Panasonic®

Operating Instructions (Overall)

AC Servo Motor & Driver
MINAS A6 series

* This product image is 100 W 200 V type of A6 series.

- Thank you for purchasing this Panasonic product.
- Before operating this product, please read the instructions carefully, and save this manual for future use.
- Read the the Safety Operating Instructions before using the products (P.6 to 9).
- This product is for industrial equipment. Don’t use this product at general household.

Thank you for purchasing Digital AC Servo Motor & Driver, MINAS A6 series. This instruction manual contains information necessary to correctly and safely use the MINAS A6 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

2) Contents of this document are subject to change without notice.

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

Operating requirements and procedure

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

3. Connection

Wiring ... I/O settings

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

4. Setup

Describes parameters ... JOG running

Shows describes parameters and procedure of test operation.

5. Adjustment

Gain adjustment ... Auto tuning

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

6. When in Trouble

Read this section when you encounter trouble or error.

7. Supplement

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

Contents

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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.

	Indicates something that must not be done.
	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 breakdowns.
	Do not place combustibles near by the motor, driverd regenerative resistor and dynamic brake resister..	
	Don't 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.
	Don't use cables soaked in water or oil.	Failure to observe this instruction could result in electrical shocks, damages and breakdowns.
	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 breakdowns.
	Never connect the motor directly to the commercial power supply.	
	Don't 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. **Failure to observe this instruction could result in damages and breakdowns.**	
	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.
	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 breakdowns.
	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 injuries.
	Don't drop or cause topple over of something during transportation or installation.	Failure to observe this instruction could result in injuries and breakdowns.
	Do not step on the Product nor place the heavy object on them.	Failure to observe this instruction could result in electrical shocks, injuries, breakdowns and damages.
	Don't place any obstacle object around the motor and peripheral, which blocks air passage.	Temperature rise will cause burn injury or fire.
	Don't 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 breakdowns.
	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 breakdowns.
	Never 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 injuries.
	Do not use the built-in brake as a "Braking" to stop the moving load.	Failure to observe this instruction could result in injuries and breakdowns.
	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 injuries.
	Never 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.
	Test-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.

Conformance to international standards

(A6 series SF type) (A6 series SE, SG type)

Conformed Standards

		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 (E164620)	UL1004-1, UL1004-6 (E327868)
CSA Standards		C22.2 No.14	C22.2 No.100-04
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 A6 series SE type and SG type don't correspond to the functional safety standards.
*2 Information related to the Radio Waves Act (South Korea)
This servo driver is a Class A commercial electromagnetic radio wave generator not designed for home use. The user and distributor should be aware of this fact.

A 급 기기 (업무용 방송통신기자재)
이 기기는 업무용(A 급) 전자파적합기기로서 판매자
또는 사용자는 이 점을 주의하시기 바라며, 가정외의
지역에서 사용하는 것을 목적으로 합니다.

(대상기종 : Servo Driver)

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

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

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

Notes on Maintenance and Inspection

1) Turn on and turn off should be done by operators or inspectors themselves. When establishing a system using safety functions, completely understand the applicable safety standards and the operating instruction manual or technical documents for the product.
2) Internal circuit of the driver is kept charged with high voltage for a while even after power-off. Turn off the power and allow 15 minutes or longer after LED display of the front panel has gone off, before performing maintenance and inspection.
3) Disconnect all of the connection to the driver when performing megger test (Insulation resistance measurement) to the driver, otherwise it could result in breakdown of the driver.
4) Do not use 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
Motor with Gear Reducer	Annual	• Loose tightening • Trace of overheat • Damage to the terminal block • Loose fasteners on terminal block

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

Guideline for Parts Replacement

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

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

<table>
<tr><th>Product</th><th>Component</th><th>Standard replacement cycles (hour)</th><th>Note</th></tr>
<tr><td rowspan="5">Driver</td><td>Smoothing condenser</td><td>Approx. 5 years</td><td rowspan="9">These hours or cycles are reference.
When you experience any error, replacement is required even before this standard replacement cycle.</td></tr>
<tr><td>Cooling fan</td><td>2 to 3 years
(10000 to 30000 hours)</td></tr>
<tr><td>Aluminum electrolytic capacitor (on PCB)</td><td>Approx. 5 years</td></tr>
<tr><td>Rush current preventive relay</td><td>Approx. 100000 times (depending on working condition)</td></tr>
<tr><td>Rush current preventive resistor</td><td>Approx. 20000 times (depending on working condition)</td></tr>
<tr><td rowspan="4">Motor</td><td>Bearing</td><td>3 to 5 years
(20000 to 30000 hours)</td></tr>
<tr><td>Oil seal</td><td>5000 hours</td></tr>
<tr><td>Encoder</td><td>3 to 5 years
(20000 to 30000 hours)</td></tr>
<tr><td>Battery
for absolute encoder</td><td>Life time of battery read P7-14 please.</td></tr>
</table>

Related page
• P.7-148“Warranty”

1. Before Using the Products

1. Introduction

Outline

MINAS A6 series AC Servo Motor & Drivers are the brand new servo system that fulfills all requirements from various types of machines such as high-speed, high-precision, high performance and easy setup and adjustment.

Accomplishing an overwhelming performance improvement over traditional A5 series, it comes standard equipped with the feature of 2DOF(Two-degree-of-freedom) control scheme which became popular in A5Ⅱ series. Also by further possible easy setup and adjustment, anyone can feel the high-performance of this new product.

Newly designed products have 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.

In addition, the “FIT gain” function of PANATERM which was available only at A5Ⅱ series will become available in all models of A6 series. Moreover, auto-adjustment function makes possible high-speed and high-precision adjustment more easily and in a signiticantly reduced short period of time.

Besides, we have ensured the compatibility betweetn A5 series and A6 series. Four control modes (Position, Speed, Torque and Full-closed) used in A5 series will be continuously equipped in A6 series and parameter specificatioins will be compatible as well. Furthermore, we have improved damping control, added extra one frequency selectable notch filter, and made it possible to control two damping filters during 2DOF.

By simply replacing conventional model to A6 series you can expect improved performance of your equipment.

These products assure higher stablility at low-stiffness machines and high-precision and high-speed operation at high-stiffness machines. These products can correspond to wide range of machines.

This manual is written as a guide for you so that can fully correctly make use of all functions and advantages of New MINAS A6 series.

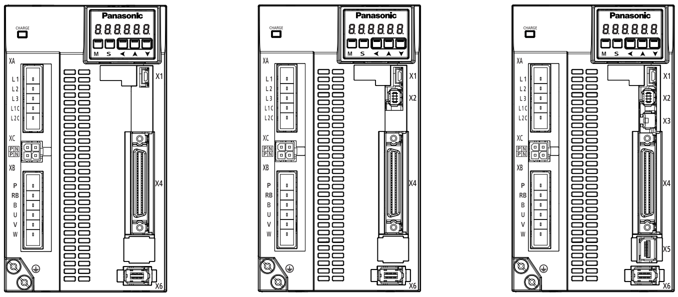
Yet, we have prepared standard type ,communication type and multi-function type of MINAS A6 series.This manual has been guiding based on featuers of multi-function type model. Please be aware that some specified features of the multi-function type might not be available in the standard type.

When incremental data want to be used with traditional A5 series, you can use A6 series 23-bit Absolute encoder(multi-turn data is not be used).

1. Introduction

Outline

The standard type, communication type and multi-function type with the following different specifications.



Standard Type (SE) | Communication Type (SG) | Multi-function Type (SF)

Function		Standard Type	Communication Type	Multi-function Type
USB communication		○	○	○
Absolute system			○	○
RS232/485 communication			○	○
Modbus communication*1			○	○
Block Operation*1	By Modbus communication		○	○
	By input signal	○	○	○
Safety function				○
Command pulse input		○	○	○
Analog voltage input				○
Feedback scale connect				○

Connector	Standard Type	Communication Type	Multi-function Type
X1: USB connector	○	○	○
X2: Serial communication connector		○	○
X3: Safety function connector			○
X4: I/O connector	○	○	○
X5: Feedback scale connector			○
X6: Encoder connector	○	○	○

The function and connection in this book to enable / disable the following is supplemented by the table.
Example can be used only in the multi-function type.

SE	SG	SF
		○

SE: Standard type
SG: Communication type
SF: Multi-function type

*1The RS232 communication and RS485 communication is the “MINAS standard protacol”. The detial of “Modbus communication”, “Block operation” refer to technical reference of Modbus communication and Block operation Specification witch can download from HP.

1 Before Using the Products

1. Introduction

On Opening the Product Package

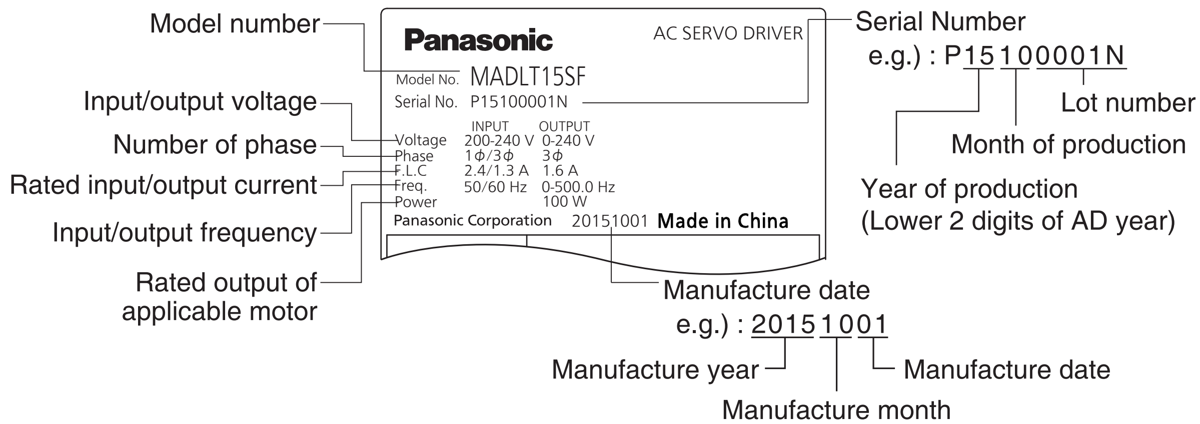
- Make sure that the model is what you have ordered.
- Check if the product is damaged or not during transportation.
- Check if the Safety Operating Instructions are included or not.
- Check if the power connector, motor connectors, connector for external regenerative resistor connection (E-frame) and safety by-pass plug are included or not.
  (Neither the power connector nor motor connector are included to F-frame.)
  (Neither the plug of XC connentor is not in cluded to C-frame and D-frame.)
  (Safety bypass plug is not supplied with for standard type and communication type, because they do not use this plug.)

Contact to a dealer if you find any failures.

2. Driver

Check of the Model

Contents of Name Plate



Model Designation

M A D L T 1 5 S F * * *

1~3: Frame-size symbol; 4: Series; 5: Safety function; 6: Max. current rating of amp; 7: Power supply; 8: Interface specifications; 9: Driver specifications; 10~12: Special specifications (letters and numbers)

Frame-size symbol

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

Series

Symbol	Series name
L	A6 series

Safety function

Symbol	Specifications
N	No functional safety
T	Safety torque off

Special specifications
(letters and numbers)

Driver specifications

■Rotary specifications

Symbol	Specifications
E	Standard type
G	Communication type
F	Multi-function type

Max. current rating of amp

Symbol	Max. current rating
0	6 A
1	8 A
2	12 A
3	22 A
4	24 A
5	40 A
8	60 A
9	80 A
A	100 A
B	120 A

Power supply

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

Interface specifications

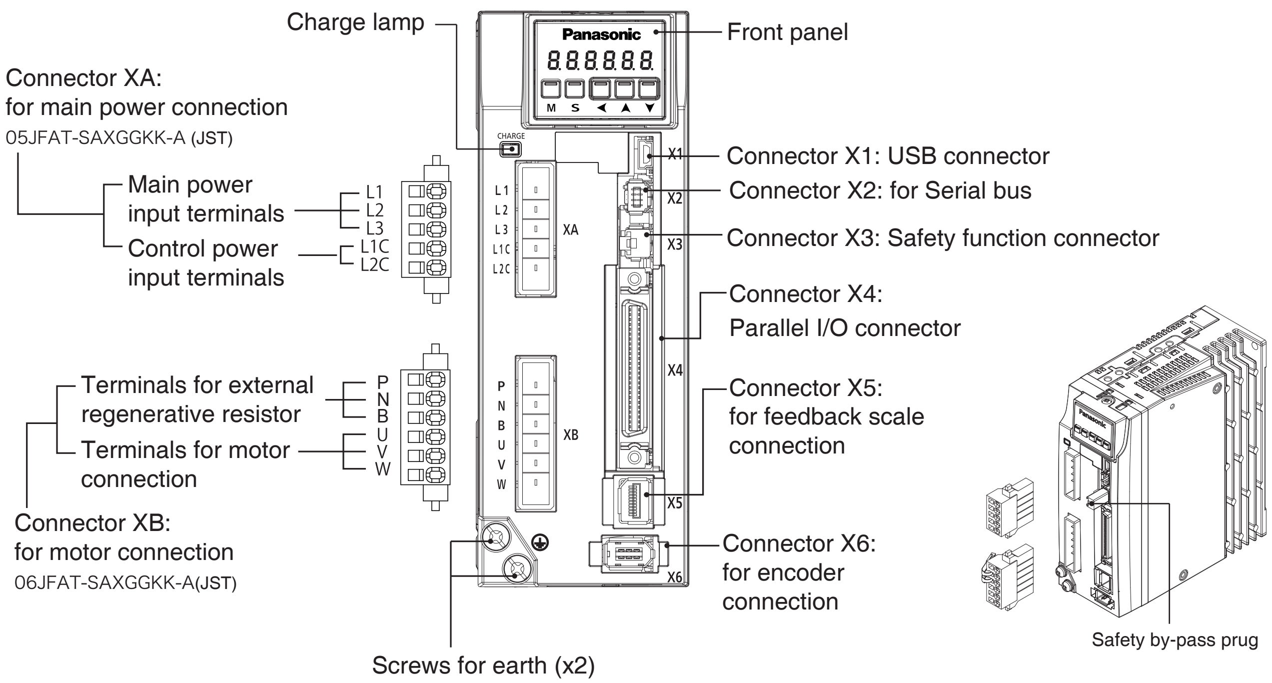
Symbol	Specifications
N	RTEX
S	Analog/Pulse

Related page • P.1-19 “Check of the Combination of the Driver and the Motor”

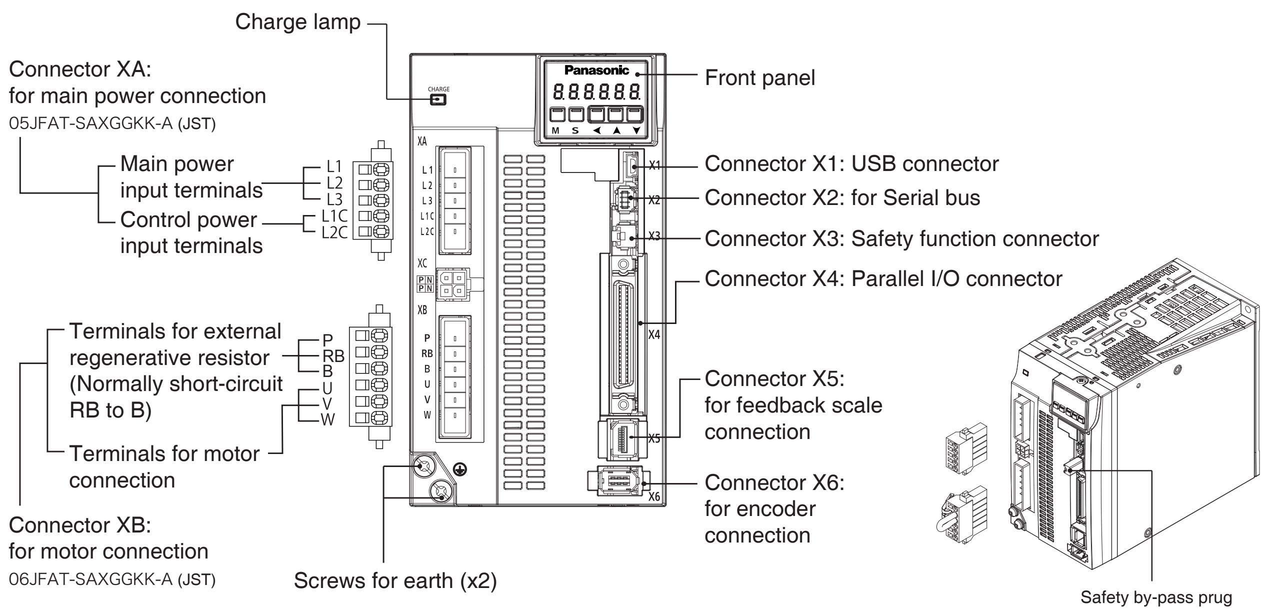
2. Driver

Parts Description

A to B-frame



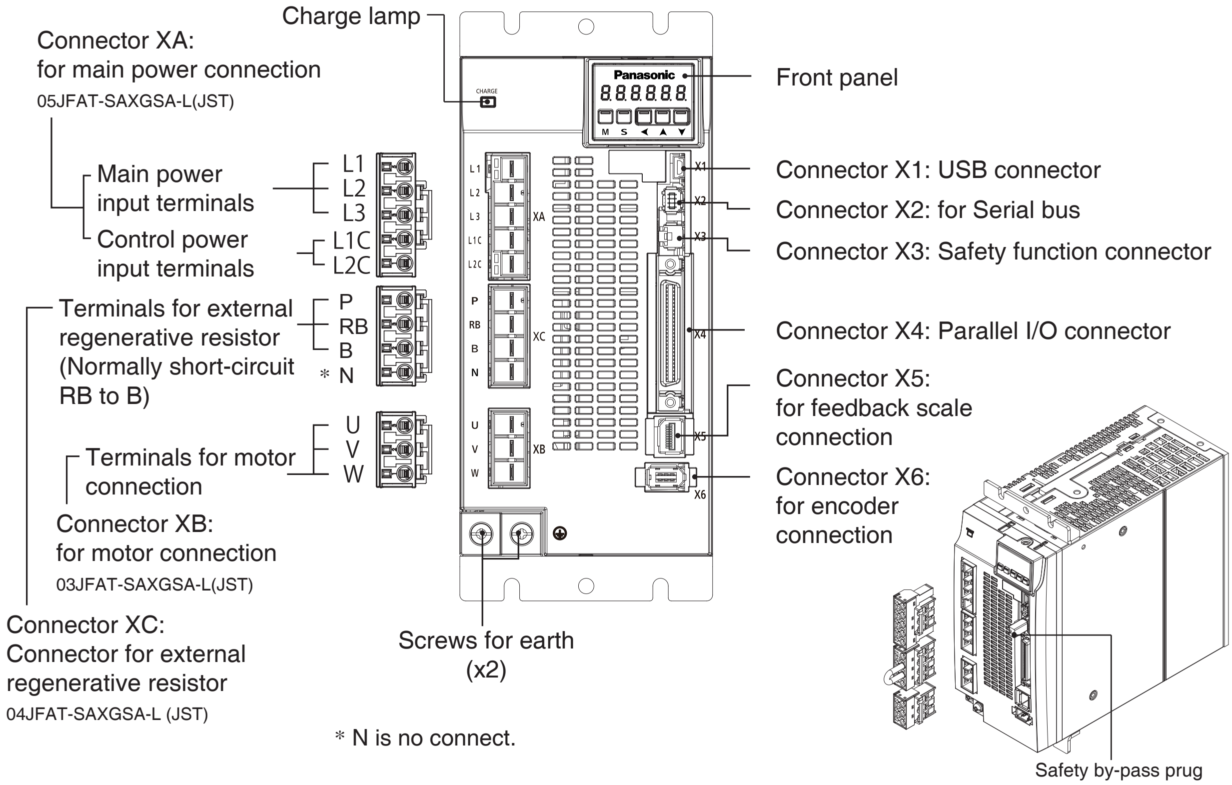
C to D-frame



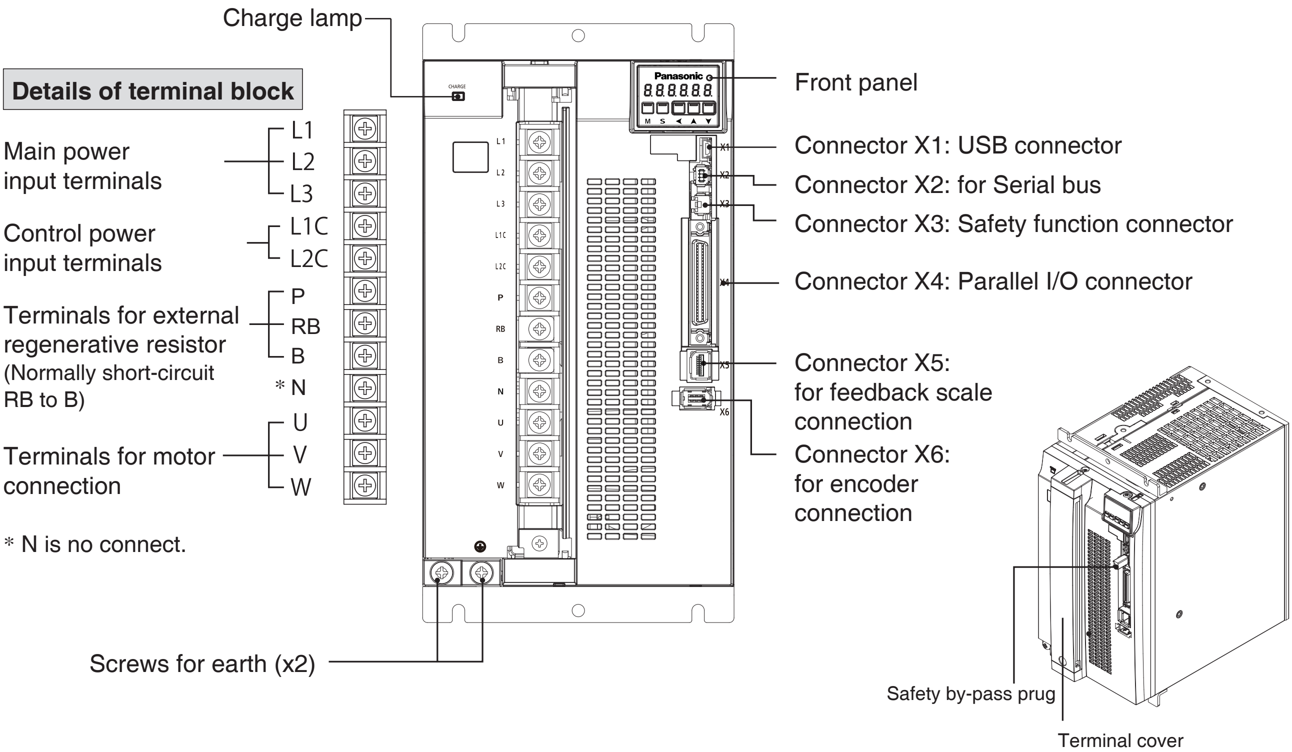
Note

• Connector XA and XB are attached in A to D-frame driver.

E-frame



F-frame



Note • Connector XA, XB and XC are attached in E-frame driver.

2. Driver

Specifications (Multi-function type)

Basic Specifications	Input power	100 V	Main circuit		Single phase, 100 V to 120 V $^{+10\ \%}_{-15\ \%}$ 50 Hz/60 Hz
			Control circuit		Single phase, 100 V to 120 V $^{+10\ \%}_{-15\ \%}$ 50 Hz/60 Hz
		200 V	Main circuit	A to D-frame	Single/3-phase, 200 V to 240 V $^{+10\ \%}_{-15\ \%}$ 50 Hz/60 Hz
				E to F-frame	3-phase, 200 V to 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, (sensed current: 20 mA) [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/s² or less, 10 Hz to 60 Hz
	Control method				IGBT PWM Sinusoidal wave drive
	Encoder feedback				23-bit (8388608 resolution) absolute encoder, 7-wire serial
	Feedback scale feedback				A/B phase, initialization signal defferential input. Manufacturers that support serial communication scale(*2) Increment type Absolute type
	Parallel I/O connector	Control signal	Input		General purpose 10 inputs The function of general-purpose input is selected by parameters.
			Output		General purpose 6 outputs The function of general-purpose input is selected by parameters.
		Analog signal	Input		3 inputs (16-bit A/D : 1 input, 12-bit A/D : 2 inputs)
			Output		2 outputs (Analog monitor: 2 output) Output from I/F connector pin 42, pin 43.
		Pulse signal	Input		2 inputs (Photocoupler input, Line receiver input) Photocoupler input is compatible with both line driver I/F and open collector I/F. Line receiver input is compatible with line driver I/F.
			Output		4 outputs (Line driver: 3 output, open collector: 1 output) Feed out the encoder feedback pulse (A, B and Z-phase) or feedback scale pulse (EXA, EXB and EXZ-phase) in line driver. Z-phase and EXZ-phase pulse is also fed out in open collector. ※When Block motion and full-closed control is valid, pulse signal can not be output.
	Communication function		USB		Connection with PC etc.
			RS232		1 : 1 communication to a host.
			RS485		1 : n communication to a host.
			Modbus-RTU		1 : 1 communication to a host(RS232 communication) or 1 : n communication to a host(RS485 communication).
	Safety function				Used for functional safety.
	Front panel				(1) 5 keys (2) LED (6-digit)
	Regeneration				A, B-frame: No built-in regenerative resistor (external resistor only) C to F-frame: Built-in regenerative resistor (external resistor is also enabled.)
	Dynamic brake				A to F-frame: Built-in
	Control mode				Switching among the following 7 mode is enabled, (1) Position control (2) Velocity control (3) Toque control (4) Position/Velocity control (5) Position/Torque control (6) Velocity/Torque control (7) Full-closed control
Function	Common	Auto tuning			The load inertia is identified in real time by the driving state of the motor operating according to the command given by the controlling device and set up support software “PANATERM”. The gain is set automatically in accordance with the rigidity setting.
		Division of encoder feedback pulse			Set up of any value is enabled (encoder feedback pulses count is the max.).
		Protective function	Hard error		Over-voltage, under-voltage, over-speed, over-load, over-heat, over-current and encoder error etc.
			Soft error		Excess position deviation, command pulse division error, EEPROM error etc.
		Traceability of alarm data			The alarm data history can be referred to.
		Infinite rotation absolute function			Available
		Deterioration diagnosis waring function			Available

Caution

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

*2 Please refer to the latest macker in our HP.

Related page

• P.1-20 “Installation of Driver” • P.1-24 “Installation of Motor”

Function	Position control	Control input		Deviation counter clear, command pulse input inhibition, command division/multiplication switching, vibration suppression control switching, etc.
		Control output		Positioning complete, etc.
		Pulse input	Max. command pulse frequency	Exclusive interface for Photocoupler and line driver: 500 kpulse/s Exclusive interface for line receiver: 8 Mpulse/s
			Input pulse signal format	Differential input. Selectable with parameter. ((1) Positive and Negative direction, (2) A and B-phase, (3) Command and direction)
			Electronic gear (Division/Multiplication of command pulse)	Process command pulse frequency × electronic gear ratio $\left(\frac{1 \text{ to } 2^{30}}{1 \text{ to } 2^{30}}\right)$ as positional command input. Use electronic gear ratio in the range 1/1000 times to 8000 times.
			Smoothing filter	Primary delay filter or FIR type filter is adaptable to the command input
		Analog input	Torque limit command input	Individual torque limit for both positive and negative direction is enabled.
			Torque feed forward input	Analog voltage can be used as torque feed forward input.
		Vibration suppression control		Maximum of 3 may be used simultaneously
		Model-type damping filter		Maximum of 2 may be used simultaneously
		Two-degree-of-freedom control system		Available
		Load variation suppression function		Available
		Position compare output function		Available [Condition] Block operation valid setting Return to origin completed state in increment mode (when block operation origin return invalidation setting is set to invalid)
		External scale position information monitor function under semi-closed control		Available
		Block operation		Available*1
	Velocity control	Control input		Internal command velocity selection 1, Internal command velocity selection 2, Internal command velocity selection 3, speed zero clamp, etc.
		Control output		Speed arrival, etc.
		Analog input	Velocity command input	Speed command input can be provided by means of analog voltage. Parameters are used for scale setting and command polarity. (6 V/Rated rotational speed Default)
			Torque limit command input	Torque limit can be applied to each direction respectively.
			Torque feed forward input	Analog voltage can be used as torque feed forward input.
		Internal velocity command		Switching the internal 8speed is enabled by command input.
		Soft-start/down function		0 to 10s/1000 r/min r/min Setting is possible for acceleration and deceleration respectively. S shaped acceleration/deceleration is possible.
		Zero-speed clamp		Internal velocity command can be clamped to 0 with speed zero clamp input.
		Velocity command filter		Available
		Two-degree-of-freedom control system		Available
		Load variation suppression function		Available
		Position compare output function		Unavailable
		External scale position information monitor function under semi-closed control		Available
		Block operation		Unavailable

Caution

*1 For details of block operation functions, please refer to Technical reference (Modbus communication and Block operation Specification).

Function	Torque control	Control input		Speed zero clamp, torque command sign input, etc.
		Control output		Speed arrival, etc.
		Analog input	Torque command input	Torque command input can be provided by means of analog voltage. Parameters are used for scale setting and command polarity. (6 V/rated torque Default)
		Speed limit function		Speed limit value with parameter t is enabled.
		Two-degree-of-freedom control system		Unavailable
		Load variation suppression function		Unavailable
		Position compare output function		Unavailable
		External scale position information monitor function under semi-closed control		Available
		Block operation		Unavailable
	Full-closed control	Control input		Deviation counter clear, command pulse input inhibition, command division/multiplication switching, vibration suppression control switching, etc.
		Control output		Positioning complete, etc.
		Pulse input	Max. command pulse frequency	Exclusive interface for Photocoupler and line driver: 500 kpulse/s Exclusive interface for line receiver: 8 Mpulse/s
			Input pulse signal format	Differential input. Selectable with parameter. ((1) Positive and Negative direction, (2) A and B-phase, (3) Command and direction)
			Electronic gear (Division/Multiplication of command pulse)	Process command pulse frequency × electronic gear ratio $\left(\frac{1 \text{ to } 2^{30}}{1 \text{ to } 2^{30}}\right)$ as positional command input. Use electronic gear ratio in the range 1/1000 times to 8000 times.
			Smoothing filter	Primary delay filter or FIR type filter is adaptable to the command input
		Analog input	Torque limit command input	Individual torque limit for both positive and negative direction is enabled.
		Setup range of division/multiplication of feedback scale		1/40 times to 1280 times The ratio of encoder pulse (numerator) to external scale pulse (denominator) can be set to 1 to 2^{23} (numerator) to 1 to 2^{23} (denominator), but should be set to a ratio within the range shown above.
		Vibration suppression control		Maximum of 2 may be used simultaneously
		Model damping filter		Unavailable
		Two-degree-of-freedom control system		Available
		Load variation suppression function		Unavailable
		Position compare output function		Available [Condition] Block operation valid setting Return to origin completed state in case of increment mode (block operation return to origin invalid setting set to invalid)
		External scale position information monitor function under semi-closed control		Unavailable
		Block operation		Available[*1]

Caution

*1 For details of block operation functions, please refer to Technical reference (Modbus communication and Block operation Specification).

2. Driver

Specifications (Communication type)

Basic Specifications	Input power	100 V	Main circuit		Single phase, 100 V to 120 V +10 % –15 % 50 Hz/60 Hz
			Control circuit		Single phase, 100 V to 120 V +10 % –15 % 50 Hz/60 Hz
		200 V	Main circuit	A to D-frame	Single/3-phase, 200 V to 240 V +10 % –15 % 50 Hz/60 Hz
				E to F-frame	3-phase, 200 V to 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, (sensed current: 20 mA) [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)
			Altitude		Lower than 1000 m
			Vibration		5.88 m/s^2 or less, 10 Hz to 60 Hz (No continuous use at resonance frequency)
	Control method				IGBT PWM Sinusoidal wave drive
	Encoder feedback				23-bit (8388608 resolution) absolute encoder, 7-wire serial
	Parallel I/O connector	Control signal	Input		General purpose 10 inputs The function of general-purpose input is selected by parameters.
			Output		General purpose 6 outputs The function of general-purpose input is selected by parameters.
		Analog signal	Output		2 outputs (Analog monitor: 2 output) Output from I/F connector pin 42, pin 43.
		Pulse signal	Input		2 inputs (Photocoupler input, Line receiver input) Photocoupler input is compatible with both line driver I/F and open collector I/F. Line receiver input is compatible with line driver I/F.
			Output		4 outputs (Line driver: 3 output, open collector: 1 output) Feed out the encoder feedback pulse (A, B and Z-phase) in line driver. Z-phase is also fed out in open collector.
	Communication function		USB		Connection with PC etc.
			RS232		1 : 1 communication to a host.
			RS485		1 : n communication to a host.
			Modbus-RTU		1 : 1 communication to a host(RS232 communication) or 1 : n communication to a host(RS485 communication).
	Front panel				(1) 5 keys (2) LED (6-digit)
	Regeneration				A, B-frame: No built-in regenerative resistor (external resistor only) C to F-frame: Built-in regenerative resistor (external resistor is also enabled.)
	Dynamic brake				A to F-frame: Built-in
	Control mode				(1) Position control (2) Internal velocity control (3) Position/ Internal velocity control
Funtion	Common	Auto tuning			The load inertia is identified in real time by the driving state of the motor operating according to the command given by the controlling device and set up support software “PANATERM”. The gain is set automatically in accordance with the rigidity setting.
		Division of encoder feedback pulse			Set up of any value is enabled (encoder pulses count is the max.).

Caution *1 Air containing water vapor will become saturated with water vapor as the temperature falls, causing dew.

Related page • P.1-20 “Installation of Driver” • P.1-24 “Installation of Motor”

Funtion	Common	Protective function	Hard error	Over-voltage, under-voltage, over-speed, over-load, over-heat, over-current and encoder error etc.
			Soft error	Excess position deviation, command pulse division error, EEPROM error etc.
		Traceability of alarm data		The alarm data history can be referred to.
		Infinite rotation absolute function		Available
		Deterioration diagnosis waring function		Available
	Position control	Control input		Deviation counter clear, command pulse input inhibition, command division/ multiplication switching, vibration suppression control switching, etc.
		Control output		Positioning complete, etc.
		Pulse input	Max. command pulse frequency	Exclusive interface for Photocoupler and line driver: 500 kpulse/s Exclusive interface for line receiver: 8 Mpulse/s
			Input pulse signal format	Differential input ((1) Positive and Negative direction, (2) A and B-phase, (3) Command and direction)
			Electronic gear (Division/ Multiplication of command pulse)	Process command pulse frequency × electronic gear ratio $\left(\frac{1 \text{ to } 2^{30}}{1 \text{ to } 2^{30}}\right)$ as positional command input. Use electronic gear ratio in the range 1/1000 times to 8000 times.
			Smoothing filter	Primary delay filter or FIR type filter is adaptable to the command input
		Vibration suppression control		Maximum of 3 may be used simultaneously
		Model-type damping filter		Maximum of 2 may be used simultaneously
		Two-degree-of-freedom control system		Available
		Load variation suppression function		Available
		Position compare output function		Available [Condition] Block operation valid setting Return to origin completed state in increment mode (when block operation origin return invalidation setting is set to invalid)
		External scale position information monitor function under semi-closed control		Unavailable
		Block operation		Available*1
	Internal velocity control	Control input		(1) Selection of internal velocity setup (2) Speed zero clamp, etc.
		Control output		Speed arrival, etc.
		Internal velocity command		Switching the internal 8speed is enabled by command input.
		Soft-start/down function		Individual setup of acceleration and deceleration is enabled, with 0 s/1000 r/min to 10 s/1000 r/min. Sigmoid acceleration/deceleration is also enabled.
		Zero-speed clamp		0-clamp of internal velocity command with speed zero clamp input is enabled.
		Two-degree-of-freedom control system		Available
		Load variation suppression function		Available
		Position compare output function		Available [Condition] Block operation valid setting Return to origin completed state in increment mode (when block operation origin return invalidation setting is set to invalid)
		External scale position information monitor function under semi-closed control		Unavailable
		Block operation		Available*1

Caution

*1 For details of block operation functions, please refer to Technical reference (Modbus communication and Block operation Specification).

2. Driver

Specifications (Standard type)

Basic Specifications	Input power	100 V	Main circuit		Single phase, 100 V to 120 V +10 % –15 % 50 Hz/60 Hz
			Control circuit		Single phase, 100 V to 120 V +10 % –15 % 50 Hz/60 Hz
		200 V	Main circuit	A to D-frame	Single/3-phase, 200 V to 240 V +10 % –15 % 50 Hz/60 Hz
				E to F-frame	3-phase, 200 V to 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, (sensed current: 20 mA) [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)
			Altitude		Lower than 1000 m
			Vibration		5.88 m/s^2 or less, 10 Hz to 60 Hz (No continuous use at resonance frequency)
	Control method				IGBT PWM Sinusoidal wave drive
	Encoder feedback				23-bit (8388608 resolution) absolute encoder, 7-wire serial
	Parallel I/O connector	Control signal		Input	General purpose 10 inputs The function of general-purpose input is selected by parameters.
				Output	General purpose 6 outputs The function of general-purpose input is selected by parameters.
		Analog signal		Output	2 outputs (Analog monitor: 2 output) Output from I/F connector pin 42, pin 43.
		Pulse signal		Input	2 inputs (Photocoupler input, Line receiver input) Photocoupler input is compatible with both line driver I/F and open collector I/F. Line receiver input is compatible with line driver I/F.
				Output	4 outputs (Line driver: 3 output, open collector: 1 output) Feed out the encoder feedback pulse (A, B and Z-phase) or feedback scale pulse (EXA, EXB and EXZ-phase) in line driver. Z-phase and EXZ-phase pulse is also fed out in open collector.
	Communication function			USB	Connection with PC etc.
	Front panel				(1) 5 keys (2) LED (6-digit)
	Regeneration				A, B-frame: No built-in regenerative resistor (external resistor only) C to F-frame: Built-in regenerative resistor (external resistor is also enabled.)
	Dynamic brake				A to F-frame: Built-in
	Control mode				(1) Position control (2) Internal velocity control (3) Position/ Internal velocity control
Funtion	Common	Auto tuning			The load inertia is identified in real time by the driving state of the motor operating according to the command given by the controlling device and set up support software “PANATERM”. The gain is set automatically in accordance with the rigidity setting.
		Division of encoder feedback pulse			Set up of any value is enabled (encoder pulses count is the max.).

Caution *1 Air containing water vapor will become saturated with water vapor as the temperature falls, causing dew.

Related page • P.1-20 “Installation of Driver” • P.1-24 “Installation of Motor”

Function	Common	Protective function	Hard error	Over-voltage, under-voltage, over-speed, over-load, over-heat, over-current and encoder error etc.
			Soft error	Excess position deviation, command pulse division error, EEPROM error etc.
		Traceability of alarm data		The alarm data history can be referred to.
		Infinite rotation absolute function		Available
		Deterioration diagnosis waring function		Available
	Position control	Control input		Deviation counter clear, command pulse input inhibition, command division/ multiplication switching, vibration suppression control switching, etc.
		Control output		Positioning complete, etc.
		Pulse input	Max. command pulse frequency	Exclusive interface for Photocoupler and line driver: 500 kpulse/s Exclusive interface for line receiver: 8 Mpulse/s
			Input pulse signal format	Differential input ((1) Positive and Negative direction, (2) A and B-phase, (3) Command and direction)
			Electronic gear (Division/Multiplication of command pulse)	Process command pulse frequency × electronic gear ratio $\left(\frac{1 \text{ to } 2^{30}}{1 \text{ to } 2^{30}}\right)$ as positional command input. Use electronic gear ratio in the range 1/1000 times to 8000 times.
			Smoothing filter	Primary delay filter or FIR type filter is adaptable to the command input
		Vibration suppression control		Maximum of 3 may be used simultaneously
		Model-type damping filter		Maximum of 2 may be used simultaneously
		Two-degree-of-freedom control system		Available
		Load variation suppression function		Available
		Position compare output function		Available [Condition] Block operation valid setting Return to origin completed state in increment mode (when block operation origin return invalidation setting is set to invalid)
		External scale position information monitor function under semi-closed control		Unavailable
		Block operation		Available*1
	Internal velocity control	Control input		(1) Selection of internal velocity setup (2) Speed zero clamp, etc.
		Control output		Speed arrival, etc.
		Internal velocity command		Switching the internal 8speed is enabled by command input.
		Soft-start/down function		Individual setup of acceleration and deceleration is enabled, with 0 s/1000 r/min to 10 s/1000 r/min. Sigmoid acceleration/deceleration is also enabled.
		Zero-speed clamp		0-clamp of internal velocity command with speed zero clamp input is enabled.
		Two-degree-of-freedom control system		Available
		Load variation suppression function		Available
		Position compare output function		Available [Condition] Block operation valid setting Return to origin completed state in increment mode (when block operation origin return invalidation setting is set to invalid)
		External scale position information monitor function under semi-closed control		Unavailable
		Block operation		Available*1

Caution

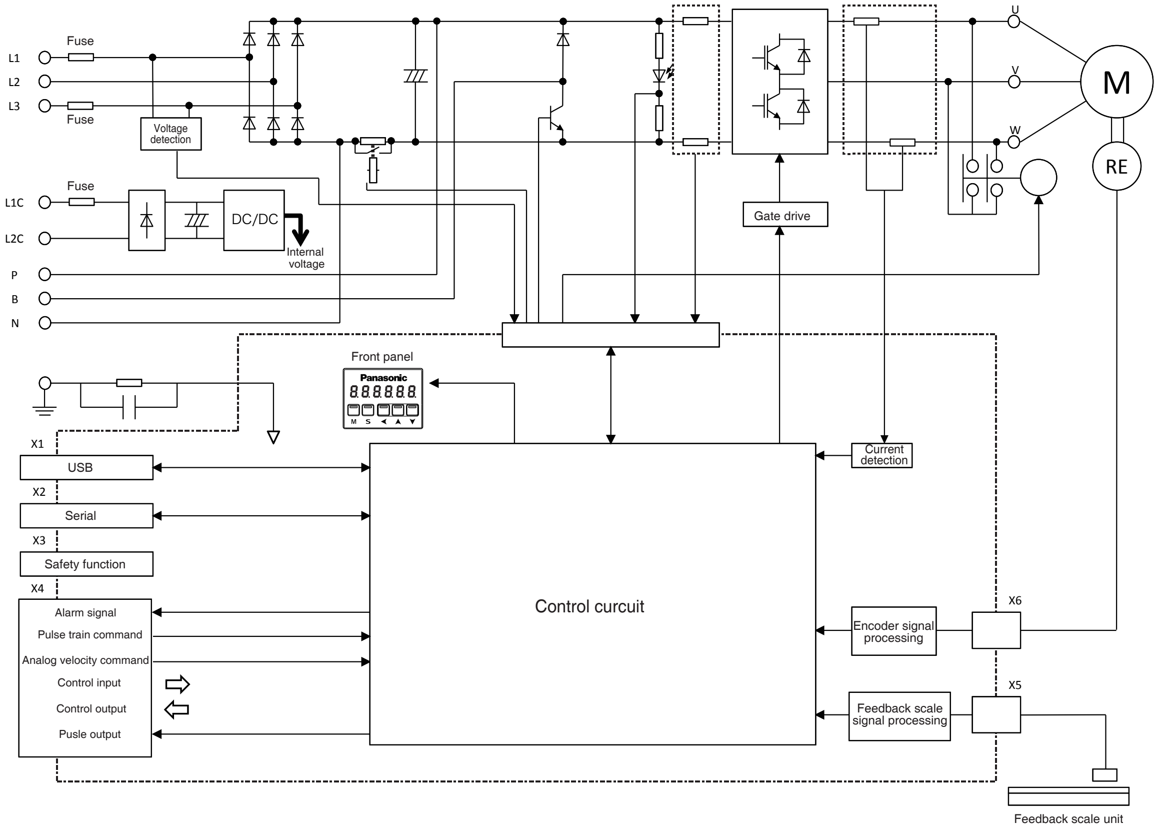
*1 For details of block operation functions, please refer to Technical reference (Modbus communication and Block operation Specification).

