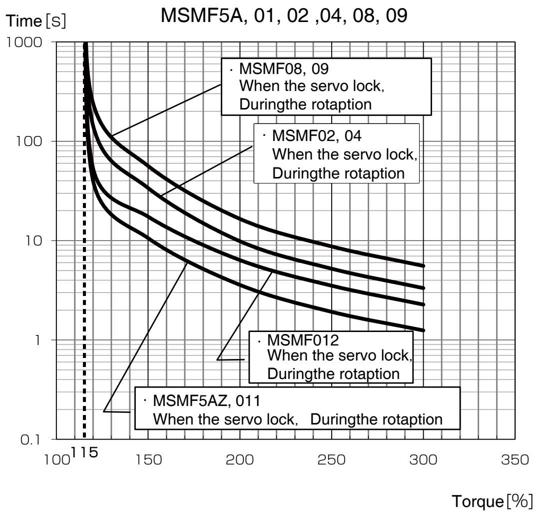
Error code No. Main	Sub	Protective function	Causes	Measures
92	0	* **Encoder data recovery error protection**	Initialization process of internal position information has not conducted normally under absolute and semi-closed control mode.	· Secure encoder power supply voltage at DC5 V±5 % (4.75 to 5.25 V). Care must be taken when the encoder lines are lengthy. · If motor wires and encoder wires are bundled together, separate them. · Connect shield to FG.
	3	**Multi-rotation upper limit value inconsistency error protection**	At continuous rotating absolute encoder function, there was a disagreement between the upper-limit value of encoder multi-turn data and the upper-limit value of driver parameter multi-turn data.	Check the value set for the parameter.
93	0	* **Parameter setup error 1**	Electronic gear ratio exceeds the allowable range.	· Check the setting value of the parameter. · Electronic gear ratio must be in the range 1/1000 to 8000.
	5	* **Parameter setup error protection 4**	· The combination conditions of Pr 7.20"RTEX communication cycle setup", Pr7.91 "RTEX communication cycle expansion setting", Pr 7.21 "RTEX command updating cycle setup" and bit0 (RTEX communication data size) of Pr 7.22 "RTEX function extended setup 1" and electronic gear ratio are not met · Feed forward settings of Pr7.35–Pr7.37 are duplicated.	· Check settings of the parameters. · For correct setting conditions, refer to the setting of network.
	8	* **Parameter setting error protection 6**	· The continuous rotating absolute encoder function was set to enable with other than the 23-bit motor. · Absolute home position offset is set outside the range in continuous rotating absolute mode.	Check the value set for the parameter.
94	2	**Home position return error protection**	An error with profile home position return occurred.	· Check sensor installation status etc. for any problem.

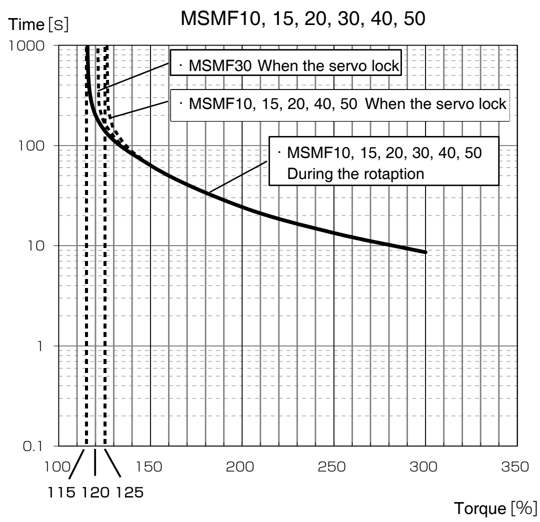
Error code No. Main	Sub	Protective function	Causes	Measures
94	3	**Home position return error protection2**	・While Pr7.41 “RTEX function extended setup 5”bit 7 is set to 1, and returning to the origin by using the Z phase, either of positive direction/negative direction run inhibit input (POT/NOT) is switched ON when the operation for returned to the detected Z phase position is performed. ・Returning amount to the detected Z phase position becomes abnormal when returning to the origin by using the Z phase.	・Enlarge the distance between the Z phase and positive direction/negative direction run inhibit input (POT/NOT). ・After checking the safety, set Pr7.41 bit 7 (setting of detection of run inhibit input when returning to the origin of Z phase) to 0 (disabled).
95	0~4	*** Motor automatic recognition error protection**	The motor and the driver have not been matched.	・Replace the motor which matches to the driver.
96	2	**Control unit error protection 1**	An error occurred in the servo driver control unit.	・Turn the power off and then on again. ・Return the products to the dealer or manufacturer.
	3	**Control unit error protection 2**		
	4	**Control unit error protection 3**	The servo driver received an RTEX communication frame in an invalid timing.	・Check whether the host device transmits RTEX communication frames in unstable cycles. ・Keep the accuracy of the transmission cycle of the host device within ±0.05 %.
	5	**Control unit error protection 4**	An error occurred in the servo driver control unit.	・Turn the power off and then on again. ・Return the products to the dealer or manufacturer.
	6	**Control unit error protection 5**		
	7	**Control unit error protection 6**		

Error code No. Main	Error code No. Sub	Protective function	Causes	Measures
98	1	＊ **RTEX hardware error protection 1**	Fault is determined in RTEX communication related peripheral device.	• Turn off the power once, then re-enter. • If error repeats, this might be a failure. Stop using the products, and replace the motor and the driver. • Return the products to the dealer or manufacturer.
	2	＊ **RTEX hardware error protection 2**		
	3	＊ **RTEX hardware error protection 3**		
Other No.		**Other error**	Control circuit has malfunctioned due to excess noise or other causes. Some error has occurred inside of the driver while triggering self-diagnosis function of the driver.	• Turn off the power once, then re-enter. • If error repeats, this might be a failure. Stop using the products, and replace the motor and the driver and External scale. Return the products to the dealer or manufacturer.

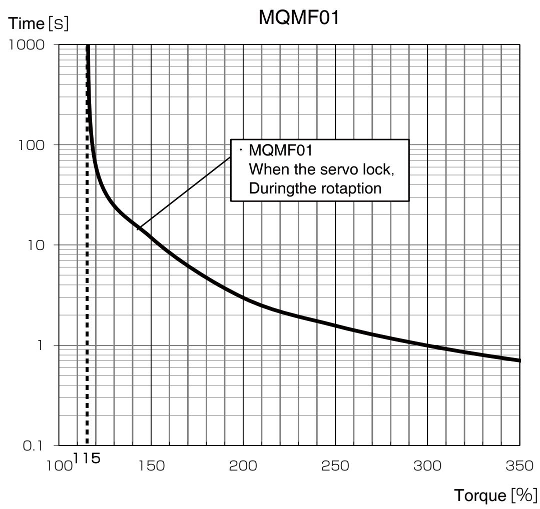
Time Characteristics of Err16.0 (Overload Protection)

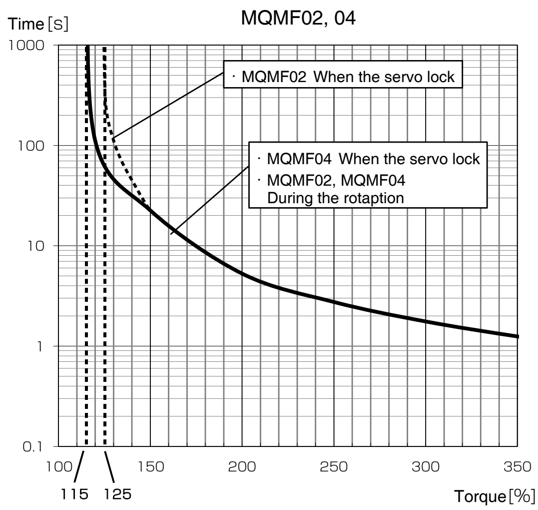
MSMF Overload protection time characteristics





MQMF Overload protection time characteristics

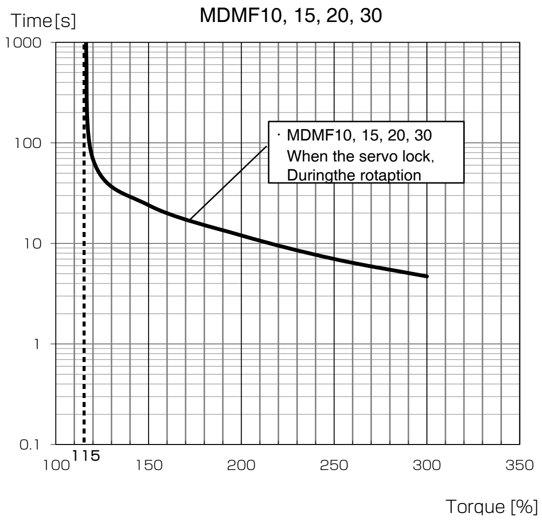


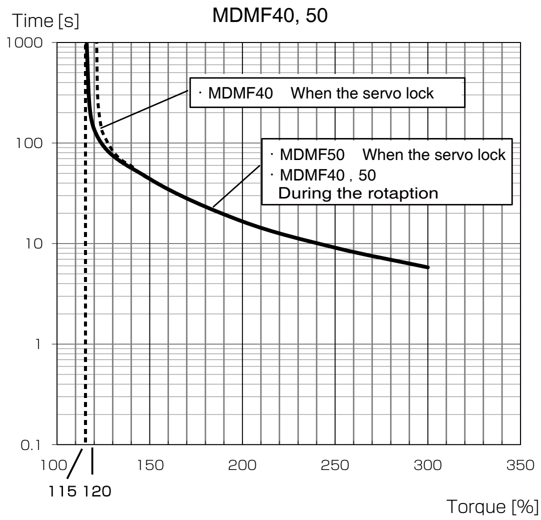


Caution Use the motor so that actual torque stays in the continuous running range shown in “S-T characteristic” of the motor. For the S-T characteristics, see P.7-11 Motor characteristics (S-T characteristics).

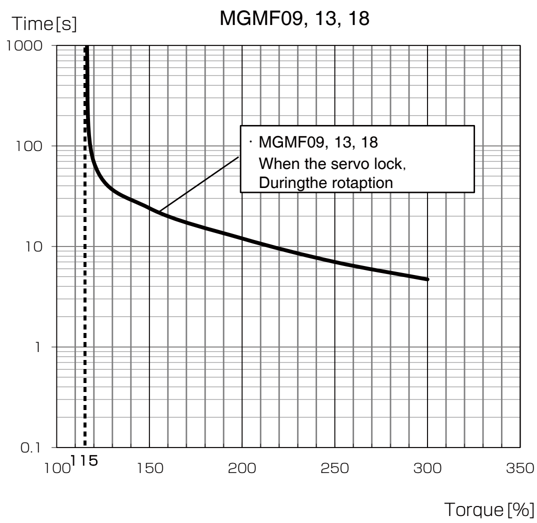
Time characteristics of Err16.0 (Overload protection)

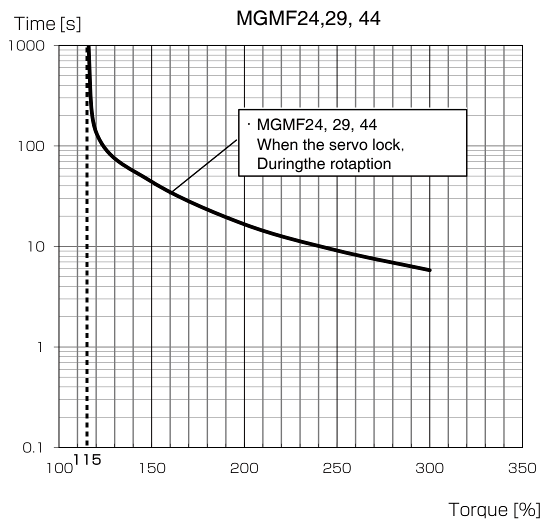
MDMF Overload protection time characteristics





MGMF Overload protection time characteristics

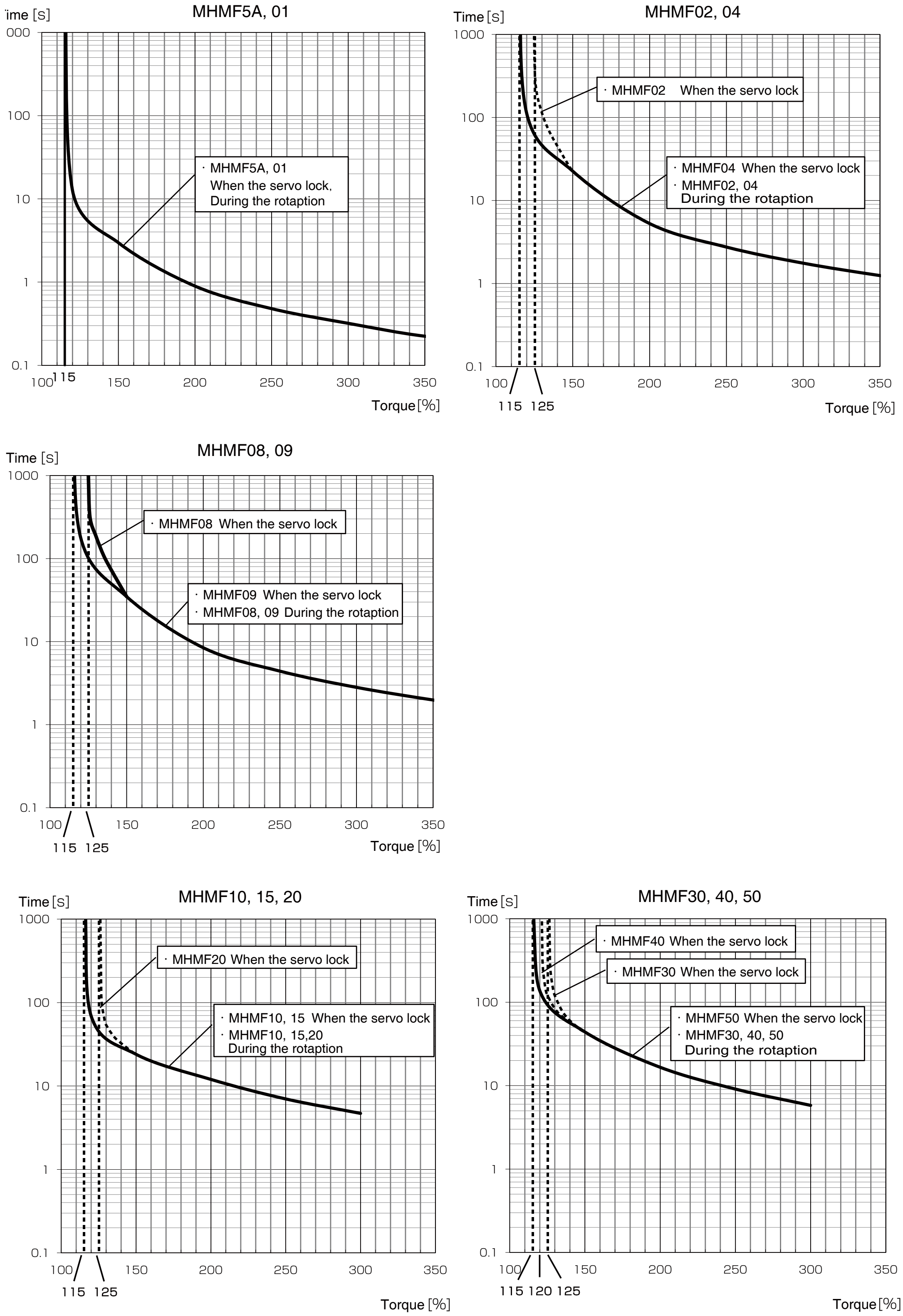




Caution Use the motor so that actual torque stays in the continuous running range shown in "S-T characteristic" of the motor. For the S-T characteristics, see P.7-11 Motor characteristics (S-T characteristics).

Time characteristics of Err16.0 (Overload protection)

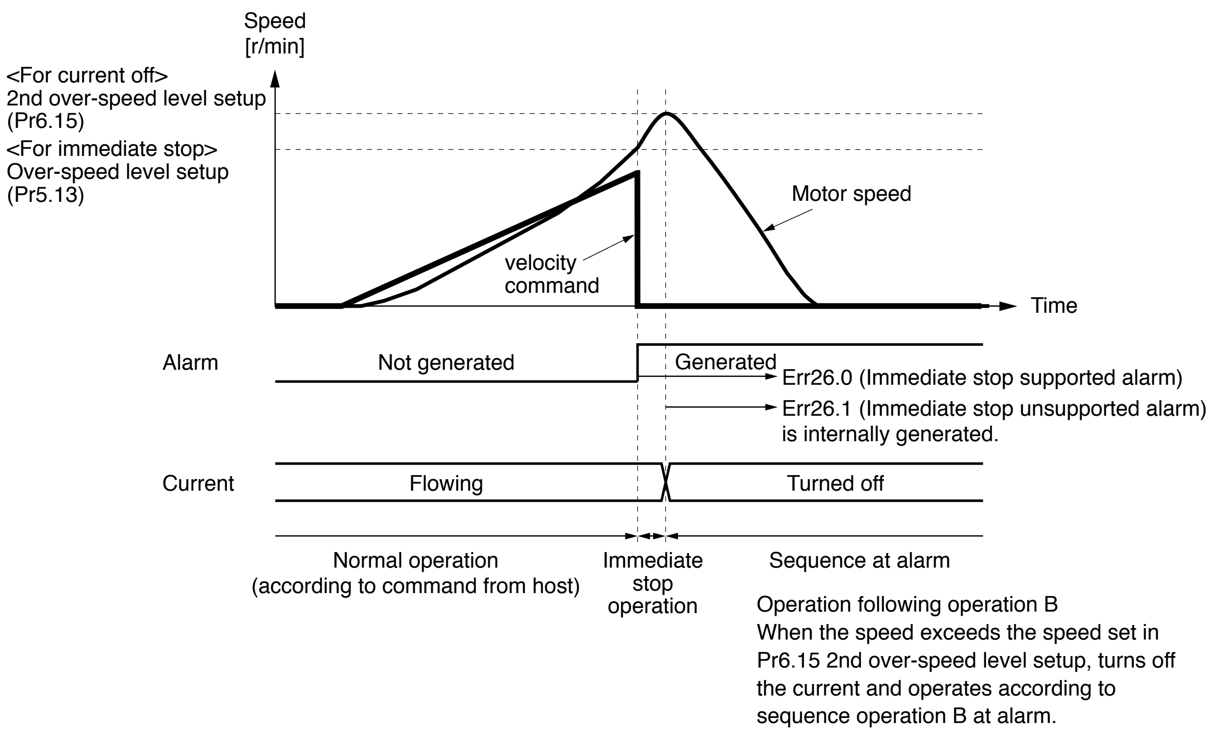
MHMF Overload protection time characteristics



Caution Use the motor so that actual torque stays in the continuous running range shown in “S-T characteristic” of the motor. For the S-T characteristics, see P.7-11 Motor characteristics (S-T characteristics).

Setting Pr5.13 Over-speed level setup and Pr6.15 2nd over-speed level setup

In a specific condition, the motor will not stop normally when the immediate stop function is activated.
For example, as shown below, when the motor speed exceeds Pr5.13 Over-speed level setup, and immediate stop function is activated, the motor speed cannot be controlled.
As a safety measure against over-speed, Err26.1 (2nd over-speed protection) is provided. Because Err26.1 is an immediate stop unsupported alarm, it shuts off motor current and stops the motor by following sequence operation B of alarm process. In Pr6.15 2nd over-speed level setup, set the allowable over-speed level.
Set Pr5.13 to the lower value compared with that of Pr6.15 to have sufficient margin. When both settings are the same or margin is small, Err26.0 and Err26.1 may be detected at the same time. In this case Err26.0 is displayed, but because Err26.1 is also generated internally, immediate stop unsupported alarm is given priority and immediate stop is not performed.
Furthermore, if the setup value of Pr6.15 is lower than that of Pr5.13, Err26.1 is generated before Err26.0, disabling immediate stop.



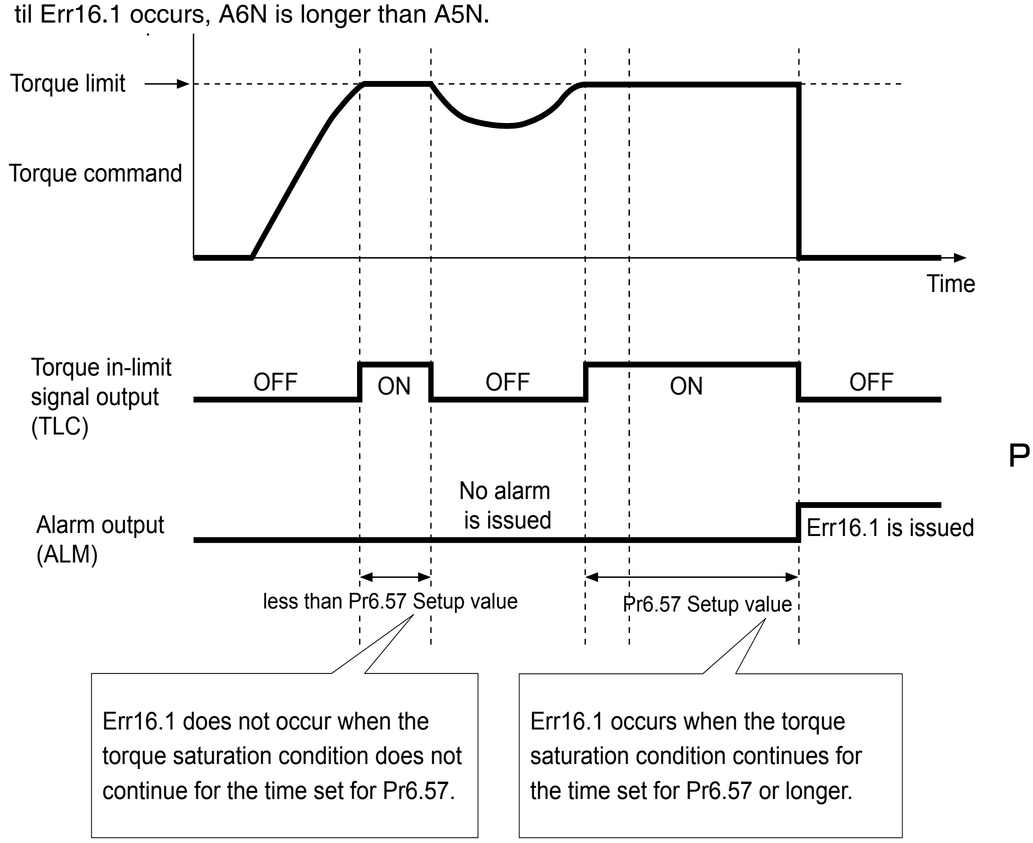
Torque Saturation Protection（Err16.1）

If torque saturated has continued for a fixed period, an alarm can be activated.

Relevant parameters

Parameter No.	Title	Range	Unit	Function
Pr6.57	Torque saturation anomaly detection time	0 to 5000	ms	Set the torque saturation error protection detection time. If torque saturation erroneously occurs for a set time, Err16.1 “Torque saturation error protection” occurs. When 0 is set, the value set for Pr7.16 is enabled.
Pr7.16	Torque saturation error protection frequency	0 to 30000	time	If torque saturated is continued during a preset frequency, Err 16.1 “Torque saturation protection” will be activated. The number of times is counted up every 0.25 ms. For example, when 30000 is set, Err16.1 occurs if the torque saturation condition continues for 7.5 seconds. The count is cleared when the torque saturation condition is removed. When the value set for Pr6.57 is other than 0, the value set for Pr6.57 is enabled.

・Set both Pr6.57 and Pr7.16 to 0 to make this function disabled.
・ When torque is controlled, this function is disabled and Err 16.1 will not be activated.
・ If the immediate stop alarm is activated, this function is disabled and Err 16.1 will not be activated.
・ Count cycle is different from the MINAS-A5N series.In the case of the same setting, the time until Err16.1 occurs, A6N is longer than A5N.



Related page • P.3-100、3-107 “Details of Parameter”

Allowable Motor Operating Range Setting Function(Err34.0)

1) Outline

If the motor with respect to the position command input range exceeds the motor operating range that is set by Pr5.14“Motor working range setup”, it can be alarm stop at the Err34.0 “motor movable range set protection”

The allowable motor operating range is calculated internally by the amplifier under the following formula:

- Positive direction allowable motor operating range = Positive direction position com mand entry input range + Pr5.14
- Negative direction allowable motor operating range = Negative direction position command entry input range - Pr5.14

2) Applicable range

This function works under the following conditions.

	Conditions under which the software limit works
Control mode	• Position control
Others	• To be in the servo ON state. • Parameters except for controls such as torque limit setup, are correctly set, assuring that the motor can run smoothly..

3) Cautions

- This function is not a protection against the abnormal position command.
- When this software limit protection is activated, the motor decelerates and stops according to Pr 5.10“Sequence at alarm”.
  The work (load) may collide to the machine end and be damaged depending on the load during this deceleration, hence set up the range of Pr 5.14 including the deceleration movement.
- When changing the control mode (for the purpose of only to control velocity or torque), do not use this function. Instead, use software limit function or drive inhibit input.
- When any of the following values ([encoder pulse] or [external scale pulse]) managed internally in the amplifier, exceeds ±231, Err34.0 “motor movable range set protection” detection process will be invalidated”[*1]
  - Position command input range
  - Actual motor position for judgment
  - Motor movable range
- In case any of the following conditions are satisfied, the position command input range and the actual motor position for judgment managed inside the amplifier will be cleared and Err34.0 “Motor movable range setting error protection” detection process will be invalidated.
  - When the control power is turned on
  - Servo-OFF state
  - Velocity control state or torque control state
  - During frequency response measurement using setup support software (PANATERM).
  - During the time position deviation is cleared (position deviation cleared for servo OFF or for decelerated stop from alarm, etc.)

- In case any of the following conditions are satisfied, the position command input range and the actual motor position for judgment managed inside the amplifier will be cleared and Err34.0 “Motor movable range setting error protection” detection process will be invalidated.
  - During trial run or Z phase search operation using setup support software (PANATERM).
  - Under absolute clear using setup support software (PANATERM)
  - Pr5.14 = 0
  - When Pr5.14 satisfies the following formula (when the value of Pr5.14 converted into external pulse units exceeds 2^{31}). *1
    Pr5.14 > ((2^{31} -1) * Pr3.24 * 10) / (Encoder resolution * Pr3.25)
  - When clearing position deviation during deceleration to stop due to over-travel inhibit input
  - When returning to home

*1 However, it is possible to generate Err34.0 by force even when the Err34.0 detection process is disabled, by enabling the following setting.
Pr6.97 “Function expansion setup 3”
bit2 Expansion of Allowable motor operating range abnormal protection
0: Invalid, 1: Valid

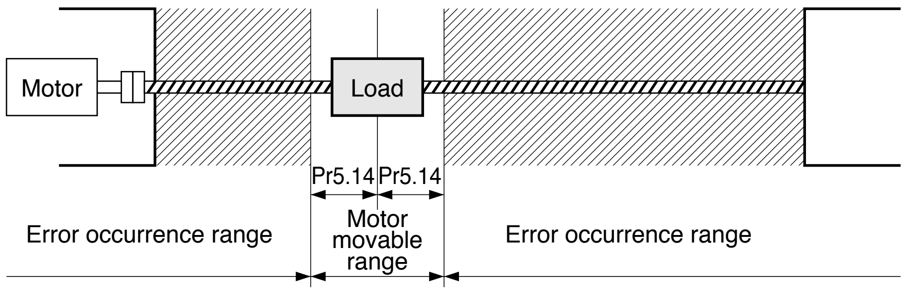
4) Relevant parameters

Parameter No.	Title	Range	Unit	Function
Pr5.14	Motor working range setup	0 to1000	0.1 revolution	Sets allowable motor operating range corresponding to position command input range. In case the set value is exceeded, Err34.0 “Allowable motor operating range abnormal protection” will occur. Protection function invalid when set value = 0. In addition, protection function will be invalid for each condition indicated in the aforementioned precaution.
Pr6.97	Function expansion setup 3	-2147483648 to 2147483647	–	Sets various function in bit units: bit 2: Expansion of Allowable motor operating range abnormal protection 0: Invalid, 1: valid

5) Example of movement

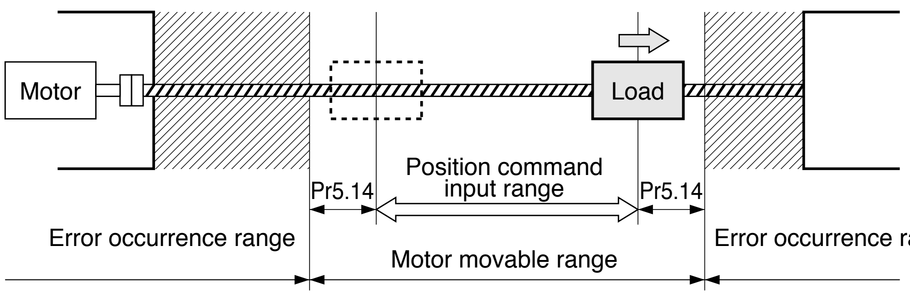
(1) When no position command is entered (Servo-ON status),

The motor movable range will be the travel range which is set at both sides of the motor with Pr5.14 since no position command is entered. When the load enters to the Err34.0 occurrence range (oblique line range), software limit protection will be activated.



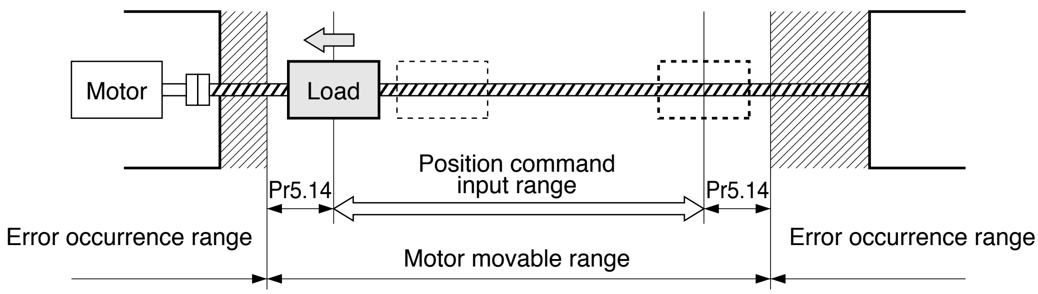
(2) When the load moves to the right (at Servo-ON),

When the position command to the right direction is entered, the motor movable range will be expanded by entered position command, and the movable range will be the position command input range + Pr5.14 setups in both sides.



(3) When the load moves to the left (at Servo-ON),

When the position command to the left direction, the motor movable range will be expanded further.



1. Troubleshooting

Fall Prevention Function in the Event of Alarms

Outline

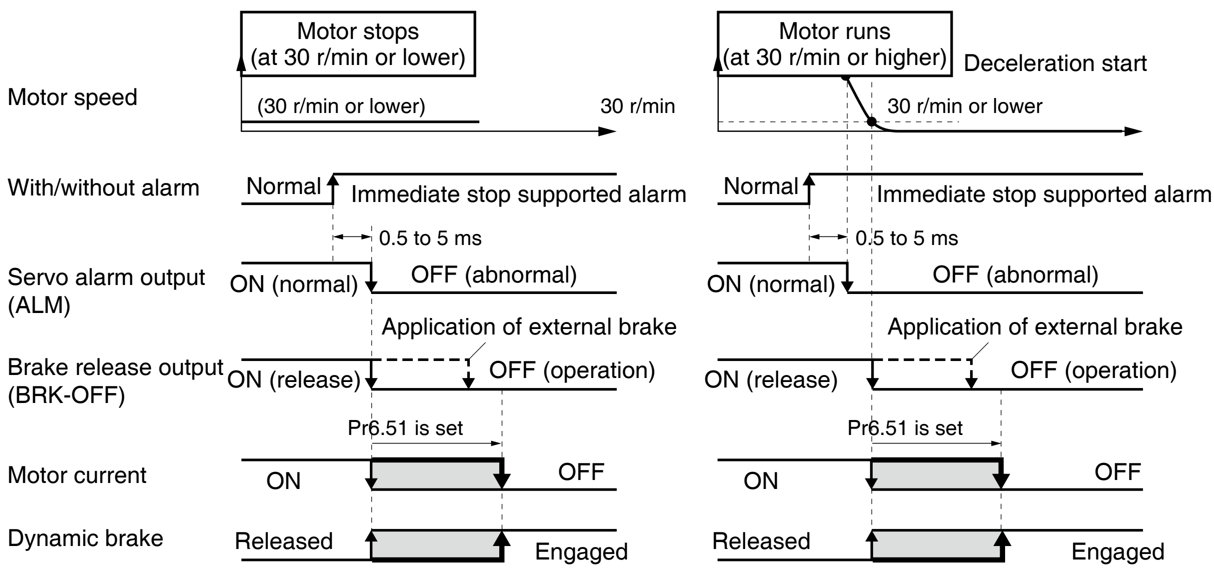
Since the servo drive cuts off motor energization when alarm occurs, a workpiece may fall from the vertical axis such as a robot arm during the period from when brake release output (BRK-OFF) becomes OFF to when external brake actually operates.
This function can prevent a fall when alarm occurs by setting the sequence at alarm to immediate stop.
This function cannot be used for alarm that does not support immediate stop.

Related Parameters

Class	No.	Title	Function
5	10	Sequence at alarm	To set the state during deceleration and after stopping when alarm is generated. Setting to 4 through 7 enables an immediate stop.
6	10	Function expansion setting	To set the bit concerning drop prevention function. bit10: Fall prevention function, under alarm 0: Invalid 1: Valid When the drop prevention function is made enabled, usually set to 1. Note: The lest significant bit is designated as bit0.
6	51	Immediate stop completion wait time	When alarm that must respond to an immediate stop is generated, after turning OFF the brake release output (BRK-OFF), set the time to maintain the motor energization. In the case of zero setting, the drop prevention function is disabled.

Content

• Drop prevention function action when alarm that must respond to an immediate stop



Note In the event that the drop prevention function is enabled when alarm is generated, set Pr5.10 “Sequence at alarm” to 4, Pr6.10 “Function expansion setting” bit 10 to “1,” and a value longer than the time when brake release output (BRK-OFF) is turned OFF and external brake actually operates to Pr6.51 “Immediate stop end wait time.”

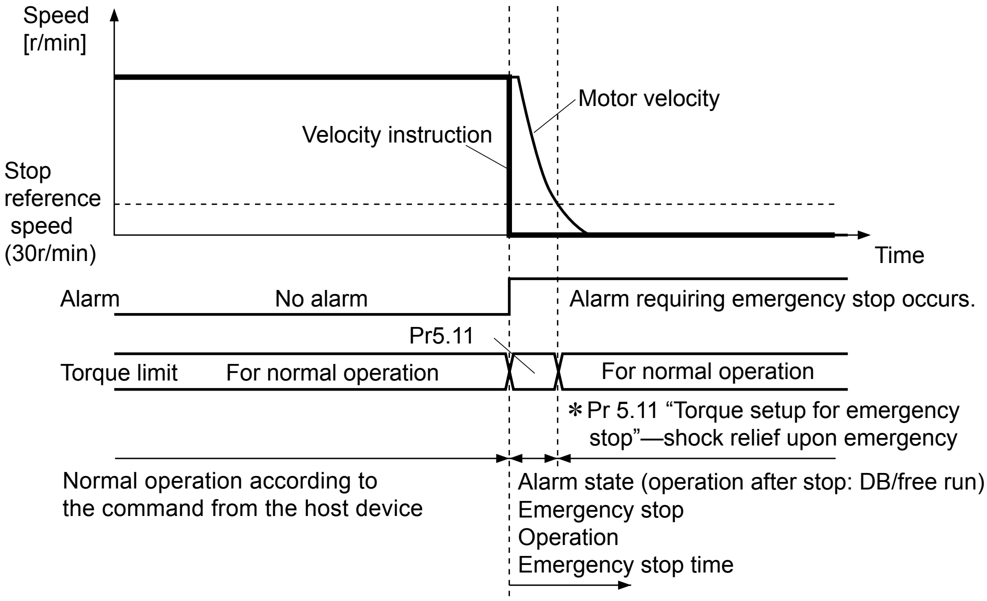
Emergency Stop upon Occurrence of Alarm

When an alarm requiring emergency stop occurs, the system controls and immediately stops the motor.

1) Relevant parameters

Panameter No.	Title	Range	Unit	Function
Pr5.10	Sequence at alarm	0 to 7	—	Specify the status during deceleration and after stop, after occurrence of alarm.Setting the parameter to one of 4 to 7, enables emergency stop.
Pr5.11	Torque setup for emergency stop	0 to 500	%	Set up the torque limit at emergency stop. When setup value is 0, the torque limit for normal operation is applied.
Pr5.13	Over-speed level setup	0 to 20000	r/min	If the motor speed exceeds this setup value, Err26.0 Over-speed protection occurs.The over-speed level becomes internal value of the over-speed protection level. speed by setting up this to 0.
Pr6.14	Emergency stop time at alarm	0 to 1000	ms	Set up the time allowed to complete emergency stop in an alarm condition. Exceeding this time puts the system in alarm state. When setup value is 0, immediate stop is disabled and the immediate alarm stop is enabled.
Pr6.15	2nd over-speed level setup	0 to 20000	r/min	When the motor speed exceeds this setup time during emergency stop sequence in an alarm condition, Err 26.1 2nd over-speed protection will be activated. The over-speed level becomes internal value of the over-speed protection level. speed by setting up this to 0.

2) Emergency stop sequence upon occurrence of an alarm requiring emergency stop



After occurrence of an alarm requiring emergency stop: when the speed has not dropped down to 30 r/min after the elapse of time set by Pr 6.14 "Emergency stop time at alarm", the system generates the alarm. The system also enters the alarm state if an alarm that does not require emergency stop occurs in the driver during the sequence of the emergency stop.

Caution

・As protection of an alarm requiring emergency stop occurs,please set an allowable over-speed level for Pr6.15 “2nd over-speed level setup”.
For the immediate cessation of an error corresponding to the second overspeed protection trip and the error is generated.but, set Pr5.13 to a small value with a sufficient margin for Pr6.15. If the margin is insufficient or the set value is the same, both Err26.0 and Err26.1 may be detected. In this case, Err26.0 will be displayed. However, because Err26.1 is also activated internally, priority is given to the alarm that does not require emergency stop, and emergency stop is not executed.

・When there is a plurality of alarm, LED front panel will display the information previously generated.
When confirmed by USB communication (PANATERM)
・Ararm Screen …Plurality of content for An error occurred in the current is displayed.
（First, the first line）
・Other Screen…… Only the previously generated content is displayed.

1 Before Using the Products
2 Preparation
3 Setup
4 Trial Run
5 Adjustment
6 When in Trouble
7 Supplement

Outline

When the alarm that must respond to an immediate stop comes on, drop in the vertical axis, etc. is prevented by keeping the motor energized for the time from when the brake release output (BRK-OFF) is turned OFF to when the external brakes actually begin to work.

Scope of Application

This function cannot be applied unless the following conditions are satisfied.

	Condition for activation of slow stop function
Control mode	• Position control, velocity control or torque control*1
Others	• Servo-ON state • Elements other than control parameters, such as torque limit, etc. have been appropriately set, without any problems in normal operations.

*1 During immediate stop, it is forced to become position control.

*2 Without this function before function extended version1,when it is version 2 only position control mode with this function,please make this funtion invaild in velocity control mode and torque conrtol mode

Related Parameters

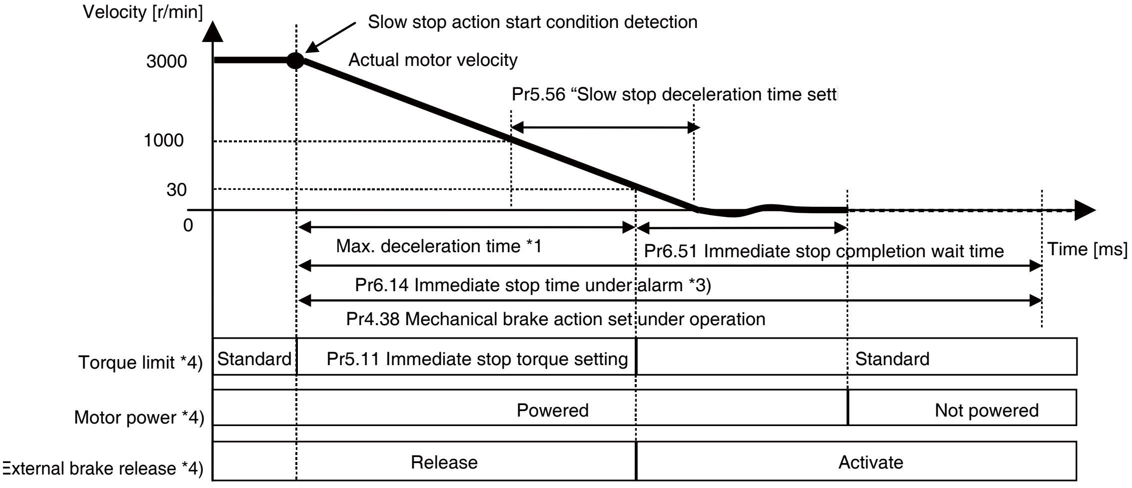
Class No.	Parameter name	Set range	Units	Functions
Pr5.05	Sequence at over-travel inhibit	0 to 2	–	When Pr 5.04 “Over-travel inhibit input setup” = 0, specify the status during deceleration and stop after application of the over-travel inhibition (POT, NOT). *Set up emergency stop to enable Slow Stop function.
Pr5.06	Sequence at Servo-Off	0 to 9	–	Specify the status during deceleration and after stop, after servo-off. *Set up emergency stop to enable Slow Stop function.
Pr5.07	Sequence at main power off	0 to 9	–	Specify the status during deceleration after main power interrupt or after stoppage. *Set up emergency stop to enable Slow Stop function.
Pr5.10	Sequence at alarm	0 to 7	–	Specify the status during deceleration and after stop, after occurrence of alarm. *Set up emergency stop to enable Slow Stop function.
Pr5.56	Slow stop deceleration time setting	0 to 10000	ms/(1000r/min)	Sets the deceleration time under slow stop. This function will become effective when Pr6.10 “Function enhancement setting” bit 15 is set to 1.
Pr5.57	Slow stop S-shape acceleration and deceleration setting	0 to 1000	ms	Sets the S-shape time for deceleration under slow stop. This function will become effective when Pr6.10 “Function enhancement setting” bit 15 is set to 1.

Class No.	Parameter name	Set range	Units	Functions
Pr6.10	Function enhancement settings	-32768 to 32767	–	bit 10: Fall prevention function, under alarm 0 :Invalid, 1: Valid Normally set to 1 to activate slow stop function function bit 15: Slow stop function 0 :Invalid, 1: Valid
Pr6.14	Immediate stop time under alarm	0 to 1000	ms	Sets the allowable time for stopping when alarm is triggered for immediate stop. Exceeding this set value will trigger a forced alarm condition. In case the set value is 0 (zero), no immediate stop will be made, but an alarm condition will immediately occur. In case the slow stop function is to be used, set it to a length sufficiently longer than the maximum deceleration time, as the motor velocity will have a delay from the deceleration and stop command. This parameter is valid only for Sequence at alarm. This parameter is invalid for Sequence upon inputting of over-travel inhibition, Sequence at Servo-Off and Sequence at main power OFF. * Please refer to (3) of this item for maximum deceleration time.

Contents

- Slow stop operation

The figure below indicates the case of slow stop operation under alarm.



*1)The maximum deceleration time is approximately the value obtained by the following formula:

Maximum deceleration time [ms]

$$= \frac{\text{Maximum velocity under normal operation pattern [r/min]) x Pr5.56 [ms/(1000 r/min)]}}{1000} + \text{Pr5.57[ms]}$$

*2) To be the detection of following conditions:

- Drive prohibited input with slow stop function valid setting.
- Servo-OFF with slow stop function valid setting.
- Main power OFF with slow stop function valid setting.
- Immediate stop response alarm triggered with slow stop function valid setting.
  For immediate stop response alarm, refer to P.6-4.

*3) Please set Pr6.14 "Immediate stop time under alarm" to a value that is sufficiently long in length than the completion of slow stop operation. The stop judgment under slow stop operation is based on actual velocity. Therefore, the time required for the actual deceleration may take longer than the maximum deceleration time.

In the immediate stop operation from immediate stop response alarm, in case the immediate stop continuation duration exceeds Pr6.14 "Immediate stop time under alarm", an alarm state will be triggered regardless of the actual motor velocity.

Furthermore, immediate alarm condition will be triggered in case immediate stop non-response alarm is generated inside the driver during immediate stop.Also,

Pr6.14 "Emergency stop time at alarm" is valid only for Sequence at alarm.

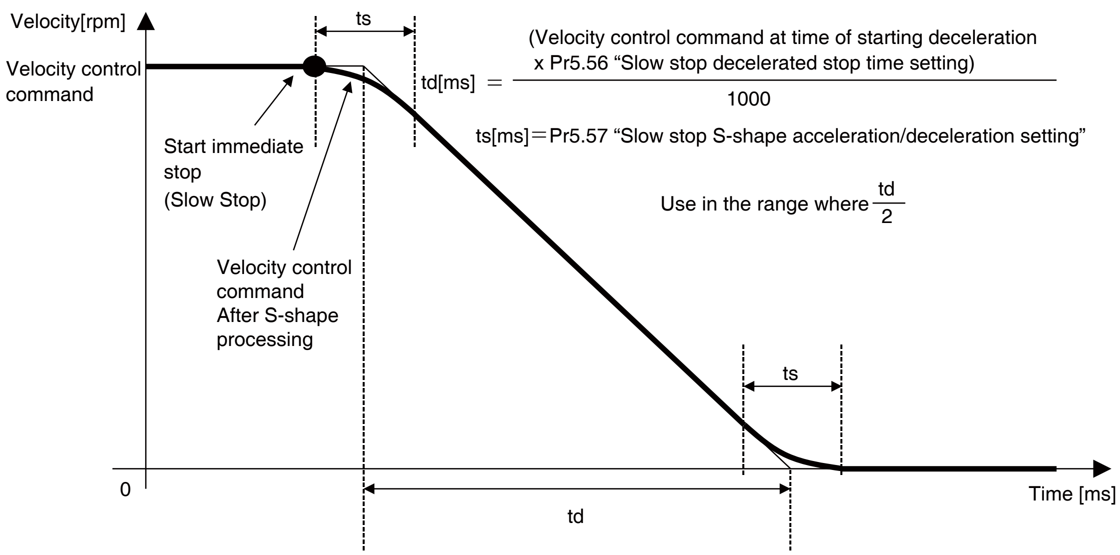
Pr6.14 "Emergency stop time at alarm" is invalid for Sequence upon inputting of over-travel inhibition,Sequence at Servo-Off and Sequence at main power OFF.

*4) There will be a maximum variance of about 5 [ms] in the switching timing.

Note) Please maintain the main circuit power supply during the time of decelerated stop.

· S shape processing of slow stop operation

S shape process at the time of slow stop operation can be made by setting Pr5.57. Refer to the following figure to set Pr5.57.



*) Velocity control command at the time of starting slow stop operation shall be calculated from the actual velocity.

· Braking distance

*When Pr 5.56 and Pr5.57 has been set, the braking distance under immediate stop will increase by approximately the following formula. Please confirm its influence on the actual machine operations, when using.

1) In case of linear deceleration (Pr5.57 =0)

Linear deceleration brake distance [revolution] Linear decelerating time [s]

$$= \frac{\text{(Velocity control command at time of starting deceleration [r/min])} \times \text{Pr5.56 [ms/(1000)[r/min]}}{1000 \times 1000}$$

Linear deceleration brake distance [revolution]

$$= \frac{\text{(Velocity control command at time of starting deceleration [r/min])} \times \text{Linear decelerating time [s]}}{60 \times 2}$$

$$= \frac{\text{(Velocity control command at time of starting deceleration [r/min])}^2 \times \text{Pr5.56 [ms/(1000)[r/min]}}{60 \times 2 \times 1000 \times 1000}$$

2) For S-shape deceleration (Pr5.57 ≠ 0)

S-shape deceleration braking distance [revolution]

$$= \text{Linear deceleration brake distance [revolution]} + \frac{\text{(Velocity control command at time of starting deceleration [r/min])} \times \text{Pr5.57 [ms]}}{60 \times 1000 \times 2}$$

Note) The above formulae are braking distances for the velocity control command only and the actual motor control delay has to be taken into account. Furthermore, in case the torque command under deceleration is restricted by immediate stop torque stetting, the braking distance will not be as per the formulae indicated above.

- The amplifier is provided with a warning function, in addition to the various protection functions. The alarm will be triggered before the protective function is activated, and you can check the conditions such as overload beforehand.

Warning displayed

Normal display and warning code（Hex.）slowly displayed alternately.the right dot flashes when the warning code is displayed.
（Over-load warning in case of servo on）

Warning code（2 sec.）
the right dot flashes

The normal display
（4 sec.）

- One of the following warning modes can be selected through the setting of Pr 6.27 “Warning latch state setup”: the warning non-latch mode in which the warning is automatically cleared 1 sec. after the cause of warning is removed, and the warning latch mode in which the warning is kept issued even after the cause of warning is removed. To clear the latched state, use the alarm clearing procedure is the same with alarm clearing. Note that the battery warning is latched by the encoder: after unlatching at the encoder, the warning is cleared.

■ Relevant parameters

Class No.	Parameter name	Set range	Units	Functions
Pr4.40	Selection of alarm output 1	0 to 40	—	Select the type of alarm issued as the alarm output 1 (WARN1). Setup value 0: ORed output of all alarms. For 1 and subsequent see the table in the next page
Pr4.41	Selection of alarm output 2	0 to 40	—	Select the type of alarm issued as the alarm output 2.(WARN2) Setup value 0: ORed output of all alarms. For 1 and subsequent see the table in the next page.
Pr6.27	Warning latch state setup	0 to 3	—	Set the latching state of warning. General warning and extended warning can be specified. bit 0: Extended warning 0: unlatch, 1: latch bit 1: General warning 0: unlatch, 1: latch
Pr6.37	Oscillation detecting level	0 to 1000	0.1 %	Set the threshold of oscillation detection. When torque vibration beyond this setting is detected, an oscillation detection alarm is activated. If the set value is 0, this function is disabled and the alarm is not activated.
Pr6.38	Warning mask setting	−32768 to 32767	–	Set the warning detection mask.If bit is set to1,warning detection will be invalid. （I/O connector and RTEX conmmunication state flag is the Common.）
Pr6.39	Warning mask setting 2	−32768 to 32767	–	
Pr7.14	Main power off warning detection time	0 to 2000	1 ms	Specifies a time to wait until a main power off warning is detected when main power shut-off continues. TREX communication status AC_OFF becomes 1 when main power off is detected. 0 to 9, 2000: Warning detection is disabled. 10 to 1999: Unit is [ms]
Pr7.26	RTEX continuous error warning setup	0 to 32767	No. of times	WngC0h (RTEX continuous communication error warning) is generated as the number of continuous communication errors reaches the parameter setting. When the setting is 0, the function is disabled and warning is not generated.

Pr7.27	RTEX accumulated error warning setup	0 to 32767	No. of times	WngC1h (RTEX accumulated communication error warning) is generated as number of accumulated communication errors reaches the parameter setting. When the setting is 0, the function is disabled and warning is not generated.
Pr7.28	RTEX_Update_Counter error warning setup	0 to 32767	No. of times	If Update_Counter is accumulated exceeding the setting value of this parameter and correct update fails, WngC2h (RTEX_Update_Counter error warning) is issued. When the setting is 0 or 1, the function is disabled and warning is not generated.