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

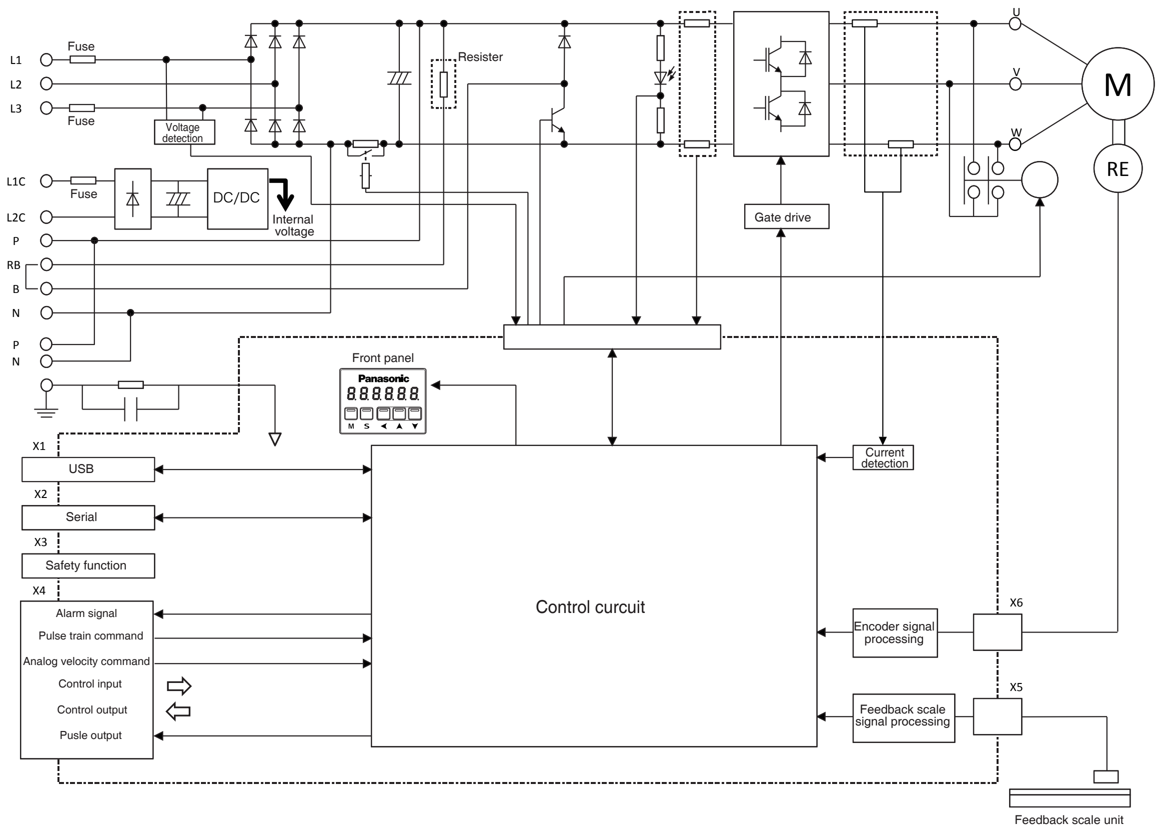
2. Driver

Block Diagram

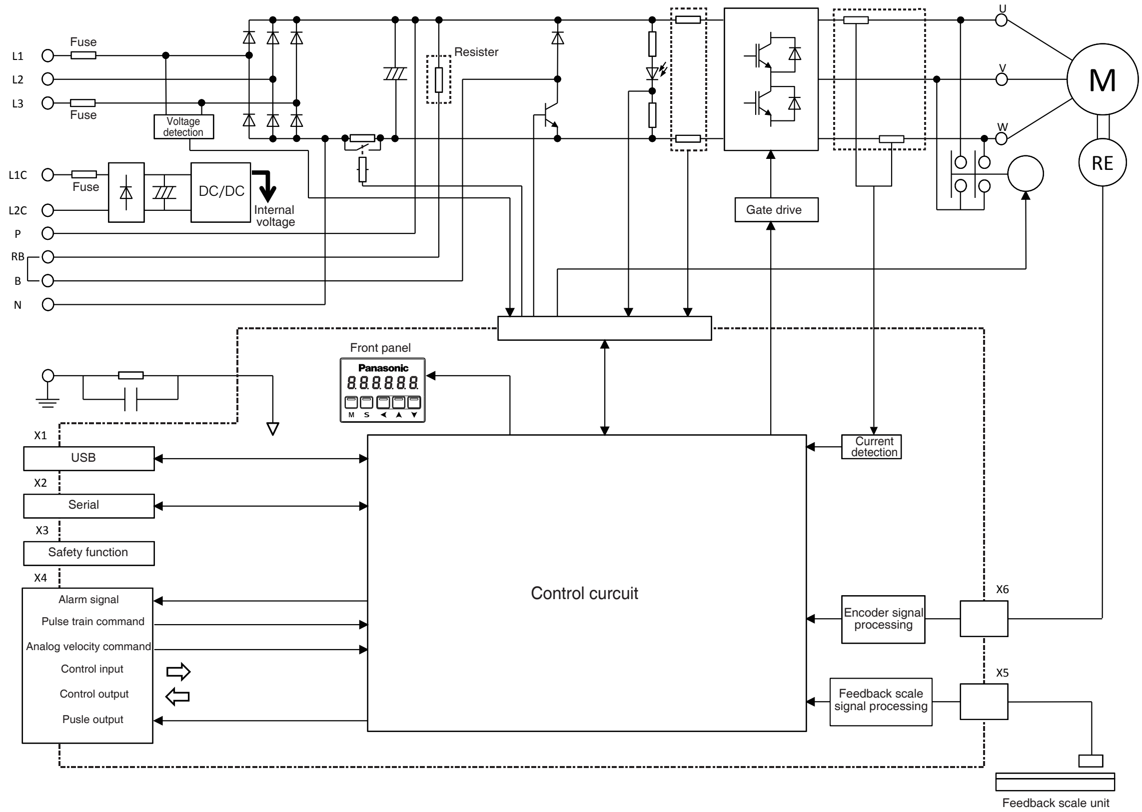
A, B-frame (100 V/200 V)



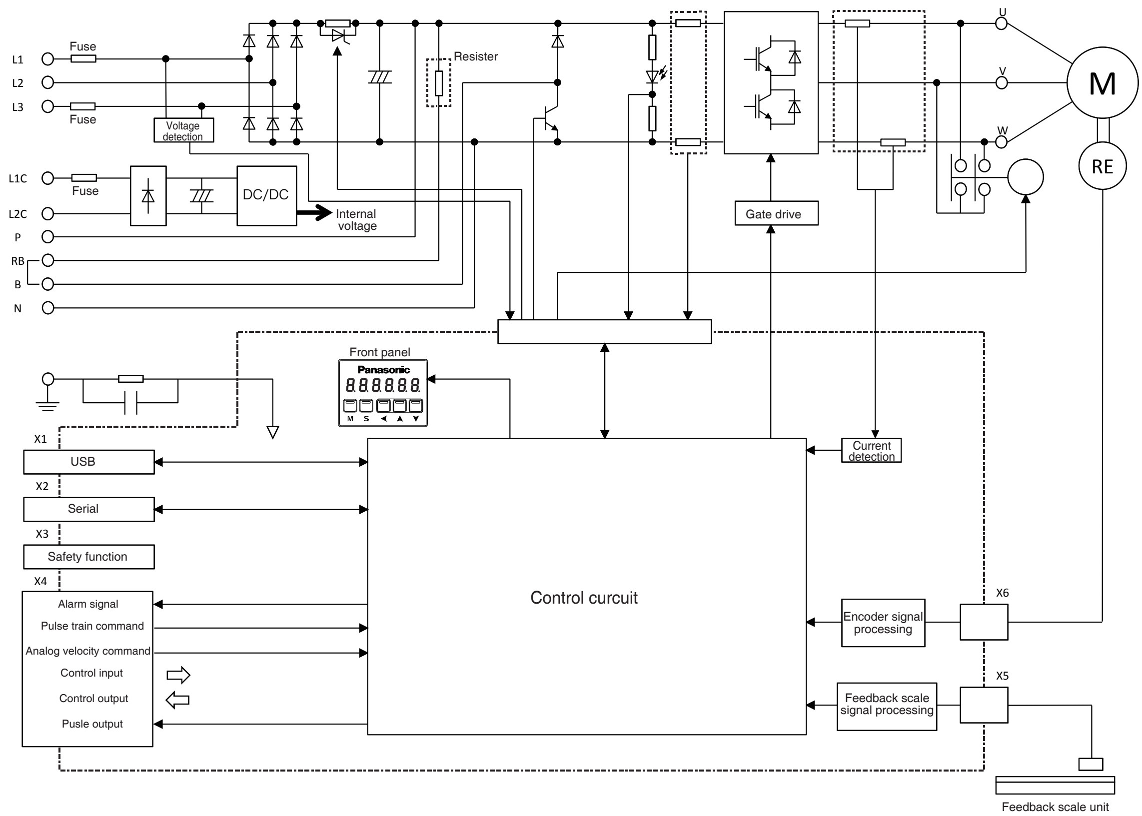
C, D-frame (100 V/200 V)



E-frame (200 V)



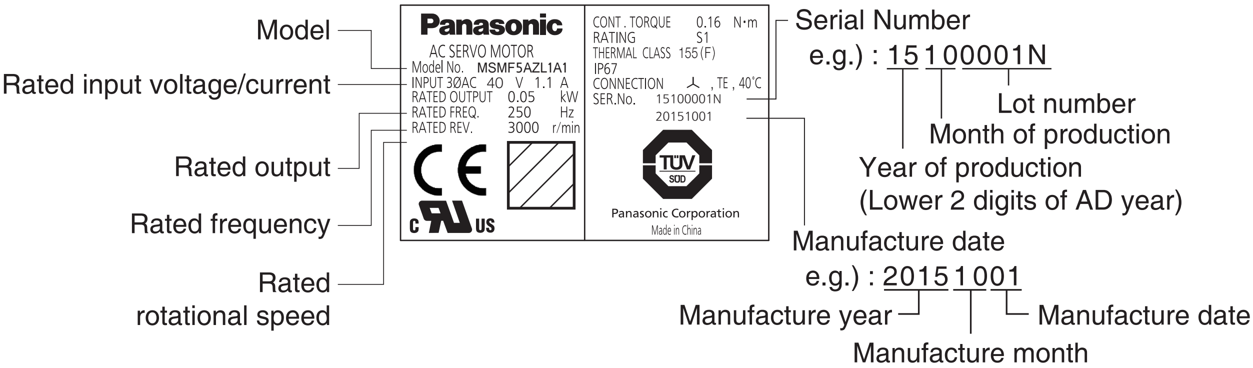
F-frame (200 V)



3. Motor

Check of the Model

Contents of Name Plate



Model Designation

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

1~3: Type / 4: Series / 5~6: Motor rated output / 7: Voltage specifications / 8: Rotary encoder specifications / 9: Design order / 10~11: Motor structure / 12: Special specifications

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	0.85 kW/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.1-19 "Check of the Combination of the Driver and the Motor" • P.7-84 to 7-107 "Dimensions of motor"

3. Motor

Check of the Model

Contents of Name Plate

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		●		●		●		●

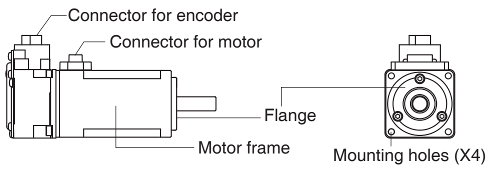
Note
- For details of specific model, refer to the Dimensions of Supplement.

Related page
- P.1-19 "Check of the Combination of the Driver and the Motor" • P.7-84 to 7-107 "Dimensions of motor"

3. Motor

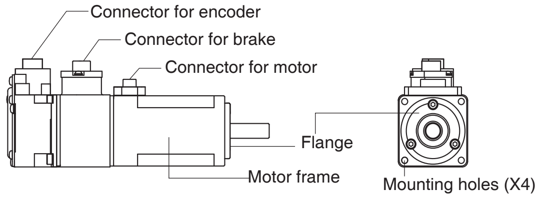
Parts Description

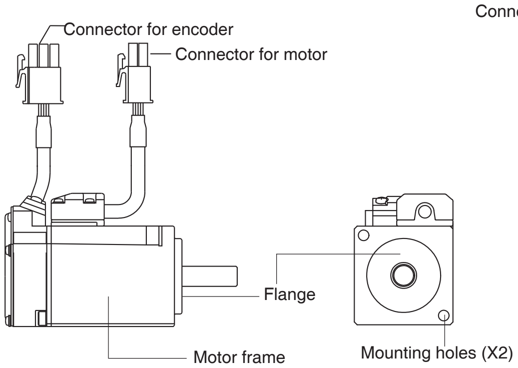
- MSMF 50 W to 1.0 kW(□80)
- MHMF 50 W to 1.0 kW(□80)

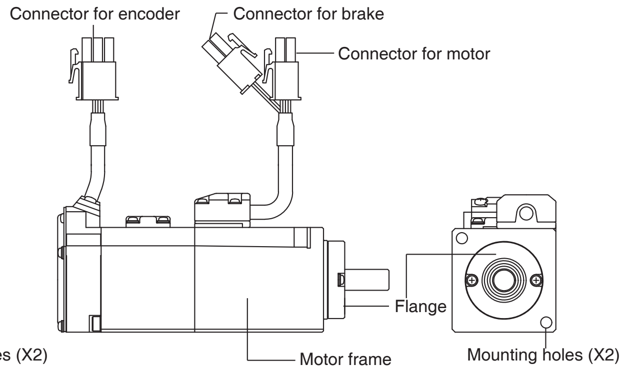


- MQMF 100 W to 400 W

[with Brake]

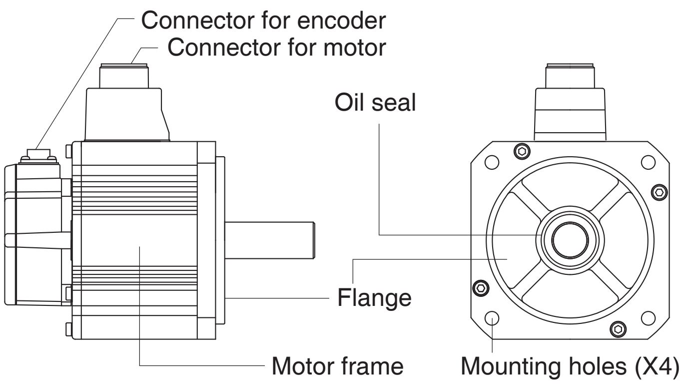






e.g.) : Low inertia type (MSMF series, 50 W), High inertia type (MHMF series, 50 W)

- 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.7-84 to 7-107)

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□01S□	A frame
			MSMF011L1□□□	100 W	MADL□11S□	
			MSMF021L1□□□	200 W	MBDL□21S□	B frame
			MSMF041L1□□□	400 W	MCDL□31S□	C frame
Single/ 3-phase, 200 V			MSMF5AZL1□□□	50 W	MADL□05S□	A frame
			MSMF012L1□□□	100 W		
			MSMF022L1□□□	200 W	MADL□15S□	
			MSMF042L1□□□	400 W	MBDL□25S□	B frame
			MSMF082L1□□□	750 W	MCDL□35S□	C frame
			MSMF092L1□□□	1.0 kW	MDDL□45S□	D frame
			MSMF102L1□□□	1.0 kW	MDDL□55S□	D frame
			MSMF152L1□□□	1.5 kW		
3-phase, 200 V			MSMF202L1□□□	2.0 kW	MEDL□83S□	E frame
			MSMF302L1□□□	3.0 kW	MFDL□A3S□	F frame
			MSMF402L1□□□	4.0 kW	MFDL□B3S□	
			MSMF502L1□□□	5.0 kW		
Single 100 V	MQMF Middle inertia	3000 r/min	MQMF011L1□□□	100 W	MADL□11S□	A frame
			MQMF021L1□□□	200 W	MBDL□21S□	B frame
			MQMF041L1□□□	400 W	MCDL□31S□	C frame
Single/ 3-phase, 200 V			MQMF012L1□□□	100 W	MADL□05S□	A frame
			MQMF022L1□□□	200 W	MADL□15S□	
			MQMF042L1□□□	400 W	MBDL□25S□	B frame
Single/ 3-phase, 200 V	MDMF Middle inertia	2000 r/min	MDMF102L1□□□	1.0 kW	MDDL□45S□	D frame
			MDMF152L1□□□	1.5 kW	MDDL□55S□	
3-phase, 200 V			MDMF202L1□□□	2.0 kW	MEDL□83S□	E frame
			MDMF302L1□□□	3.0 kW	MFDL□A3S□	F frame
			MDMF402L1□□□	4.0 kW	MFDL□B3S□	
			MDMF502L1□□□	5.0 kW		
Single/ 3-phase, 200 V	MGMF Middle inertia	1500 r/min	MGMF092L1□□□	850 W	MDDL□45S□	D frame
			MGMF132L1□□□	1.3 kW	MDDL□55S□	
3-phase, 200 V			MGMF182L1□□□	1.8 kW	MEDL□83S□	E frame
			MGMF242L1□□□	2.4 kW	MEDL□93S□	
			MGMF292L1□□□	2.9 kW	MFDL□B3S□	F frame
			MGMF442L1□□□	4.4 kW		
Single 100 V	MHMF High inertia	3000 r/min	MHMF5AZL1□□□	50 W	MADL□01S□	A frame
			MHMF011L1□□□	100 W	MADL□11S□	
			MHMF021L1□□□	200 W	MBDL□21S□	B frame
			MHMF041L1□□□	400 W	MCDL□31S□	C frame
Single/ 3-phase, 200 V			MHMF5AZL1□□□	50 W	MADL□05S□	A frame
			MHMF012L1□□□	100 W		
			MHMF022L1□□□	200 W	MADL□15S□	
			MHMF042L1□□□	400 W	MBDL□25S□	B frame
			MHMF082L1□□□	750 W	MCDL□35S□	C frame
			MHMF092L1□□□	1.0 kW	MDDL□55S□	D frame
			MHMF102L1□□□	1.0 kW	MDDL□45S□	
			MHMF152L1□□□	1.5 kW	MDDL□55S□	
3-phase, 200 V			MHMF202L1□□□	2.0 kW	MEDL□83S□	E frame
			MHMF302L1□□□	3.0 kW	MFDL□A3S□	F frame
			MHMF402L1□□□	4.0 kW	MFDL□B3S□	
			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.7-108 the Options of Supplement.

5. Installation

Driver

Install the driver properly to avoid a breakdown 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.

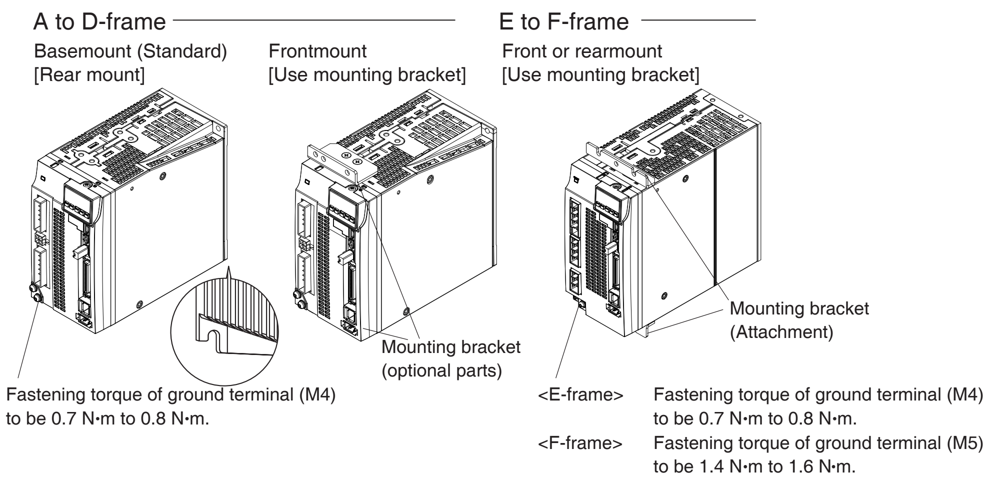
Environmental Conditions

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 , 10 Hz to 60 Hz (Do not continuously use the driver for along time at the resonance point.)
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.

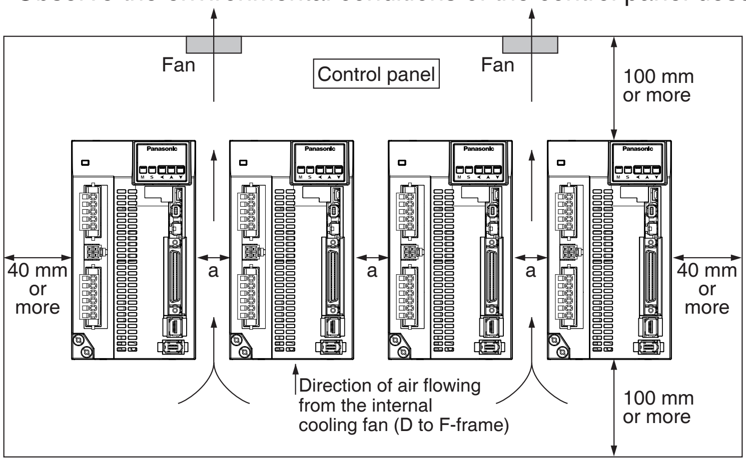
How to Install

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. For choosing the correct optional mounting bracket, refer to P.7-141 “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.



	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

- We have been making the best effort to ensure the highest quality, however, application of exceptionally large external noise disturbance and static electricity, or failure in input power, wiring and components may result in unexpected action. 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.
- There might be a chance of smoke generation due to the failure of these products. Pay an extra attention when you apply these products in a clean room environment.
- 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 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.1-7 “Specifications” • P.1-24 “Installation of motor”
• P.7-78 “Dimensions of driver” • P.7-141 “Mounting bracket”

- 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.
- When establishing a system using safety functions, completely understand the applicable safety standards and the operating instruction manual or technical documents for the product.
- 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 heat dissipation. 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. A proper consideration should be given to cool the driver so that the ambient temperature matches the specified operating temperature range.
- 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 if the motor is used in a clean room or similar environment.
- 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.
- 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).

Recommended Electric Wires for Driver

- For the main circuit, use electric wire that withstands at least 600 VAC with temperature rating 75˚C or higher.
- When using bundled wires running through metallic conduit, the amounts of current determined according to the reduction rate must be subtracted from the nominal allowable current.
- Electric wires
  <In high ambient temperature>
  Use heat resistant wire.
  Common polyvinyl chloride wires will deteriorate by heat at a higher rate.
  <In low ambient temperature>
  The surface of vinyl chloride insulation becomes hardened and brittle at low temperature and needs specific protective measure when used in cold region.
- Bend radius of the cable must be 10 times or more its finish outside diameter.
- Cables cannot be used for continuous regeneration because they are not designed for such application.

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 mm² 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: mm²)	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
	11 to 30 (excl.)	115
	30 to 38 (excl.)	139
	38 to 68 (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) (W/km)	Test voltage (V/1 min.)	Minimum insulation resistance (MW•km)	(Reference) Approx. mass (kg/km)
Nominal cross section (mm²)	Structure or shape (wires/mm²)	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.

5. 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 49 m/s^2 (5 G) at running, 24.5 m/s^2 (2.5 G) at stall
Impact	Motor only	Lower than 98 m/s^2 (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 5 cm 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.

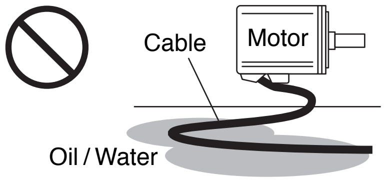
How to Install

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) Don't 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)

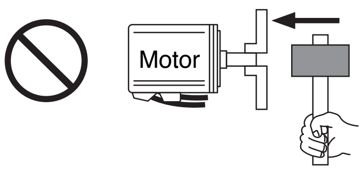
Permissible Load to Output Shaft

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.1-26, "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.1-20 "Installation of driver"
• P.1-24 "Permissible Load at Output Shaft" • P.7-84 "Dimensions of motor"

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

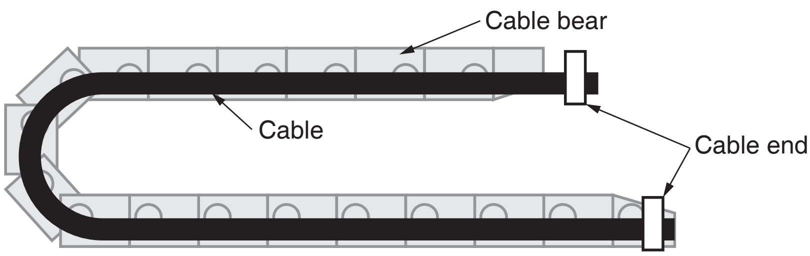
Wiring Precautions on Movable Section

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.1-19 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.

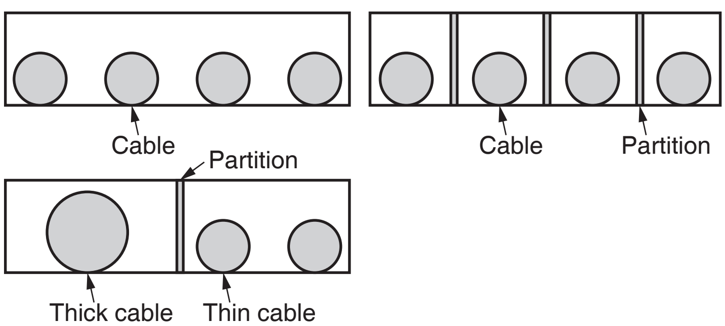
• Cable distortion

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.

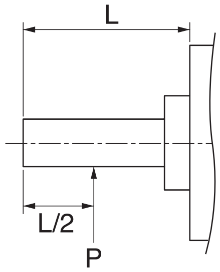
[Wiring arrangement in cable bear – example]



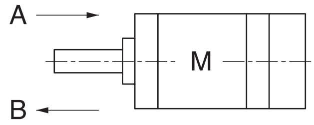
6. Permissible Load at Output Shaft

Motor

Radial load (P) direction



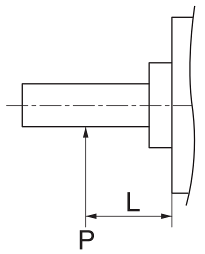
Thrust load (A and B) direction



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) ～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～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～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～5.0 kW	$P=\frac{46256}{L+19}$

2. Preparation

1. 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 or 1 prescribed in IEC60664-1
Use a copper cable with temperature rating of 75 ˚C or higher.
Make sure to install a circuit breaker(MCCB) or fuse which are UL recognized on the power supply.

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

(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 rated current of circuit breaker and fuse, refer to P.2-10 “Driver and List of Applicable Peripheral Equipments”.
For Overload protection time characterstics, refer to P.6-17

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.

Conformed Standards

		Driver	Motor
EC Directives	EMC Directives	EN55011 EN61000-6-2 EN61000-6-4 EN61800-3	–
	Low-Voltage Directives	EN61800-5-1	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 (E164620)	UL1004-1, UL1004-6 (E327868)
CSA Standards		C22.2 No.14	C22.2 No.100-04
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 A6 series standard type and communication type don't correspond to the functional safety standards.
*2 Information related to the Radio Waves Act (South Korea)
This servo driver is a Class A commercial electromagnetic radio wave generator not designed for home use. The user and distributor should be aware of this fact.

A 급 기기 (업무용 방송통신기자재)
이 기기는 업무용(A 급) 전자파적합기기로서 판매자
또는 사용자는 이 점을 주의하시기 바라며, 가정외의
지역에서 사용하는 것을 목적으로 합니다.

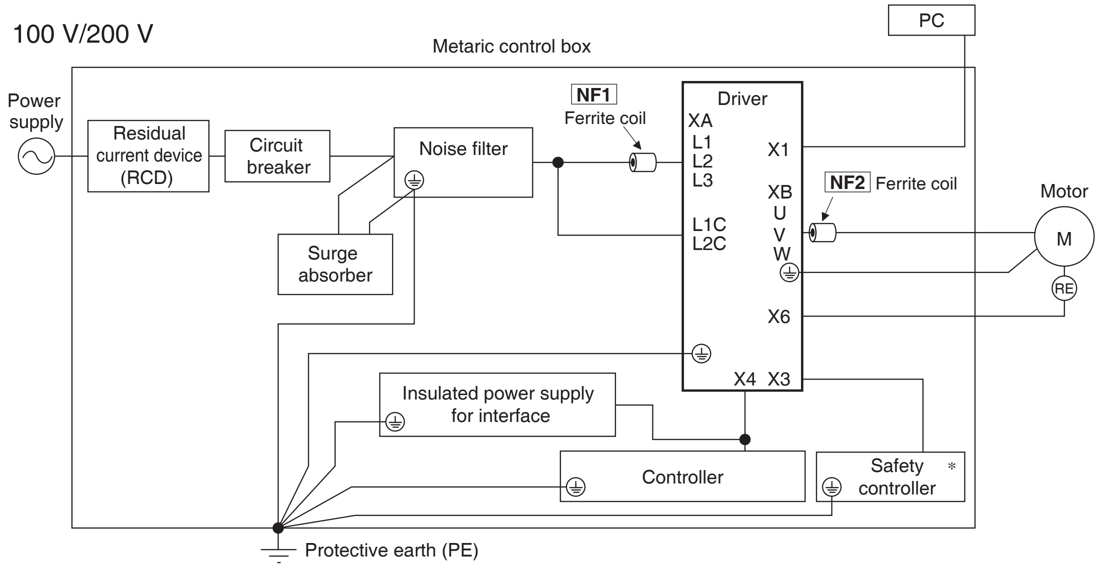
(대상기종 : Servo Driver)

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

Composition of Peripheral Equipments

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.)



For NF1 to NF2, refer to the Table "Ferrite coil" (P.2-5).
* The standard type and communication type are not provided with X3 terminal.

• 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 noise filter, as shown in the figure, for each cable, I/O line and power source 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.

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.2-4).
*2 The number of turns are 0.

Remarks To connect the noise filter to the connector XB connection cable, adjust the sheath length at the tip of the cable, as required.

Caution Fix the ferrite coil in order to prevent excessive stress to the cables.

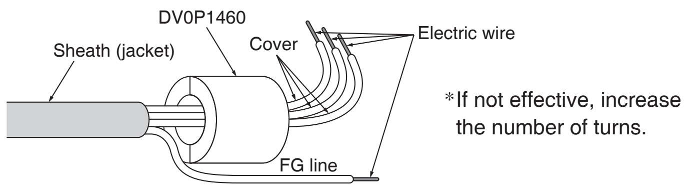
<Attaching ferrite coil>

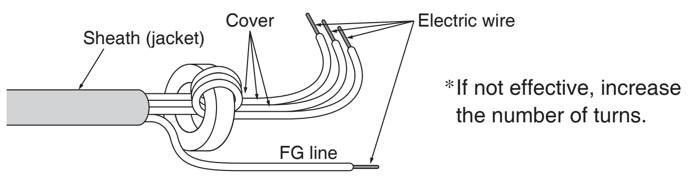
Signal wire — Wind cables the number of turns required to form the ferrite coil.

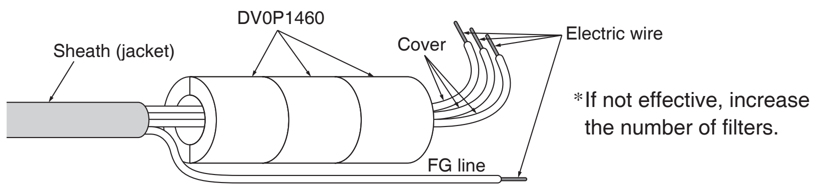
Power wire — If sheathed (jacketed): remove the sheath (jacket) to the length so that wires (L1, L2, L3) can be wound on the ferrite coil (including power line dedicated filter). For effective noise reduction capability, L1, L2 and L3 should be wound together.
If not effective, increase the number of 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 capability, 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.







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.

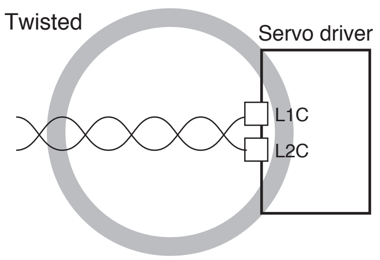
Power Supply

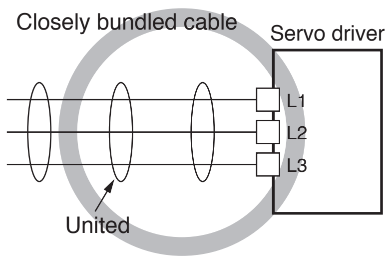
100 V type: (A to C-frame)	Single phase, 100 V	$^{+10\ \%}_{-15\ \%}$	to	120 V	$^{+10\ \%}_{-15\ \%}$	50 Hz/60 Hz
200 V type: (A to D-frame)	Single/3-phase, 200 V	$^{+10\ \%}_{-15\ \%}$	to	240 V	$^{+10\ \%}_{-15\ \%}$	50 Hz/60 Hz
200 V type: (E to F-frame)	3-phase, 200 V	$^{+10\ \%}_{-15\ \%}$	to	240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

Install a circuit breaker 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.

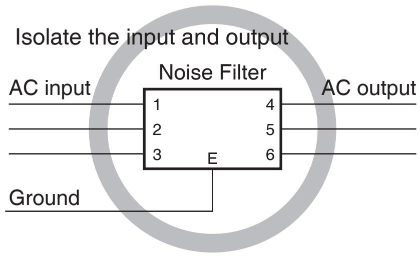
Note For driver and applicable peripheral equipments, refer to P.2-10 "Driver and List of Applicable Peripheral Equipments".

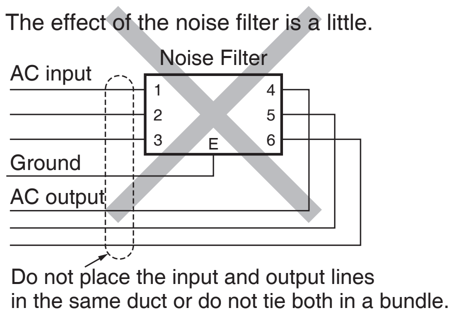
Noise Filter

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	

Remarks

- 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)





Related page • P.2-10 "Driver and List of Applicable Peripheral Equipments" • P.7-108 "Options"

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.

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.

Note For driver and applicable peripheral equipments, refer to P.2-10 "Driver and List of Applicable Peripheral Equipments".

Related page
• P.7-108 "Options"

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 X6 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.2-10 “Driver and List of Applicable Peripheral Equipments”.

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. System Configuration and Wiring

Driver and List of Applicable Peripheral Equipments

List of Peripheral Equipments

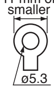
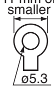
Driver	Voltage *1	Rated output	Required Power (at the rated load)	Circuit breaker (rated current)	Noise filter (Single phase/3-phase)	Surge absorber (Single phase/3-phase)	Noise filter for signal	Rated operating current of magnetic (contactor Contact configuration) *2
MADL□□□□□	Single phase, 100 V	50 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/DV0PM20042	DV0P4190/DV0P1450		
MBDL□□□□□	Single 100 V	200 W	approx. 0.5 kVA		DV0P4170	DV0P4190		
	Single/3-phase, 200 V	400 W	approx. 0.9 kVA		DV0P4170/DV0PM20042	DV0P4190/DV0P1450		
MCDL□□□□□	Single 100 V	400 W	approx. 0.9 kVA	15 A	DV0PM20042	DV0P4190		
	Single/3-phase, 200 V	750 W	approx. 1.3 kVA			DV0P4190/DV0P1450		
MDDL□□□□□	3-phase, 200 V	1.0 kW	approx. 1.8 kVA	20 A	DV0P4220			30 A (3P+1a)
		0.9 kW	approx. 1.8 kVA					
		1.0 kW	approx. 1.8 kVA					
		1.5 kW	approx. 2.3 kVA					
MEDL□□□□□	3-phase, 200 V	2.0 kW	approx. 3.3 kVA	30 A	DV0PM20043	DV0P1450	DV0P1460 RJ8035 (Recommended component) *4	60 A (3P+1a)
		2.5 kW	approx. 3.8 kVA					
MFDL□□□□□	3-phase, 200 V	2.0 kW	approx. 3.8 kVA	50 A	DV0P3410	DV0P1450	DV0P1460 RJ8035 (Recommended component) *4	60 A (3P+1a)
		3.0 kW	approx. 4.5 kVA					
		4.0 kW	approx. 6.0 kVA					100 A (3P+1a)
		4.5 kW	approx. 6.8 kVA					
		5.0 kW	approx. 7.5 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 mm^2/ AWG18 600 VAC or more	Connection to exclusive connector	0.75 mm^2/ AWG18 600 VAC or more	Connection to exclusive connector	0.75 mm^2/ AWG18 600 VAC or more	0.28 mm^2/ AWG22 to 0.75 mm^2/ 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 mm^2/ AWG14 600 VAC or more				2.0 mm^2/ AWG14 600 VAC or more	0.75 mm^2/ 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.7-108 Surge absorber...P.7-110
Ferrite coil...P.7-111 Motor/brake connector...P.2-28

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 or smaller  ø5.3 Terminal block M5		11 mm or smaller  ø5.3 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 and magnetic contactor

To comply to EC Directives, install a circuit breaker between the power and the noise filter without fail, and the circuit breaker should conform to IEC Standards and UL recognized (Listed and ⓊL 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 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, and maintain the peeled off length of 8 to 9 mm. (Refer to P.2-31)

• 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	1.0 to 1.7	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	0.7 to 0.8	M2.6	0.3 to 0.35
F	M5	1.4 to 1.6		

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.

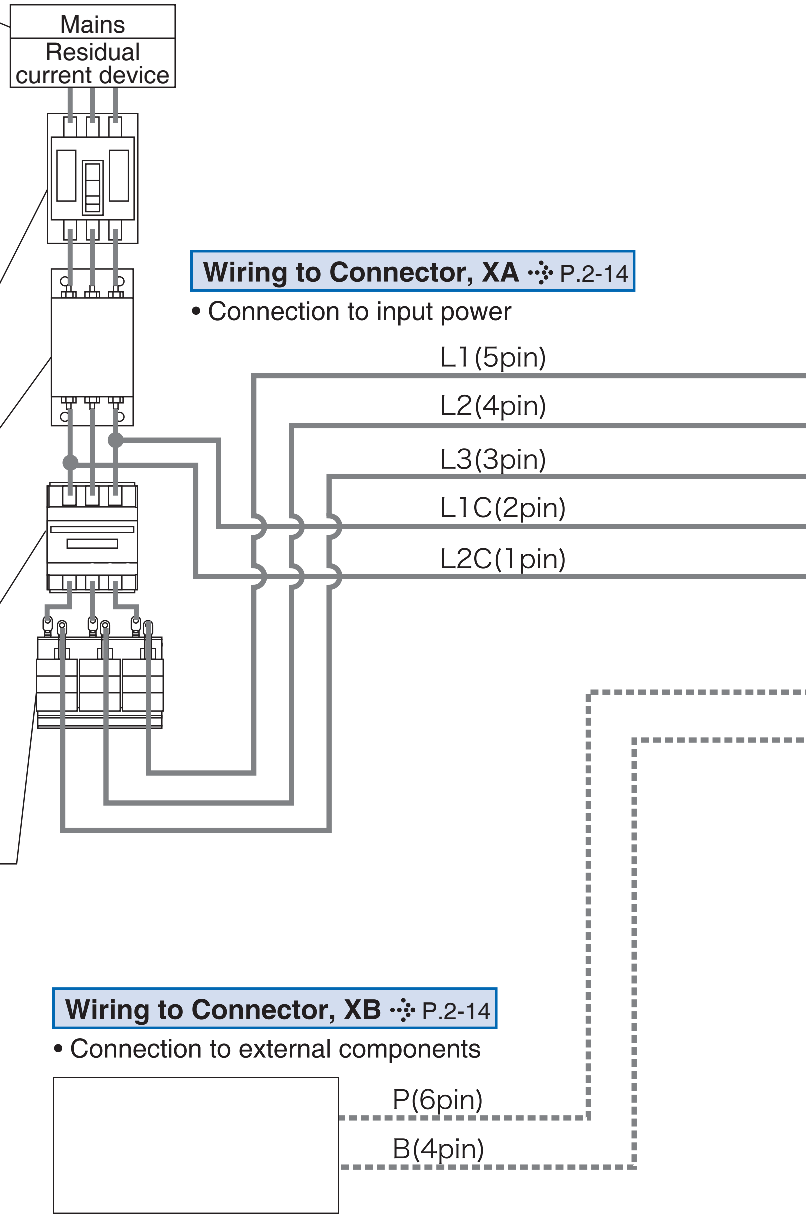
Be sure to conduct wiring properly and securely. Insecure or improper wiring may cause the motor running out of control or being damaged from overheating. In addition, pay attention not to allow conductive materials, such as wire chips, entering the driver during the installation and wiring.

2. System Configuration and Wiring

Overall Wiring (A to B-frame, 100 V/200 V type)

Connecting Example of A to B-frame

- **Apply the voltage designated on the nameplate from the power source.**
  Symmetric current should be 5000 Arms or below. If the short-circuit current on the power source exceeds this value, use a current-limiting device (e.g. current-limiting fuse, current-limiting circuit breaker or transformer).



Wiring to Connector, XA P.2-14

- Connection to input power

- **Wiring of Main Connector (XA)**

  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.
  - **Never start nor stop the servo motor with this Magnetic Contactor.**

  Reactor (L) (to be supplied by customer)
  Reduces harmonic current of the main power.

- **Wiring of Motor Connector (XB)**

  Pin P (6-pin), B (4-pin)
  - When you connect an external regenerative resistor, connect the external regenerative resistor between P and B, set up Pr0.16 to 1 or 2.

Wiring to Connector, XB P.2-14

- Connection to external components

Regenerative resistor (optional)

Remarks

- When you use an external regenerative resistor, **install an external protective apparatus, such as thermal fuse without fail.**
- Thermal fuse and thermal protector are built in to the regenerative resistor (Option). **If the thermal fuse is activated, it will not resume.**
- Mount the regenerative resistor **on incombustible material such as metal.**

Note

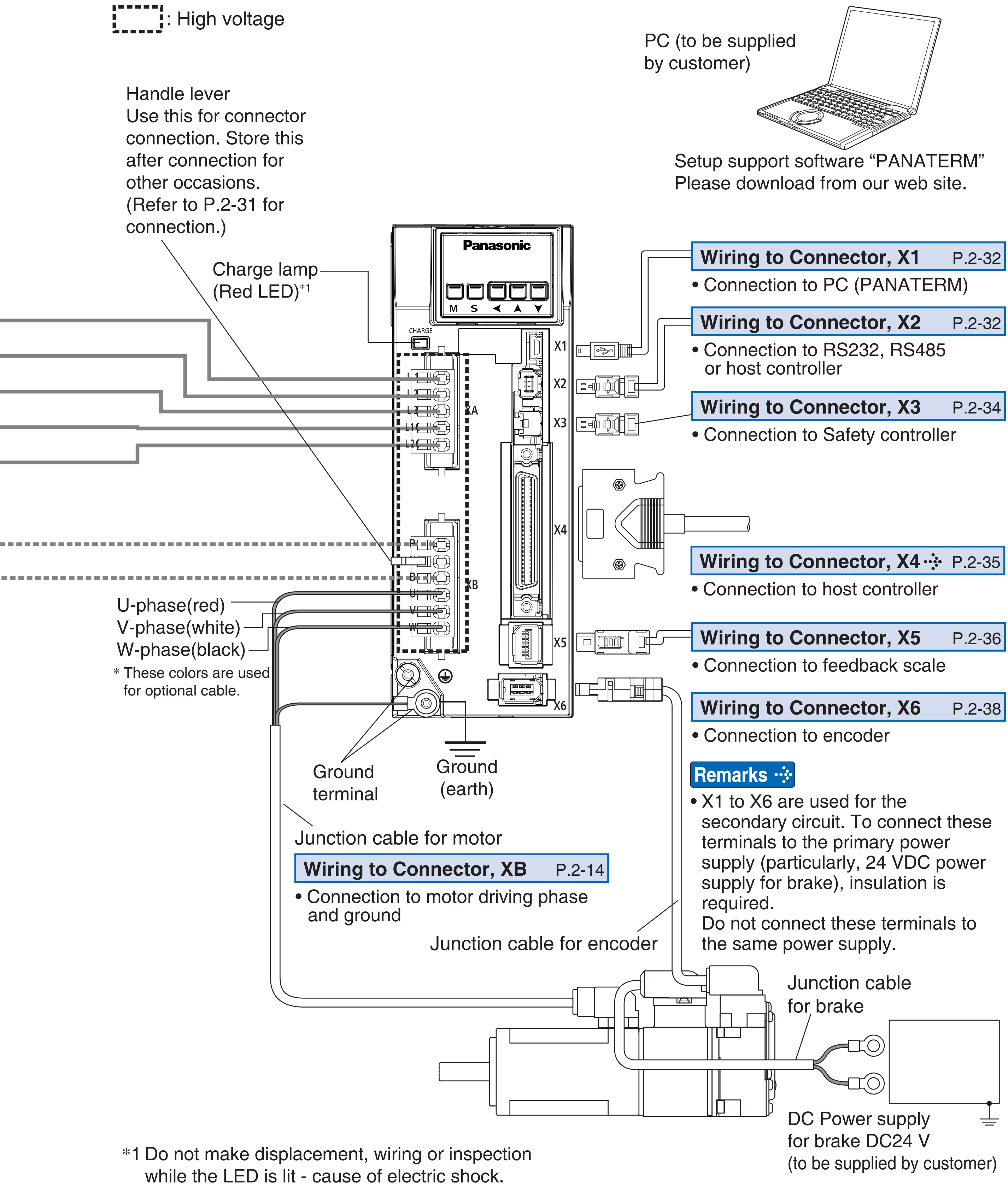
Note that no regenerative resistor is equipped in Frame A and B type.

Note

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

Related page

• P.7-108... "Options"



Remarks

- X1 to X6 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 LED is lit - cause of electric shock.

Related page
• P.2-14"Wiring of the Main Circuit (A to B-frame, 100 V/200 V type)" • P.2-28 "Specifications of Motor connector"

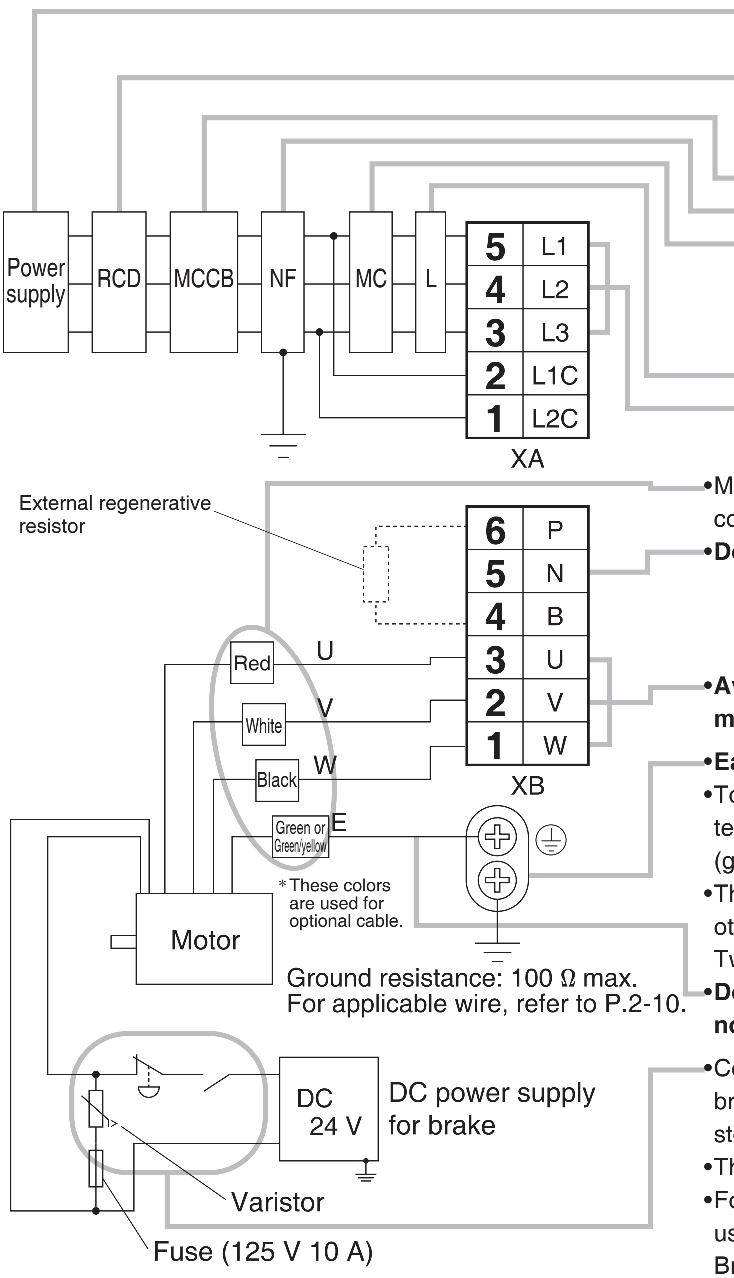
URL: http://industrial.panasonic.com/ww/products/motors-compressors/fa-motors

A to B-frame, 100 V / 200 V type

- 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

1) Wire connector (XA and XB).
2) Connect the wired connector to the driver. Fully insert the connector to the bottom until it clicks.



- 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.
- Make sure to provide a noise filter.
- Provide coil surge suppression units to the coil of the Magnetic Contactor recommended by manufacturer. **Never 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 don't use L2.**
- Match the colors of the motor lead wires to those of the corresponding motor output terminals (U,V,W).
- **Don't connect anything to N.**
- **Avoid shorting and grounding. Don't 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.
- **Don't 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 "Specifications of Built-in Holding Brake" on P.2-45.
- 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.2-28 "Specifications of Motor connector" • P.2-31 "Wiring method to connector"
• P.7-132 "Connector kit for XA" • P.7-133 "Connector kit for XB"

2. System Configuration and Wiring

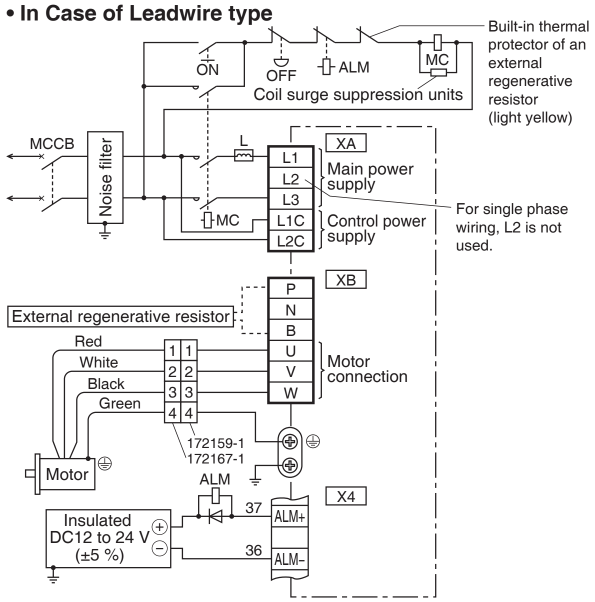
Wiring Diagram (A to B-frame, 100 V/200 V type)

Compose the circuit so that the main circuit power will be shut off when an error occurs. However, if you want to use “immediate stop function” and the main circuit power turns off, please be aware that you will no longer be able to use “immediate stop function”.

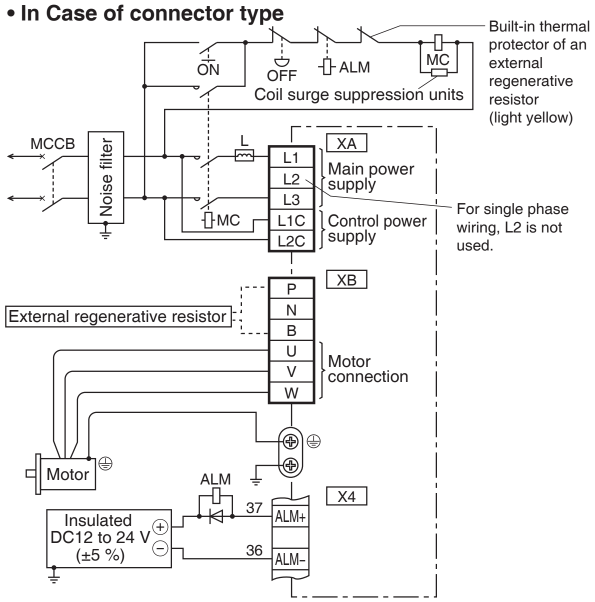
In Case of Single Phase, A to B-frame, 100 V / 200 V type

Power supply Single phase, 100 V –15 % to 120 V +10 % / 200 V –15 % to 240 V +10 %

• **In Case of Leadwire type**



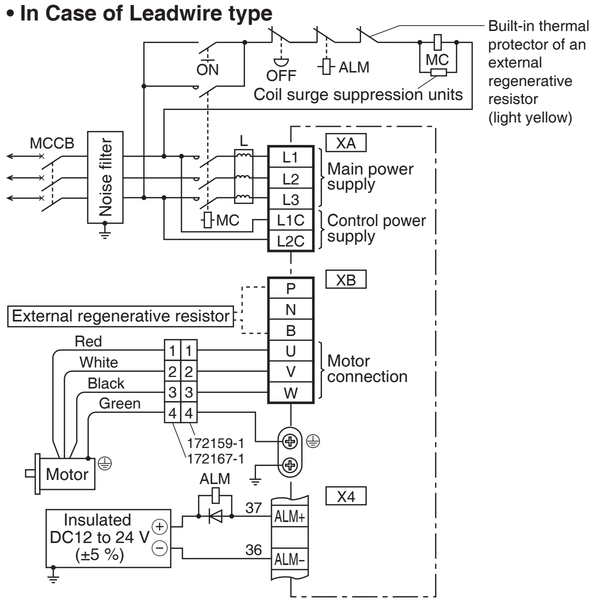
• **In Case of connector type**



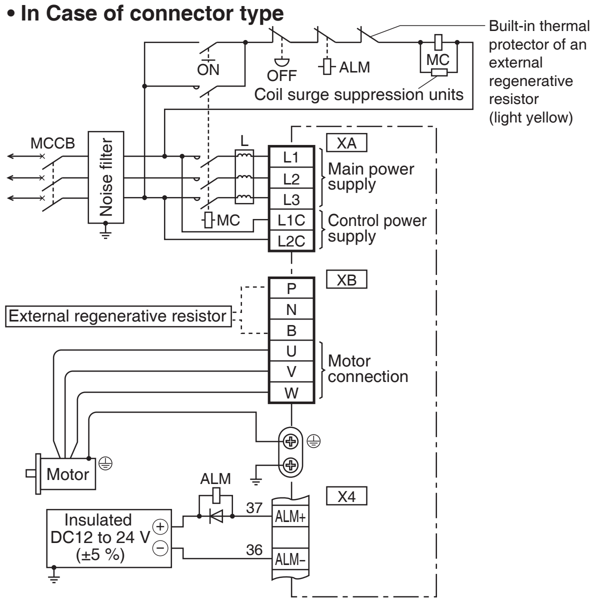
In Case of 3-Phase, A to B-frame, 200 V type

Power supply 3-phase, 200 V –15 % to 240 V +10 %

• **In Case of Leadwire type**



• **In Case of connector type**



Note.1)

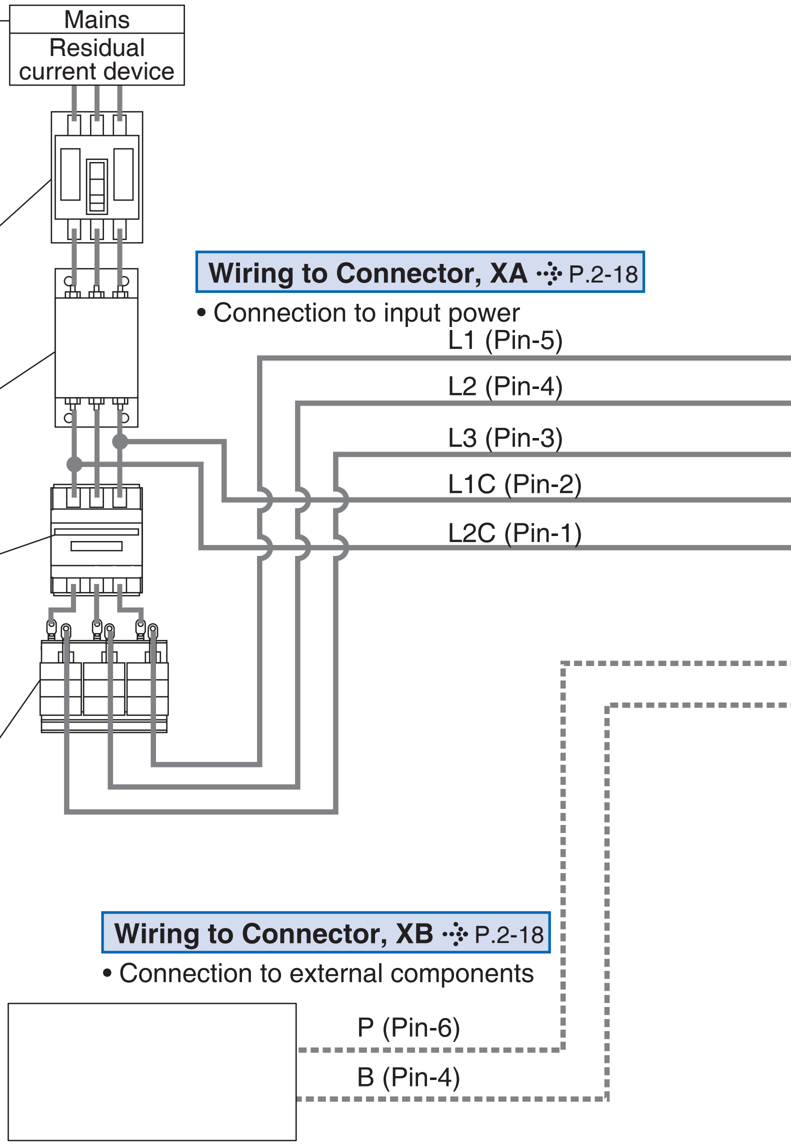
Frame No.	Short wire (Accessory)	Built-in regenerative resistor	Connection of the connector XB	
			In case of using an external regenerative resistor.	In case of not using an external regenerative resistor.
A-frame B-frame	without	without	•Connect an external regenerative resistor between P-B	•Always open between P-B

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

Related page • P.2-28 “Specifications of Motor connector” • P.2-31 “Wiring method to connector”

Overall Wiring (C to D-frame, 100 V/200 V type)

Connecting Example of C to D-frame



- Apply the voltage designated on the nameplate from the power source.
  Symmetric current should be 5000 Arms or below. If the short-circuit current on the power source exceeds this value, use a current-limiting device (e.g. current-limiting fuse, current-limiting circuit breaker or transformer).

- **Wiring of Main Connector (XA)**

  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.
  - **Never start nor stop the servo motor with this Magnetic Contactor.**

  Reactor (L) (to be supplied by customer)
  Reduces harmonic current of the main power.

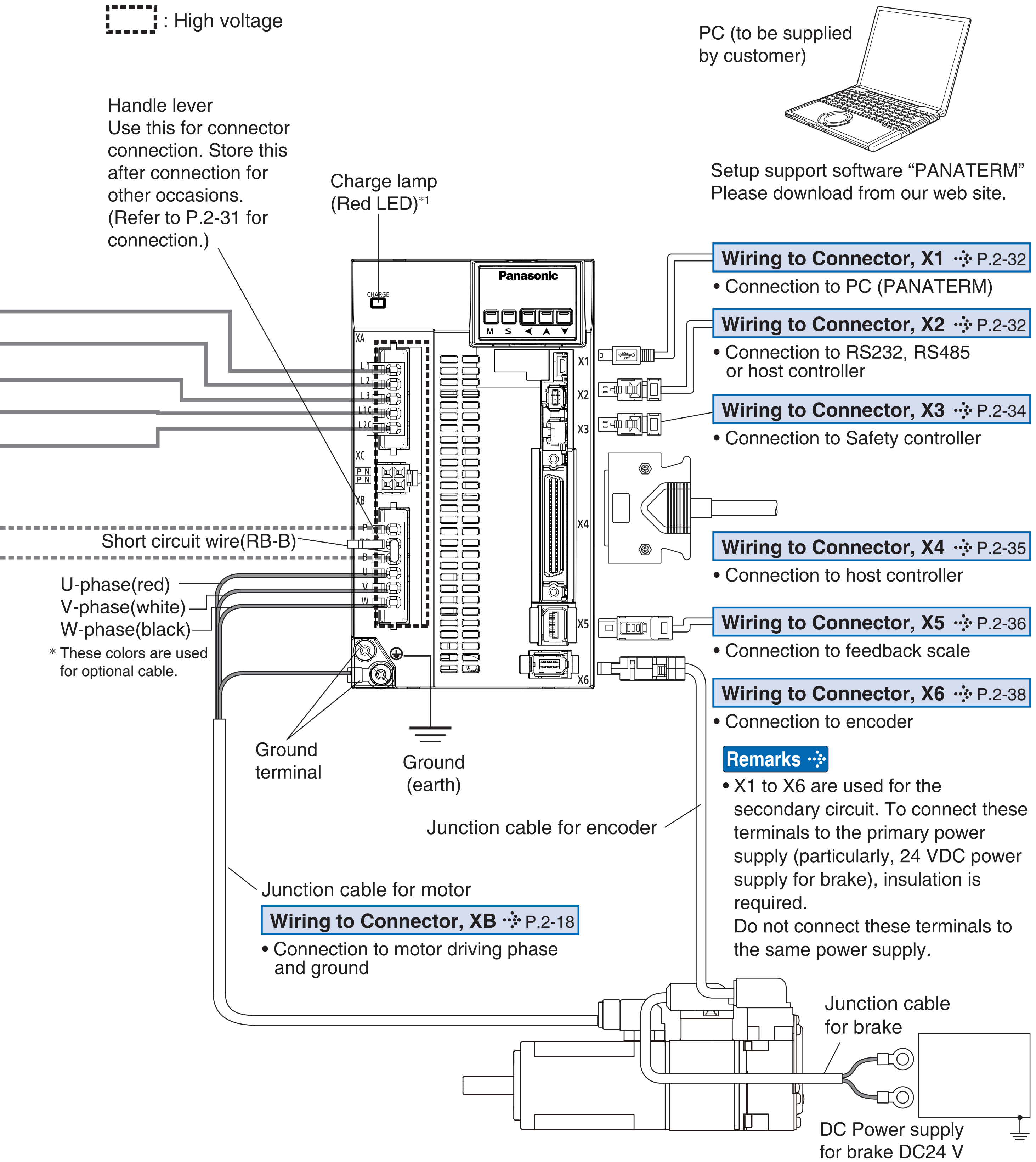
- **Wiring of Motor Connector (XB)**

  Pin P (6-pin), B (4-pin), and RB (5-pin)
  - **RB and B to be kept shorted for normal operation.**
  - When you connect an external regenerative resistor, disconnect a short circuit wire between RB and B, then connect the external regenerative resistor between P and B, set up Pr0.16 to 1 or 2.

Remarks
- When you use an external regenerative resistor, **install an external protective apparatus, such as thermal fuse without fail.**
- Thermal fuse and thermal protector are built in to the regenerative resistor (Option). **If the thermal fuse is activated, it will not resume.**
- Mount the regenerative resistor **on incombustible material such as metal.**

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

Related page
• P.7-108... "Options"



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

Related page
• P.2-18"Wiring of the Main Circuit (A to B-frame, 100 V/200 V type)" • P.2-28 "Specifications of Motor connector"

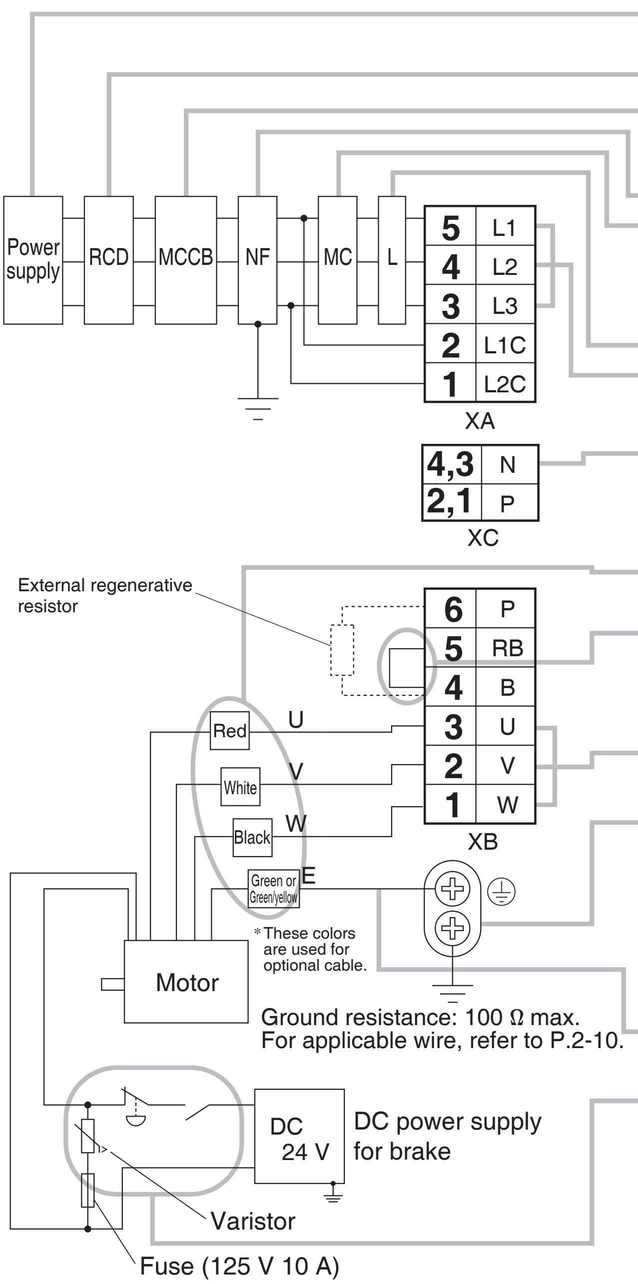
URL: http://industrial.panasonic.com/ww/products/motors-compressors/fa-motors

C to D-frame, 100 V / 200 V type

- 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

1) Wire connector (XA and XB).
2) Connect the wired connector to the driver. Fully insert the connector to the bottom until it clicks.



- 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.
- Make sure to provide a noise filter.
- Provide coil surge suppression units to the coil of the Magnetic Contactor recommended by manufacturer. **Never 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 don't 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).
- Don't disconnect the shorting cable between B2 and B3 (C and D frame type). Disconnect this only when the external regenerative register is used.
- **Avoid shorting and grounding. Don't 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.
- **Don't 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 "Specifications of Built-in Holding Brake" on P.2-45.
- 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.2-28 "Specifications of Motor connector" • P.2-31 "Wiring method to connector"
- P.7-132 "Connector kit for XA" • P.7-133 "Connector kit for XB"

2. System Configuration and Wiring

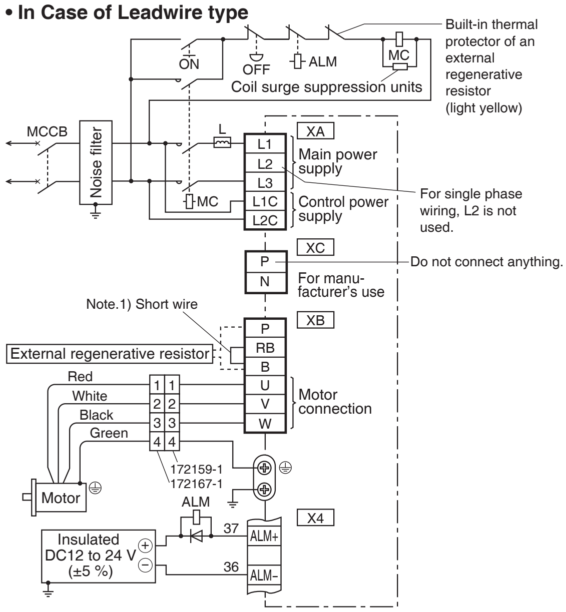
Wiring Diagram (C to D-frame, 100 V/200 V type)

Compose the circuit so that the main circuit power will be shut off when an error occurs. However, if you want to use “immediate stop function” and the main circuit power turns off, please be aware that you will no longer be able to use “immediate stop function”.

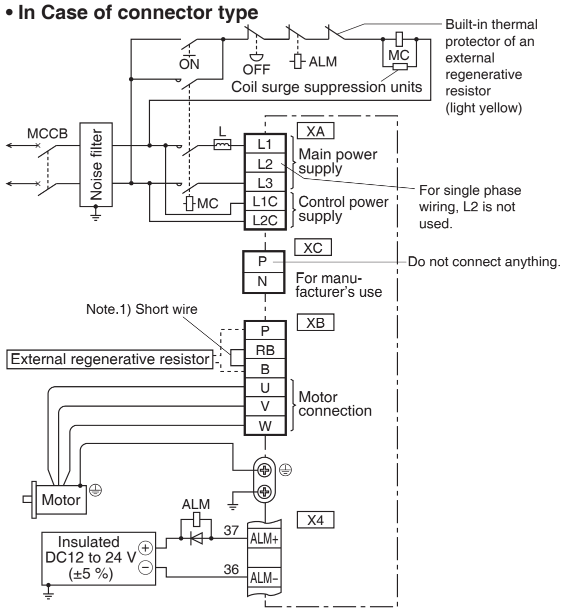
In Case of Single Phase, C to D-frame, 100 V / 200 V type

Power supply Single phase, 100 V –15 % to 120 V +10 % / 200 V –15 % to 240 V +10 %

• In Case of Leadwire type



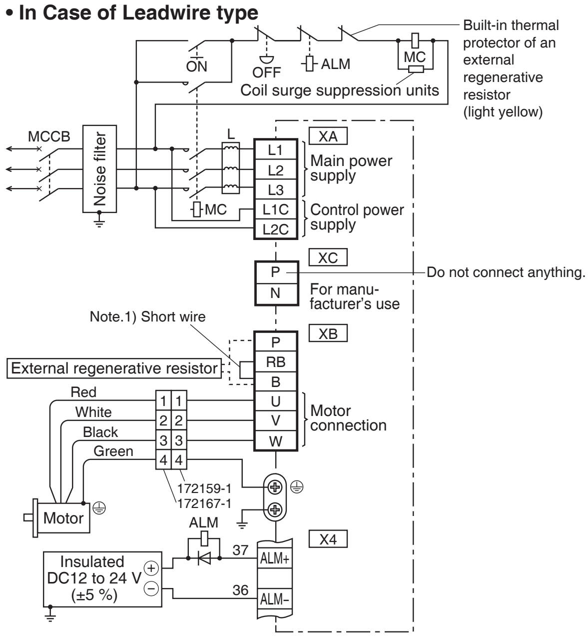
• In Case of connector type



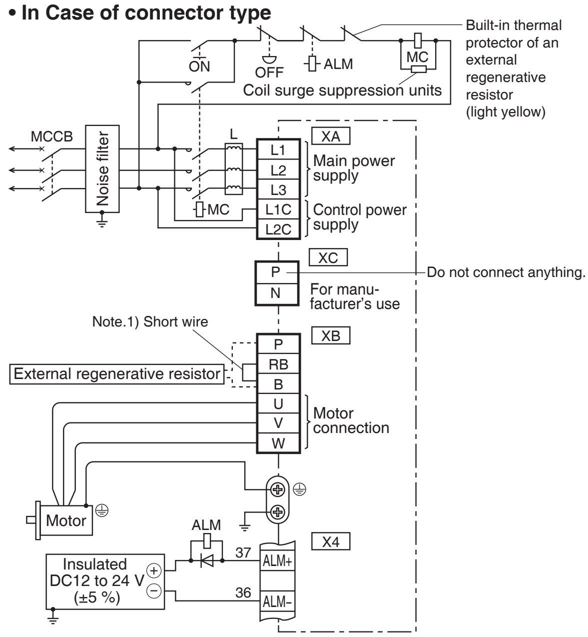
In Case of 3-Phase, C to D-frame, 200 V type

Power supply 3-phase, 200 V –15 % to 240 V +10 %

• In Case of Leadwire type



• In Case of connector type



Note.1)

Frame No.	Short wire (Accessory)	Built-in regenerative resistor	Connection of the connector XB	
			In case of using an external regenerative resistor.	In case of not using an external regenerative resistor.
C-frame D-frame	with	with	•Remove the short wire accessory from between RB-B. •Connect an external regenerative resistor between P-B	•Shorted between RB-B with an attached short wire

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

Related page • P.2-28 “Specifications of Motor connector” • P.2-31 “Wiring method to connector”

Overall Wiring (E-frame, 200 V type)

Connecting Example of E-frame

- Apply the voltage designated on the nameplate from the power source.
  Symmetric current should be 5000 Arms or below.
  If the short-circuit current on the power source exceeds this value, use a current-limiting device (e.g. current-limiting fuse, current-limiting circuit breaker or transformer)

- **Wiring of Main Connector (XA)**

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

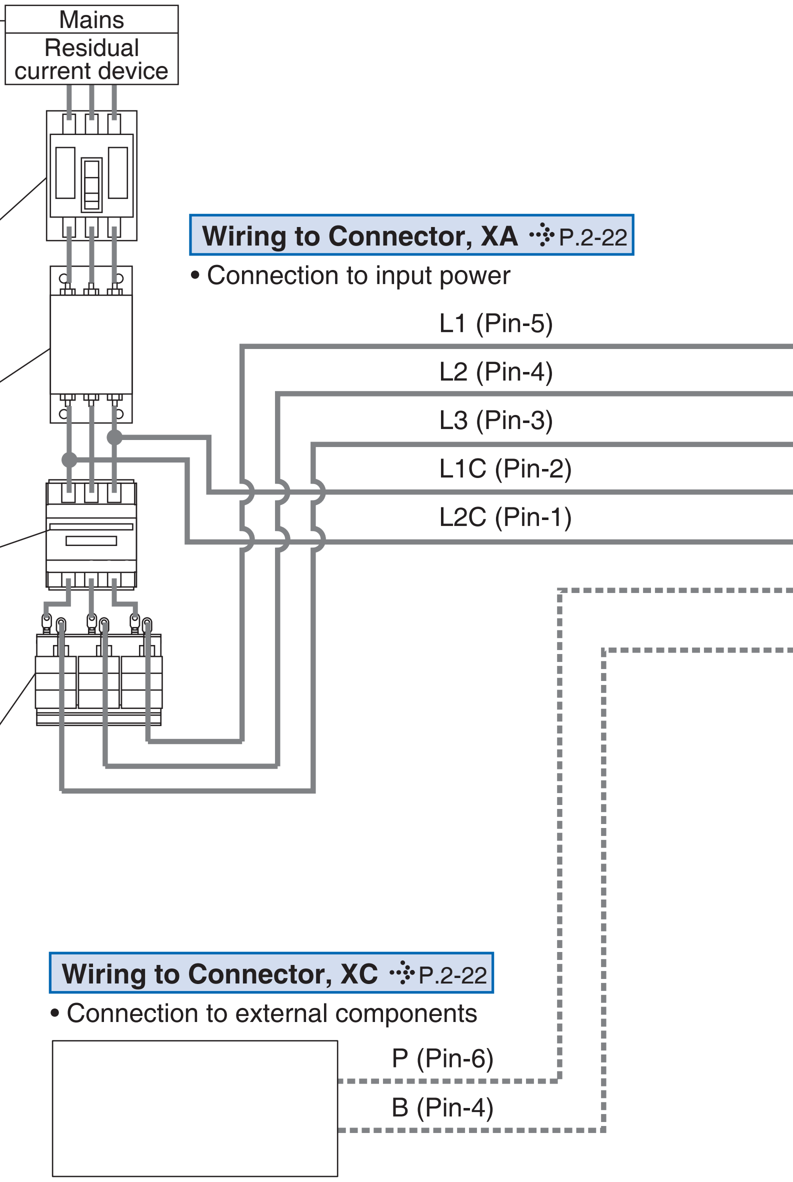
  Noise Filter (NF)
  Removes external noise from the power lines. And reduces an effect of the noise generated by the servo driver.

  Magnetic Contactor (MC)
  Turns on/off the main power of the servo driver.
  Use coil surge suppression units together with this.
  - **Never start nor stop the servo motor with this Magnetic Contactor.**

  Reactor (L) (to be supplied by customer)
  Reduces harmonic current of the main power.

- **Wiring of Motor Connector (XC)**

  Pin P (4-pin), RB (2-pin), and B(3-pin)
  - **RB and B to be kept shorted for normal operation.**
  - When you connect an external regenerative resistor, disconnect a short circuit wire between RB and B, then connect the external regenerative resistor between P and B, set up Pr0.16 to 1 or 2.



Regenerative resistor (optional)

Remarks

- When you use an external regenerative resistor, **install an external protective apparatus, such as thermal fuse without fail.**
- Thermal fuse and thermal protector are built in to the regenerative resistor (Option). **If the thermal fuse is activated, it will not resume.**
- Mount the regenerative resistor **on incombustible material such as metal.**

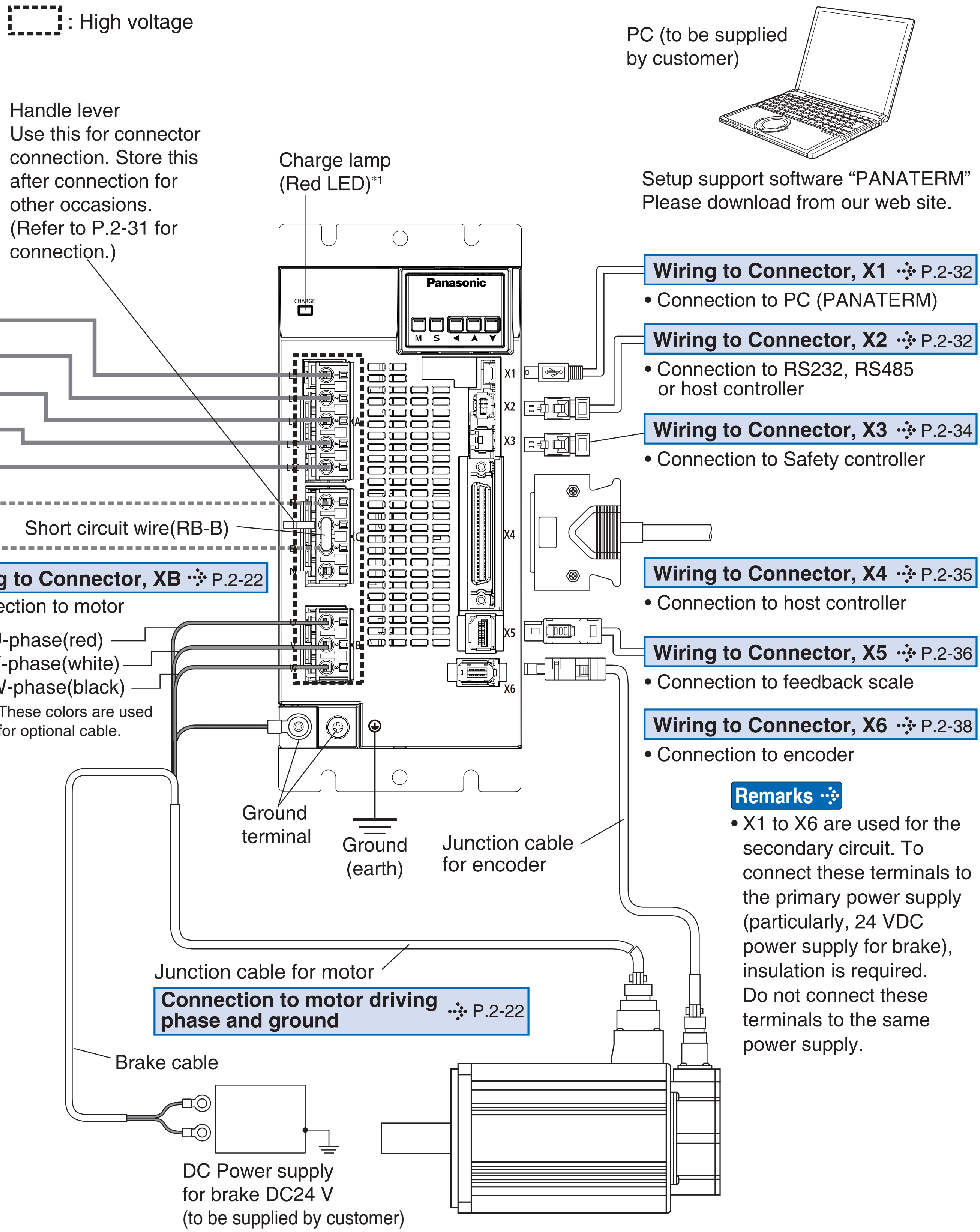
Note

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

Related page

• P.7-108... "Options"

Overall Wiring (E-frame, 200 V type)



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

Note

- The figure above shows connections on the mutifuction type.
- Only for the standard type is not provided with X2, X3 and X5.

Related page

• P.2-18 "Wiring of the Main Circuit (E-frame, 200 V type)" • P.2-28 "Specifications of Motor connector"

URL: http://industrial.panasonic.com/ww/products/motors-compressors/fa-motors

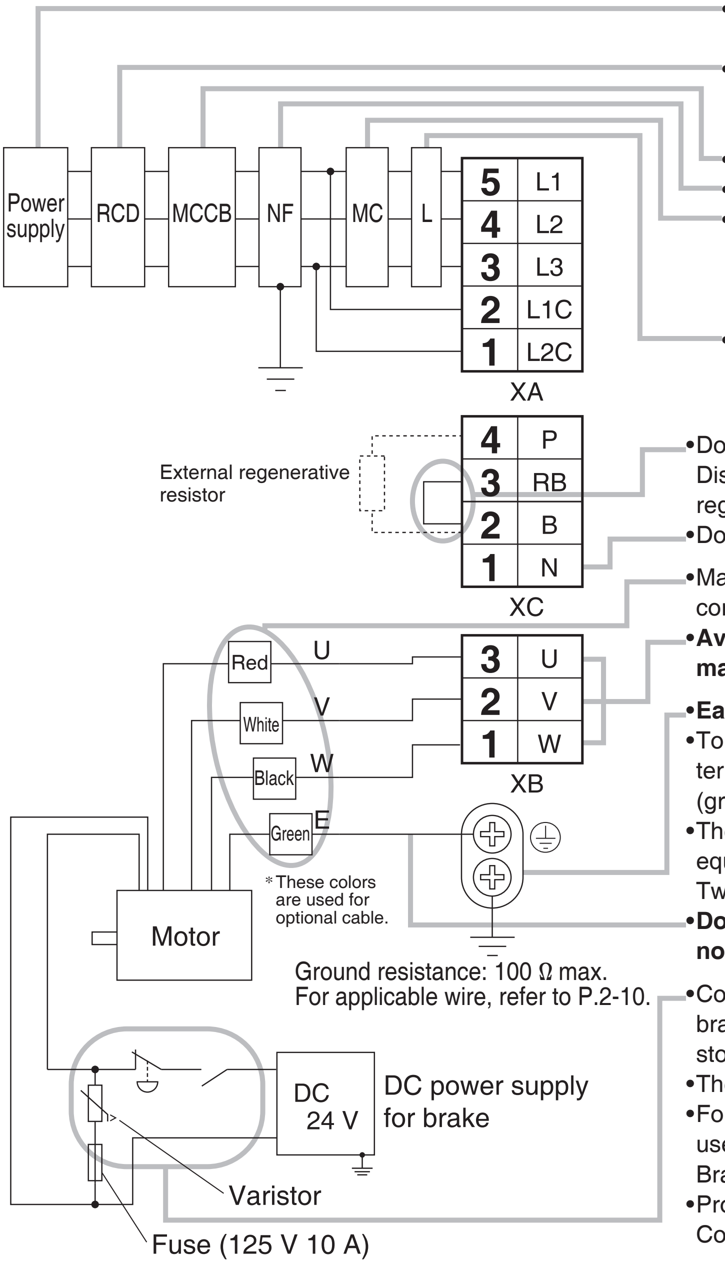
Wiring of the Main Circuit (E-frame, 200 V type)

E-frame, 200 V type

- 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

1) Wire connector (XA, XB and XC).
2) Connect the wired connector to the driver.
   Fully insert the connector to the bottom until it clicks.



- 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.
- Make sure to provide a noise filter.
- Provide coil surge suppression units to the coil of the Magnetic Contactor recommended by manufacturer. **Never start/stop the motor with this Magnetic Contactor.**
- Provide an AC Reactor.

- Don't 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. Don't 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.
- **Don't 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 “Specifications of Built-in Holding Brake” on P.2-45.
- 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.2-28 “Specifications of Motor connector”
- P.2-31“Wiring method to connector”
- P.7-132 “Connector kit for XA,XC”
- P.7-133 “Connector kit for XB”

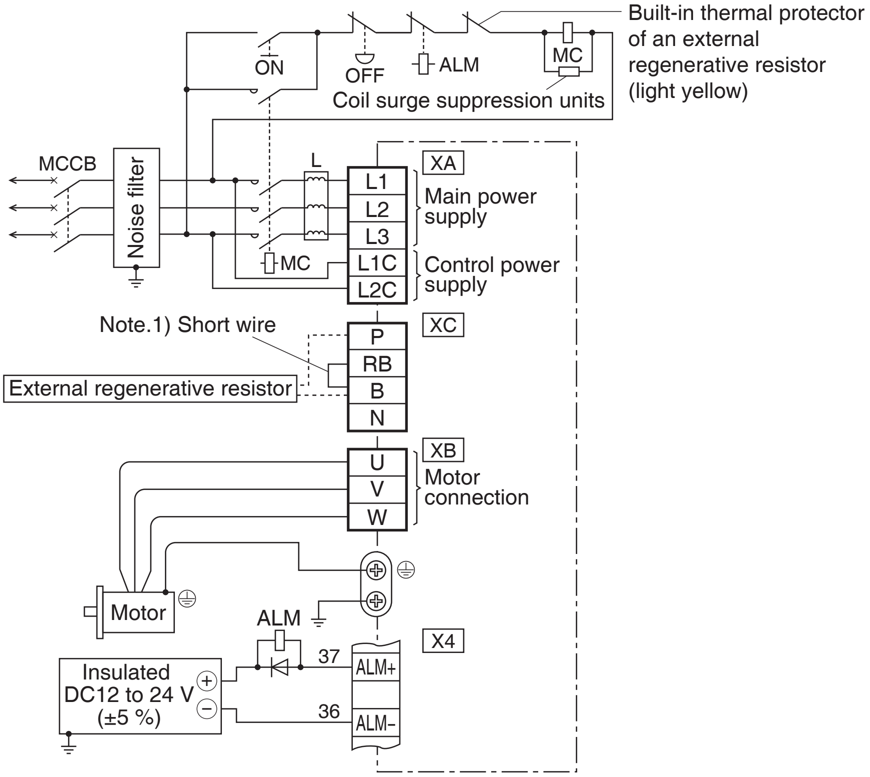
2. System Configuration and Wiring

Wiring Diagram (E-frame, 200 V type)

Compose the circuit so that the main circuit power will be shut off when an error occurs. However, if you want to use "immediate stop function" and the main circuit power turns off, please be aware that you will no longer be able to use "immediate stop function".

In Case of 3-Phase, E-frame, 200 V type

Power supply 3-phase, 200 V –15 % to 240 V +10 %



Note.1)

Frame No.	Short wire (Accessory)	Built-in regenerative resistor	Connection of the connector XC	
			In case of using an external regenerative resistor.	In case of not using an external regenerative resistor.
E-frame	with	with	• Remove the short wire accessory from between RB-B. • Connect an external regenerative resistor between P-B.	• Shorted between RB-B with an attached short wire

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

Related page • P.2-28 "Specifications of Motor connector" • P.2-31 "Wiring method to connector"

Overall Wiring (F-frame, 200 V type)

Connecting Example of F-frame

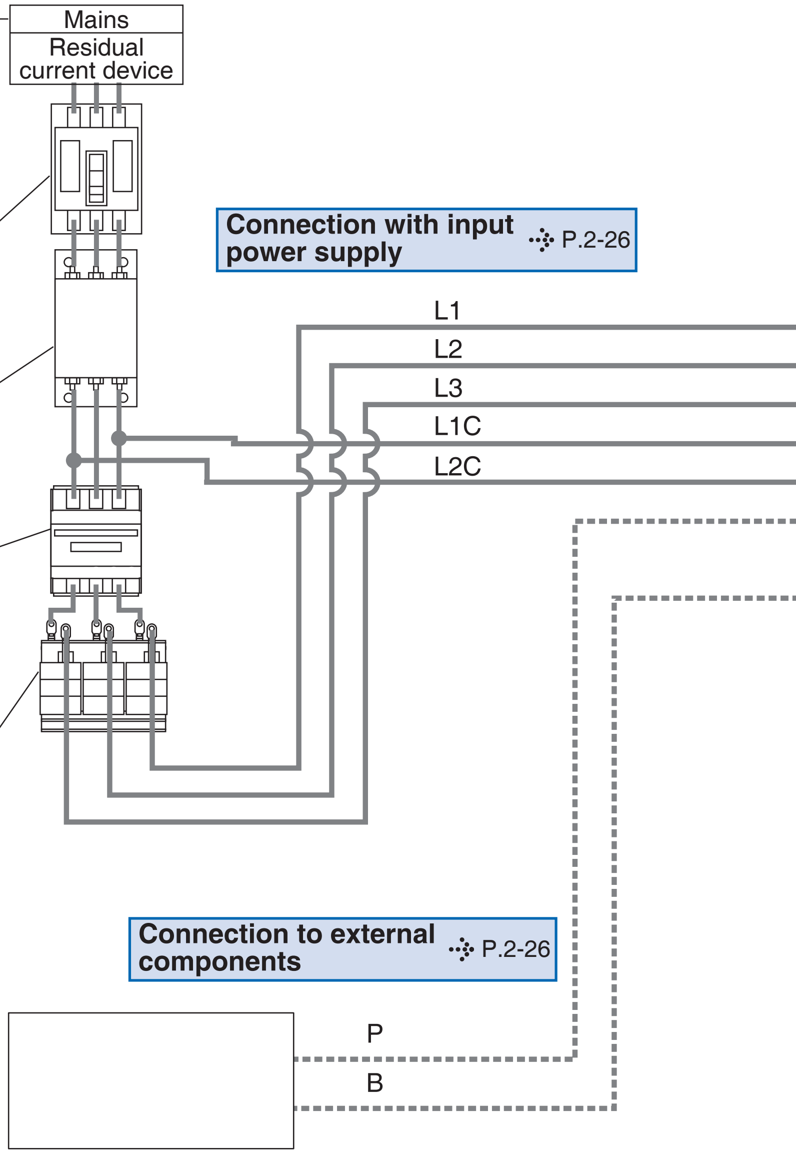
- Apply the voltage designated on the nameplate from the power source.
  Symmetric current should be 5000 Arms or below.
  If the short-circuit current on the power source exceeds this value, use a current-limiting device (e.g. current-limiting fuse, current-limiting circuit breaker or transformer).
- **Wiring of Main Circuit**

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.
- **Never start nor stop the servo motor with this Magnetic Contactor.**

Reactor (L) (to be supplied by customer)
Reduces harmonic current of the main power.



Regenerative resistor (optional)

Pin P, RB and B
- **RB and B to be kept shorted for normal operation.**
- When you connect an external regenerative resistor, disconnect a short bar between RB and B, then connect the external regenerative resistor between P and B, set up Pr0.16 to 1 or 2.

Pin N
- Do not connect anything.

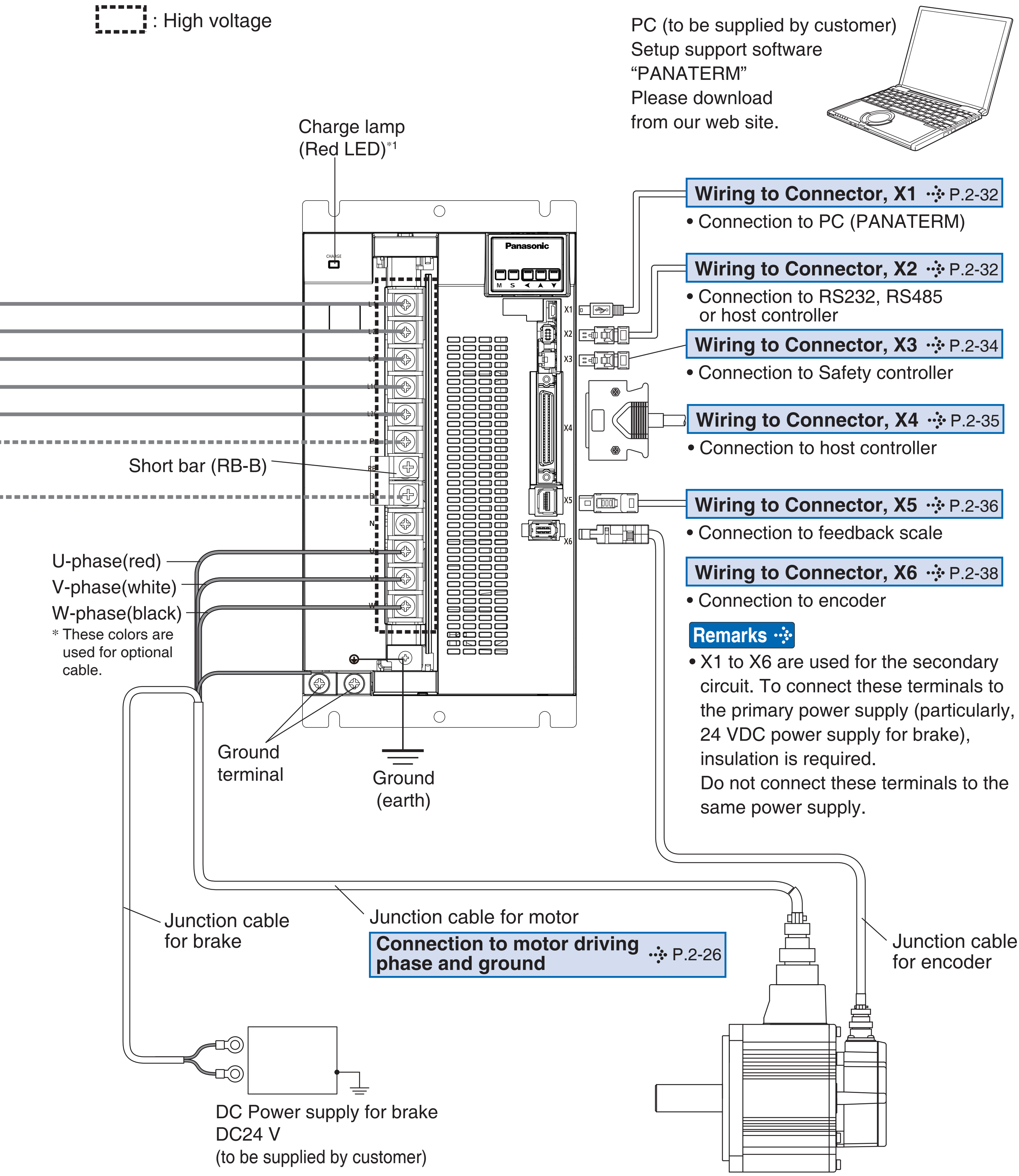
Remarks
- When you use an external regenerative resistor, **install an external protective apparatus, such as thermal fuse without fail.**
- Thermal fuse and thermal protector are built in to the regenerative resistor (Option). **If the thermal fuse is activated, it will not resume.**
- Mount the regenerative resistor **on incombustible material such as metal.**

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

Related page
- P.7-108... "Options"

2. System Configuration and Wiring

Overall Wiring (F-frame, 200 V type)



Remarks

- X1 to X6 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 LED is lit - cause of electric shock.

Related page • P.2-26 “Wiring of the Main Circuit (F-frame, 200 V type)” • P.2-28 “Specifications of Motor connector”

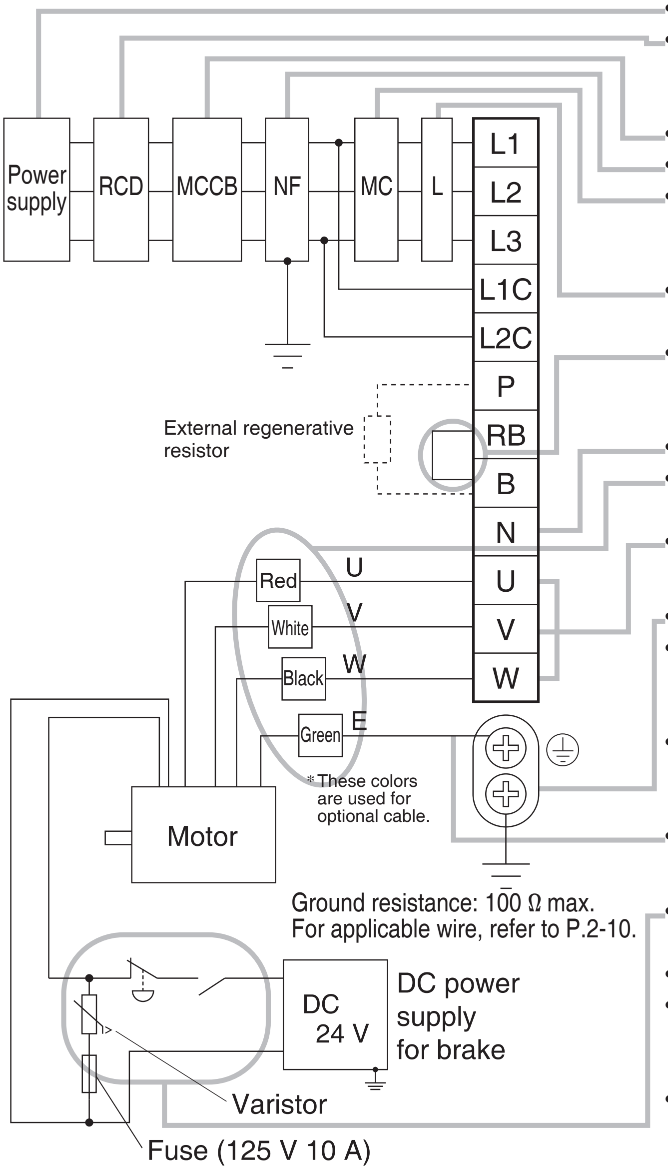
URL: http://industrial.panasonic.com/ww/products/motors-compressors/fa-motors

F-frame, 200 V type

- 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

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 "Driver and List of Applicable Peripheral Equipments" (P.2-10).
   Tighten the terminal block screw with a torque between 1.0 N•m and 1.7 N•m.
3) Attach the terminal cover, and fix with screws.
   Tighten the screw securing the cover with a torque written on P.2-11.