List of Warning Code

■ Warning

Alarm No. (Hex.)	Alarm	Content	Warning latch	Output setting	Waning mask
			Pr6.27 *1	Pr4.38/ Pr4.39 *2	Pr6.38/Pr6.39 Corresponding bit *3
A0	Overload warning	Load factor is 85% or more the protection level.	○	1	Pr6.38 bit7
A1	Over-regeneration warning	Regenerative load factor is 85% or more the protection level.	○	2	Pr6.38 bit5
A2	Battery warning *4	Battery voltage is 3.2 V or lower.	Latch fixed	3	Pr6.38 bit0
A3	Fan warning	Fan has stopped for 1 sec.	○	4	Pr6.38 bit6
A4	Encoder communication warning	The number of successive encoder communication errors has exceeded the specified value.	○	5	Pr6.38 bit4
A5	Encoder overheat warning	Encoder temperature has exceeded the specified value.	○	6	Pr6.38 bit3
A6	Oscillation detection warning	Oscillation or vibration has been detected.	○	7	Pr6.38 bit13
A7	Lifetime detection warning	The life expectancy of capacity or fan has dropped below specified value.	Latch fixed	8	Pr6.38 bit2
A8	Manufacturers use	–	–	–	–
A9	Manufacturers use	–	–	–	–
AC *6	Deterioration diagnosis warning	Load characteristic estimates and torque command under constant speed has exceeded the set range.	○	22	Pr6.39 bit7

■ Extend Warning

Alarm No. (Hex.)	Alarm	Content	Warning latch	Output setting	Waning mask
			Pr6.27 *1	Pr4.38/ Pr4.39 *2	Pr6.38/Pr6.39 Corresponding bit *3
C0	RTEX continuous communication error warning	The No. of detected continuous reading errors (CRC error) of the data delivered to the local node reaches the number specified by Pr 7.26 "RTEX continuous error warning setup".	○	11	Pr6.38 bit9
C1	RTEX accumulated communication error warning	The accumulated number of detected reading errors (CRC error) of the data delivered to the local node reaches the number specified by Pr 7.27 "RTEX accumulated error warning setup".	Latch fixed	12	Pr6.38 bit10
C2	RTEX_ Update_Counter error warning	Accumulated amount exceeded the times specified by Pr7.28 "RTEX_Update_Counter error warning setup", so that Update_Counter was not updated.	Latch fixed	13	Pr6.38 bit11
C3	Main power off warning	When setting of Pr7.14 "Main power off warning detection time" is 10-1999, instantaneous power interruption occurs between L1 and L3 and lasts for a time longer than the setting of Pr7.14.	○	14	Pr6.38 bit12
D2	PANATERM command execution	When bit0 of Pr7.99"RTEX function Extended setup 6" is 1 RTEX communication was established, the operation command (such as trail run and FFT) by setup support software (PANATERM) was executed.	○	30	Pr6.38 bit8

*1 The part “○” indicates Pr6.27 “Latched time of warning” and can set the time interval 1 to 10s or no time limit. Note that the battery warning and the end of life warning have “no time limit.”
*2 Through Pr4.40 “Warning output select 1” and Pr4.41 “Warning output select 2,” select the warning issued as the warning output signal 1 (WARN1) and signal 2 (WARN2). In case of setting value 0, OR output of all warnings will be obtained. In addition, do not use the setup values other than those listed in the above table.
*3 Each warning detection can be disabled by Pr6.38 “Warning mask setup” and Pr6.37 “Warning mask setting 2.” The corresponding bits are indicated in the table. The warning detection will be disabled by bit=1.
*4 When the single-turn absolute function is enabled, a battery alarm is not detected.
*5 Warnings can be cleared by using the alarm clear. While the alarm clear input (A-CLR) is kept ON, the all existing warnings are always cleared.
*6 Invalidated when Pr6.97 “Function expansion setting 3” bit1 = 0.

2. Setup of Gain Pre-adjustment Protection

Before starting gain adjustment, set the following parameters based on the conditions of use, to assure safe operation.

1) Setup of over-travel inhibit input

By inputting the limit sensor signal to the driver, the bumping against mechanical end can be prevented. Refer to interface specification, positive/negative direction over-travel inhibit input (POT/NOT). Set the following parameters which are related to over-travel inhibit input.

Pr5.04 Setup of over-travel inhibit input
Pr5.05 Sequence at over-travel inhibit

Caution
Generally, because limit input control is valid by controllor,over-travel inhibit input of driver is invalid.Be sure to confirm the controller specifications.

Related page P.2-51（POT/NOT）、P.3-79（Pr5.04）、P.3-80（Pr5.05）

2) Setup of torque limit

By limiting motor maximum torque, damage caused by failure or disturbance such as bite of the machine and collision will be minimized. To apply standardized limit through parameters, set Pr0.13 The 1st torque limit.

If the torque limit setup is lower than the value required during the actual application, the following two protective features will be triggered: over-speed protection when overshoot occurs, and excess positional deviation protection when response to the command delays.

By allocating the torque in-limit output (TLC) of interface specification to the output signal, torque limit condition can be detected externally.

Related page P.2-55（TLC）、P.3-45（Pr0.13）、P.3-85（Pr5.21）

3) Setup of over-speed protection

Generates Err26.0 Over-speed protection when the motor speed is excessively high.
Default setting is the applicable motor maximum speed [r/min] × 1.2.
If your application operates below the motor maximum speed, set Pr5.13 Setup of over-speed level by using the formula below.

Pr5.13 Setup of over-speed level = Vmax × (1.2 to 1.5) Vmax: motor maximum speed [r/min] in operating condition Factor in ( ) is margin to prevent frequent activation of over-speed protection.

When running the motor at a low speed during initial adjustment stage, setup the over-speed protection by multiplying the adjusting speed by a certain margin to protect the motor against possible oscillation.

Related page P.3-84（Pr5.13）

(Continued ...)

4) Setup of the excess positional deviation protection

During the position control or full-closed control, this function detects potential excessive difference between the position command and motor position and issues Err24.0 ”Position deviation excess protection”.

Excess position deviation level can be set by Pr0.14 “Position deviation excess setting.” The detection position can be selected from command position deviation [pulse (command unit)] and encoder position deviation [pulse (encoder unit)] or full-closed deviation [pulse (external scale unit)] in Pr5.20 “Position setting unit selection”. (See the control block diagram)

Default is set to 100000 [pulse (command unit)].

Because the position deviation during normal operation depends on the operating speed and gain setting, fill the values obtained from the equation below based on your operating condition and input the resulting value to Pr0.14.

4-1) In case two degree-of-freedom is set to valid (Pr6.47 bit 0 = 1)

■ For Pr5.20 = 0 (Detection by command position deviation)

Using command positional deviation (after filter) (Pr7.23 bit14=0)

> * In this case, the position deviation cannot be obtained through calculation formula. Set the value including allowance, by estimating the maximum value of command position deviation (Pmax) from the actual operation waveform that could be used.
>
> Pr 0.14“Setup of positional deviation excess” = Vc / Kp × (1.2 to 2.0)
>
> Factor in ( ) is margin to prevent frequent activation of excess positional deviation protection

Using command positional deviation (before filter) (Pr7.23 bit14=1)

.• For Pr5.20 = 1 (Detection by encoder position deviation or full-closed position deviation)

> Pr0.14 “Setup of positional deviation excess” = (P1 + P2 + P3 + P4) × (1.2 to 2.0)
>
> Factor in ( ) is margin to prevent frequent activation of excess positional deviation protection.

Position command smoothing (second-order) accumulator pulse count:

P1 = Vc ×(set value for Pr2.22 / 10000)×2

Position command FIR filter accumulator pulse count :

P2 = Vc ×(set value for Pr2.23 / 10000) / 2

Adjustment filter accumulator pulse count : P3 = Vc × (set value for Pr6.48 / 10000)

Damping filter accumulator pulse count : P4 = Vc / (π × damping frequency [Hz])

.• Vc : maximum frequency of positional command pulse [pulse (command unit)/s]

.• Damping frequency is 1/10 of the set values for Pr2.14 (first), Pr2.16 (second), Pr2.18 (third) and Pr2.20 (fourth) and is calculated only when the set values are effective. In case multiple damping controls are valid, P4 shall be calculated for each damping filter and P4 shall be the total of the calculated values.

■ For Pr5.20 = 1 (Detection through encoder positional deviation)

> * In this case, the positional deviation cannot be calculated by a formula. So estimate the maximum Pmax of the encoder positional deviation or the full-closed positional deviation by the waveform of a real machine that may be used, and set a value on the safe side.
> Pr0.14 "Setup of positional deviation excess" = Pmax × (1.2 to 2.0)
> Factor in ( ) is margin to prevent frequent activation of excess positional deviation protection.

- Measure with the smallest value when switching position loop gain K
- Setting of command filter and damping control will not have any effect in case Pr 5.20 = 1.

4-2) In case two degree-of-freedom control is invalid (Pr6.47 bit 0 = 0))

• For Pr5.20 = 0 (Detection by command position deviation)

Using command positional deviation (after filter) (Pr7.23 bit14=0)

> Pr0.14 "Setup of positional deviation excess" = P1 × (1.2 to 2.0)
> Factor in ( ) is margin to prevent frequent activation of excess positional deviation protection.

Command positional deviation: P1 = Vc / Kp × ((100 - (set value for Pr1.10 / 10)) / 100)

- Vc : maximum frequency of positional command pulse [pulse (command unit)/s]
- Kp : Position loop gain [1/s] (When switching position loop gain Kp, select the smallest value for calculation.)

Using command positional deviation (before filter) (Pr7.23 bit14=1)

> Pr0.14 "Setup of positional deviation excess" = (P1 + P2 + P3 + P4) × (1.2 to 2.0)
> Factor in ( ) is margin to prevent frequent activation of excess positional deviation protection.

Command positional deviation: P1 = Vc / Kp × ((100 - (set value for Pr1.10 / 10)) / 100)

Position command smoothing (first-order) accumulator pulse count:

P2 = Vc × (set value for Pr2.22 / 10000)

Position command FIR filter accumulator pulse count :

P3 = Vc× (set value for Pr2.23 / 10000) / 2

Damping filter accumulator pulse count : P4 = Vc / (π × damping frequency [Hz])

- Vc : maximum frequency of positional command pulse [pulse (command unit)/s]
- Kp : Position loop gain [1/s] (When switching position loop gain Kp, select the smallest value for calculation.)
- Damping frequency is 1/10 of the set values for Pr2.14 (first), Pr2.16 (second), Pr2.18 (third) and Pr2.20 (fourth) and is calculated only when the set values are effective. In case multiple damping controls are valid, P4 shall be calculated for each damping filter and P4 shall be the total of the calculated values.

■ **For Pr5.20 = 1 (Detection through encoder positional deviation)**

Pr0.14 "Setup of positional deviation excess" = P1 × (1.2 to 2.0) Factor in ( ) is margin to prevent frequent activation of excess positional deviation rotection.

Encoder positional deviation : P1 = Ve / Kp × ((100 - (set value for Pr1.10 / 10)) / 100)

- Ve : Maximum operating frequency [pulse/s] in encoder units
- Kp : Position loop gain [1/s] (When switching position loop gain Kp, select the smallest value for calculation.)
- Setting of command filter and damping control will not have any effect in case Pr 5.20 = 1.

Notes: When switching from the velocity control to position control, position deviation correcting function is used, which will increase calculation value and error. To cope with these problems, increase the margin.

5) Setup of motor working range

During the position control, this function detects the motor position which exceeds the revolutions set to Pr 5.14 "Motor working range setup", and issues

Err 34.0 "Software limit protection".

For details, refer to 6-2 Motor working range setup function of RTEX communication Functional Specification .

3. About the Protection Function Setting while Returning to the Origin by Using the Z Phase

If the following parameters are set, the run inhibit input (POT, NOT) is detected when returning to the Z phase detection position, which is treated as the origin, with the operation for returning to origin by using the Z phase.

If run inhibit input is detected during the return operation, the protection function used for interrupting and stopping energization can be enabled by making Err94.3 "returning to origin error 2" occur.

Pr7.41 bit7 "RTEX function extended setup 4 Run inhibit input detection setting when returning to origin of Z phase"=1

(Caution)

· If the above value is set to the parameter and the Z phase in the vicinity of run inhibit input (POT/NOT) is configured as the origin, Err94.3 may be erroneously detected because overshoot occurs while returning to the Z phase detection position treated as the origin.

In this case, the position at run inhibit is input needs to be separated from the Z phase, which is treated as the position for completing return to the origin; therefore be sure to prevent occurrence of returning operation in the vicinity of run inhibit input (POT/NOT).

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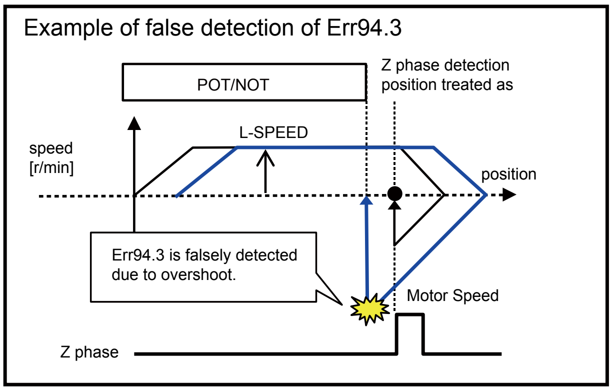

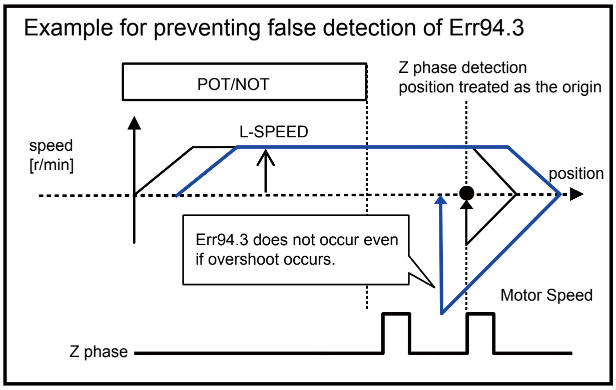

· If the above value is not set for the parameter, detection of run inhibit input (POT/NOT) while returning to the Z phase detection position, which is treated as the origin when returning to the origin by use of the Z phase, is disabled.

3. About the Protection Function Setting while Returning to the Origin by Using the Z Phase

■ Relevant parameters

Class No.	Parameter name	Set range	Units	Functions
Pr5.04 *1)	Over-travel inhibit input setup	0 to 2	—	Set up the operation of the run-inhibition (POT, NOT) inputs. Set the parameter according to the specification of upper controller. Normally it should be set to 1 (disabled) because the operation is controlled by an upper controller. 0:POT → inhibits CW drive, NOT → inhibits CCW drive. When POT is input during CW driving, stops the drive according to Pr 5.05 “Sequence at over-travel inhibit”. The similar function NOT is applied in reverse direction. Regardless of operating condition, torque in over-travel inhibition direction is 0. 1:POT and NOT are disabled, having no effect on operation. 2:POT or NOT input activates Err 38.0 Run-inhibition input protection
Pr7.41	RTEX function extended setup 5	-32768 to 32767	—	bit0 to 6: For manufacturer’s use bit7: Run inhibit input detection setting when returning to origin of Z phase 0:Invalid 1:Valid

*1) While returning to the profile origin, settings of Pr5.04 “Over-travel inhibit input setup” and Pr5.05 “Sequence at over-travel inhibit” are temporarily disabled; therefore we recommend setting Pr7.41 bit 7 to 1.
When using the function for returning to the profile origin without using the run inhibit input, do not assign the run inhibit input (POT/NOT) to general-purpose input. This setting is not disabled only if Pr5.04 is set to 1.

■ Relevant protective function

Error No. Main	Error No. Sub	Protective function	Causes	Measures
94	3	Home position return error protection2	· While Pr7.41 “RTEX function extended setup 5” bit 7 is set to 1, and returning to the origin by using the Z phase, either of positive direction/negative direction run inhibit input (POT/NOT) is switched ON when the operation for returned to the detected Z phase position is performed. · Returning amount to the detected Z phase position becomes abnormal when returning to the origin by using the Z phase.	· Enlarge the distance between the Z phase and positive direction/negative direction run inhibit input (POT/NOT). · After checking the safety, set Pr7.41 bit 7 (setting of detection of run inhibit input when returning to the origin of Z phase) to 0 (disabled).

Attribute		
History	clear	emergency stop
Have record	Can be cleared	Non-compatible

4. Troubleshooting

Motor Does Not Run

Classification	Causes		Measures
Parameter	Setup of the control mode is not correct	Check that the present control mode is correct with monitor mode of the UBS communication (PANATERM).	1) Set up Pr0.01 again.
	Setup of electronic gear is not correct. (Position)	Check that the motor moves by expected revolution against the command pulses.	1) Check the setups of Pr0.08, Pr0.09, Pr0.10 again.
Wiring	Servo-ON input of Connector X4 (EX-SON) is open.	In the monitor mode by USB communication (PANATERM), is the Pin No. corresponding to EX-SON in “ - ” state?	Check and make a wiring so as to connect the EX-SON input signal.
	Positive/negative direction over-travel inhibit input of Connector X4 (NOT/POT) is open.	The monitor mode 0f USB communication (PANATERM), is the Pin No. corresponding to NOT/POT in “ A ” state?	1) Check and make a wiring so as to connect NOT/POT inputs signal. 2) Set up Pr5.04 to 1 (invalid) and reset the power.
Installation	Main power is shut off.	The monitor mode of USB communication (PANATERM), is the Pin No. corresponding to S-RDY in “ - ” state?	Check the wiring/voltage of main power of the driver (L1, L2 and L3).
	The motor shaft drags, the motor does not run.	1) Check that you can turn the motor shaft, after turning off the power and separate it from the machine. 2) Check that you can turn the motor shaft while applying DC24 V to the brake in case of the motor with electro-magnetic brake.	If you cannot turn the motor shaft, consult with the dealer for repair.

Related page
• P.2-47 “Wiring to the Connector,X4”
• P.3-39 “Details of Parameter”

4. Troubleshooting

Unstable Rotation (Not Smooth)

Classification	Causes	Measures
Adjustment	Gain adjustment is not proper.	Increase the setup of Pr1.01, 1st velocity loop gain. Enter torque filter of Pr1.04 and increase the setup of Pr1.01 again.
Wiring	Servo on signal of Connector X4 is chattering.	Check the wiring and connection of the Connector X4. Correct the wiring and connection so that the Servo-ON signal can be turned on normally. Review the controller.

4. Troubleshooting

Positioning Accuracy Is Poor

Classification	Causes	Measures
System	Position command is not correct. (Amount of command pulse)	Count the feedback pulses with a monitor function of the USB conmmunication (PANATERM) or feedback pulse monitor mode of the console while repeating the movement of the same distance.If the value does not return to the same value, review the controller.
Adjustment	Position loop gain is small.	Check the position deviation with the monitor function of the USB communication (PANATERM) or at the monitor mode of the console. Increase the setup of Pr1.00 within the range where no oscillation occurs.
Parameter	Setup of the positioning complete range is large.	Lower the setup of Pr4.31 within the range where no chattering of complete signal occurs.
	Setup of the division/ multiplication is not correct.	Check if the repetition accuracy is same or not. If it does not change, use a larger capacity motor and driver.
	Velocity loop gain is proportion action at motor in stall.	Set up Pr1.02 and Pr1.07 of time constant of velocity loop integration to 9999 or smaller.
Wiring	Servo on signal of Connector X4 is chattering.	Check the wiring and connection of the connector X4.Correct the wiring and connection so that the servo-On signal can be turned on normally. Review the controller.
Installation	Load inertia is large.	Check the overshoot at stopping with graphic function of the USB communication (PANATERM) . If no improvement is obtained, increase the driver and motor capacity.

Related page
• P.3-39 “Details of Parameter” • P.2-47 “Wiring to the Connector, X4”
• P.7-9 “Outline of Setup Support Software “PANATERM”

4. Troubleshooting

Origin Point Slips

Classification	Causes	Measures
System	Z-phase is not detected.	Check that the Z-phase matches to the center of proximity dog. Execute the homing matching to the controller correctly.
	Homing creep speed is fast.	Lower the homing speed at origin proximity. Or widen the origin sensor.
Wiring	Chattering of proximity sensor (proximity dog sensor) output .	Check the dog sensor input signal of the controller with oscilloscope. Review the wiring near to proximity dog and make a noise measure or reduce noise.
	Noise is on the encoder line.	Reduce noise (installation of noise filter or ferrite core), shield treatment of I/F cables, use of a twisted pair or separation of power and signal lines.

6 When in Trouble

4. Troubleshooting

Abnormal Motor Noise or Vibration

Classification	Causes	Measures
Adjustment	Gain setup is large.	Lower the gain by setting up lower values to Pr1.01 and 1.06, of velocity loop gain and Pr1.00 and Pr1.05 of position loop gain.
Installation	Resonance of the machine and the motor.	Re-adjust Pr1.04 and 1.09. Check if the machine resonance exists or not with frequency characteristics analyzing function of the USB communication (PANATERM). Set up the notch frequency to Pr2.01, Pr2.04, Pr2.07 or Pr2.10 if resonance exists.
	Motor bearing	Check the noise and vibration near the bearing of the motor while running the motor with no load. Replace the motor to check. Request for repair.
	Electro-magnetic sound, gear noise, rubbing noise at brake engagement, hub noise or rubbing noise of encoder.	Check the noise of the motor while running the motor with no load. Replace the motor to check. Request for repair.

4. Troubleshooting

Overshoot/Undershoot, Overheating of the Motor (Motor Burn-Out)

Classification	Causes	Measures
Adjustment	Gain adjustment is not proper.	Check with graphic function of PANATERM or monitor. Make a correct gain adjustment. Refer to “5. Adjustment”.
Installation	Load inertia is large.	Check with graphic function of USB communication(PANATERM) or monitor.Make an appropriate adjustment. Increase the motor and driver capacity and lower the inertia ratio. Use a gear reducer.
	Looseness or slip of the machine.	Review the mounting to the machine.
	Ambient temperature, environment.	Lower the temperature with cooling fan if the ambient temperature exceeds the predications.
	Stall of cooling fan, dirt of fan ventilation duct.	Check the cooling fans of the driver and the machine. Replace the driver fan or request for repair.
	Failure of motor bearing.	Check that the motor does not generate rumbling noise while turning it by hand after shutting off the power. Replace the motor and request for repair if the noise is heard.
	Electromagnetic brake is kept engaged (brake un-released).	Check the voltage at brake terminals. Apply the power (DC24 V) to release the brake.
	Motor failure (oil, water or others)	Avoid the installation place where the motor is subject to high temperature, humidity, oil, dust or iron particles.
	Motor has been turned by external force while dynamic brake has been engaged.	Check the running pattern, working condition and operating status, and inhibit the operation under the condition of the left.

6 When in Trouble

4. Troubleshooting

Motor Speed Does Not Reach to the Setup, Motor Revolutions (Travel) Is Too Large or Small

Classification	Causes	Measures
Adjustment	Position loop gain is low.	Set up Pr1.00and Pr1.05, position loop gain to approx. 1000.
	Division/Multiplication is not proper.	Set up correct values to Pr0.08, 1st numerator of electronic gear, Pr0.09, numerator multiplier of electronic gear and Pr0.10, denominator of electronic gear. Refer to parameter setup at each mode.

Related page • P.3-39 “Details of Parameter” • P.7-9 “Outline of Setup Support Software “PANATERM”

4. Troubleshooting

Parameter Returns to Previous Setup

Classification	Causes	Measures
Parameter	No writing to EEPROM has been carried out before turning off the power.	Refer to P.3-38, "Detail of Attribute " of Preparation.

7. Supplement

1. Absolute System

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1. Absolute System

Outline

Outline of Absolute System

When you compose an absolute system using an absolute encoder, you are not required to carry out homing operation at the power-on, and this function suits very well to such an application as a robot.
In absolute system,a battery with multiple data backup is connected with a motor with and absolute encoder.
Absolute data is transmitted to the controller at the current position of the RTEX communication response.(drive to controller)

● **Relevant parameters**

No.	Title	Function
Pr7.13	Absolut homing position offset	Set encoder position when using absolute encoder and offset of mechanical coordinate position.

Position information after initialization

$$\text{All position information} = \frac{\text{Absolute encoder value}}{\text{Electronic gear}} + \text{Pr7.13 (Absolut homing position offset)}$$

This information will be sent to the controller through RTEX communination.

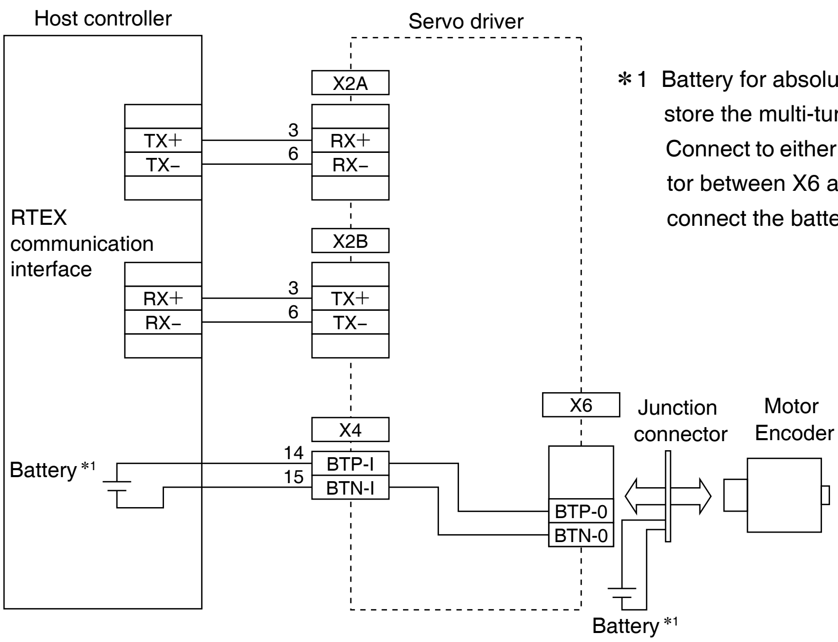
The Configuration of an Absolute System Using an Absolute Encoder (Example of Servo Drive 1 Axis Connection)

Connect the motor with absolute encoder and battery of absolute encoder, and setup the parameter Pr0.15 to 0 or 2（set abdolute encoder）,you can capture the exact prsent position information after the power-ON.

Shift the system to origin once after installing the battery and clear the multi-turn data by clearing the absolute encoder,then you can detect the absolute position without carrying put homing operation.

● **Relevant parameters**

Class	No.	Attribute	Title	Range	Unit	Function
0	15	C	Absolute encoder setup	0 ～ 4	—	Select the use method of the absolute encoder. 0:Use as an absolute system (absolute mode). 1:Use as an incremental system (incremental mode). 2:Use as an absolute system (absolute mode), however ignore the multi-turn counter over. 3:Use as an absolute system, however not use the multi-turn counter (single-turn absolute mode). 4:Used as an absolute system (absolute mode), however any upper limit value can be set for the multiturn counter, and ignore the multi-turn counter over. (continuous rotating absolute mode)



＊1 Battery for absolute encoder is required to store the multi-turn data into the encoder. Connect to either X4 or the junction connector between X6 and the encoder, when you connect the battery. Do not connect to both.

Note * Battery for absolute encoder is required to store the multi-turn data into the encoder. Connect the battery between BAT+ and BAT– of the motor.

1. Absolute System

Battery (for Backup) Installation

After installing and connecting the back-up battery to the motor,execute and absolute encoder setup.Refer to the follwing procedure.

First Installation of the Battery

After installing and connecting the back-up battery to the motor, execute an absolute encoder setup. Refer to P.7-8, “Setup (Initialization) of Absolute Encoder “.
It is recommended to perform ON/OFF action once a day after installing the battery for refreshing the battery.
A battery error might occur due to voltage delay of the battery if you fail to carry out the battery refreshment.

Caution
Use the following battery for absolute encoder.
Battery…………Part No.：DV0P2990（3.6 V　2000 mAh）
Battery box……Part No.：DV0P4430

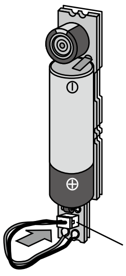
Replacement of the Battery

It is necessary to replace the battery for absolute encoder when battery alarm occurs.
Replace while turning on the control power. Data stored in the encoder might be lost when you replace the battery while the control power of the driver is off.
Afer replacing the battery,clear the battery alarm.Press the PANATERM(can download from official website) in the monitor window to clear the alarm,or through the RTEX communication to clear the alarm.

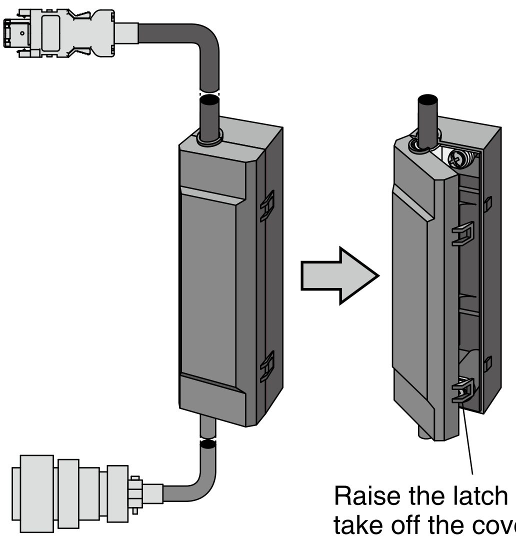
Caution
When you clear absolute encoder,all of error and multi-turn data will be cleared together with alarm.

How to Replace the Battery（Method for Mounting to Juncation Cable for Encoder）

1) Refresh the new battery.
Connector with lead wire of the battery to CN601 and leave of 5 min.
Pull out the connector from CN601 5 min after.

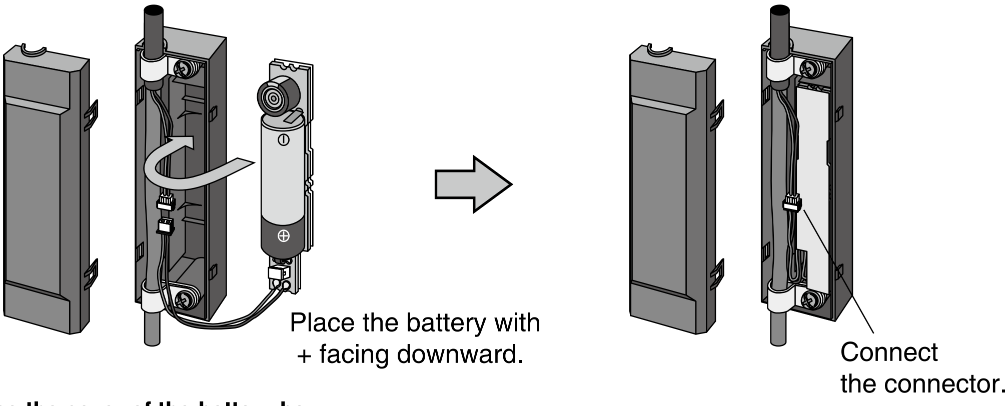


2) Take off the cover of the battery box.

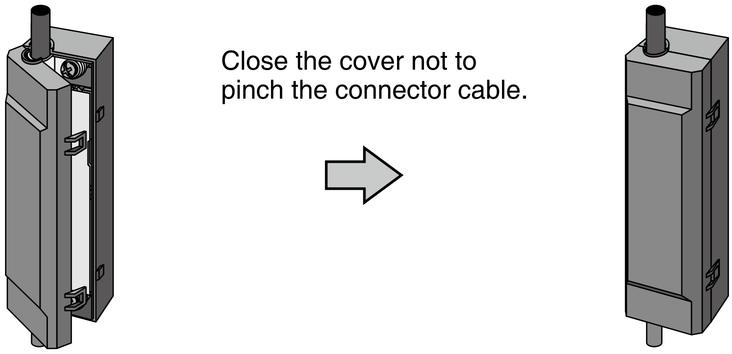


Related page
• P.7-100 “Battery For Absolute Encoder”

3) Install the battery to the battery box.



4) Close the cover of the battery box.



Caution

- Be absolutely sure to follow the precautions below since improper use of the battery can cause electrolyte to leak from the battery, giving rise to trouble where the product may become corroded, and/or the battery itself may rupture.
  1) Insert the battery with its “+” and “–” electrodes oriented correctly.
  2) Leaving a battery which has been used for a long period of time or a battery which is no longer usable sitting inside the product can cause electrolyte leakage and other trouble. For this reason, ensure that such a battery is replaced at an early date. (As a general guideline, it is recommended that the battery be replaced every two years.)
     - The electrolyte inside the battery is highly corrosive, and if it should leak out, it will not only corrode the surrounding parts but also give rise to the danger of short-circuiting since it is electrically conductive. For this reason, ensure that the battery is replaced periodically.
  3) Do not disassemble the battery or throw it into a fire.
     - Do not disassemble the battery since fragments of the interior parts may fly into your eyes, which is extremely dangerous. It is also dangerous to throw a battery into a fire or apply heat to it as doing to may cause it to rupture.
  4) Do not cause the battery to be short-circuited. Under no circumstances must the battery tube be peeled off.
     - It is dangerous for metal items to make contact with the “+” and “–” electrodes of the battery since such objects may cause a high current to flow all at once, which will not only reduce the battery performance but also generate considerable heat, possibly leading to the rupture of the battery.
  5) This battery is not rechargeable. Under no circumstances must any attempt be made to recharge it.

Caution

The disposal of used batteries after they have been replaced may be subject to restrictions imposed by local governing authorities. In such cases, ensure that their disposal is in accordance with these restrictions.

Life of the Battery

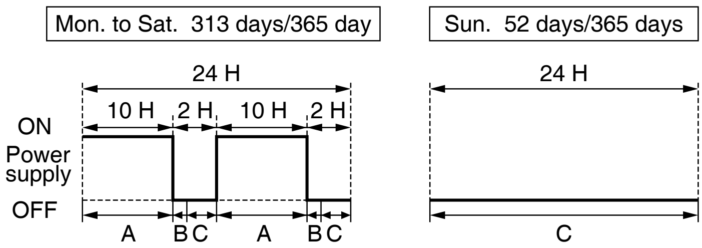
Following example shows the life calculation of the back-up battery used in assumed robot operation.
2000[mAh] of battery capacity is used for calculation.

Note that the following value is not a guaranteed value, but only represents a calculated value.

Caution

The values below were calculated with only the current consumption factored in. The calculations do not factor in electrolyte leakage and other forms of battery deterioration.
Life time may be shortened depending on ambient condition.

1) 2 cycles/day



A : Current consumption in normal mode 0 [μA]
B : Current consumption at power failure timer mode 90 [μA]
C : Current consumption at power failure mode 30 [μA]

Annual consumption capacity =
(10 H × A + 0.0014 H × B + 2 H × C) × 2 × 313 days + 24 H × C × 52 days =
75.1 [mAh])
Battery life = 2000 [mAh]/75.1 [mAh/year] = 26.6 [year]

2) 1 cycle/day

(2nd cycle of the above 1) is for rest,calculation of battery life for example.

Annual consumption capacity =
(10 H × A + 0.0014 H × B + 14 H × C) × 313 days + 24 H × C × 52 days =
168.9 [mAh])
Battery life = 2000 [mAh]/168.9 [mAh/year] = 11.8 (11.841) [year]

When you Make Your Own Cable for 23bit Absolute Encoder

When you make your own cable for 23bit absolute encoder, connect the optional battery for absolute encoder, DV0P2990 as per the wiring diagram below. Connector of the battery for absolute encoder shall be provided by customer as well.

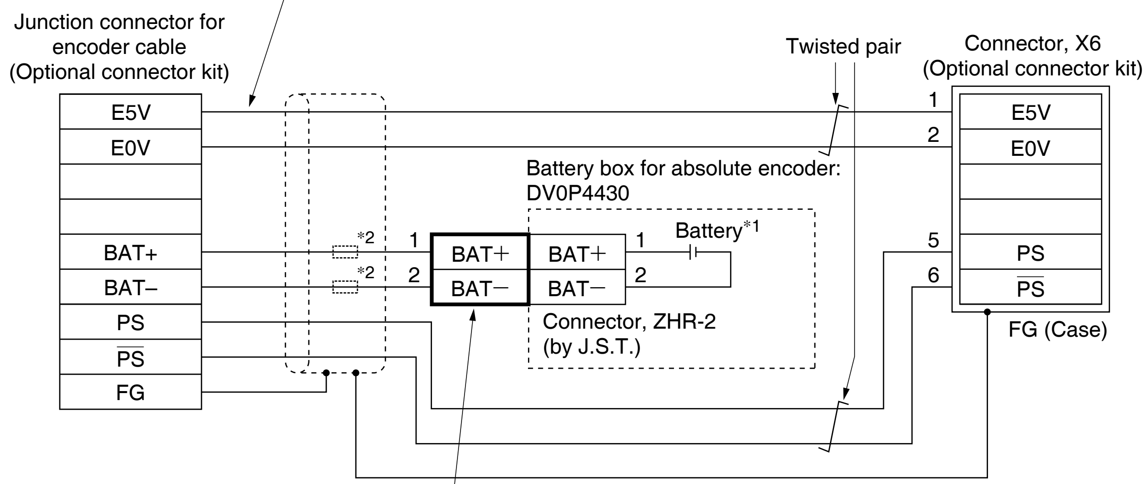
Caution Install and fix the battery securely. If the installation and fixing of the battery is not appropriate, it may cause the wire malfunction or damage of the battery.
Refer to the instruction manual of the battery for handling the battery.

- **Installation Place**
  1) Indoors, where the products are not subjected to rain or direct sun beam.
  2) Where the products are not subjected to corrosive atmospheres such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, chloric gas, sulfuric gas, acid, alkaline and salt and so on, and are free from splash of inflammable gas, grinding oil, oil mist, iron powder or chips and etc.
  3) Well-ventilated and humid and dust-free place.
  4) Vibration-free place

- **Wiring Diagram**

- **Pin number of optional connector kit**

		E5V	E0V	BAT+	BAT–	PS	$\overline{PS}$	FG
Small motor	lead cable type	7	8	1	2	4	5	3
	connect type	6	3	5	2	7	4	1
Large motor	connect type(JN2)	6	1	6	5	3	7	9
	connect type(JL10)	H	G	T	S	K	L	J



Title	Part No.	Manufacturer
Connector	ZMR-2	J.S.T.
Connector pin	SMM-003T-P0.5	J.S.T.
Clamping Jig	YRS-800	J.S.T.

Connector for absolute encoder connection (To be provided by customer)

*1 Battery for absolute encoder (Option): DV0P2990

*2 Since applicable wire diameters of the battery connector and connector at encoder side are different, please connect wires by soldering.

Related page • P.7-100"Battery For Absolute Encoder"

1. Absolute System

Setup (Initialization) of Absolute Encoder

Absolute multi-turn data will be maintained by the absolute encoder battery.
When operating the machine for the first time after installing the battery to the absolute encoder, clear the encoder data (multi-turn data) to 0 at the origin by following the procedure described below.
Clear the absolute encoder from PANATERM or RTEX communication. Turn off power and then on again.
Through RTEX communication to clear the absolute encoder method and process,please confirm the controller specifications.

Related page • P.2-47 “Wiring to the Connector,X4”

2. Outline of Setup Support Software, "PANATERM"

Setup on the PC

Connector X1 of MINAS A6N can be connected to your PC through USB cable for computer. Once you download the setup support software PANATERM from our web site and install it to your PC, the following tasks can be easily performed.

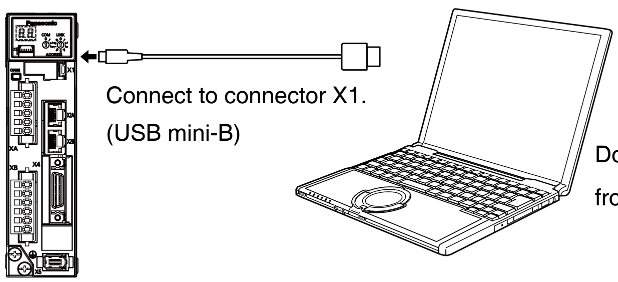
Outline of PANATERM

With the PANATERM, you can execute the followings.
(1) Setup and storage of parameters, and writing to the memory (EEPROM).
(2) Monitoring of I/O and pulse input and load factor.
(3) Display of the present alarm and reference of the error history.
(4) Data measurement of the wave-form graphic and bringing of the stored data.
(5) Normal auto-gain tuning
(6) Frequency characteristic measurement of the machine system.

Note

Distribution media such as CD-ROM for this software are not prepared.
Download the software from our web site and install it to your PC.
Use option [LAN dongle(DVOPM20105)]for wireless connection.
For details, see the website of Panasonic.

How to Connect



• USB cable

The connection cable should be provided with USB mini-B connector at the driver side and the PC compatible connector on the other end.
If the cable has no noise filter, install a signal noise filter (DV0P1460) to both ends of the cable.

Note

In additon to PANATERM,you can debug "Panasonic Motor Setup App" through iPhone, Android applications.For details, see the website of Panasonic.

System Required for PANATERM

To use PANATERM, the following system components are required.

• **PC**

OS	Windows® VISTA SP1 (32-bit Ver.) Windows® 7,8 (32-bit Ver., 64-bit Ver.) (Japanese, English, Chinese or Korean version)
CPU	Pentium III 512 MHz or better
Memory	256 MB or more (512 MB recommended)
Hard disk	512 MB or more free space
Serial communication	USB port

• **Display**

Resolution	1024 × 768 pixel or more
No. of colors	24-bit color (True Color) or better

* Please confirm the latest system requirements on the homepage.

Note

In additon to PANATERM,you can debug "Panasonic Motor Setup App" through iPhone, Android applications.For details, see the website of Panasonic.

MSMF Series (50 W)

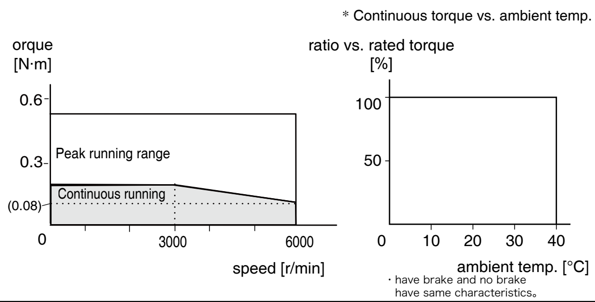
•Note that the motor characteristics may vary due to the existence of oil seal or brake.

Motor model	Unit	MSMF5AZL1□□	
Brake		without	with
Oil seal		without/with	
Output rating	W	50	
Matched drive		MADL□01□□	
		MADL□05□□	
Power supply of drive	V(AC)	100/200	
Rated torque	N·m	0.16	
Continuous stall torque	N·m	0.16	
Max.instantaneous speed	N·m	0.48	
Rated curren	A (rms)	1.1	
Max.instantaneous current	A (o-p)	4.7	
Rated rotational speed	r/min	3000	
Max.rotational speed	r/min	6000	
Rotor inertia	$\times 10^{-4}$ kg·m^2	0.026	0.029

MSMF series (50 W)

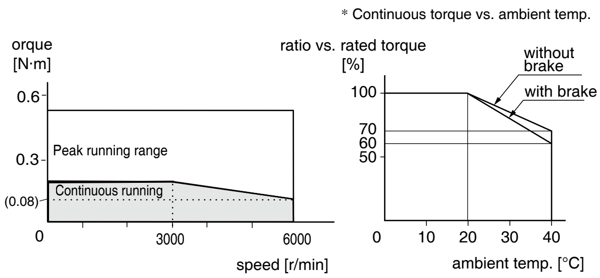
Without oil seal

●MSMF5AZL1□□
Input voltage to driver: AC100 V/200 V



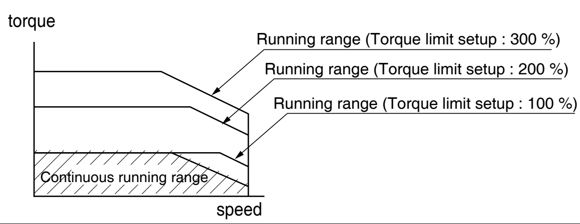
With oil seal

●MSMF5AZL1□□
Input voltage to driver: AC100 V/200 V



* These are subject to change. Contact us when you use these values for your machine design.

• When you lower the torque limit setup (Pr0.13 and 5.22), running range at high speed might be lowered as well.



MSMF Series (100 W)

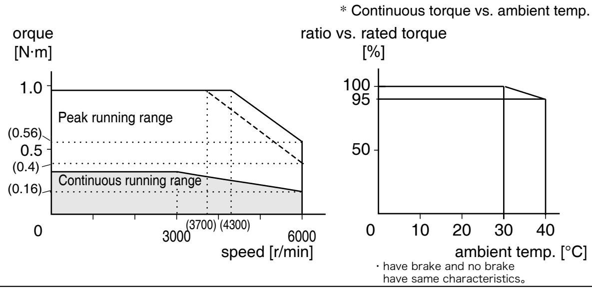
•Note that the motor characteristics may vary due to the existence of oil seal or brake.

Motor model	Unit	MSMF011L1 □□		MSMF012L1 □□	
Brake		without	with	without	with
Oil seal		without/with		without/with	
Output rating	W	100		100	
Matched drive		MADL □ 11 □□		MADL □ 05 □□	
Power supply of drive	V(AC)	100		200	
Rated torque	N·m	0.32		0.32	
Continuous stall torque	N·m	0.32		0.32	
Max.instantaneous speed	N·m	0.95		0.95	
Rated curren	A（rms）	1.6		1.1	
Max.instantaneous current	A（o-p）	6.9		4.7	
Rated rotational speed	r/min	3000		3000	
Max.rotational speed	r/min	6000		6000	
Rotor inertia	$\times10^{-4}$ kg·m^2	0.048	0.051	0.048	0.051

MSMF series (100 W)

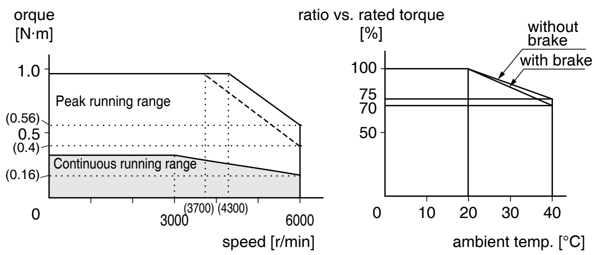
Without oil seal

●**MSMF011L1□□**
Input voltage to driver: AC100 V
(Dotted line represents torque at 10 % less voltage.)
* Continuous torque vs. ambient temp.

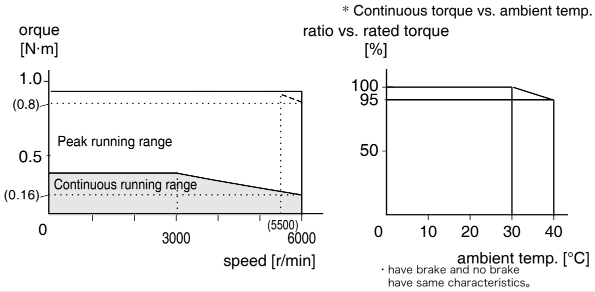


With oil seal

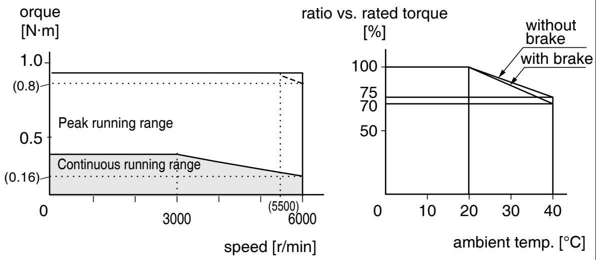
●**MSMF011L1□□**
Input voltage to driver: AC100 V
(Dotted line represents torque at 10 % less voltage.)
* Continuous torque vs. ambient temp.



●**MSMF012L1□□**
Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)
* Continuous torque vs. ambient temp.



●**MSMF012L1□□**
Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)
* Continuous torque vs. ambient temp.



* These are subject to change. Contact us when you use these values for your machine design.

3. Motor Characteristics (S-T Characteristics)

MSMF Series (200 W)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

Motor model	Unit	MSMF021L1 □□		MSMF022L1 □□	
Brake		without	with	without	with
Oil seal		without/with		without/with	
Output rating	W	200		200	
Matched drive		MBDL □ 21 □□		MADL □ 15 □□	
Power supply of drive	V(AC)	100		200	
Rated torque	N·m	0.64		0.64	
Continuous stall torque	N·m	0.64		0.64	
Max.instantaneous speed	N·m	1.91		1.91	
Rated curren	A (rms)	2.5		1.5	
Max.instantaneous current	A (o-p)	10.6		6.5	
Rated rotational speed	r/min	3000		3000	
Max.rotational speed	r/min	6000		6000	
Rotor inertia	$\times10^{-4}$ kg·m^2	0.14	0.17	0.14	0.17

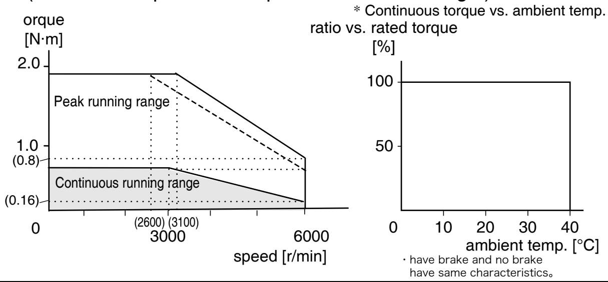
MSMF series (200 W)

Without oil seal	With oil seal

Without oil seal

●MSMF021L1□□

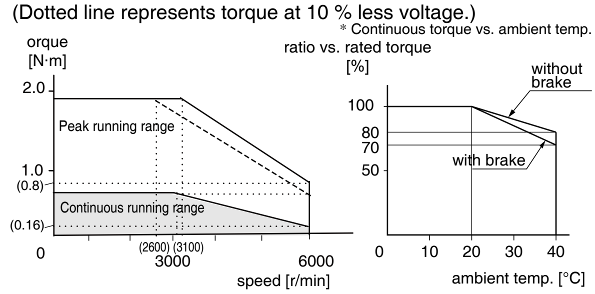
Input voltage to driver: AC100 V
(Dotted line represents torque at 10 % less voltage.)



With oil seal

●MSMF021L1□□

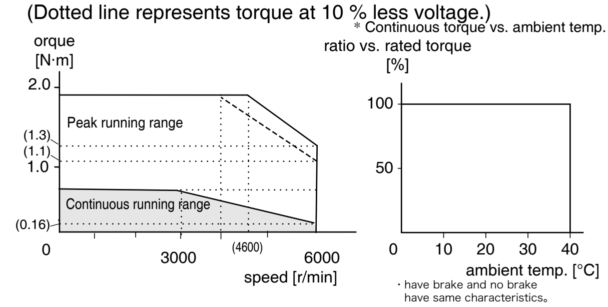
Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



Without oil seal

●MSMF022L1□□

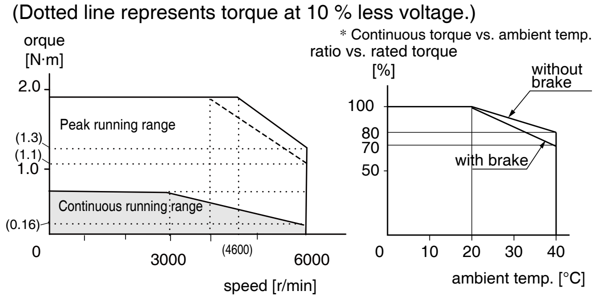
Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



With oil seal

●MSMF022L1□□

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



* These are subject to change. Contact us when you use these values for your machine design.