- 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.
- Make sure to provide a noise filter.
- Provide coil surge suppression units to the coil of the Magnetic Contactor recommended by manufacturer. **Never start/stop the motor with this Magnetic Contactor.**
- Provide an AC Reactor.
- Don't 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. Don't 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.
- **Don't 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 “Specifications of Built-in Holding Brake” on P.2-45.
- 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.2-28 “Specifications of Motor connector”

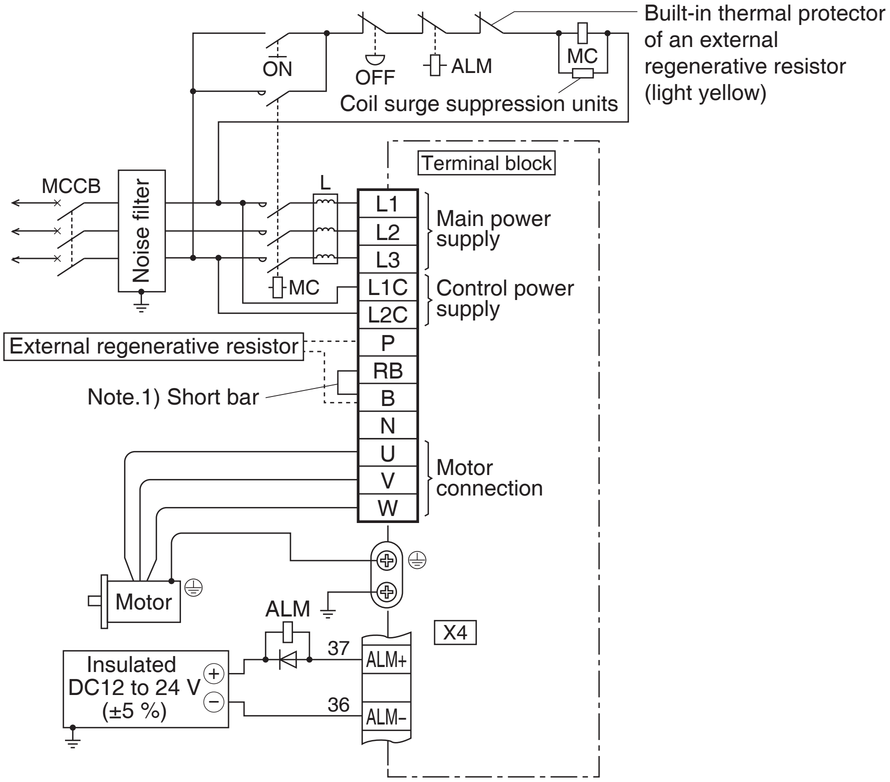
2. System Configuration and Wiring

Wiring Diagram (F-frame, 200 V type)

Compose the circuit so that the main circuit power will be shut off when an error occurs. However, if you want to use “immediate stop function” and the main circuit power turns off, please be aware that you will no longer be able to use “immediate stop function”.

In Case of 3-Phase, F-frame, 200 V type

Power supply 3-phase, 200 V –15 % to 230 V +10 %



Note.1)

Frame No.	Short bar (Accessory)	Built-in regenerative resistor	Connection of terminal block	
			In case of using an external regenerative resistor.	In case of not using an external regenerative resistor.
F-frame	with	with	• Remove the short bar accessory from between RB-B. • Connect an external regenerative resistor between P-B.	• Shorted between RB-B with an attached short bar

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

Related page • P.2-28 “Specifications of Motor connector”

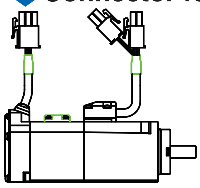
Specifications of Motor connector

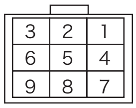
When leadwire type was be used

- **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





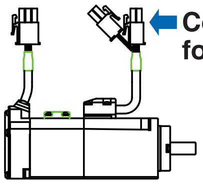
172169-1

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

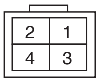
*When use absolute encoder (multi-turn data is not used), do not connect to 1-pin and 2-pin.

Connector for brake

Connector for motor



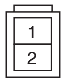
<Connector for motor>



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

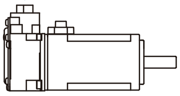
When connector type was be used

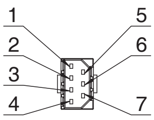
- **When the motors of <MSMF, MQMF, MHMF(50 W to 1.0 kW)> are used, they are connected as shown below.**

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

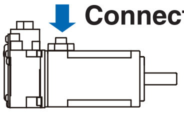
*When use absolut encoder (multi-turn data is not used), do not connect to 2-pin and 5-pin.

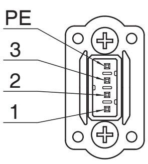
Tightening torque of the screw (M2) 0.19 N·m to 0.21 N·m

* 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

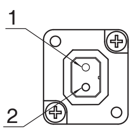
PIN No.	Application
1	U-phase
2	V-phase
3	W-phase
PE	Ground

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.

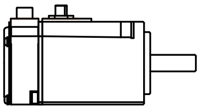
Tightening torque of the screw (M2) 0.19 N·m to 0.21 N·m

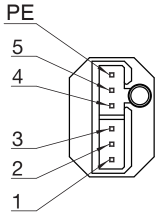
* Be sure to use only the screw supplied with the connector, to avoid damage.

Remarks Do not connect anything to NC.

MHMF(50 W, 100 W)

Connector for motor





JN11AH06NN2

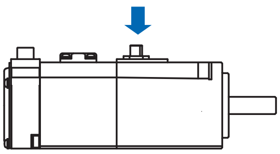
PIN No.	Application
1	U-phase
2	V-phase
3	W-phase
4	NC
5	NC
PE	Ground

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

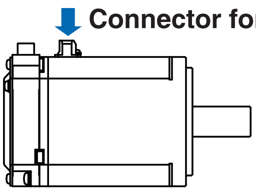


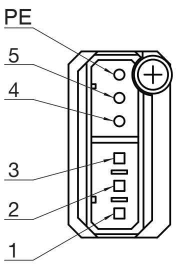
PIN No.	Application
1	U-phase
2	V-phase
3	W-phase
4	Brake
5	Brake
PE	Ground

* Electromagnetic brake is a nonpolar device.

MQMF, MHMF(200 W to 1.0 kW(□80))

Connector for motor





JN11AH06NN1

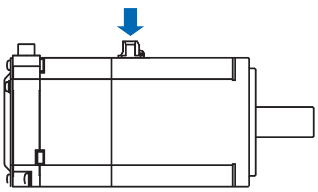
PIN No.	Application
1	U-phase
2	V-phase
3	W-phase
4	NC
5	NC
PE	Ground

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.

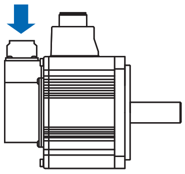
Remarks Do not connect anything to NC.

- **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.**

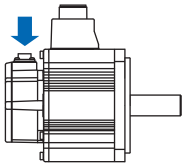
  Connector: Made by Japan Aviation Electronics Industry, Ltd. (The figures below show connectors for the motor.)

• Connector for encoder

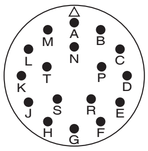
Connector for encoder (Large type) JL10



Connector for encoder (Small type) LN2



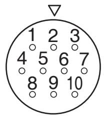
<Encoder connector JL10>



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 absolut 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.

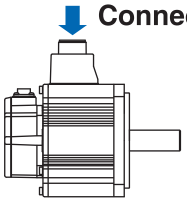
• Connector for motor/brake

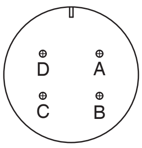
Table of Connector for motor and Connector for brake

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
	2.9 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

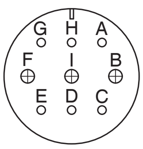




A JL10-2E20-4PE-B

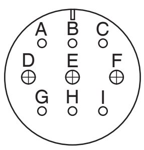
B JL10-2E22-22PE-B

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.

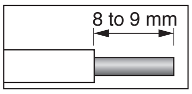
2. System Configuration and Wiring

Wiring method to connector

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

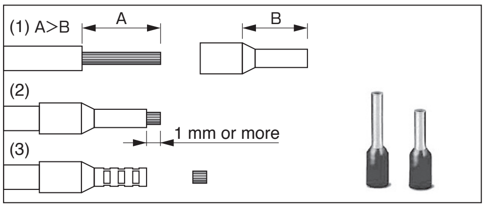
How to connect

1. Peel off the insulation cover of the cable.
   - For single wire (Please obey the length in figure.)
   - For stranded wires (ferrules must be used as illustrated below).



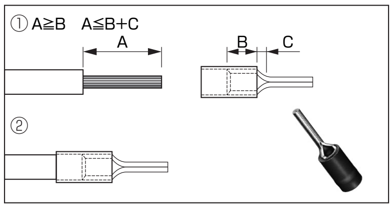
Example: Ferrules with plastic insulating sleeve (AI series, Phoenix Contact, Ltd.)

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

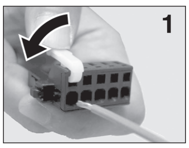
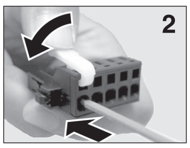
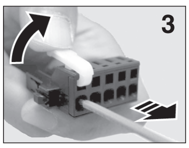
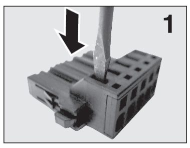
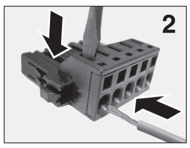
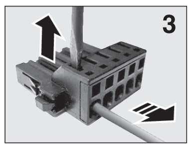
<Cables Compatible with Connector>

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 2 methods.
   (a) Insert the cable using the supplied handle lever.
   (b) Insert the cable using a flat-blade screwdriver (Edge width: 3.0 mm to 3.5 mm).

(a) Using handle lever			(b) Using screw driver		
 1	 2	 3	 1	 2	 3
Attach the handle lever to the handling slot on the upper portion. Press down the lever to push down the spring.	Insert the peeled cable while pressing down the lever, until it hits the insertion slot (round hole).	Release the lever.	Press the screw driver to the handling slot on the upper portion to push down the spring.	Insert the peeled cable while pressing down the screw driver, until it hits the insertion slot (round hole).	Release the screw driver.

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

- Take off the connector from the Servo Driver before making connection.
- Insert only one cable into each one of cable insertion slot.
- Pay attention to injury by screw driver.
- Please keep the operating lever after use.

3. Wiring to the connector, X1

Connecting host computer

SE	SG	SF
○	○	○

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.	Contents
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.

4. Wiring to the connector, X2

Connecting communication connector

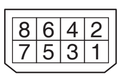
SE	SG	SF
	○	○

This is used for connection to the host controller when two or more units are used. RS232 and RS485 interfaces are supplied.

Application	Symbol	Connector Pin No.	Contents
Signal ground	GND	1	Connected to ground of control circuit.
NC	–	2	Do not connect.
RS232 signal	TXD	3	RS232 The transmission / reception method.
	RXD	4	
RS485 signal	485–	5	RS485 The transmission / reception method.
	485+	6	
	485–	7	
	485+	8	
Frame ground	FG	Shell	Connected with protective earth terminal in the servo driver.

Connector (plug): 1-2201855-1 or 2040008-1 (optional, available from Tyco Electronics)

[Connector pin assignment]



(Viewed from cable)

Remarks

- X1 to X6 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

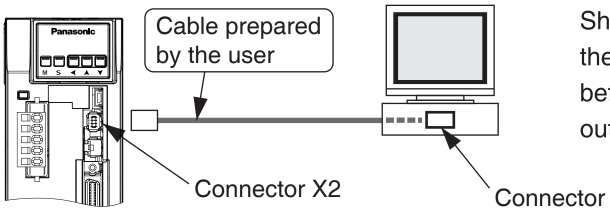
- P.7-130 “Connector Kit for Communication Cable (for RS485, RS232)”

• This servo driver features 2 kinds of communication function, RS232 and RS485, and you can use in 3 connecting methods.

To communicate with a single driver through RS232

Connect the host (PC or controller) to an driver through RS232.

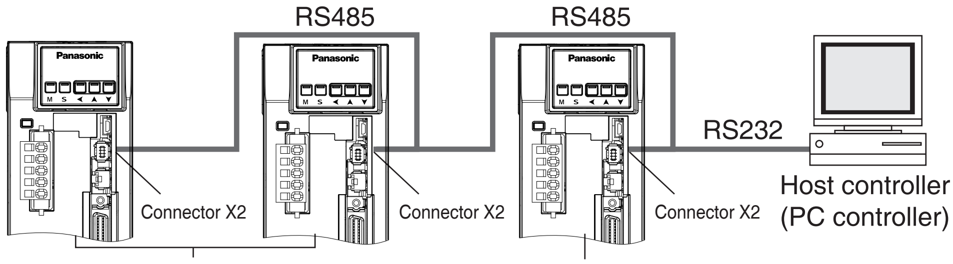
[How to connect]



Shut off both powers of the PC andthe driver before inserting/pulling out the connector.

To communicate with multiple drivers through RS232 and RS485

By connecting the host (PC and host controller) and one driver via RS232 and connecting other drivers via RS485 each other, you can connect multiple drivers.



Set the axis number (Pr5.31) of driver to be connected through RS485 to a value in the range 1 to 31.

Set the axis number (Pr5.31) of driver to be connected to the host through RS232 to 0.

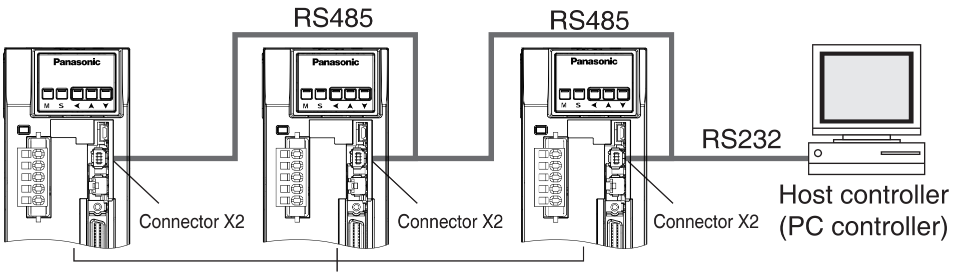
Note

• You can connect up to 32 drivers with the host.

• For details, refer to P.7-28, "Communication"of Supplement.

To communicate with multiple drivers only through RS485

Communications between the host (PC or controller) and multiple drivers can be made through RS485.



Set the axis number (Pr5.31) of driver to be connected through RS485 to a value in the range 1 to 31.

Note

• You can connect up to 31 drivers with the host.

• For details, refer to P.7-28, "Communication"of Supplement.

Remarks

• X1 to X6 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.

5. Wiring to the connector, X3

Safety function connector

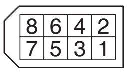
SE	SG	SF
		○

A safety by-pass plug is supplied as standard equipment. Do not disconnect it in normal times.
When controlling the safety function from the connected host controller, accessory connector cannot be used. Prepare and wire the connector (option) as specified below.
Since the standard connector cannot be used when controlling the safety function from the host controller, purchase the optional connector and make connection as shown below. When you do not configuring a safety circuit, please use the safety bypass plug of accessory to the driver.
For wiring of the safety bypass plug supplied with the driver, refer to the figure below.

Application	Symbol	Connector Pin No.	Contents
NC	–	1	Do not connect.
	–	2	
Safety input 1	SF1–	3	These are two independent circuits that turn off the operation signal to the power module to shut off the motor current.
	SF1+	4	
Safety input 2	SF2–	5	
	SF2+	6	
EDM output	EDM–	7	This is an output for monitoring the failure of the safety function.
	EDM+	8	
Frame ground	FG	Shell	Connected with protective earth terminal in the servo driver.

Connector (plug): 2201855-1 or 2013595-1 (optional, available from Tyco Electronics)

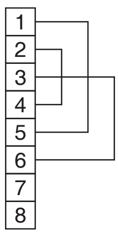
[Connector pin assignment]



(Viewed from cable)

Safety bypass plug supplied with the driver (internal wiring)

Pin No.



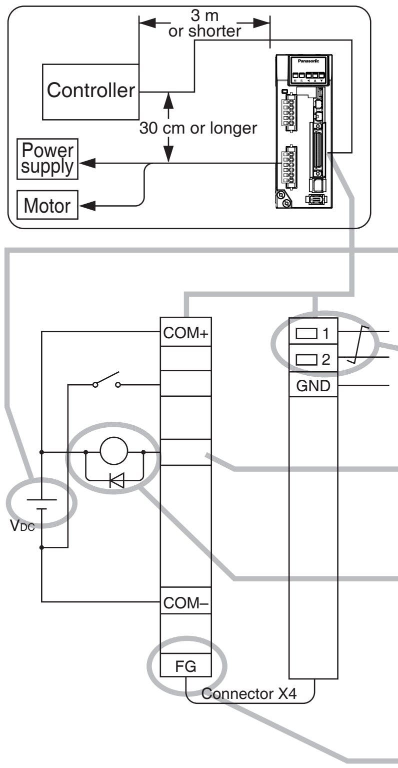
Wiring if the safety circuit is not configured.
When using the safety function, do not make these connections.

Remarks
- X1 to X6 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.

Caution
- Disconnecting this connector during operation results in immediate stop.

Related page
- P.7-130 “Connector Kit for Safety”

Tips on wiring



- Peripheral apparatus such as host controller should be located within 3 m.
- Separate the main circuit at least 30 cm away.
  Don't 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.
- Use shield twisted pair for the wiring of command pulse input and encoder signal output.
- Don't apply more than 24 V to the control signal output terminals, nor run 50 mA or more to them.
- 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.

Related page

- For details, refer to P.3-31, “Wiring Diagram to the connector, X4” and P.3-33, “Inputs and outputs on connector X4”.
- **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	
or		
Connecter (soldering type)	54306-5019	Molex Inc.
Connector cover	54331-0501	
or		
Connecter (soldering type)	10150-3000PE	Sumitomo 3M
Connector cover	10350-52A0-008	

or equivalent.

Note

- For details, refer to P.7-108, “Options” of Supplement.

Remarks

- Tightening torque of the screws for connector (X4) for the connection to the host 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 X6 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.

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

7. Wiring to the connector, X5

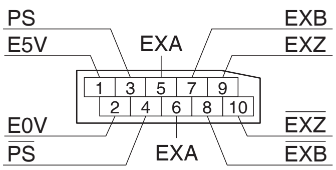
Connect on to External Scale

SE	SG	SF
		○

Provide a power supply for the external scale on your part or use the following power output (250 mA or less).

Application	Symbol	Connector Pin No.	Contents
Power supply output	EX5V	1	Supply the power of external scale or A, B, Z phase encoder.
	EX0V	2	Connected to ground of control circuit.
I/F of external scale signals	EXPS	3	Serial signal The transmission / reception method.
	/EXPS	4	
A, B, Z phase Endoder signal input	EXA	5	Parallel signal reception Correspondence speed : 4 Mpps (after quadruple)
	/EXA	6	
	EXB	7	
	/EXB	8	
	EXZ	9	
	/EXZ	10	
Frame ground	FG	Shell	Connected with protective earth terminal in the servo driver.

Connector (plug) sirial external signal: MUF-PK10K-X (by J.S.T. Mfg. Co., Ltd.)



(Viewed from cable)

• Caution

1) Unit can accommodate two incremental and absolute type as the corresponding serial signals for external scale.Please is whether or not the external scale is your maker is available at our website.

2) **Recommended external scale ratio is 1/40 ≤ External scale ratio ≤ 1280**

If you set up the external scale ratio to smaller value than 50/position loop gain (Pr1.00 and Pr.1.05), you may not be able to control per 1 pulse unit, even if within the range as described above. Setup of larger scale ratio may result in larger noise.

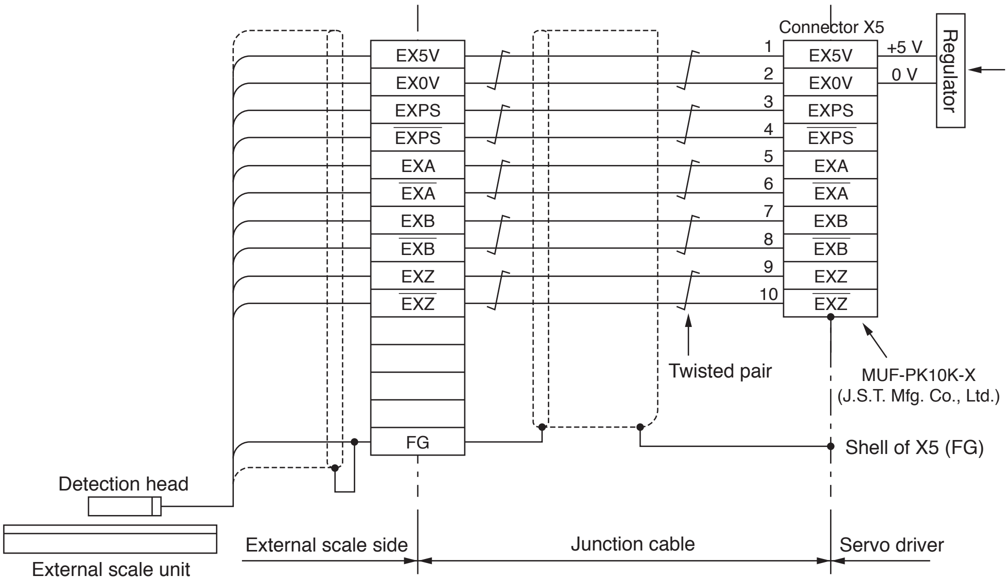
Remarks

• X1 to X6 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.4-6 “Details of Parameter” • P.7-131 “Connector Kit for External Scale”

Wiring Diagram of X5



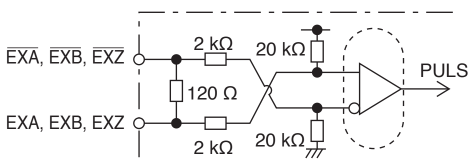
How to Wiring

Wire the signals from the external scale to the external scale connector, X5.

1) Cable for the external scale to be the twisted pair with bundle shielding and to having the twisted core wire with diameter of 0.18 mm^2.
2) Cable length to be max. 20 m. Double wiring for 5 V power supply is recommended when the wiring length is long to reduce the voltage drop effect.
3) Connect the outer film of the shield wire of the external scale to the shield of the junction cable. Also connect the outer film of the shield wire to the shell (FG) of connector X5 of the driver without fail.
4) Separate the wiring from the power line (L1, L2, L3, L1C, L2C, U, V, W, ⏚) as much as possible (30 cm or more). Do not pass these wires in the same duct, nor bundle together.
5) Do not connect anything to the vacant pins of X5.
6) The maximum power available from the connector X5 is 250 mA at 5 V ±5 %. If you use an external scale requiring more power, you should provide the suitable power source by yourself. Some external scales need longer initialization period after power up. Your design should meet this operation timing after power up.
7) When driving the external scale from an external power supply, keep the EX5V pin open circuit so that it does not receive any external voltage. Connect the GND circuit (0 V) to EX0V (connector X5, pin 2) of the driver to eliminate potential difference.

Input circuit

- **EXA, EXB, EXZ input circuit**



Remarks

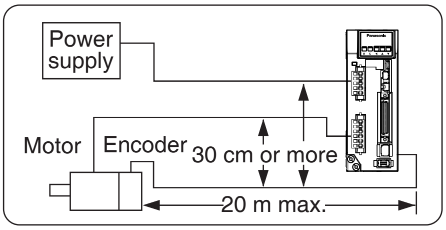
- X1 to X6 are used for the secondary circuit. To connect these terminals to the primary power supply (particularly, the 24 VDC power supply for brake), insulation is required.
Do not connect these terminals to the same power supply.

8. Wiring to the connector, X6

Connection to Encoder

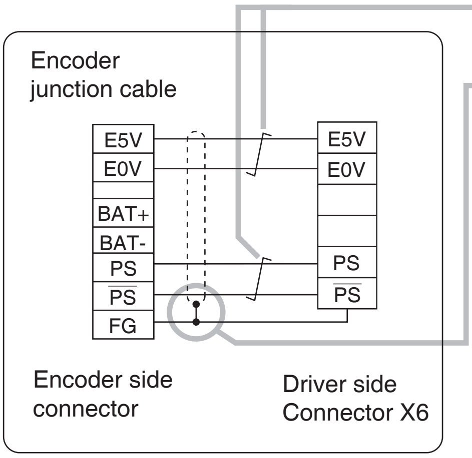
SE	SG	SF
○	○	○

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. Don't guide this wiring through the same duct with the main, nor bind them together.
- The voltage of input power to encoder side connector should be in the range 4.75 VDC – 5.25 VDC.
- When you make your own encoder junction cable (for connectors, refer to P.7-111, "Options (Connector Kit for Motor and 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 mm^2 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 FG
       Large type motor (850 W to 5.0 kW): connect to FG
  5) Connect nothing to the empty terminals of each connector.



Remarks
- X1 to X6 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.

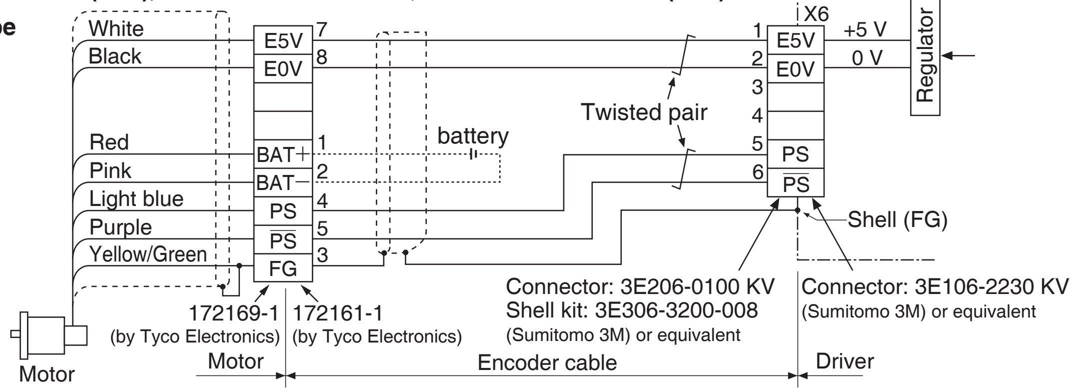
Related page
- P.7-131 “Connector Kit for Encoder”

Wiring Diagram

• 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)

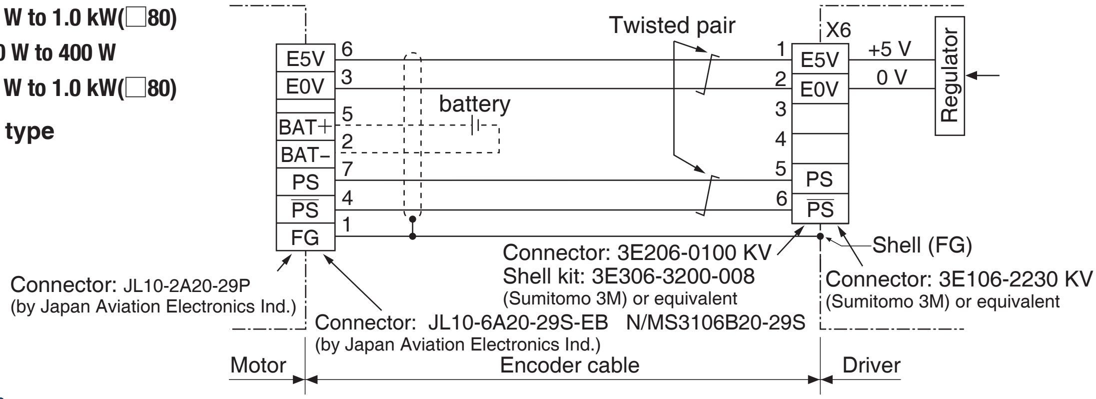
Leadwire type



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.

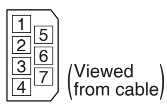
●MSMF 50 W to 1.0 kW(□80)
●MQMF 100 W to 400 W
●MHMF 50 W to 1.0 kW(□80)

Connector type



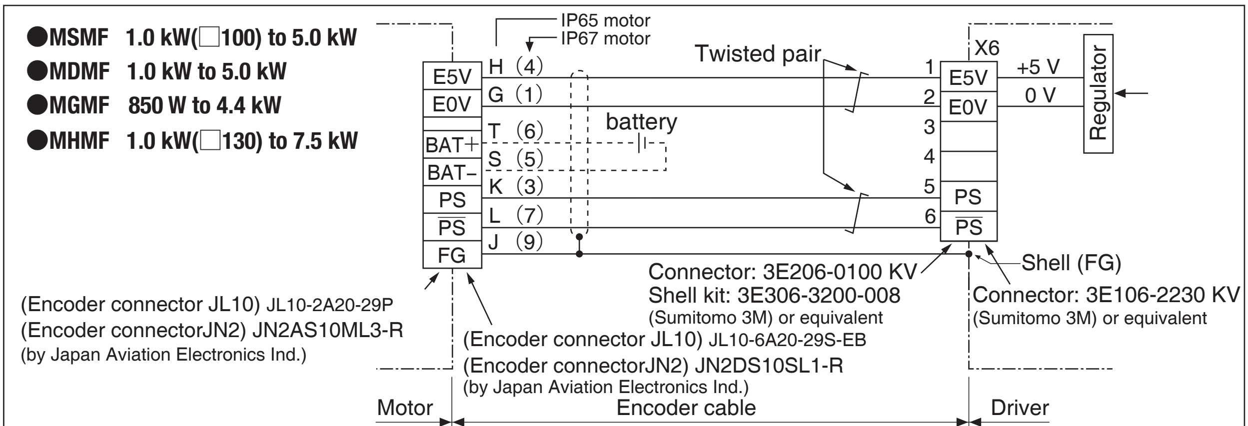
Caution • Tighten the motor connector mounting screw (M2) with a torque between 0.19 and 0.21 N•m. To avoid damage, be sure to use only the screw supplied with the connector.
• Do not remove the gasket supplied with the junction cable connector. Securely install the gasket in place. Otherwise, the degree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

[Connector pin assignment]



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.

●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

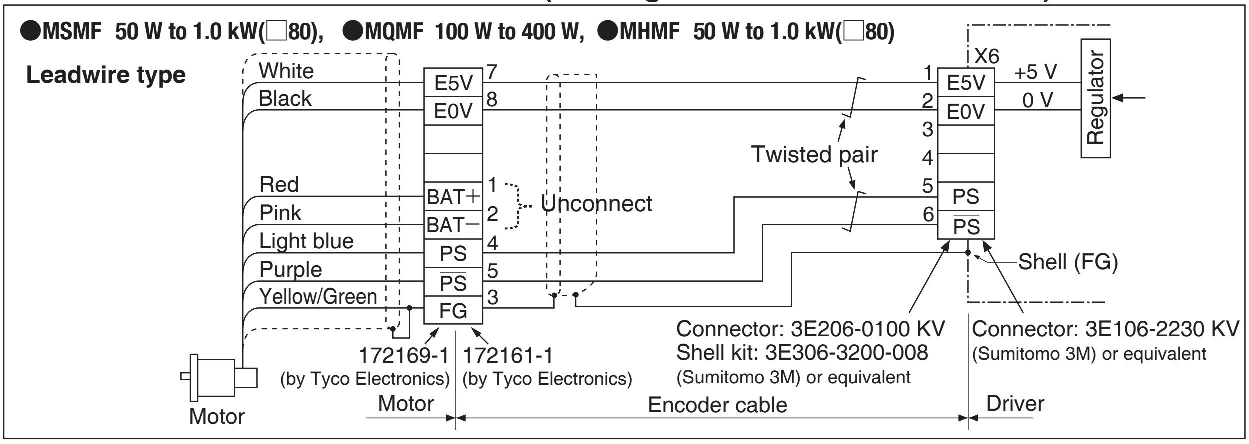


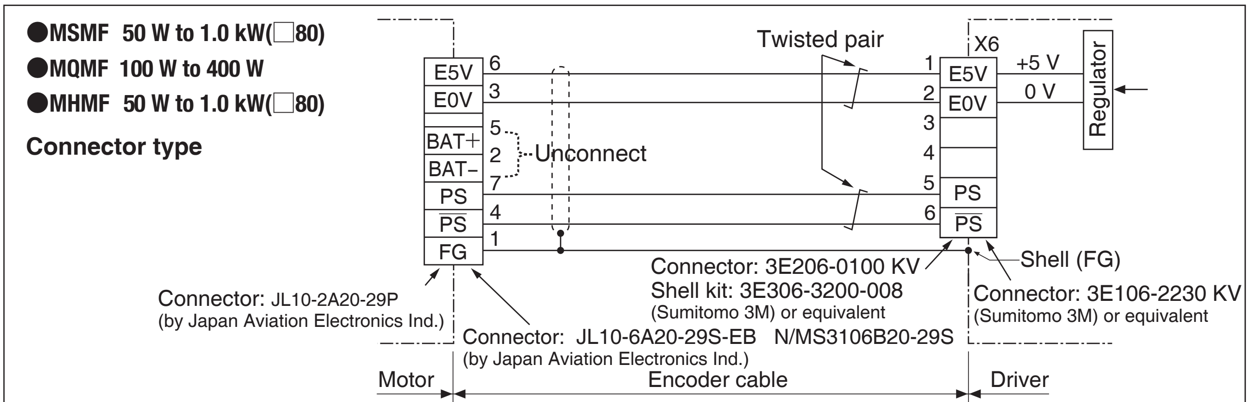
Remarks • Connect the battery for absolute encoder across 6P and 5P of the junction connector (the figure above).
• A battery holder and a battery connection cable should be the option cable or prepared by the user.

Remarks • X1 to X6 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.

Wiring Diagram

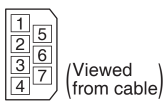
• In case of 23-bit absolute encoder (as single turn data was be used)

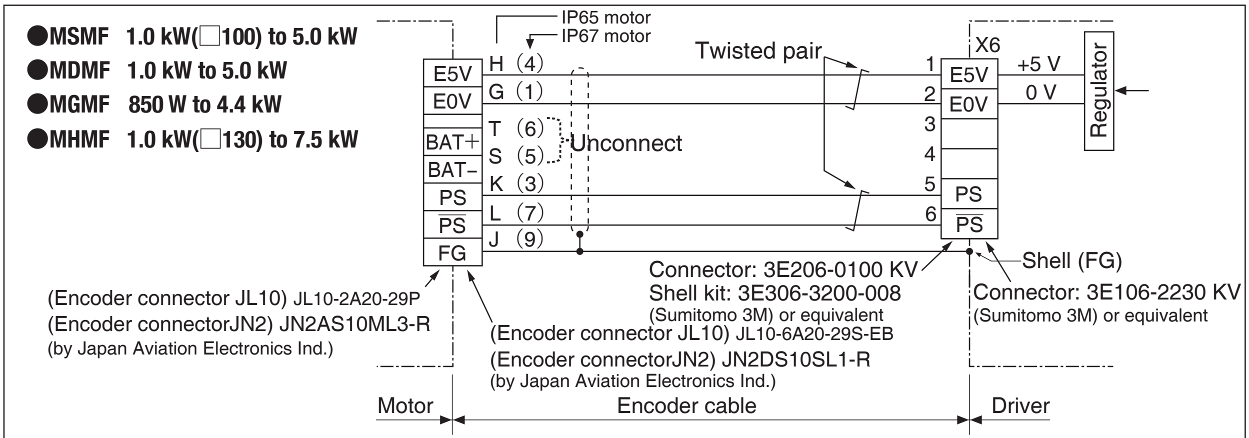




Caution
- Tighten the motor connector mounting screw (M2) with a torque between 0.19 and 0.21 N•m. To avoid damage, be sure to use only the screw supplied with the connector.
- Do not remove the gasket supplied with the junction cable connector. Securely install the gasket in place. Otherwise, the degree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

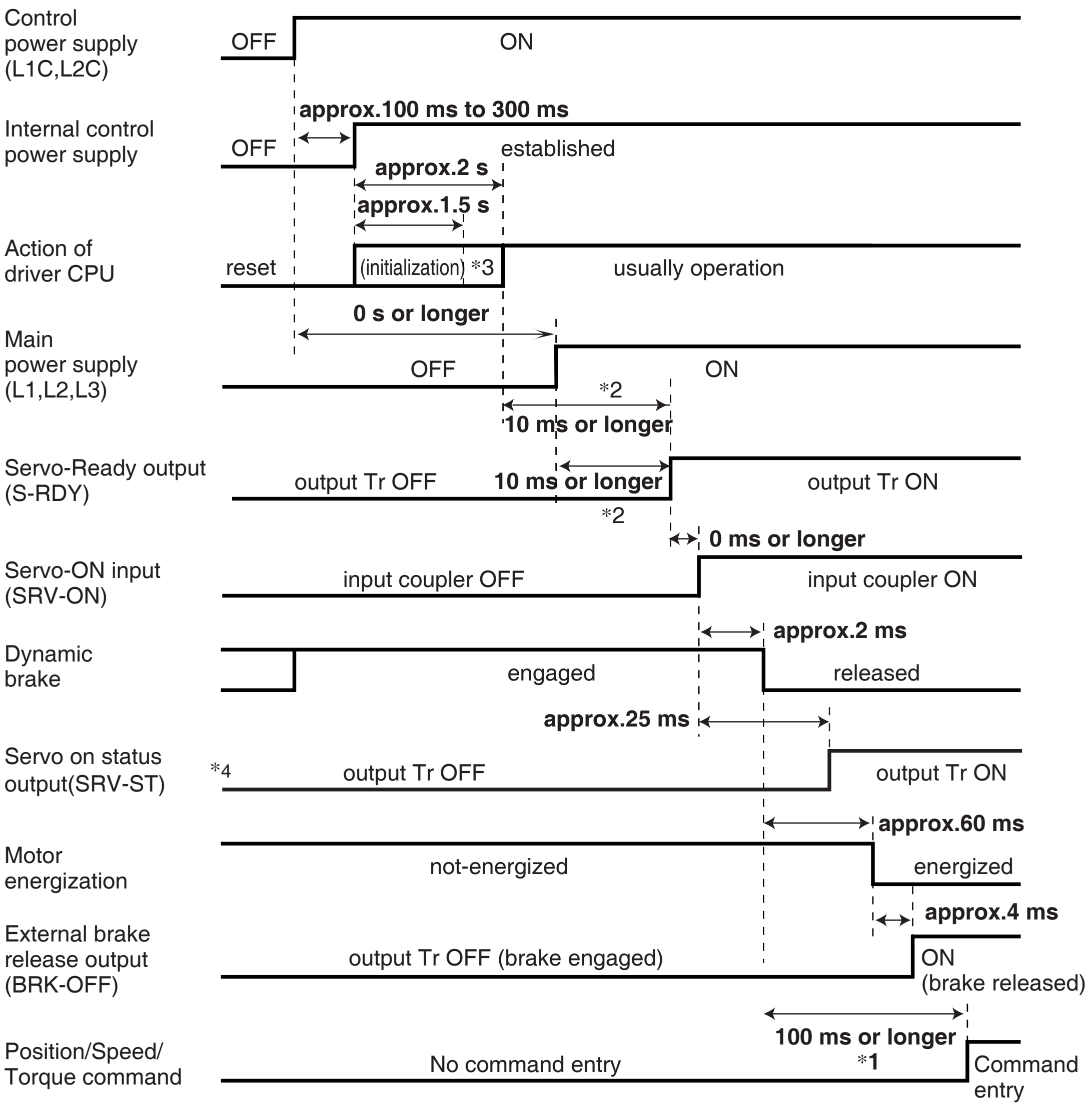
[Connector pin assignment]





Remarks
- X1 to X6 are used for the secondary circuit. To connect these terminals to the primary power supply (particularly, the 24 VDC power supply for control, the 24 VDC power supply for brake), insulation is required.
  Do not connect these terminals to the same power supply.

Servo-on signal accept timing on power-up



- The above chart shows the timing from AC power-ON to command input.
- Activate the external command input according to the above timing chart.

Caution

*1. In this term Servo-ON input (SRV-ON) turns ON as a hard ware, but operation command can not be received.

*2. S-RDY output will turn on when both conditions are met, initialization of micro computer has been completed and the main power has been turned on.

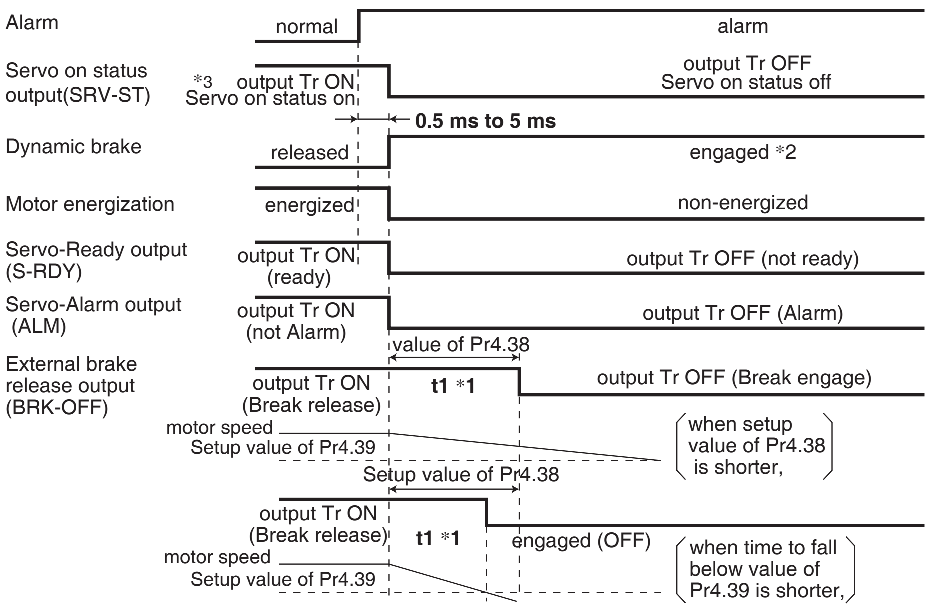
*3. After Internal control power supply , protective functions are active from approx. 1.5 sec after the start of initializing microcomputer. Please set the signals, especially for protective function, for example over-travel inhibit input (POT, NOT) or external scale input, so as to decide their logic until this term.
The lapse time can be changed with Pr6.18 Wait time after power-up.

*4. Servo ON status output (SRV-ST) is a signal indicating that it has received the Servo-On input; please note that it is not an indication showing command input is possible.

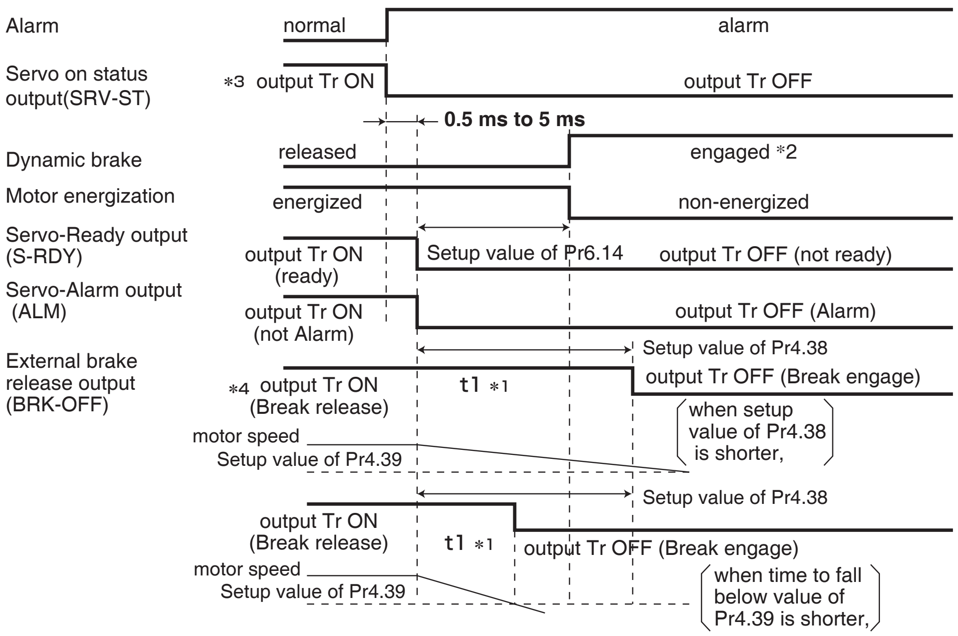
Related page
• P.4-6 to P.4-85... "Details of parameter"

When an Error (Alarm) Has Occurred (at Servo-ON Command)

● DB/Free run deceleration operation



● Immediate stop operation



Caution

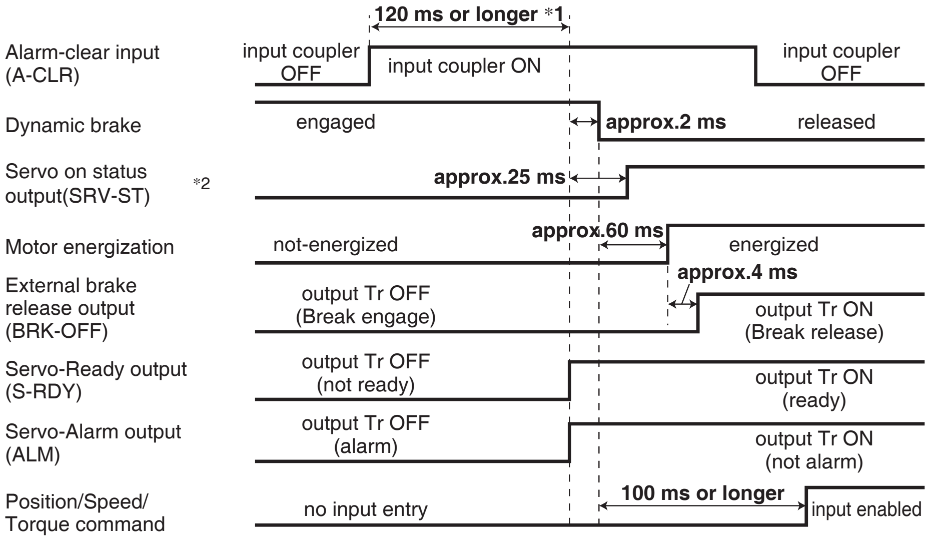
*1. t1 will be a shorter time of either the setup value of Pr4.38[Mechanical brake action at running setup] or elapsing time for the motor speed to fall below Pr4.39[Brake release speed setup].
t1 will be 0 when the motor is in stall regardless of the setup pf Pr4.37.

*2. When an alarm is generated, the dynamic brake operates according to Pr5.10 Sequence at alarm.

*3. Servo ON status output (SRV-ST) is a signal indicating that it has received the Servo-On input; please note that it is not an indication showing command input is possible.

*4. The setting where Pr4.38 “Mechanical braking setting during operation” = Pr6.14 “Immediate stop time in case of alarm” is recommended.
When set to Pr4.38≤Pr6.14, the brake will be operated after lapse of Pr4.38 time.
When set to Pr4.38>Pr6.14, the brake will not operate even after lapse of Pr4.38 time, but will operate when transitioned to OFF state.

When an Alarm Has Been Cleared (at Servo-ON Command)



Caution

*1. The alarm clear input recognition time can be changed in Pr5.16 Alarm clear input setup.
*2. Servo ON status output (SRV-ST) is a signal indicating that it has received the Servo-On input; please note that it is not an indication showing command input is possible.

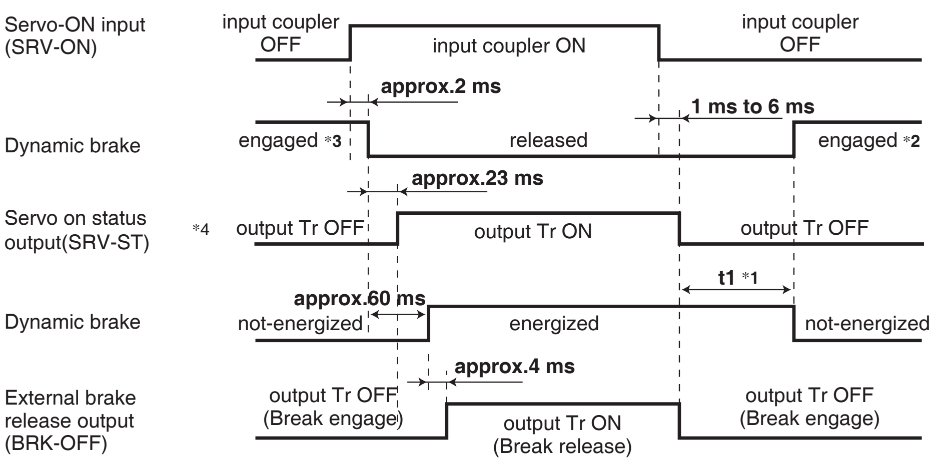
2 Preparation

9. Timing Chart

Servo-Lock

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.**



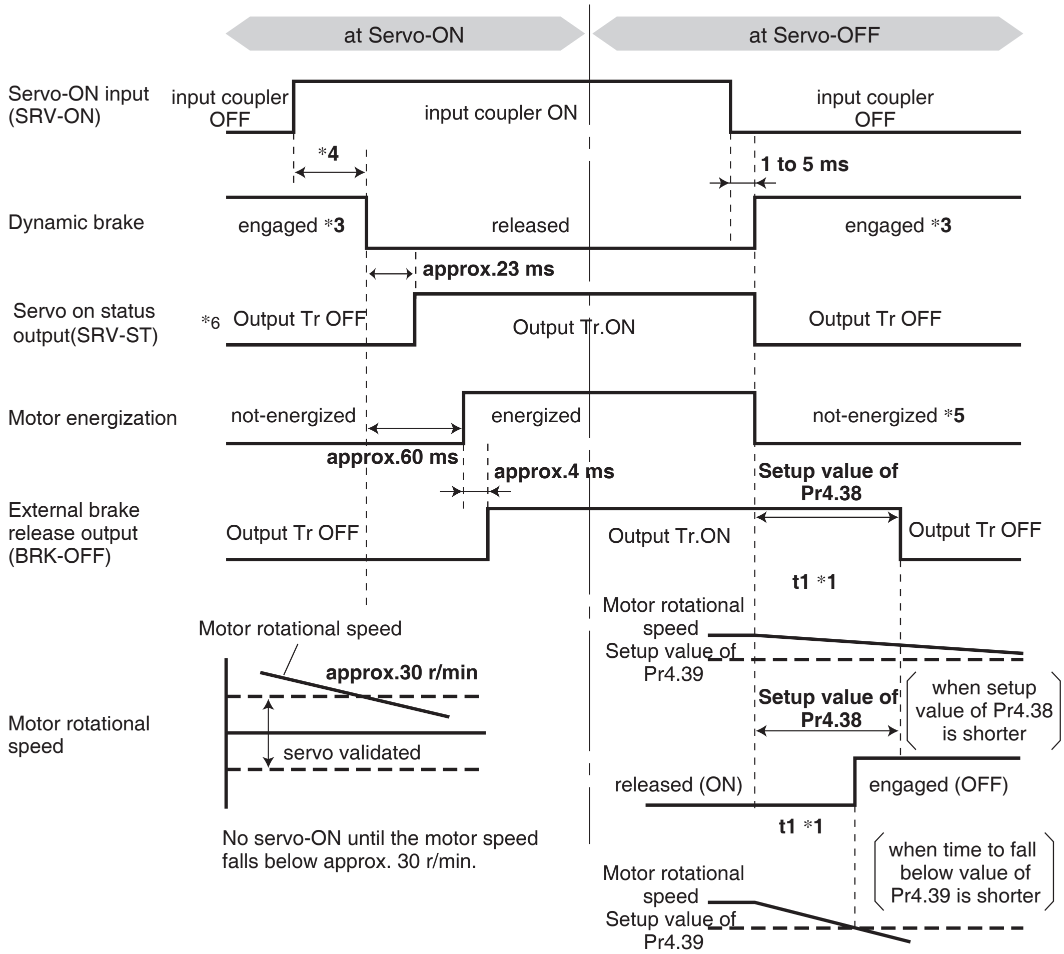
Caution

*1 t1 depends on the setup value of Pr4.37 Setup of mechanical brake action at stalling.
*2 The operation of dynamic brake during servo off depends on the setup value of Pr5.06 Sequence at servo off.
*3. Servo-ON will not be activated until the motor speed falls below approx. 30 r/min.
*4. Servo ON status output (SRV-ST) is a signal indicating that it has received the Servo-On input; please note that it is not an indication showing command input is possible.

Related page • P.4-47, 4-54 “Details of Parameter”

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 Pr4.38 “Mechanical brake action at running setup” or elapsing time for the motor speed to fall below Pr4.39 “Brake release speed setup”.

*2. Even though the SRV-ON signal is turned on again during the motor deceleration, Servo-ON will not be activated until the motor stops.

*3. For the action of dynamic brake at alarm occurrence, refer to an explanation of Pr5.06, “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.5.08, “Sequence at Servo-OFF”.

*6. Servo ON status output (SRV-ST) is a signal indicating that it has received the Servo-On input; please note that it is not an indication showing command input is possible.

Related page • P.2-47 “Dynamic brake”

10. Built-in Holding Brake

Outline

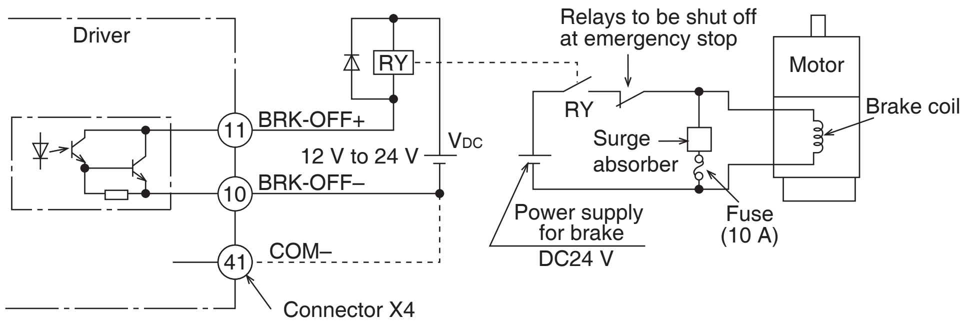
In the applications where the motor drives the vertical axis, this brake would be used to hold and prevent the work (moving load) from falling by gravity while the power to the servo is shut off.

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.



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.7-146, "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.

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.2-42, "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.

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.

10. 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	25.0 or more	4.7	80 or less	25 or less	1.29		1800	3000	5440
	2.9 kW									
	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±10 %(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.)

11. 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.
(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.3-33 “Inputs and outputs on connector X4”
• P.4-6 to 4-85... “Details of Parameter”
• P.6-4 “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	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	Hold
5	Free-run	D B	Hold
6	D B	Free-run	Hold
7	Free-run	Free-run	Hold
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	Hold
5	Free-run	D B	Hold
6	D B	Free-run	Hold
7	Free-run	Free-run	Hold
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.

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	Hold
1	Free-run	D B	Hold
2	D B	Free-run	Hold
3	Free-run	Free-run	Hold
4	Engaged A: Emergency stop Engaged B: DB	D B	Hold
5	Engaged A: Emergency stop Engaged B: Free-run	D B	Hold
6	Engaged A: Emergency stop Engaged B: DB	Free-run	Hold
7	Engaged A: Emergency stop Engaged B: Free-run	Free-run	Hold

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	Driving condition: After stalling	Contents of deviation counter
0	DB	Torque command to inhibited direction is 0	Hold
1	Torque command to inhibited direction is 0	Torque command to inhibited direction is 0	Hold
2	Emergency stop	Torque command to inhibited direction is 0	clear

Torque limit value during deceleration will be that of Pr5.11 (Setup of torque at emergency stop) when the setup value is 2.
Changes will be validated after the control power is turned on.

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

• You can refer and set up the parameter with either one of the following.
1) front panel of the driver
2) combination of the setup support software, "PANATERM" and PC.

Note How to control the front panel, refer to P.2-74.

Setup with the PC

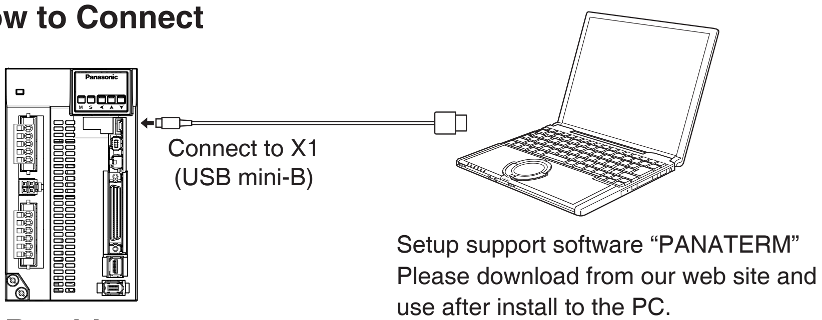
It is possible to connect your personal computer to connector X1 of MINAS A6 using a USB cable for personal computer connection. Downloading the setup support software “PANATERM” from our web site and installing it on your personal computer will allow you to perform the following easily.

• 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, 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 Because no production software such as CD-ROM is available, download the setup support software from our web site and install it on your personal computer.

• How to Connect



• USB cable

On the driver, use commercially available USB mini-B connector.
The connector on the personal computer side should be in accordance with the specifications of the PC.
When the cable does not have noise filter, attach a signal line noise filter (DV0P1460) to both ends of the cable.

Related page
• P.4-2 “Details of Parameter”
• P.7-26 “Setup support software [PANATERM]”

12. Setup of Parameter and Mode

Composition and List of Parameters

- **The parameter No. is displayed in the form of PrX.YY (X: Classification, YY: No.).**
- **For the details on the parameters, refer to P.4-4 "Details of parameter".**

Parametr No.		Class name	Group	page
Class	No.*			
0	00 to 18	Basic setting	Parameter for Basic setting	P.2-52
1	00 to 78	Gain adjustment	Parameter for Gain adjustment	P.2-52
2	00 to 37	Damping control	Parameter for Damping control	P.2-55
3	00 to 29	Verocity/ Torque/ Full-closed control	Parameter for Verocity/ Torque/ Full-closed control	P.2-57
4	00 to 57	I/F monitor setting	Parameter for I/F monitor setting	P.2-58
5	00 to 86	Enhancing setting	Parameter for Enhancing setting	P.2-60
6	00 to 98	Special setting	Parameter for Special setting	P.2-63
7	00 to 93	Special setting	Parameter for Special setting	P.2-66
8	00 to 19	For manufactuer's use	Not be used.	P.2-67
9	00 to 50	For manufactuer's use	Not be used.	P.2-68
15	00 to 35	For manufactuer's use	Not be used.	P.2-69

* The Parameter No. consists of 2 digits.

- **In this document, following symbols represent each mode.**

Symbol	Control mode	Setup value of Pr0.01
P	Position control	0
S	Velocity control	1
T	Torque control	2
F	Full-Closed control	6
P/S	Position (1st)/Velocity (2nd) control	3 *
P/T	Position (1st)/Torque (2nd) control	4 *
S/T	Velocity (1st)/Torque (2nd) control	5 *

* When you select the combination mode of 3, 4 or 5, you can select either 1st or 2nd with control mode switching input (C-MODE).
  When C-MODE is ON : 1st mode selection
  When C-MODE is OFF : 2nd mode selection
  Do not enter the command 10ms before/after the switching.

[Class 0] Basic setting

Parametr No. Class	Parametr No. No.	Title	Range	Default A,B-frame	Default C-frame	Default D,E,F-frame	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
0	00	Rotational direction setup	0 to 1	1			–	○	○	○	○	○	4-6
0	01	Control mode setup	0 to 6	0			–	○	○	○	○	○	
0	02	Real-time auto-gain tuning setup	0 to 6	1			–		○	○	○	○	4-7
0	03	Selection of machine stiffness at real-time auto-gain tuning	0 to 31	13		11	–		○	○	○	○	4-8
0	04	Inertia ratio	0 to 10000	250			%		○	○	○	○	4-9
0	05	Selection of command pulse input	0 to 2	0			–	○	○			○	
0	06	Command pulse rotational direction setup	0 to 1	0			–	○	○			○	4-10
0	07	Command pulse input mode setup	0 to 3	1			–	○	○			○	
0	08	Command pulse counts per one motor revolution	0 to 2^{23}	10000			pulse	○	○				4-11
0	09	1st numerator of electronic gear	0 to 2^{30}	0			–		○			○	
0	10	Denominator of electronic gear	0 to 2^{30}	10000			–		○			○	
0	11	Output pulse counts per one motor revolution	1 to 2097152	2500			P/r	○	○	○	○	○	4-12
0	12	Reversal of pulse output logic	0 to 3	0			–	○	○	○	○	○	4-14
0	13	1st torque limit	0 to 500	500 *1			%		○	○	○	○	
0	14	Position deviation excess setup	0 to 2^{30}	100000			Command unit		○			○	
0	15	Absolute encoder setup	0 to 4	1			–	○	○	○	○	○	
0	16	External regenerative resistor setup	0 to 3	3	0		–	○	○	○	○	○	4-15
0	17	Load factor of external regenerative resistor selection	0 to 4	0			–	○	○	○	○	○	
0	18	For manufactuer's use	–	0			–						

[Class 1] Gain adjustment

Parametr No. Class	Parametr No. No.	Title	Range	Default A,B-frame	Default C-frame	Default D,E,F-frame	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
1	00	1st gain of position loop	0 to 30000	480		320	0.1 /s*		○			○	4-16
1	01	1st gain of velocity loop	1 to 32767	270		180	0.1 Hz*		○	○	○	○	
1	02	1st time constant of velocity loop integration	1 to 10000	210		310	0.1 ms*		○	○	○	○	

• Partial parameter of standard type and communication type are different from a table in a shipment parameter.
• Definition of symbols under “Power Off/On” - : if a change is made, it will be reflected upon the parameter when the power to the driver is turned off and then on again.
• Definition of symbols under “Related mode” - P: position control, S: velocity control, T: torque control, F: full closed control

*1 Default settings depend on the combination of driver and motor. Refer to P. 2-68 “Torque limit setting”.

Caution The symbol “ * ” attached to “Unit”. indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

Note Parameter describes of this page is P.4-6 to P.4-16.

Parametr No. Class	Parametr No. No.	Title	Range	Default A,B -frame	Default C -frame	Default D,E,F -frame	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
1	03	1st filter of speed detection	0 to 5	0			–		○	○	○	○	4-16
1	04	1st time constant of torque filter	0 to 2500	84		126	0.01 ms		○	○	○	○	
1	05	2nd gain of position loop	0 to 30000	480		320	0.1 /s*		○			○	4-17
1	06	2nd gain of velocity loop	1 to 32767	270		180	0.1 Hz*		○	○	○	○	
1	07	2nd time constant of velocity loop integration	1 to 10000	210		310	0.1 ms*		○	○	○	○	
1	08	2nd filter of speed detection	0 to 5	0			–		○	○	○	○	
1	09	2nd time constant of torque filter	0 to 2500	84		126	0.01 ms*		○	○	○	○	
1	10	Velocity feed forward gain	0 to 4000	1000			0.10 %*		○			○	
1	11	Velocity feed forward filter	0 to 6400	0			0.01 ms*		○			○	
1	12	Torque feed forward gain	0 to 2000	1000			0.10%*		○	○		○	4-18
1	13	Torque feed forward filter	0 to 6400	0			0.01 ms*		○	○		○	
1	14	2nd gain setup	0 to 1	1			–		○	○	○	○	
1	15	Mode of position control switching	0 to 10	0			–		○			○	4-19
1	16	Delay time of position control switching	0 to 10000	10			0.1 ms*		○			○	
1	17	Level of position control switching	0 to 20000	0			–		○			○	4-20
1	18	Hysteresis at position control switching	0 to 20000	0			–		○			○	
1	19	Position gain switching time	0 to 10000	10			0.1 ms*		○			○	
1	20	Mode of velocity control switching	0 to 5	0			–			○			4-21
1	21	Delay time of velocity control switching	0 to 10000	0			0.1 ms*			○			
1	22	Level of velocity control switching	0 to 20000	0			–			○			
1	23	Hysteresis at velocity control switching	0 to 20000	0			–			○			4-22
1	24	Mode of torque control switching	0 to 3	0			–				○		
1	25	Delay time of torque control switching	0 to 10000	0			0.1 ms*				○		
1	26	Level of torque control switching	0 to 20000	0			–				○		
1	27	Hysteresis at torque control switching	0 to 20000	0			–				○		
1	28	For manufactuer's use	–	1000			–						
1	29	For manufactuer's use	–	1000			–						
1	30	For manufactuer's use	–	0			–						

- Partial parameter of standard type and communication type are different from a table in a shipment parameter.
- Definition of symbols under “Power Off/On” - : if a change is made, it will be reflected upon the parameter when the power to the driver is turned off and then on again.
- Definition of symbols under “Related mode” - P: position control, S: velocity control, T: torque control, F: full closed control

Caution

The symbol “ * ” attached to “Unit”. indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

Note

Parameter describes of this page is P.4-16 to P.4-22.

Parametr No. Class	No.	Title	Range	Default A,B -frame	Default C -frame	Default D,E,F -frame	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
1	31	For manufactuer's use	–	480		320	–						4-22
1	32	For manufactuer's use	–	270		180	–						
1	33	For manufactuer's use	–	210		310	–						
1	34	For manufactuer's use	–	84		126	–						
1	35	For manufactuer's use	–	250			–						
1	36	For manufactuer's use	–	1000			–						
1	37	For manufactuer's use	–	1000			–						
1	38	For manufactuer's use	–	0			–						
1	39	For manufactuer's use	–	480		320	–						
1	40	For manufactuer's use	–	270		180	–						
1	41	For manufactuer's use	–	210		310	–						
1	42	For manufactuer's use	–	84		126	–						
1	43	For manufactuer's use	–	250			–						
1	44	For manufactuer's use	–	1000			–						
1	45	For manufactuer's use	–	1000			–						
1	46	For manufactuer's use	–	0			–						
1	47	For manufactuer's use	–	480		320	–						
1	48	For manufactuer's use	–	270		180	–						
1	49	For manufactuer's use	–	210		310	–						
1	50	For manufactuer's use	–	84		126	–						
1	51	For manufactuer's use	–	250			–						
1	52	For manufactuer's use	–	1000			–						
1	53	For manufactuer's use	–	1000			–						
1	54	For manufactuer's use	–	0			–						
1	55	For manufactuer's use	–	480		320	–						
1	56	For manufactuer's use	–	270		180	–						
1	57	For manufactuer's use	–	210		310	–						
1	58	For manufactuer's use	–	84		126	–						
1	59	For manufactuer's use	–	250			–						

- Partial parameter of standard type and communication type are different from a table in a shipment parameter.
- Definition of symbols under “Power Off/On” - : if a change is made, it will be reflected upon the parameter when the power to the driver is turned off and then on again.
- Definition of symbols under “Related mode” - P: position control, S: velocity control, T: torque control, F: full closed control

Caution The symbol “ * ” attached to “Unit”. indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

Parametr No. Class	No.	Title	Range	Default A,B -frame	Default C -frame	Default D,E,F -frame	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
1	60	For manufactuer's use	–	1000			–						
1	61	For manufactuer's use	–	1000			–						
1	62	For manufactuer's use	–	0			–						
1	63	For manufactuer's use	–	480		320	–						
1	64	For manufactuer's use	–	270		180	–						
1	65	For manufactuer's use	–	210		310	–						
1	66	For manufactuer's use	–	84		126	–						
1	67	For manufactuer's use	–	250			–						
1	68	For manufactuer's use	–	1000			–						
1	69	For manufactuer's use	–	1000			–						4-22
1	70	For manufactuer's use	–	0			–						
1	71	For manufactuer's use	–	480		320	–						
1	72	For manufactuer's use	–	270		180	–						
1	73	For manufactuer's use	–	210		310	–						
1	74	For manufactuer's use	–	84		126	–						
1	75	For manufactuer's use	–	250			–						
1	76	For manufactuer's use	–	1000			–						
1	77	For manufactuer's use	–	1000			–						
1	78	For manufactuer's use	–	0			–						

[Class 2] Damping control

Parametr No. Class	No.	Title	Range	Default A,B -frame	Default C -frame	Default D,E,F -frame	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
2	00	Adaptive filter mode setup	0 to 6	0			–		○	○		○	
2	01	1st notch frequency	50 to 5000	5000			Hz		○	○	○	○	
2	02	1st notch width selection	0 to 20	2			–		○	○	○	○	4-23
2	03	1st notch depth selection	0 to 99	0			–		○	○	○	○	
2	04	2nd notch frequency	50 to 5000	5000			Hz		○	○	○	○	
2	05	2nd notch width selection	0 to 20	2			–		○	○	○	○	4-24

- Partial parameter of standard type and communication type are different from a table in a shipment parameter.
- Definition of symbols under “Power Off/On” - : if a change is made, it will be reflected upon the parameter when the power to the driver is turned off and then on again.
- Definition of symbols under “Related mode” - P: position control, S: velocity control, T: torque control, F: full closed control

Caution The symbol “ * ” attached to “Unit”. indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

Note Parameter describes of this page is P.4-23 to P.4-24.

Parametr No.		Title	Range	Default			Unit	Turning on of power supply	Related Control Mode				Detail page
Class	No.			A,B -frame	C -frame	D,E,F -frame			P	S	T	F	
2	06	2nd notch depth selection	0 to 99	0			–		○	○	○	○	4-24
2	07	3rd notch frequency	50 to 5000	5000			Hz		○	○	○	○	
2	08	3rd notch width selection	0 to 20	2			–		○	○	○	○	
2	09	3rd notch depth selection	0 to 99	0			–		○	○	○	○	
2	10	4th notch frequency	50 to 5000	5000			Hz		○	○	○	○	
2	11	4th notch width selection	0 to 20	2			–		○	○	○	○	
2	12	4th notch depth selection	0 to 99	0			–		○	○	○	○	4-25
2	13	Selection of damping filter switching	0 to 6	0			–		○			○	
2	14	1st damping frequency	0 to 3000	0			0.1 Hz*		○			○	4-26
2	15	1st damping filter setup	0 to 1500	0			0.1 Hz*		○			○	
2	16	2nd damping frequency	0 to 3000	0			0.1 Hz*		○			○	
2	17	2nd damping filter setup	0 to 1500	0			0.1 Hz*		○			○	
2	18	3rd damping frequency	0 to 3000	0			0.1 Hz*		○			○	
2	19	3rd damping filter setup	0 to 1500	0			0.1 Hz*		○			○	
2	20	4th damping frequency	0 to 3000	0			0.1 Hz*		○			○	
2	21	4th damping filter setup	0 to 1500	0			0.1 Hz*		○			○	
2	22	Positional command smoothing filter	0 to 10000	92		139	0.1 ms*		○	○		○	4-27
2	23	Positional command FIR filter	0 to 10000	10			0.1 ms*		○			○	4-28
2	24	5th notch frequency	50 to 5000	5000			Hz		○	○	○	○	4-29
2	25	5th notch width selection	0 to 20	2			–		○	○	○	○	
2	26	5th notch depth selection	0 to 99	0			–		○	○	○	○	
2	27	1st damping width setting	0 to 1000	0			–		○			○	
2	28	2nd damping width setting	0 to 1000	0			–		○			○	
2	29	3rd damping width setting	0 to 1000	0			–		○			○	
2	30	4th damping width setting	0 to 1000	0			–		○			○	
2	31	For manufactuer's use	–	0			–						4-30
2	32	For manufactuer's use	–	0			–						
2	33	For manufactuer's use	–	0			–						
2	34	For manufactuer's use	–	0			–						

- Partial parameter of standard type and communication type are different from a table in a shipment parameter.
- Definition of symbols under “Power Off/On” - : if a change is made, it will be reflected upon the parameter when the power to the driver is turned off and then on again.
- Definition of symbols under “Related mode” - P: position control, S: velocity control, T: torque control, F: full closed control

Caution The symbol “ * ” attached to “Unit”. indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

Note Parameter describes of this page is P.4-6 to P.4-85.

Parametr No. Class	Parametr No. No.	Title	Range	Default A,B-frame	Default C-frame	Default D,E,F-frame	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
2	35	For manufactuer's use	–	0			–						4-30
2	36	For manufactuer's use	–	0			–						
2	37	For manufactuer's use	–	0			–						

[Class 3] Verocity/ Torque/ Full-closed control

Parametr No. Class	Parametr No. No.	Title	Range	Default A,B-frame	Default C-frame	Default D,E,F-frame	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
3	00	Speed setup, Internal/External switching	0 to 3	0			–			○			4-31
3	01	Speed command rotational direction selection	0 to 1	0			–			○			
3	02	Input gain of speed command	10 to 2000	500			(r/min)/V			○	○		4-32
3	03	Reversal of speed command input	0 to 1	1			–			○			
3	04	1st speed of speed setup	–20000 to 20000	0			r/min			○			4-33
3	05	2nd speed of speed setup	–20000 to 20000	0			r/min			○			
3	06	3rd speed of speed setup	–20000 to 20000	0			r/min			○			
3	07	4th speed of speed setup	–20000 to 20000	0			r/min			○			
3	08	5th speed of speed setup	–20000 to 20000	0			r/min			○			
3	09	6th speed of speed setup	–20000 to 20000	0			r/min			○			
3	10	7th speed of speed setup	–20000 to 20000	0			r/min			○			
3	11	8th speed of speed setup	–20000 to 20000	0			r/min			○			
3	12	Acceleration time setup	0 to 10000	0			ms/(1000 r/min)			○			
3	13	Deceleration time setup	0 to 10000	0			ms/(1000 r/min)			○			
3	14	Sigmoid acceleration/ deceleration time setup	0 to 1000	0			ms			○			4-34
3	15	Speed zero-clamp function selection	0 to 3	0			–			○	○		
3	16	Speed zero clamp level	10 to 20000	30			r/min			○	○		
3	17	Selection of torque command	0 to 2	0			–				○		4-35
3	18	Torque command direction selection	0 to 1	0			–				○		
3	19	Input gain of torque command	10 to 100	30			0.1 V/100 %*				○		
3	20	Input reversal of torque command	0 to 1	0			–				○		4-36
3	21	Speed limit value 1	0 to 20000	0			r/min				○		

- Partial parameter of standard type and communication type are different from a table in a shipment parameter.
- Definition of symbols under “Power Off/On” - : if a change is made, it will be reflected upon the parameter when the power to the driver is turned off and then on again.
- Definition of symbols under “Related mode” - P: position control, S: velocity control, T: torque control, F: full closed control

Caution The symbol “ * ” attached to “Unit”. indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

Note Parameter describes of this page is P.4-6 to P.4-85.

Parametr No. Class	Parametr No. No.	Title	Range	Default (A,B-frame / C-frame / D,E,F-frame)	Unit	Turning on of power supply	Related Control Mode P	Related Control Mode S	Related Control Mode T	Related Control Mode F	Detail page
3	22	Speed limit value 2	0 to 20000	0	r/min				○		4-36
3	23	External scale selection	0 to 6	0	–	○				○	4-37
3	24	Numerator of external scale division	0 to 2^{23}	0	–	○				○	
3	25	Denominator of external scale division	1 to 2^{23}	10000	–	○				○	
3	26	Reversal of direction of external scale	0 to 3	0	–	○				○	4-38
3	27	External scale Z phase disconnection detection disable	0 to 1	0	–	○				○	
3	28	Hybrid deviation excess setup	1 to 2^{27}	16000	Command unit	○				○	
3	29	Hybrid deviation clear setup	0 to 100	0	Revolution	○				○	

[Class 4] I/F monitor setting

Parametr No. Class	Parametr No. No.	Title	Range	Default (A,B-frame / C-frame / D,E,F-frame)	Unit	Turning on of power supply	Related Control Mode P	Related Control Mode S	Related Control Mode T	Related Control Mode F	Detail page
4	00	SI1 input selection (Pin No.8)	0 to 00FFFFFFh	8553090	–	○	○	○	○	○	4-39
4	01	SI2 input selection (Pin No.9)	0 to 00FFFFFFh	8487297	–	○	○	○	○	○	4-40
4	02	SI3 input selection (Pin No.26)	0 to 00FFFFFFh	9539850	–	○	○	○	○	○	
4	03	SI4 input selection (Pin No.27)	0 to 00FFFFFFh	394758	–	○	○	○	○	○	
4	04	SI5 input selection (Pin No.28)	0 to 00FFFFFFh	4108	–	○	○	○	○	○	
4	05	SI6 input selection (Pin No.29)	0 to 00FFFFFFh	197379	–	○	○	○	○	○	
4	06	SI7 input selection (Pin No.30)	0 to 00FFFFFFh	3847	–	○	○	○	○	○	
4	07	SI8 input selection (Pin No.31)	0 to 00FFFFFFh	263172	–	○	○	○	○	○	
4	08	SI9 input selection (Pin No.32)	0 to 00FFFFFFh	328965	–	○	○	○	○	○	
4	09	SI10 input selection (Pin No.33)	0 to 00FFFFFFh	3720	–	○	○	○	○	○	
4	10	SO1 output selection (Pin No.10, 11)	0 to 00FFFFFFh	197379	–	○	○	○	○	○	4-41
4	11	SO2 output selection (Pin No.34, 35)	0 to 00FFFFFFh	131586	–	○	○	○	○	○	
4	12	SO3 output selection (Pin No.36, 37)	0 to 00FFFFFFh	65793	–	○	○	○	○	○	
4	13	SO4 output selection (Pin No.38, 39)	0 to 00FFFFFFh	328964	–	○	○	○	○	○	
4	14	SO5 output selection (Pin No.12)	0 to 00FFFFFFh	460551	–	○	○	○	○	○	
4	15	SO6 output selection (Pin No.40)	0 to 00FFFFFFh	394758	–	○	○	○	○	○	

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- Definition of symbols under “Related mode” - P: position control, S: velocity control, T: torque control, F: full closed control

Note Parameter describes of this page is P.4-6 to P.4-85.

Parametr No.		Title	Range	Default			Unit	Turning on of power supply	Related Control Mode				Detail page
Class	No.			A,B -frame	C -frame	D,E,F -frame			P	S	T	F	
4	16	Type of analog monitor 1	0 to 28	0			–		○	○	○	○	
4	17	Analog monitor 1 output gain	0 to 214748364	0			–		○	○	○	○	
4	18	Type of analog monitor 2	0 to 28	4			–		○	○	○	○	4-42
4	19	Analog monitor 2 output gain	0 to 214748364	0			–		○	○	○	○	
4	20	For manufactuer's use	–	0			–						
4	21	Analog monitor output setup	0 to 2	0			–		○	○	○	○	
4	22	Analog input 1 (AI1) offset setup	–5578 to 5578	0			0.366 mV		○	○	○	○	
4	23	Analog input 1 (AI1) filter	0 to 6400	0			0.01 ms*		○	○	○	○	
4	24	Analog input 1 (AI1) overvoltage setup	0 to 100	0			0.1 V*		○	○	○	○	4-44
4	25	Analog input 2 (AI2) offset setup	–342 to 342	0			5.86 mV		○	○	○	○	
4	26	Analog input 2 (AI2) filter	0 to 6400	0			0.01 ms*		○	○	○	○	
4	27	Analog input 2 (AI2) overvoltage setup	0 to 100	0			0.1 V*		○	○	○	○	
4	28	Analog input 3 (AI3) offset setup	–342 to 342	0			5.86 mV		○	○	○	○	
4	29	Analog input 3 (AI3) filter	0 to 6400	0			0.01 ms*		○	○	○	○	
4	30	Analog input 3 (AI3) overvoltage setup	0 to 100	0			0.1 V*		○	○	○	○	
4	31	Positioning complete (In-position) range	0 to 2097152	10			Command unit		○			○	4-45
4	32	Positioning complete (In-position) output setup	0 to 10	0			–		○			○	
4	33	INP hold time	0 to 30000	0			1 ms		○			○	
4	34	Zero-speed	10 to 20000	50			r/min		○	○	○	○	4-46
4	35	Speed coincidence range	10 to 20000	50			r/min			○	○		
4	36	At-speed (Speed arrival)	10 to 20000	1000			r/min			○	○		
4	37	Mechanical brake action at stalling setup	0 to 10000	0			1 ms		○	○	○	○	4-47
4	38	Mechanical brake action at running setup	0 to 10000	0			1 ms		○	○	○	○	
4	39	Brake release speed setup	30 to 3000	30			r/min	○	○	○	○	○	
4	40	Selection of alarm output 1	0 to 28	0			–		○	○	○	○	
4	41	Selection of alarm output 2	0 to 28	0			–		○	○	○	○	4-48
4	42	2nd Positioning complete (In-position) range	0 to 2097152	10			Command unit		○			○	
4	44	Position compare output pulse width setting	0 to 32767	0			0.1ms	○	○			○	4-49

• Partial parameter of standard type and communication type are different from a table in a shipment parameter..
• Definition of symbols under “Power Off/On” - : if a change is made, it will be reflected upon the parameter when the power to the driver is turned off and then on again.
• Definition of symbols under “Related mode” - P: position control, S: velocity control, T: torque control, F: full closed control

*1 Default settings depend on the combination of driver and motor. Refer to P. 2-84 “Torque limit setting”.

Caution

The symbol “ * ” attached to “Unit”. indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

Note

Parameter describes of this page is P.4-6 to P.4-85.

Parametr No. Class	Parametr No. No.	Title	Range	Default (A,B -frame / C -frame / D,E,F -frame)	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
4	45	Position compare output polarity select	0 to 63	0	–	○	○			○	
4	47	Pulse output select	0 to 7	0	–	○	○	○	○	○	4-49
4	48	Position compare value 1	-2147483648 to 2147483647	0	Command unit		○			○	
4	49	Position compare value 2	-2147483648 to 2147483647	0	Command unit		○			○	
4	50	Position compare value 3	-2147483648 to 2147483647	0	Command unit		○			○	
4	51	Position compare value 4	-2147483648 to 2147483647	0	Command unit		○			○	
4	52	Position compare value 5	-2147483648 to 2147483647	0	Command unit		○			○	
4	53	Position compare value 6	-2147483648 to 2147483647	0	Command unit		○			○	4-50
4	54	Position compare value 7	-2147483648 to 2147483647	0	Command unit		○			○	
4	55	Position compare value 8	-2147483648 to 2147483647	0	Command unit		○			○	
4	56	Position compare output delay compensation amount	-32768 to 32767	0	0.1μs	○	○			○	
4	57	Position compare output assignment setting	-2147483648 to 2147483647	0	–	○	○			○	4-51

[Class 5] Enhancing setting

Parametr No. Class	Parametr No. No.	Title	Range	Default (A,B -frame / C -frame / D,E,F -frame)	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
5	00	2nd numerator of electronic gear	0 to 2^{30}	0	–		○			○	
5	01	3rd numerator of electronic gear	0 to 2^{30}	0	–		○			○	
5	02	4th numerator of electronic gear	0 to 2^{30}	0	–		○			○	4-52
5	03	Denominator of pulse output division	0 to 8388608	0	–	○	○	○	○	○	
5	04	Over-travel inhibit input setup	0 to 2	1	–	○	○	○	○	○	
5	05	Sequence at over-travel inhibit	0 to 2	0	–	○	○	○	○	○	4-53
5	06	Sequence at Servo-Off	0 to 9	0	–		○	○	○	○	4-54
5	07	Sequence at main power OFF	0 to 9	0	–		○	○	○	○	
5	08	LV trip selection at main power OFF	0 to 3	1	–		○	○	○	○	
5	09	Detection time of main power off	20 to 2000	70	1 ms	○	○	○	○	○	4-55
5	10	Sequence at alarm	0 to 7	0	–		○	○	○	○	
5	11	Torque setup for emergency stop	0 to 500	0	%		○	○	○	○	4-56

- Partial parameter of standard type and communication type are different from a table in a shipment parameter.
- Definition of symbols under “Power Off/On” - : if a change is made, it will be reflected upon the parameter when the power to the driver is turned off and then on again.
- Definition of symbols under “Related mode” - P: position control, S: velocity control, T: torque control, F: full closed control

Caution The symbol “ * ” attached to “Unit”. indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

Note Parameter describes of this page is P.4-6 to P.4-85.

Parametr No.		Title	Range	Default			Unit	Turning on of power supply	Related Control Mode				Detail page
Class	No.			A,B -frame	C -frame	D,E,F -frame			P	S	T	F	
5	12	Over-load level setup	0 to 500	0			%		○	○	○	○	
5	13	Over-speed level setup	0 to 20000	0			r/min		○	○	○	○	
5	14	Motor working range setup	0 to 1000	10			0.1 revolution*		○			○	4-56
5	15	I/F reading filter	0 to 3	0			–	○	○	○	○	○	
5	16	Alarm clear input setup	0 to 1	0			–	○	○	○	○	○	
5	17	Counter clear input mode	0 to 4	3			–		○			○	
5	18	Invalidation of command pulse inhibit input	0 to 1	1			–		○			○	4-57
5	19	Command pulse inhibit input reading setup	0 to 5	0			–	○	○			○	
5	20	Position setup unit select	0 to 1	0			–	○	○			○	
5	21	Selection of torque limit	0 to 6	1			–		○	○		○	
5	22	2nd torque limit	0 to 500	500 *1			%		○	○		○	4-58
5	23	Torque limit switching setup 1	0 to 4000	0			ms/100 %		○	○		○	
5	24	Torque limit switching setup 2	0 to 4000	0			ms/100 %		○	○		○	
5	25	External input positive direction torque limit	0 to 500	500 *1			%		○	○		○	4-59
5	26	External input negative direction torque limit	0 to 500	500 *1			%		○	○		○	
5	27	Input gain of analog torque limit	10 to 100	30			0.1 V/100 %*		○	○		○	
5	28	LED initial status	0 to 42	1			–	○	○	○	○	○	
5	29	RS232 baud rate setup	0 to 7	2			–	○	○	○	○	○	4-60
5	30	RS485 baud rate setup	0 to 7	2			–	○	○	○	○	○	
5	31	Axis address	0 to 127	1			–	○	○	○	○	○	
5	32	Command pulse input maximum setup	250 to 8000	4000			kpulse/s	○	○			○	
5	33	Pulse regenerative output limit setup	0 to 1	0			–	○	○	○	○	○	4-61
5	34	For manufactuer's use	–	4			–						
5	35	Front panel lock setup	0 to 1	0			–	○	○	○	○	○	
5	36	For manufactuer's use	–	0			–						
5	37	Modbus connection setting	0 to 2	0			–	○	○	○	○	○	
5	38	Modbus communication setting	0 to 5	0			–	○	○	○	○	○	4-62
5	39	Modbus response waiting time	0 to 10000	0			ms		○	○	○	○	
5	40	Modbus communication timeout time	0 to 10000	0			ms		○	○	○	○	

- Partial parameter of standard type and communication type are different from a table in a shipment parameter.
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Caution The symbol “ * ” attached to “Unit”. indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

Note Parameter describes of this page is P.4-6 to P.4-85.

Parametr No. Class	No.	Title	Range	Default A,B -frame	Default C -frame	Default D,E,F -frame	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
5	41	For manufactuer's use	–	0			–						4-62
5	42	Modbus broadcast setting	-32768 to 32767	0			–		○	○	○	○	4-63
5	45	Quadrant projection positive direction compensation value	-1000 to 1000	0			0.1%		○			○	
5	46	Quadrant projection negative direction compensation value	-1000 to 1000	0			0.1%		○			○	
5	47	Quadrant projection compensation delay time	0 to 1000	0			ms		○			○	
5	48	Quadrant projection compensation filter setting L	0 to 6400	0			0.01 ms		○			○	
5	49	Quadrant projection compensation filter setting H	0 to 10000	0			0.1 ms		○			○	
5	50	For manufactuer's use	–	0			–						4-64
5	51	For manufactuer's use	–	0			–						
5	52	For manufactuer's use	–	0			–						
5	53	For manufactuer's use	–	0			–						
5	54	For manufactuer's use	–	0			–						
5	55	For manufactuer's use	–	0			–						
5	56	Slow stop deceleration time setting	0 to 10000	0			ms/ (1000 r/min)		○				
5	57	Slow stop S-shape acceleration and deceleration setting	0 to 1000	0			ms		○				
5	58	Modbus mirror register setting 1[*1]	-32768 to 32767	24591			–	○	○	○	○	○	
5	59	Modbus mirror register setting 2[*1]	-32768 to 32767	24592			–	○	○	○	○	○	
5	60	Modbus mirror register setting 3[*1]	-32768 to 32767	16421			–	○	○	○	○	○	
5	61	Modbus mirror register setting 4[*1]	-32768 to 32767	24613			–	○	○	○	○	○	4-65
5	62	Modbus mirror register setting 5[*1]	-32768 to 32767	17429			–	○	○	○	○	○	
5	63	Modbus mirror register setting 6[*1]	-32768 to 32767	17418			–	○	○	○	○	○	
5	64	Modbus mirror register setting 7[*1]	-32768 to 32767	17427			–	○	○	○	○	○	
5	65	Modbus mirror register setting 8[*1]	-32768 to 32767	17419			–	○	○	○	○	○	
5	66	Deterioration diagnosis convergence judgment time	0 to 10000	0			0.1s	○	○	○	○	○	
5	67	Deterioration diagnosis inertia ratio upper limit	0 to 10000	0			%	○	○	○	○	○	
5	68	Deterioration diagnosis inertia ratio lower limit	0 to 10000	0			%	○	○	○	○	○	

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- Definition of symbols under “Related mode” - P: position control, S: velocity control, T: torque control, F: full closed control

Caution The symbol “ * ” attached to “Unit”. indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

Note Parameter describes of this page is P.4-6 to P.4-85.

Parametr No. Class	Parametr No. No.	Title	Range	Default A,B -frame	Default C -frame	Default D,E,F -frame	Unit	Turning on of power supply	Related Control Mode P	Related Control Mode S	Related Control Mode T	Related Control Mode F	Detail page
5	69	Deterioration diagnosis unbalanced load upper limit	-1000 to 1000	0			0.1%	○	○	○	○	○	4-65
5	70	Deterioration diagnosis unbalanced load lower limit	-1000 to 1000	0			0.1%	○	○	○	○	○	
5	71	Deterioration diagnosis dynamic friction upper limit	-1000 to 1000	0			0.1%	○	○	○	○	○	4-66
5	72	Deterioration diagnosis dynamic friction lower limit	-1000 to 1000	0			0.1%	○	○	○	○	○	
5	73	Deterioration diagnosis viscous friction upper limit	0 to 10000	0			0.1%/ (10000r/min)	○	○	○	○	○	
5	74	Deterioration diagnosis viscous friction lower limit	0 to 10000	0			0.1%/ (10000r/min)	○	○	○	○	○	
5	75	Deterioration diagnosis velocity setting	-20000 to 20000	0			r/min	○	○	○	○	○	
5	76	Deterioration diagnosis torque average time	0 to 10000	0			ms	○	○	○	○	○	
5	77	Deterioration diagnosis torque upper limit	-1000 to 1000	0			0.1%	○	○	○	○	○	
5	78	Deterioration diagnosis torque lower limit	-1000 to 1000	0			0.1%	○	○	○	○	○	
5	79	Modbus mirror register setting 9 *1	-32768 to 32767	17410			–	○	○	○	○	○	4-67
5	80	Modbus mirror register setting 10 *1	-32768 to 32767	17411			–	○	○	○	○	○	
5	81	Modbus mirror register setting 11 *1	-32768 to 32767	16398			–	○	○	○	○	○	
5	82	Modbus mirror register setting 12 *1	-32768 to 32767	16402			–	○	○	○	○	○	
5	83	Modbus mirror register setting 13 *1	-32768 to 32767	16411			–	○	○	○	○	○	
5	84	Modbus mirror register setting 14 *1	-32768 to 32767	16405			–	○	○	○	○	○	
5	85	Modbus mirror register setting 15 *1	-32768 to 32767	16406			–	○	○	○	○	○	
5	86	Modbus mirror register setting 16 *1	-32768 to 32767	0			–	○	○	○	○	○	

[Class 6] Special setting

Parametr No. Class	Parametr No. No.	Title	Range	Default A,B -frame	Default C -frame	Default D,E,F -frame	Unit	Turning on of power supply	Related Control Mode P	Related Control Mode S	Related Control Mode T	Related Control Mode F	Detail page
6	00	Analog torque feed forward conversion gain	0 to 100	0			0.1 V/100 %*		○	○		○	4-68
6	02	Speed deviation excess setup	0 to 20000	0			r/min		○				
6	04	JOG trial run command speed	0 to 500	300			r/min		○	○	○	○	
6	05	Position control 3rd gain effective time	0 to 10000	0			0.1 ms*		○			○	

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- Definition of symbols under “Related mode” - P: position control, S: velocity control, T: torque control, F: full closed control

Caution The symbol “ * ” attached to “Unit”. indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

Note Parameter describes of this page is P.4-6 to P.4-85.

Parametr No. Class	No.	Title	Range	Default A,B -frame	Default C -frame	Default D,E,F -frame	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
6	06	Position control 3rd gain scale factor	50 to 1000	100			%		○			○	4-68
6	07	Additional value to torque command	–100 to 100	0			%		○	○		○	4-69
6	08	Torque compensation value in positive direction	–100 to 100	0			%		○			○	
6	09	Torque compensation value in negative direction	–100 to 100	0			%		○			○	
6	10	Function expansion setup	-32768 to 32767	16			–		○	○	○	○	
6	11	Current response setup	10 to 100	100			%						4-70
6	13	Second inertia ratio	0 to 10000	250			%		○	○	○	○	
6	14	Immediate stop time at the time of alarming	0 to 1000	200			1 ms		○	○	○	○	
6	15	2nd over-speed level setup	0 to 20000	0			r/min		○	○	○	○	
6	16	For manufacturer's use	–	0			–		○	○	○	○	
6	17	Front panel parameter writing selection	0 to 1	0			–	○	○	○	○	○	
6	18	Power turn-on wait time	0 to 100	0			0.1 s*	○	○	○	○	○	
6	19	Encoder Z phase setup	0 to 32767	0			pulse	○	○	○	○	○	4-71
6	20	Z-phase setup of external scale	0 to 400	0			μs	○				○	
6	21	Serial absolute external scale Z phase setup	0 to 2^{28}	0			pulse	○				○	
6	22	A, B phase external scale pulse output method selection	0 to 1	0			–	○				○	4-72
6	23	Load fluctuation correction gain	–100 to 100	0			%		○	○			
6	24	Load fluctuation correction filter	10 to 2500	53			0.01 ms*		○	○			
6	27	Alarm latch time selection	0 to 10	5			s	○	○	○	○	○	
6	28	Special function selection	0 to 1	0			–	○	○				
6	30	For manufacturer's use	–	0			–						4-73
6	31	Real time auto tuning estimation speed	0 to 3	1			–		○	○	○	○	
6	32	Real time auto tuning custom setup	-32768 to 32767	0			–		○	○	○	○	4-74
6	33	For manufacturer's use	–	1000			–						4-76
6	34	Hybrid vibration suppression gain	0 to 30000	0			0.1 /s*					○	
6	35	Hybrid vibration suppression filter	0 to 32000	10			0.01 ms*					○	
6	36	Dynamic brake operation input	0 to 1	0			–	○	○	○	○	○	
6	37	Oscillation detecting level	0 to 1000	0			0.1 %*		○	○	○	○	

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- Definition of symbols under "Related mode" - P: position control, S: velocity control, T: torque control, F: full closed control

Caution The symbol " * " attached to "Unit". indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

Note Parameter describes of this page is P.4-6 to P.4-85.