3. Motor Characteristics (S-T Characteristics)

MSMF Series (400 W)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

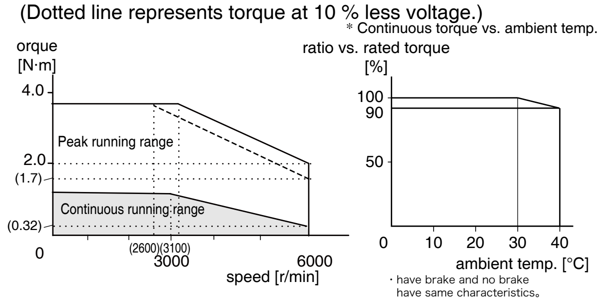
Motor model	Unit	MSMF041L1 □□		MSMF042L1 □□	
Brake		without	with	without	with
Oil seal		without/with		without/with	
Output rating	W	400		400	
Matched drive		MCDL □ 31 □□		MBDL □ 25 □□	
Power supply of drive	V(AC)	100		200	
Rated torque	N·m	1.27		1.27	
Continuous stall torque	N·m	1.27		1.27	
Max.instantaneous speed	N·m	3.82		3.82	
Rated curren	A (rms)	4.6		2.4	
Max.instantaneous current	A (o-p)	19.5		10.2	
Rated rotational speed	r/min	3000		3000	
Max.rotational speed	r/min	6000		6000	
Rotor inertia	$\times 10^{-4}$ kg·m^2	0.27	0.30	0.27	0.30

MSMF series (400 W)

Without oil seal

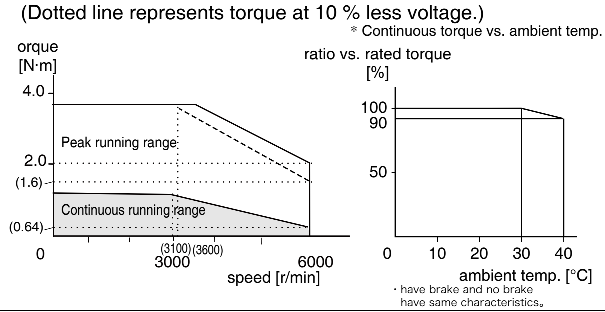
●**MSMF041L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



●**MSMF042L1□□**

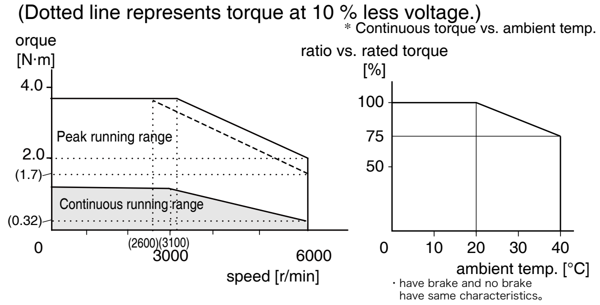
Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



With oil seal

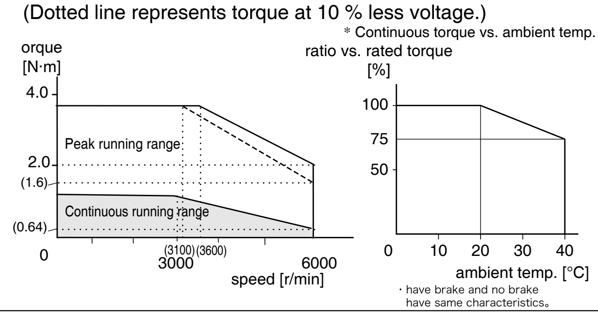
●**MSMF041L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



●**MSMF042L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



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3. Motor Characteristics (S-T Characteristics)

MSMF Series (750 W to 1.0 kW(□80))

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

Motor model	Unit	MSMF082L1□□		MSMF092L1□□	
Brake		without	with	without	with
Oil seal		without/with		without/with	
Output rating	W	750		1000	
Matched drive		MCDL□35□□		MDDL□45□□	
Power supply of drive	V(AC)	200		200	
Rated torque	N·m	2.39		3.18	
Continuous stall torque	N·m	2.39		3.18	
Max.instantaneous speed	N·m	7.16		9.55	
Rated curren	A (rms)	4.1		5.7	
Max.instantaneous current	A (o-p)	17.4		24.2	
Rated rotational speed	r/min	3000		3000	
Max.rotational speed	r/min	6000		6000	
Rotor inertia	$\times 10^{-4}$ kg·m^2	0.96	1.06	1.26	1.36

MSMF series (750 W to 1.0 kW(□80))

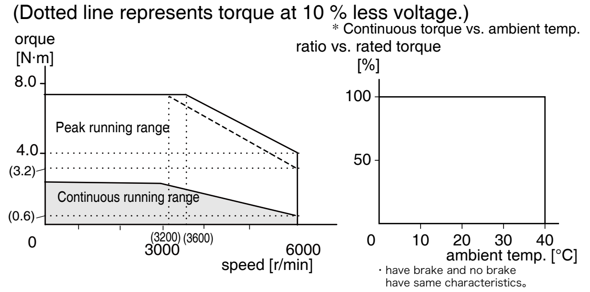
Without oil seal	With oil seal

Without oil seal

●MSMF082L1□□

Input voltage to driver: AC200 V

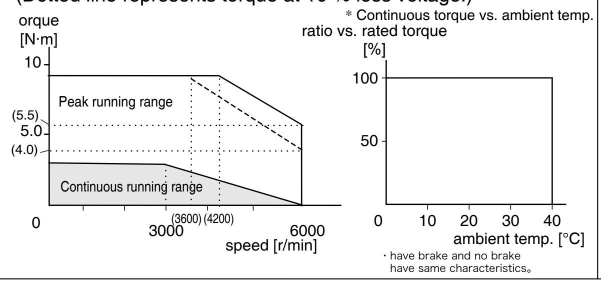
(Dotted line represents torque at 10 % less voltage.)



●MSMF092L1□□

Input voltage to driver: AC200 V

(Dotted line represents torque at 10 % less voltage.)

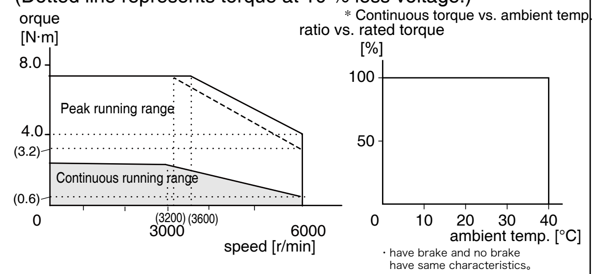


With oil seal

●MSMF082L1□□

Input voltage to driver: AC200 V

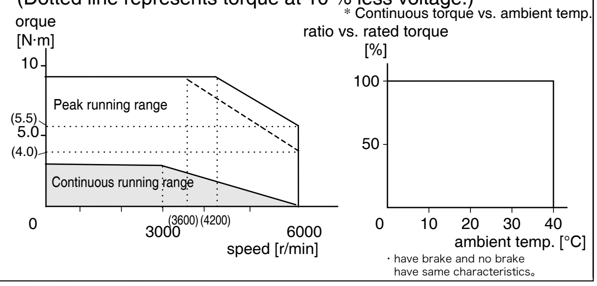
(Dotted line represents torque at 10 % less voltage.)



●MSMF092L1□□

Input voltage to driver: AC200 V

(Dotted line represents torque at 10 % less voltage.)



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3. Motor Characteristics (S-T Characteristics)

MSMF Series (1.0 kW (□100) to 2.0 kW)

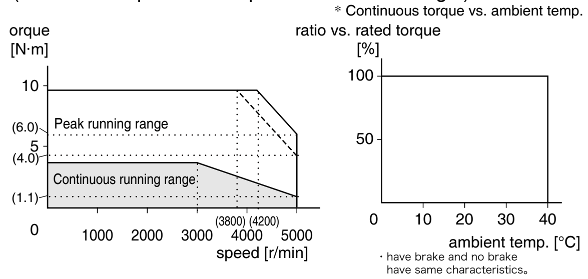
•Note that the motor characteristics may vary due to the existence of oil seal or brake.

Motor model	Unit	MSMF102 L1 □□		MSMF152 L1 □□		MSMF202 L1 □□	
Brake		without	with	without	with	without	with
Oil seal		with		with		with	
Output rating	kW	1.0		1.5		2.0	
Matched drive		MDDL □ 55 □□		MDDL □ 55 □□		MEDL □ 83 □□	
Power supply of drive	V(AC)	200		200		200	
Rated torque	N·m	3.18		4.77		6.37	
Continuous stall torque	N·m	3.82		5.72		7.64	
Max.instantaneous speed	N·m	9.55		14.3		19.1	
Rated curren	A（rms)	6.6		8.2		11.3	
Max.instantaneous current	A（o-p)	28		35		48	
Rated rotational speed	r/min	3000		3000		3000	
Max.rotational speed	r/min	5000		5000		5000	
Rotor inertia	$\times 10^{-4}$ kg·m^2	2.15	2.47	3.10	3.45	4.06	4.41

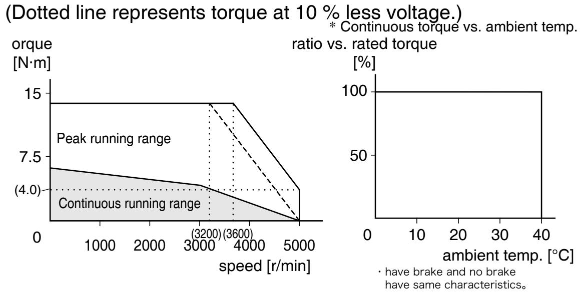
MSMF series (1.0 kW(□100) to 2.0 kW)

With oil seal

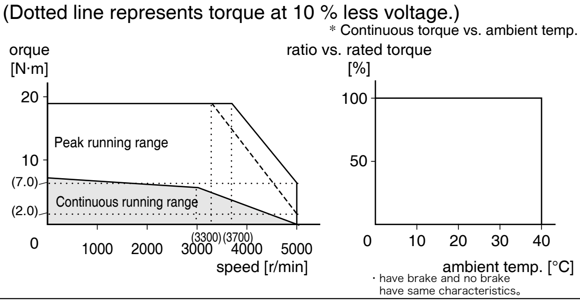
●**MSMF102 L1□□**
Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



●**MSMF152 L1□□**
Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



●**MSMF202 L1□□**
Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



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3. Motor Characteristics (S-T Characteristics)

MSMF Series (3.0 kW to 5.0 kW)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

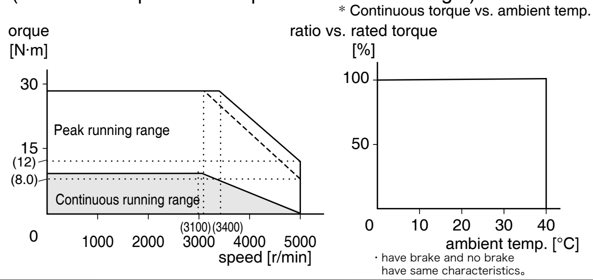
Motor model	Unit	MSMF302L1 □□		MSMF402L1 □□		MSMF502L1 □□	
Brake		without	with	without	with	without	with
Oil seal		with		with		with	
Output rating	kW	3.0		4.0		5.0	
Matched drive		MFDL □ A3 □□		MFDL □ B3 □□		MFDL □ B3 □□	
Power supply of drive	V(AC)	200		200		200	
Rated torque	N·m	9.55		12.7		15.9	
Continuous stall torque	N·m	11.0		15.2		19.1	
Max.instantaneous speed	N·m	28.6		38.2		47.7	
Rated curren	A（rms)	18.1		19.6		24	
Max.instantaneous current	A（o-p)	77		83		102	
Rated rotational speed	r/min	3000		3000		3000	
Max.rotational speed	r/min	5000		4500		4500	
Rotor inertia	$\times 10^{-4}$ kg·m^2	7.04	7.38	14.4	15.6	19.0	20.2

MSMF series (3.0 kW to 5.0 kW)

With oil seal

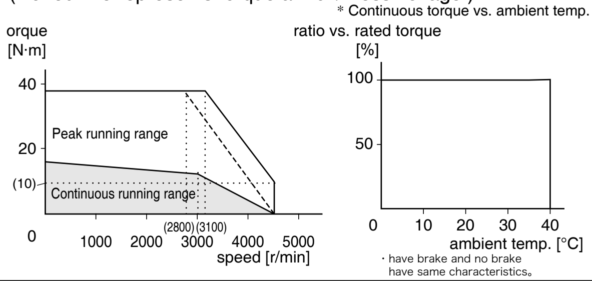
●**MSMF302L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



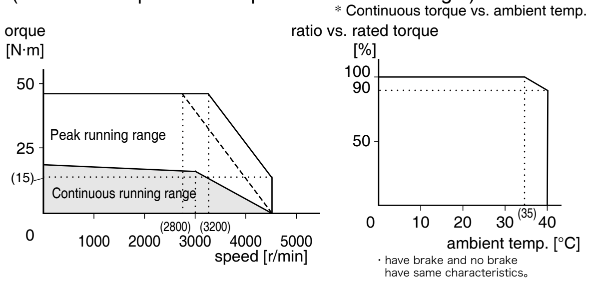
●**MSMF402L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



●**MSMF502L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



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3. Motor Characteristics (S-T Characteristics)

MQMF Series (100 W)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

Motor model	Unit	MQMF011L1 □□		MQMF012L1 □□	
Brake		without	with	without	with
Oil seal		without/with		without/with	
Output rating	W	100		100	
Matched drive		MADL □ 11 □□		MADL □ 05 □□	
Power supply of drive	V(AC)	100		200	
Rated torque	N·m	0.32		0.32	
Continuous stall torque	N·m	0.33		0.33	
Max.instantaneous speed	N·m	1.11		1.11	
Rated curren	A (rms)	1.6		1.1	
Max.instantaneous current	A (o-p)	7.9		5.5	
Rated rotational speed	r/min	3000		3000	
Max.rotational speed	r/min	6500		6500	
Rotor inertia	$\times10^{-4}$ kg·m^2	0.15	0.18	0.15	0.18

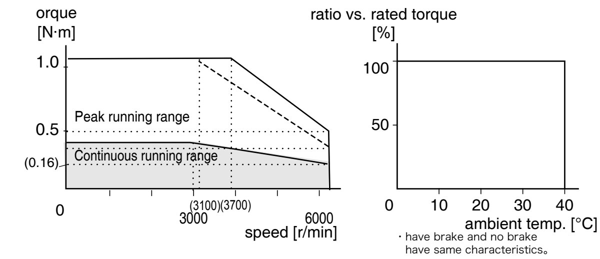
MQMF series (100 W)

Without oil seal

●MQMF011L1□□

Input voltage to driver: AC100 V
(Dotted line represents torque at 10 % less voltage.)

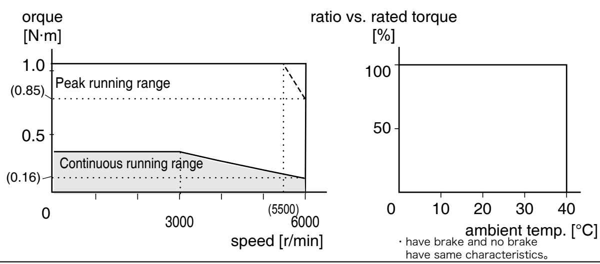
＊Continuous torque vs. ambient temp.



●MQMF012L1□□

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)

＊Continuous torque vs. ambient temp.

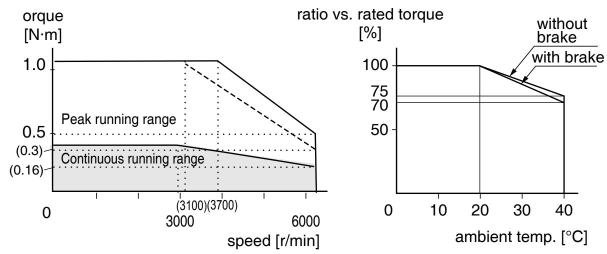


With oil seal

●MQMF011L1□□

Input voltage to driver: AC100 V
(Dotted line represents torque at 10 % less voltage.)

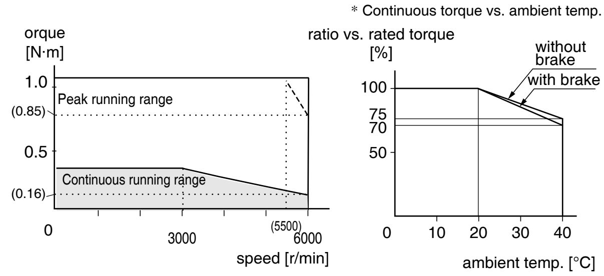
＊Continuous torque vs. ambient temp.



●MQMF012L1□□

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)

＊Continuous torque vs. ambient temp.



＊These are subject to change. Contact us when you use these values for your machine design.

3. Motor Characteristics (S-T Characteristics)

MQMF Series (200 W)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

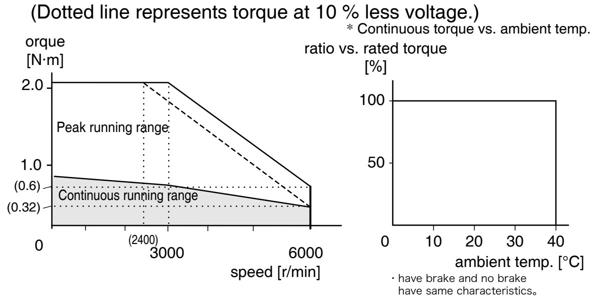
Motor model	Unit	MQMF021L1 □□		MQMF022L1 □□	
Brake		without	with	without	with
Oil seal		without/with		without/with	
Output rating	W	200		200	
Matched drive		MBDL □ 21 □□		MADL □ 15 □□	
Power supply of drive	V(AC)	100		200	
Rated torque	N·m	0.64		0.64	
Continuous stall torque	N·m	0.76		0.76	
Max.instantaneous speed	N·m	2.23		2.23	
Rated curren	A (rms)	2.1		1.4	
Max.instantaneous current	A (o-p)	10.4		6.9	
Rated rotational speed	r/min	3000		3000	
Max.rotational speed	r/min	6500		6500	
Rotor inertia	$\times10^{-4}$ kg·m^2	0.50	0.59	0.50	0.59

MQMF series (200 W)

Without oil seal

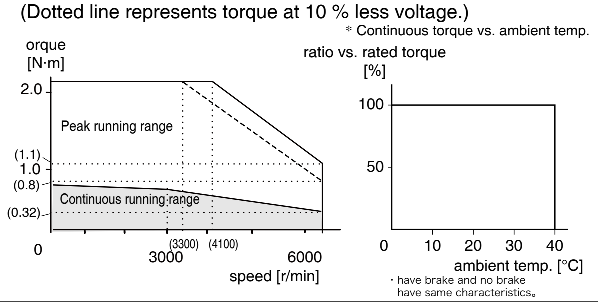
●**MQMF021L1□□**

Input voltage to driver: AC100 V
(Dotted line represents torque at 10 % less voltage.)



●**MQMF022L1□□**

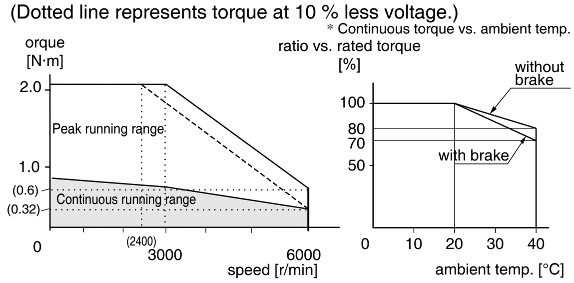
Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



With oil seal

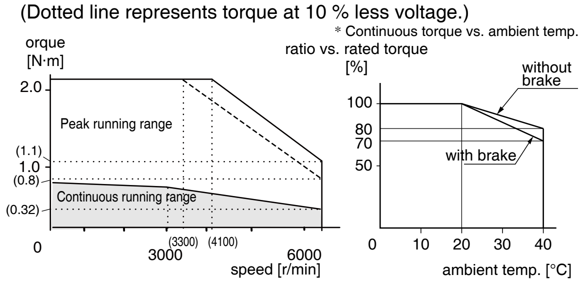
●**MQMF021L1□□**

Input voltage to driver: AC100 V
(Dotted line represents torque at 10 % less voltage.)



●**MQMF022L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



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3. Motor Characteristics (S-T Characteristics)

MQMF Series (400 W)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

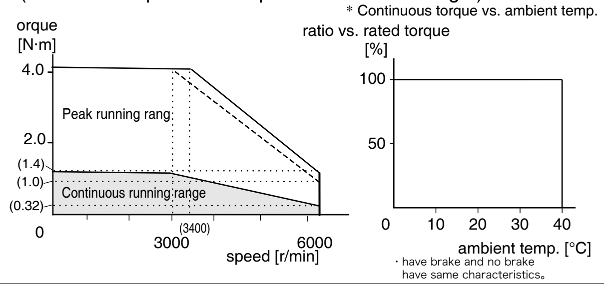
Motor model	Unit	MQMF041L1 □□		MQMF042L1 □□	
Brake		without	with	without	with
Oil seal		without/with		without/with	
Output rating	W	400		400	
Matched drive		MCDL □ 31 □□		MBDL □ 25 □□	
Power supply of drive	V(AC)	100		200	
Rated torque	N·m	1.27		1.27	
Continuous stall torque	N·m	1.40		1.40	
Max.instantaneous speed	N·m	4.46		4.46	
Rated curren	A（rms)	4.1		2.1	
Max.instantaneous current	A（o-p)	20.3		10.4	
Rated rotational speed	r/min	3000		3000	
Max.rotational speed	r/min	6500		6500	
Rotor inertia	$\times 10^{-4}$ kg·m^2	0.98	1.06	0.98	1.06

MQMF series (400 W)

Without oil seal

●**MQMF041L1□□**

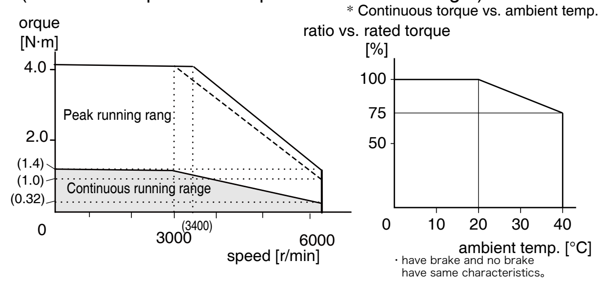
Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



With oil seal

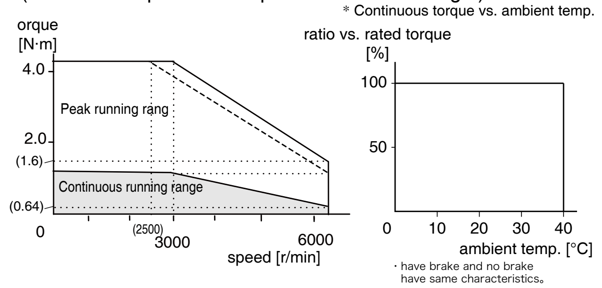
●**MQMF041L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



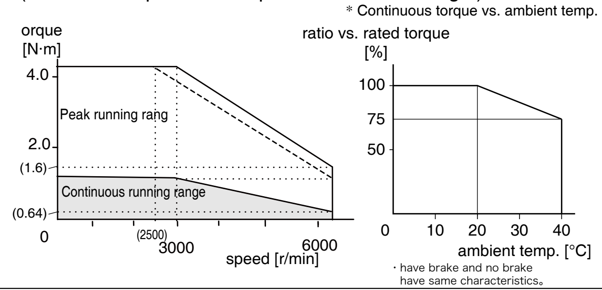
●**MQMF042L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



●**MQMF042L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



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3. Motor Characteristics (S-T Characteristics)

MDMF Series (1.0 kW to 2.0 kW)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

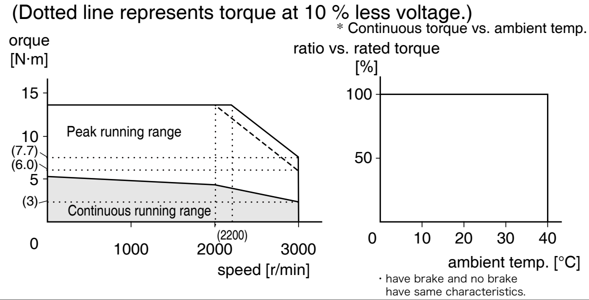
Motor model	Unit	MDMF102L1 □□		MDMF152L1 □□		MDMF202L1 □□	
Brake		without	with	without	with	without	with
Oil seal		with		with		with	
Output rating	kW	1.0		1.5		2.0	
Matched drive		MDDL □ 45 □□		MDDL □ 55 □□		MEDL □ 83 □□	
Power supply of drive	V(AC)	200		200		200	
Rated torque	N·m	4.77		7.16		9.55	
Continuous stall torque	N·m	5.25		7.52		10.0	
Max.instantaneous speed	N·m	14.3		21.5		28.6	
Rated curren	A (rms)	5.2		8.0		9.9	
Max.instantaneous current	A (o-p)	22		34		42	
Rated rotational speed	r/min	2000		2000		2000	
Max.rotational speed	r/min	3000		3000		3000	
Rotor inertia	$\times 10^{-4}$ kg·m^2	6.18	7.40	9.16	10.4	12.1	13.3

MDMF series (1.0 kW to 2.0 kW)

With oil seal

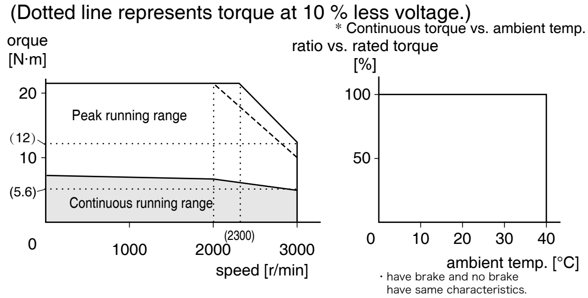
●MDMF102L1□□

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



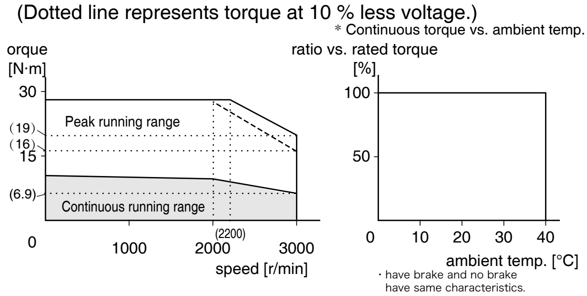
●MDMF152L1□□

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



●MDME202L1□□

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



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3. Motor Characteristics (S-T Characteristics)

MDMF Series (3.0 kW to 5.0 kW)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

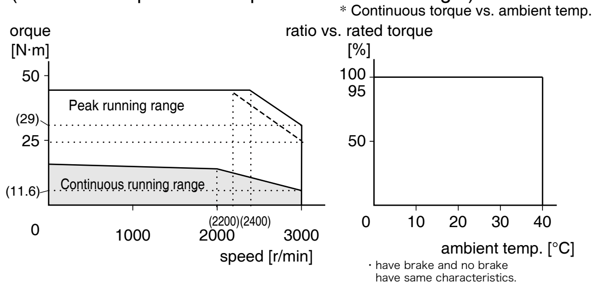
Motor model	Unit	MDMF302L1□□		MDMF402L1□□		MDMF502L1□□	
Brake		without	with	without	with	without	with
Oil seal		with		with		with	
Output rating	kW	3.0		4.0		5.0	
Matched drive		MFDL□A3□□		MFDL□B3□□		MFDL□B3□□	
Power supply of drive	V(AC)	200		200		200	
Rated torque	N·m	14.3		19.1		23.9	
Continuous stall torque	N·m	15.0		22.0		26.3	
Max.instantaneous speed	N·m	43.0		57.3		71.6	
Rated curren	A（rms）	16.4		20.0		23.3	
Max.instantaneous current	A（o-p）	70		85		99	
Rated rotational speed	r/min	2000		2000		2000	
Max.rotational speed	r/min	3000		3000		3000	
Rotor inertia	$\times 10^{-4}$ kg·m^2	18.6	19.6	46.9	52.3	58.2	63.0

MDMF series (3.0 kW to 5.0 kW)

With oil seal

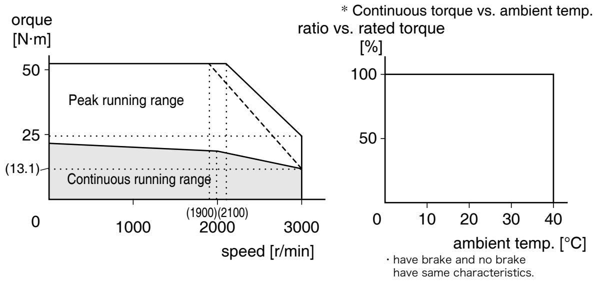
●MDMF302L1□□

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



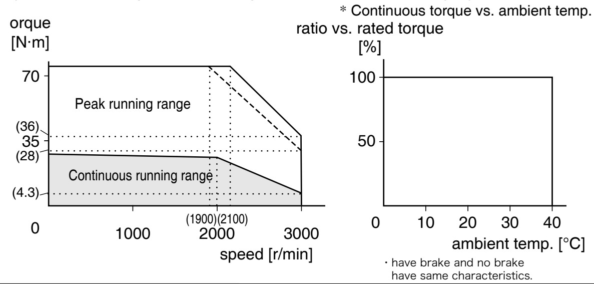
●MDMF402L1□□

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



●MDMF502L1□□

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



* These are subject to change. Contact us when you use these values for your machine design.

3. Motor Characteristics (S-T Characteristics)

MGMF Series (0.85 kW to 1.8 kW)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

Motor model	Unit	MGMF092L1□□		MGMF132L1□□		MGMF182L1□□	
Brake		without	with	without	with	without	with
Oil seal		with		with		with	
Output rating	kW	0.85		1.3		1.8	
Matched drive		MDDL□45□□		MDDL□55□□		MEDL□83□□	
Power supply of drive	V(AC)	200		200		200	
Rated torque	N·m	5.41		8.28		11.5	
Continuous stall torque	N·m	5.41		8.28		11.5	
Max.instantaneous speed	N·m	14.3		23.3		28.7	
Rated curren	A (rms)	5.9		9.3		11.8	
Max.instantaneous current	A (o-p)	22		37		42	
Rated rotational speed	r/min	1500		1500		1500	
Max.rotational speed	r/min	3000		3000		3000	
Rotor inertia	×10^{-4} kg·m^2	6.18	7.40	9.16	10.4	12.1	13.3

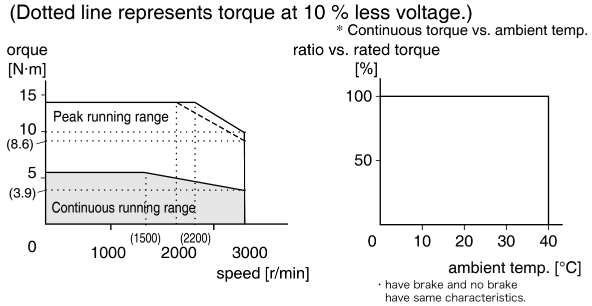
MGMF series (850 W to 1.8 kW)

With oil seal

●**MGMF092L1□□**

Input voltage to driver: AC200 V

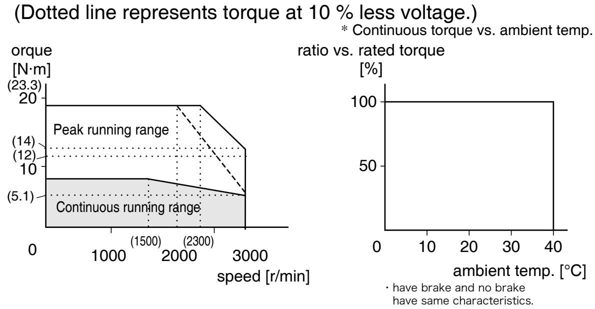
(Dotted line represents torque at 10 % less voltage.)



●**MGMF132L1□□**

Input voltage to driver: AC200 V

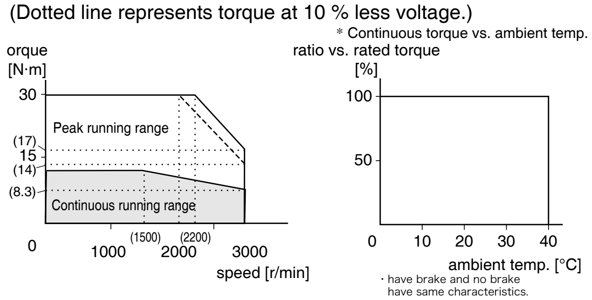
(Dotted line represents torque at 10 % less voltage.)



●**MGMF182L1□□**

Input voltage to driver: AC200 V

(Dotted line represents torque at 10 % less voltage.)



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3. Motor Characteristics (S-T Characteristics)

MGMF Series (2.4 kW to 4.4 kW)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

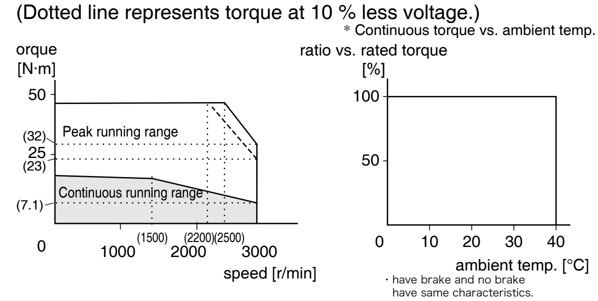
Motor model	Unit	MGMF242L1 □□		MGMF292L1 □□		MGMF442L1 □□	
Brake		without	with	without	with	without	with
Oil seal		with		with		with	
Output rating	kW	2.4		2.9		4.4	
Matched drive		MEDL □ 93 □□		MFDL □ B3 □□		MFDL □ B3 □□	
Power supply of drive	V(AC)	200		200		200	
Rated torque	N·m	15.3		18.5		28.0	
Continuous stall torque	N·m	15.3		18.5		28.0	
Max.instantaneous speed	N·m	45.3		45.2		70.0	
Rated curren	A (rms)	16.0		19.3		27.2	
Max.instantaneous current	A (o-p)	66.5		67		96	
Rated rotational speed	r/min	1500		1500		1500	
Max.rotational speed	r/min	3000		3000		3000	
Rotor inertia	$\times 10^{-4}$ kg·m^2	46.9	52.3	46.9	52.3	58.2	63.0

MGMF series (2.4 kW to 4.4 kW)

With oil seal

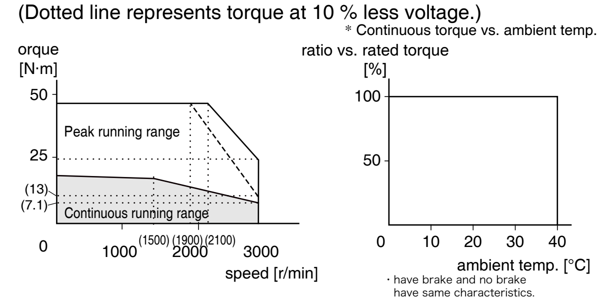
●**MGMF242L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



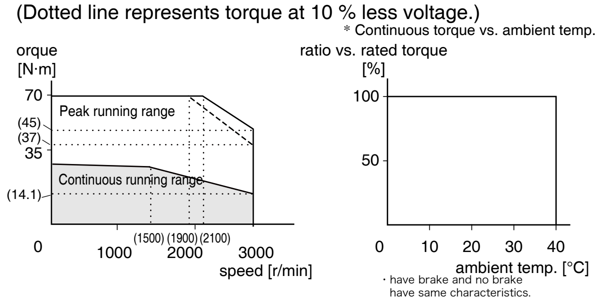
●**MGMF292L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



●**MGMF442L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



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3. Motor Characteristics (S-T Characteristics)

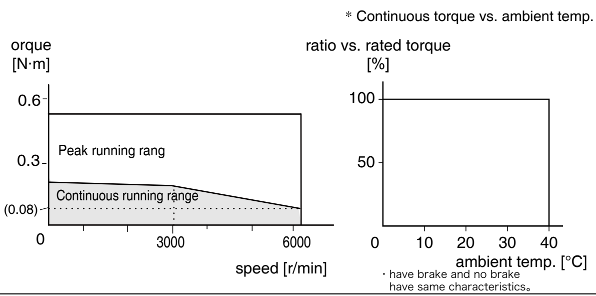
MHMF Series (50 W)

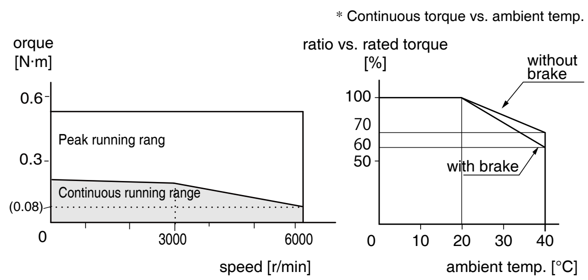
•Note that the motor characteristics may vary due to the existence of oil seal or brake.

Motor model	Unit	MHMF5AZL1 □□	
Brake		without	with
Oil seal		without/with	
Output rating	W	50	
Matched drive		MADL □ 01 □□	
		MADL □ 05 □□	
Power supply of drive	V(AC)	100/200	
Rated torque	N·m	0.16	
Continuous stall torque	N·m	0.16	
Max.instantaneous speed	N·m	0.56	
Rated curren	A (rms)	1.1	
Max.instantaneous current	A (o-p)	5.5	
Rated rotational speed	r/min	3000	
Max.rotational speed	r/min	6500	
Rotor inertia	$\times 10^{-4}$ kg·m^2	0.038	0.042

MHMF series (50 W)

Without oil seal	With oil seal
●MHMF5AZL1□□ Input voltage to driver: AC100 V/200 V	●MHMF5AZL1□□ Input voltage to driver: AC100 V/200 V





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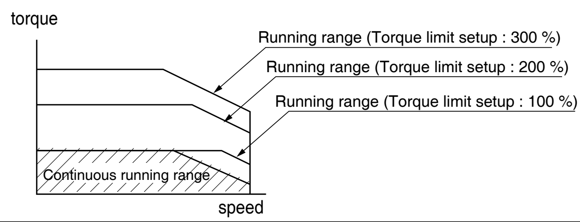
• When you lower the torque limit setup (Pr0.13 and 5.22), running range at high speed might be lowered as well.



3. Motor Characteristics (S-T Characteristics)

MHMF Series (100 W)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

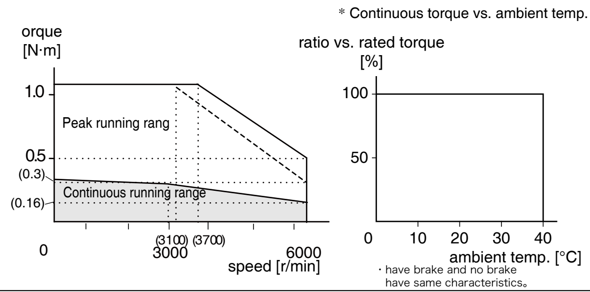
Motor model	Unit	MHMF011L1 □□		MHMF012L1 □□	
Brake		without	with	without	with
Oil seal		without/with		without/with	
Output rating	W	100		100	
Matched drive		MADL □ 11 □□		MADL □ 05 □□	
Power supply of drive	V(AC)	100		200	
Rated torque	N·m	0.32		0.32	
Continuous stall torque	N·m	0.33		0.33	
Max.instantaneous speed	N·m	1.11		1.11	
Rated curren	A (rms)	1.6		1.1	
Max.instantaneous current	A (o-p)	7.9		5.5	
Rated rotational speed	r/min	3000		3000	
Max.rotational speed	r/min	6500		6500	
Rotor inertia	$\times 10^{-4}$ kg·m^2	0.071	0.074	0.071	0.074

MHMF series (100 W)

Without oil seal

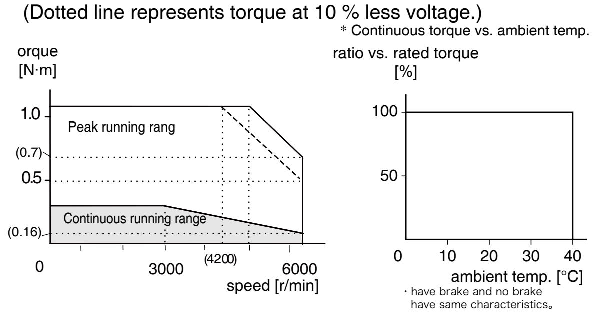
●**MHMF011L1□□**

Input voltage to driver: AC100 V/200 V



●**MHMF012L1□□**

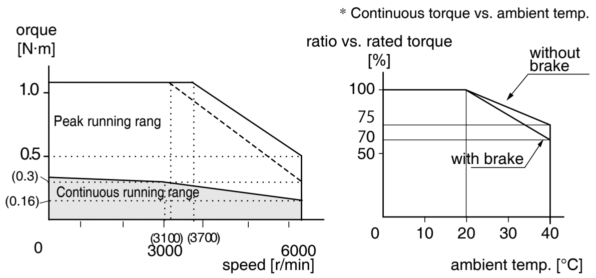
Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



With oil seal

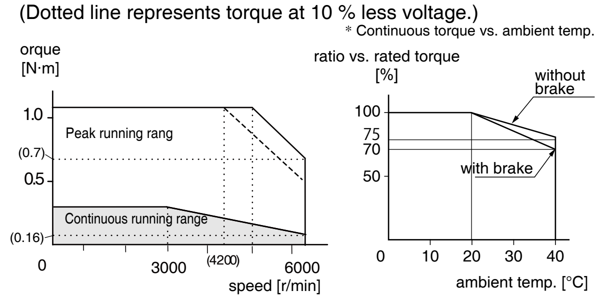
●**MHMF011L1□□**

Input voltage to driver: AC100 V/200 V



●**MHMF012L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



* These are subject to change. Contact us when you use these values for your machine design.

3. Motor Characteristics (S-T Characteristics)

MHMF Series (200 W)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

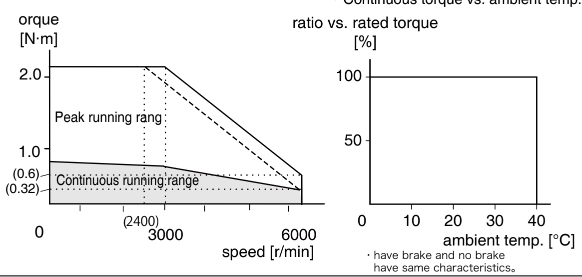
Motor model	Unit	MHMF021L1 □□		MHMF022L1 □□	
Brake		without	with	without	with
Oil seal		without/with		without/with	
Output rating	W	200		200	
Matched drive		MBDL □ 21 □□		MADL □ 15 □□	
Power supply of drive	V(AC)	100		200	
Rated torque	N·m	0.64		0.64	
Continuous stall torque	N·m	0.76		0.76	
Max.instantaneous speed	N·m	2.23		2.23	
Rated curren	A (rms)	2.1		1.4	
Max.instantaneous current	A (o-p)	10.4		6.9	
Rated rotational speed	r/min	3000		3000	
Max.rotational speed	r/min	6500		6500	
Rotor inertia	$\times 10^{-4}$ kg·m^2	0.29	0.31	0.29	0.31

MHMF series (200 W)

Without oil seal	With oil seal

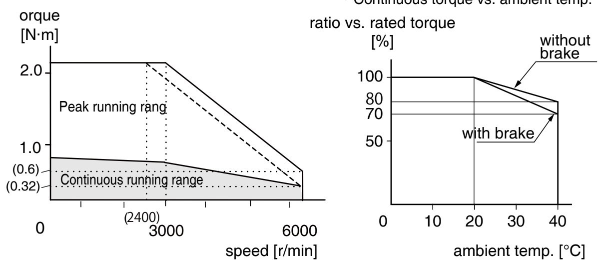
●MHMF021L1□□ (Without oil seal)

Input voltage to driver: AC100 V
(Dotted line represents torque at 10 % less voltage.)
* Continuous torque vs. ambient temp.



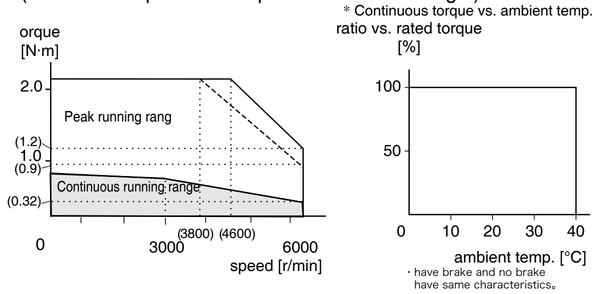
●MHMF021L1□□ (With oil seal)

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)
* Continuous torque vs. ambient temp.



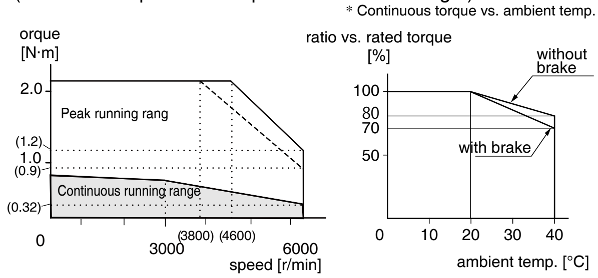
●MHMF022L1□□ (Without oil seal)

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)
* Continuous torque vs. ambient temp.



●MHMF022L1□□ (With oil seal)

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)
* Continuous torque vs. ambient temp.



* These are subject to change. Contact us when you use these values for your machine design.

MHMF Series (400 W)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

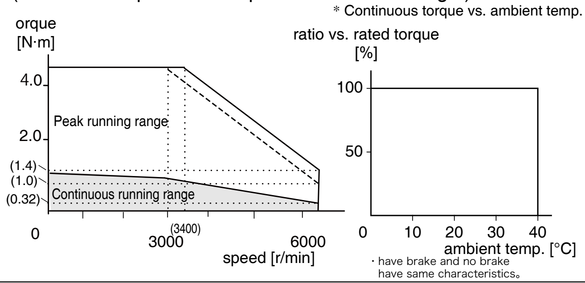
Motor model	Unit	MHMF041L1□□		MHMF042L1□□	
Brake		without	with	without	with
Oil seal		without/with		without/with	
Output rating	W	400		400	
Matched drive		MCDL□31□□		MBDL□25□□	
Power supply of drive	V(AC)	100		200	
Rated torque	N·m	1.27		1.27	
Continuous stall torque	N·m	1.40		1.40	
Max.instantaneous speed	N·m	4.46		4.46	
Rated curren	A（rms）	4.1		2.1	
Max.instantaneous current	A（o-p）	20.3		10.4	
Rated rotational speed	r/min	3000		3000	
Max.rotational speed	r/min	6500		6500	
Rotor inertia	$\times 10^{-4}$ kg·m^2	0.56	0.58	0.56	0.58

MHMF series (400 W)

Without oil seal

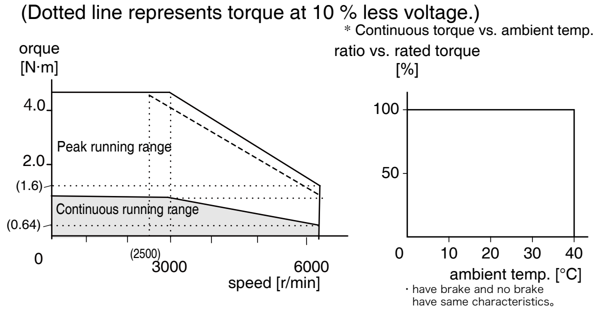
●**MHMF041L1□□**

Input voltage to driver: AC100 V
(Dotted line represents torque at 10 % less voltage.)



●**MHMF042L1□□**

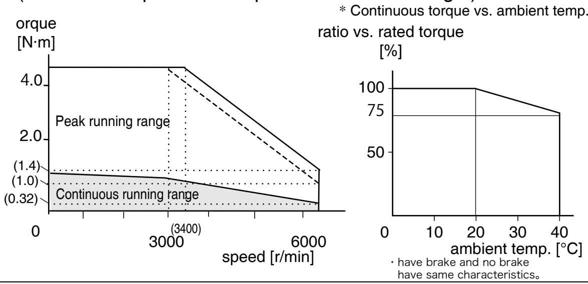
Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



With oil seal

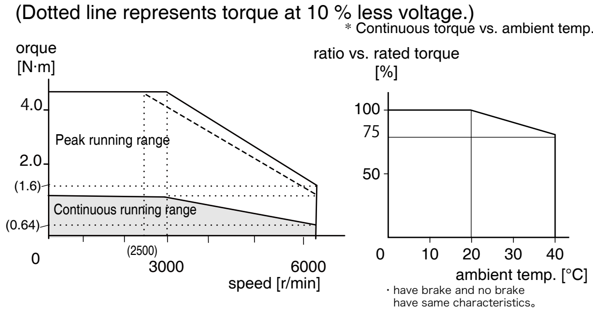
●**MHMF041L1□□**

Input voltage to driver: AC100 V
(Dotted line represents torque at 10 % less voltage.)



●**MHMF042L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



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3. Motor Characteristics (S-T Characteristics)

MHMF Series (750 W to 1.0 kW(□ 80))

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

Motor model	Unit	MHMF082L1□□		MHMF092L1□□	
Brake		without	with	without	with
Oil seal		without/with		without/with	
Output rating	W	750		1000	
Matched drive		MCDL□35□□		MDDL□45□□	
Power supply of drive	V(AC)	200		200	
Rated torque	N·m	2.39		3.18	
Continuous stall torque	N·m	2.86		3.34	
Max.instantaneous speed	N·m	8.36		11.1	
Rated curren	A (rms)	3.8		5.7	
Max.instantaneous current	A (o-p)	18.8		28.2	
Rated rotational speed	r/min	3000		3000	
Max.rotational speed	r/min	6000		6000	
Rotor inertia	×10^{-4} kg·m^2	1.56	1.66	2.03	2.13

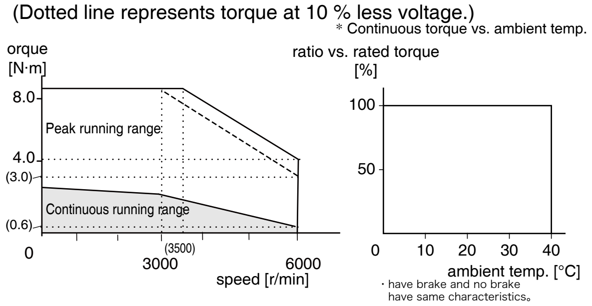
MHMF series (750 W to 1.0 kW(□80))

Without oil seal

●MHMF082L1□□

Input voltage to driver: AC200 V

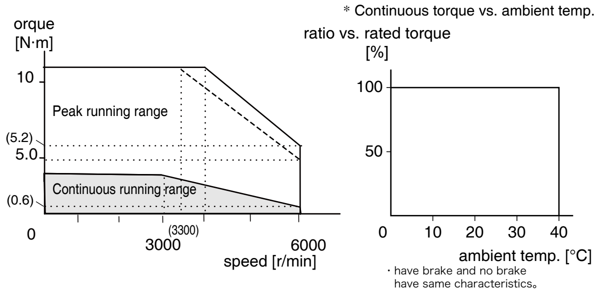
(Dotted line represents torque at 10 % less voltage.)



●MHMF092L1□□

Input voltage to driver: AC200 V

(Dotted line represents torque at 10 % less voltage.)

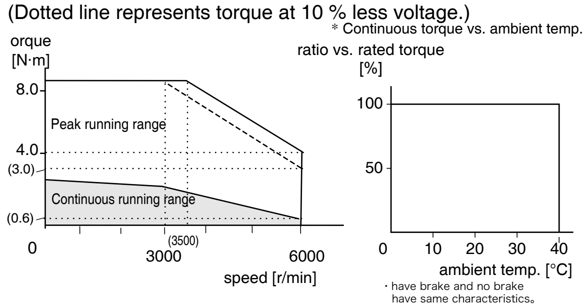


With oil seal

●MHMF082L1□□

Input voltage to driver: AC200 V

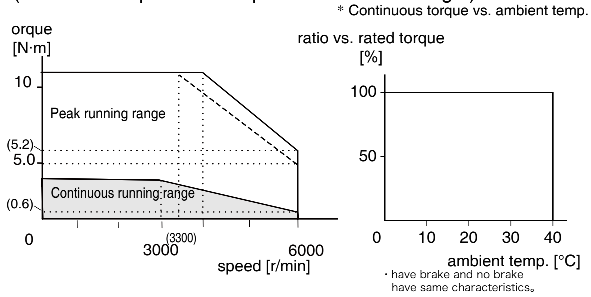
(Dotted line represents torque at 10 % less voltage.)



●MHMF092L1□□

Input voltage to driver: AC200 V

(Dotted line represents torque at 10 % less voltage.)