Parametr No. Class	No.	Title	Range	Default A,B -frame	Default C -frame	Default D,E,F -frame	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
6	38	Alarm mask setup	-32768 to 32767	4			–	○	○	○	○	○	
6	39	For manufactuer's use	–	0			–						
6	41	1st damping depth	0 to 1000	0			–		○			○	4-77
6	42	Two-stage torque filter time constant	0 to 2500	0			0.01 ms		○	○	○	○	
6	43	Two-stage torque filter damping term	0 to 1000	0			–		○	○	○	○	
6	47	Function expansion settings 2	-32768 to 32767	1			–	○	○	○	○	○	
6	48	Adjustment filter	0 to 2000	A:11 B,C:12		17	0.1 ms		○	○		○	4-78
6	49	Command response filter/adjustment filter damping term setting	0 to 99	15			–		○			○	
6	50	Viscous friction compensation gain	0 to 10000	0			0.1 %/ (10000 r/min)		○	○		○	
6	51	Immediate stop completion wait time	0 to 10000	0			ms		○	○	○	○	
6	52	For manufacturer's use	–	0			–						4-79
6	53	For manufacturer's use	–	0			–						
6	54	For manufacturer's use	–	0			–						
6	57	Torque saturation error protection detection time	0 to 5000	0			ms		○	○		○	
6	58	Serial absolute external scale Z phase shift amount [*1]	-2147483648 to 2147483647	0			pulse	○	○	○	○	○	4-80
6	60	2nd damping depth	0 to 1000	0			–		○			○	
6	61	1st resonance frequency	0 to 3000	0			0.1Hz		○				
6	62	1st resonance damping ratio	0 to 1000	0			–		○				
6	63	1st anti-resonance frequency	0 to 3000	0			0.1Hz		○				
6	64	1st anti-resonance damping ratio	0 to 1000	0			–		○				
6	65	1st response frequency	0 to 3000	0			0.1Hz		○				4-81
6	66	2nd resonance frequency	0 to 3000	0			0.1Hz		○				
6	67	2nd resonance damping ratio	0 to 1000	0			–		○				
6	68	2nd anti-resonance frequency	0 to 3000	0			0.1Hz		○				
6	69	2nd anti-resonance damping ratio	0 to 1000	0			–		○				
6	70	2nd response frequency	0 to 3000	0			0.1 Hz		○				
6	71	3rd damping depth	0 to 1000	0			–		○			○	4-82
6	72	4th damping depth	0 to 1000	0			–		○			○	

- Partial parameter of standard type and communication type are different from a table in a shipment parameter.
- Definition of symbols under “Power Off/On” - : if a change is made, it will be reflected upon the parameter when the power to the driver is turned off and then on again.
- Definition of symbols under “Related mode” - P: position control, S: velocity control, T: torque control, F: full closed control

Caution The symbol “ * ” attached to “Unit”. indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

Parametr No. Class	Parametr No. No.	Title	Range	Default (A,B-frame / C-frame / D,E,F-frame)	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
6	73	Load estimation filter	0 to 2500	0	0.01 ms		○	○		○	
6	74	Torque compensation frequency 1	0 to 5000	0	0.1 Hz		○	○		○	
6	75	Torque compensation frequency 2	0 to 5000	0	0.1 Hz		○	○		○	4-82
6	76	Load estimation count	0 to 8	0	–		○	○		○	
6	87	For manufacturer's use	–	0	–						
6	88	Absolute multi-rotation data upper limit	0 to 65534	0	–	○	○	○	○	○	
6	97	Function expansion setting 3	-2147483648 to 2147483647	0	–		○	○	○	○	4-83
6	98	Function expansion setting 4	-2147483648 to 2147483647	0	–	○	○	○	○	○	

[Class 7] Special setting

Parametr No. Class	Parametr No. No.	Title	Range	Default (A,B-frame / C-frame / D,E,F-frame)	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
7	00	For manufacturer's use	–	0	–						
7	01	For manufacturer's use	–	0	–						
7	03	For manufacturer's use	–	0	–						
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	–						
7	08	For manufacturer's use	–	0	–						
7	09	For manufacturer's use	–	0	–						4-84
7	10	For manufacturer's use	–	0	–						
7	11	For manufacturer's use	–	0	–						
7	12	For manufacturer's use	–	0	–						
7	13	For manufacturer's use	–	0	–						
7	14	Main power turn-off warning detection time	0 to 2000	0	ms	○	○	○	○	○	
7	15	For manufacturer's use	–	0	–						
7	16	For manufacturer's use	–	0	–						
7	20	For manufacturer's use	–	0	–						

- Partial parameter of standard type and communication type are different from a table in a shipment parameter.
- Definition of symbols under “Power Off/On” - : if a change is made, it will be reflected upon the parameter when the power to the driver is turned off and then on again.
- Definition of symbols under “Related mode” - P: position control, S: velocity control, T: torque control, F: full closed control

Caution The symbol “ * ” attached to “Unit”. indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

Note Parameter describes of this page is P.4-6 to P.4-85.

Parametr No.		Title	Range	Default			Unit	Turning on of power supply	Related Control Mode				Detail page
Class	No.			A,B -frame	C -frame	D,E,F -frame			P	S	T	F	
7	21	For manufacturer's use	–	1			–						
7	22	Special function enhancement setting 1	-32768 to 32767	0			–						
7	23	For manufacturer's use	–	0			–						
7	24	For manufacturer's use	–	0			–						
7	25	For manufacturer's use	–	0			–						
7	26	For manufacturer's use	–	0			–						
7	27	For manufacturer's use	–	0			–						
7	28	For manufacturer's use	–	0			–						
7	29	For manufacturer's use	–	0			–						
7	30	For manufacturer's use	–	0			–						
7	31	For manufacturer's use	–	0			–						
7	32	For manufacturer's use	–	0			–						4-84
7	33	For manufacturer's use	–	0			–						
7	34	For manufacturer's use	–	0			–						
7	35	For manufacturer's use	–	0			–						
7	36	For manufacturer's use	–	0			–						
7	37	For manufacturer's use	–	0			–						
7	38	For manufacturer's use	–	0			–						
7	39	For manufacturer's use	–	0			–						
7	41	For manufacturer's use	–	0			–						
7	87	For manufacturer's use	–	0			–						
7	91	For manufacturer's use	–	0			–						
7	93	For manufacturer's use	–	0			–						

[Class 8] For manufacturer's use

Parametr No.		Title	Range	Default			Unit	Turning on of power supply	Related Control Mode				Detail page
Class	No.			A,B -frame	C -frame	D,E,F -frame			P	S	T	F	
8	00	For manufacturer's use	–	0			–						4-85
8	01	For manufacturer's use	–	100			–						

- Partial parameter of standard type and communication type are different from a table in a shipment parameter.
- Definition of symbols under “Power Off/On” - : if a change is made, it will be reflected upon the parameter when the power to the driver is turned off and then on again.
- Definition of symbols under “Related mode” - P: position control, S: velocity control, T: torque control, F: full closed control

Caution The symbol “ * ” attached to “Unit”. indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

Note Parameter describes of this page is P.4-6 to P.4-85.

Parametr No. Class	No.	Title	Range	Default A,B-frame	Default C-frame	Default D,E,F-frame	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
8	02	For manufacturer's use	–	0			–						4-84
8	03	For manufacturer's use	–	0			–						
8	04	For manufacturer's use	–	100			–						
8	05	For manufacturer's use	–	0			–						
8	10	For manufacturer's use	–	0			–						
8	12	For manufacturer's use	–	0			–						
8	13	For manufacturer's use	–	0			–						
8	14	For manufacturer's use	–	0			–						
8	15	For manufacturer's use	–	0			–						
8	19	For manufacturer's use	–	0			–						

[Class 9] For manufacturer's use

Parametr No. Class	No.	Title	Range	Default A,B-frame	Default C-frame	Default D,E,F-frame	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
9	00	For manufacturer's use	–	0			–						4-84
9	01	For manufacturer's use	–	0			–						
9	02	For manufacturer's use	–	0			–						
9	03	For manufacturer's use	–	1000			–						
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			–						

- Partial parameter of standard type and communication type are different from a table in a shipment parameter.
- Definition of symbols under “Power Off/On” - : if a change is made, it will be reflected upon the parameter when the power to the driver is turned off and then on again.
- Definition of symbols under “Related mode” - P: position control, S: velocity control, T: torque control, F: full closed control

Caution The symbol “ * ” attached to “Unit”. indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

Parametr No. Class	No.	Title	Range	Default A,B-frame	Default C-frame	Default D,E,F-frame	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
9	17	For manufacturer's use	–	0			–						4-84
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			–						
9	25	For manufacturer's use	–	40			–						
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	48	For manufacturer's use	–	0			–						
9	49	For manufacturer's use	–	0			–						
9	50	For manufacturer's use	–	0			–						

[Class 15] For manufacturer's use

Parametr No. Class	No.	Title	Range	Default A,B-frame	Default C-frame	Default D,E,F-frame	Unit	Turning on of power supply	Related Control Mode P	S	T	F	Detail page
15	00	For manufacturer's use	–	0			–						4-84
15	16	For manufacturer's use	–	2			–						
15	17	For manufacturer's use	–	4			–						
15	30	For manufacturer's use	–	6			–						
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	–	0			–						

- Partial parameter of standard type and communication type are different from a table in a shipment parameter.
- Definition of symbols under “Power Off/On” - : if a change is made, it will be reflected upon the parameter when the power to the driver is turned off and then on again.
- Definition of symbols under “Related mode” - P: position control, S: velocity control, T: torque control, F: full closed control

Caution The symbol “ * ” attached to “Unit”. indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

12. Setup of Parameter and Mode

Setup of Torque Limit

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	Max. 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
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.

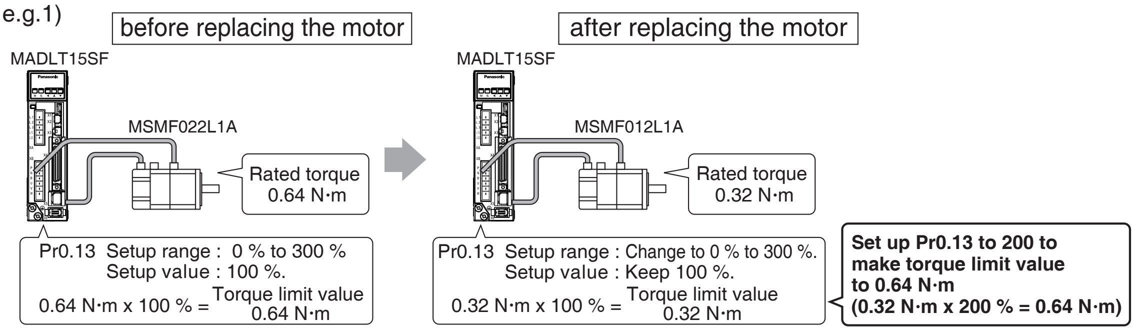
Cautions on Replacing the Motor

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)

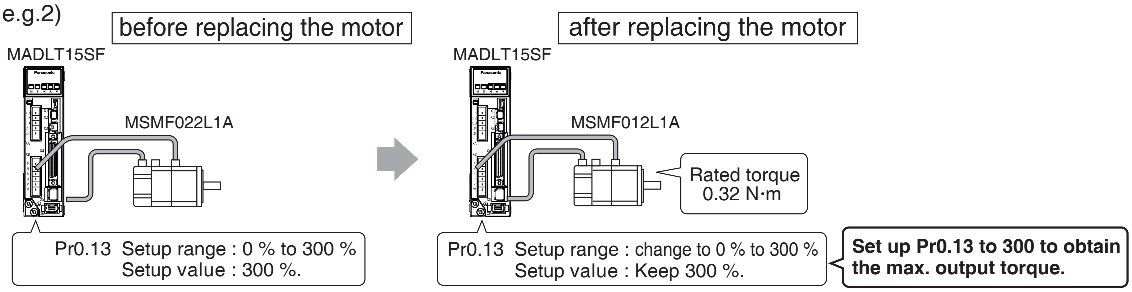
e.g.1)



2. When you want to obtain the max. motor torque,

You need to reset the torque limiting setup to the upper limit, because the upper limit value might be different from the previous motor. (see e.g.2)

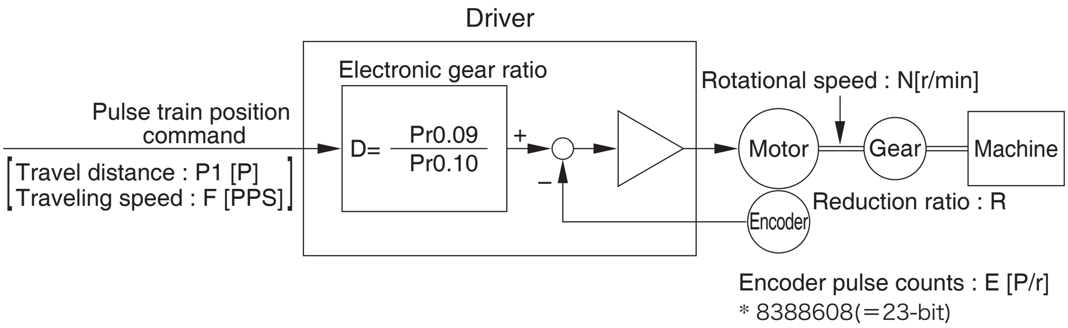
e.g.2)



<Note>

Please don't use other combination besides the combination of designation.

For details of combination refer to P.1-19 "4. Check of the Combination of the Driver and the Motor " .



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]

$$M = P1 \times (D/E) \times (1/R) \times L \ldots\ldots (1)$$

therefore, position resolution (travel distance ΔM per one command pulse) will be described by the formula (2)

$$\Delta M = (D/E) \times (1/R) \times L \ldots\ldots (2)$$

modifying the above formula (2), electronic gear ratio can be found in the formula (3).

$$D = (\Delta M \times E \times R) \times L \ldots\ldots (3)$$

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).

$$V = F \times (D/E) \times (1/R) \times L \ldots\ldots (4)$$

$$N = F \times (D/E) \times 60 \ldots\ldots (5)$$

modifying the above formula (5), electronic gear ratio can be found in the formula (6).

$$D = (N \times E) / (F \times 60) \ldots\ldots (6)$$

Note

1) Make a position resolution, ΔM 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

Relation between Electronic Gear and Position Resolution or Traveling Speed

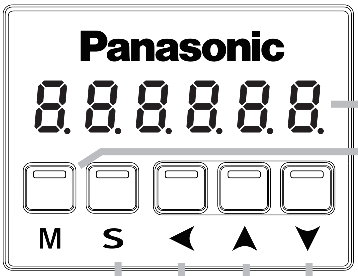
	Electronic gear ratio $D = \frac{\Delta M \times E \times R}{L}$	$D = \frac{Pr0.09}{Pr0.10}$
Lead of ball screw, L =10 mm Gear reduction ratio, R = 1 Position resolution, ΔM =0.005 mm Encoder, 23-bit (E= 2^{23} P/r)	$\frac{0.0005 \times 2^{23} \times 1}{10} = \frac{5 \times 2^{23}}{10 \times 10^4} = \frac{41943040}{100000}$	Pr0.09 = 41943040 Pr0.10 = 100000

<table>
<tr><td></td><td colspan="2">Motor rotational speed (r/min), $N = F \times \frac{D}{E} \times 60$</td></tr>
<tr><td>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</td><td colspan="2">$500000 \times \frac{0.0005 \times 2^{23} \times 1}{20} \times \frac{1}{2^{23}} \times 60$

$= 750$</td></tr>
<tr><td rowspan="4">Ditto
To make it to 2000 r/min.</td><td>Electronic gear ratio $D = \frac{N \times E}{F \times 60}$</td><td>$D = \frac{Pr0.09}{Pr0.10}$</td></tr>
<tr><td>$D = \frac{2000 \times 2^{23}}{500000 \times 60} = \frac{\cancel{2000} \times 2^{23}}{\cancel{2000} \times 500 \times 30} = \frac{8388608}{15000}$</td><td>Pr0.09 = 8388608
Pr0.10 = 15000</td></tr>
<tr><td colspan="2">Travel distance per command pulse (mm)
(Position resolution)
$\Delta M = \frac{D}{E} \times \frac{1}{R} \times L$</td></tr>
<tr><td colspan="2">$\frac{2000 \times 2^{23}}{500000 \times 60} \times \frac{1}{2^{23}} \times \frac{1}{1} \times 20 = 0.00133$ mm</td></tr>
</table>

Related page • P.4-10 “Details of Parameter”

Setup with the Front Panel



Display LED (6-digit)
Switch to error display screen when error occurs, and LED will flash (about 2 Hz).
LED will flash slowly (about 1 Hz) when warning occurs.

Mode switching button
(valid at SELECTION display)
Press this to switch 4 kinds of mode.
1) Monitor Mode
2) Parameter Set up Mode
3) EEPROM Writing Mode
4) Auxiliary Function Mode

SET Button (valid at any time)
Press this to switch SELECTION and EXECUTION display.

Press these to change display and data, select parameters and execute actions.
(Change/Selection/Execution is valid to the digit which decimal point flashes.)
Numerical value increases by pressing, ▲ ,
decreases by pressing ▼ .

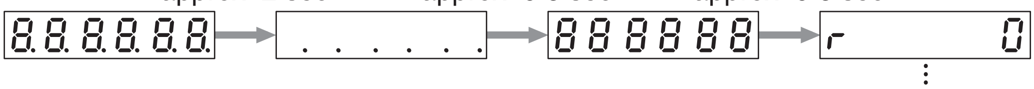
Shifting of the digit for data changing to higher digit.

Initial Status of the Front Panel Display (7 Segment LED)

Status

Front panel display shows the following after turning on the power of the driver.

approx. 2 sec approx. 0.6 sec approx. 0.6 sec

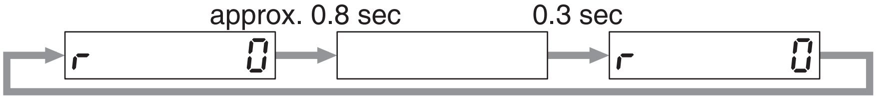


Initial display of LED
(Determined by the setup of Parameter, Pr5.28 "Initial status of LED".)

Upon Occurrence of an Alarm

If a driver alarm is generated, the front panel display shows the following repeatedly.

approx. 0.8 sec 0.3 sec



Repeatedly(during continuous alarm)

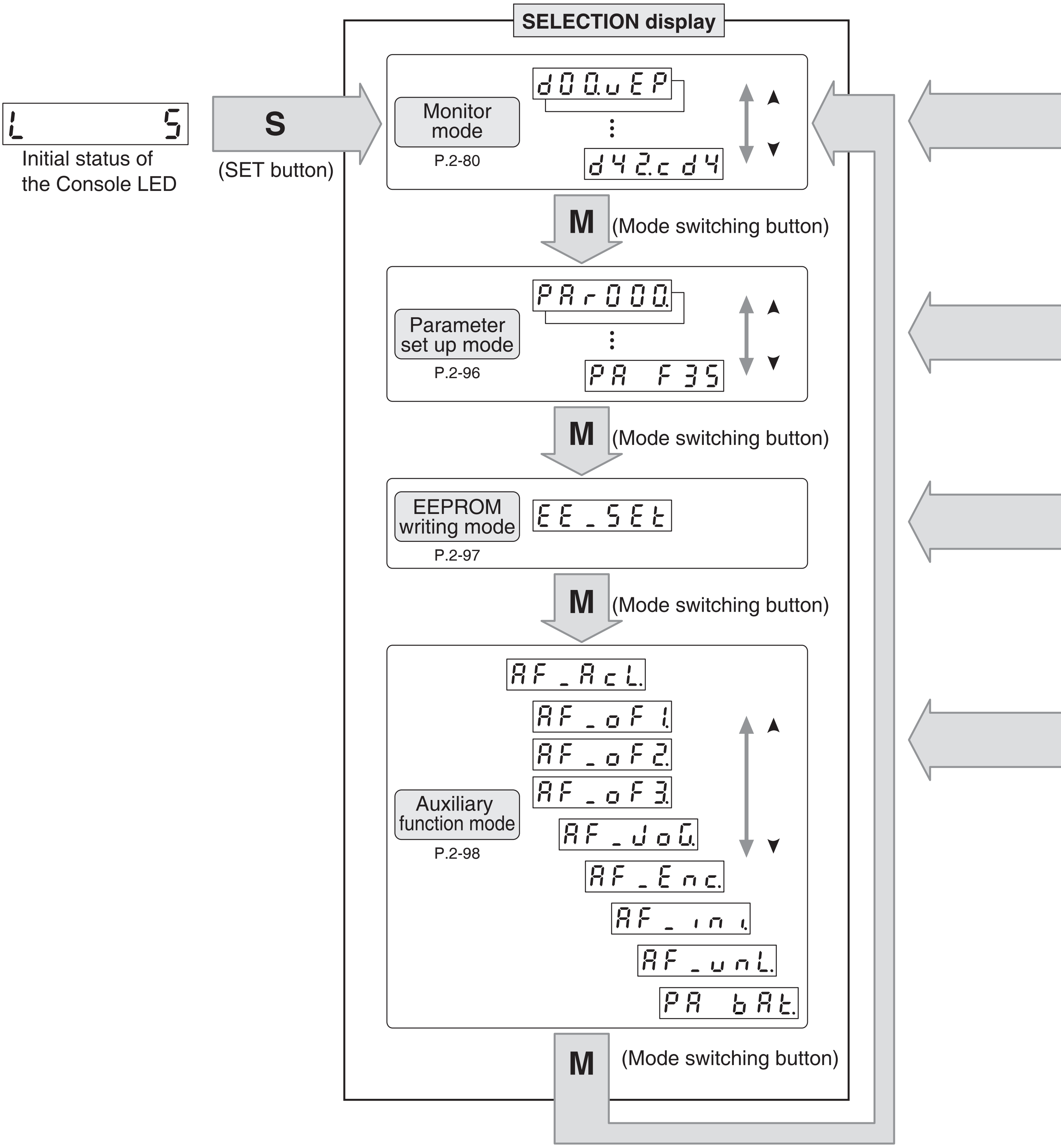
Below shows possible cause of an alarm.

alarm No.	Alarm	Content
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.
A8	External scale error alarm	The external scale detects the alarm.
A9	External scale communication alarm	The number of successive external scale communication errors exceeds the specified value.
AC	Deterioration diagnosis warning	Load characteristic estimates and torque command under constant speed has exceeded the set range.
C3	Main power off warning	In case that Pr7.14 (Detection time of main power off warning) is 10 to 1999, the mains power between L1 and L3 has stopped instantaneously for more than the time prescribed in Pr7.14.

Related page
• P.4-6 to P.4-85 “Details of Parameter”

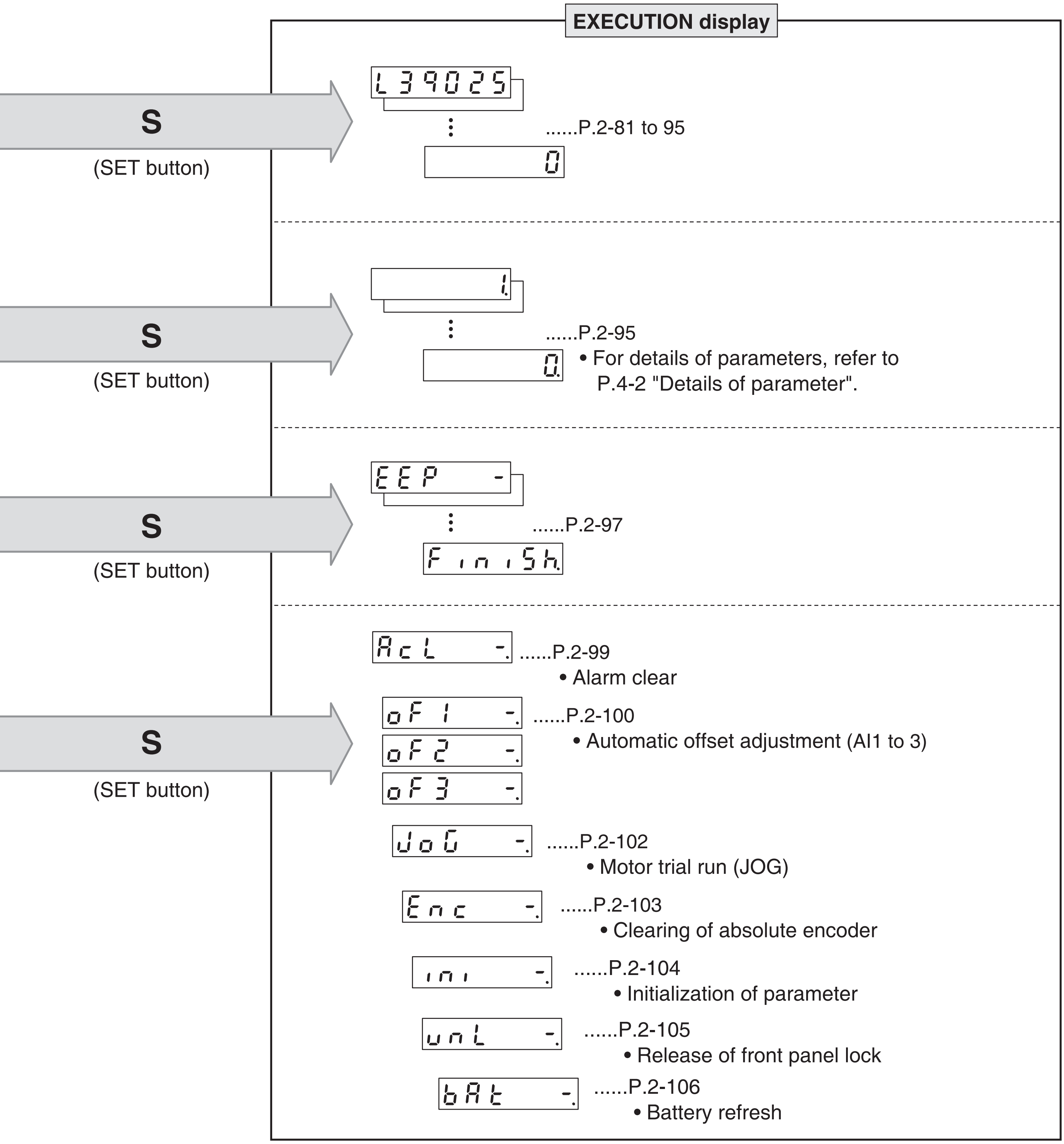
Structure of Each Mode

Use each button on the touch panel to select the structure and switch the mode.



Note You can change the flashing decimal point with ◄, then shift the digit for data change " . "

Caution On power-up, the monitor mode executed is displayed according to the setup of Pr5.28 LED initial status.


EXECUTION display
S
(SET button)
L39025
0
......P.2-81 to 95
S
(SET button)
1.
0.
......P.2-95
• For details of parameters, refer to P.4-2 "Details of parameter".
S
(SET button)
EEP -
Finish.
......P.2-97
S
(SET button)
AcL -.
......P.2-99
• Alarm clear
oF1 -.
oF2 -.
oF3 -.
......P.2-100
• Automatic offset adjustment (AI1 to 3)
JoG -.
......P.2-102
• Motor trial run (JOG)
Enc -.
......P.2-103
• Clearing of absolute encoder
ini -.
......P.2-104
• Initialization of parameter
unL -.
......P.2-105
• Release of front panel lock
bAt -.
......P.2-106
• Battery refresh

14. How to Use the Front Panel

Setup of front panel lock

Outline

To prevent operational error e.g. unintentional parameter modification, the front panel may be locked.

Once locked, operations on the panel are limited as follows:

Mode	Locked panel conditions
Monitor Mode	No limitation: all monitored data can be checked.
Parameter Set up Mode	No parameter can be changed but setting can be checked.
EEPROM Writing Mode	Cannot be run. (No display)
Auxiliary Function Mode	Cannot be run except for “Release of front panel lock”. (No display)

How to operate

• Related parameters

Parameter No.		Title	Function
Class	No.		
5	35	Setup of front panel lock	Locks the operation attempted from the front panel.

Lock and unlock can be made in one of two ways.

Procedure	Front panel	Setup support software PANATERM
Lock	(1) Set Pr5.35 “Front panel lock” to 1, and writ the setting to EEPROM. (2) Turn on power to the driver. (3) The front panel is locked.	
Unlock	(1) Execute the auxiliary function mode, front panel lock release function. (2) Turn on power to the driver. (3) The front panel is unlocked.	(1) Set Pr5.35 “Front panel lock” to 0, and writ the setting to EEPROM. (2) Turn on power to the driver. (3) The front panel is unlocked.

Note For details of front panel lock release, refer to P.2-105.

Related page • P.4-6 to P.4-85 “Details of Parameter”

14. How to Use the Front Panel

Exclusive functions by operations performed by communications

Outline

To prevent operations by communication (USB/RS232/RS485/Modbus) and operation from the front panel being in conflict with each other, the following exclusive functions will be triggered depending on their respective state:

Mode	Locked panel conditions
The front panel is in “execution display” other than the monitor mode.	Parameter write and EEPROM write by communications will result in command error and not executed. In addition, connection of set-up support software, PANATERM (USB communication) cannot be established.
Execution right has been acquired by RS232/RS485/Modbus communications.	No operations other than monitor mode can be made from the front panel.
Set-up support software (PANATERM) (USB communication) is connected.	

Please refer to P.7-27 "Communication" for RS232/RS485 communications and to Technical reference (Modbus communication and Block operation Specification) for Modbus communications.

14. How to Use the Front Panel

Monitor Mode (SELECTION display)

To change the monitor display setting, select the display option to be changed from " SELECTION display", and press S to change to " EXECUTION display". After completion of changing, press S to return to the selection display,

Monitor Mode SELECTION display

Display example	Description	Pages to refer
d00.uEP	Positional command deviation	P.2-81(1)
d01.SPd	Motor speed	P.2-81(2)
d02.cSP	Positional command speed	P.2-81(2)
d03.cUL	Velocity control command	P.2-81(2)
d04.tr9	Torque command	P.2-81(2)
d05.nPS	Feedback pulse sum	P.2-82(3)
d06.cPS	Command pulse sum	P.2-82(3)
d08.FPS	External scale feedback pulse sum	P.2-82(3)
d09.cnt	Control mode	P.2-82(4)
d10. io	I/O signal status	P.2-83(5)
d11.Ain	Analog input value	P.2-84(6)
d12.Err	Error factor and reference of history	P.2-85(7)
d13. rn	Alarm Display	P.2-87(8)
d14. rG	Regenerative load factor	P.2-88(9)
d15. oL	Over-load factor	P.2-88(9)
d16.Jrt	Inertia ratio	P.2-88(9)
d17. ch	Factor of no-motor running	P.2-89(10)
d18.ict	No. of changes in I/O signals	P.2-90(11)
d20.Abs	Absolute encoder data	P.2-90(12)
d21.AES	Absolute external scale position	P.2-91(13)
d22.rEc	No. of encoder/ external scale communication errors monitor	P.2-91(14)
d23. id	Communication axis address	P.2-91(15)
d24.PEP	Encoder positional deviation [Encoder unit]	P.2-91(16)
d25.PFE	External scale deviation [External scale unit]	P.2-92(17)
d26.hYb	Hybrid deviation [Command unit]	P.2-92(18)
d27. Pn	Voltage across PN [V]	P.2-92(19)
d28. no	Software version	P.2-92(20)
d29.ASE	Driver serial number	P.2-93(21)
d30.nSE	Motor serial number	P.2-93(22)
d31. tE	Accumulated operation time	P.2-93(23)
d32.Aud	Automatic motor recognizing function	P.2-93(24)
d33.Ath	Temperature information	P.2-94(25)
d35. SF	Safety condition monitor	P.2-94(26)
d39.cd1	For manufacturer's use	P.2-95(27)
d40.cd2	For manufacturer's use	
d41.cd3	For manufacturer's use	
d42.cd4	For manufacturer's use	

<Return to "Positional command deviation".>

Display shifts toward the arrowed direction by pressing ▲ and reversed direction by pressing ▼ .

S (SET button) ↔ EXECUTION display

M (Mode switch button) ↔ Parameter Setup Mode SELECTION display

Note When you turn on the Product for the first time, display shows r 0. (at motor stall) To change this display, change the setup of Pr5.28 (Initial status of LED).

14. How to Use the Front Panel

Monitor Mode (EXECUTION display)

(1) Display of positional command deviation [command unit]

Displays positional deviation of the command unit in High order or Low order.

L 39025

Positional command deviation

L ......Low order

H ......High order

• To switch between Low order (L) and High order (H), press ◄ .

eg. Positional command deviation＝10339025

L 39025 ⟷ H 103

(2) Display of motor speed, positional command speed, velocity control command and torque command

• Motor speed (r/min)

r 1000

Displays the motor speed (r/min).

• Positional command speed (r/min)

r 1000

Displays positional command speed (r/min).

• Velocity control command (r/min)

r 1000

Displays velocity control command (r/min).

• Torque command (%)

t 100

Displays torque command (%).

(3) Display of Feedback Pulse Sum, Command Pulse Sum and External Scale Feedback Pulse Sum

• Feedback Pulse Sum [Encoder feedback pulse]

`L 39025`

Feedback Pulse Sum

L ......Low order

H ......High order

• To switch between Low order (L) and High order (H), press ◄ .

`L 39025` ←→ `H 103`

• Command Pulse Sum [Command Pulse]

`L 39025`

Command Pulse Sum

L ......Low order

H ......High order

• To switch between Low order (L) and High order (H), press ◄ .

`L 39025` ←→ `H 103`

• External Scale Feedback Pulse Sum

`L 39025`

External Scale Feedback Pulse Sum

L ......Low order

H ......High order

• To switch between Low order (L) and High order (H), press ◄ .

`L 39025` ←→ `H 103`

(4) Display of Control Mode

`PoScnt` .....Position control mode

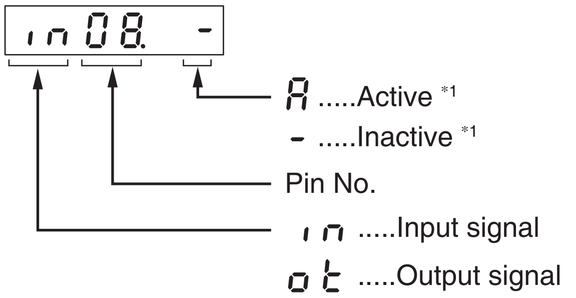
`SPdcnt` .....Velocity control mode

`tr9cnt` .....Torque control mode

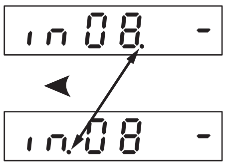
`FcLcnt` .....Full-closed control mode

(5) Display of I/O Signal Status

Displays the control input and output signal to be connected to connector X4.
Use this function to check if the wiring is correct or not.



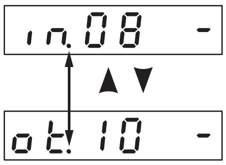
• Shift the flashing decimal point with ◀ .



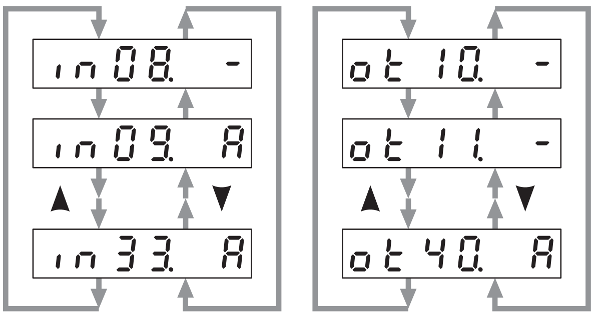
(Right side of decimal point : Pin No. selection)

(Left side of decimal point : Input/Output Pin No. selection)

• Select In or Out by pressing ▲ or ▼ button.



• Select the Pin No. to be monitored by pressing ▲ ▼ .



(Lowest place Pin No. of output signal)

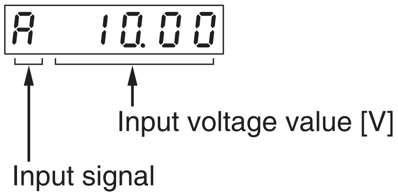
(Highest place Pin No. of input signal)

*1 When input signal	Active	: Input signal photocoupler is ON.
	Inactive	: Input signal photocoupler is OFF.
When output signal	Active	: Output signal transistor is ON.
	Inactive	: Output signal transistor is OFF.

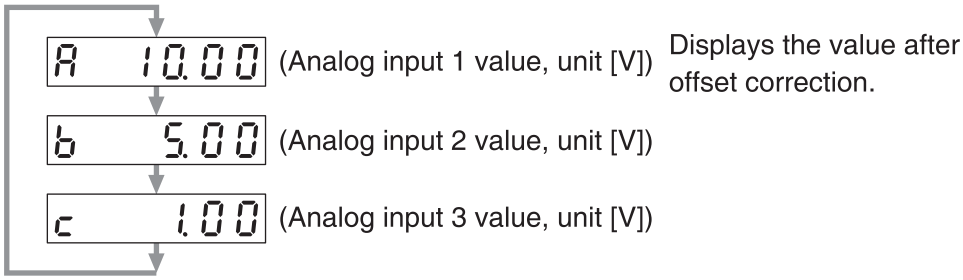
Note

For detail of input/output signal, refer to P.3-33 “Inputs and outputs on connector X4”
For detail of Error Code, refer to P.6-2 “Protective Function”.

(6) Display of Analog Input Value



•Select the signal No. to be monitored by pressings ▲ ▼ .



Caution Voltage exceeding ± 10 V can not be displayed correctly.

(7) Display of Error Factor and Reference of History

Err. - - -

Error code No. (- - - appears if no error occurs)

Err. ....Present error

E-0. ....History 0 (latest error)

E13. ....History 13 (oldest error)

• You can refer the last 14 error factors (including present one)
Press ▲ ▼ to select the factor to be referred.

<List of error code No.>

Error code		Protective function	Attribute		
Main	Sub		History	Can be cleared	Immediate stop
11	0	Control power supply under- voltage protection		○	
12	0	Over-voltage protection	○	○	
13	0	Main power supply under-voltage protection (between P to N)		○	
	1	Main power supply under-voltage protection (AC interception detection)		○	○
14	0	Over-current protection	○		
	1	IPM error protection	○		
15	0	Over-heat protection	○		○
	1	Encoders abnormal over-heat protection	○		○
16	0	Over-load protection	○	○	Switchable
	1	Torque saturation anomaly protection	○	○	
18	0	Over-regeneration load protection	○		○
	1	Over-regeneration Tr error protection	○		
21	0	Encoder communication disconnect error protection	○		
	1	Encoder communication error protection	○		
23	0	Encoder communication data error protection	○		
24	0	Position deviation excess protection	○	○	○
	1	Velocity deviation excess protection	○	○	○
25	0	Hybrid deviation excess error protection	○		○
26	0	Over-speed protection	○	○	○
	1	2nd over-speed protection	○	○	
27	0	Command pulse input frequency error protection	○	○	○
	1	Absolute clear abnormal protection	○		
	2	Command pulse multiplier error protection	○	○	○
28	0	Limit of pulse replay error protection	○	○	○
29	0	Deviation counter overflow abnormality protection	○	○	
	1	Counter overflow protection 1	○		
	2	Deviation counter overflow abnormality protection 2	○		
31	0	Safety function error protection 1	○		
	2	Safety function error protection 2	○		
33	0	IF overlaps allocation error 1 protection	○		
	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	○		
	6	CL fitting error protection	○		
	7	INH fitting error protection	○		
34	0	Software limit protection	○	○	
36	0 to 1	EEPROM parameter error protection			
37	0 to 2	EEPROM check code error protection			

Error code		Protective function	Attribute		
Main	Sub		History	Can be cleared	Immediate stop
38	0	Over-travel inhibit input protection		○	
39	0	Analog input1 excess protection	○	○	○
	1	Analog input2 excess protection	○	○	○
	2	Analog input3 excess protection	○	○	○
40	0	Absolute system down error protection	○	○	
41	0	Absolute counter over error protection	○		
42	0	Absolute over-speed error protection	○	○	
43	0	Initialization failure	○		
44	0	Absolute single turn counter error protection	○		
45	0	Absolute multi-turn counter error protection	○		
47	0	Absolute status error protection	○		
48	0	Encoder Z-phase error protection	○		
49	0	Encoder CS signal error protection	○		
50	0	External scale connection error protection	○		
	1	External scale communication error protection	○		
51	0	External scale status 0 error protection	○		
	1	External scale status 1 error protection	○		
	2	External scale status 2 error protection	○		
	3	External scale status 3 error protection	○		
	4	External scale status 4 error protection	○		
	5	External scale status 5 error protection	○		
55	0	A-phase connection error protection	○		
	1	B-phase connection error protection	○		
	2	Z-phase connection error protection	○		
70	0	U-phase current detector error protection	○		
	1	W-phase current detector error protection	○		
72	0	Thermal error	○		
80	0	Modbus communications timeout protection	○	○	○
87	0	Compulsory alarm input protection		○	○
92	0	Encoder data recovery abnormal protection	○		
	3	Multi-turn data upper-limit value disagreement error protection	○		
93	0	Parameter setting error protection 1	○		
	1	Block data setting error protection	○	○	
	2	Parameter setting error protection 2	○		
	3	External scale connection error protection	○		
	8	Parameter setting error protection 6	○		
94	0	Block operation error protection	○	○	
	2	Return to origin error protection	○	○	
95	0 to 4	Motor automatic recognition error protection			
97	0	Control mode setting error prtection			
Other number		Other error	○		

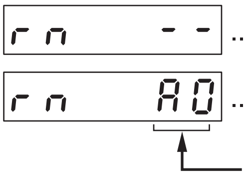
Note

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.)

Caution

1) Certain alarms are not included in the history. For detailed information on alarms e.g. alarm numbers, refer to P.6-2.
2) When one of the errors which are listed in error history occurs, this error and history o shows the same error No.

(8) Alarm Display

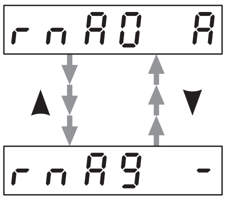


......No alarm occurred

......High priority alarm

Alarm number

• To display the alarm occurrence condition, press ▲ or ▼ button.

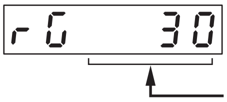


alarm No.	Alarm	Content	Latched time *1
A0	Overload protection	Load factor is 85 % or more the protection level.	1 s to 10 s or ∞
A1	Over-regeneration alarm	Regenerative load factor is 85 % or more the protection level.	10 s or ∞
A2	Battery alarm	Battery voltage is 3.2 V or lower.	Fixed at ∞
A3	Fan alarm	Fan has stopped for 1 sec.	1 s to 10 s or ∞
A4	Encoder communication alarm	The number of successive encoder communication errors exceeds the specified value.	1 s to 10 s or ∞
A5	Encoder overheat alarm	The encoder detects overheat alarm.	1 s to 10 s or ∞
A6	Oscillation detection alarm	Oscillation or vibration is detected.	1 s to 10 s or ∞
A7	Lifetime detection alarm	Life expectancy of capacitor or fan is short.	Fixed at ∞
A8	External scale error alarm	The external scale detects the alarm.	1 s to 10 s or ∞
A9	External scale communication alarm	The number of successive external scale communication errors exceeds the specified value.	1 s to 10 s or ∞
AC	Deterioration diagnosis warning	Load characteristic estimates and torque command under constant speed has exceeded the set range.	1 s to 10 s or ∞
C3	Main power off warning	In case that Pr7.14 (Detection time of main power off warning) is 10 to 1999, the mains power between L1 and L3 has stopped instantaneously for more than the time prescribed in Pr7.14.	1 s to 10 s or ∞

*1 Alarms can be cleared by using the alarm clear. Because the all existing alarms are kept cleared while the alarm clear input (A-CLR) is kept ON, be sure to turn it OFF during normal operation. Either 1 s to 10 s or ∞ can be selected by using user parameter.
Exception: Battery alarm is fixed at ∞ because it is latched by the encoder.
Because the end of life alarm means that the life expectancy cannot be extended, the alarm is set at ∞.

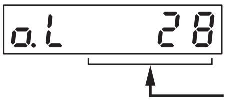
(9) Display of Regenerative Load Factor, Over-load Factor and Inertia Ratio

• Regenerative Load Factor



Display the ratio (%) against the alarm trigger level of regenerative protection.
This is valid when Pr0.16 (External regenerative resistor setup) is 0 or 1.

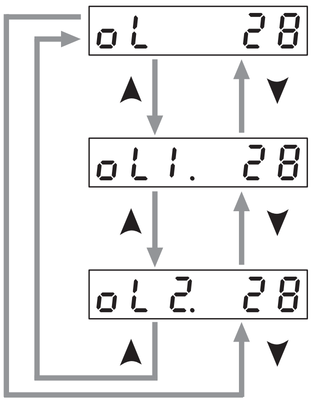
• Over-load Factor



Displays the ratio (%) against the rated load.
Refer to P.6-14, "Overload Protection Time Characteristics" of When in Trouble.

Overload factor (%)

• Displays Overload factor by pressing ▲ or ▼ button.

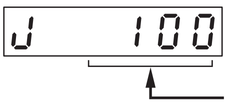


Overload factor (%) — Displays the Overload factor witch is bigger in Overload factor 1 and 2.

For manufacturer's use

For manufacturer's use

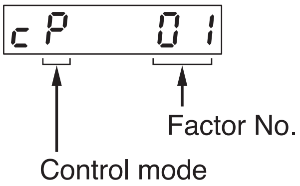
• Inertia Ratio



Displays the inertia ratio (%) .
Value of Pr0.04 (Inertia Ratio) will be displayed as it is.

10) Display of the Factor of No-Motor Running

Displays the factor of no-motor running in number.



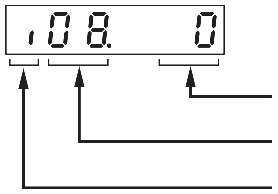
P ....Position control
t ....Torque control
S .... Velocity control
F .... Full-closed control

• Explanation of factor No.

Factor No.	Factor	Related Control Mode P	S	T	F	Content
flashing	Occurrence of error/alarm	○	○	○	○	An error is occurring, and an alarm is triggered.
00	No particular factor	○	○	○	○	No factor is detected for No-motor run. The motor runs in normal case.
01	Main power shutoff	○	○	○	○	The main power of the driver is not turned on.
02	No entry of SRV-ON input	○	○	○	○	The Servo-ON input (SRV-ON) is not connected to COM–.
03	Over-travel inhibition input is valid	○	○	○	○	While Pr5.04 is 0 (Run-inhibition input is valid), • Positive direction over-travel inhibition input (POT) is open and speed command is Positive direction. • Negative direction over-travel inhibition input (NOT) is open and speed command is Negative direction.
04	Torque limit setup is small	○	○	○	○	Either one of the valid torque limit setup value of Pr0.13 (1st) or Pr5.22 (2nd) is set to 5 % or lower than the rating.
05	Analog torque limit input is valid.	○	○		○	While Pr5.21 is 0 (analog torque limit input accepted), • Positive direction analog torque limit input (P-ATL) is negative voltage and speed command is Positive direction. • Negative direction analog torque limit input (N-ATL) is positive voltage and speed command is Negative direction.
06	INH input is valid.	○			○	Pr5.18 is 0 (Command pulse inhibition input is valid.), and INH is open.
07	Command pulse input frequency is low.	○			○	The position command per each control cycle is 1 pulse or smaller due to, • No correct entry of command pulse • No correct connection to the input selected with Pr0.05. • No matching to input status selected with Pr0.06 pr Pr0.07.
08	CL input is valid.	○			○	While Pr5.17 is 0 (Deviation counter clear at level), the deviation counter clear input (CL) is connected to COM–.
09	ZEROSPD input is valid.		○	○		While Pr3.15 is 1 (Speed zero clamp is valid.), the speed zero clamp input (ZEROSPD) is open.
10	External speed command is small.		○			While the analog speed command is selected, the analog speed command is smaller than 0.06[V].
11	Internal speed command is 0.		○			While the internal speed command is selected, the internal speed command is set to lower than 30 [r/min]
12	Torque command is small.			○		The analog torque command input (SPR or P-ATL) is smaller than 5 [%] of the rating.
13	Speed limit is small.			○		• While Pr3.17 is 0 (speed is limited by 4th speed of internal speed), Pr3.07, (4th speed of speed setup) is set to lower than 30 [r/min]. • While Pr3.17 is 1 (speed is limited by SPR input), the analog speed limit input (SPR) is smaller than 0.06 [V].
14	Other factor	○	○	○	○	The motor runs at 20 [r/min] or lower even though the factors from 1 to 13 are cleared, (the command is small, the load is heavy, the motor lock or hitting, driver/motor fault etc.)

Note * Motor might run even though the other number than 0 is displayed.
Refer to "6.In trouble".

(11) Display of No. of changes in I/O signals



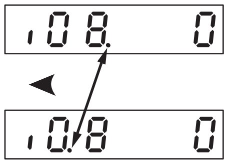
No. of changes in I/O signals (the signal is invalid)

Pin No.

i .....Input signal

o .....Output signal

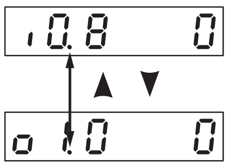
• Shift the flashing decimal point with ◄ .



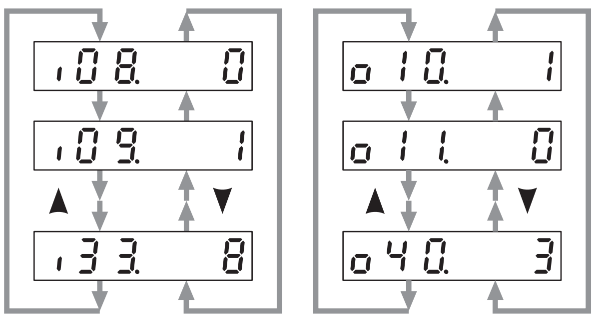
(Left side of decimal point : Pin No. selection)

(Right side of decimal point : Input/Output Pin No. selection)

• The switch of input/output, by pressing ▲ or ▼ button.



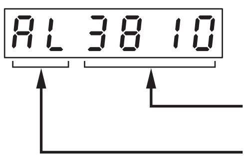
• Select the No. of pin, the number of changes on that pin should be displayed, by pressing ▲ or ▼ button.



(Lowest place Pin No. of output signal)

(Highest place Pin No. of input signal)

(12) Display of absolute encoder data



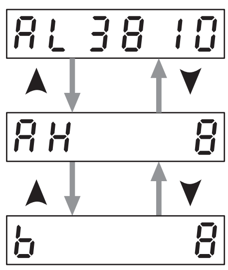
Encoder data

AL ......One revolution data, Low order (L)

AH ......One revolution data, High order (H)

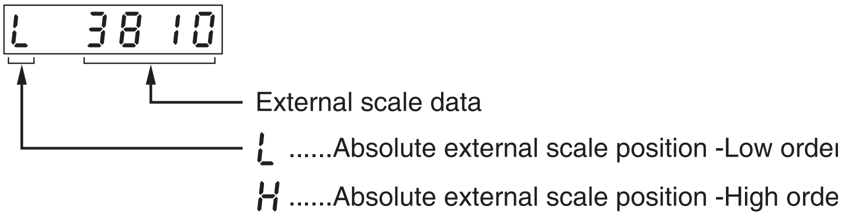
b ......Multi-revolution data

• Select the data to be displayed by pressing ▲ or ▼ button.

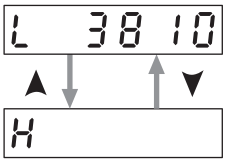


(13) Display of absolute external scale position

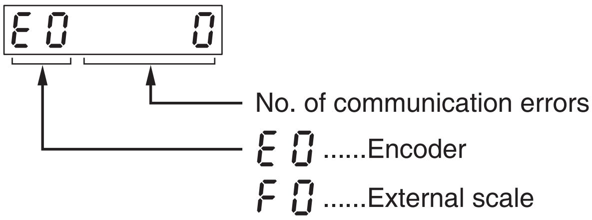
- Displays the absolute position of serial absolute scale.
- If a serial incremental scale, displays the scale position relative to the power on position which is defined as 0.



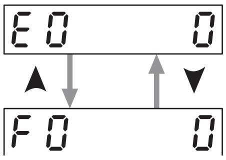
- Select encoder or external scale by pressing ▲ or ▼ button.



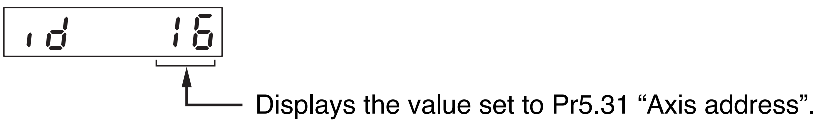
(14) Display of No. of encoder/ external scale communication errors monitor



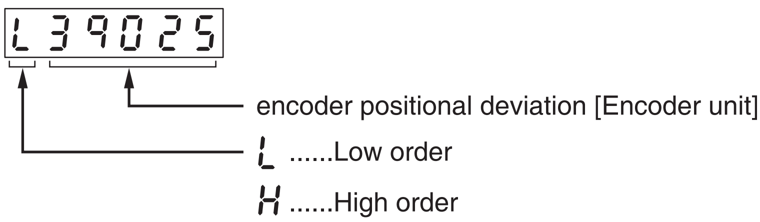
- Select encoder or external scale by pressing ▲ or ▼ button



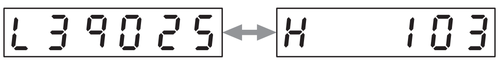
(15) Display of communication axis address



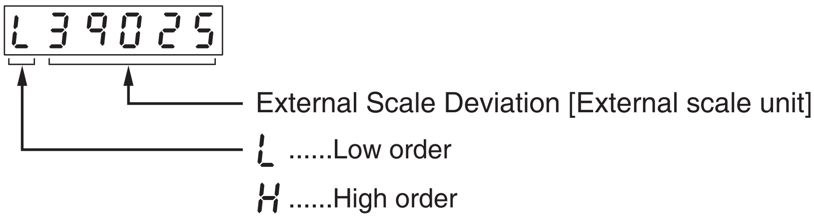
(16) Display of encoder positional deviation [Encoder unit]



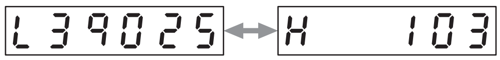
- To switch between Low order (L) and High order (H), press ◄ .



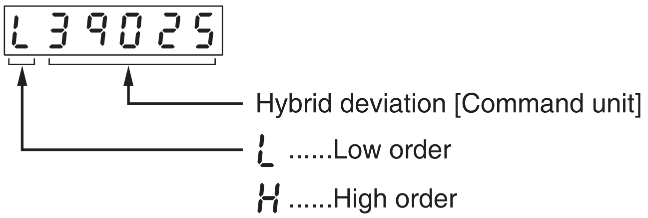
(17) Display of External Scale Deviation [External Scale Unit]



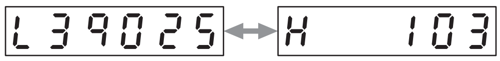
• To switch between Low order (L) and High order (H), press ◄ .



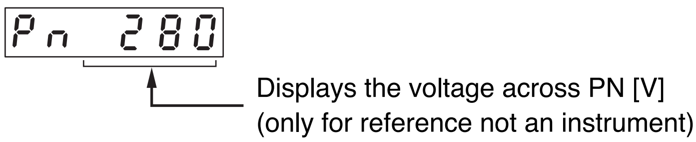
(18) Display of hybrid deviation [Command unit]



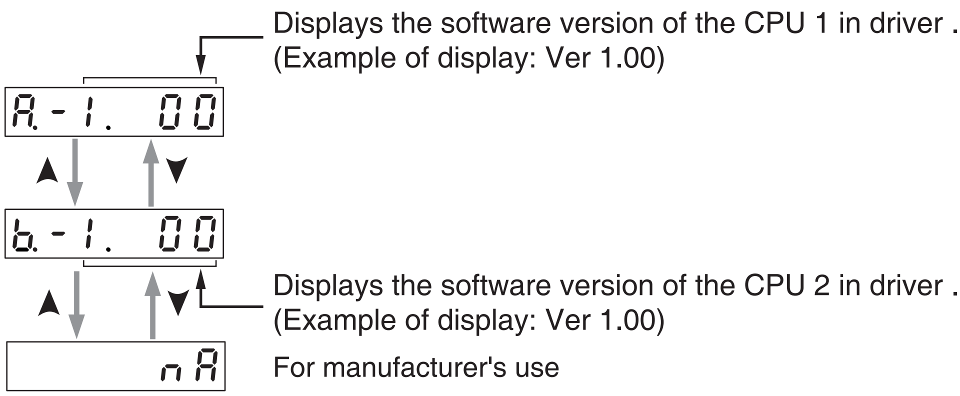
• To switch between Low order (L) and High order (H), press ◄ .



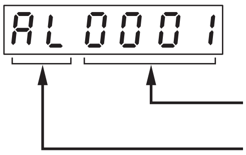
(19) Display of voltage across PN [V]



(20) Display of Software Version



(21) Display of driver serial number

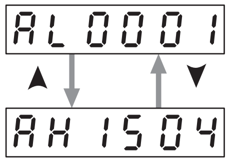


Driver serial number

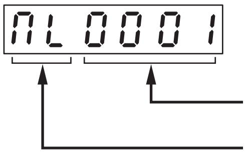
AL ......Driver serial number- Low order

AH ......Driver serial number- High order

• To switch between Low order (L) and High order (H), press ▲ or ▼.
(Example of display: Serial number P15040001N)



(22) Display of motor serial number

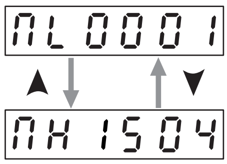


Motor serial number

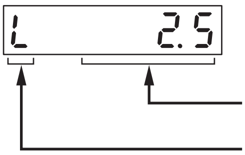
nL ......Motor serial number- Low order

nH ......Motor serial number- High order

• To switch between Low order (L) and High order (H), press ▲ or ▼.
(Example of display: Serial number 15040001N)



(23) Display of accumulated operation time

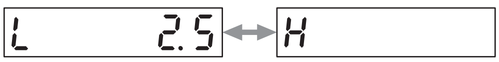


Displays accumulated operation time [h].

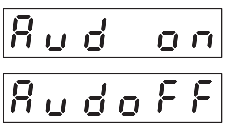
L ......Low order

H ......High order

• To switch between Low order (L) and High order (H), press ◄ .



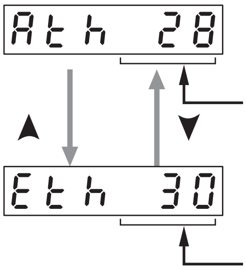
(24) Automatic Motor Recognizing Function



......Automatic recognition is valid.

......Automatic recognition is invalid.

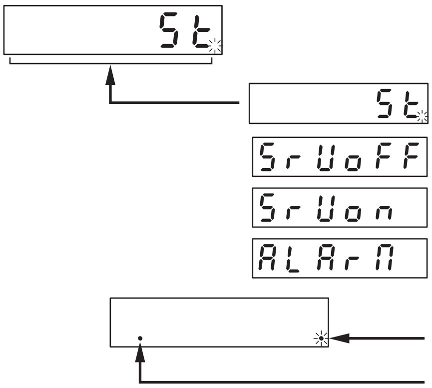
(25) Display of temperature



Displays the driver temperature [C].
(This is not meter readings but only for reference.)

Displays the encoder temperature [C].
(This is not meter readings but only for reference.)

(26) Display of safety condition monitor



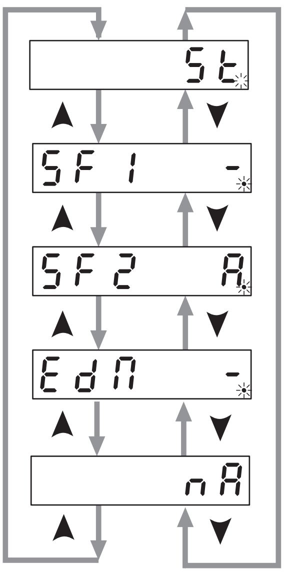
: Safety condition
: Servo-off condition
: Servo-on condition
: Alarm condition

Dot information

Flashing Normal change is possible

Servo ready condition
OFF: Dot unlit
ON: Dot lit

- Select desired monitor option by pressing ▲ or ▼ button.



- ...Input photocoupler OFF　A ...Input photocoupler ON

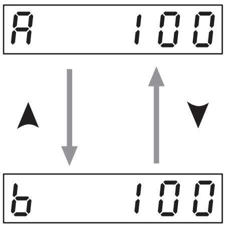
- ...Input photocoupler OFF　A ...Input photocoupler ON

- ...Output photocoupler OFF　A ...Output photocoupler ON

For manufacturer's use

Related page P.7-2 “safety”.

(27) Motor power consumption



Motor power consumption [W]

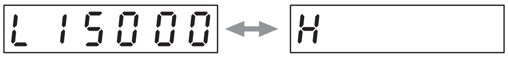
Motor electrical power [Wh]

Precautions)

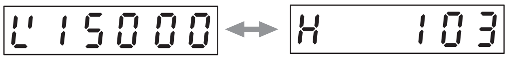
If the monitor data is displayed with lower (L) and higher (H), displays of the front panel are as follows.

Example 1) Monitor data = 15000 (within the display range of lower (L)) .

eg.1) Monitor data=15000(within the display range of lower (L))



eg.2) Monitor data=10315000(if data exceeds the display range of lower (L))



Display of L chang to L'

Parameter Setup Mode

Monitor Mode SELECTION display

M (Mode switch button)

Parameter Setup Mode SELECTION display

PA r 0 0 0.

Parameter No. (Hexadecimal No.)

Class

Note

For parameters which place is displayed with " r ", the content changed and written to EEPROM becomes valid after turning off the power once.

- Press ▲ or ▼ to select parameter No. to be set.

PA r 0 0 0.	Pr0.00
PA r 0 0 1.	Pr0.01
⋮	⋮
PA 0 1 7.	Pr0.17
PA 0 1 8.	Pr0.18
PA r 0 0 0.	Pr0.00

- Press ◄ and the flashing decimal separator shifts to the high order position, allowing the figure at this digit to any other figure.

PA r 0 0 1.	Pr0.01
PA r 0 1 1.	Pr0.11
PA 1 1 1.	Pr1.11

- Display the No. of parameter to be changed and press S to change to EXECUTION display.

S (SET button)

EXECUTION display

1 0 0 0.

Parameter value

You can change the value which digit has a flashing decimal point.

- Press ▲ or ▼ to set up the value of parameter. (Value increases with ▲ decreases with ▼.)
- Press ◄ and the flashing decimal separator shifts to the high order position, allowing the figure at this digit to any other figure.
- Prolonged depression of S updates the parameter in the driver. Note that the parameter value selected by ▲ or ▼ is not reflected until S is pressed in this way.
- To cancel the value selected by ▲ or ▼, press M instead of S, and the driver internal parameter value is kept unchanged and the display returns to the parameter number display screen.

Remarks

After changing the parameter value and pressing S, the content will be reflected in the control. Do not extremely change the parameter value which change might affect the motor movement very much (especially velocity loop or position loop gains).

M (Mode switch button)

EEPROM Writing Mode SELECTION display

Note

- After setting up parameters, return to SELECT mode, referring to structure of each mode (P.4-42).
- Each parameter has a limit in number of places for upper-shifting.

EEPROM Writing Mode

Parameter Setup Mode **SELECTION display**

M (Mode switch button)

EEPROM Writing Mode **SELECTION display**

EE_SEt

- To write the parameter to EEPROM, press **S** to change to EXECUTION display.

S (SET button)

EXECUTION display

EEP -

- Keep pressing ▲ until the display changes to StArt when you execute writing.
  * "Start" flashes instantaneously and is difficult to check visually.

EEP -
EEP --

" - " increases while keep pressing ▲ (for approx. 5sec) as the right fig. shows.

StArt — Starts writing.

FiniSh. / rESEt — Writing completes

Error — Writing error

Note

When you change the parameters which contents become valid after resetting, rESEt will be displayed after finishing wiring. Turn off the control power once to reset.

M (Mode switch button)

Auxiliary Function Mode **SELECTION display**

Caution

1. When writing error occurs, make writing again. If the writing error repeats many times, this might be a failure.
2. Don't turn off the power during EEPROM writing. Incorrect data might be written. If this happens, set up all of parameters again, and re-write after checking the data.
3. When the error defined by Err11.0 "Under voltage protection of control power supply" occurs, Error is displayed indicating that no writing is made to EEPROM.

Auxiliary Function Mode (SELECTION display)

EEPROM Writing Mode **SELECTION display**

↕ **M** (Mode switch button)

Auxiliary Function Mode **SELECTION display**

- To select the desired auxiliary function, press ▲ or ▼.

AF_AcL.	Alarm Clear
AF_oF1.	A1 Automatic Offset Adjustment
AF_oF2.	A2 Automatic Offset Adjustment
AF_oF3.	A3 Automatic Offset Adjustment
AF_JoG.	Trial Run
AF_Enc.	Clearing of Absolute Encoder
AF_ini.	Initialization of parameter
AF_unL.	Release of front panel lock
AF_bAt.	Battery refresh
AF_AcL.	Alarm Clear

- TDisplay the auxiliary function to be changed and press **S** to change to EXECUTION display.

↔ **S** (SET button)

EXECUTION display

Display example	Description	Pages to refer
AcL -.	(Alarm Clear)	P.2-99 (1)
	Pressing ▲ .	
StArt .	Alarm clear starts.	
FiniSh.	Alarm clear completes	
oF1 -.	(AI1 Automatic Offset Adjustment)	P.2-100 (2)
oF2 -.	(AI2 Automatic Offset Adjustment)	P.2-100 (2)
oF3 -.	(AI3 Automatic Offset Adjustment)	P.2-100 (2)
JoG -.	(Motor Trial Run)	P.2-101 (3)
Enc -.	(Clearing of Absolute Encoder)	P.2-103 (4)
ini -.	(Initialization of parameter)	P.2-104 (5)
unL -.	(Release of front panel lock)	P.2-105 (6)
bAt -.	(Battery refresh)	P.2-106 (7)

↕ **M** (Mode switch button)

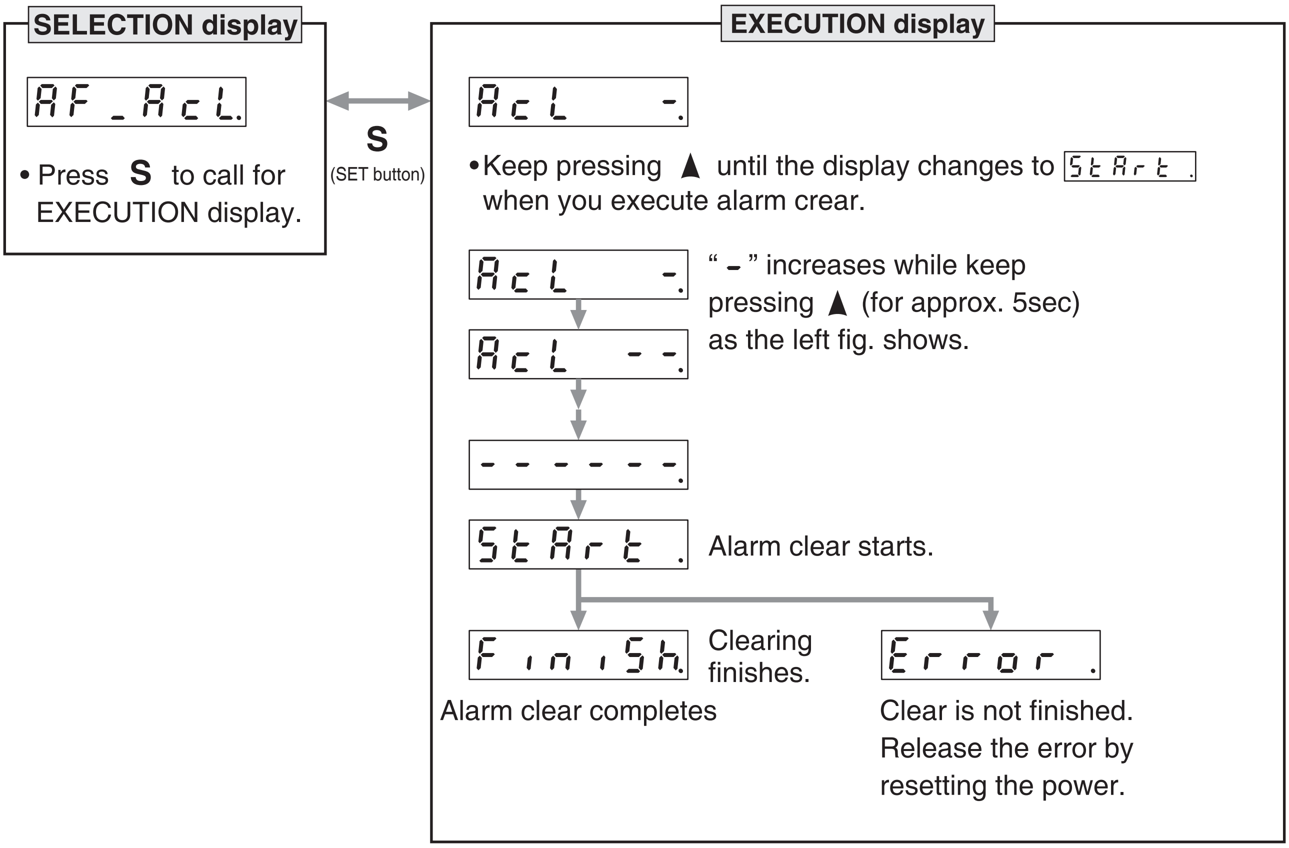
Monitor Mode **SELECTION display**

14. How to Use the Front Panel

Auxiliary Function Mode (EXECUTION display)

1) Alarm Clear Screen

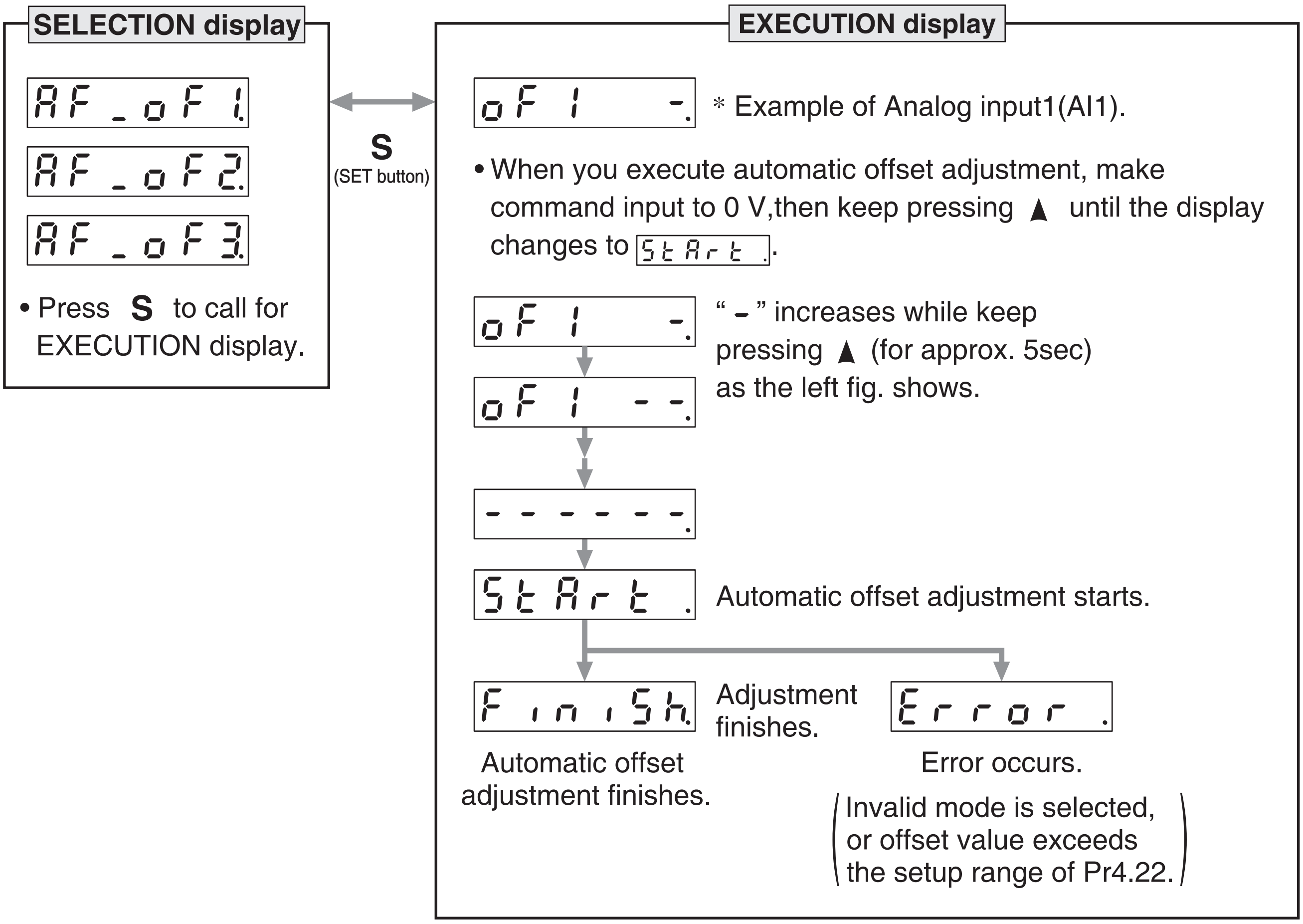
This function releases the current alarm status.
Certain alarms will persist. If this is the case, refer to P.6-2 “When in Trouble - Protective Function”.



Note • After alarm cleaning, return to SELECTION display, referring to structure of each mode (P.2-76).

(2) Analog inputs 1 to 3 automatic offset adjustment

This function automatically adjusts offset setting of analog input.
Analog input 1 (AI1)......Pr4.22 (Analog input 1 (AI1) offset setup)
Analog input 2 (AI2)......Pr4.25 (Analog input 2 (AI2) offset setup)
Analog input 3 (AI3)......Pr4.28 (Analog input 3 (AI3) offset setup)



Remarks
- You cannot write the data only by executing automatic offset adjustment. Execute a writing to EEPROM when you need to reflect the result afterward.

Note
- After completion of the automatic offset adjustment, return to SELECTION display by referring to P.2-76 “Structure of Each Mode”.

(3) Motor trial run

You can make a trial run (JOG run) without connecting the Connector, Connector X4 to the host controller such as PLC.

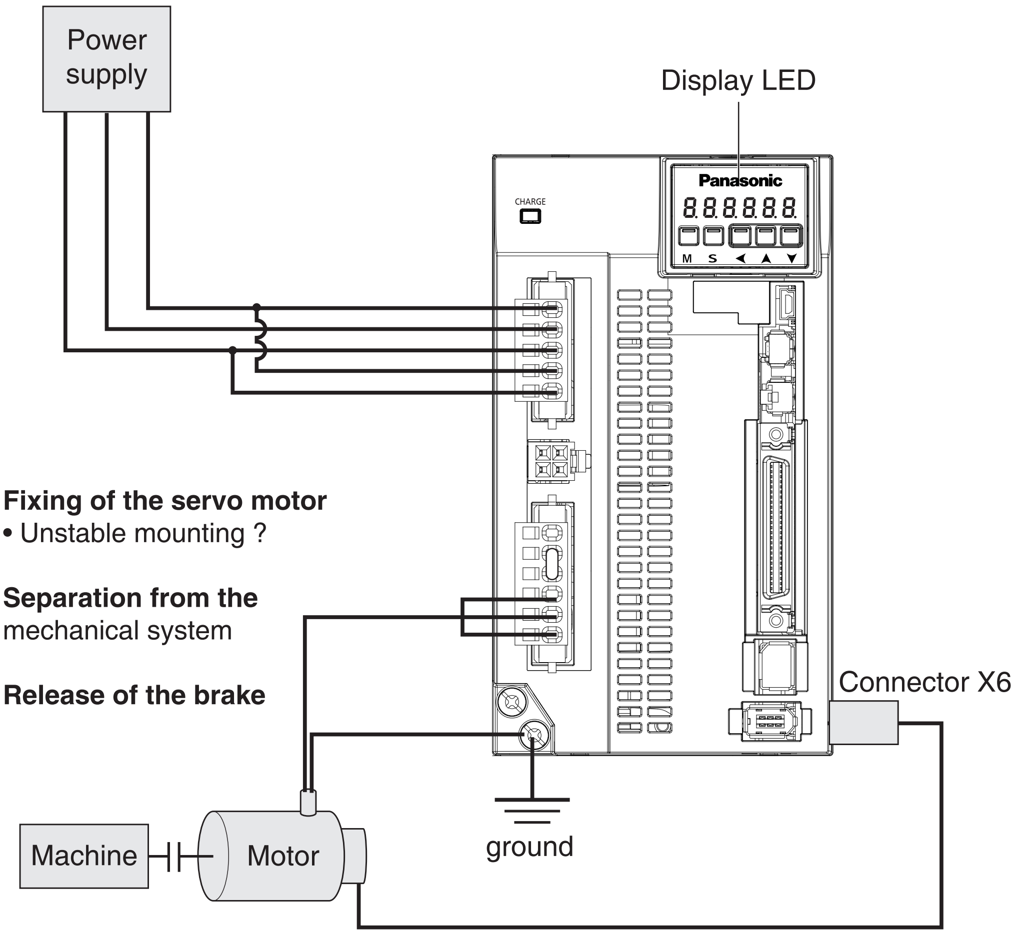
Remarks

- Separate the motor from the load, detach the Connector, Connector X4 before the trial run.
- Bring the user parameter setups (especially Pr0.04 and Pr1.01 to 1.04) to defaults, to avoid oscillation or other failure.

• Inspection Before Trial Run

(1) Inspection on wiring
- Miswiring ? (Especially power input and motor output)
- Short or grounded ?
- Loose connection ?

(2) Confirmation of power supply and voltage
- Rated voltage ?



(3) Fixing of the servo motor
- Unstable mounting ?

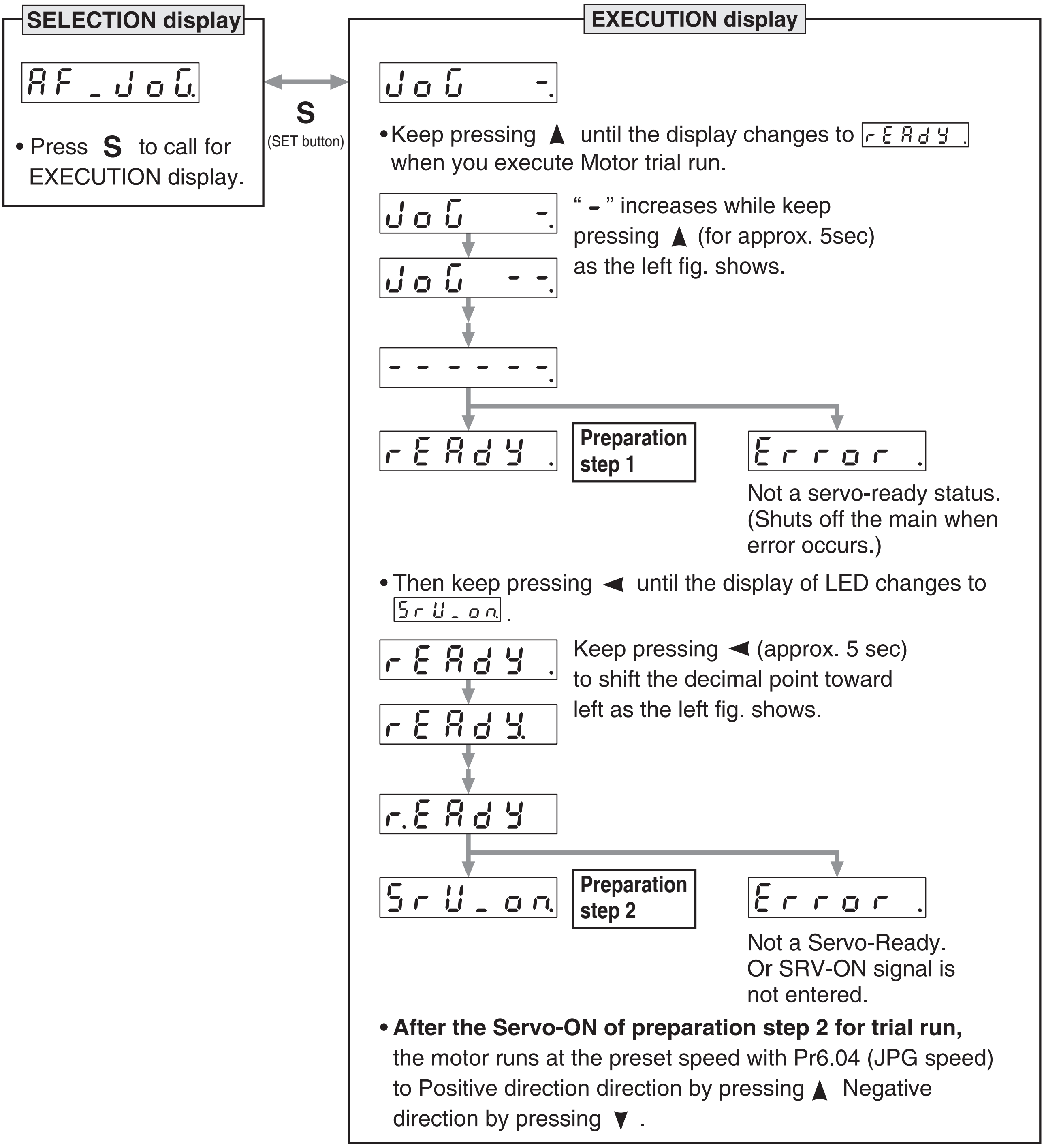
(4) Separation from the mechanical system

(5) Release of the brake

(6) Turn to Servo-OFF after finishing the trial run by pressing S .

Related page
• For wiring details, refer to P2-12 “Overall Wiring”.
• P.4-9 “Pr0.04”
• P.4-16 “Pr1.01 to 1.04”

• Procedure for Trial Run



Caution

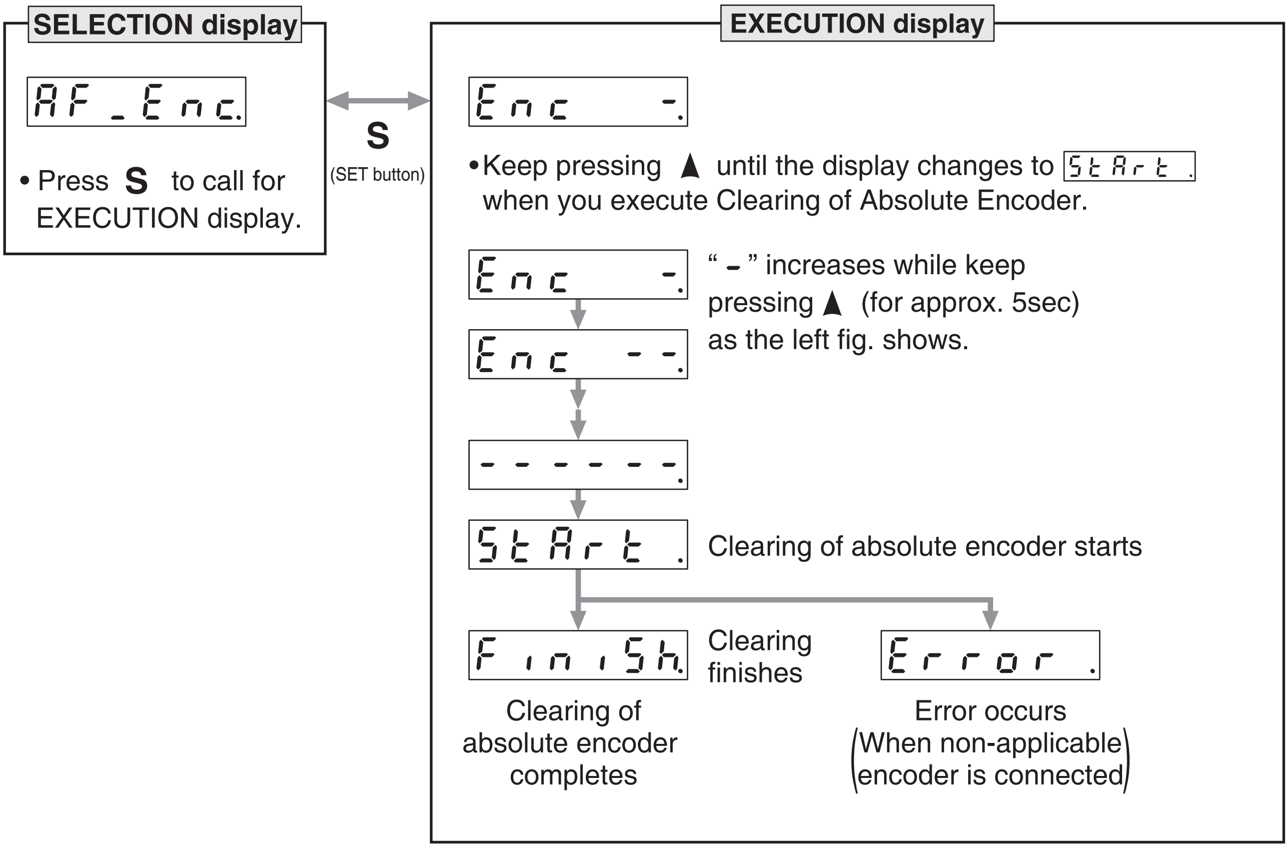
- Before starting the trial run, set the gain-related parameters to appropriate values to avoid problems such as oscillation. If the load is removed, be sure to set Pr0.04 "Inertia Ratio" to 0.
- During the trial run, use the velocity control mode. Various settings including parameters should assure safe and positive operation under appropriate velocity control.
- If SRV-ON becomes valid during trial run, the display changes to Error. which is normal run through external command.

Note

- After finished trial running, return to SELECTION display, referring to structure of each mode (P.2-76).

4) Clearing of Absolute Encoder

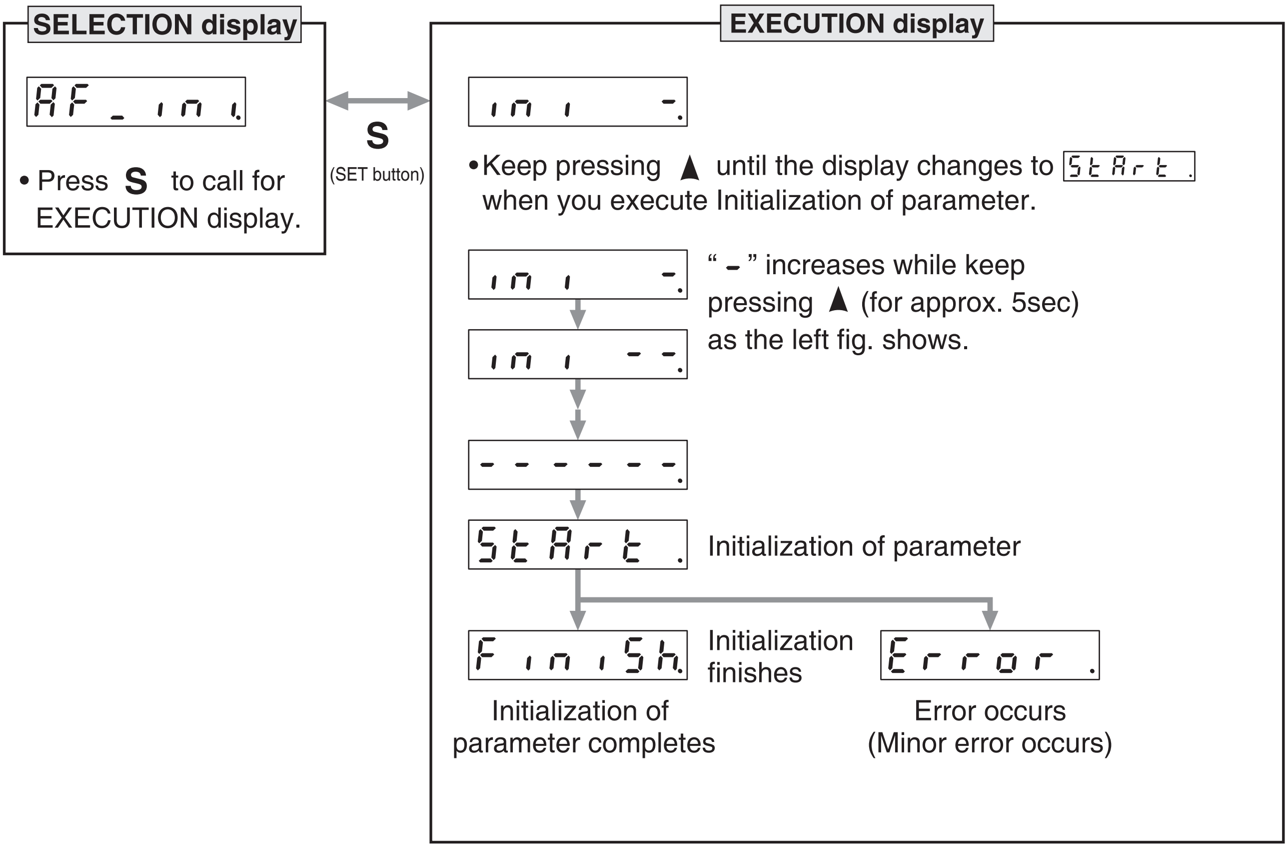
You can clear the multi-turn data of the absolute encoder.



Note • After clearing of absolute encoder finishes, return to SELECTION display, referring to structure of each mode (P.2-76).

(5) Initialization of parameter

Initialize the parameter.



Caution

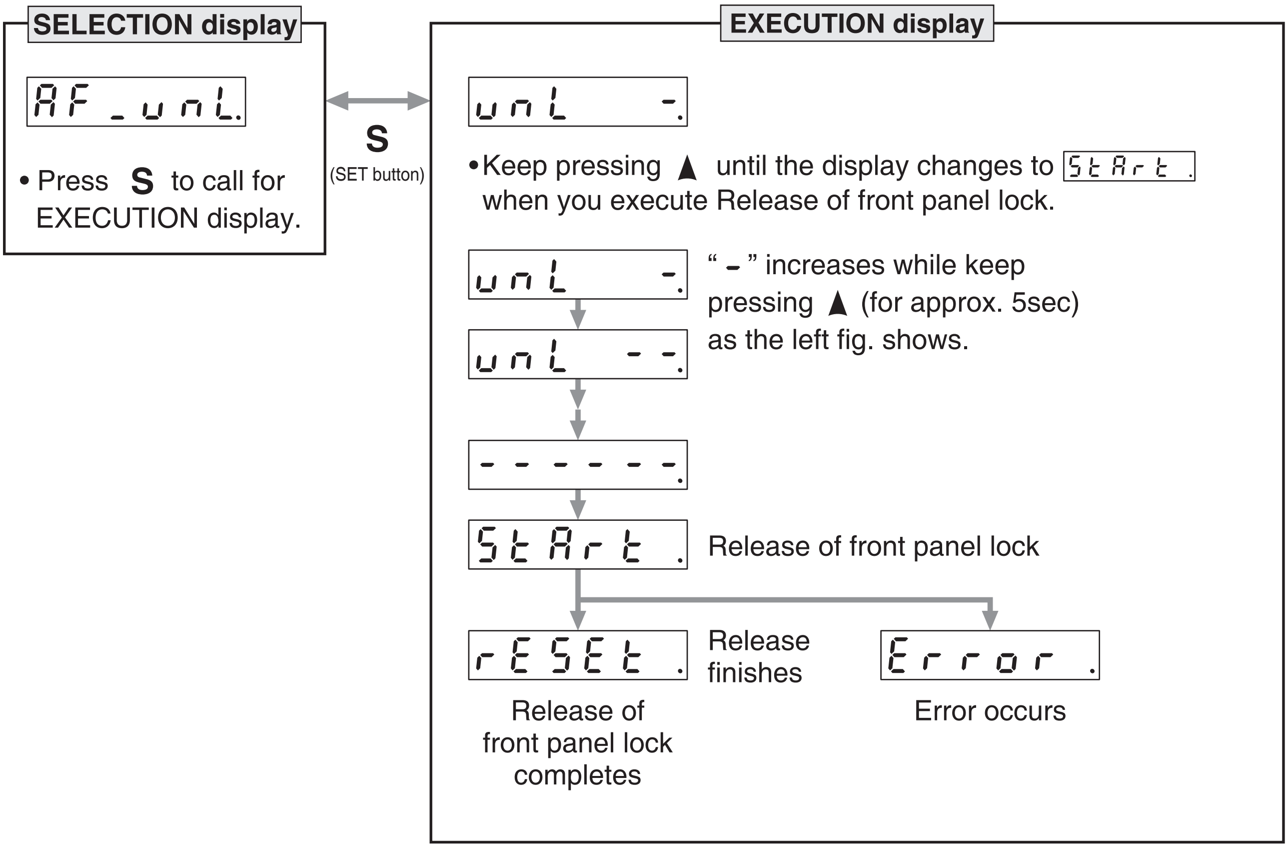
• Parameter cannot be initialized when one of the following error occurs: Err11.0 "Under voltage protection of control power supply", EEPROM related errors (Err36.0, Err36.1, Err36.2, Err37.0, Err37.1 and Err37.2) - initialization will result in "Error" display.

Note

• After initialization of parameter finishes, return to SELECTION display, referring to structure of each mode (P.2-76).

(6) Release of front panel lock

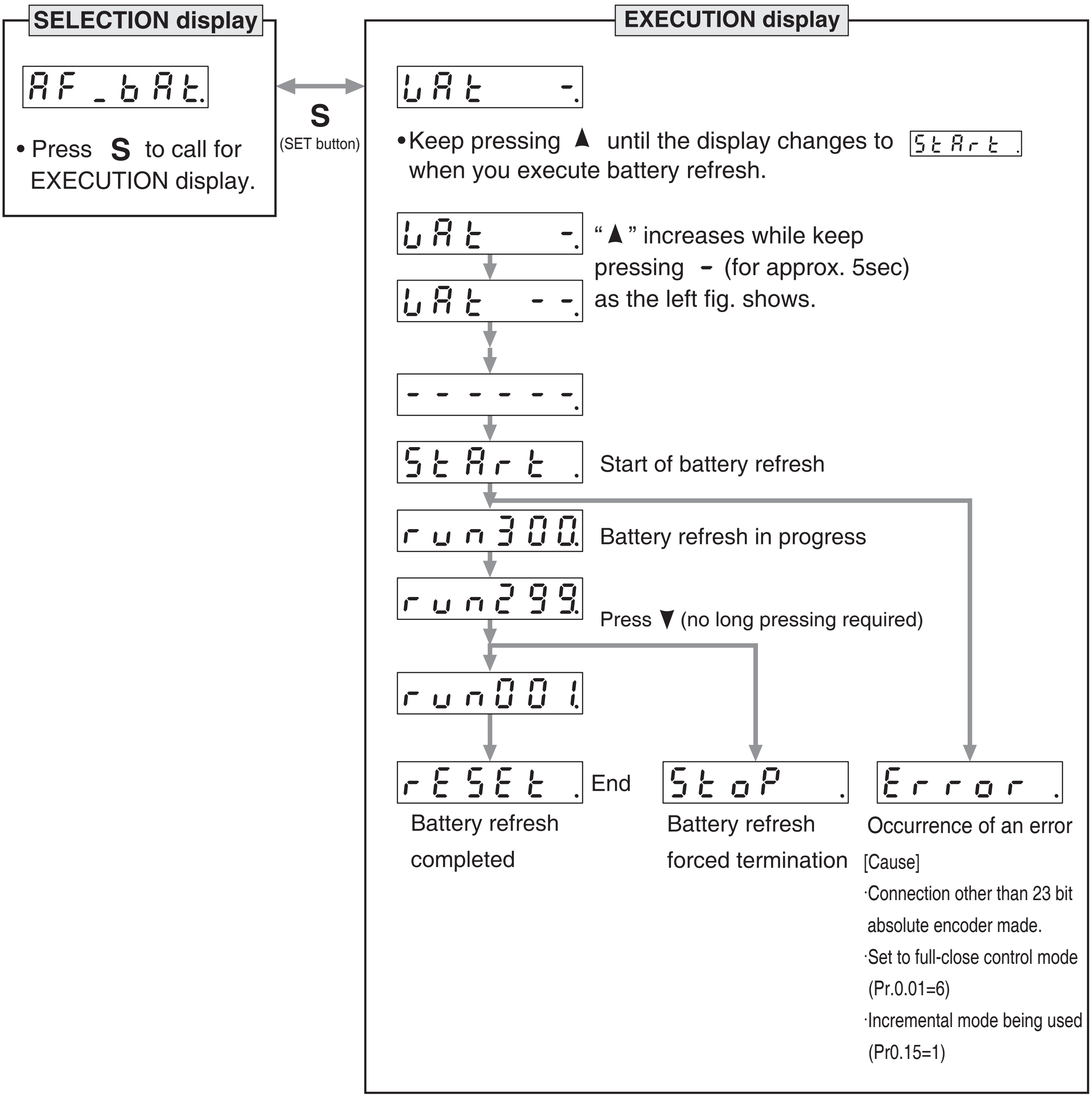
Release the front panel lock setting.