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3. Motor Characteristics (S-T Characteristics)

MHMF Series(1.0 kW (□130) to 2.0 kW)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

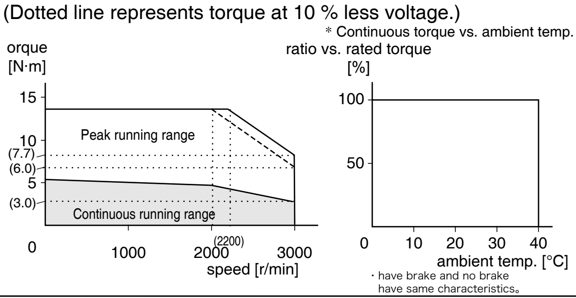
Motor model	Unit	MHMF102L1 □□		MHMF152L1 □□		MHMF202L1 □□	
Brake		without	with	without	with	without	with
Oil seal		with		with		with	
Output rating	kW	1.0		1.5		2.0	
Matched drive		MDDL □ 45 □□		MDDL □ 55 □□		MEDL □ 83 □□	
Power supply of drive	V(AC)	200		200		200	
Rated torque	N·m	4.77		7.16		9.55	
Continuous stall torque	N·m	5.25		7.52		11.5	
Max.instantaneous speed	N·m	14.3		21.5		28.6	
Rated curren	A (rms)	5.2		8.0		12.5	
Max.instantaneous current	A (o-p)	22		34		53	
Rated rotational speed	r/min	2000		2000		2000	
Max.rotational speed	r/min	3000		3000		3000	
Rotor inertia	$\times 10^{-4}$ kg·m^2	22.9	24.1	33.4	34.6	55.7	61.0

MHMF series (1.0 kW(□130) to 2.0 kW)

With oil seal

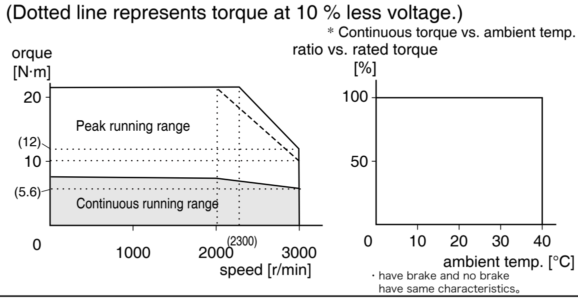
●**MHMF102L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



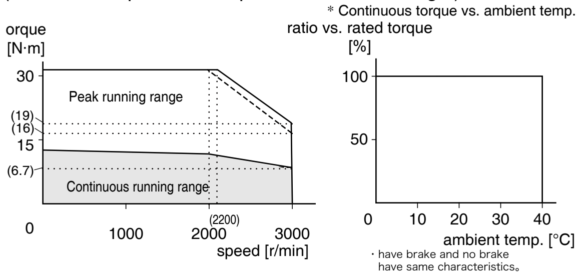
●**MHMF152L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



●**MHMF202L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



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3. Motor Characteristics (S-T Characteristics)

MHMF Series (3.0 kW to 5.0 kW)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

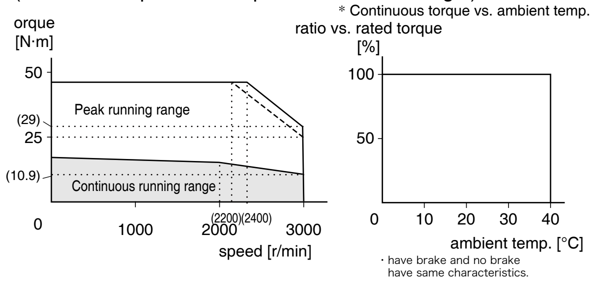
Motor model	Unit	MHMF302L1□□		MHMF402L1□□		MHMF502L1□□	
Brake		without	with	without	with	without	with
Oil seal		with		with		with	
Output rating	kW	3.0		4.0		5.0	
Matched drive		MFDL□A3□□		MFDL□B3□□		MFDL□B3□□	
Power supply of drive	V(AC)	200		200		200	
Rated torque	N·m	14.3		19.1		23.9	
Continuous stall torque	N·m	17.2		22.0		26.3	
Max.instantaneous speed	N·m	43.0		57.3		71.6	
Rated curren	A (rms)	17.0		20.0		23.3	
Max.instantaneous current	A (o-p)	72		85		99	
Rated rotational speed	r/min	2000		2000		2000	
Max.rotational speed	r/min	3000		3000		3000	
Rotor inertia	$\times10^{-4}$ kg·m^2	85.3	90.7	104	110	146	151

MHMF series (3.0 kW to 5.0 kW)

With oil seal

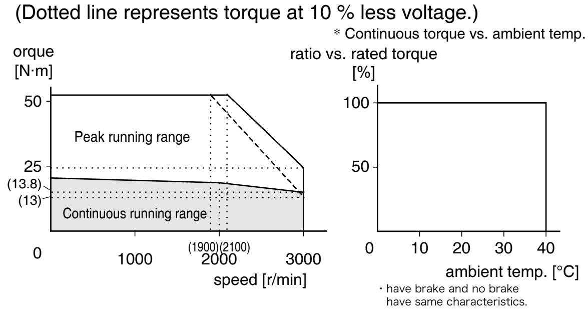
●**MHMF302L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



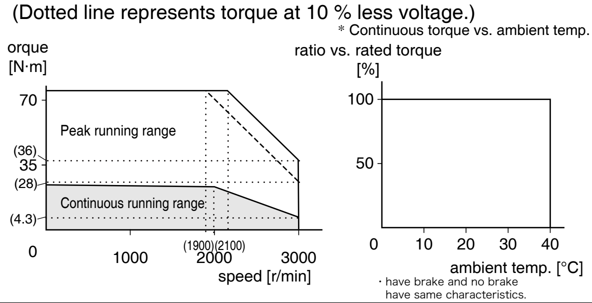
●**MHMF402L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



●**MHMF502L1□□**

Input voltage to driver: AC200 V
(Dotted line represents torque at 10 % less voltage.)



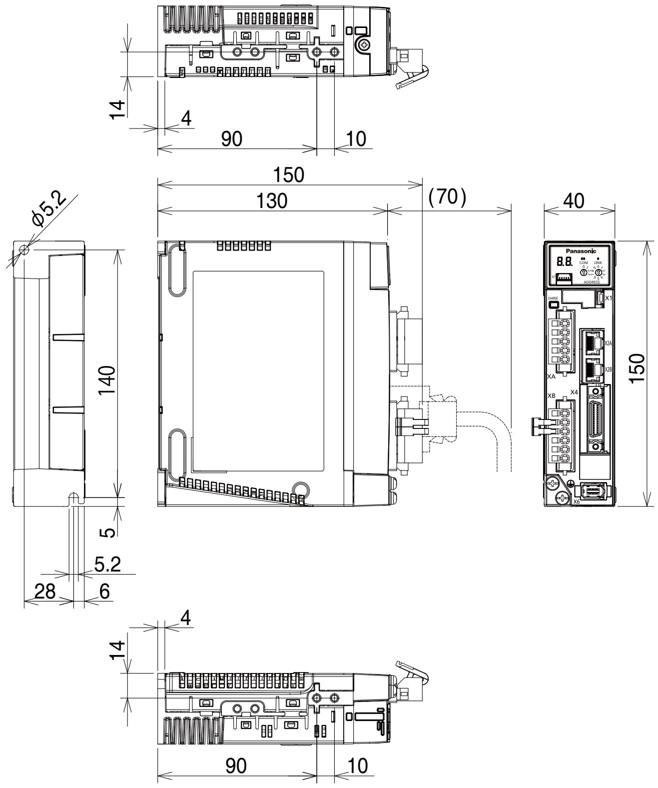
* These are subject to change. Contact us when you use these values for your machine design.

4. Dimensions

Driver

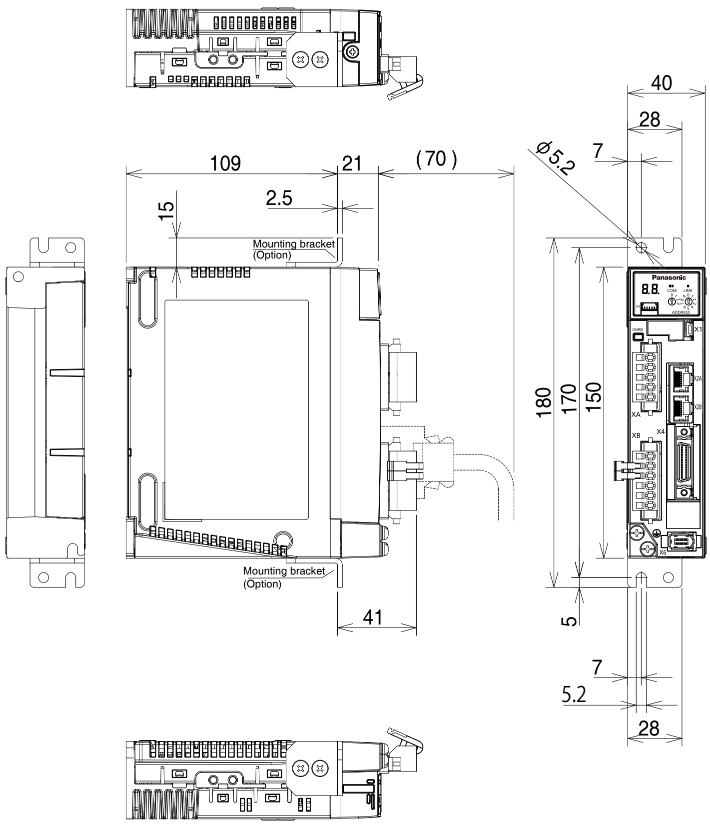
[Unit: mm]

A-frame (Base-mounting Type)



Mass: 0.8 kg

A-frame (Rack-mounting Type)

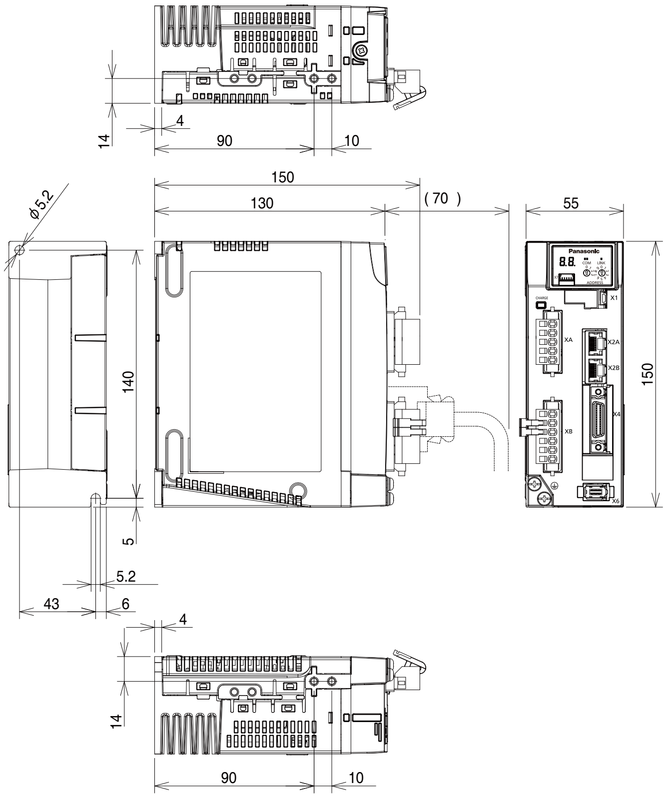


Mass: 0.8 kg

Related page
• P.1-4 “Driver” • P.1-15 “Check of the Combination of the Driver and the Motor”
• P.2-18 “List of Applicable Peripheral Equipments to Driver”

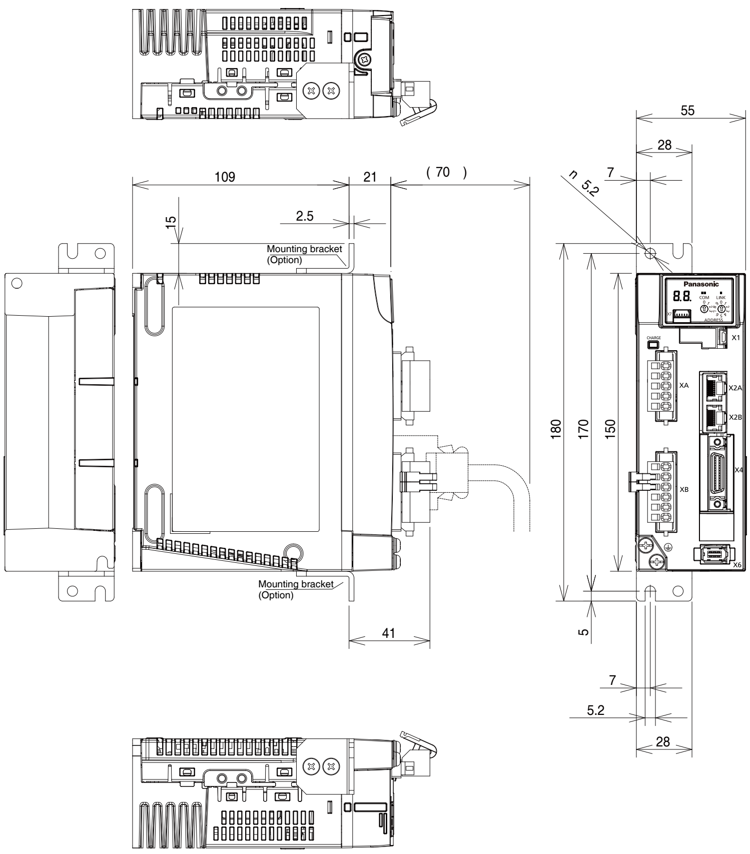
[Unit: mm]

B-frame (Base-mounting Type)



Mass: 0.9 kg

B-frame (Rack-mounting Type)

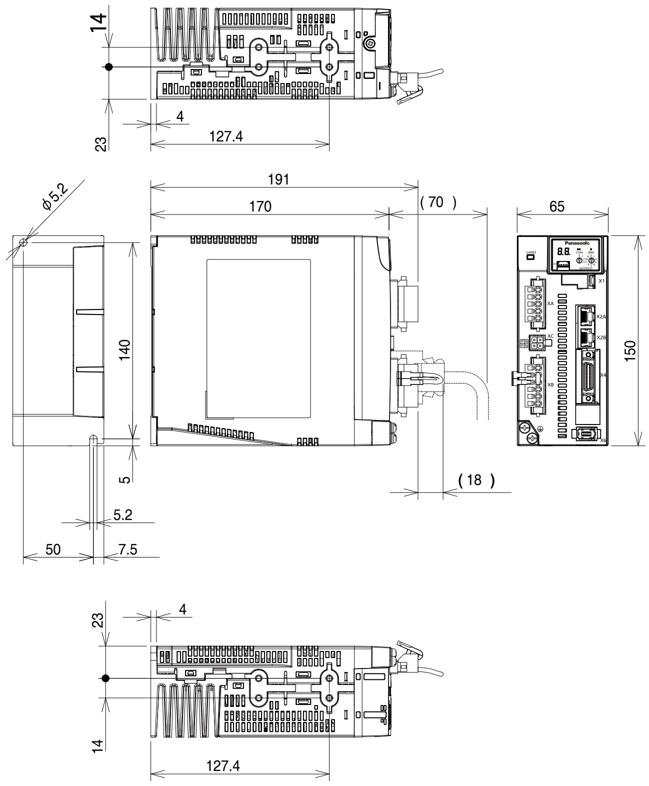


Mass: 1.0 kg

Related page
• P.1-4 “Driver” • P.1-15 “Check of the Combination of the Driver and the Motor”
• P.2-18 “List of Applicable Peripheral Equipments to Driver”

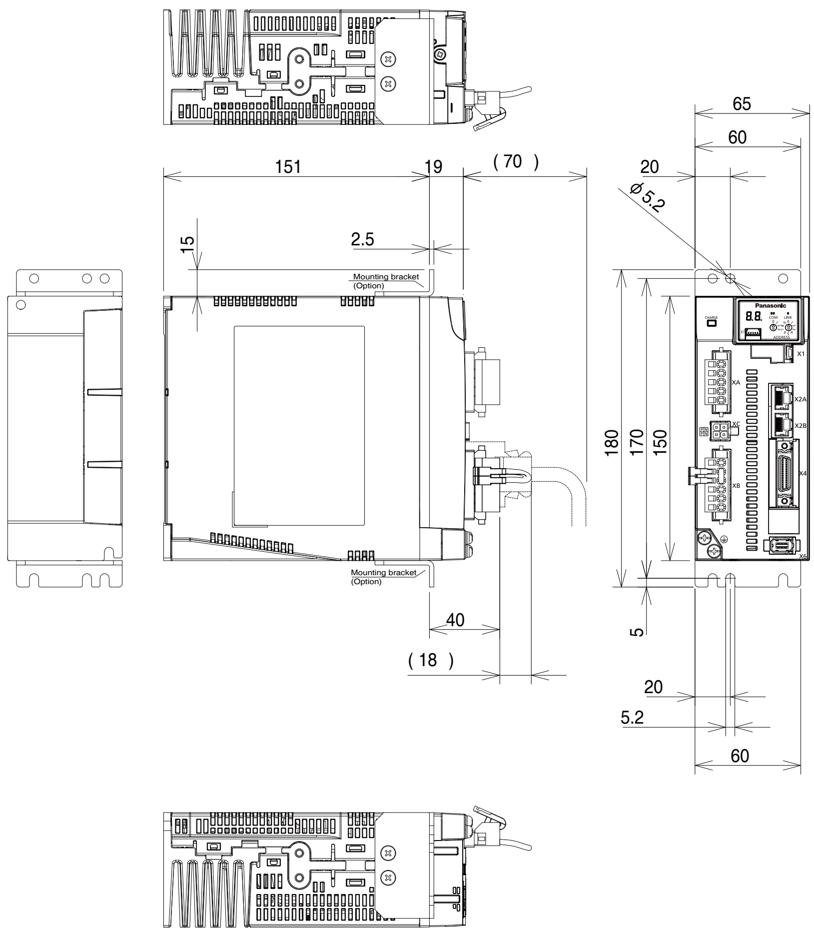
[Unit: mm]

C-frame (Base-mounting Type)



Mass:1.5 kg

C-frame (Rack-mounting Type)



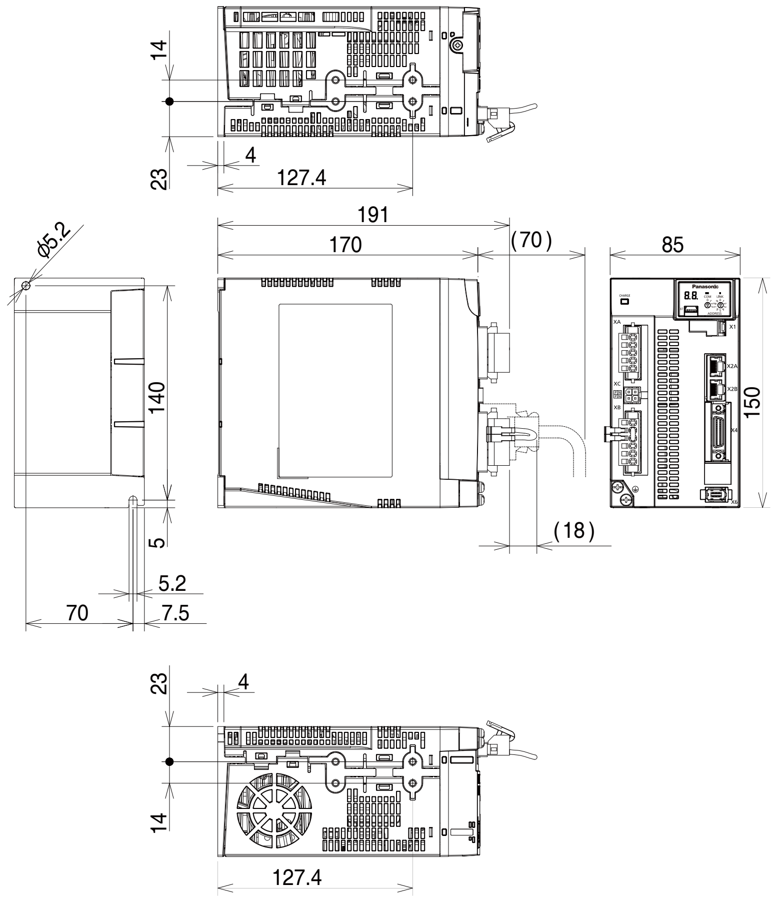
Mass: 1.6 kg

4. Dimensions

Driver

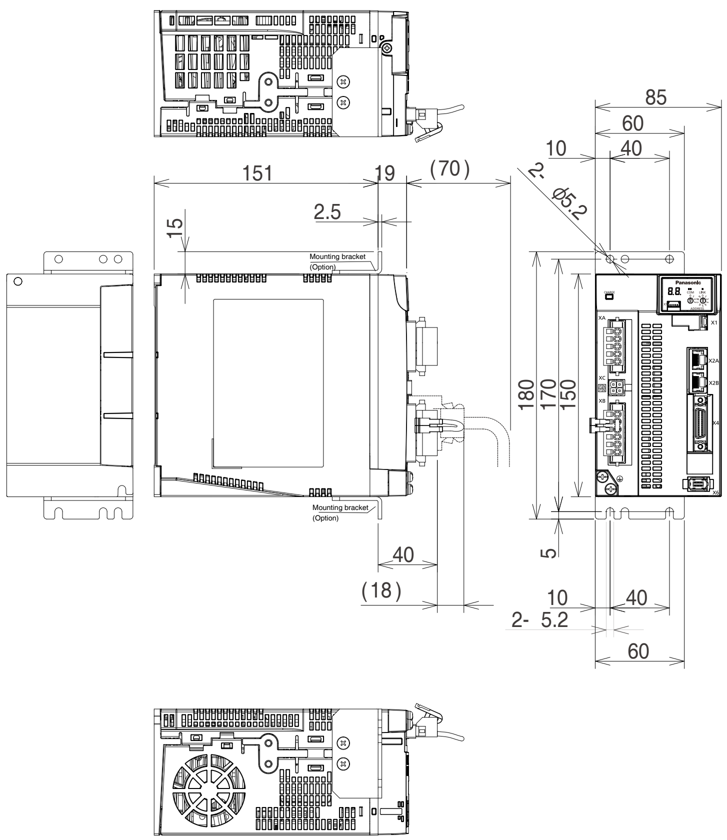
[Unit: mm]

D-frame (Base-mounting Type)



Mass: 1.9 kg

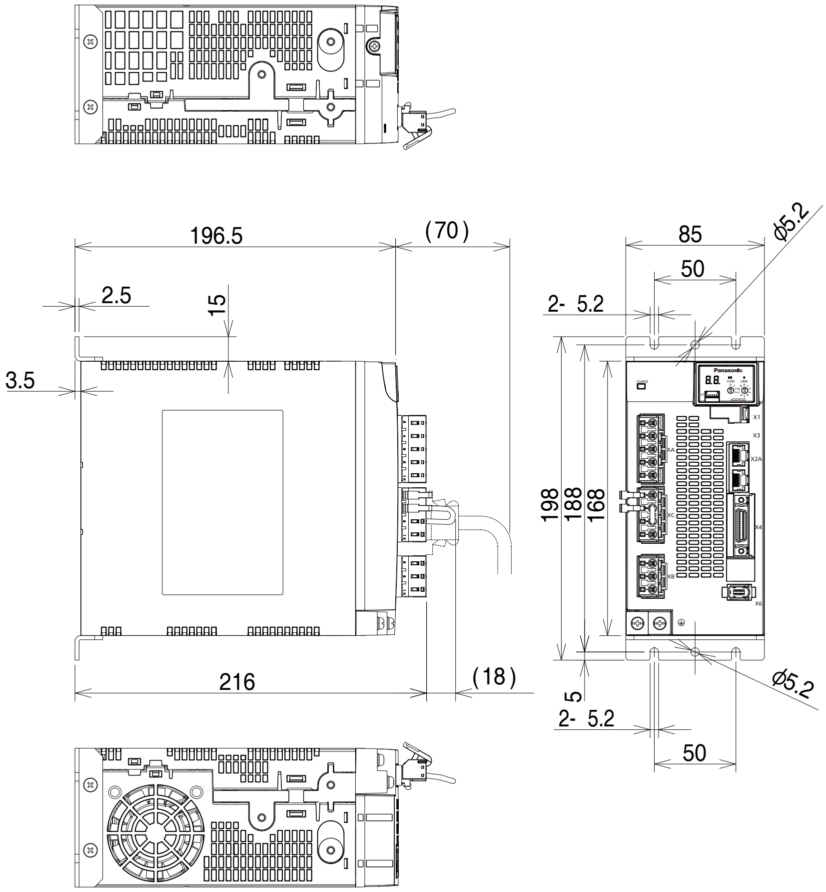
D-frame (Rack-mounting Type)



Mass: 2.0 kg

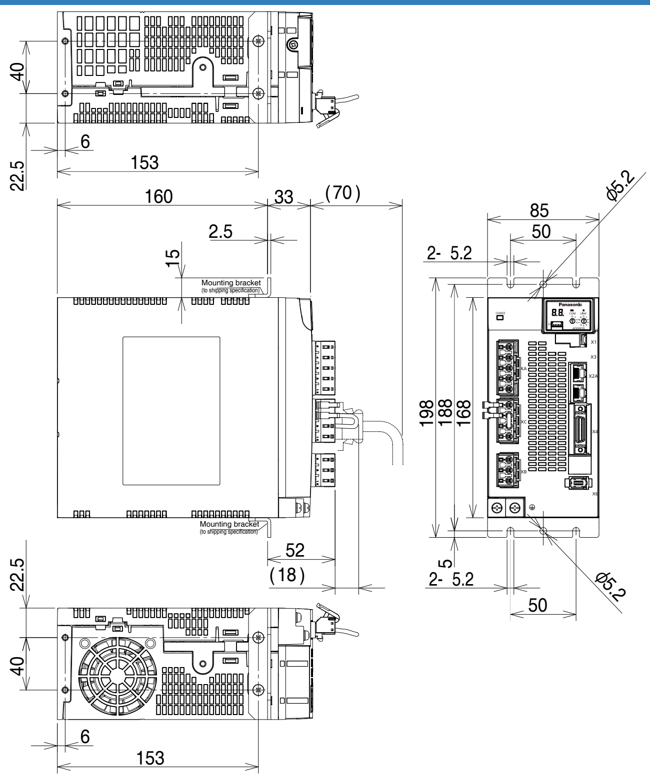
[Unit: mm]

E-frame (Base-mounting Type)



Mass: 2.7 kg

E-frame (Rack-mounting Type)



Mass: 2.7 kg

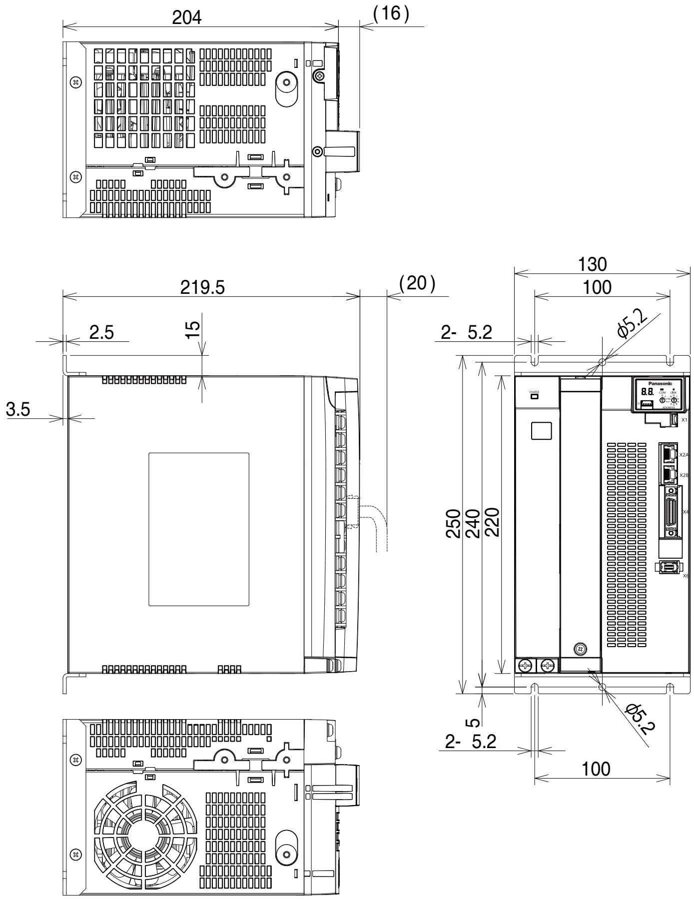
Related page
• P.1-4 “Driver” • P.1-15 “Check of the Combination of the Driver and the Motor”
• P.2-18 “List of Applicable Peripheral Equipments to Driver”

4. Dimensions

Driver

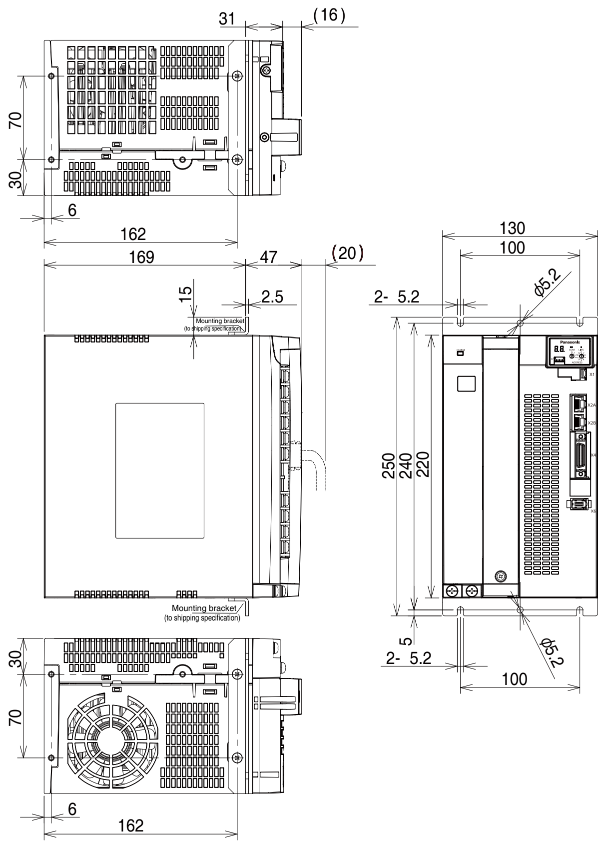
[Unit: mm]

F-frame (Base-mounting Type)



Mass: 5.2 kg

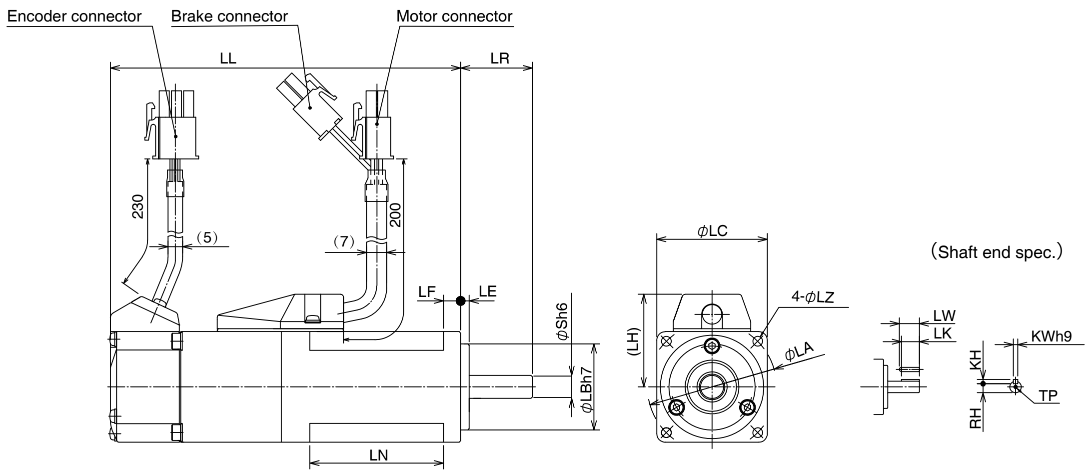
F-frame (Rack-mounting Type)



Mass: 5.2 kg

[単位：mm]

MSMF 50 W to 100 W (Leadwire Type)



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

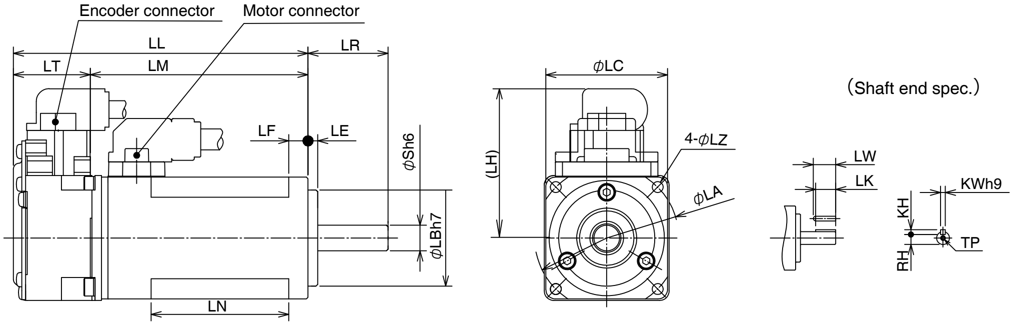
MSMF series (Low inertia)			
Motor output		50 W	100 W
Motor model	**MSMF**	5AZL1□2	01□L1□2
LL	Without brake	72	92
	With brake	102	122
LR		25	
S		8	
LA		45	
LB		30	
LC		38	
LE		3	
LF		6	
LH		32	
LN		26.5	46.5
LZ		3.4	
Key way dimensions	LW	14	
	LK	12.5	
	KW	3	
	KH	3	
	RH	6.2	
	TP	M3 depth 6	
Mass (kg)	Without brake	0.32	0.47
	With brake	0.53	0.68
Connector specifications		Refer to P.2-40 “Specifications of Motor Connector”	

Caution Reduce the moment of inertia ratio if high speed response operation is required.

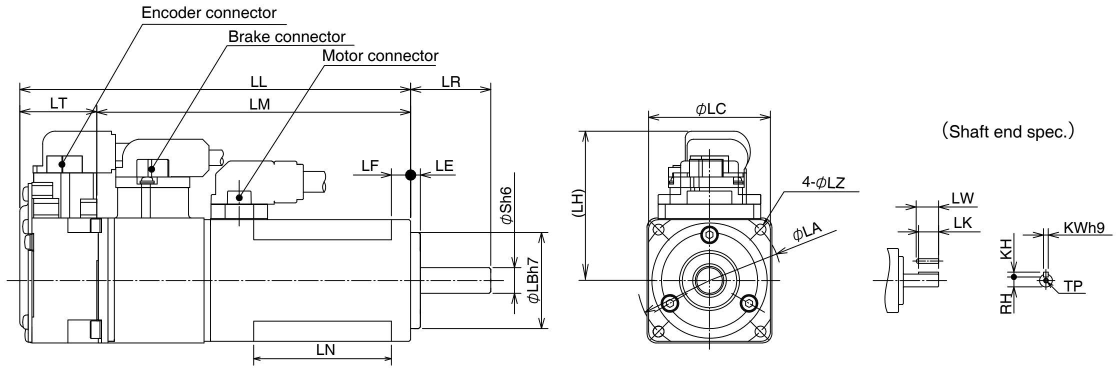
Related page
• P.1-11“Check of the Model” • P.1-15“Check of the Combination of the Driver and the Motor”
• P.7-11 ～ P.7-12 “S-T Characteristics”

[Unit: mm]

MSMF 50 W to 100 W (Connector Type)



With brake



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

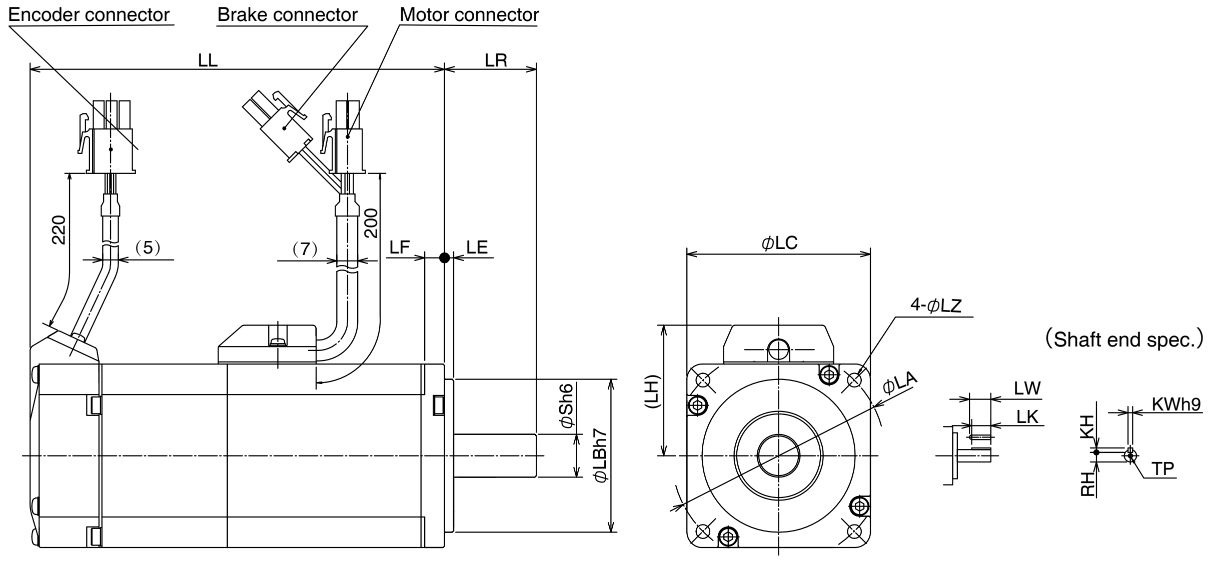
MSMF series (Low inertia)			
Motor output		50 W	100 W
Motor model	**MSMF**	5AZL1□1	01□L1□1
LL	Without brake	72	92
	With brake	102	122
LR		25	
S		8	
LA		45	
LB		30	
LC		38	
LE		3	
LF		6	
LH		46.6	
LM	Without brake	48	68
	With brake	78	98
LT		24	
LN		23	43
LZ		3.4	
Key way dimensions	LW	14	
	LK	12.5	
	KW	3	
	KH	3	
	RH	6.2	
	TP	M3 depth 6	
Mass (kg)	Without brake	0.32	0.47
	With brake	0.53	0.68
Connector specifications		Refer to P.2-40 “Specifications of Motor Connector”	

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page • P.1-11 “Check of the Model” • P.1-15 “Check of the Combination of the Driver and the Motor”
• P.7-11 ～ P.7-12 “S-T Characteristics”

[Unit: mm]

MSMF 200 W to 1.0 kW (□ 80) (Leadwire Type)



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

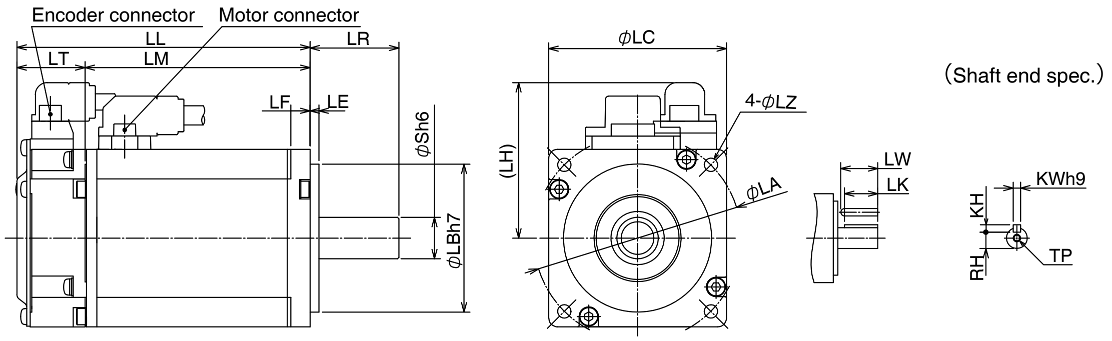
MSMF series (Low inertia)					
Motor output		200 W	400 W	750 W	1.0 kW
Motor model	MSMF	02□L1□2	04□L1□2	082L1□2	092L1□2
LL	Without brake	79.5	99	112.2	127.2
	With brake	116	135.5	149.2	164.2
LR		30		35	
S		11	14	19	
LA		70		90	
LB		50		70	
LC		60		80	
LE		3			
LF		6.5		8	
LH		43		53	
LZ		4.5		6	
Key way dimensions	LW	20	25	25	
	LK	18	22.5	22	
	KW	4	5	6	
	KH	4	5	6	
	RH	8.5	11	15.5	
	TP	M4 depth 8	M5 depth 10		
Mass (kg)	Without brake	0.82	1.2	2.3	2.8
	With brake	1.3	1.7	3.1	3.6
Connector specifications		Refer to P.2-40 "Specifications of Motor Connector"			

Caution Reduce the moment of inertia ratio if high speed response operation is required.

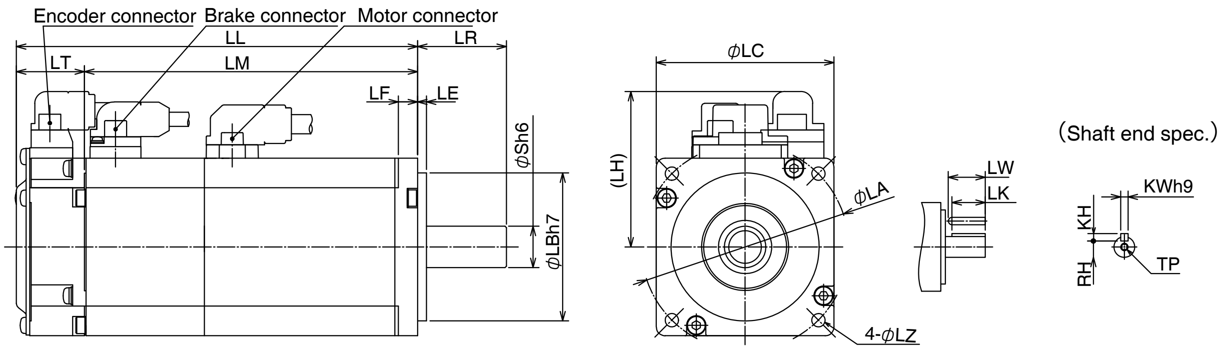
Related page
• P.1-11 "Check of the Model" • P.1-15 "Check of the Combination of the Driver and the Motor"
• P.7-13 ～ P.7-15 "S-T Characteristics"

[Unit: mm]

MSMF 200 W to 1.0 kW (□ 80) (Connector Type)



With brake



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

MSMF series (Low inertia)

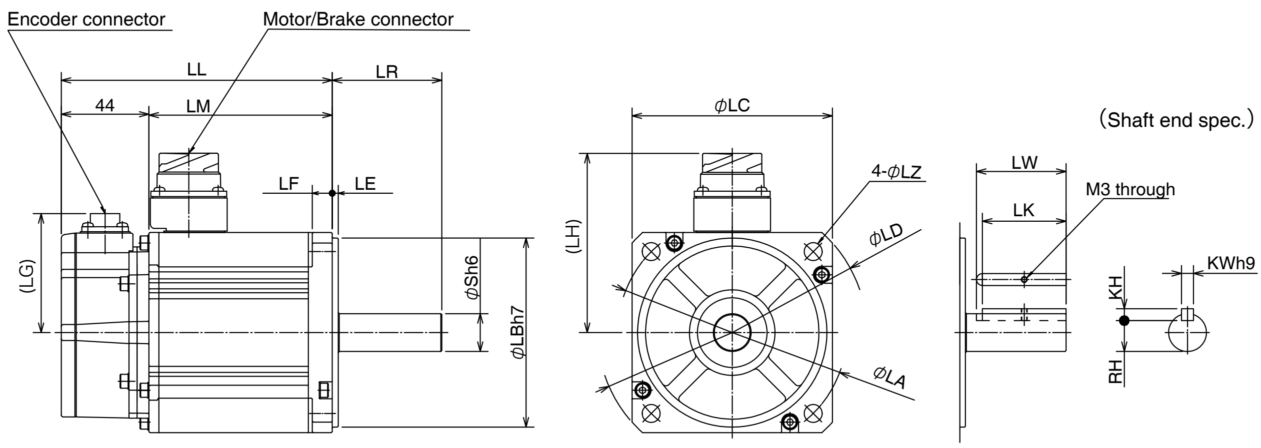
Motor output		200 W	400 W	750 W	1.0 kW
Motor model	MSMF	02□L1□1	04□L1□1	082L1□1	092L1□1
LL	Without brake	79.5	99	112.2	127.2
	With brake	116	135.5	148.2	163.2
LR		30		35	
S		11	14	19	
LA		70		90	
LB		50		70	
LC		60		80	
LE		3			
LF		6.5		8	
LH		52.5		60	
LM	Without brake	56.5	76	86.2	101.2
	With brake	93	112.5	122.2	137.2
LT		23		26	
LZ		4.5		6	
Key way dimensions	LW	20	25		
	LK	18	22.5	22	
	KW	4	5	6	
	KH	4	5	6	
	RH	8.5	11	15.5	
	TP	M4 depth 8	M5 depth 10		
Mass (kg)	Without brake	0.82	1.2	2.3	2.8
	With brake	1.3	1.7	3.1	3.6
Connector specifications		Refer to P.2-40 "Specifications of Motor Connector"			

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11 "Check of the Model" • P.1-15 "Check of the Combination of the Driver and the Motor"
• P.7-13, ~ P.7-15"S-T Characteristics"

[Unit: mm]

MSMF 1.0 kW (□100) to 5.0 kW (□100) (Encoder Connector Type JN2)



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

MSMF series (Low inertia)

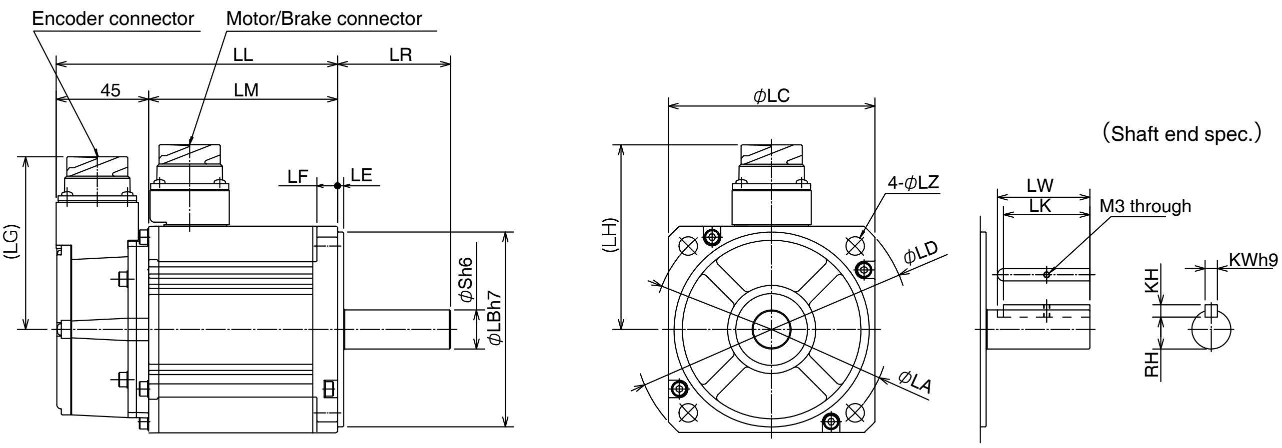
Motor output		1.0 kW	1.5 kW	2.0 kW	3.0 kW	4.0 kW	5.0 kW
Motor model	MSMF	102L1□□	152L1□□	202L1□□	302L1□□	402L1□□	502L1□□
LL	Without brake	136	154.5	173.5	185	204	239
	With brake	163	181.5	200.5	210	232	267
LR		55				65	
S		19			22	24	
LA		115			145		
LB		95			110		
LC		100			120	130	
LD		135			162	165	
LE		3				6	
LF		10			12		
LG		60					
LH	Without brake	90			113	118	
	With brake	101			113	118	
LM	Without brake	92	110.5	129.5	141	160	195
	With brake	119	137.5	156.5	166	188	223
LZ		9					
Key way dimensions	LW	45				55	
	LK	42			41	51	
	KW	6			8		
	KH	6			7		
	RH	15.5			18	20	
Mass (kg)	Without brake	3.6	4.6	5.6	8.7	11.5	14.5
	With brake	4.7	5.6	6.6	9.9	13.2	16.1
Connector specifications		Refer to P.2-40 "Specifications of Motor Connector"					

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11"Check of the Model" • P.1-15 "Check of the Combination of the Driver and the Motor"
• P.7-16 ~ 7-17"S-T Characteristics"

[Unit: mm]

MSMF 1.0 kW（□100） to 5.0 kW (Encoder Connector Type JL10)



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

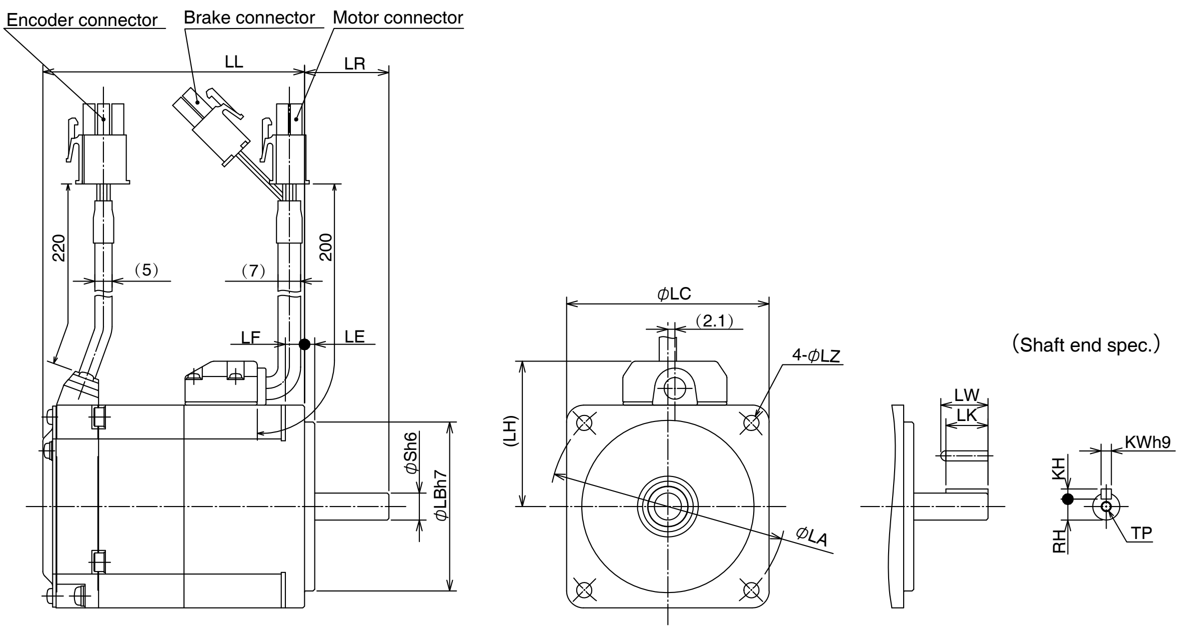
<table>
<tr><th colspan="8">MSMF series (Low inertia)</th></tr>
<tr><td colspan="2">Motor output</td><td>1.0 kW</td><td>1.5 kW</td><td>2.0 kW</td><td>3.0 kW</td><td>4.0 kW</td><td>5.0 kW</td></tr>
<tr><td colspan="2">Motor model MSMF</td><td>102L1□□</td><td>152L1□□</td><td>202L1□□</td><td>302L1□□</td><td>402L1□□</td><td>502L1□□</td></tr>
<tr><td rowspan="2">LL</td><td>Without brake</td><td>137</td><td>155.5</td><td>174.5</td><td>186</td><td>205</td><td>240</td></tr>
<tr><td>With brake</td><td>164</td><td>182.5</td><td>201.5</td><td>211</td><td>233</td><td>268</td></tr>
<tr><td colspan="2">LR</td><td colspan="4">55</td><td colspan="2">65</td></tr>
<tr><td colspan="2">S</td><td colspan="3">19</td><td>22</td><td colspan="2">24</td></tr>
<tr><td colspan="2">LA</td><td colspan="3">115</td><td colspan="3">145</td></tr>
<tr><td colspan="2">LB</td><td colspan="3">95</td><td colspan="3">110</td></tr>
<tr><td colspan="2">LC</td><td colspan="3">100</td><td>120</td><td colspan="2">130</td></tr>
<tr><td colspan="2">LD</td><td colspan="3">135</td><td>162</td><td colspan="2">165</td></tr>
<tr><td colspan="2">LE</td><td colspan="4">3</td><td colspan="2">6</td></tr>
<tr><td colspan="2">LF</td><td colspan="3">10</td><td colspan="3">12</td></tr>
<tr><td colspan="2">LG</td><td colspan="6">84</td></tr>
<tr><td rowspan="2">LH</td><td>Without brake</td><td colspan="3">90</td><td>113</td><td colspan="2">118</td></tr>
<tr><td>With brake</td><td colspan="3">101</td><td>113</td><td colspan="2">118</td></tr>
<tr><td rowspan="2">LM</td><td>Without brake</td><td>92</td><td>110.5</td><td>129.5</td><td>141</td><td>160</td><td>195</td></tr>
<tr><td>With brake</td><td>119</td><td>137.5</td><td>156.5</td><td>166</td><td>188</td><td>223</td></tr>
<tr><td colspan="2">LZ</td><td colspan="6">9</td></tr>
<tr><td rowspan="5">Key way dimensions</td><td>LW</td><td colspan="4">45</td><td colspan="2">55</td></tr>
<tr><td>LK</td><td colspan="3">42</td><td>41</td><td colspan="2">51</td></tr>
<tr><td>KW</td><td colspan="3">6</td><td colspan="3">8</td></tr>
<tr><td>KH</td><td colspan="3">6</td><td colspan="3">7</td></tr>
<tr><td>RH</td><td colspan="3">15.5</td><td>18</td><td colspan="2">20</td></tr>
<tr><td rowspan="2">Mass (kg)</td><td>Without brake</td><td>3.6</td><td>4.6</td><td>5.6</td><td>8.7</td><td>11.5</td><td>14.5</td></tr>
<tr><td>With brake</td><td>4.7</td><td>5.6</td><td>6.6</td><td>9.9</td><td>13.2</td><td>16.1</td></tr>
<tr><td colspan="2">Connector specifications</td><td colspan="6">Refer to P.2-40 “Specifications of Motor Connector”</td></tr>
</table>

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11 “Check of the Model” • P.1-15 “Check of the Combination of the Driver and the Motor”
• P.7-16 ～ 7-17“S-T Characteristics”

[Unit: mm]

MQMF 100 W to 400 W (Leadwire Type)



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

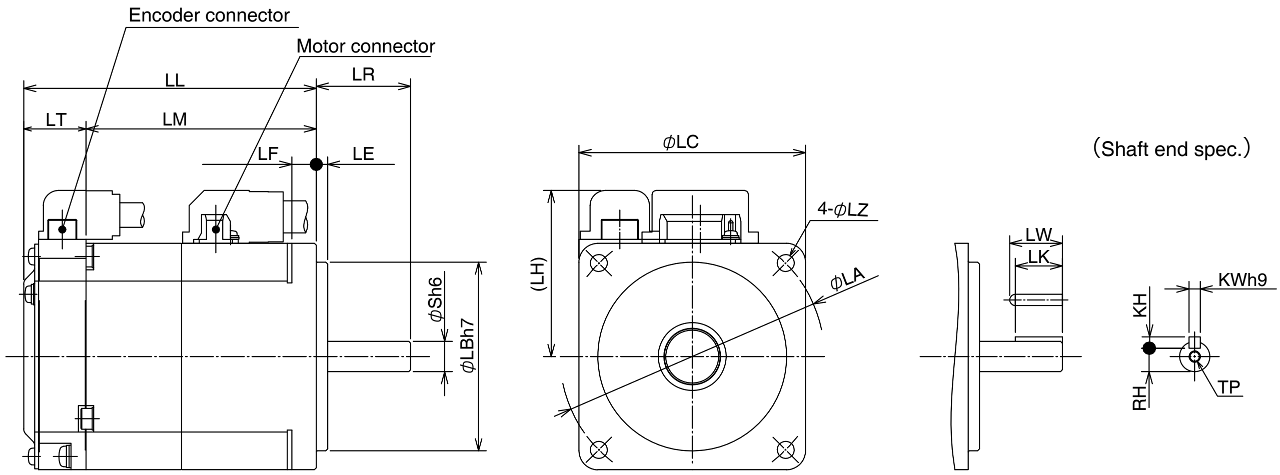
MQMF series (Middle inertia)					
Motor output			100 W	200 W	400 W
Motor model		MQMF	01□L1□2	02□L1□2	04□L1□2
LL	Without oil seal	Without brake	56.2	62.3	74.8
		With brake	77.5	85.9	98.4
	With oil seal	Without brake	59.7	65.8	78.3
		With brake	81	89.4	101.9
LR			25	30	
S			8	11	14
LA			70	90	
LB			50	70	
LC			60	80	
LE			3		
LF			5.7	8	
LH			43	53	
LZ			4.5	6	
Key way dimensions	LW		14	20	25
	LK		12.5	18	22.5
	KW		3	4	5
	KH		3	4	5
	RH		6.2	8.5	11
	TP		M3 depth 6	M4 depth 8	M5 depth 10
Mass (kg)	Without oil seal	Without brake	0.54	1.1	1.5
		With brake	0.79	1.5	2.0
	With oil seal	Without brake	0.57	1.2	1.6
		With brake	0.82	1.6	2.1
Connector specifications			Refer to P.2-40 "Specifications of Motor Connector"		

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
- P.1-11 "Check of the Model" • P.1-15 "Check of the Combination of the Driver and the Motor"
- P.7-18 〜 7-20S-T Characteristics"

[Unit: mm]

MQMF 100 W to 400 W (Connector Type)



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

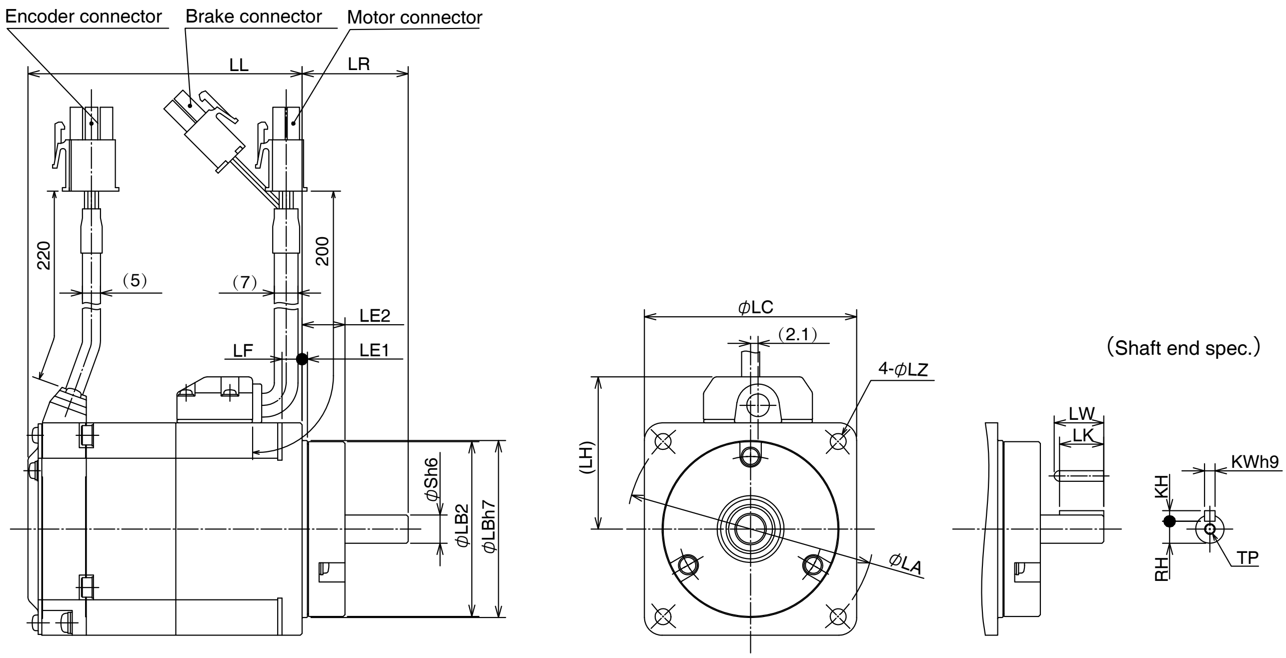
MQMF series (Middle inertia)					
Motor output			100 W	200 W	400 W
Motor model		MQMF	01□L1□1	02□L1□1	04□L1□1
LL	Without oil seal	Without brake	56.2	62.3	74.8
		With brake	77.5	85.9	98.4
	With oil seal	Without brake	59.7	65.8	78.3
		With brake	81	89.4	101.9
LR			25	30	
S			8	11	14
LA			70	90	
LB			50	70	
LC			60	80	
LE			3		
LF			5.7	8	
LH			44	54	
LM	Without oil seal	Without brake	39.7	45.8	58.3
		With brake	61	69.4	81.9
	With oil seal	Without brake	43.2	49.3	61.8
		With brake	64.5	72.9	85.4
LT			16.5		
LZ			4.5	6	
Key way dimensions	LW		14	20	25
	LK		12.5	18	22.5
	KW		3	4	5
	KH		3	4	5
	RH		6.2	8.5	11
	TP		M3 depth 6	M4 depth 8	M5 depth 10
Mass (kg)	Without oil seal	Without brake	0.54	1.1	1.5
		With brake	0.79	1.5	2.0
	With oil seal	Without brake	0.57	1.2	1.6
		With brake	0.82	1.6	2.1
Connector specifications			Refer to P.2-40 “Specifications of Motor Connector”		

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11 “Check of the Model” • P.1-15 “Check of the Combination of the Driver and the Motor”
• P7-18 ~ 7-20“S-T Characteristics”

[Unit: mm]

MQMF 100 W to 400 W (Leadwire Type, with Oil Seal (With Protect Lip))



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

MQMF series (Middle inertia)

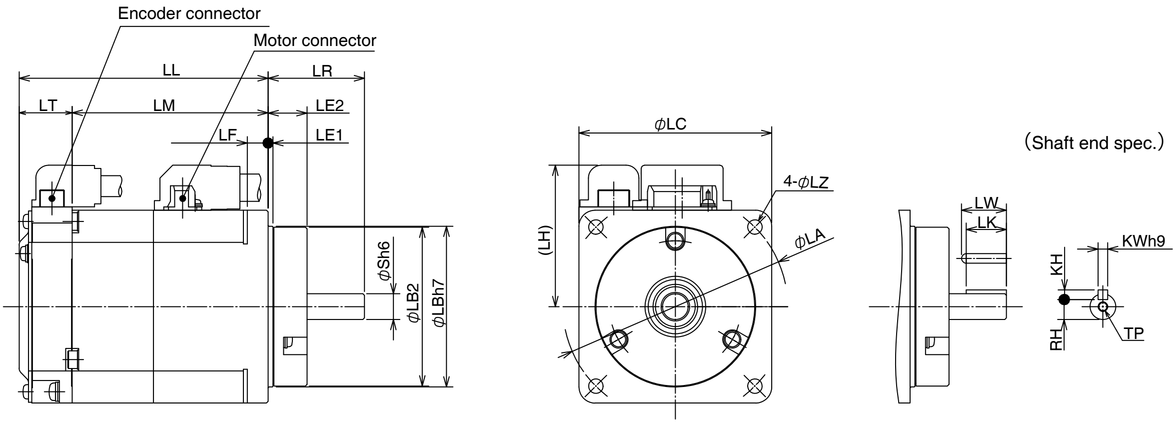
Motor output			100 W	200 W	400 W
Motor model		MQMF	01□L1□4	02□L1□4	04□L1□4
LL	With oil seal (With protect lip)	Without brake	56.2	62.3	74.8
		With brake	77.5	85.9	98.4
LR			30	35	
S			8	11	14
LA			70	90	
LB1			50	70	
LB2			49.4	69.4	
LC			60	80	
LE1			1.5		
LE2			12.1		
LF			5.7	8	
LH			43	53	
LZ			4.5	6	
Key way dimensions	LW		14	20	20.5
	LK		12.5	18	18
	KW		3	4	5
	KH		3	4	5
	RH		6.2	8.5	11
	TP		M3 depth 6	M4 depth 8	M5 depth 10
Mass (kg)		Without brake	0.57	1.2	1.6
		With brake	0.82	1.6	2.1
Connector specifications			Refer to P.2-40 "Specifications of Motor Connector"		

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page • P.1-11 "Check of the Model" • P.1-15 "Check of the Combination of the Driver and the Motor"
• P.7-18 ～ 7-20"S-T Characteristics"

[Unit: mm]

MQMF 100 W to 400 W (Leadwire Type, With Oil Seal (With Protect Lip))



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

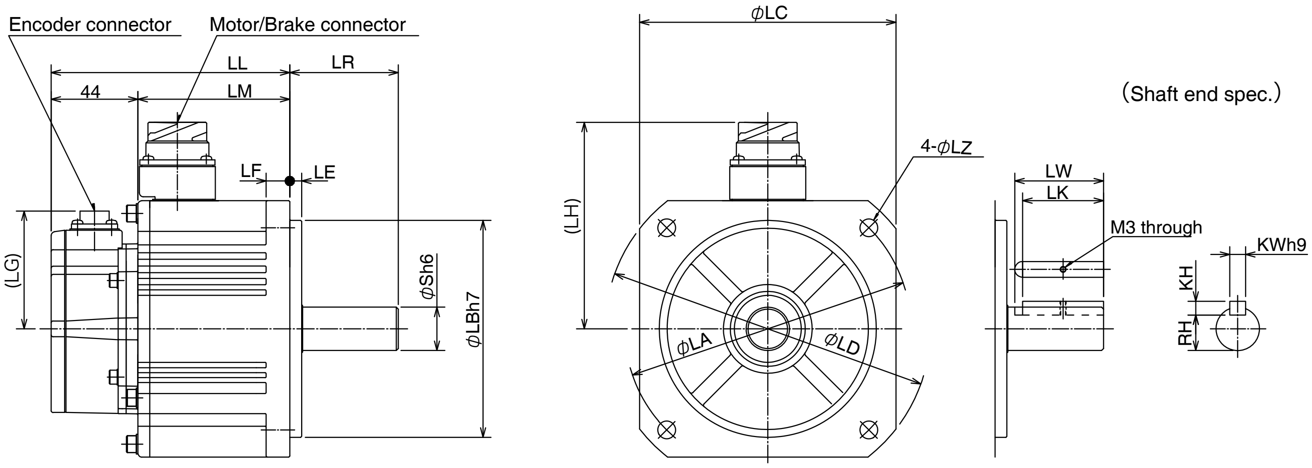
MQMF series (Middle inertia)					
Motor output			100 W	200 W	400 W
Motor model		MQMF	01□L1□3	02□L1□3	04□L1□3
LL	With oil seal (With protect lip)	Without brake	56.2	62.3	74.8
		With brake	77.5	85.9	98.4
LR			30	35	
S			8	11	14
LA			70	90	
LB1			50	70	
LB2			49.4	69.4	
LC			60	80	
LE1			1.5		
LE2			12.1		
LF			5.7	8	
LH			44	54	
LM		Without brake	39.7	45.8	58.3
		With brake	61	69.4	81.9
LT			16.5		
LZ			4.5	6	
Key way dimensions	LW		14	20	20.5
	LK		12.5	18	18
	KW		3	4	5
	KH		3	4	5
	RH		6.2	8.5	11
	TP		M3 depth 6	M4 depth 8	M5 depth 10
Mass (kg)		Without brake	0.57	1.2	1.6
		With brake	0.82	1.6	2.1
Connector specifications			Refer to P.2-40 “Specifications of Motor Connector”		

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11 “Check of the Model” • P.1-15 “Check of the Combination of the Driver and the Motor”
• P.7-18 ～ 7-20“S-T Characteristics”

[Unit: mm]

MDMF 1.0 kW to 5.0 kW (Encoder Connector Type JN2)



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

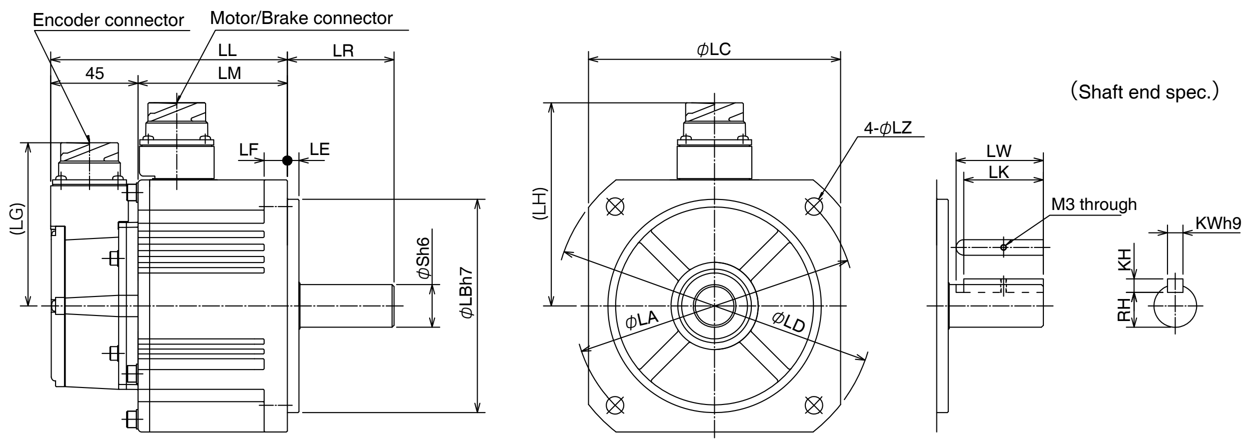
<table>
<tr><th colspan="8">MDMF series (Middle inertia)</th></tr>
<tr><td colspan="2">Motor output</td><td>1.0 kW</td><td>1.5 kW</td><td>2.0 kW</td><td>3.0 kW</td><td>4.0 kW</td><td>5.0 kW</td></tr>
<tr><td colspan="2">Motor model MDMF</td><td>102L1□□</td><td>152L1□□</td><td>202L1□□</td><td>302L1□□</td><td>402L1□□</td><td>502L1□□</td></tr>
<tr><td rowspan="2">LL</td><td>Without brake</td><td>121</td><td>135</td><td>149</td><td>177</td><td>160</td><td>175</td></tr>
<tr><td>With brake</td><td>149</td><td>163</td><td>177</td><td>205</td><td>189</td><td>204</td></tr>
<tr><td colspan="2">LR</td><td colspan="3">55</td><td>65</td><td colspan="2">70</td></tr>
<tr><td colspan="2">S</td><td colspan="3">22</td><td>24</td><td colspan="2">35</td></tr>
<tr><td colspan="2">LA</td><td colspan="4">145</td><td colspan="2">200</td></tr>
<tr><td colspan="2">LB</td><td colspan="4">110</td><td colspan="2">114.3</td></tr>
<tr><td colspan="2">LC</td><td colspan="4">130</td><td colspan="2">176</td></tr>
<tr><td colspan="2">LD</td><td colspan="4">165</td><td colspan="2">233</td></tr>
<tr><td colspan="2">LE</td><td colspan="4">6</td><td colspan="2">3.2</td></tr>
<tr><td colspan="2">LF</td><td colspan="4">12</td><td colspan="2">18</td></tr>
<tr><td colspan="2">LG</td><td colspan="6">60</td></tr>
<tr><td rowspan="2">LH</td><td>Without brake</td><td colspan="3">105</td><td>118</td><td colspan="2">140</td></tr>
<tr><td>With brake</td><td colspan="3">116</td><td>118</td><td colspan="2">140</td></tr>
<tr><td rowspan="2">LM</td><td>Without brake</td><td>77</td><td>91</td><td>105</td><td>133</td><td>116</td><td>131</td></tr>
<tr><td>With brake</td><td>105</td><td>119</td><td>133</td><td>161</td><td>145</td><td>160</td></tr>
<tr><td colspan="2">LZ</td><td colspan="4">9</td><td colspan="2">13.5</td></tr>
<tr><td rowspan="5">Key way dimensions</td><td>LW</td><td colspan="3">45</td><td colspan="3">55</td></tr>
<tr><td>LK</td><td colspan="3">41</td><td>51</td><td colspan="2">50</td></tr>
<tr><td>KW</td><td colspan="4">8</td><td colspan="2">10</td></tr>
<tr><td>KH</td><td colspan="4">7</td><td colspan="2">8</td></tr>
<tr><td>RH</td><td colspan="3">18</td><td>20</td><td colspan="2">30</td></tr>
<tr><td rowspan="2">Mass (kg)</td><td>Without brake</td><td>4.6</td><td>5.7</td><td>6.9</td><td>9.3</td><td>13.4</td><td>15.6</td></tr>
<tr><td>With brake</td><td>6.1</td><td>7.2</td><td>8.4</td><td>10.9</td><td>16.8</td><td>19.0</td></tr>
<tr><td colspan="2">Connector specifications</td><td colspan="6">Refer to P.2-40 “Specifications of Motor Connector”</td></tr>
</table>

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11 “Check of the Model” • P.1-15 “Check of the Combination of the Driver and the Motor”
• P.7-21 ～ 7-22“S-T Characteristics”

[Unit: mm]

MDMF 1.0 kW to 5.0 kW (Encoder Connector Type JL10)



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

MDMF series (Middle inertia)

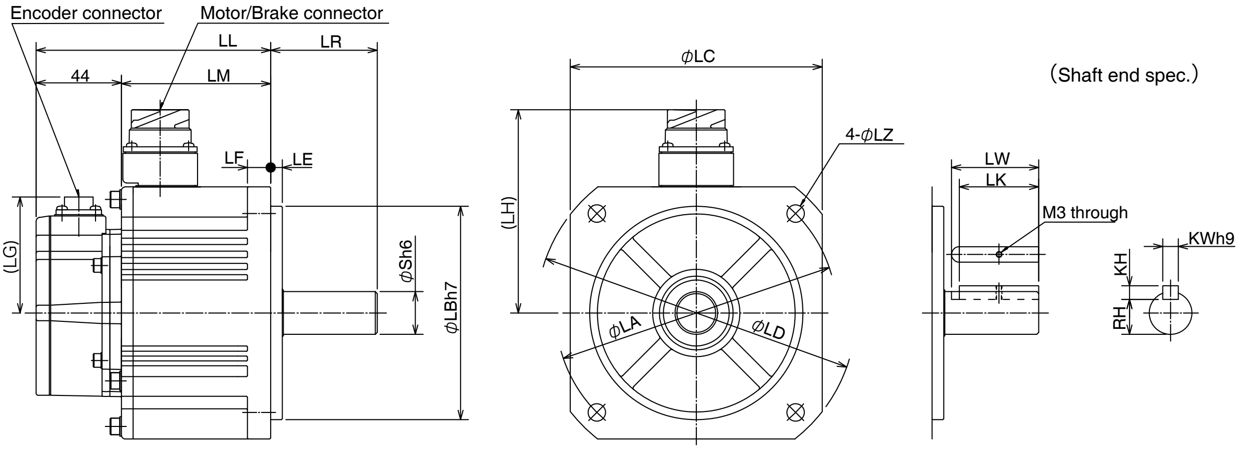
Motor output		1.0 kW	1.5 kW	2.0 kW	3.0 kW	4.0 kW	5.0 kW
Motor model	MDMF	102L1□□	152L1□□	202L1□□	302L1□□	402L1□□	502L1□□
LL	Without brake	122	136	150	178	161	176
	With brake	150	164	178	206	190	205
LR		55			65	70	
S		22			24	35	
LA		145				200	
LB		110				114.3	
LC		130				176	
LD		165				233	
LE		6				3.2	
LF		12				18	
LG		84					
LH	Without brake	105			118	140	
	With brake	116			118	140	
LM	Without brake	77	91	105	133	116	131
	With brake	105	119	133	161	145	160
LZ		9				13.5	
Key way dimensions	LW	45			55		
	LK	41			51	50	
	KW	8				10	
	KH	7				8	
	RH	18			20	30	
Mass (kg)	Without brake	4.6	5.7	6.9	9.3	13.4	15.6
	With brake	6.1	7.2	8.4	10.9	16.8	19.0
Connector specifications		Refer to P.2-40 "Specifications of Motor Connector"					

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11 "Check of the Model" • P.1-15 "Check of the Combination of the Driver and the Motor"
• P.7-21 ～ 7-22"S-T Characteristics"

[Unit: mm]

MGMF 0.85kW to 4.4kW (Encoder Connector Type JN2)



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

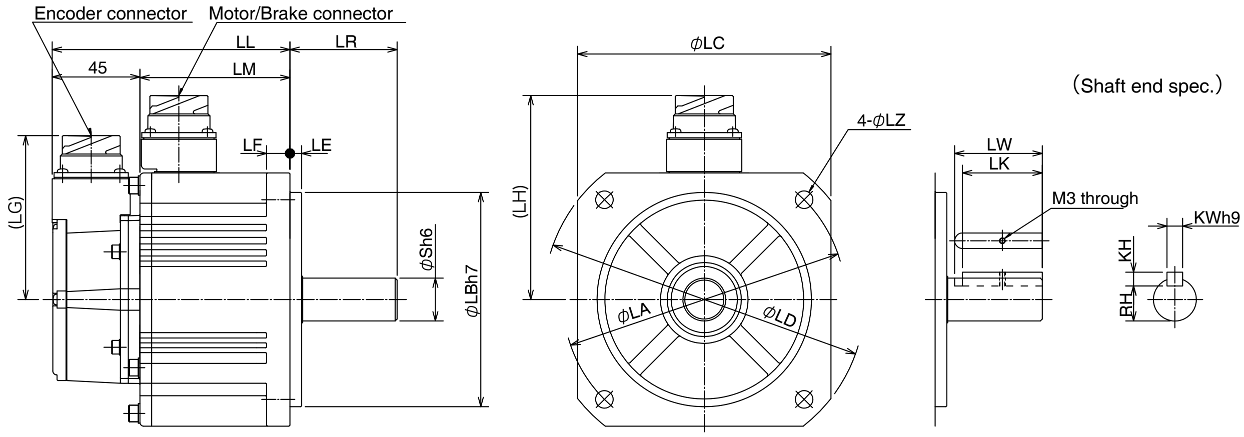
MGMF series (Low inertia)							
Motor output		0.85 kW	1.3 kW	1.8 kW	2.4 kW	2.9 kW	4.4kW
Motor model	MGMF	092L1□□	132L1□□	182L1□□	242L1□□	292L1□□	442L1□□
LL	Without brake	121	135	149	160		175
	With brake	149	163	177	189		204
LR		55			70		
S		22			35		
LA		145			200		
LB		110			114.3		
LC		130			176		
LD		165			233		
LE		6			3.2		
LF		12			18		
LG		60					
LH	Without brake	105			140		
	With brake	116			140		
LM	Without brake	77	91	105	116		131
	With brake	105	119	133	145		160
LZ		9			13.5		
Key way dimensions	LW	45			55		
	LK	41			50		
	KW	8			10		
	KH	7			8		
	RH	18			30		
Mass (kg)	Without brake	4.6	5.7	6.9	13.4		15.6
	With brake	6.1	7.5	8.4	16.8		19.0
Connector specifications		Refer to P.2-40 "Specifications of Motor Connector"					

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11 "Check of the Model" • P.1-15"Check of the Combination of the Driver and the Motor"
• P.7-23 ~ 7-24"S-T Characteristics"

[Unit: mm]

MGMF 0.85kW to 4.4kW (Encoder Connector Type JL10)



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

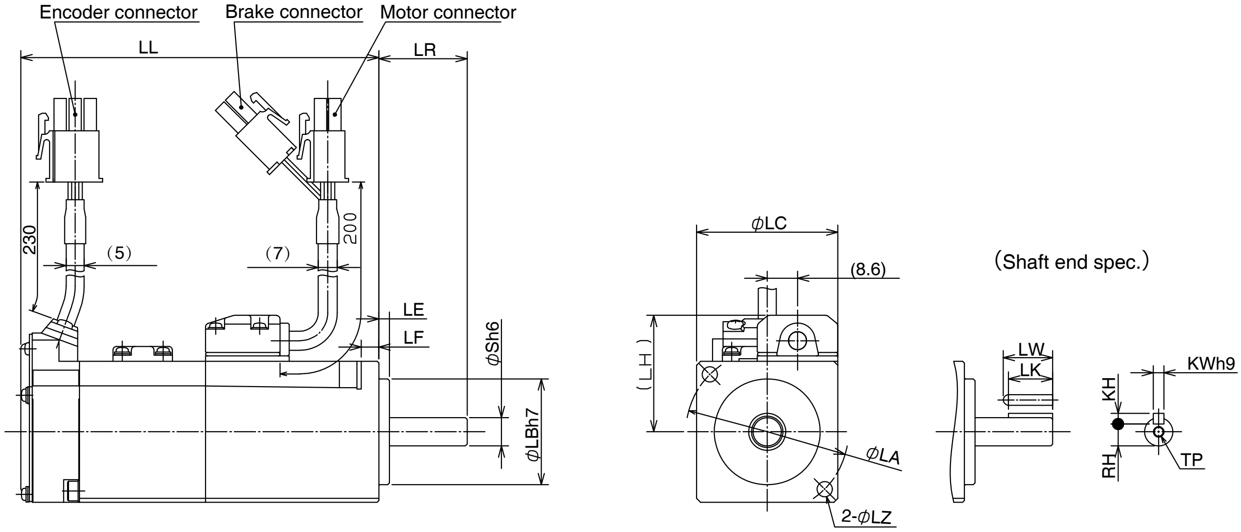
MGMF series (Low inertia)							
Motor output		0.85 kW	1.3 kW	1.8 kW	2.4 kW	2.9 kW	4.4kW
Motor model	MGMF	092L1□□	132L1□□	182L1□□	242L1□□	292L1□□	442L1□□
LL	Without brake	122	136	150	161		176
	With brake	150	164	178	190		205
LR		55			70		
S		22			35		
LA		145			200		
LB		110			114.3		
LC		130			176		
LD		165			233		
LE		6			3.2		
LF		12			18		
LG		84					
LH	Without brake	105			140		
	With brake	116			140		
LM	Without brake	77	91	105	116		131
	With brake	105	119	133	145		160
LZ		9			13.5		
Key way dimensions	LW	45			55		
	LK	41			50		
	KW	8			10		
	KH	7			8		
	RH	18			30		
Mass (kg)	Without brake	4.6	5.7	6.9	13.4		15.6
	With brake	6.1	7.5	8.4	16.8		19.0
Connector specifications		Refer to P.2-40 "Specifications of Motor Connector"					

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11 "Check of the Model" • P.1-15 "Check of the Combination of the Driver and the Motor"
• P.7-23 ～ 7-24"S-T Characteristics"

[Unit: mm]

MHMF 50 W to 100 W (Leadwire Type)



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

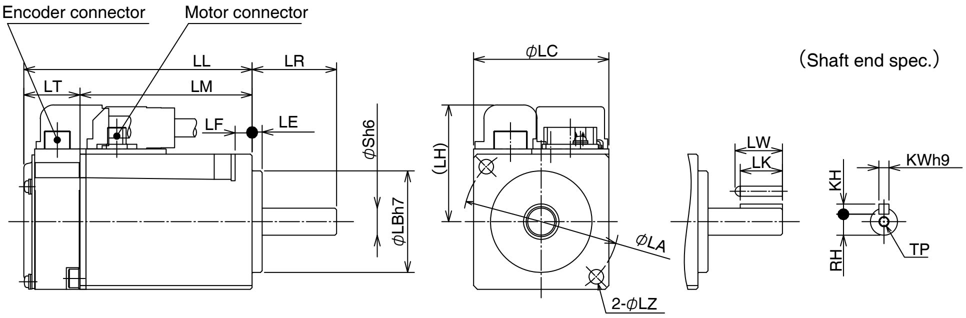
MHMF series (High inertia)				
Motor output			50 W	100 W
Motor model		MHMF	5AZL1□2	01□L1□2
LL	Without oil seal	Without brake	53.5	67.5
		With brake	87.4	101.4
	With oil seal	Without brake	57.5	71.5
		With brake	91.4	105.4
LR			25	
S			8	
LA			46	
LB			30	
LC			40	
LE			3	
LF			5	
LH			33	
LZ			4.3	
Key way dimensions	LW		14	
	LK		12.5	
	KW		3	
	KH		3	
	RH		6.2	
	TP		M3 depth 6	
Mass (kg)	Without oil seal	Without brake	0.29	0.4
		With brake	0.51	0.62
	With oil seal	Without brake	0.31	0.42
		With brake	0.53	0.64
Connector specifications			Refer to P.2-40 "Specifications of Motor Connector"	

Caution Reduce the moment of inertia ratio if high speed response operation is required.

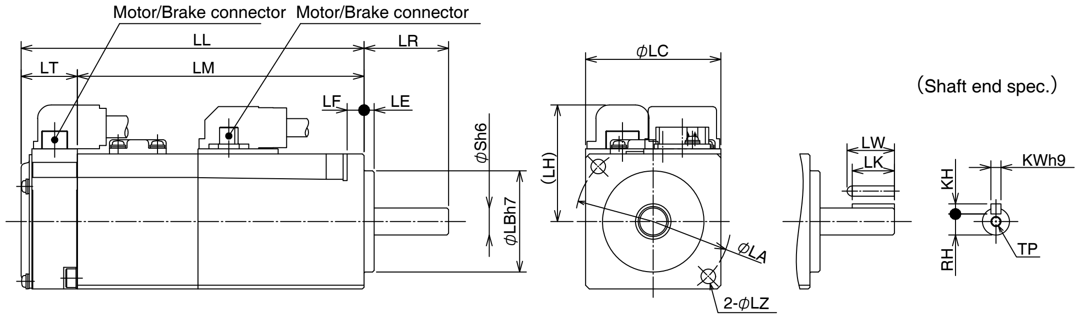
Related page
• P.1-11 "Check of the Model" • P.1-15 "Check of the Combination of the Driver and the Motor"
• P.7-25 〜 7-26"S-T Characteristics"

[Unit: mm]

MHMF 50 W to 100 W (Connector Type)



With brake



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

MHMF series (High inertia)

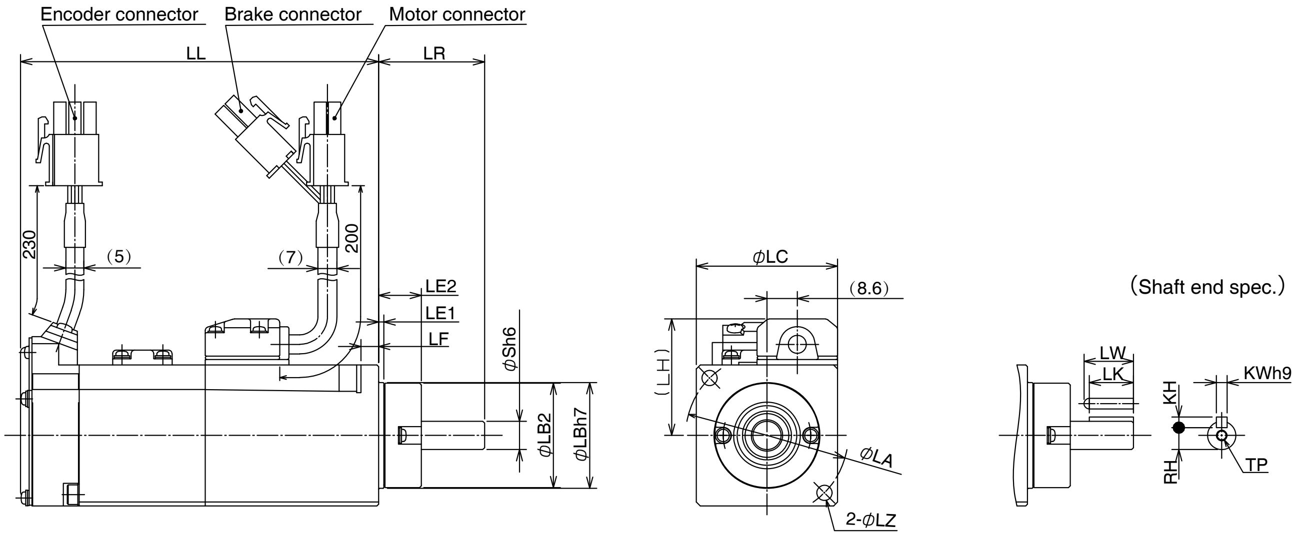
Motor output			50 W	100 W
Motor model		MHMF	5AZL1□1	01□L1□1
LL	Without oil seal	Without brake	53.5	67.5
		With brake	87.4	101.4
	With oil seal	Without brake	57.5	71.5
		With brake	91.4	105.4
LR			25	
S			8	
LA			46	
LB			30	
LC			40	
LE			3	
LF			5	
LH			34.5	
LM	Without oil seal	Without brake	36.9	50.9
		With brake	70.8	84.8
	With oil seal	Without brake	40.9	54.9
		With brake	74.8	88.8
LT			16.6	
LZ			4.3	
Key way dimensions	LW		14	
	LK		12.5	
	KW		3	
	KH		3	
	RH		6.2	
	TP		M3 depth 6	
Mass (kg)	Without oil seal	Without brake	0.29	0.40
		With brake	0.51	0.62
	With oil seal	Without brake	0.31	0.42
		With brake	0.53	0.64
Connector specifications			Refer to P.2-40 "Specifications of Motor Connector"	

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11 "Check of the Model" • P.1-15 "Check of the Combination of the Driver and the Motor"
• P.7-25 ~ 7-26"S-T Characteristics"

[Unit: mm]

MHMF 50 W to 100 W (Leadwire Type, with Oil Seal (With Protect Lip))



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

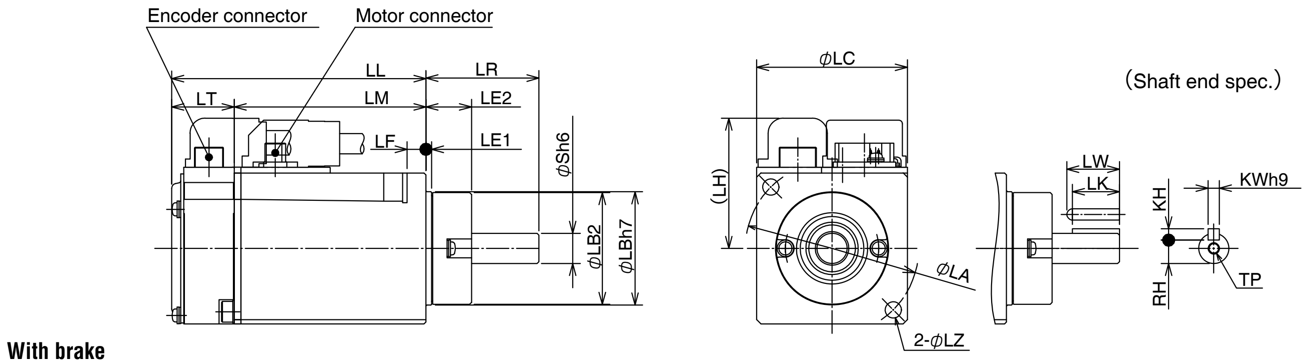
MHMF series (High inertia)				
Motor output			50 W	100 W
Motor model		MHMF	5AZL1□4	01□L1□4
LL	With oil seal (With protect lip)	Without brake	53.5	67.5
		With brake	87.4	101.4
LR			30	
S			8	
LA			46	
LB1			30	
LB2			29.6	
LC			40	
LE1			1.5	
LE2			12.1	
LF			5	
LH			33	
LZ			4.3	
Key way dimensions	LW		14	
	LK		12.5	
	KW		3	
	KH		3	
	RH		6.2	
	TP		M3 depth 6	
Mass (kg)		Without brake	0.31	0.42
		With brake	0.53	0.64
Connector specifications			Refer to P.2-40 “Specifications of Motor Connector”	

Caution Reduce the moment of inertia ratio if high speed response operation is required.

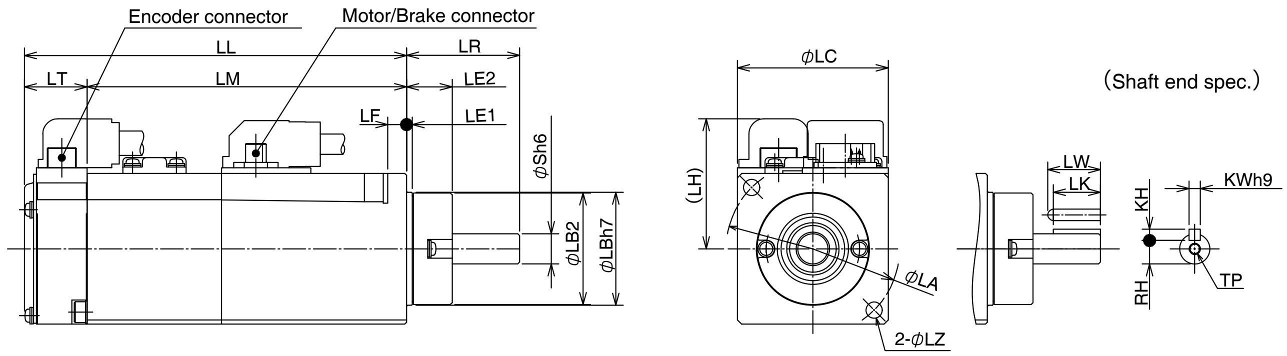
Related page
• P.1-11 “Check of the Model” • P.1-15 “Check of the Combination of the Driver and the Motor”
• P.7-25 〜 7-26“S-T Characteristics”

[Unit: mm]

MHMF 50 W to 100 W (Connector Type, with Oil Seal (With Protect Lip))



With brake



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

MHMF series (High inertia)

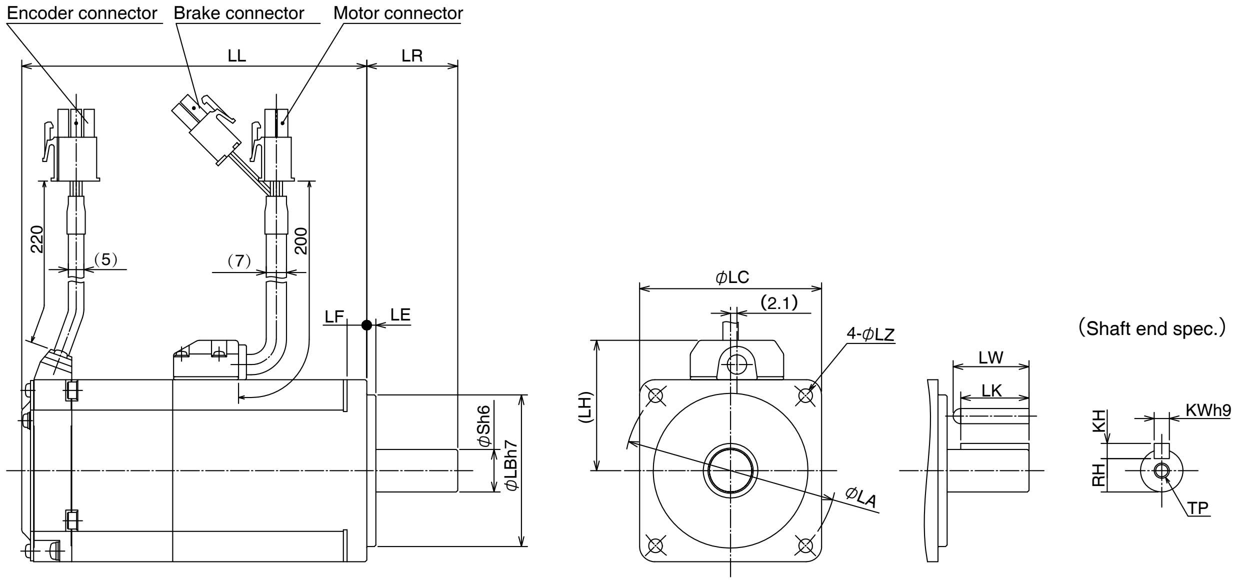
Motor output			50 W	100 W
Motor model		MHMF	5AZL1□3	01□L1□3
LL	With oil seal (With protect lip)	Without brake	53.5	67.5
		With brake	87.4	101.4
LR			30	
S			8	
LA			46	
LB1			30	
LB2			29.6	
LC			40	
LE1			1.5	
LE2			12.1	
LF			5	
LH			34.5	
LM		Without brake	36.9	50.9
		With brake	70.8	84.8
LT			16.6	
LZ			4.3	
Key way dimensions	LW		14	
	LK		12.5	
	KW		3	
	KH		3	
	RH		6.2	
	TP		M3 depth 6	
Mass (kg)		Without brake	0.31	0.42
		With brake	0.53	0.64
Connector specifications			Refer to P.2-40 “Specifications of Motor Connector”	

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11 “Check of the Model” • P.1-15 “Check of the Combination of the Driver and the Motor”
• P.7-25 ～ 7-26“S-T Characteristics”

[Unit: mm]

MHMF 200 W to 1.0 kW(□ 80)(Leadwire Type)



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

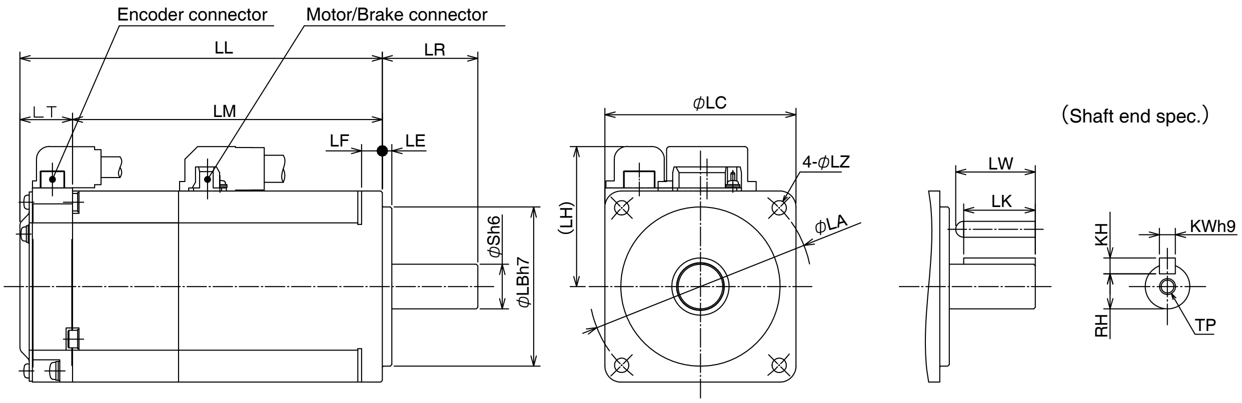
MHMF series (High inertia)						
Motor output			200 W	400 W	750 W	1.0 kW
Motor model		MHMF	02□L1□2	04□L1□2	082L1 □ 2	092L1 □ 2
LL	Without oil seal	Without brake	67.5	84.5	91.9	104.7
		With brake	96.8	113.8	125.5	138.3
	With oil seal	Without brake	71	88	95.4	108.2
		With brake	100.3	117.3	129	141.8
LR			30		35	
S			11	14	19	
LA			70		90	
LB			50		70	
LC			60		80	
LE			3			
LF			6.5		8	
LH			43		53	
LZ			4.5		6	
Key way dimensions	LW		20	25		
	LK		18	22.5	22	
	KW		4	5	6	
	KH		4	5	6	
	RH		8.5	11	15.5	
	TP		M4 depth 8	M5 depth 10		
Mass (kg)	Without oil seal	Without brake	0.75	1.1	2.2	2.7
		With brake	1.1	1.5	2.9	3.4
	With oil seal	Without brake	0.78	1.2	2.3	2.8
		With brake	1.2	1.6	3.0	3.5
Connector specifications			Refer to P.2-40 "Specifications of Motor Connector"			

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11 "Check of the Model" • P.1-15"Check of the Combination of the Driver and the Motor"
• P.7-27 ～ 7-29"S-T Characteristics"

[Unit: mm]

MHMF 200 W to 1.0 kW(□80)(Connector Type)



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

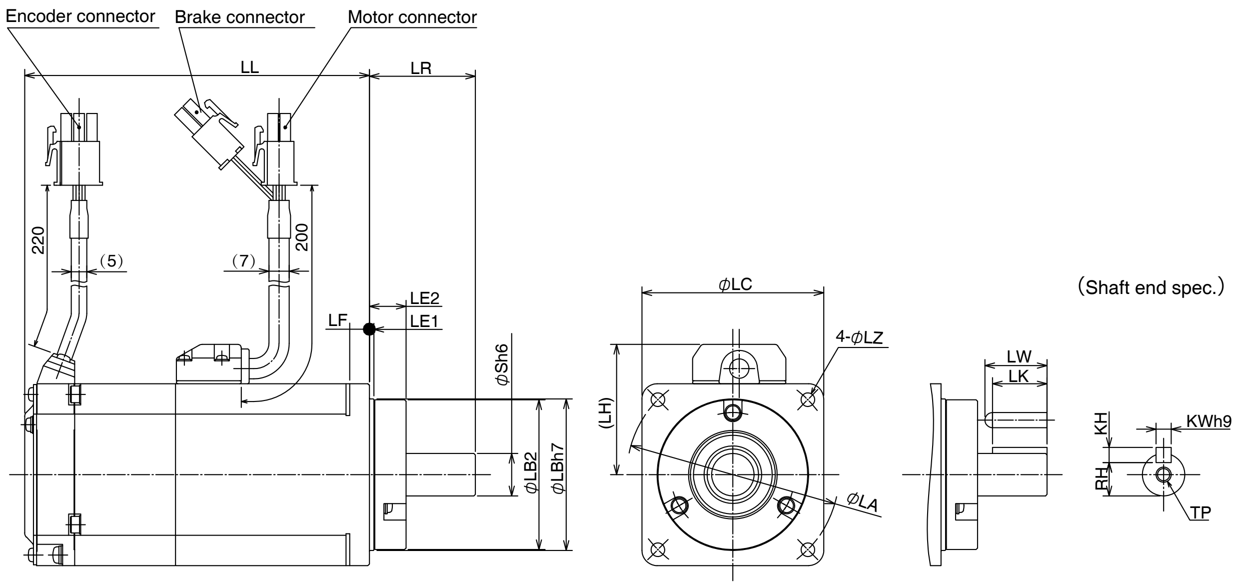
MHMF series (High inertia)						
Motor output			200 W	400 W	750 W	1.0 kW
Motor model		MHMF	02□L1□1	04□L1□1	082L1□1	092L1□1
LL	Without oil seal	Without brake	67.5	84.5	91.9	104.7
		With brake	96.8	113.8	125.5	138.3
	With oil seal	Without brake	71	88	95.4	108.2
		With brake	100.3	117.3	129	141.8
LR			30		35	
S			11	14	19	
LA			70		90	
LB			50		70	
LC			60		80	
LE			3			
LF			6.5		8	
LH			44		54	
LM	Without oil seal	Without brake	51	68	75.4	88.2
		With brake	80.3	97.3	109	121.8
	With oil seal	Without brake	54.5	71.5	78.9	91.7
		With brake	83.8	100.8	112.5	125.3
LT			16.5			
LZ			4.5		6	
Key way dimensions	LW		20	25		
	LK		18	22.5	22	
	KW		4	5	6	
	KH		4	5	6	
	RH		8.5	11	15.5	
	TP		M4 depth 8	M5 depth 10		
Mass (kg)	Without oil seal	Without brake	0.75	1.1	2.2	2.7
		With brake	1.1	1.5	2.9	3.4
	With oil seal	Without brake	0.78	1.2	2.3	2.8
		With brake	1.2	1.6	3.0	3.5
Connector specifications			Refer to P.2-40 "Specifications of Motor Connector"			

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11 "Check of the Model" • P.1-15 "Check of the Combination of the Driver and the Motor"
• P.7-27 ~ 7-29"S-T Characteristics"

[Unit: mm]

MHMF 200 W to 1.0 kW(□80)(Leadwire Type,with Oil Seal(With Protect Lip))



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

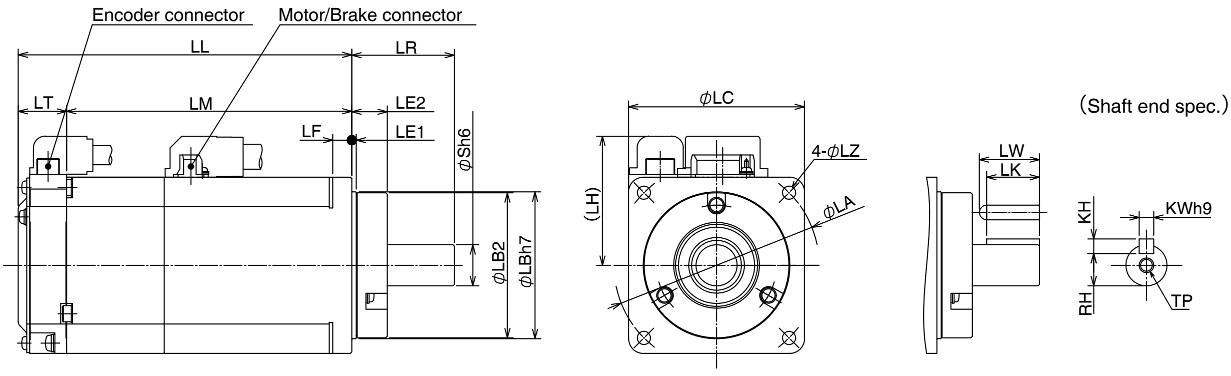
MHMF series (High inertia)						
Motor output			200 W	400 W	750 W	1.0 kW
Motor model		MHMF	02□L1□4	04□L1□4	082L1□4	092L1□4
LL	With oil seal (With protect lip)	Without brake	67.5	84.5	91.9	104.7
		With brake	96.8	113.8	125.5	138.3
LR			35		40	
S			11	14	19	
LA			70		90	
LB1			50		70	
LB2			49.4		69.4	
LC			60		80	
LE1			1.5			
LE2			12.1			
LF			6.5		8	
LH			43		53	
LZ			4.5		6	
Key way dimensions	LW		20	20.5	25	
	LK		18	18	22	
	KW		4	5	6	
	KH		4	5	6	
	RH		8.5	11	15.5	
	TP		M4 depth 8	M5 depth 10		
Mass (kg)		Without brake	0.78	1.2	2.3	2.8
		With brake	1.2	1.6	3.0	3.5
Connector specifications			Refer to P.2-40 “Specifications of Motor Connector”			

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11 “Check of the Model” • P.1-15 “Check of the Combination of the Driver and the Motor”
• P.7-27 ～ 7-29“S-T Characteristics”

[Unit: mm]

MHMF 200 W to 1.0 kW(□ 80)(Connector Type,with Oil Seal(With Protect Lip))



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

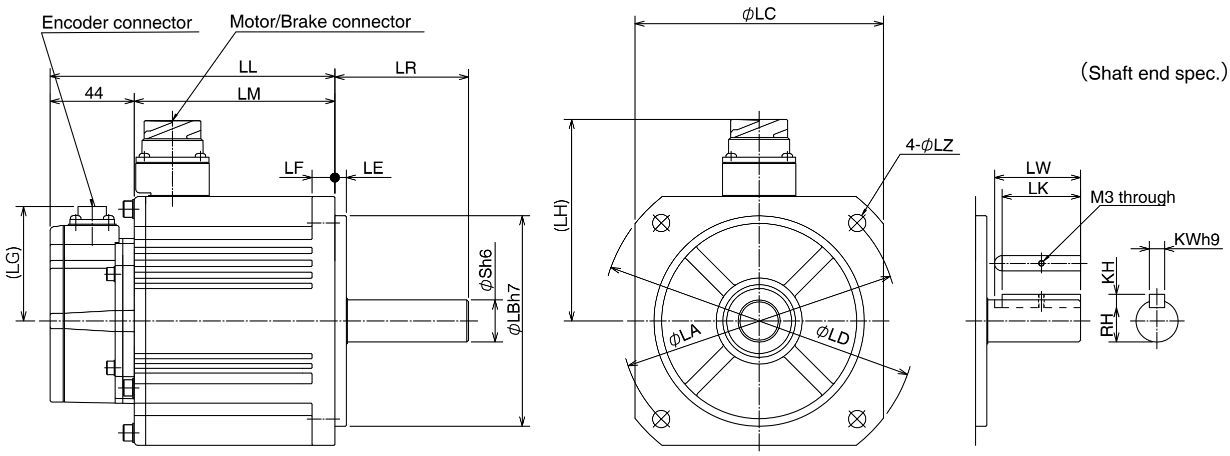
MHMF series (High inertia)						
Motor output			200 W	400 W	750 W	1.0 kW
Motor model		MHMF	02□L1□3	04□L1□3	082L1 □ 3	092L1 □ 3
LL	With oil seal (With protect lip)	Without brake	67.5	84.5	91.9	104.7
		With brake	96.8	113.8	125.5	138.3
LR			35		40	
S			11	14	19	
LA			70		90	
LB1			50		70	
LB2			49.4		69.4	
LC			60		80	
LE1			1.5			
LE2			12.1			
LF			6.5		8	
LH			44		54	
LM		Without brake	51	68	75.4	88.2
		With brake	80.3	97.3	109	121.8
LT			16.5			
LZ			4.5		6	
Key way dimension	LW		20	20.5	25	
	LK		18	18	22	
	KW		4	5	6	
	KH		4	5	6	
	RH		8.5	11	15.5	
	TP		M4 depth 8	M5 depth 10		
Mass (kg)		Without brake	0.78	1.2	2.3	2.8
		With brake	1.2	1.6	3.0	3.5
Connector specifications			Refer to P.2-40 “Specifications of Motor Connector”			

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11 “Check of the Model” • P.1-15 “Check of the Combination of the Driver and the Motor”
• P.7-27 ～ 7-29“S-T Characteristics”

[Unit: mm]

MHMF 1.0 kW to 5.0 kW(□130)(Encoder Connector Type JN2)



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

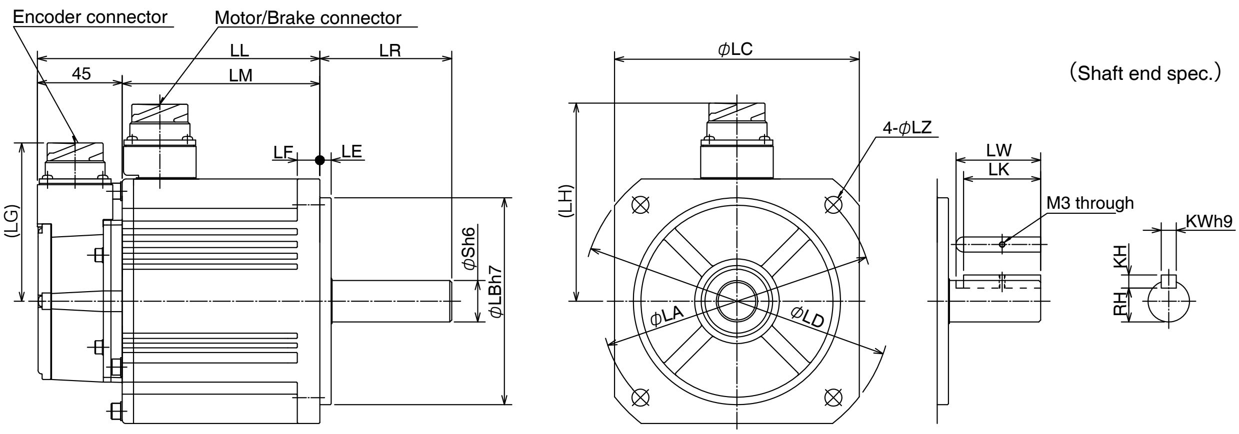
MHMF series (High inertia)							
Motor output		1.0 kW	1.5 kW	2.0 kW	3.0 kW	4.0 kW	5.0 kW
Motor model	MHMF	102L1□□	152L1□□	202L1□□	302L1□□	402L1□□	502L1□□
LL	Without brake	149	163	160	175	189.5	205.5
	With brake	177	191	189	204	218.5	234.5
LR		70		80			
S		22		35			
LA		145		200			
LB		110		114.3			
LC		130		176			
LD		165		233			
LE		6		3.2			
LF		12		18			
LG		60					
LH	Without brake	105		140			
	With brake	116		140			
LM	Without brake	105	119	116	131	145.5	161.5
	With brake	133	147	145	160	174.5	190.5
LZ		9		13.5			
Key way dimensions	LW	45		55			
	LK	41		50			
	KW	8		10			
	KH	7		8			
	RH	18		30			
Mass (kg)	Without brake	6.1	7.7	11.3	13.8	16.2	19.6
	With brake	7.6	9.2	14.6	17.2	19.4	22.8
Connector specifications		Refer to P.2-40 "Specifications of Motor Connector"					

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11 "Check of the Model" • P.1-15 "Check of the Combination of the Driver and the Motor"
• P.7-30 ～ 7-31"S-T Characteristics"

[Unit: mm]

MHMF 1.0 kW to 5.0 kW(□130)(Encoder Connector Type JL10)



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information.

[Unit: mm]

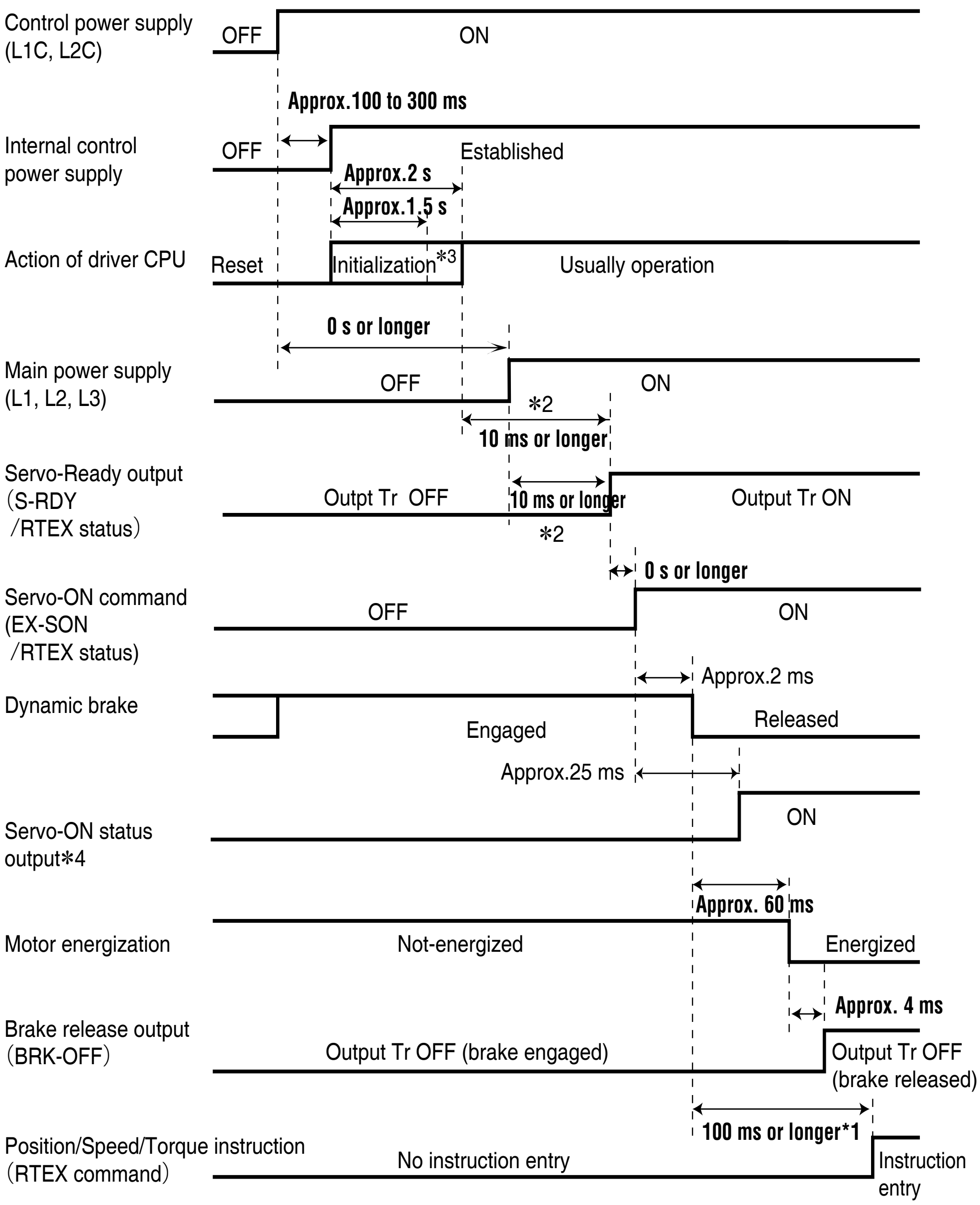
MHMF series (High inertia)

Motor output		1.0 kW	1.5 kW	2.0 kW	3.0 kW	4.0 kW	5.0 kW
Motor model	MHMF	102L1□□	152L1□□	202L1□□	302L1□□	402L1□□	502L1□□
LL	Without brake	150	164	161	176	190.5	206.5
	With brake	178	192	190	205	219.5	235.5
LR		70		80			
S		22		35			
LA		145		200			
LB		110		114.3			
LC		130		176			
LD		165		233			
LE		6		3.2			
LF		12		18			
LG		84					
LH	Without brake	105		140			
	With brake	116		140			
LM	Without brake	105	119	116	131	145.5	161.5
	With brake	133	147	145	160	174.5	190.5
LZ		9		13.5			
Key way dimensions	LW	45		55			
	LK	41		50			
	KW	8		10			
	KH	7		8			
	RH	18		30			
Mass (kg)	Without brake	6.1	7.7	11.3	13.8	16.2	19.6
	With brake	7.6	9.2	14.6	17.2	19.4	22.8
Connector specifications		Refer to P.2-40 "Specifications of Motor Connector"					

Caution Reduce the moment of inertia ratio if high speed response operation is required.

Related page
• P.1-11 "Check of the Model" • P.1-15 "Check of the Combination of the Driver and the Motor"
• P.7-30 ～ 7-31"S-T Characteristics"

Servo-on Signal Accept Timing on Power-up



- The above chart shows the timing from AC power-ON to command input.
- Input the servo-On command, position/velocity/torque commands according to the above timing chart.

Caution

*1 It is shown that in this interval,although you can enter the SRV-ON command,but it can not handle it.

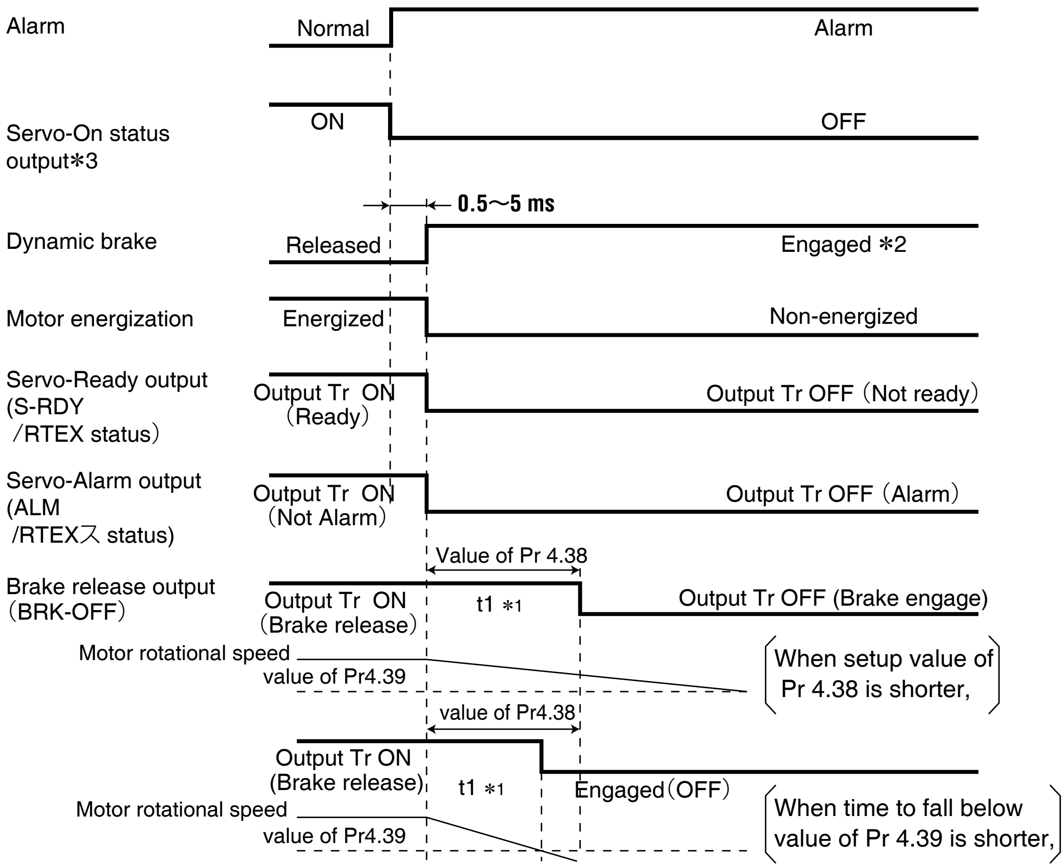
*2 The servo ready is turned on when all the following conditions are satisfied: “Initialization of microcomputer is completed”, “Main power supply is established”, “No alarm is issued”, and “Synchronization (phase matching) between RTEX communication and servo is completed and RTEX communication is established”.

*3 After Internal control power supply, protective functions are active from approx. 1.5 sec after the start of initializing microcomputer. Please set the signals, especially for protective function, for example over-travel inhibit input (POT, NOT) or external scale input,so as to decide their logic until this term. The lapse time can be changed with Pr 6.18 “Power-up wait time”.

*4 Note that the servo-on status output signal is to let you know of the receipt of servo-on command and is not an output to let you know that command input is possible.

Related page
・P.3-39 ～ “Details of Parameter”

When an Error (Alarm) has Occurred (At Servo-ON Command)



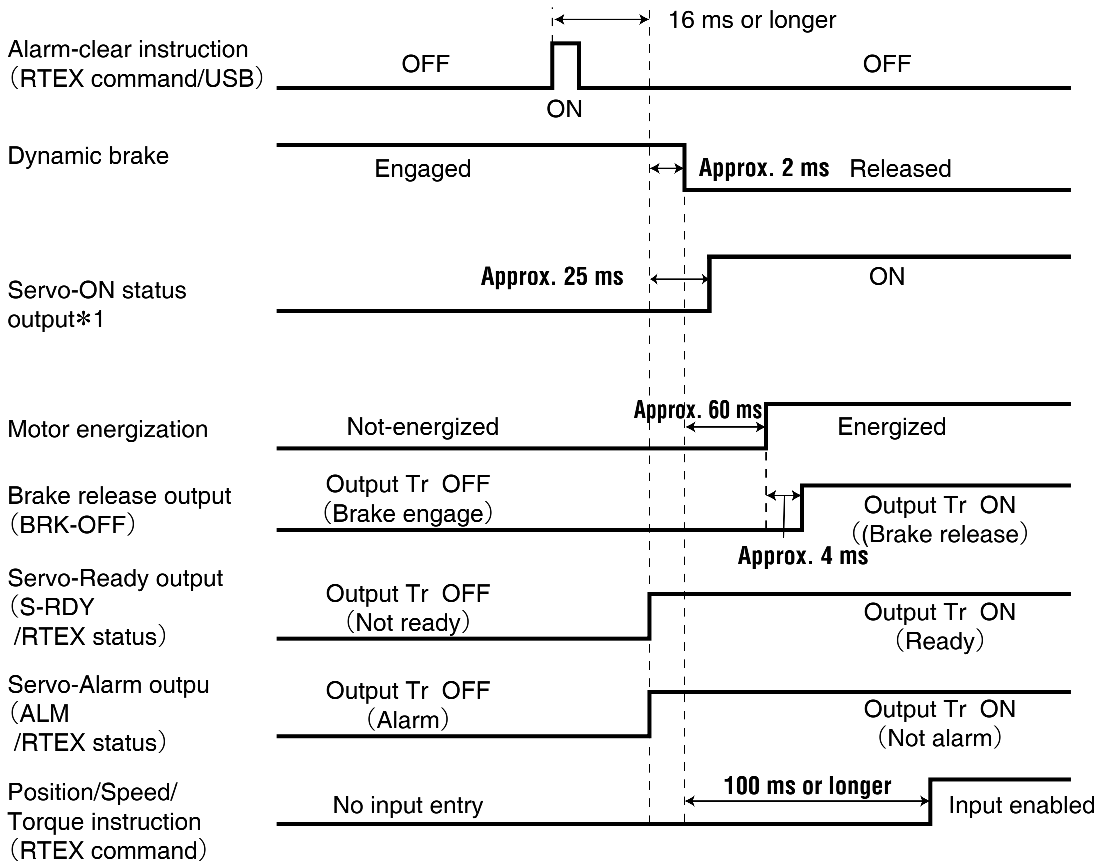
Caution

*1 t1 will be a shorter time of either the setup value of Pr 4.38 " Mechanical brake action at running setup" or elapsing time for the motor speed to fall below Pr 4.39 "Brake release speed setup".

*2 When an alarm is generated, the dynamic brake operates according to Pr 5.10 "Sequence at alarm".

*3 Note that the servo-on status output signal is to let you know of the receipt of servo-on command and is not an output to let you know that command input is possible.

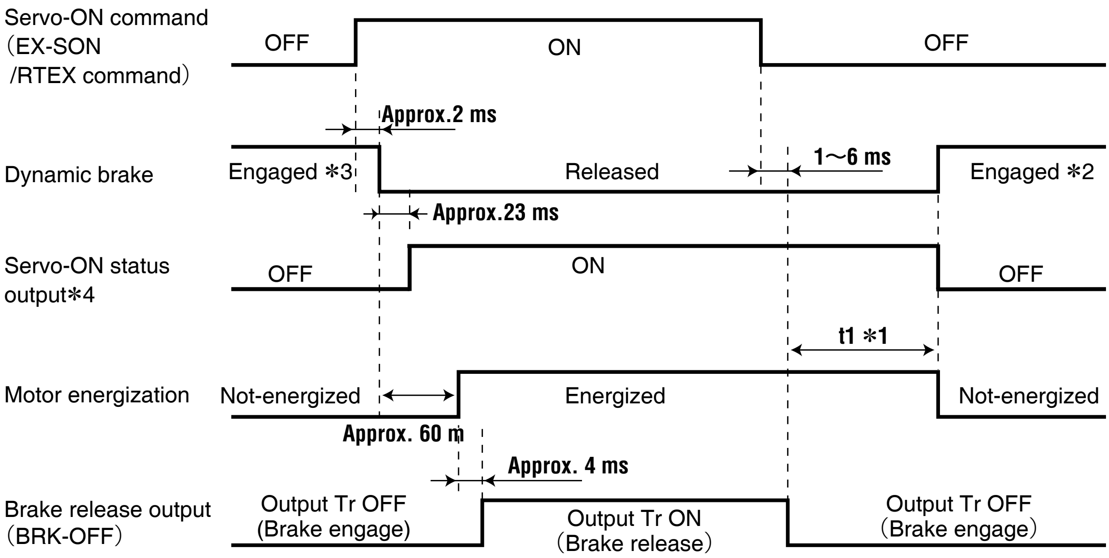
When an Alarm has been Cleared (At Servo-ON Command)



Caution *1 Note that the servo-on status output signal is to let you know of the receipt of servo-on command and is not an output to let you know that command input is possible.

Servo-ON/OFF Action while the Motor Is at Stall (Servo-Lock)

Remarks **To turn on/off the servo during normal operation, first stop the motor.**



Caution

*1 t1 depends on the setup value of Pr 4.37“Mechanical brake action at stalling setup”.

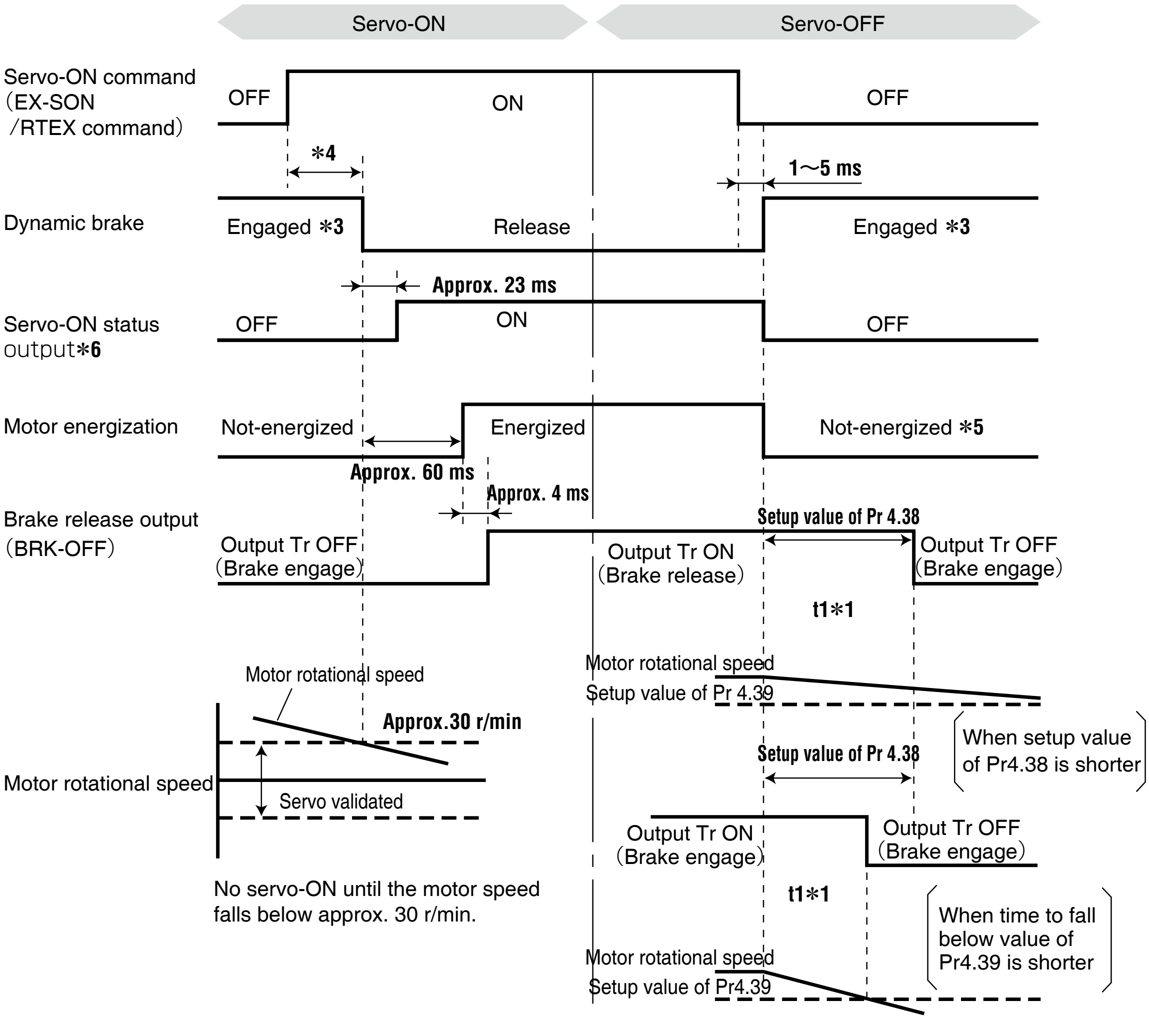
*2 The operation of dynamic brake during servo off depends on the setup value of Pr 5.06 “Sequence at Servo-off”.

*3 Servo-ON will not be activated until the motor speed falls below approx. 30 r/min.

*4 Note that the servo-on status output signal is to let you know of the receipt of servo-on command and is not an output to let you know that command input is possible.

Servo-ON/OFF Action while the Motor Is in Motion

Remarks **Timing at emergency stop or trip. Do not repeat this sequence.**



Caution

*1 t1 will be a shorter time of either the setup value of Pr 4.38 “Mechanical brake action at running setup” or elapsing time for the motor speed to fall below Pr 4.39 “Brake release speed setup”.

*2 Even when the servo-ON command is turned on again while the motor is decelerating, transition to servo-ON is not performed until the motor stops.

*3 For the action of dynamic brake at alarm occurrence, refer to an explanation of Pr 5.06, “Sequence at Servo-off” as well.

*4 Servo-ON will not be activated until the motor speed falls below approx. 30 r/min.

*5 For the motor energization during deceleration at Servo-OFF depends on the setup value of Pr .5.06, “Sequence at Servo-off”.

*6 Note that the servo-on status output signal is to let you know of the receipt of servo-on command and is not an output to let you know that command input is possible.

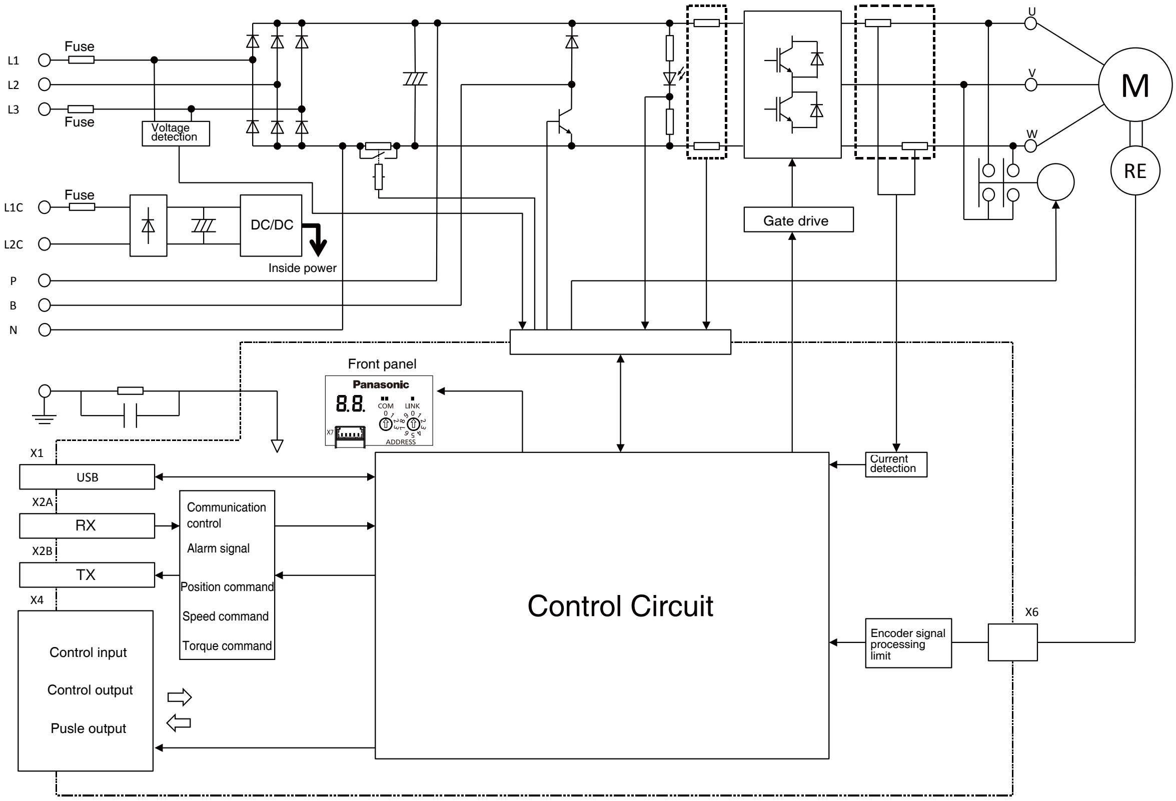
Related page

・P.2-67“Dynamic Brake”

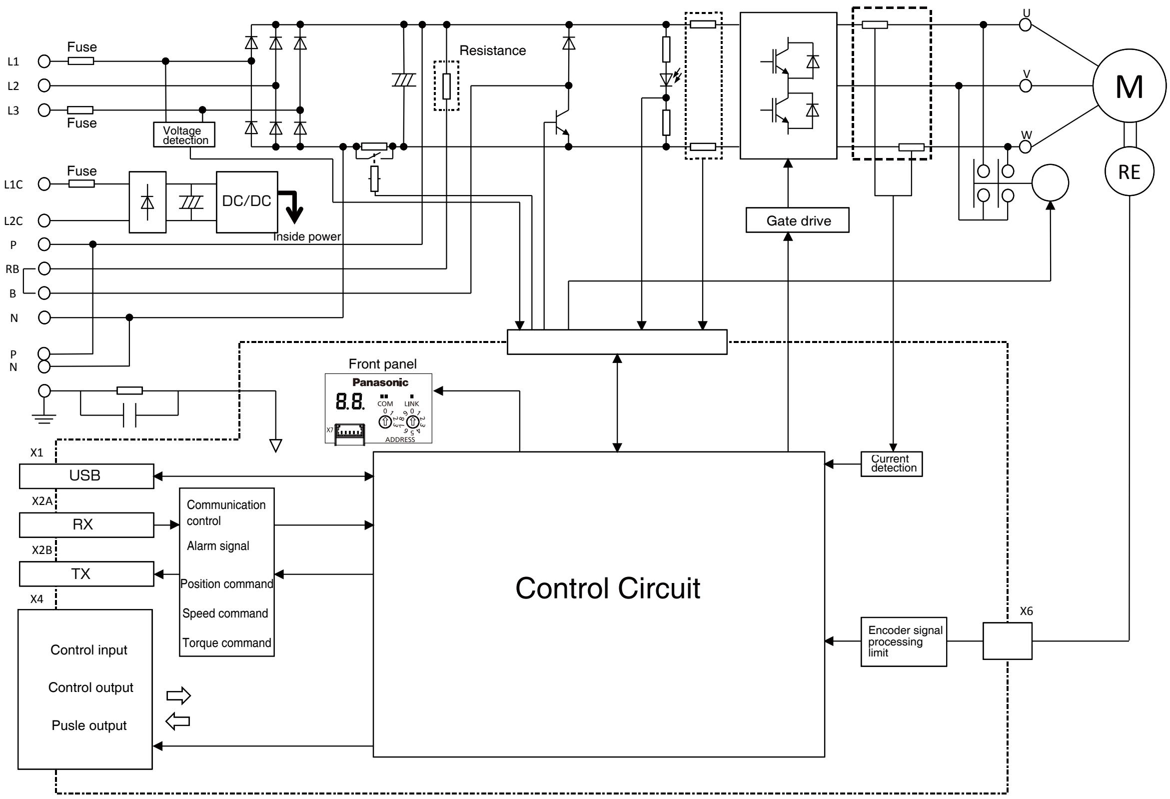
6. Block Diagram

Driver

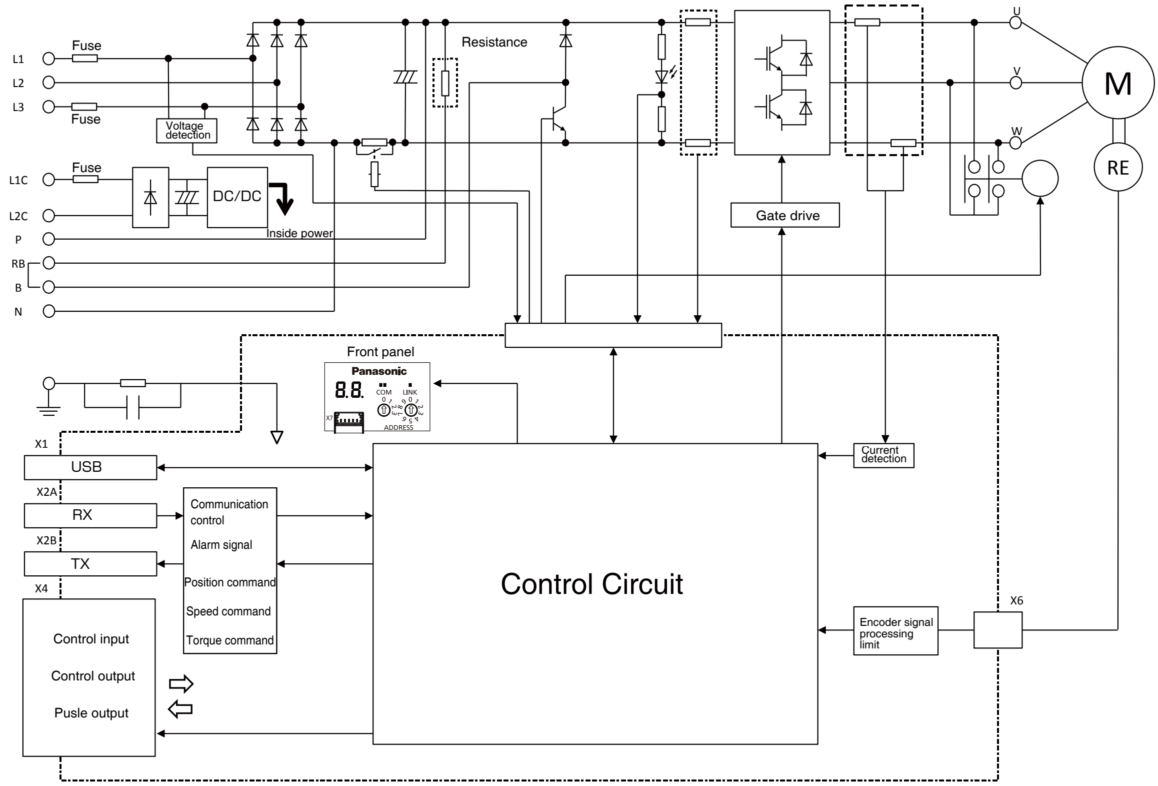
A, B-frame (100 V/200 V)



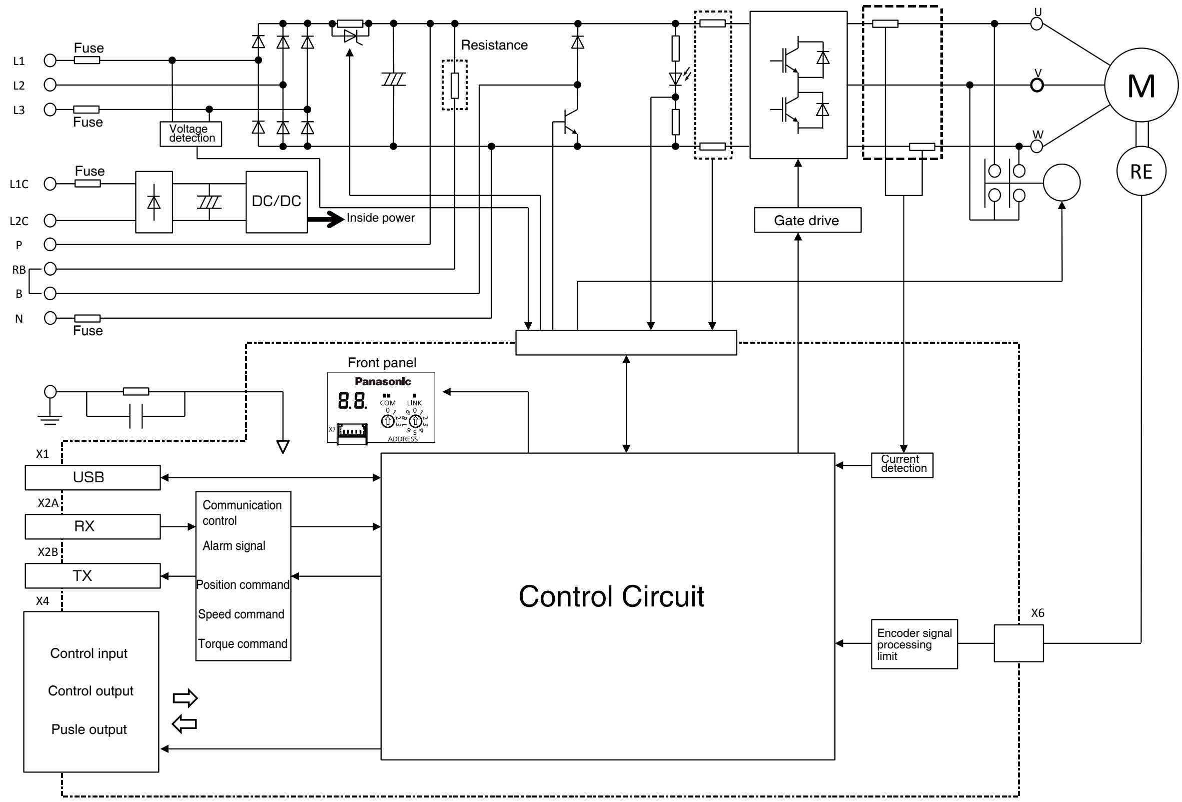
C, D-frame (100 V/200 V)



E-frame (200 V)



F-frame (200 V)



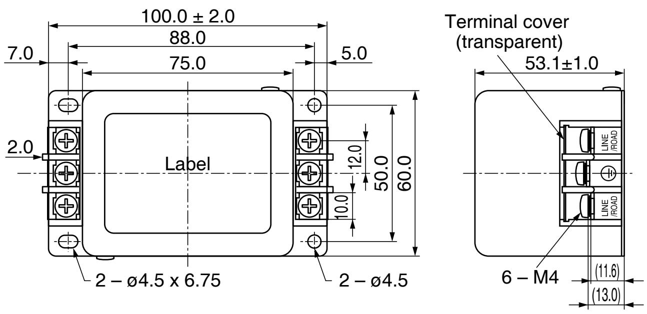
7. Options

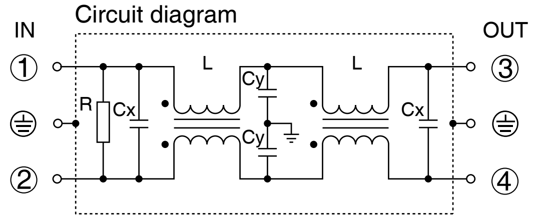
Noise Filter

When you install one noise filter at the power supply for multi-axes application, contact to a manufacture of the noise filter. If noise margin is required, connect 2 filters in series to emphasize effectiveness.

• Options

Option part No.	Voltage specifications for driver	Manufacturer's part No.	Applicable driver (frame)	Manufacturer
DV0P4170	Single phase 100 V, 200 V	SUP-EK5-ER-6	A and B-frame	Okaya Electric Ind.

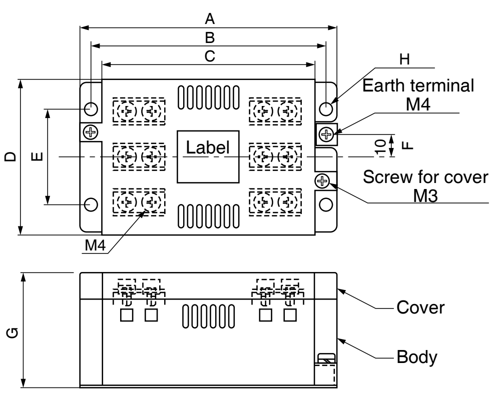




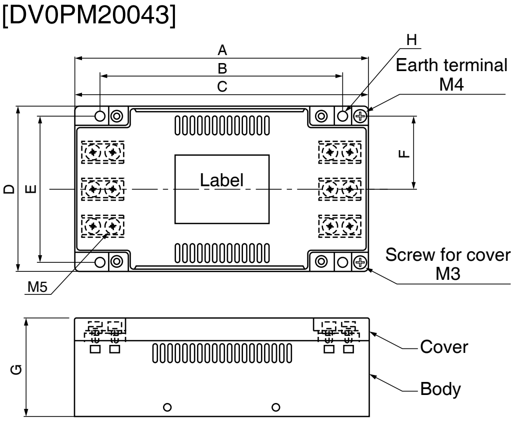
[Unit: mm]

Option part No.	Voltage specifications for driver	Manufacturer's part No.	Applicable driver (frame)	Manufacturer
DV0PM20042	3-phase 200 V	3SUP-HU10-ER-6	A and B-frame	Okaya Electric Ind.
	Single phase 100 V, 200 V 3-phase 200 V		C-frame	
DV0P4220	Single/3-phase 200 V	3SUP-HU30-ER-6	D-frame	
DV0PM20043	3-phase 200 V	3SUP-HU50-ER-6	E-fram	

[DV0PM20042, DV0P4220]



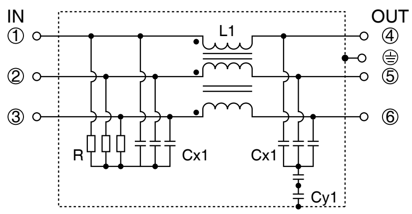
[DV0PM20043]



[Size] [Unit: mm]

	A	B	C	D	E	F	G	H
DV0PM20042	115	105	95	70	43	10	52	5.5
DV0P4220	145	135	125	70	50	10	52	5.5
DV0PM20043	165	136	165	90	80	40	54	5.5

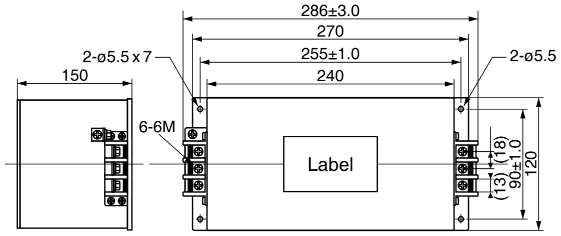
Circuit diagram



For single phase application, use 2 terminals among 3 terminals, leaving the remaining terminal unconnected.

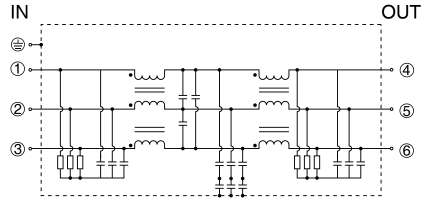
Related page
• P.2-10 "About Conformance to International Standards"
• P.2-18 "List of Applicable Peripheral Equipments to Driver"

Option part No.	Voltage specifications for driver	Manufacturer's part No.	Applicable driver (frame)	Manufacturer
DV0P3410	3-phase 200 V	3SUP-HL50-ER-6B	F-frame	Okaya Electric Ind.



[Unit: mm]

Circuit diagram



Remarks

- Select a noise filter of capacity that exceeds the capacity of the power source (also check for load condition).
- For detailed specification of the filter, contact the manufacturer.

Caution **Use options correctly after reading operation manuals of the options to better understand the precautions.**
Take care not to apply excessive stress to each optional part.

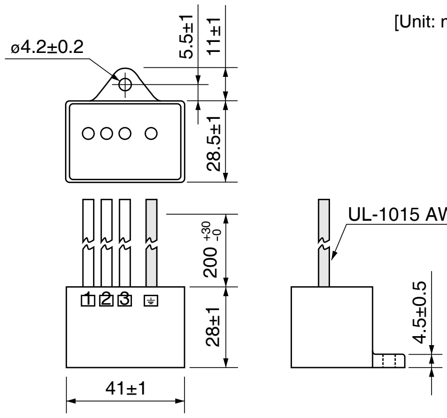
7. Options

Surge Absorber

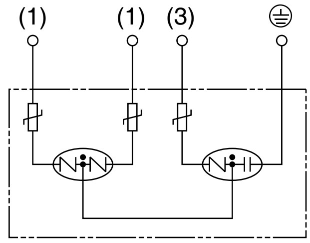
Provide a surge absorber for the primary side of noise filter.

Option part No.	Voltage specifications for driver	Manufacturer's part No.	Manufacturer
DV0P1450	3-phase 200 V	R･A･V-781BXZ-4	Okaya Electric Ind.

[Unit: mm]

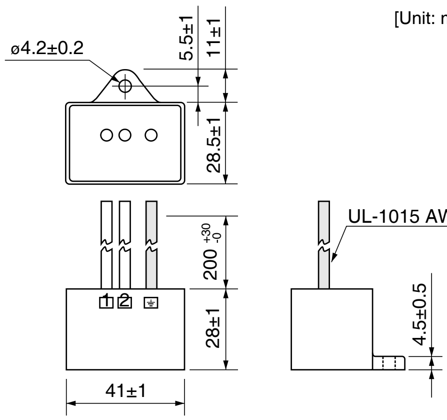


Circuit diagram

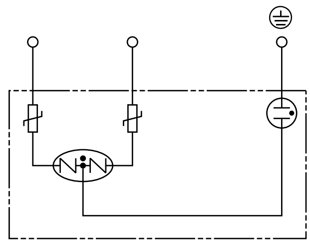


Option part No.	Voltage specifications for driver	Manufacturer's part No.	Manufacturer
DV0P4190	Single phase 100 V, 200 V	R･A･V-781BWZ-4	Okaya Electric Ind.

[Unit: mm]



Circuit diagram



Remarks Take off the surge absorber when you execute a dielectric test to the machine or equipment, or it may damage the surge absorber.

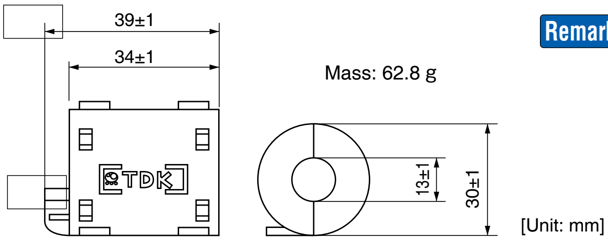
Related page
• P.2-10 “About Conformance to International Standards”
• P.2-18 “List of Applicable Peripheral Equipments to Driver”

7. Options

Ferrite Core

• **Options**

Option part No.	Manufacturer's part No.	Manufacturer
DV0P1460	ZCAT3035-1330	TDK Corp.



Remarks To connect the noise filter to the connector XB connection cable, adjust the sheath length at the tip of the cable, as required.

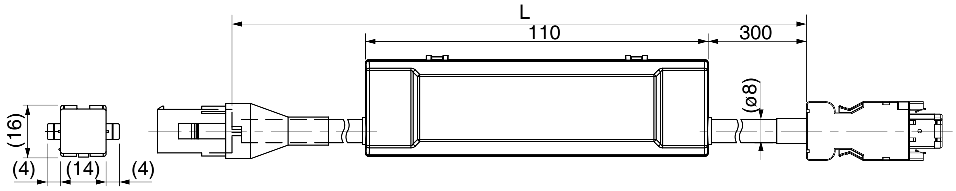
Remarks Fix the signal line ferrite core in place to eliminate excessive stress to the cables.

7. Options

Junction Cable for Encoder

Part No.	MFECA0* * 0EAE	Compatible motor output	MSMF 50 W～ 1.0 kW(□ 80) MQMF 100 W～ 400 W MHMF 50 W～ 1.0 kW(□ 80) (Leadwire type)
Specifications	For encode With battery box		

[Unit: mm]

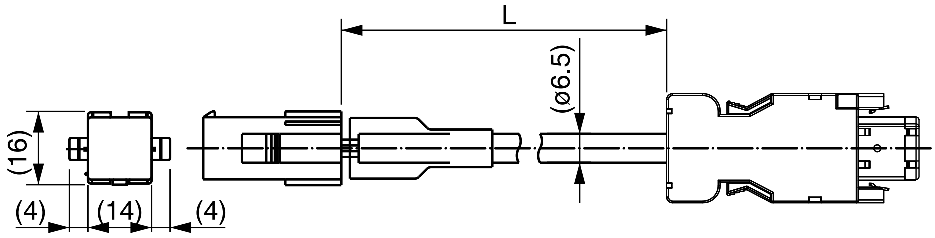


Title	Part No.	Manufacturer
Connector (Driver side)	3E206-0100 KV	Sumitomo 3M (or equivalent)
Shell kit	3E306-3200-008	
Connector (Motor side)	172161-1	Japan Aviation Electronics Ind.
Connector pin	170365-1	
Cable	0.20 mm² x 4P(8-wire)	Hitachi Electric Cable Co., Ltd.

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFECA0030EAE
$5^{+0.30}_{-0.00}$	MFECA0050EAE
$10^{+0.40}_{-0.00}$	MFECA0100EAE
$20^{+0.60}_{-0.00}$	MFECA0200EAE

Part No.	MFECA0 * * 0EAD	Compatible motor output	MSMF 50 W～ 1.0 kW(□ 80) MQMF 100 W～ 400 W MHMF 50 W～ 1.0 kW(□ 80) (Leadwire type)
Specifications	For encode Without battery box		

[Unit: mm]



Title	Part No.	Manufacturer
Connector (Driver side)	3E206-0100 KV	Sumitomo 3M (or equivalent)
Shell kit	3E306-3200-008	
Connector (Motor side)	172161-1	Japan Aviation Electronics Ind.
Connector pin	170365-1	
Cable	0.20 mm² x 3P(6-wire)	Hitachi Electric Cable Co., Ltd.

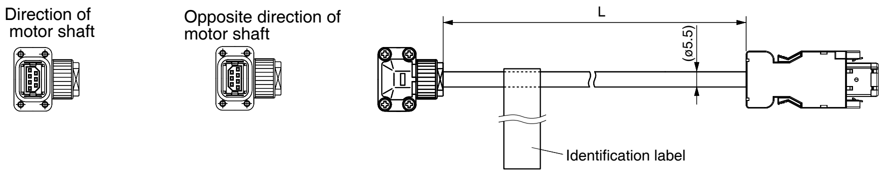
L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFECA0030EAD
$5^{+0.30}_{-0.00}$	MFECA0050EAD
$10^{+0.40}_{-0.00}$	MFECA0100EAD
$20^{+0.60}_{-0.00}$	MFECA0200EAD

Caution Option cable does not conform to IP65 and IP67.

Related page
• P.2-40"Specifications of Motor Connector"

Part No.	**MFECA0 ＊＊ 0MJD** (Highly bendable type, Direction of motor shaft) **MFECA0 ＊＊ 0MKD** (Highly bendable type, Opposite direction of motor shaft) **MFECA0 ＊＊ 0TJD** (Standard bendable type, Direction of motor shaft) **MFECA0 ＊＊ 0TKD** (Standard bendable type, Opposite direction of motor shaft)	Compatible motor output	MSMF 50 W～ 1.0 kW(□80) MQMF 100 W～ 400 W MHMF 50 W～ 1.0kW(□80) (Connector type)
Specifications	For encode Without battery box		

[Unit: mm]

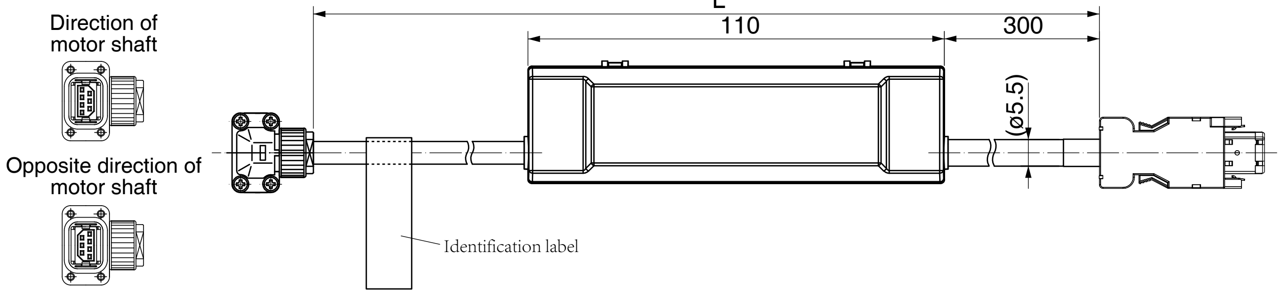


Title	Part No.	Manufacturer
Connector (Driver side)	3E206-0100 KV	Sumitomo 3M (or equivalent)
Shell kit	3E306-3200-008	
Connector (Motor side)	JN6FR07SM1	Japan Aviation Electronics Ind.
Connector pin	LY10-C1-A1-10000	
Cable	AWG24×4P, AWG22×2P	Hitachi Electric Cable Co., Ltd.

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFECA0030MJD
$5^{+0.30}_{-0.00}$	MFECA0050MJD
$10^{+0.40}_{-0.00}$	MFECA0100MJD
$20^{+0.60}_{-0.00}$	MFECA0200MJD

Part No.	**MFECA0 ＊＊ 0MJE** (Highly bendable type, Direction of motor shaft) **MFECA0 ＊＊ 0MKE** (Highly bendable type, Opposite direction of motor shaft) **MFECA0 ＊＊ 0TJE** (Standard bendable type, Direction of motor shaft) **MFECA0 ＊＊ 0TKE** (Standard bendable type, Opposite direction of motor shaft)	Compatible motor output	MSMF 50 W～ 1.0 kW(□80) MQMF 100 W～ 400 W MHMF 50 W～ 1.0kW(□80) (Connector type)
Specifications	For encode With battery box		

[Unit: mm]



Title	Part No.	Manufacturer
Connector (Driver side)	3E206-0100 KV	Sumitomo 3M (or equivalent)
Shell kit	3E306-3200-008	
Connector (Battery side)	ZMR-02	J.S.T Mfg. Co., Ltd.
Connector pin	SMM-003T-P0.5	
Connector (Motor side)	JN6FR07SM1	Japan Aviation Electronics Ind.
Connector pin	LY10-C1-A1-10000	
Cable	AWG24×4P, AWG22×2P	Hitachi Electric Cable Co., Ltd.

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFECA0030MJE
$5^{+0.30}_{-0.00}$	MFECA0050MJE
$10^{+0.40}_{-0.00}$	MFECA0100MJE
$20^{+0.60}_{-0.00}$	MFECA0200MJE

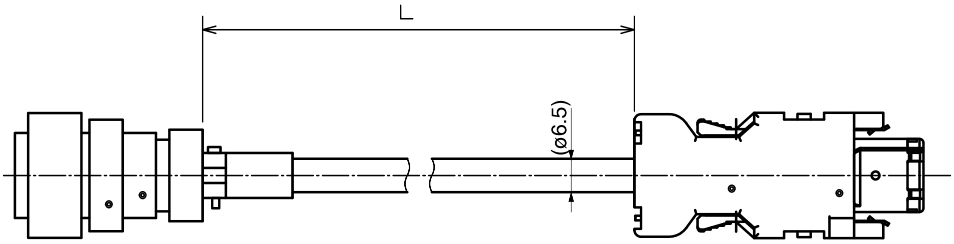
Caution Option cable does not conform to IP65 and IP67.

Related page

- P.2-40"Specifications of Motor Connector"

Part No.	MFECA0 ＊＊ 0EPD	Compatible motor output	MSMF 1.0 kW(□100)～5.0 kW MDMF 1.0 kW～5.0 kW MHMF 1.0 kW(□130)～5.0 kW MGMF 0.85 kW～4.4 kW
Specifications	For encode Without battery box(JL10 One-touch lock type)		

[Unit: mm]

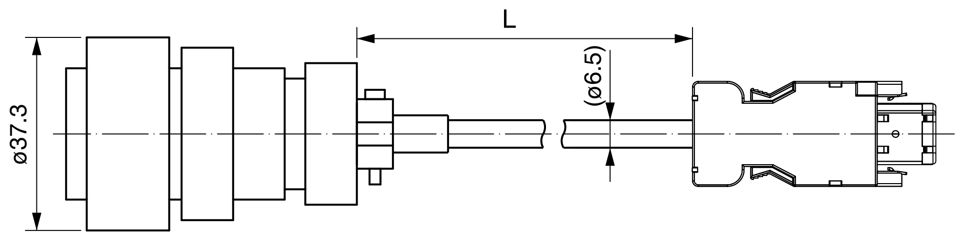


Title	Part No.	Manufacturer
Connector (Driver side)	3E206-0100 KV	Sumitomo 3M (or equivalent)
Shell kit	3E306-3200-008	
Connector (Motor side)	JL10-6A20-29S-EB	Japan Aviation Electronics Ind.
Connector pin	JL04-2022CK(09)-R	
Cable	0.2 mm2 × 3P (6-wire)	Oki Electric Cable Co., Ltd.

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFECA0030EPD
$5^{+0.30}_{-0.00}$	MFECA0050EPD
$10^{+0.40}_{-0.00}$	MFECA0100EPD
$20^{+0.60}_{-0.00}$	MFECA0200EPD

Part No.	MFECA0 ＊＊ 0ESD	Compatible motor output	MSMF 1.0 kW(□100)～5.0 kW MDMF 1.0 kW～5.0 kW MHMF 1.0 kW(□130)～5.0 kW MGMF 0.85 kW～4.4 kW
Specifications	For encode Without battery box(screwed type)		

[Unit: mm]



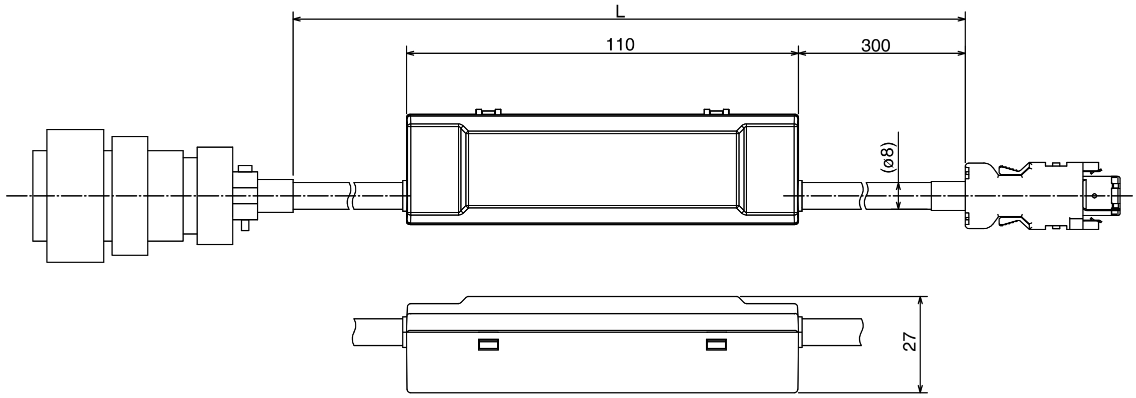
Title	Part No.	Manufacturer
Connector (Driver side)	3E206-0100 KV	Sumitomo 3M (or equivalent)
Shell kit	3E306-3200-008	
Connector (Motor side)	N/MS3106B20-29S	Japan Aviation Electronics Ind.
Cable clamp	N/MS3057-12A	
Cable	0.2 mm² ×3P (6-wire)	Oki Electric Cable Co., Ltd.

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFECA0030ESD
$5^{+0.30}_{-0.00}$	MFECA0050ESD
$10^{+0.40}_{-0.00}$	MFECA0100ESD
$20^{+0.60}_{-0.00}$	MFECA0200ESD

Caution Option cable does not conform to IP65 and IP67.

Part No.	MFECA0 ＊＊ 0EPE	Compatible motor output	MSMF 1.0 kW(□100) to 5.0 kW MDMF 1.0 kW to 5.0 kW MHMF 1.0 kW(□130) to 5.0 kW MGMF 0.85 kW to 4.4 kW
Specifications	For encode With battery box(JL10 One-touch lock type)		

[Unit: mm]

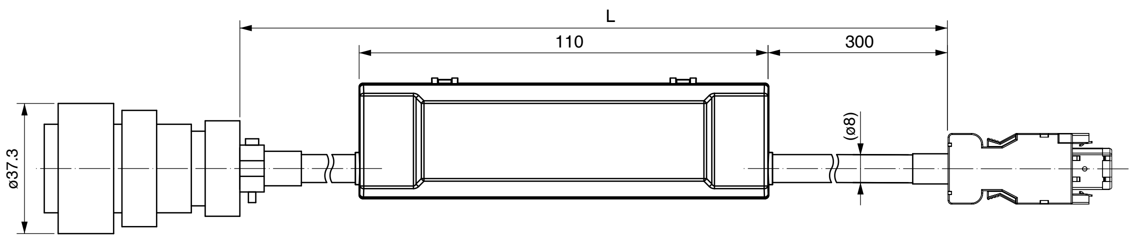


Title	Part No.	Manufacturer
Connector (Driver side)	3E206-0100 KV	Sumitomo 3M (or equivalent)
Shell kit	3E306-3200-008	
Connector (Battery side)	ZMR-02	J.S.T Mfg. Co., Ltd.
Connector pin	SMM-003T-P0.5	
Connector (Motor side)	JL10-6A20-29S-EB	Japan Aviation Electronics Ind.
Connector pin	JL04-2022CK(09)-R	
Cable	0.2 mm² ×4P（8-wire）	Oki Electric Cable Co., Ltd.

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFECA0030EPE
$5^{+0.30}_{-0.00}$	MFECA0050EPE
$10^{+0.40}_{-0.00}$	MFECA0100EPE
$20^{+0.60}_{-0.00}$	MFECA0200EPE

Part No.	MFECA0 ＊＊ 0ESE	Compatible motor output	MSMF 1.0 kW(□100) to 5.0 kW MDMF 1.0 kW to 5.0 kW MHMF 1.0 kW(□130) to 5.0 kW MGMF 0.85 kW to 4.4 kW
Specifications	For encode With battery box(screwed type)		

[Unit: mm]



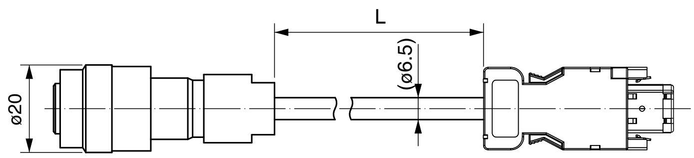
Title	Part No.	Manufacturer
Connector (Driver side)	3E206-0100 KV	Sumitomo 3M (or equivalent)
Shell kit	3E306-3200-008	
Connector (Motor side)	N/MS3106B20-29S	Japan Aviation Electronics Ind.
Cable clamp	N/MS3057-12A	
Cable	0.2 mm² ×4P（8-wire）	Oki Electric Cable Co., Ltd.

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFECA0030ESE
$5^{+0.30}_{-0.00}$	MFECA0050ESE
$10^{+0.40}_{-0.00}$	MFECA0100ESE
$20^{+0.60}_{-0.00}$	MFECA0200ESE

Caution Option cable does not conform to IP65 and IP67.

Part No.	MFECA0 ＊＊ 0ETD	Compatible motor output	MSMF 1.0 kW(□100) to 5.0 kW MDMF 1.0 kW to 5.0 kW MHMF 1.0 kW(□130) to 5.0 kW MGMF 0.85 kW to 4.4 kW
Specifications	For encode Without battery box(JN2 One-touch lock type)		

[Unit: mm]

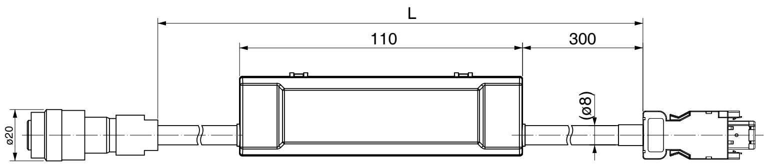


Title	Part No.	Manufacturer
Connector (Driver side)	3E206-0100 KV	Sumitomo 3M (or equivalent)
Shell kit	3E306-3200-008	
Connector (Motor side)	JN2DS10SL1-R	Japan Aviation Electronics Ind.
Connector pin	JN1-22-22S-PKG100	
Cable	0.2 mm² ×3P	Oki Electric Cable Co., Ltd.

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFECA0030ETD
$5^{+0.30}_{-0.00}$	MFECA0050ETD
$10^{+0.40}_{-0.00}$	MFECA0100ETD
$20^{+0.60}_{-0.00}$	MFECA0200ETD

Part No.	MFECA0 ＊＊ 0ETE	Compatible motor output	MSMF 1.0 kW(□100) to 5.0 kW MDMF 1.0 kW to 5.0 kW MHMF 1.0 kW(□130) to 5.0 kW MGMF 0.85 kW to 4.4 kW
Specifications	For encode With battery box(JN2 One-touch lock type)		

[Unit: mm]



Title	Part No.	Manufacturer
Connector (Driver side)	3E206-0100 KV	Sumitomo 3M (or equivalent)
Shell kit	3E306-3200-008	
Connector (Battery side)	ZMR-02	J.S.T Mfg. Co., Ltd.
Connector pin	SMM-003T-P0.5	
Connector (Motor side)	JN2DS10SL1-R	Japan Aviation Electronics Ind.
Connector pin	JN1-22-22S-PKG100	
Cable	0.2 mm² ×3P	Oki Electric Cable Co., Ltd.

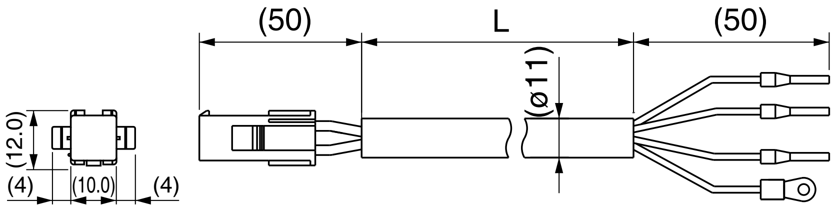
L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFECA0030ETE
$5^{+0.30}_{-0.00}$	MFECA0050ETE
$10^{+0.40}_{-0.00}$	MFECA0100ETE
$20^{+0.60}_{-0.00}$	MFECA0200ETE

Caution Option cable does not conform to IP65 and IP67.

Junction Cable for Motor (Without Brake)

Part No.	MFMCA0 ＊＊ 0EED	Applicable model	MSMF 50 W to 1.0 kW(□ 80) MQMF 100 W to 400 W MHMF 50 W to 1.0 kW(□ 80) (Leadwire type)

[Unit: mm]

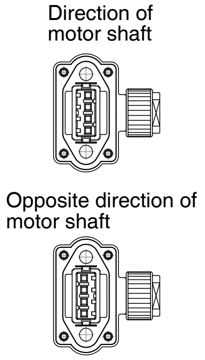


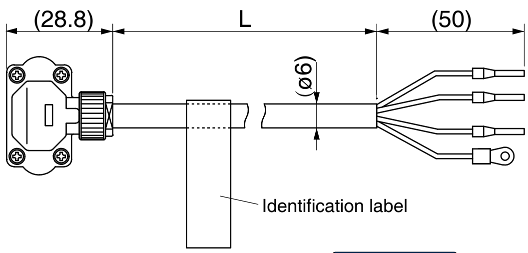
Title	Part No.	Manufacturer
Connector	172159-1	Tyco Electronics
Connector pin	170366-1	
Rod terminal	AI0.75-8GY	Phoenix Contact
Nylon insulated round terminal	N1.25-M4	J.S.T Mfg. Co., Ltd.
Cable	ROBO-TOP 600 V 0.75 mm^2 4-wire type	Daiden Co.,Ltd.

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCA0030EED
$5^{+0.30}_{-0.00}$	MFMCA0050EED
$10^{+0.40}_{-0.00}$	MFMCA0100EED
$20^{+0.60}_{-0.00}$	MFMCA0200EED

Part No.		Applicable model	
	MFMCA0 ＊＊ 0NJD (Highly bendable type, Direction of motor shaft)		MSMF 50 W to 1.0 kW(□80) (Connector type)
	MFMCA0 ＊＊ 0NKD (Highly bendable type, Opposite direction of motor shaft)		
	MFMCA0 ＊＊ 0RJD (Standard bendable type, Direction of motor shaft)		
	MFMCA0 ＊＊ 0RKD (Standard bendable type, Opposite direction of motor shaft)		

[Unit: mm]





Remark Motor cable for opposite direction of motor shaft cannot be used with a motor 50 W and 100 W.

Title	Part No.	Manufacturer
Connector	JN8FT04SJ1	Japan Aviation Electronics Ind.
Connector pin	ST-TMH-S-C1B-3500	
Rod terminal	AI0.75-8GY	Phoenix Contact
Nylon insulated round terminal	N1.25-M4	J.S.T Mfg. Co., Ltd.
Cable	AWG18 4-wire	Hitachi Electric Cable Co., Ltd.

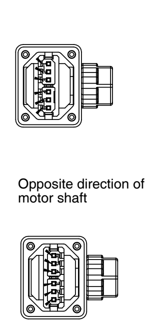
L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCA0030NJD
$5^{+0.30}_{-0.00}$	MFMCA0050NJD
$10^{+0.40}_{-0.00}$	MFMCA0100NJD
$20^{+0.60}_{-0.00}$	MFMCA0200NJD

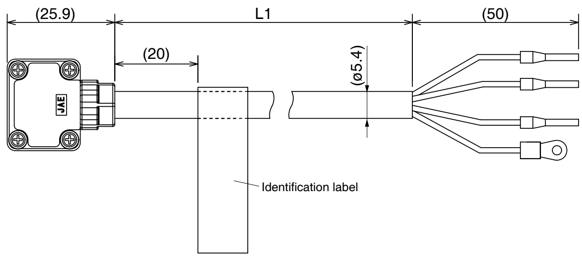
Caution Option cable does not conform to IP65 and IP67.

Related page • P.2-40“Specifications of Motor Connector”

Part No.	MFMCA0 ＊＊ 7UFD (Highly/Standard bendable type, Direction of motor shaft) MFMCA0 ＊＊ 7UGD (Highly/Standard bendable type, Opposite direction of motor shaft)	Applicable model	MHMF 50 W, 100 W (Connector type)

[Unit: mm]



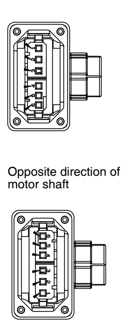


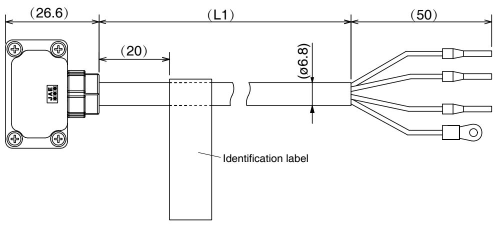
Title	Part No.	Manufacturer
Connector	JN11FH06SN2	Japan Aviation Electronics Ind.
Connector pin	JN11S10K4A1	
Rod terminal	AI0.34-8TQ	Phoenix Contact
Nylon insulated round terminal	N1.25-M4	J.S.T Mfg. Co., Ltd.
Cable	AWG22 6-wire	Nikko Electronics Wire Co., Ltd.

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCA0037UFD
$5^{+0.30}_{-0.00}$	MFMCA0057UFD
$10^{+0.40}_{-0.00}$	MFMCA0107UFD
$20^{+0.60}_{-0.00}$	MFMCA0207UFD

Part No.	MFMCA0 ＊＊ 0UFD (Highly bendable type, Direction of motor shaft) MFMCA0 ＊＊ 0UGD (Highly bendable type, Opposite direction of motor shaft) MFMCA0 ＊＊ 0WFD (Standard bendable type, Direction of motor shaft) MFMCA0 ＊＊ 0WGD (Standard bendable type, Opposite direction of motor shaft)	Applicable model	MQMF 100 W to 400 W MHMF 200 W to 1.0 kW(□80) (Connector type)

[Unit: mm]





Title	Part No.	Manufacturer
Connector	JN11FH06SN1	Japan Aviation Electronics Ind.
Cable clamp	JN11S35H3A1	
Rod terminal	AI0.75-8GY	Phoenix Contact
Nylon insulated round terminal	N1.25-M4	J.S.T Mfg. Co., Ltd.
Cable	AWG18 6-wire	Nikko Electronics Wire Co., Ltd.

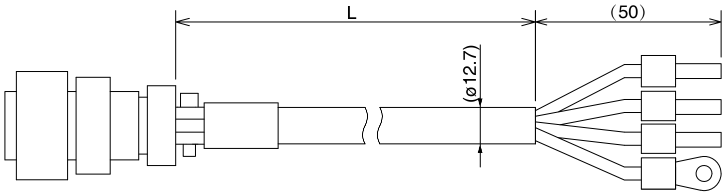
L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCA0030UFD
$5^{+0.30}_{-0.00}$	MFMCA0050UFD
$10^{+0.40}_{-0.00}$	MFMCA0100UFD
$20^{+0.60}_{-0.00}$	MFMCA0200UFD

Caution Option cable does not conform to IP65 and IP67.

Related page
- P.2-40"Specifications of Motor Connector"

Part No.	MFMCD0 ＊＊ 2EUD	Applicable model	MSMF 1.0 kW(□100) to 2.0 kW, MDMF 1.0 kW to 2.0 kW MHMF 1.0 kW(□130) to 1.5 kW, MGMF 0.85 kW to 1.8 kW (One-touch lock type)

[Unit: mm]

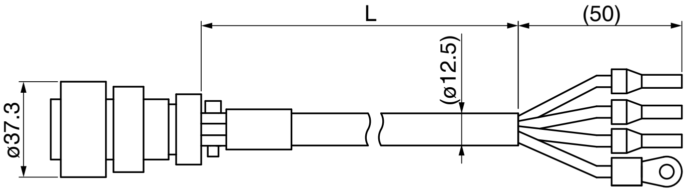


Title	Part No.	Manufacturer
Connector	JL10-6A20-4SE-EB	Japan Aviation Electronics Ind.
Connector pin	JL04-2022CK(14)-R	Japan Aviation Electronics Ind.
Rod terminal	NTUB-2	J.S.T Mfg. Co., Ltd.
Nylon insulated round terminal	N2-M4	J.S.T Mfg. Co., Ltd.
Cable	ROBO-TOP 600 V 2.0 mm^2 4-wire	Dyden Corporation

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCA0032EUD
$5^{+0.30}_{-0.00}$	MFMCA0052EUD
$10^{+0.40}_{-0.00}$	MFMCA0102EUD
$20^{+0.60}_{-0.00}$	MFMCA0202EUD

Part No.	MFMCD0 ＊＊ 2ECD	Applicable model	MSMF 1.0 kW(□100) to 2.0 kW, MDMF 1.0 kW to 2.0 kW MHMF 1.0 kW(□130) to 1.5 kW, MGMF 0.85 kW to 1.8 kW (Screwed type)

[Unit: mm]

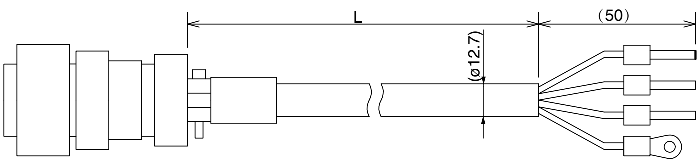


Title	Part No.	Manufacturer
Connector	JL04V-6A20-4SE-EB-R	Tyco Electronics
Connector pin	JL04-2022CK(14)-R	Tyco Electronics
Rod terminal	NTUB-2	J.S.T Mfg. Co., Ltd.
Nylon insulated round terminal	N2-M4	J.S.T Mfg. Co., Ltd.
Cable	ROBO-TOP 600V 2.0mm^2 4-wire	Dyden Corporation

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCD0032ECD
$5^{+0.30}_{-0.00}$	MFMCD0052ECD
$10^{+0.40}_{-0.00}$	MFMCD0102ECD
$20^{+0.60}_{-0.00}$	MFMCD0202ECD

Part No.	MFMCE0 ＊＊ 2EUD	Applicable model	MHMF 2.0 kW (One-touch lock type)

[Unit: mm]



Title	Part No.	Manufacturer
Connector	JL10-6A22-22SE-EB	Japan Aviation Electronics Ind.
Connector pin	JL04-2022CK(14)-R	Japan Aviation Electronics Ind.
Rod terminal	NTUB-2	J.S.T Mfg. Co., Ltd.
Nylon insulated round terminal	N2-M4	J.S.T Mfg. Co., Ltd.
Cable	ROBO-TOP 600 V 2.0 mm^2 4-wire	Dyden Corporation

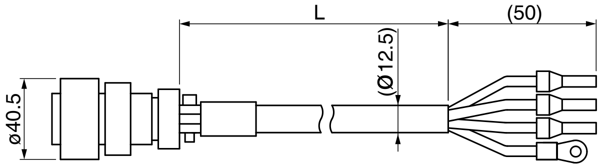
L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCE0032EUD
$5^{+0.30}_{-0.00}$	MFMCE0052EUD
$10^{+0.40}_{-0.00}$	MFMCE0102EUD
$20^{+0.60}_{-0.00}$	MFMCE0202EUD

Caution Option cable does not conform to IP65 and IP67.

Related page
• P.2-40“Specifications of Motor Connector”

Part No.	MFMCE0 ＊＊ 2ECD	Applicable model	MHMF 2.0 kW (Screwed type)

[Unit: mm]

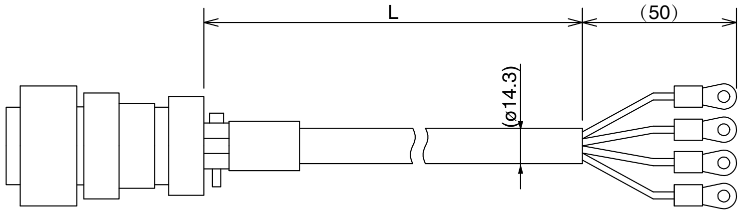


Title	Part No.	Manufacturer
Connector	JL04V-6A22-22SE-EB-R	Japan Aviation Electronics Ind.
Connector pin	JL04-2022CK(14)-R	
Rod terminal	NTUB-2	J.S.T Mfg. Co., Ltd.
Nylon insulated round terminal	N2-M4	J.S.T Mfg. Co., Ltd.
Cable	ROBO-TOP 600V 2.0 mm² 4-wire	Dyden Corporation

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCE0032ECD
$5^{+0.30}_{-0.00}$	MFMCE0052ECD
$10^{+0.40}_{-0.00}$	MFMCE0102ECD
$20^{+0.60}_{-0.00}$	MFMCE0202ECD

Part No.	MFMCA0 ＊＊ 3EUT	Applicable model	MSMF 3.0 kW to 5.0 kW, MDMF 3.0 kW to 5.0 kW MHMF 3.0 kW to 5.0 kW, MGMF 2.9 kW,4.4 kW (One-touch lock type)

[Unit: mm]

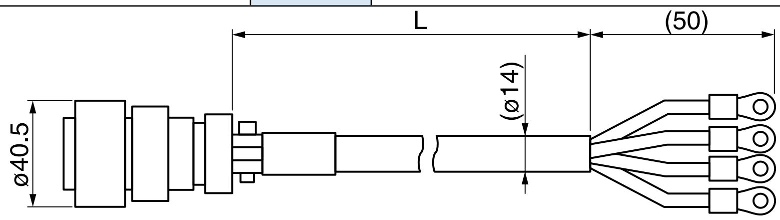


Title	Part No.	Manufacturer
Connector	JL10-6A22-11SE-EB	Japan Aviation Electronics Ind.
Cable clamp	JL04-2022CK(14)-R	
Nylon insulated round terminal	N5.5-5	J.S.T Mfg. Co., Ltd.
Cable	ROBO-TOP 600 V 3.5 mm² 4-wire	Dyden Corporation

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCA0033EUT
$5^{+0.30}_{-0.00}$	MFMCA0053EUT
$10^{+0.40}_{-0.00}$	MFMCA0103EUT
$20^{+0.60}_{-0.00}$	MFMCA0203EUT

Part No.	MFMCA0 ＊＊ 3ECT	Applicable model	MSMF 3.0 kW to 5.0 kW, MDMF 3.0 kW to 5.0 kW MHMF 3.0 kW to 5.0 kW, MGMF 2.9 kW,4.4 kW (Screwed type)

[Unit: mm]



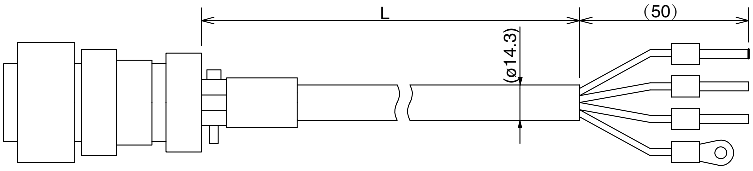
Title	Part No.	Manufacturer
Connector	JL04V-6A22-22SE-EB-R	Japan Aviation Electronics Ind.
Cable clamp	JL04-2022CK(14)-R	
Nylon insulated round terminal	N5.5-5	J.S.T Mfg. Co., Ltd.
Cable	ROBO-TOP 600V 3.5 mm² 4-wire	Dyden Corporation

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCA0033ECT
$5^{+0.30}_{-0.00}$	MFMCA0053ECT
$10^{+0.40}_{-0.00}$	MFMCA0103ECT
$20^{+0.60}_{-0.00}$	MFMCA0203ECT

Caution Option cable does not conform to IP65 and IP67.

Related page • P.2-40“Specifications of Motor Connector”

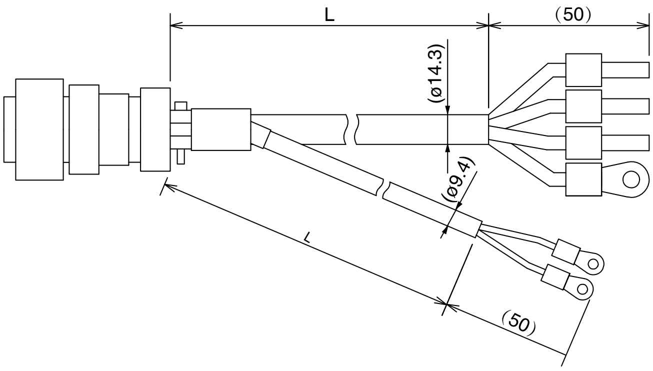
Part No.	MFMCE0 ＊＊ 3EUT	Applicable model	MGMF 2.4 kW (One-touch lock type)



Title	Part No.	Manufacturer
Connector	JL10-6A22-11SE-EB	Japan Aviation Electronics Ind.
Connector pin	JL04-2022CK(14)-R	
Rod terminal	TMENTC3.5-11S	NICHIFU. Co., Ltd.
Nylon insulated round terminal	N5.5-5	J.S.T Mfg. Co., Ltd.
Cable	ROBO-TOP 600 V 3.5 mm^2 4-wire	Dyden Corporation

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCE0033EUT
$5^{+0.30}_{-0.00}$	MFMCE0053EUT
$10^{+0.40}_{-0.00}$	MFMCE0103EUT
$20^{+0.60}_{-0.00}$	MFMCE0203EUT

Part No.	MFMCD0 ＊＊ 3FUT	Applicable model	MGMF 2.4 kW (One-touch lock type)



Title		Part No.	Manufacturer
Connector		JL04V-6A24-11SE-EB-R	Japan Aviation Electronics Ind.
Cable clamp		JL04-2428CK(17)-R	
Rod terminal		TMENTC3.5-11S	NICHIFU. Co., Ltd.
Nylon insulated round terminal	Earth	N5.5-5	J.S.T Mfg. Co., Ltd.
	Brake	N1.25-M4	
Cable		ROBO-TOP 600V 3.5 mm^2 4-wire ROBO-TOP 600V 0.75 mm^2 2-wire	Dyden Corporation

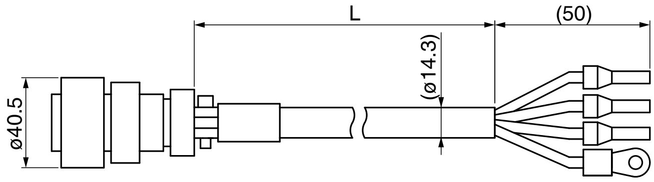
L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCD0033FUT
$5^{+0.30}_{-0.00}$	MFMCD0053FUT
$10^{+0.40}_{-0.00}$	MFMCD0103FUT
$20^{+0.60}_{-0.00}$	MFMCD0203FUT

Caution Option cable does not conform to IP65 and IP67.

Related page • P.2-40"Specifications of Motor Connector"

Junction Cable for Motor (Without Brake)

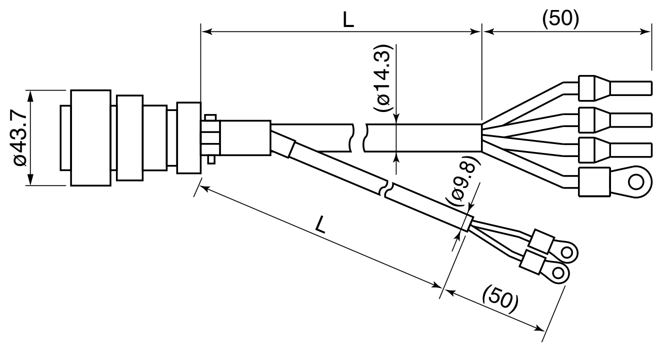
Part No.	MFMCE0 ＊＊ 3ECT	Applicable model	MGMF 2.4 kW (Screwed type)



Title	Part No.	Manufacturer
Connector	JL10-6A22-22SE-EB	Japan Aviation Electronics Ind.
Connector pin	JL04-2022CK(14)-R	Japan Aviation Electronics Ind.
Rod terminal	TMENTC3.5-11S	NICHIFU. Co., Ltd.
Nylon insulated round terminal	N5.5-5	J.S.T Mfg. Co., Ltd.
Cable	ROBO-TOP 600 V 3.5 mm^2 4-wire	Dyden Corporation

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCE0033ECT
$5^{+0.30}_{-0.00}$	MFMCE0053ECT
$10^{+0.40}_{-0.00}$	MFMCE0103ECT
$20^{+0.60}_{-0.00}$	MFMCE0203ECT

Part No.	MFMCD0 ＊＊ 3FCT	Applicable model	MGMF 2.4 kW (Screwed type)



Title		Part No.	Manufacturer
Connector		JL04V-6A24-11SE-EB-R	Japan Aviation Electronics Ind.
Cable clamp		JL04-2428CK(17)-R	Japan Aviation Electronics Ind.
Rod terminal		TMENTC3.5-11S	NICHIFU. Co., Ltd.
Nylon insulated round terminal	Earth	N5.5-5	J.S.T Mfg. Co., Ltd.
	Brake	N1.25-M4	
Cable		ROBO-TOP 600V 3.5 mm^2 4-wire ROBO-TOP 600V 0.75 mm^2 2-wire	Dyden Corporation

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCD0033FCT
$5^{+0.30}_{-0.00}$	MFMCD0053FCT
$10^{+0.40}_{-0.00}$	MFMCD0103FCT
$20^{+0.60}_{-0.00}$	MFMCD0203FCT

Caution Option cable does not conform to IP65 and IP67.

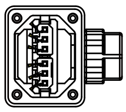
Related page • P.2-40"Specifications of Motor Connector"

Junction Cable for Motor (With Brake)

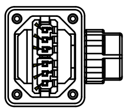
Part No.		Applicable model	
Part No.	**MFMCA0 ＊＊ 7VFD** (Highly/Standard bendable type, Direction of motor shaft) **MFMCA0 ＊＊ 7VGD** (Highly/Standard bendable type, Opposite direction of motor shaft)	Applicable model	MHMF 50 W, 100 W (Connector type)

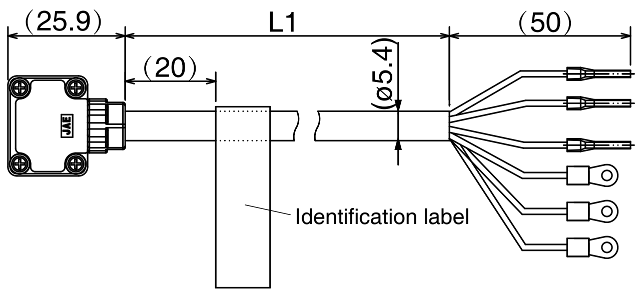
[Unit: mm]

Direction of motor shaft



Opposite direction of motor shaft





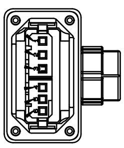
Title	Part No.	Manufacturer
Connector	JN11FH06SN2	Japan Aviation Electronics Ind.
Connector pin	JN11S10K4A1	Japan Aviation Electronics Ind.
Rod terminal	AI0.75-8GY	Phoenix Contact
Nylon insulated round terminal	N1.25-M4	J.S.T Mfg. Co., Ltd.
Cable	AWG22 6-wire	Nikko Electronics Wire Co., Ltd.

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCA0037VFD
$5^{+0.30}_{-0.00}$	MFMCA0057VFD
$10^{+0.40}_{-0.00}$	MFMCA0107VFD
$20^{+0.60}_{-0.00}$	MFMCA0207VFD

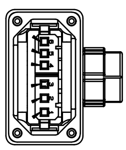
Part No.		Applicable model	
Part No.	**MFMCA0 ＊＊ 0VFD** (Highly bendable type, Direction of motor shaft) **MFMCA0 ＊＊ 0VGD** (Highly bendable type, Opposite direction of motor shaft) **MFMCA0 ＊＊ 0XFD** (Standard bendable type, Direction of motor shaft) **MFMCA0 ＊＊ 0XGD** (Standard bendable type, Opposite direction of motor shaft)	Applicable model	MQMF 100 W to 400 W MHMF 200 W to 1.0 kW(□ 80) (Connector type)

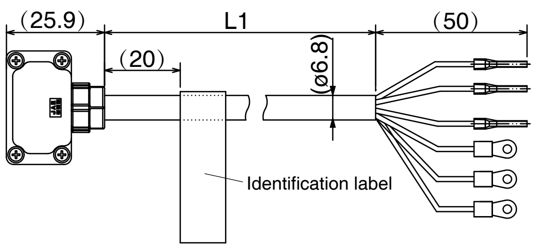
[Unit: mm]

Direction of motor shaft



Opposite direction of motor shaft





Title	Part No.	Manufacturer
Connector	JN11FH06SN1	Japan Aviation Electronics Ind.
Connector pin	JJN11S35H3A1	Japan Aviation Electronics Ind.
Rod terminal	AI0.75-8GY	Phoenix Contact
Nylon insulated round terminal	N1.25-M4	J.S.T Mfg. Co., Ltd.
Cable	AWG18 6-wire	Nikko Electronics Wire Co., Ltd.

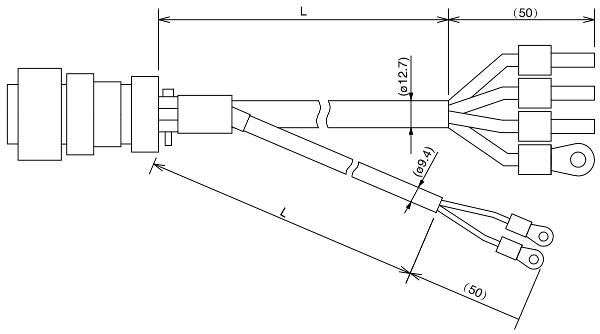
L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCA0030VFD
$5^{+0.30}_{-0.00}$	MFMCA0050VFD
$10^{+0.40}_{-0.00}$	MFMCA0100VFD
$20^{+0.60}_{-0.00}$	MFMCA0200VFD

Caution Option cable does not conform to IP65 and IP67.

Related page • P.2-40"Specifications of Motor Connector"

Part No.	MFMCA0 ＊＊ 2FUD	Applicable model	MSMF 1.0 kW(□ 100) to 2.0 kW, MDMF 1.0 kW to 2.0 kW MHMF 1.0 kW(□ 130) to 1.5 kW, MGMF 0.85 kW to 1.8 kW (One-touch lock type)

[Unit: mm]

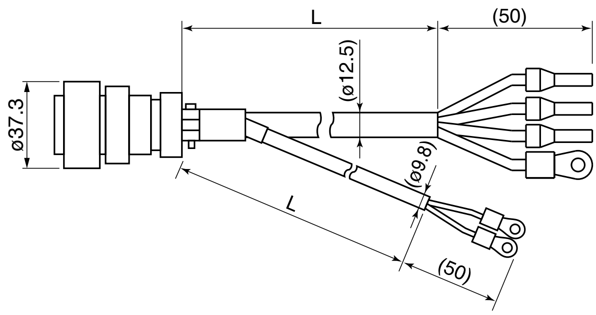


Title		Part No.	Manufacturer
Connector		JL10-6A20-18SE-EB	Japan Aviation Electronics Ind.
Cable clamp		JL042022CK(14)-R	Japan Aviation Electronics Ind.
Rod terminal		NTUB-2	J.S.T Mfg. Co., Ltd.
Nylon insulated round terminal	Earth	N2-M4	J.S.T Mfg. Co., Ltd.
	Brake	N1.25-M4	
Cable		ROBO-TOP 600 V 0.75 mm² 2-wire ROBO-TOP 600 V 2.0 mm² 4-wire	Dyden Corporation

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCA0032FUD
$5^{+0.30}_{-0.00}$	MFMCA0052FUD
$10^{+0.40}_{-0.00}$	MFMCA0102FUD
$20^{+0.60}_{-0.00}$	MFMCA0202FUD

Part No.	MFMCA0 ＊＊ 2FCD	Applicable model	MSMF 1.0 kW(□ 100) to 2.0 kW, MDMF 1.0 kW to 2.0 kW MHMF 1.0 kW(□ 130) to 1.5 kW, MGMF 0.85 kW to 1.8 kW (Screwed type)

[Unit: mm]



Title		Part No.	Manufacturer
Connector		JL04V-6A20-18SE-EB-R	Japan Aviation Electronics Ind.
Cable clamp		JL04-2022CK(14)-R	Japan Aviation Electronics Ind.
Rod terminal		NTUB-2	J.S.T Mfg. Co., Ltd.
Nylon insulated round terminal	Earth	N2-M4	J.S.T Mfg. Co., Ltd.
	Brake	N1.25-M4	
Cable		ROBO-TOP 600V 2.0 mm² 4-wire ROBO-TOP 600V 0.75 mm² 2-wire	Dyden Corporation

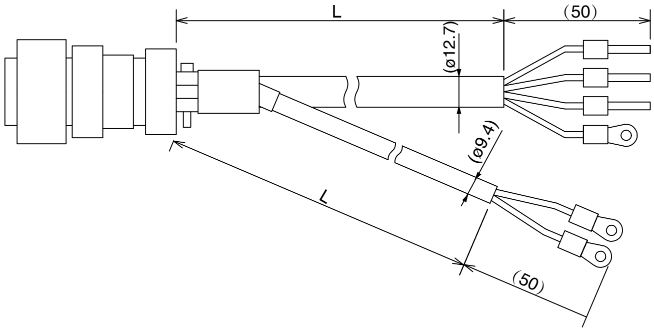
L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCA0032FCD
$5^{+0.30}_{-0.00}$	MFMCA0052FCD
$10^{+0.40}_{-0.00}$	MFMCA0102FCD
$20^{+0.60}_{-0.00}$	MFMCA0202FCD

Caution Option cable does not conform to IP65 and IP67.

Related page • P.2-40"Specifications of Motor Connector"

Part No.	MFMCE0 ＊＊ 2FUD	Applicable model	MHMF 2.0 kW (One-touch lock type)

[Unit: mm]

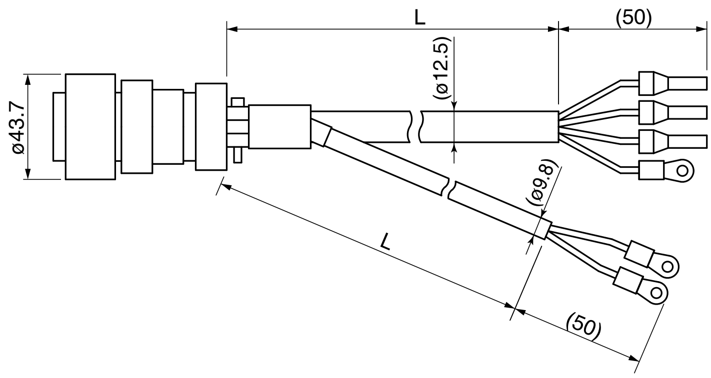


Title		Part No.	Manufacturer
Connector		JL10-6A24-11SE-EB	Japan Aviation Electronics Ind.
Cable clamp		JL04-2428CK(17)-R	Japan Aviation Electronics Ind.
Rod terminal		NTUB-2	J.S.T Mfg. Co., Ltd.
Nylon insulated round terminal	Earth	N2-M4	J.S.T Mfg. Co., Ltd.
	Brake	N1.25-M4	
Cable		ROBO-TOP DP6/2501 0.75 mm² 2-wire ROBO-TOP DP6/2501 2.0 mm² 4-wire	Dyden Corporation

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCE0032FUD
$5^{+0.30}_{-0.00}$	MFMCE0052FUD
$10^{+0.40}_{-0.00}$	MFMCE0102FUD
$20^{+0.60}_{-0.00}$	MFMCE0202FUD

Part No.	MFMCE0 ＊＊ 2FCD	Applicable model	MHMF 2.0 kW (Screwed type)

[Unit: mm]



Title		Part No.	Manufacturer
Connector		JL04V-6A24-11SE-EB-R	Japan Aviation Electronics Ind.
Cable clamp		JL04-2428CK(17)-R	Japan Aviation Electronics Ind.
Rod terminal		NTUB-2	J.S.T Mfg. Co., Ltd.
Nylon insulated round terminal	Earth	N2-M4	J.S.T Mfg. Co., Ltd.
	Brake	N1.25-M4	
Cable		ROBO-TOP 600V 2.0 mm² 4-wire ROBO-TOP 600V 0.75 mm² 2-wire	Dyden Corporation

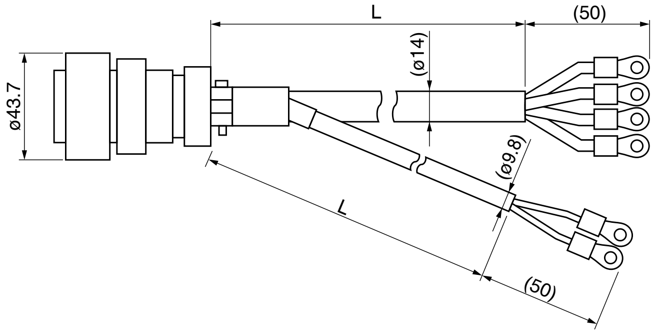
L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCE0032FCD
$5^{+0.30}_{-0.00}$	MFMCE0052FCD
$10^{+0.40}_{-0.00}$	MFMCE0102FCD
$20^{+0.60}_{-0.00}$	MFMCE0202FCD

Caution Option cable does not conform to IP65 and IP67.

Related page
• P.2-40"Specifications of Motor Connector"

Part No.	MFMCA0 ＊＊ 3FCT	Applicable model	MSMF 3.0 kW to 5.0 kW, MDMF 3.0 kW to 5.0 kW MHMF 3.0 kW to 5.0 kW, MGMF 2.9kW,4.4 kW (Screwed type)

[Unit: mm]

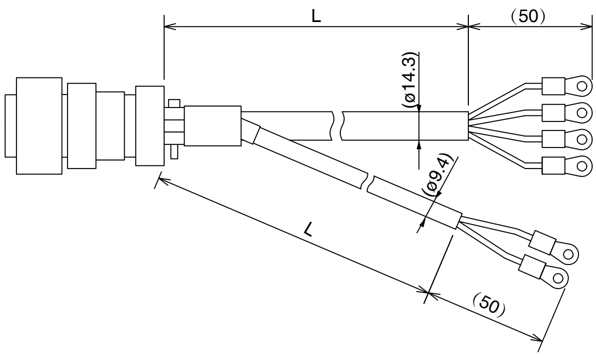


Title		Part No.	Manufacturer
Connector		JL04V-6A24-11SE-EB-R	Japan Aviation Electronics Ind.
Cable clamp		JL04-2428CK(17)-R	Japan Aviation Electronics Ind.
Nylon insulated round terminal	Earth	N5.5-5	J.S.T Mfg. Co., Ltd.
Nylon insulated round terminal	Brake	N1.25-M4	J.S.T Mfg. Co., Ltd.
Cable		ROBO-TOP 600V 3.5 mm² 4-wire ROBO-TOP 600V 0.75 mm² 2-wire	Dyden Corporation

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCA0033FCT
$5^{+0.30}_{-0.00}$	MFMCA0053FCT
$10^{+0.40}_{-0.00}$	MFMCA0103FCT
$20^{+0.60}_{-0.00}$	MFMCA0203FCT

Part No.	MFMCA0 ＊＊ 3FUT	Applicable model	MSMF 3.0 kW to 5.0 kW, MDMF 3.0 kW to 5.0 kW MHMF 3.0 kW to 5.0 kW, MGMF 2.9kW,4.4 kW (One-touch lock type)

[Unit: mm]



Title		Part No.	Manufacturer
Connector		JL10-6A24-11SE-EB	Japan Aviation Electronics Ind.
Cable clamp		JL04-2428CK(17)-R	Japan Aviation Electronics Ind.
Nylon insulated round terminal	Earth	N5.5-5	J.S.T Mfg. Co., Ltd.
Nylon insulated round terminal	Brake	N1.25-M4	J.S.T Mfg. Co., Ltd.
Cable		ROBO-TOP DP6/2501 0.75 mm² 2-wire ROBO-TOP DP6/2501 3.5 mm² 4-wire	Dyden Corporation

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCA0033FUT
$5^{+0.30}_{-0.00}$	MFMCA0053FUT
$10^{+0.40}_{-0.00}$	MFMCA0103FUT
$20^{+0.60}_{-0.00}$	MFMCA0203FUT

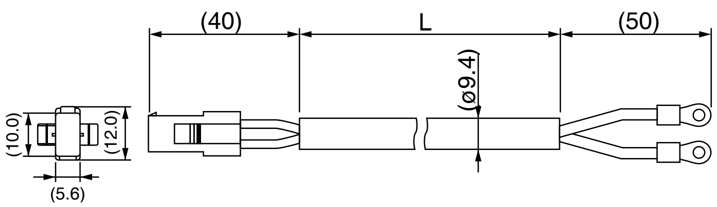
Caution Option cable does not conform to IP65 and IP67.

Related page
• P.2-40“Specifications of Motor Connector”

Junction Cable for Brake

Part No.	MFMCB0 ＊＊ 0GET	Applicable model	MSMF 50 W to 1.0 kW(□ 80) MQMF 100 W to 400 W MHMF 50 W to 1.0 kW(□ 80) (Leadwire type)

[Unit: mm]

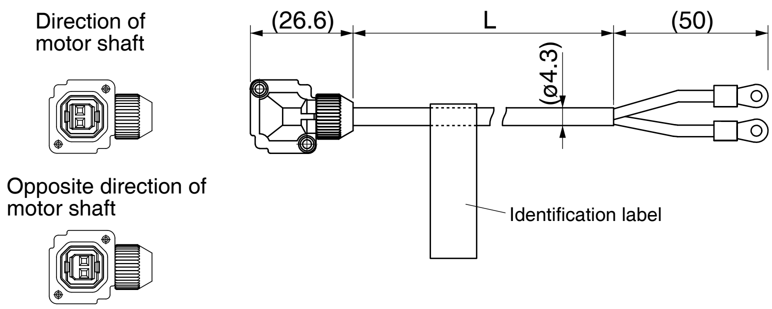


Title	Part No.	Manufacturer
Connector	172157-1	Tyco Electronics
Connector pin	170366-1, 170362-1	Tyco Electronics
Nylon insulated round terminal	N1.25-M4	J.S.T Mfg. Co., Ltd.
Cable	ROBO-TOP 600 V 0.75 mm² 2-wire	Dyden Corporation

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCB0030GET
$5^{+0.30}_{-0.00}$	MFMCB0050GET
$10^{+0.40}_{-0.00}$	MFMCB0100GET
$20^{+0.60}_{-0.00}$	MFMCB0200GET

Part No.		Applicable model	
	MFMCB0 ＊＊ 0PJT (Highly bendable type, Direction of motor shaft) MFMCB0 ＊＊ 0PKT (Highly bendable type, Opposite direction of motor shaft) MFMCB0 ＊＊ 0SJT (Standard bendable type, Direction of motor shaft) MFMCB0 ＊＊ 0SKT (Standard bendable type, Opposite direction of motor shaft)		MSMF 50 W to 1.0 kW(□80) (Connector type)

[Unit: mm]



Title	Part No.	Manufacturer
Connector	JN4FT02SJMR	Japan Aviation Electronics Ind.
Connector pin	ST-TMH-S-C1B-3500	Japan Aviation Electronics Ind.
Nylon insulated round terminal	N1.25-M4	J.S.T Mfg. Co., Ltd.
Cable	AWG22 2-wire	Hitachi Cable, Ltd.

L (m)	Part No.
$3^{+0.26}_{-0.00}$	MFMCB0030PJT
$5^{+0.30}_{-0.00}$	MFMCB0050PJT
$10^{+0.40}_{-0.00}$	MFMCB0100PJT
$20^{+0.60}_{-0.00}$	MFMCB0200PJT

Caution Option cable does not conform to IP65 and IP67.

Related page
• P.2-40"Specifications of Motor Connector"

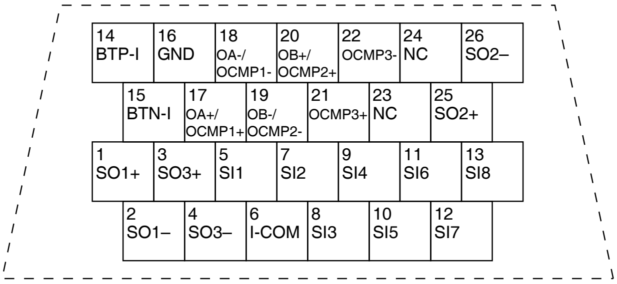
Connector Kit for Interface

Part No.	DV0P0770

• Components

Title	Part No.	Number	Manufacturer	Note
Connector	10126-3000PE	1	Sumitomo 3M (or equivalent)	For Connector X4 (26-pins)
Connector cover	10326-52A0-008	1		

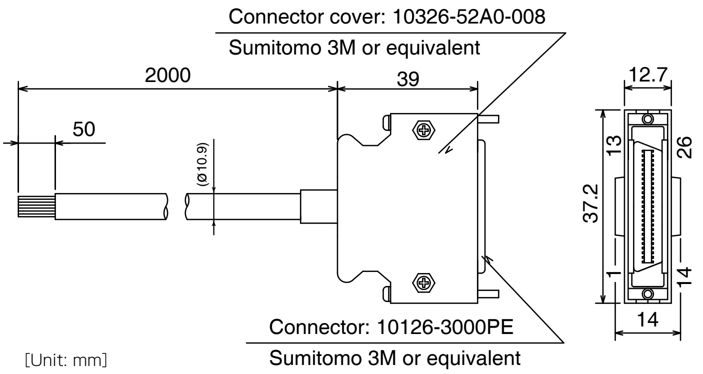
• Pin disposition (26 pins) (viewed from the soldering side)



1) Check the stamped pin-No. on the connector body while making a wiring.
2) For the function of each signal title or its symbol, refer to the wiring example of the connector X4.
3) Do not connect anything to NC pins in the above table.

Interface Cable

Part No.	DV0P0800



This 2 m connector cable contains AWG26 conductors.

• Table for wiring

Pin No.	Signal	color	Pin No.	Signal	color	Pin No.	Signal	color
1	SO1+	Orange (Red1)	10	SI5	Pink (Black1)	19	OB–	Pink (Red2)
2	SO1–	Orange (Black1)	11	SI6	Yellow (Red2)	20	OB+	Pink (Black2)
3	SO3+	Gray (Red1)	12	SI7	Orange (Black2)	21	NC	Orange (Red3)
4	SO3–	Gray (Black1)	13	SI8	Gray (Red2)	22	NC	Gray (Red3)
5	SI1	White (Red1)	14	BTP-I	Gray (Black2)	23	NC	Gray (Black3)
6	I-COM	White (Black1)	15	BTN-I	White (Red2)	24	NC	White (Red3)
7	SI2	Yellow (Red1)	16	GND	White (Black2)	25	SO2+	White (Black3)
8	SI3	Yellow (Black1)	17	OA+	Yellow (Red2)	26	SO2–	Yellow (Black3)
9	SI4	Pink (Red1)	18	OA–	Yellow (Black2)			

<Remarks>

Color designation of the cable e.g.) Pin-1 Cable color : Orange (Red1) : One red dot on the cable

The shield of this cable is connected to the connector shell but not to the terminal.

Related page
・P.2-47"Wiring to the Connector,X4"

Connector Kit for Encoder

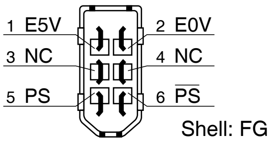
Part No.	DV0PM20010

• Components

Title	Part No.	Manufacturer	Note
Connector	3E206-0100 KV	Sumitomo 3M [*1]	For Connector X6
Shell kit	3E306-3200-008		

*1 Old model number: 55100-0670 (Japan Molex Inc.)

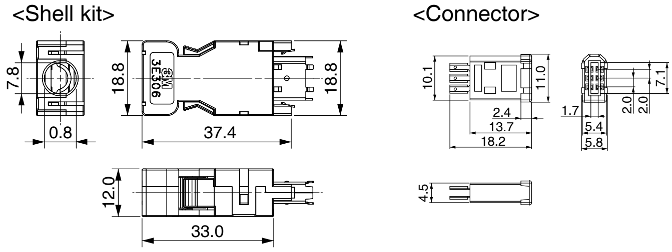
• Pin disposition of connector, connector X6



(Viewed from cable)
<Remarks> Do not connect anything to NC pins.

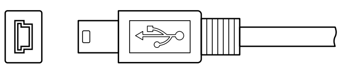
• Dimensions

[Unit: mm]



Remarks

• Connector X1: use with commercially available cable.
  • Configuration of connector X1: USB mini-B



• For crimp tool etc., necessary to produce a cable, access the web site of the manufacturer or consult with the manufacturer for details. For inquiries of manufacturer, refer to P.7-107 "List of Peripheral Equipments".

Connector Kit for Power Supply Input

Part No.	**DV0PM20032** (For A to D-frame: Single row type)

- **Components**

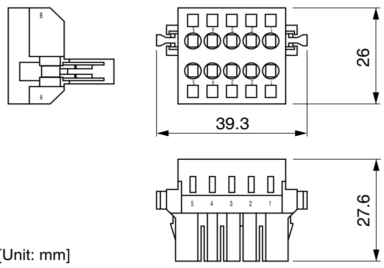
Title	Part No.	Number	Manufacturer	Note
Connector	05JFAT-SAXGF	1	J.S.T Mfg. Co., Ltd.	For Connector XA
Handle lever	J-FAT-OT	2		

Part No.	**DV0PM20033** (For A to D-frame: Double row type)

- **Components**

Title	Part No.	Number	Manufacturer	Note
Connector	05JFAT-SAXGSA-C	1	J.S.T Mfg. Co., Ltd.	For Connector XA
Handle lever	J-FAT-OT	2		

- **Dimensions**



[Unit: mm]

* When connection multiple axes in series, make sure the sum of the current value does not exceed the rated current (11.25 A) of DV0PM20033.

Remarks

When using drivers MDDL∗55∗∗ in single-phase power supply, do not use DV0PM20033.

Driver part No.	Power supply	Rated input current
MADL ∗ 01 ∗ ∗	Single phase 100 V	1.7 A
MADL ∗ 11 ∗ ∗	Single phase 100 V	2.0 A
MADL ∗ 05 ∗ ∗	Single phase/3-phase 200 V	1.6 A/0.9 A
MADL ∗ 15 ∗ ∗	Single phase/3-phase 200 V	2.0 A/1.1 A
MBDL ∗ 21 ∗ ∗	Single phase 100 V	4.5 A
MBDL ∗ 25 ∗ ∗	Single phase/3-phase 200 V	3.7 A/2.1 A
MCDL ∗ 31 ∗ ∗	Single phase 100 V	7.0 A
MCDL ∗ 35 ∗ ∗	Single phase/3-phase 200 V	6.4 A/3.4 A
MDDL ∗ 45 ∗ ∗	Single phase/3-phase 200 V	7.9 A/4.6 A
MDDL ∗ 55 ∗ ∗	Single phase/3-phase 200 V	13.6 A/7.2 A

Part No.	**DV0PM20044** (For E-frame 200 V)

- **Components**

Title	Part No.	Number	Manufacturer	Note
Connector	05JFAT-SAXGSA-L	1	J.S.T Mfg. Co., Ltd.	For Connector XA
Handle lever	J-FAT-OT-L	2		

Connector Kit for Regenerative Resistor Connection

Part No.	**DV0PM20045** (For E-frame)

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector	05JFAT-SAXGSA-L	1	J.S.T Mfg. Co., Ltd.	For Connector XC
Handle lever	J-FAT-OT-L	2		

Connector Kit for Motor Connection

Part No.	**DV0PM20034** (For A to D-frame)

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector	06JFAT-SAXGF	1	J.S.T Mfg. Co., Ltd.	For Connector XB
Handle lever	J-FAT-OT	2		

Part No.	**DV0PM20046** (For E-frame)

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector	03JFAT-SAXGSA-L	1	J.S.T Mfg. Co., Ltd.	For Connector XB
Handle lever	J-FAT-OT-L	2		

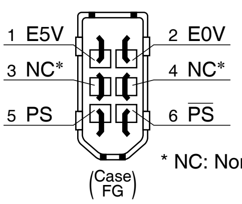
Connector Kit for Motor/Encoder Connection

Part No.	**DV0P4290**	Applicable model	MSMF 50 W to 1.0 kW(□ 80) MQMF 100 W to 400 W MHMF 50 W to 1.0 kW(□ 80)	Without brake

• **Components**

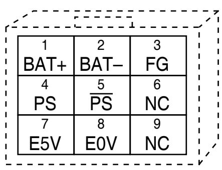
Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent)	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Connector	172161-1	1	Tyco Electronics	For Encoder cable (9-pins)
Connector pin	170365-1	9		
Connector	172159-1	1	Tyco Electronics	For Motor cable (4-pins)
Connector pin	170366-1	4		

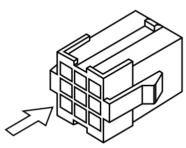
• Pin disposition of connector connector X6



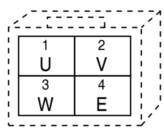
* NC: None Connect

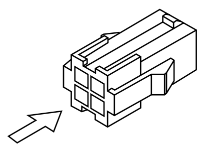
• Pin disposition of connector for encoder cable





• Pin disposition of connector for motor cable



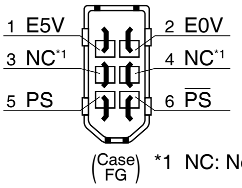


Part No.	DV0PM20035	Applicable model	MSMF 50 W to 1.0 kW (Connector Type IP67)	Without brake

• **Components**

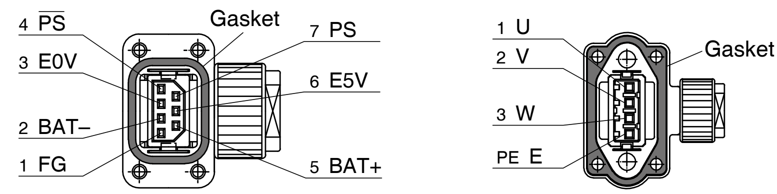
Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent) *1	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Encoder connector	N/MS3106B20-29S	1	Japan Aviation Electronics Ind.	For Encoder cable
Cable clamp	N/MS3057-12A	1		

*1 Old model number: Connector 55100-0670 (Japan Molex Inc.)

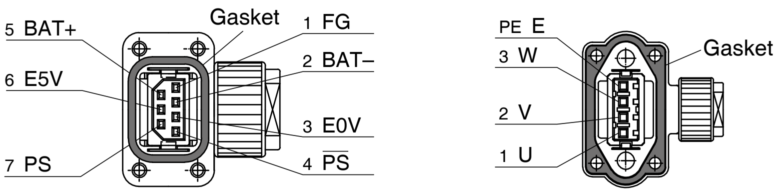


*1 NC: None Connect

[Direction of motor shaft]



[Opposite direction of motor shaft]



<Remarks>
Secure the gasket in place without removing it from the connector.
Otherwise, the degree of protection of IP67 will not be guaranteed.

Part No.	DV0PM20036	Applicable model	MSMF 1.0 kW(□ 100) to 2.0 kW MDMF 1.0 kW to 2.0 kW MHMF 1.0 kW(□ 130),1.5 kW MGMF 0.85 kW to 1.8 kW	Without brake

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent) *1	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Encoder Connector	JN2DS10SL1-R	1	Japan Aviation Electronics Ind.	For Encoder cable
Connector pin	JN1-22-22S-PKG100	5		
Motor Connector	JL04V-6A-20-4SE-EB-R	1	Japan Aviation Electronics Ind.	For Motor cable
Cable clamp	JL04-2022CK(14)-R	1		

*1 Old model number: Connector 55100-0670 (Japan Molex Inc.)

Caution
• When IP65 or IP67 are necessary, the customer must give approriate processing.

Remarks
• For crimp tool etc., necessary to produce a cable, access the web site of the manufacturer or consult with the manufacturer for details. For inquiries of manufacturer, refer to P.7-107"List of Peripheral Equipments".

Part No.	DV0PM20037	Applicable model	MSMF 3.0 kW to 5.0 kW MDMF 3.0 kW to 5.0 kW MHMF 2.0 kW to 5.0 kW MGMF 2.9 kW,4.4 kW	Without brake

- **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent) *1	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Encoder Connector	JN2DS10SL1-R	1	Japan Aviation Electronics Ind.	For Encoder cable
Connector pin	JN1-22-22S-PKG100	5		
Motor Connector	JL04V-6A22-22SE-EB-R	1	Japan Aviation Electronics Ind.	For Motor cable
Cable clamp	JL04-2022CK(14)-R	1		

＊1 Old model number: Connector 55100-0670 (Japan Molex Inc.)

Part No.	DV0PM20038	Applicable model	MSMF 1.0 kW(□ 100) to 2.0 kW MDMF 1.0 kW to 2.0 kW MHMF 1.0 kW(□ 130),1.5 kW MGMF 0.85 kW to 1.8 kW	With brake

- **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent) *1	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Encoder Connector	JN2DS10SL1-R	1	Japan Aviation Electronics Ind.	For Encoder cable
Connector pin	JN1-22-22S-PKG100	5		
Motor Connector	JL04V-6A20-18SE-EB-R	1	Japan Aviation Electronics Ind.	For Motor cable
Cable clamp	JL04-2022CK(14)-R	1		

＊1 Old model number: Connector 55100-0670 (Japan Molex Inc.)

Part No.	DV0PM20039	Applicable model	MSMF 3.0 kW to 5.0 kW MDMF 3.0 kW to 5.0 kW MHMF 2.0 kW to 5.0 kW MGMF 2.9 kW,4.4 kW	With brake

- **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent) *1	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Encoder Connector	JN2DS10SL1-R	1	Japan Aviation Electronics Ind.	For Encoder cable
Connector pin	JN1-22-22S-PKG100	5		
Motor Connector	JL04V-6A24-11SE-EB-R	1	Japan Aviation Electronics Ind.	For Motor cable
Cable clamp	JL04-2428CK(17)-R	1		

＊1 Old model number: Connector 55100-0670 (Japan Molex Inc.)

Part No.	DV0P4310	Applicable model	MSMF 1.0 kW(□ 100) to 2.0 kW MDMF 1.0 kW to 2.0 kW MHMF 1.0 kW(□ 130),1.5 kW MGMF 0.85 kW to 1.8 kW	Without brake

- **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent) *1	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Encoder Connector	N/MS3106B20-29S	1	Japan Aviation Electronics Ind.	For Encoder cable
Connector pin	N/MS3057-12A	1		
Motor Connector	N/MS3106B20-4S	1	Japan Aviation Electronics Ind.	For Motor cable
Cable clamp	N/MS3057-12A	1		

＊1 Old model number: Connector 55100-0670 (Japan Molex Inc.)

Part No.	DV0P4320	Applicable model	MSMF 3.0 kW to 5.0 kW MDMF 3.0 kW to 5.0 kW MHMF 2.0 kW to 5.0 kW MGMF 2.9 kW,4.4 kW	Without brake

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent) *1	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Encoder Connector	N/MS3106B20-29S	1	Japan Aviation Electronics Ind.	For Encoder cable
Connector pin	N/MS3057-12A	1		
Motor Connector	N/MS3106B22-22S	1	Japan Aviation Electronics Ind.	For Motor cable
Cable clamp	N/MS3057-12A	1		

*1 Old model number: Connector 55100-0670 (Japan Molex Inc.)

Part No.	DV0P4330	Applicable model	MSMF 1.0 kW(□ 100) to 2.0 kW MDMF 1.0 kW to 2.0 kW MHMF 1.0 kW(□ 130),1.5 kW MGMF 0.85 kW to 1.8 kW	With brake

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent) *1	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Encoder Connector	N/MS3106B20-29S	1	Japan Aviation Electronics Ind.	For Encoder cable
Connector pin	N/MS3057-12A	1		
Motor Connector	N/MS3106B20-18S	1	Japan Aviation Electronics Ind.	For Motor cable
Cable clamp	N/MS3057-12A	1		

*1 Old model number: Connector 55100-0670 (Japan Molex Inc.)

Part No.	DV0P4340	Applicable model	MSMF 3.0 kW to 5.0 kW MDMF 3.0 kW to 5.0 kW MHMF 2.0 kW to 5.0 kW MGMF 2.9 kW,4.4 kW	With brake

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent) *1	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Encoder Connector	N/MS3106B20-29S	1	Japan Aviation Electronics Ind.	For Encoder cable
Connector pin	N/MS3057-12A	1		
Motor Connector	N/MS3106B24-11S	1	Japan Aviation Electronics Ind.	For Motor cable
Cable clamp	N/MS3057-16A	1		

*1 Old model number: Connector 55100-0670 (Japan Molex Inc.)

Connector Kit for Motor/Brake Connection

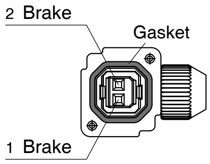
Part No.	DV0PM20040

• **Components**

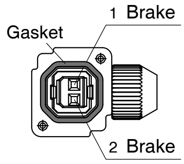
Title	Part No.	Number	Manufacturer	Note
Connector	JN4FT02SJM-R	1	Japan Aviation Electronics Ind.	For brake cable
Socket contact	ST-TMH-S-C1B-3500	2		

• Pin disposition of connector for brake cable

[Direction of motor shaft]



[Opposite direction of motor shaft]



<Remarks>

Secure the gasket in place without removing it from the connector.
Otherwise, the degree of protection of IP67 will not be guaranteed.

Connector Kit for Motor/Encoder Connection

Part No.	DV0PM24581	Applicable model	MHMF 50 W , 100 W (Connector type)	With/ Without brake

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent)	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Connector	JN6FR07SM1	1	Japan Aviation Electronics Ind.	For Encoder cable (7-pins)
Connector pin	LY10-C1-A1-10000	7		
Connector	JN11FH06SN2	1	Japan Aviation Electronics Ind.	For Motor cable (6-pins)
Connector pin	JN11S10K4A1	6		

Part No.	DV0PM24582	Applicable model	MQMF 100W to 400W , MHMF 200 W to 1.0 kW (□ 80) (Connector type)	With brake

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent)	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Connector	JN6FR07SM1	1	Japan Aviation Electronics Ind.	For Encoder cable (7-pins)
Connector pin	LY10-C1-A1-10000	7		
Connector	JN11FH06SN1	1	Japan Aviation Electronics Ind.	For Motor cable (6-pins)
Connector pin	JN11S35H3A1	6		

Part No.	DV0PM24583	Applicable model	MSMF 1.0 kW to 2.0 kW MDMF 1.0 kW to 2.0 kW MHMF 1.0 kW to 2.0 kW MGMF 0.85 kW to 1.8 kW (For Encoder connector :JN2 One-touch lock type)	Without brake

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent)	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Connector	JN2DS10SL1-R	1	Japan Aviation Electronics Ind.	For Encoder cable
Connector pin	JN1-22-22S-PKG100	5		
Connector	JL10-6A20-4SE-EB	1	Japan Aviation Electronics Ind.	For Motor cable
Connector pin	JL04-2022-CK(14)-R	1		

Connector Kit for Motor/Encoder Connection

Part No.	DV0PM24584	Applicable model	MSMF 3.0 kW to 5.0 kW MDMF 3.0 kW to 5.0 kW MHMF 2.0 kW to 5.0 kW MGMF 2.9 kW to 4.4 kW (For Encoder connector :JN2 One-touch lock type)	Without brake

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent)	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Connector	JN2DS10SL1-R	1	Japan Aviation Electronics Ind.	For Encoder cable
Connector pin	JN1-22-22S-PKG100	5		
Connector	JL10-6A22-22SE-EB	1	Japan Aviation Electronics Ind.	For Motor cable
Connector pin	JL04-2022-CK(14)-R	1		

Part No.	DV0PM24585	Applicable model	MSMF 1.0 kW (□ 100) to 2.0 kW MDMF 1.0 kW to 2.0 kW MHMF 1.0 kW (□ 130) to 1.5 kW MGMF 0.85kW to 1.8kW (For Encoder connector :JN2 One-touch lock type)	With brake

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent)	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Connector	JN2DS10SL1-R	1	Japan Aviation Electronics Ind.	For Encoder cable
Connector pin	JN1-22-22S-PKG100	1		
Connector	JL10-6A20-18SE-EB	5	Japan Aviation Electronics Ind.	For Motor cable
Cable clamp	JL04-2022-CK(14)-R	1		

Part No.	DV0PM24586	Applicable model	MSMF 3.0 kW to 5.0 kW MDMF 3.0 kW to 5.0 kW MHMF 2.0 kW to 5.0 kW MGMF 2.9 kW to 4.4 kW (For Encoder connector :JN2 One-touch lock type)	With brake

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent)	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Connector	JN2DS10SL1-R	1	Japan Aviation Electronics Ind.	For Encoder cable
Connector pin	JN1-22-22S-PKG100	5		
Connector	JL10-6A24-11SE-EB	1	Japan Aviation Electronics Ind.	For Motor cable
Cable clamp	JL04-2428-CK(17)-R	1		

Part No.	DV0PM24587	Applicable model	MSMF 1.0 kW (□ 100) to 2.0 kW MDMF 1.0 kW to 2.0 kW MHMF 1.0 kW (□ 130) to 1.5 kW MGMF 0.85 kW to 1.8 kW (For Encoder connector :JL10 One-touch lock type)	Without brake

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	Sumitomo 3M (or equivalent)	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Connector	JL10-6A20-29S-EB	1	Japan Aviation Electronics Ind.	For Encoder cable
Connector pin	JL04-2022-CK(09)-R	1		
Connector	JL10-6A20-4SE-EB	1	Japan Aviation Electronics Ind.	For Motor cable
Cable clamp	JL04-2022-CK(14)-R	1		

Connector Kit for Motor/Encoder Connection

Part No.	DV0PM24588	Applicable model	MSMF 3.0 kW to 5.0 kW MDMF 3.0 kW to 5.0 kW MHMF 2.0 kW to 5.0 kW MGMF 2.4 kW to 4.4 kW (For Encoder connector :JL10 One-touch lock type)	Without brake

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E06-0100KV	1	Sumitomo 3M (or equivalent)	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Connector	JL10-6A20-29S-EB	1	Japan Aviation Electronics Ind.	For Encoder cable
Connector pin	JL04-2022-CK(09)-R	1		
Connector	JL10-6A22-22SE-EB	1	Japan Aviation Electronics Ind.	For Motor cable
Cable clamp	JL04-2022-CK(14)-R	1		

Part No.	DV0PM24589	Applicable model	MSMF 1.0 kW (□ 100) to 2.0 kW MDMF 1.0 kW to 2.0 kW MHMF 1.0 kW (□ 130) to 1.5 kW MGMF 0.85kW to 1.8kW (For Encoder connector :JL10 One-touch lock type)	With brake

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E06-0100KV	1	Sumitomo 3M (or equivalent)	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Connector	JL10-6A20-29S-EB	1	Japan Aviation Electronics Ind.	For Encoder cable
Connector pin	JL04-2022-CK(09)-R	1		
Connector	JL10-6A20-18SE-EB	1	Japan Aviation Electronics Ind.	For Motor cable
Connector pin	JL04-2022-CK(14)-R	1		

Part No.	DV0PM24590	Applicable model	MSMF 3.0 kW to 5.0 kW MDMF 3.0 kW to 5.0 kW MHMF 2.0 kW to 5.0 kW MGMF 2.9 kW to 4.4 kW (For Encoder connector :JL10 One-touch lock type)	With brake

• **Components**

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E06-0100KV	1	Sumitomo 3M (or equivalent)	For Connector X6 (6-pins)
Shell kit	3E306-3200-008	1		
Connector	JL10-6A20-29S-EB	1	Japan Aviation Electronics Ind.	For Encoder cable
Connector pin	JL04-2022-CK(09)-R	1		
Connector	JL10-6A24-11SE-EB	1	Japan Aviation Electronics Ind.	For Motor cable
Connector pin	JL04-2428-CK(17)-R	1		

Connector Kit for Safety(Not Applicable to A6N Standard Type)

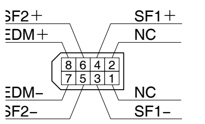
Part No.	DV0PM20025

• **Components**

Title	Part No.
Connector	2013595-1

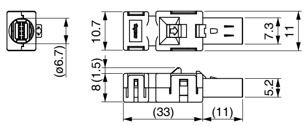
Manufacturer	Note
Tyco Electronics Japan G.K	For Connector X3 (8-pins)

• Pin disposition of connector, connector X3



Shell: FG
(Viewed from cable)
<Remarks>
Do not connect anything to NC pins.

• Dimensions
[Unit: mm]



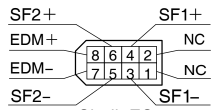
Part No.	DV0PM20103

• **Components**

Title	Part No.
Connector	CIF-PCNS08KK-071R

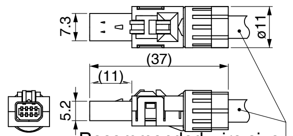
Manufacturer	Note
J.S.T Mfg. Co., Ltd.	For Connector X3 (8-pins)

• Pin disposition of connector, connector X3



Shell: FG
(Viewed from cable)
<Remarks>
Do not connect anything to NC pins.

• Dimensions
[Unit: mm]



Recommended wire size: ø5.8 mm（MAX）
Note）No wires are supplied wiith the connector kit.

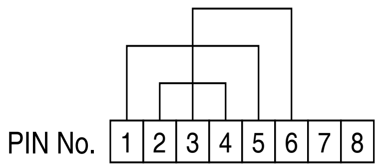
Safety Bypass Plug(Not Applicable to A6N Standard Type)

Part No.	DV0PM20094

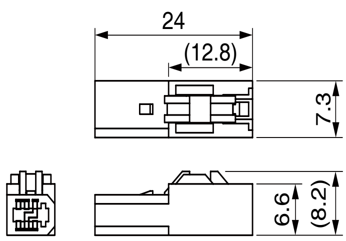
• **Components**

Title	Part No.	Manufacturer	Note
Connector	CIF-PB08AK-GF1R	J.S.T Mfg. Co., Ltd.	For Connector X3

• Internal wiring
(Wiring of the following has been applied inside the plug.)



• Dimensions (Resin color : black)
[Unit: mm]



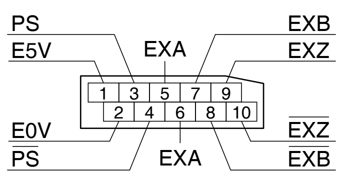
Connector Kit for External Scale(Not Applicable to A6N Standard Type)

Part No.	DV0PM20026

• **Components**

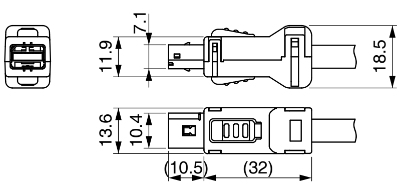
Title	Part No.	Manufacturer	Note
Connector	MUF-PK10K-X	J.S.T Mfg. Co., Ltd.	For Connector X5

• Pin disposition of connector, connector X5



(Viewed from cable)

• Dimensions
[Unit: mm]

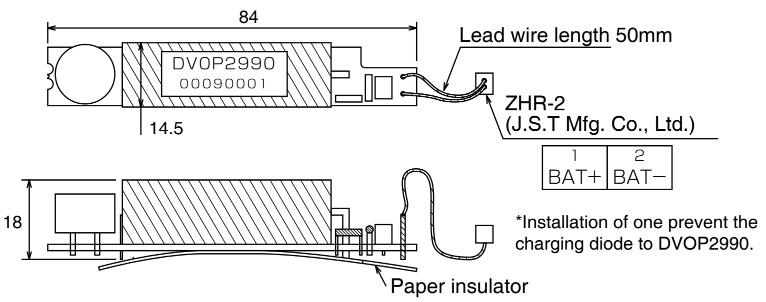


Battery for Absolute Encoder

Part No.	DV0P2990

• Lithium battery: 3.6 V 2000 mAh

[Unit: mm]



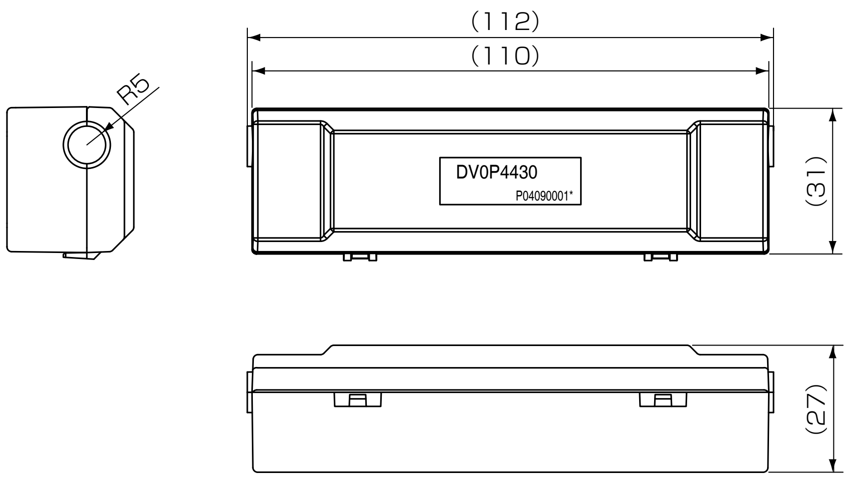
Caution This battery is categorized as hazardous substance, and you may be required to present an application of hazardous substance when you transport by air (both passenger and cargo airlines).

Battery Box for Absolute Encoder

Part No.	DV0P4430

• **Components**

[Unit: mm]



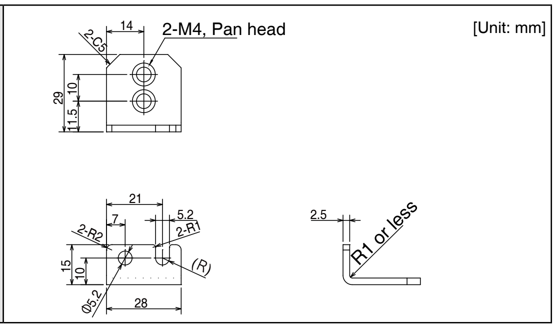
Related page • P.7-2 “Absolute System”

7. Options

Mounting Bracket

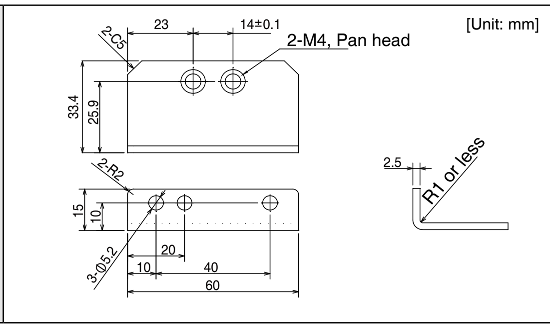
Part No.	DV0PM20100	Frame symbol of applicable driver	A-frame B-frame	Mounting screw	Upper and Bottom side sharing 2pcs M4 x L6 Pan head 4pcs

Dimensions – Upper side and Bottom side

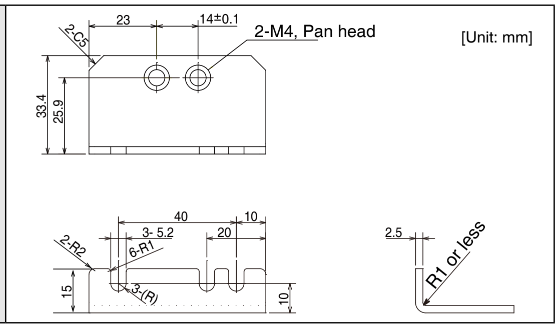


Part No.	DV0PM20101	Frame symbol of applicable driver	C-frame D-frame	Mounting screw	Upper side 2pcs Bottom side 2pcs M4 x L6 Pan head 4pcs

Dimensions – Upper sid



Bottom side



Caution

For E, F-frame, you con make a front end and back end mounting by changing the mounting direction of L-shape bracket (attachment).

Related page

• P.7-32... “Dimensions Driver”

Reactor

Fig.1

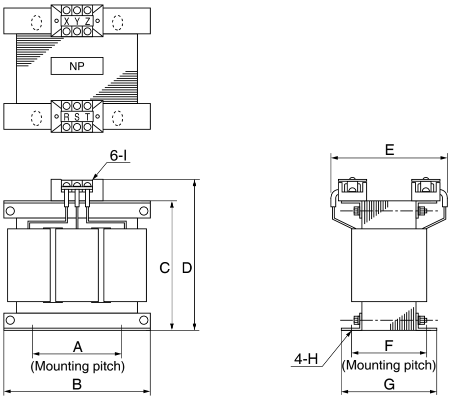
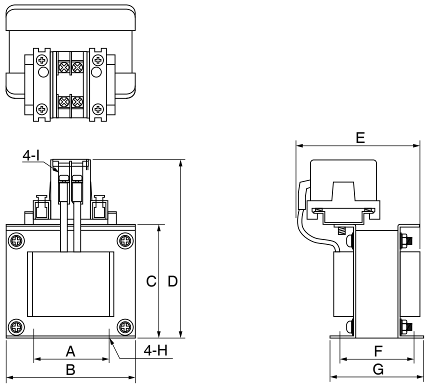
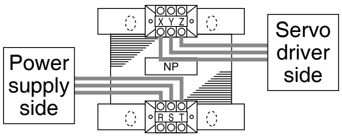
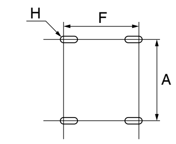


Fig.2



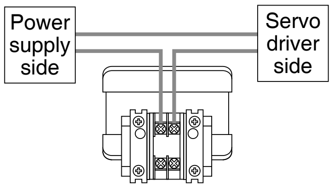
• Wiring of the reactor <3-Phase>

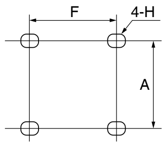




F: Center-to-center distance on outer circular arc

• Wiring of the reactor <Single phase>





F: Center-to-center distance on slotted hole

[単位：mm]

	Part No.	A	B	C	D	E (Max)	F	G	H	I	Inductance (mH)	Rated current (A)
Fig.1	**DV0P220**	65±1	125±1	(93)	136Max	155	70+3/–0	85±2	4-7ϕ×12	M4	6.81	3
	DV0P221	60±1	150±1	(113)	155Max	130	60+3/–0	75±2	4-7ϕ×12	M4	4.02	5
	DV0P222	60±1	150±1	(113)	155Max	140	70+3/–0	85±2	4-7ϕ×12	M4	2	8
	DV0P223	60±1	150±1	(113)	155Max	150	79+3/–0	95±2	4-7ϕ×12	M4	1.39	11
	DV0P224	60±1	150±1	(113)	160Max	155	84+3/–0	100±2	4-7ϕ×12	M5	0.848	16
	DV0P225	60±1	150±1	(113)	160Max	170	100+3/–0	115±2	4-7ϕ×12	M5	0.557	25
Fig.2	**DV0P227**	55±0.7	80±1	66.5±1	110Max	90	41±2	55±2	4-5ϕ×10	M4	4.02	5
	DV0P228	55±0.7	80±1	66.5±1	110Max	95	46±2	60±2	4-5ϕ×10	M4	2	8
	DV0PM20047	55±0.7	80±1	66.5±1	110Max	105	56±2	70±2	4-5ϕ×10	M4	1.39	11

Driver series	Power supply	Rated output	Part No.
MADL□ 01N□	single phase 100V	50 W	DV0P227
MADL□ 11N□		100 W	
MBDL□ 21N□		200 W	DV0P228
MCDL□ 31N□		400 W	
MADL□ 05N□	single phase 200V	50 W	DV0P227
MADL□ 05N□		100 W	
MADL□ 15N□		200 W	
MBDL□ 25N□		400 W	DV0P228
MCDL□ 35N□		750 W	
MDDL□ 45N□		1.0 kW	
MDDL□ 55N□		1.5 kW	DV0PM20047

Driver series	Power supply	Rated output	Part No.
MADL□ 05N□	3-phase, 200 V	50 W	DV0P220
MADL□ 05N□		100 W	
MADL□ 15N□		200 W	
MBDL□ 25N□		400 W	
MCDL□ 35N□		750 W	
MDDL□ 45N □ 1		850 W	DV0P221
MDDL□ 45N□		1.0 kW	DV0P222
MDDL□ 55N□		1.5 kW	
MEDL□ 83N□		2.0 kW	DV0P223
MFDL□ A3N□		3.0 kW	DV0P224
MFDL□ B3N□		5.0 kW	DV0P225

When using a reactor, be sure to install one reactor to one servo driver.

*1 When using MGMF 0.85 kW motor.

Related page • P.1-15 “Check of the Combination of the Driver and the Motor”

Harmonic Restraint

Harmonic restraint measures are not common to all countries. Therefore, prepare the measures that meet the requirements of the destination country.
With products for Japan, on September, 1994, “Guidelines for harmonic restraint on heavy consumers who receive power through high voltage system or extra high voltage system” and “Guidelines for harmonic restraint on household electrical appliances and general-purpose articles” established by the Agency for Natural Resources and Energy of the Ministry of Economy, Trade and Industry (the ex-Ministry of International Trade and Industry). According to those guidelines, the Japan Electrical Manufacturers’ Association (JEMA) have prepared technical documents (procedure to execute harmonic restraint: JEM-TR 198, JEM-TR 199 and JEM-TR 201) and have been requesting the users to understand the restraint and to cooperate with us. On January, 2016, it has been decided to exclude the general-purpose inverter and servo driver from the “Guidelines for harmonic restraint on household electrical appliances and general-purpose articles”. After that, the “Guidelines for harmonic restraint on household electrical appliances and general-purpose articles” was abolished on September 6, 2016.
We are pleased to inform you that the procedure to execute the harmonic restraint on general-purpose inverter and servo driver was modified as follows.

1. All types of the general-purpose inverters and servo drivers used by specific users are under the control of the “Guidelines for harmonic restraint on heavy consumers who receive power through high voltage system or extra high voltage system”. The users who are required to apply the guidelines must calculate the equivalent capacity and harmonic current according to the guidelines and must take appropriate countermeasures if the harmonic current exceeds a limit value specified in a contract demand. (Refer to JEM-TR 210 and JEM-TR 225. ※)
2. The “Guidelines for harmonic restraint on household electrical appliances and general-purpose articles” was abolished on September 6, 2016. However, based on conventional guidelines, JEMA applies the technical documents JEM-TR 226 and JEM-TR 227 to any users who do not fit into the “Guidelines for harmonic restraint on heavy consumers who receive power through high voltage system or extra high voltage system” from a perspective on enlightenment on general harmonic restraint. The purpose of these guidelines is the execution of harmonic restraint at every device by a user as usual to the utmost extent.

※ Technical reference issued by JEMA (Japan Electrical Manufacturers’ Association) .

7. Options

External Regenerative Resistor

Part No.	Manufacturer's part No.	Specifications: Resistance	cable core outside diameter	Mass	Rated power (reference) *1: Free air	with fan*2	Activation temperature of built-in thermal protector
		Ω	mm	kg	W	W	
DV0P4280	RF70M	50	ϕ1.27 (AWG18 stranded wire)	0.1	10	25	140±5 ˚C B-contact Open/Close capacity (resistance load) 1 A 125 VAC 6000 times 0.5 A 250 VAC 10000 times
DV0P4281	RF70M	100		0.1	10	25	
DV0P4282	RF180B	25		0.4	17	50	
DV0P4283	RF180B	50		0.2	17	50	
DV0P4284	RF240	30		0.5	40	100	
DV0P4285	RH450F	20		1.2	52	130	

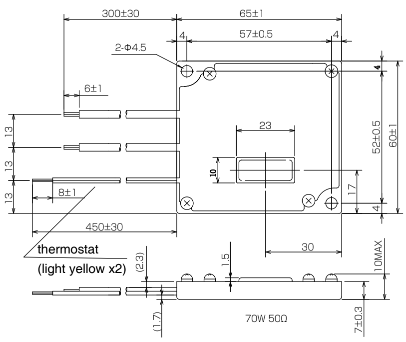
Manufacturer : Iwaki Musen Kenkyusho

*1 Power with which the driver can be used without activating the built-in thermal protector.
A built-in thermal fuse and a thermal protector are provided for safety.
The built-in thermal fuse blows depending on changes in heat dissipation condition, operating temperature limit, power supply voltage or load.
Mount the regenerative resistor on a machine operating under aggressive regenerating condition (high power supply voltage, large load inertia, shorter deceleration time, etc.) and make sure that the surface temperature will not exceed 100 °C.
Select and install a fan that maintains the surface temperature of regenerative resistor at 100 °C or below during operation.

*2 If the wind speed is 1m / s by the fan.

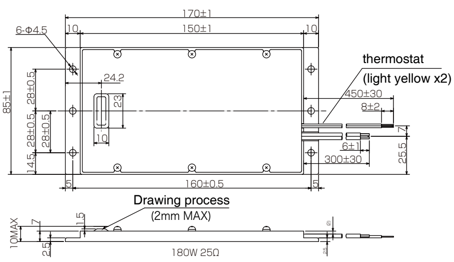
Frame	Power supply: Single phase, 100 V	Single phase, 200 V / 3-phase, 200 V
A	DV0P4280	DV0P4281 (below 100 W) DV0P4283 (200 W)
B	DV0P4283	DV0P4283
C	DV0P4282	
D	—	DV0P4284
E		DV0P4284 × 2 in parallel or DV0P4285
F		DV0P4285 × 2 in parallel

DV0P4280

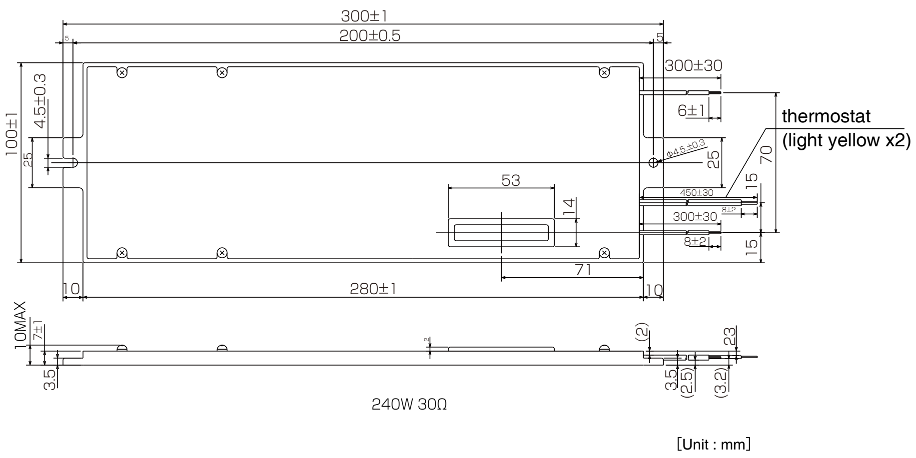


[Unit : mm]

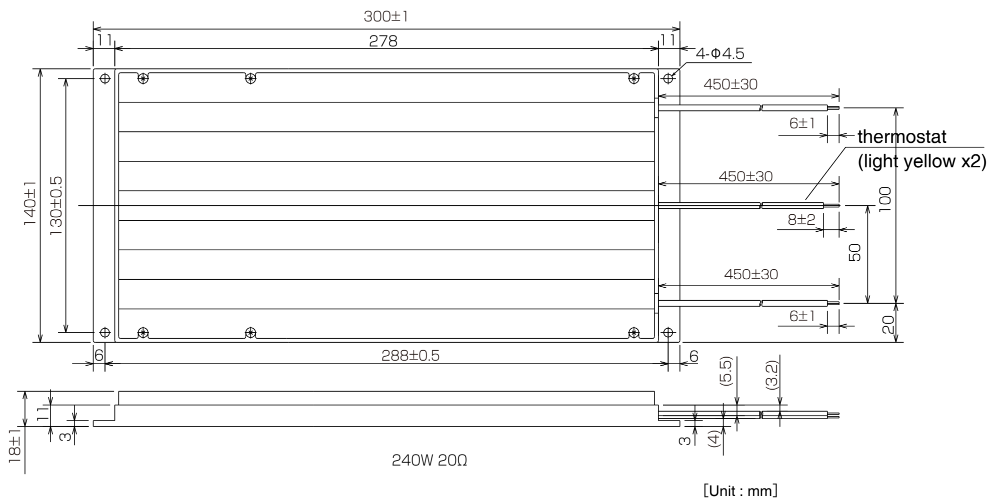
DV0P4282



DV0P4284



DV0P4285



<Caution when using external regenerative resistor>

Regenerative resistor gets very hot.

Configure a circuit so that a power supply shuts down when built-in thermal protector of the regenerative resistor works. Because it is automatic reset thermal protector, please apply a self-holding circuit to the outside in order to maintain safety in case of sudden activation. During the failure of the driver, the surface temperature of the regenerative resistor may exceed the operating temperature before thermal protector starts to work.
Built-in thermal fuse of regenerative resistor is intended to prevent from ignition during the failure of the driver and not intended to suppress the surface temperature of the resistor.

- Be attached the regenerative resistance to non-combustible material such as metal.
- Built-in thermal fuse of regenerative resistor is intended to prevent from ignition during the failure of the driver and not intended to suppress the surface temperature of the resistor.
- Do not install the regenerative resistor near flammable materials.

Surge Absorber for Motor Brake

Motor		Part No.	Manufacturer
MSMF	50 W ～ 1.0 kW(□80)	TND15G271K	NIPPON CHEMI-CON CORPORATION
	1.0 kW(□100) ～ 3.0 kW	Z15D151	SEMITEC Corporation
	4.0 kW,5.0 kW	TNR9G820K	NIPPON CHEMI-CON CORPORATION
MQMF	100 W ～ 400 W	TND15G271K	NIPPON CHEMI-CON CORPORATION
MDMF	1.0 kW ～ 3.0 kW	TNR9G820K	NIPPON CHEMI-CON CORPORATION
	4.0 kW	Z15D151	SEMITEC Corporation
	5.0 kW	NVD07SCD082	KOA Corporation
MGMF	0.85 kW ～ 1.8 kW	TNR9G820K	NIPPON CHEMI-CON CORPORATION
	2.4 kW,2.9 kW	Z15D151	SEMITEC Corporation
	4.4 kW	NVD07SCD082	KOA Corporation
MHMF	50 W ～ 1.0 kW(□80)	TND15G271K	NIPPON CHEMI-CON CORPORATION
	1.0 kW(□130),1.5 kW	TNR9G820K	NIPPON CHEMI-CON CORPORATION
	2.0 kW ～ 4.0 kW	Z15D151	SEMITEC Corporation
	5.0 kW	NVD07SCD082	KOA Corporation

7. Options

List of Peripheral Equipments

Manufacturer	Tel No.	Peripheral components
Panasonic Corporation Eco Solutions Company	81-120-878-365	Circuit breaker
Panasonic Corporation Automotive & Industrial Systems Company	81-120-878-365	Surge absorber
	81-120-101-550	Swich, Relay
Iwaki Musen Kenkyusho Co., Ltd.	81-44-833-4311	Regenerative resistor
NIPPON CHEMI-CON CORPORATION	Kanto area 81-3-5436-7711 Midland 81-52-772-8551 Kansai area 81-6-6338-2331	Surge absorber for holding brake
SEMITEC Corporation	Kanto area 81-3-3621-2703 Kansai area 81-6-6391-6491	
KOA CORPORATION	81-42-336-5300	
TDK Corp.	Kanto area 81-3-5201-7229 Midland 81-52-971-1712 Kansai area 81-6-6632-8140	Noise filter for signal lines
MICROMETALS (Nisshin Electric Co., Ltd.)	81-4-2934-4151	
KK-CORP.CO.JP	81-184-53-2307	
Okaya Electric Industries Co. Ltd.	Kanto area 81-3-4544-7040 Kansai area 81-6-6341-8815	Surge absorber Noise filter
Japan Aviation Electronics Industry, Ltd.	Kanto area 81-3-3780-2717 Midland 81-565-34-0600 Kansai area 81-6-6447-5268	Connector
Sumitomo 3M	Kanto area 81-3-5716-7290 Midland 81-52-220-7083 Kansai area 81-6-6447-3944	
Tyco Electronics	81-44-844-8052	
Japan Molex Inc.	Kanto area 81-462-65-2313 Midland 81-52-232-3977 Kansai area 81-6-6377-6760	
J.S.T. Mfg. Co., Ltd.	Kanto area 81-45-543-1271 Midland 81-561-33-0600 Kansai area 81-6-6210-2130	
Daiden Co., Ltd.	Kanto area 81-3-5805-5880 Midland 81-52-968-1710 Kansai area 81-6-6229-1881	Cable
Schaffner EMC, Inc.	81-3-5712-3650	Noise filter
TDK-Lambda Corporation	81-3-5201-7140	

Note Contact information shown above is as of October 2017
This list is for reference only and subject to change without notice.

MEMO

Warranty

Warranty Period

- Warranty period shall be 12 months from the ex-factory date or 18 months from the date of manufacturing.
  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, lightening, flood, damage from salt, abnor mal 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.
  Parts exceeding their standard lifetime specified in this document are excluded.

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.
  Panasonic in accordance with the above (1)records,in any case,the machine state is poor,and cause damage to your company and the third party,all liability,Panasonic is not responsible.
  [1] The machines are not assembled in accordance with the instructions or precautions noted in this specification.
  [2] When the machine does not match the product assembled in the machine.
  [3] This specification does not depend on your company.
  [4] When the machine condition is not caused by Panasonic reasons.

- Practical considerations for exporting the product or assembly containing the product
  When the end user of the product or end use of the product is associated with military affair or weapon, its export may be controlled by the Foreign Exchange and Foreign Trade Control Law. Complete review of the product to be exported and export formalities should be practiced.
- This product is intended to be used with a general industrial product, but not designed or manufactured to be used in a machine or system that may cause personal death when it is failed.
- Installation, wiring, operation, maintenance, etc., of the equipment should be done by qualified and experienced personnel.
- Apply adequate tightening torque to the product mounting screw by taking into consideration strength of the screw and the characteristics of material to which the product is installed. Overtightening can damage the screw and/or material; undertightening can result in loosening.
  Example) Steel screw into steel section:

M4	1.35 N·m	to	1.65 N·m.
M5	2.7 N·m	to	3.3 N·m.
M6	4.68 N·m	to	5.72 N·m.
M8	11.25 N·m	to	13.75 N·m.
M10	22.05 N·m	to	26.95 N·m.
M11	37.8 N·m	to	46.2 N·m.

- Install a safety equipments or apparatus in your application, when a serious accident or loss of property is expected due to the failure of this product.
- This product is designed for general industrial equipments.Don´t use this product under special conditions such as nuclear energy control, aerospace equipments, transportation, medical equipment, various safety equipments or special equipments.
- The wiring condition(earth wire method and cables length and shield cable condition of signal lines) may affect the noise resistance,please confirm the noise resistance of the machine.
- If the servo motor shaft is not electrically grounded, it may cause an electrolytic corrosion to the bearing, depending on the condition of the machine and its mounting environment, and may result in the bearing noise. Checking and verification by customer is required.
- 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.
- Product overload can cause the goods to fall,please follow the marking.
- Do not use benzine, thinner, alcohol, acidic cleaner and alkaline cleaner because theycan discolor or damage the exterior case.
- This product shall be treated as industrial waste when you dispose.
- This servo product related standards,laws and the user is responsible for matching between machine and components in terms of configuration, dimensions, life expectancy, characteristics, when installing the machine or changing specification of the machine. The user is also responsible for complying with applicable laws and regulations.
- The product will not be guaranteed when it is used outside its specification limits.
- Parts are subject to minor change to improve performance.

Revisions

Date	Rev.	Page	Description
Apr. 2017	Rev.1.00	—	Newly issued
Oct. 2017	Rev.2.00	12,1-7, 1-8,1-09, 3-16,3-32,3-33, 3-73, 3-89,3-95, 3-105,3-110,3-112, 3-116, 5-80,5-82, 6-4, 6-9,6-10, 6-11, 6-29,6-33	Software upgrades correspond to extensions
		1-7, 3-15, 7-9	Additional USB communication function
		1-4, 1-10	Additional nameplate production number corresponding table
		—	Error correcting

After-Sale Service (Repair)

Repair

Consult to a dealer from whom you have purchased the product for details of repair.
When the product is incorporated to the machine or equipment you have purchased, consult to the manufacturer or the dealer of the machine or equipment.

Consult

・Technical consultation
(Selection and use of motor and drive)
Free telephone hotline:0120-70-3799　TEL(072) 870-3057　FAX(072) 870-3120
Mobile phones,smart mobilephone,parts of the IP phone can not call a free hotline.
Acceptance time:Monday through Friday 9:00 ～ 12:00,13:00 ～ 17:00
(Saturday,Sunday and holidays excepted)

・Repair consultation
(Repair and buy parts)
TEL（072）870-3123　FAX（072）870-3152
Acceptance time:Monday through Friday 9:00 ～ 12:00,13:00 ～ 17:00
(Saturday,Sunday and holidays excepted)

Panasonic Corporation, Motor Business Division, Industrial Sales Group

Tokyo: Toranomon 35 Mori Building, 3-4-10, Toranomon, Minato-ku, Tokyo 105-0001
TEL +81-3-5404-5172　FAX +81-3-5404-2920

Osaka: 1-1, Morofuku 7-chome, Daito, Osaka 574-0044
TEL +81-72-870-3065　FAX +81-72-870-3151

Technical Information

・Technical information of this product (Operating Instructions, CAD data) can be downloaded and consulting questions from the following web site.
http://www3.panasonic.biz/ac/e/motor/fa-motor/ac-servo/index.jsp

・RTEX partner information
http://www3.panasonic.biz/ac/e/motor/fa-motor/ac-servo/rtex/index.jsp#head_title

For your records:
The model number and serial number of this product can be found on either the back or the bottom of the unit.
Please note them in the space provided and keep for future reference.

Date of purchase	Year　　Month　　Day	Model No.	
Store name			
	Phone(　　　　　)　　　-		

Panasonic Corporation,Motor Business Division

7-1-1 Morofuku, Daito, Osaka, 574-0044, Japan　Phone : +81-72-871-1212