Note • After release of front panel lock finishes, return to SELECTION display, referring to structure of each mode (P.2-76).

(7) Battery refresh

Battery refresh action is conducted.



Note 1) When running Battely refresh, Battely alarm may occer in that case, please run the clear Battely alarm.

Note • After release of front panel lock finishes, return to SELECTION display, referring to structure of each mode (P.2-76).

3. Connection

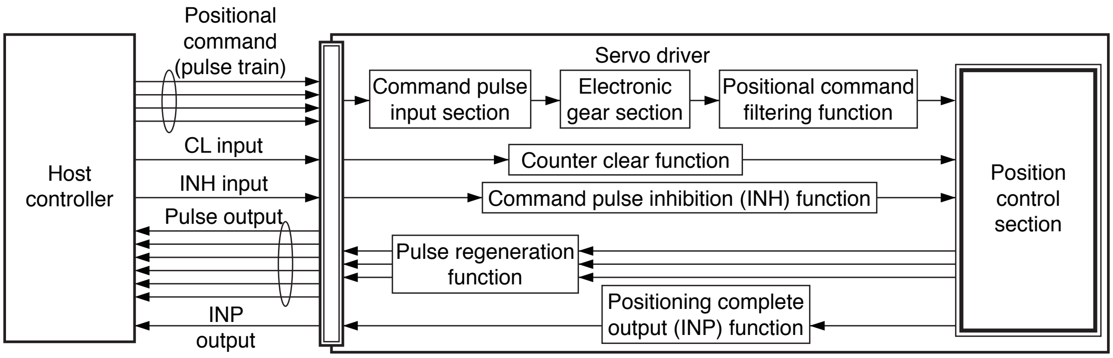
1. Outline of mode

Position Control Mode

SE	SG	SF
○	○	○

Outline

You can perform position control based on the positional command (pulse train) from the host controller.
This section describes the fundamental setup to be used for the position control.



Function

(1) Process of command pulse input

The positional commands of the following 3 types (pulse train) are available.

- 2-phase pulse
- Positive direction pulse/negative direction pulse
- Pulse train + sign

Set the pulse configuration and pulse counting method based on the specification and configuration of installation of the host controller.
The input terminals can accommodate the following 2 systems.

- Input 1 “PULSH1, PULSH2, SIGNH1, SIGNH2” line receiver input (8 Mpulse/s)
- Input 2 “PULS1, PULS2, SIGN1, SIGN2” photocoupler input (500 kpulse/s)

Caution For line driver output, “Input 2” can also be used without changing the allowable input frequency.

- **Relevant parameters**

Parameter No.	Title	Range	Function
Pr0.05	Selection of command pulse input	0 to 2	You can select either the photocoupler input or the exclusive input for line driver as the command pulse input. 0: Photocoupler input (PULS1, PULS2, SIGN1, SIGN2) 1: Exclusive input for line driver (PULSH1, PULSH2, SIGNH1, SIGNH2) 2: Photocoupler input (PULS1, PULS2, SIGN1, SIGN2) [250 kpulse/s or less]
Pr0.06	Command pulse rotational direction setup	0 to 1	Sets the counting direction when command pulse is input.
Pr0.07	Command pulse input mode setup	0 to 3	Sets the counting method when command pulse is input.

Note For details of these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

Related page

- P.3-14 and 15 “Control Block Diagram”
- P.3-21 “Wiring Diagram to the connector, X4”

(2) Electronic gear function

This function multiplies the input pulse command from the host controller by the predetermined dividing or multiplying factor and applies the result to the position control section as the positional command. By using this function, desired motor rotations or movement distance per unit input command pulse can be set; or the command pulse frequency can be increased if the desired motor speed cannot be obtained due to limited pulse output capacity of the host controller.

• Relevant parameters

Parameter No.	Title	Range	Function
Pr0.08	Command pulse counts per one motor revolution	0 to 8388608	Set the command pulses that causes single turn of the motor shaft.
Pr0.09	1st numerator of electronic gear	0 to 1073741824	Set the numerator of division/multiplication operation made according to the command pulse input.
Pr0.10	Denominator of electronic gear	1 to 1073741824	Set the Denominator of division/multiplication operation made according to the command pulse input.

Note For details of these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

(3) Positional command filtering function

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

• Relevant parameters

Parameter No.	Title	Range	Unit	Function
Pr2.22	Positional command smoothing filter	0 to 10000	0.1 ms	Set up the time constant of the 1st delay filter in response to the positional command.
Pr2.23	Positional command FIR filter	0 to 10000	0.1 ms	Set up the time constant of the 1st delay filter in response to the positional command.

Note For details of these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

(4) 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. When the output source is the encoder, Z-phase signal is output once per motor revolution; or if the feedback scale, the signal is output at absolute zero position. The output resolution, B-phase logic and output source (encoder or external scale) can be set with parameters.

• **Relevant parameters**

Parameter No.	Title	Range	Unit	Function
Pr0.11	Output pulse counts per one motor revolution	1 to 2097152	P/r	You can set up the output pulse counts per one motor revolution for each OA and OB with the Pr0.11 setup.
Pr0.12	Reversal of pulse output logic	0 to 3	—	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.
Pr5.03	Denominator of pulse output division	0 to 8388608	—	For application where the number of pulses per revolution is not an integer, this parameter can be set to a value other than 0, and the dividing ratio can be set by setting numerator of division to Pr0.11 and denominator of division to Pr5.03.
Pr5.33	Pulse regenerative output limit setup	0 to 1	—	Enable/disable detection of Err28.0 Pulse regenerative limit protection.
Pr6.20	Z-phase setup of external scale	0 to 400	μs	Set up the Z phase regenerative width of feedback scale in unit of time.
Pr6.21	Serial absolute external scale Z phase setup	0 to 268435456	pulse	Full-closed control using serial absolute feedback scale. When outputting pulses by using the feedback scale as the source of the output, set the Z phase output interval in units of A phase output pulses of the feedback scale (before multiplied by 4).
Pr6.22	A, B phase external scale pulse output method selection	0 to 1	—	Select the pulse regeneration method of A, B and Z parallel feedback scale.

Note For details of these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

(5) Deviation counter clear function

The deviation counter clear input (CL) clears the counts of positional deviation counter at the position control to 0.

• **Relevant parameters**

Parameter No.	Title	Range	Function
Pr5.17	Counter clear input mode	0 to 4	You can set up the clearing conditions of the counter clear input signal.

Note For details of these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

(6) Positioning complete output (INP) function

The completion of positioning can be verified by the positioning complete output (INP). When the absolute value of the positional deviation counter at the position control is equal to or below the positioning complete range by the parameter, the output is ON. Presence and absence of positional command can be specified as one of judgment conditions.

• Relevant parameters

Parameter No.	Title	Range	Unit	Function
Pr4.31	Positioning complete (In-position) range	0 to 2097152	Command unit	Set up the timing of positional deviation at which the positioning complete signal (INP1) is output.
Pr4.32	Positioning complete (In-position) output setup	0 to 10	—	Select the condition to output the positioning complete signal (INP1).
Pr4.33	INP hold time	0 to 30000	1 ms	Set up the hold time when Pr4.32 Positioning complete output setup = 3.
Pr4.42	2nd Positioning complete (In-position) range	0 to 2097152	Command unit	Set up the timing of positional deviation at which the positioning complete signal (INP2) is output.

Note

For details of these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

(7) Command pulse inhibition (INH) function

The command pulse input counting process can be forcibly terminated by using the command pulse inhibit input signal (INH). When INH input is ON, the servo driver ignores the command pulse, disabling pulse counting function. At then, A large number of pulses of the positional command filter function and the command frequency mulitiplication function is cleared.

The default setting of this inhibition function is disable. To use INH function, change the setting of Pr5.18 “Invalidation of command pulse prohibition input”.

• Relevant parameters

Parameter No.	Title	Range	Function
Pr5.18	Invalidation of command pulse inhibit input	0 to 1	Select command pulse inhibit input enable/disable.
Pr5.19	Command pulse inhibit input reading setup	0 to 5	Select command pulse inhibit input enable/disable signal reading period. When the status of several signals read during the predetermined reading period are same, update the signal status.

Note

For details of these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

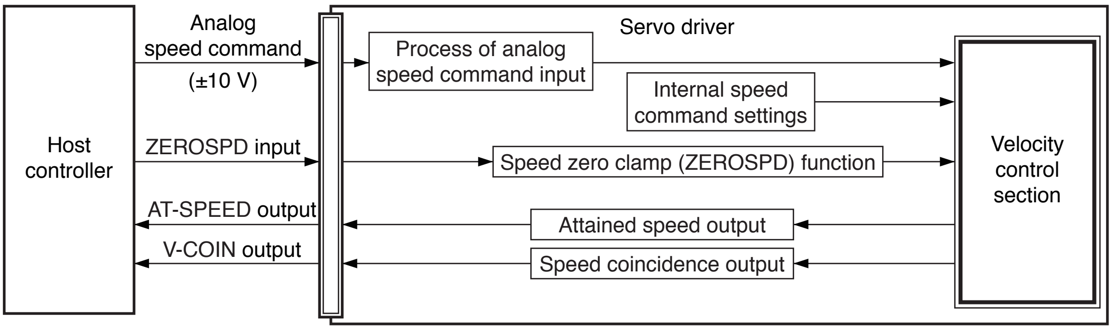
When INH input is ON, the deviation will be caused between the positional command administrated by controller and internal positional command from the fliter that receives the positional command from servo drivers, and orginal location before being input INH positional command will be lost. Therefore, it is supposed to reset the orignial location when it needs to restart return to origin action.

Velocity Control Mode

SE	SG	SF
○	○	○

Outline

You can control the speed according to the analog speed command from the host controller or the speed command set in the servo driver.



Note Only for standard type and communication type are not provided with analog input and V-COIN output.

Function

(1) Velocity control by analog speed command

The analog speed command input voltage is converted to equivalent digital speed command. You can set the filter to eliminate noise or adjust the offset.

• Relevant parameters

Parameter No.	Title	Range	Unit	Function
Pr3.00	Speed setup, Internal/ External switching	0 to 3	—	This driver is equipped with internal speed setup function so that you can control the speed with contact inputs only.
Pr3.01	Speed command rotational direction selection	0 to 1	—	Select the Positive/Negative direction specifying method.
Pr3.02	Input gain of speed command	10 to 2000	(r/min) /V	Based on the voltage applied to the analog speed command (SPR), set up the conversion gain to motor command speed.
Pr3.03	Reversal of speed command input	0 to 1	—	Specify the polarity of the voltage applied to the analog speed command (SPR).
Pr4.22	Analog input 1 (AI1) offset setup	–5578 to 5578	0.359 mV	Set up the offset correction value applied to the voltage fed to the analog input 1.
Pr4.23	Analog input 1 (AI1) filter	0 to 6400	0.01 ms	Set up the time constant of 1st delay filter that determines the lag time behind the voltage applied to the analog input 1.

Note For details of these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.
Only for standard type and communication type are not provided with analog input.

Related page
• P.3-14 “Control Block Diagram”
• P.3-21 “Wiring Diagram to the connector, X4”

(2) Velocity control by internal speed command

You can control the speed by using the internal speed command set to the parameter. By using the internal speed command selections 1, 2, 3 (INTSPD1, 2, 3), you can select best appropriate one among up to 8 internal speed command settings. Default setting uses the analog speed command. To use the internal speed command, select it through Pr3.00 “Internal/external speed setup”.

• Relevant parameters

Parameter No.	Title	Range	Unit	Function
Pr3.00	Speed setup, Internal/ External switching	0 to 3	—	This driver is equipped with internal speed setup function so that you can control the speed with contact inputs only.
Pr3.01	Speed command rotational direction selection	0 to 1	—	Select the Positive/Negative direction specifying method.
Pr3.04	1st speed of speed setup	−20000 to 20000	r/min	Set up internal command speeds, 1st to 1st.
Pr3.05	2nd speed of speed setup			Set up internal command speeds, 1st to 2nd.
Pr3.06	3rd speed of speed setup			Set up internal command speeds, 1st to 3rd.
Pr3.07	4th speed of speed setup			Set up internal command speeds, 1st to 4th.
Pr3.08	5th speed of speed setup			Set up internal command speeds, 1st to 5th.
Pr3.09	6th speed of speed setup			Set up internal command speeds, 1st to 6th.
Pr3.10	7th speed of speed setup			Set up internal command speeds, 1st to 7th.
Pr3.11	8th speed of speed setup			Set up internal command speeds, 1st to 8th.

Note For details of these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

(3) Speed zero clamp (ZEROSPD) function

You can forcibly set the speed command to 0 by using the speed zero clamp input.

• Relevant parameters

Parameter No.	Title	Range	Unit	Function
Pr3.15	Speed zero-clamp function selection	0 to 3	—	You can set up the function of the speed zero clamp input.
Pr3.16	Speed zero clamp level	10 to 20000	r/min	Select the timing at which the position control is activated as the Pr3.15 Speed zero-clamp function selection is set to 2.

Note For details of these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

(4) Attained speed output (AT-SPEED)

The signal AT-SPEED is output as the motor reaches the speed set to Pr4.36 “Attained speed”.

• Relevant parameters

Parameter No.	Title	Range	Unit	Function
Pr4.36	At-speed (Speed arrival)	10 to 20000	r/min	Set the detection timing of the speed arrival output (AT-SPEED).

Note For details of these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

(5) Speed coincidence output (V-COIN)

This signal is output when the motor speed is equal to the speed specified by the speed command. The motor speed is judged to be coincident with the specified speed when the difference from the speed command before/after acceleration/deceleration is within the range specified by Pr4.35 “Speed coincident range” .

• Relevant parameters

Parameter 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 these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

(6) Speed command acceleration/deceleration setting function

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

Using this function, you can use the soft start when inputting stepwise speed command or when using internal speed setup. You can also use S shaped acceleration/deceleration function to minimize shock due to change in speed.

• 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 speed command input.
Pr3.13	Deceleration time setup	0 to 10000	ms/ (1000 r/min)	Set up deceleration processing time in response to the speed command input.
Pr3.14	Sigmoid acceleration/ deceleration time setup	0 to 1000	ms	Set S-curve time for acceleration/ deceleration process when the speed 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 these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

1. Outline of mode

Torque Control Mode

SE	SG	SF
		○

Outline

The torque control is performed according to the torque command specified in the form of analog voltage. For controlling the torque, the speed limit input is required in addition to the torque command to maintain the motor speed within the speed limit.

With the A5 series, 3 torque control modes are available, each requires different torque command and speed limit as shown in the table below.

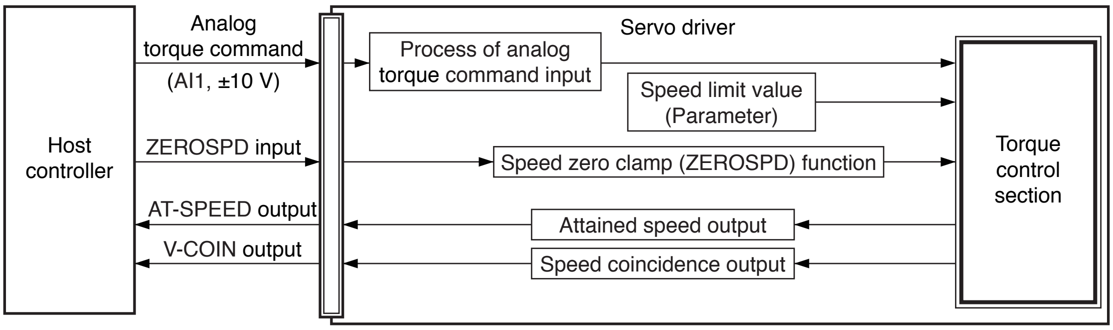
• Pr3.17 (Selection of torque command)

Setup value		Torque command input	Velocity limit input
0	Selection of torque command 1	Analog input 1 *1 (AI1, 16-bit resolution)	Parameter value (Pr3.21)
1	Selection of torque command 2	Analog input 2 (AI2, 12-bit resolution)	Analog input 1 (AI1, 16-bit resolution)
2	Selection of torque command 3	Analog input 1 *1 (AI1, 16-bit resolution)	Parameter value (Pr3.21, Pr3.22)

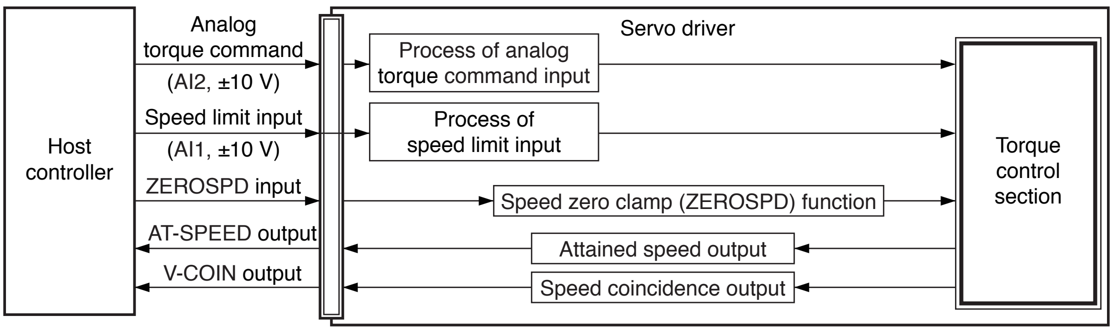
*1 For Pr0.01 Control mode setup = 5 (velocity/torque control), the torque command input is the analog input 2 (AI2, 12-bit resolution).

Note For details of these parameters, refer to P.4-35 “Details of parameter”.

<Selection of torque command 1, 3>



<Selection of torque command2>



Note Only for standard type and communication type are not provided with analog input and V-COIN output.

Related page • P.3-18 “Control Block Diagram” • P.3-22 “Wiring Diagram to the connector, X4”

Function

(1) Process of analog torque command input

This process converts the analog torque command input (voltage) to the equivalent digital torque command having the same effect. You can set the filter or adjust the offset to eliminate noise.

• Relevant parameters <Selection of torque command 1, 3>

Parameter No.	Title	Range	Unit	Function
Pr3.18	Torque command direction selection	0 to 1	—	Select the direction positive/negative direction of torque command.
Pr3.19	Input gain of torque command	10 to 100	0.1 V /100 %	Based on the voltage (V) applied to the analog torque command (TRQ R), set up the conversion gain to torque command (%).
Pr3.20	Input reversal of torque command	0 to 1	—	Set up the polarity of the voltage applied to the analog torque command (TRQR).
Pr4.22	Analog input 1 (AI1) offset setup	–5578 to 5578	0.359 mV	Set up the offset correction value applied to the voltage fed to the analog input 1.
Pr4.23	Analog input 1 (AI1) filter	0 to 6400	0.01 ms	Set up the time constant of 1st delay filter that determines the lag time behind the voltage applied to the analog input 1.

• Relevant parameters <Selection of torque command 2>

Parameter No.	Title	Range	Unit	Function
Pr3.18	Torque command direction selection	0 to 1	—	Select the direction positive/negative direction of torque command.
Pr3.19	Input gain of torque command	10 to 100	0.1 V /100 %	Based on the voltage (V) applied to the analog torque command (TRQ R), set up the conversion gain to torque command (%).
Pr3.20	Input reversal of torque command	0 to 1	—	Set up the polarity of the voltage applied to the analog torque command (TRQR).
Pr4.25	Analog input 2 (AI2) offset setup	–342 to 342	5.86 mV	Set up the offset correction value applied to the voltage fed to the analog input 2.
Pr4.26	Analog input 2 (AI2) filter	0 to 6400	0.01 ms	Set up the time constant of 1st delay filter that determines the lag time behind the voltage applied to the analog input 2.

Note

For details of these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

(2) Speed limit function

The speed limit is one of 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.

Due to gravity and other external disturbances, the torque command from the controller output makes the motor reverse direction action, the speed limit is not valid. This action becomes the problem, want to stop the motor, speed need to be set to Pr5.13 (Over-speed level setting) or Pr6.15 (Over-speed level setting) by Err26.0 (Overspeed protection) or Err26.1 (second overspeed protection) will stop the motor.

• Relevant parameters <Selection of torque command 1, 3>

Parameter No.	Title	Range	Unit	Function
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	
Pr3.15	Speed zero-clamp function selection	0 to 3	—	You can set up the function of the speed zero clamp input.

• Relevant parameters <Selection of torque command 2>

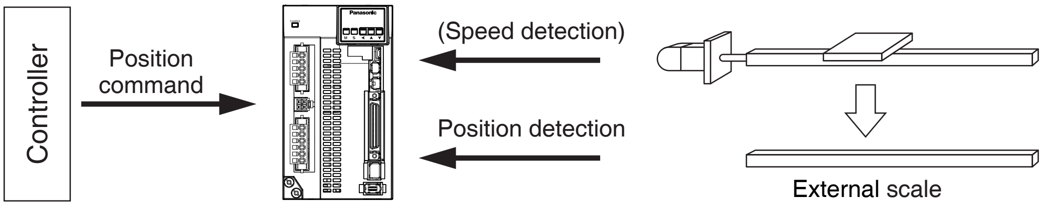
Parameter No.	Title	Range	Unit	Function
Pr3.02	Input gain of speed command	10 to 2000	(r/min) /V	Based on the voltage applied to the analog speed command (SPR), set up the conversion gain to motor command speed.
Pr4.22	Analog input 1 (AI1) offset setup	–5578 to 5578	0.359 mV	Set up the offset correction value applied to the voltage fed to the analog input 1.
Pr4.23	Analog input 1 (AI1) filter	0 to 6400	0.01 ms	Set up the time constant of 1st delay filter that determines the lag time behind the voltage applied to the analog input 1.
Pr3.15	Speed zero-clamp function selection	0 to 3	—	You can set up the function of the speed zero clamp input.

Note

For details of these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

Outline

In this full-closed control, you can make a position control by using a external scale mounted externally which detects the position directly and feeds it back. With this control, you can control without being affected by the positional variation due to the ball screw error or temperature and you can expect to achieve a very high precision positioning in sub-micron order.



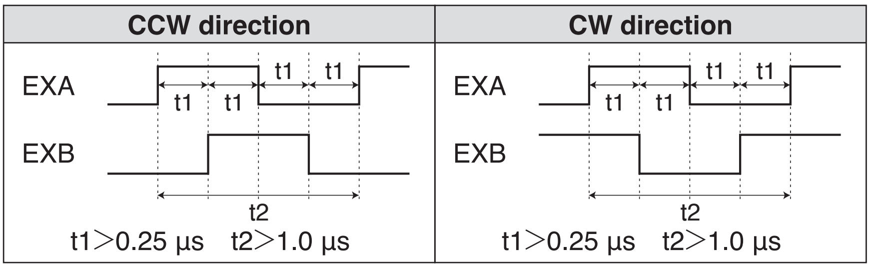
We recommend the external scale division ratio of $\frac{1}{40} \leq$ External scale division ratio $\leq$ 1280

Cautions on Full-Closed Control

(1) Enter the command pulses making the external scale as a reference.
If the command pulses do not match to the external scale pulses, use the command division/multiplication function (Pr0.09 to Pr0.10) and setup so that the command pulses after division/multiplication is based on the external scale reference.

(2) The A5 series supports the external scale of A- and B-phase output type and serial communication type. Initialize the parameters according to the following procedures and write to EEPROM and turn on power.

(3) When using a scale of A- and B-phase output type, correctly connect it so that the rotating direction of the motor (CW/CCW) and A-phase and B-phase of the external scale have the following relationship.



※ 4 Mpulse/s is to comply with the time limit of input frequency. When using the A/B phase external scale which output is more than 4 Mpulse/s, please contact our company.

<How to make an initial setup of parameters related to external scale >

1) Turn on the power after checking the wiring.
2) Check the values (initial) feedback pulse sum and external scale feedback pulse sum with the front panel.
3) Move the work and check the travel from the initial values of the above 2).
4) If the travel of the feedback pulse sum and the external scale feedback pulse sum are reversed in positive and negative, set up the reversal of external scale direction (Pr3.26) to 1.
5) Set up the external scale division ratio Pr3.24/Pr3.25 based on the design values.

$$\text{External scale division ratio} = \frac{\text{Encoder resolution per motor revolution [pulse]}}{\text{External scale's resolution per motor revolution [pulse]}} = \frac{\text{Pr3.24}}{\text{Pr3.25}}$$

If a wrong scale is applied, difference between the position calculated by using encoder feedback pulses and the position calculated by using external scale pulses as moving distance increases: larger difference will cause excessive deviation error protect.

Related page
• P.3-19 “Control Block Diagram” • P.3-22 “Wiring Diagram to the connector, X4”
• P.3-35 “Inputs and outputs on connector X4” • P.4-6 to P.4-85 “Details of parameter”

6) Set up appropriate value of hybrid deviation excess (Pr3.28) in command unit, in order to avoid the damage to the machine.
   * A6-series driver calculates the difference between the encoder position and the external scale position as hybrid deviation, and is used to prevent the machine runaway or damage in case of the external scale breakdown or when the motor and the load is disconnected.
     If the hybrid deviation excess range is too wide, detection of the breakdown or the disconnection will be delayed and error detection effect will be lost. If this is too narrow, it may detect the normal distortion between the motor and the machine under normal operation as an error.
   * When the external scale division ration is not correct, hybrid deviation excess error (Err25.0) may occur especially when the work travels long distance, even though the external scale and the motor position matches.
     In this case, widen the hybrid deviation excess range by matching the external scale division ratio to the closest value.

Function

(1) Selection of external scale type

Select the type of external scale to be used.

• Relevant parameters

Parameter No.	Title	Range	Function
Pr3.23	External scale selection	0 to 6	Select the type of external scale.
Pr3.26	Reversal of direction of external scale	0 to 3	Reverse the direction of external scale, feedback counter.

Note For details of these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

(2) Setup of external scale division ratio

Set up the division ratio of encoder resolution and external scale resolution.

• Relevant parameters

Parameter No.	Title	Range	Function
Pr3.24	Numerator of external scale division	0 to 2^{23}	Set up the numerator of the external scale dividing setup.
Pr3.25	Denominator of external scale division	1 to 2^{23}	Set up the Denominator of the external scale dividing setup.

Note For details of these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

(3) Setup of hybrid excessive deviation

This function detects the positional difference between the motor (encoder) and load (external scale) and enables the hybrid excessive deviation protection if the difference exceeds Pr3.28 “Hybrid excessive deviation setup”.
Hybrid excessive deviation is mainly caused by feedback scale error, wrong connection and loose connection between the motor and load.

• Relevant parameters

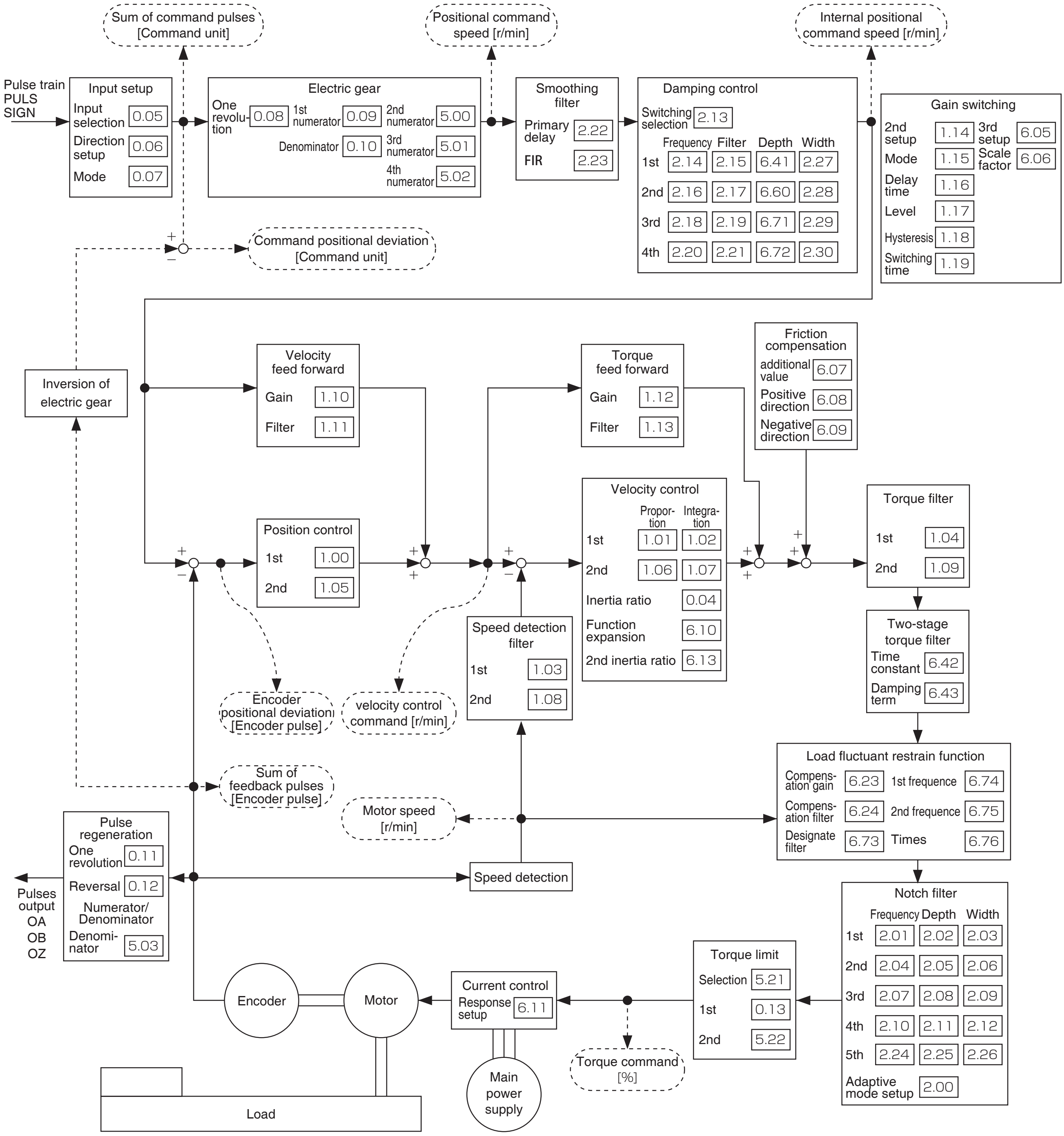
Parameter No.	Title	Range	Function
Pr3.28	Hybrid deviation excess setup	1 to 2^{27}	You can setup the permissible gap (hybrid deviation) between the present motor position and the present external scale position.
Pr3.29	Hybrid deviation clear setup	0 to 100	As the motor turns the number of revolutions set by this parameter, the hybrid deviation is cleared to 0.

Note For details of these parameters, refer to P.4-6 to P.4-85 “Details of parameter”.

2. Control Block Diagram

Position Control Mode (Two-degree-of-freedom control noneffective)

SE	SG	SF
○	○	○

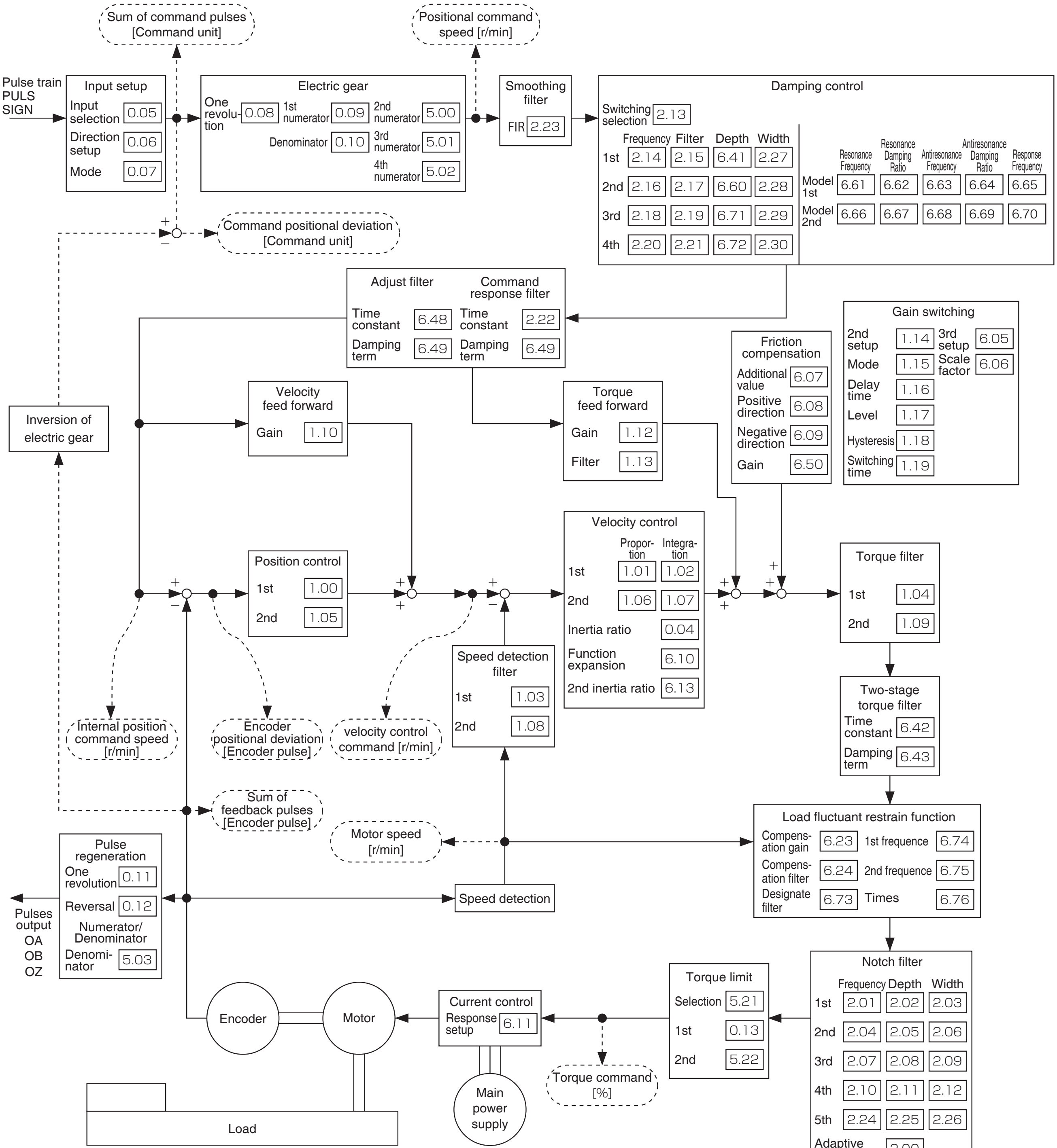


Related page
• P.3-21 “Wiring example of position control mode”
• P.3-23 “Connecting example to host controller”
• P.3-33 “Inputs and outputs on connector X4” • P.4-2 “List of Parameters”

2. Control Block Diagram

Position Control Mode (Two-degree-of-freedom control effective)

SE	SG	SF
○	○	○

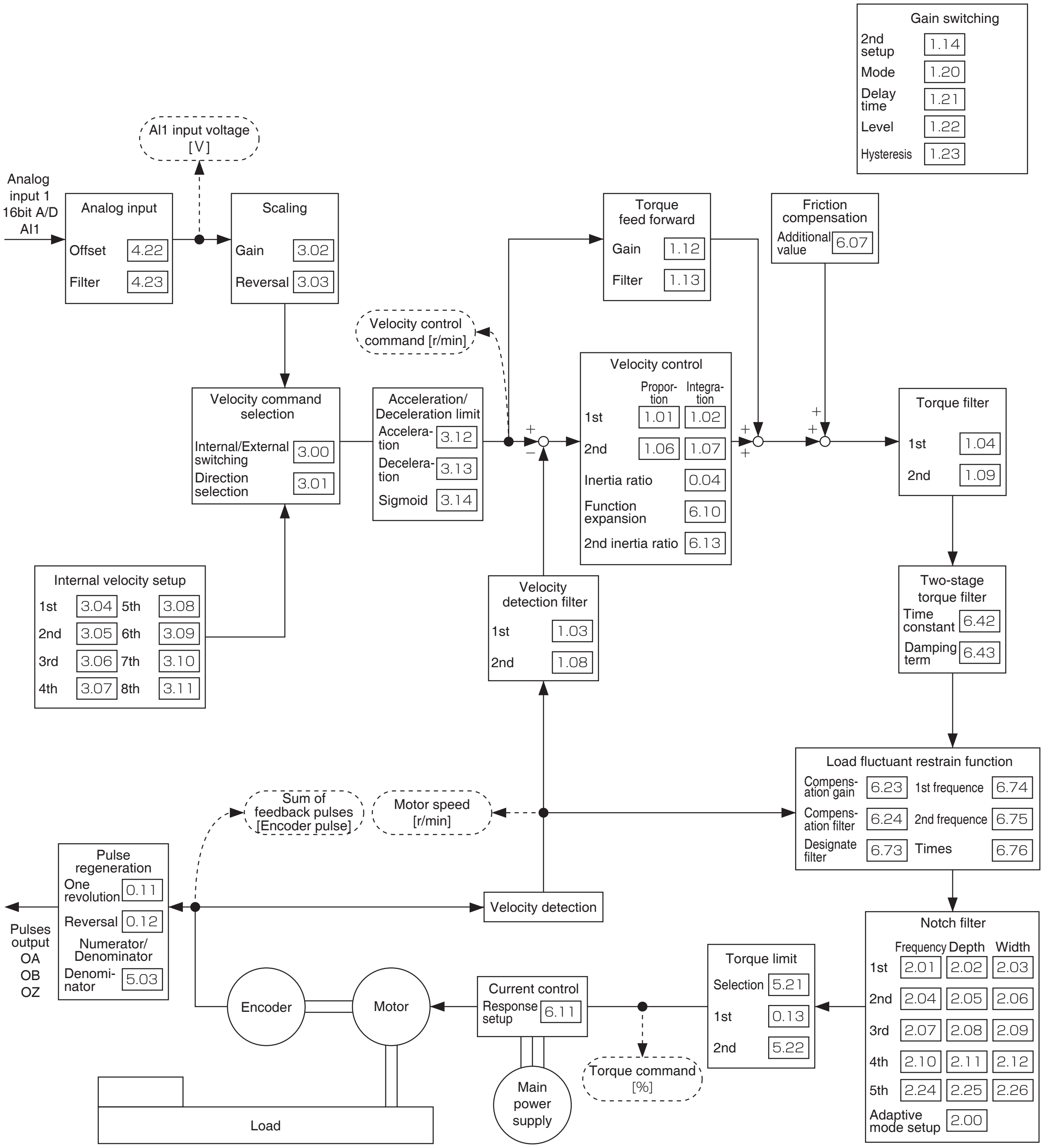


Related page
• P.3-21 “Wiring example of position control mode”
• P.3-23 “Connecting example to host controller”
• P.3-33 “Inputs and outputs on connector X4” • P.4-2 “List of Parameters”

2. Control Block Diagram

Velocity Control Mode (2DOF control noneffective)

Internal speed command	SE	SG	SF	Analog input	SE	SG	SF
	○	○	○				○

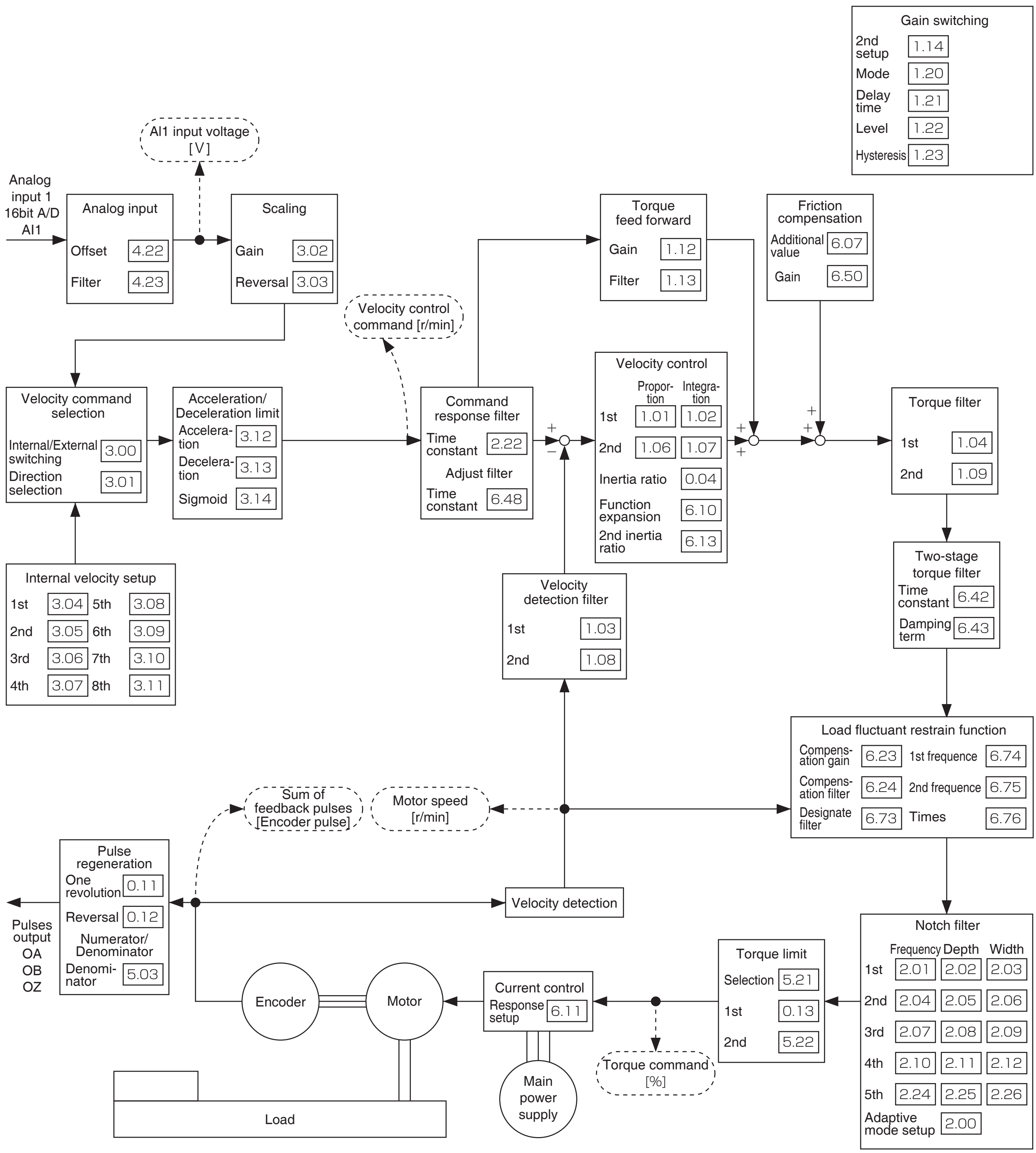


Related page
• P.3-21 “Wiring example of velocity control mode”
• P.3-23 “Connecting example to host controller”
• P.3-33 “Inputs and outputs on connector X4” • P.4-2 “List of Parameters”

2. Control Block Diagram

Velocity Control Mode (2DOF control effective)

	SE	SG	SF
Internal speed command	○	○	○
Analog input			○



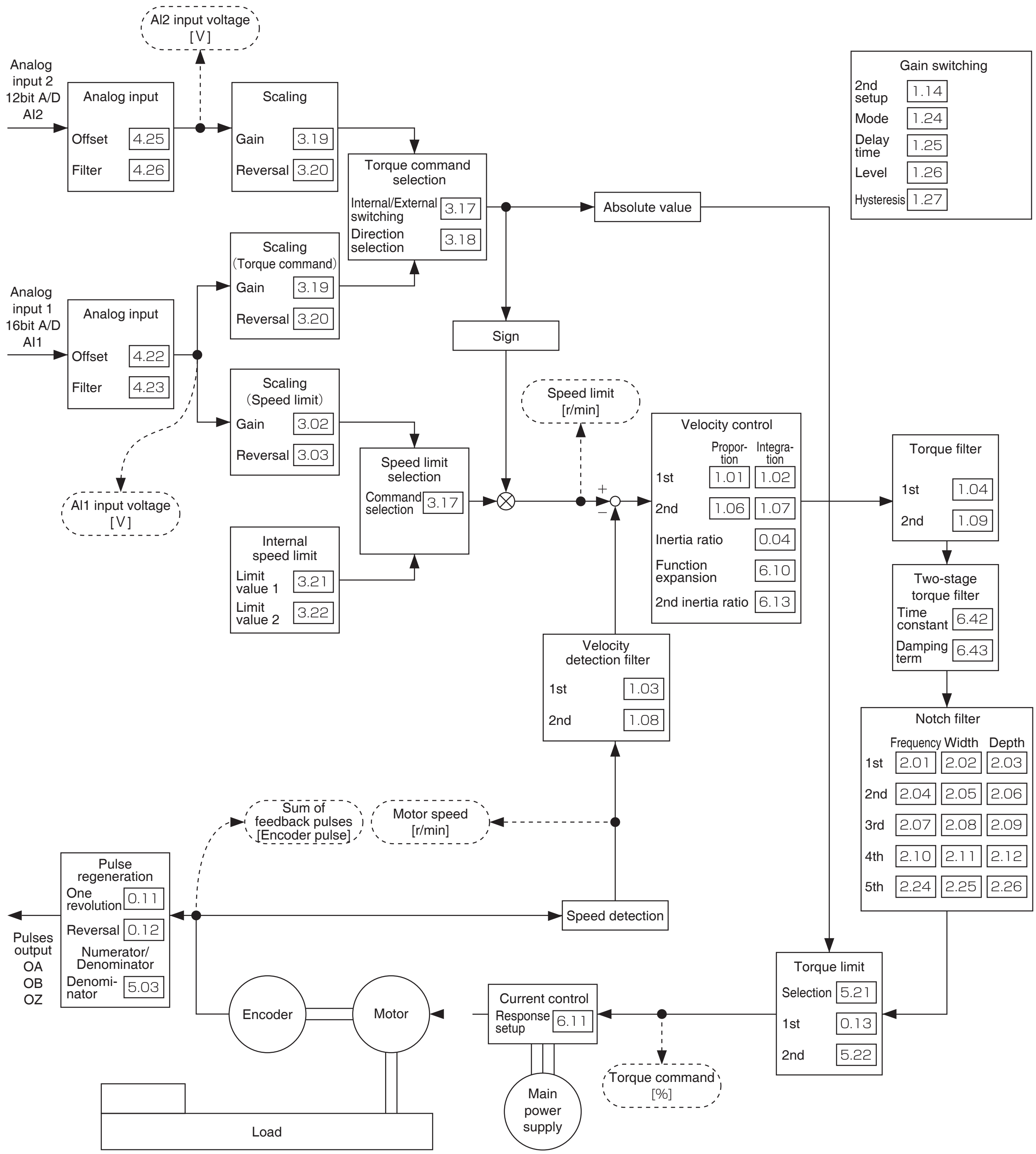
Related page

• P.3-21 “Wiring example of velocity control mode”
• P.3-23 “Connecting example to host controller”
• P.3-33 “Inputs and outputs on connector X4” • P.4-2 “List of Parameters”

2. Control Block Diagram

Torque Control Mode

SE	SG	SF
		○

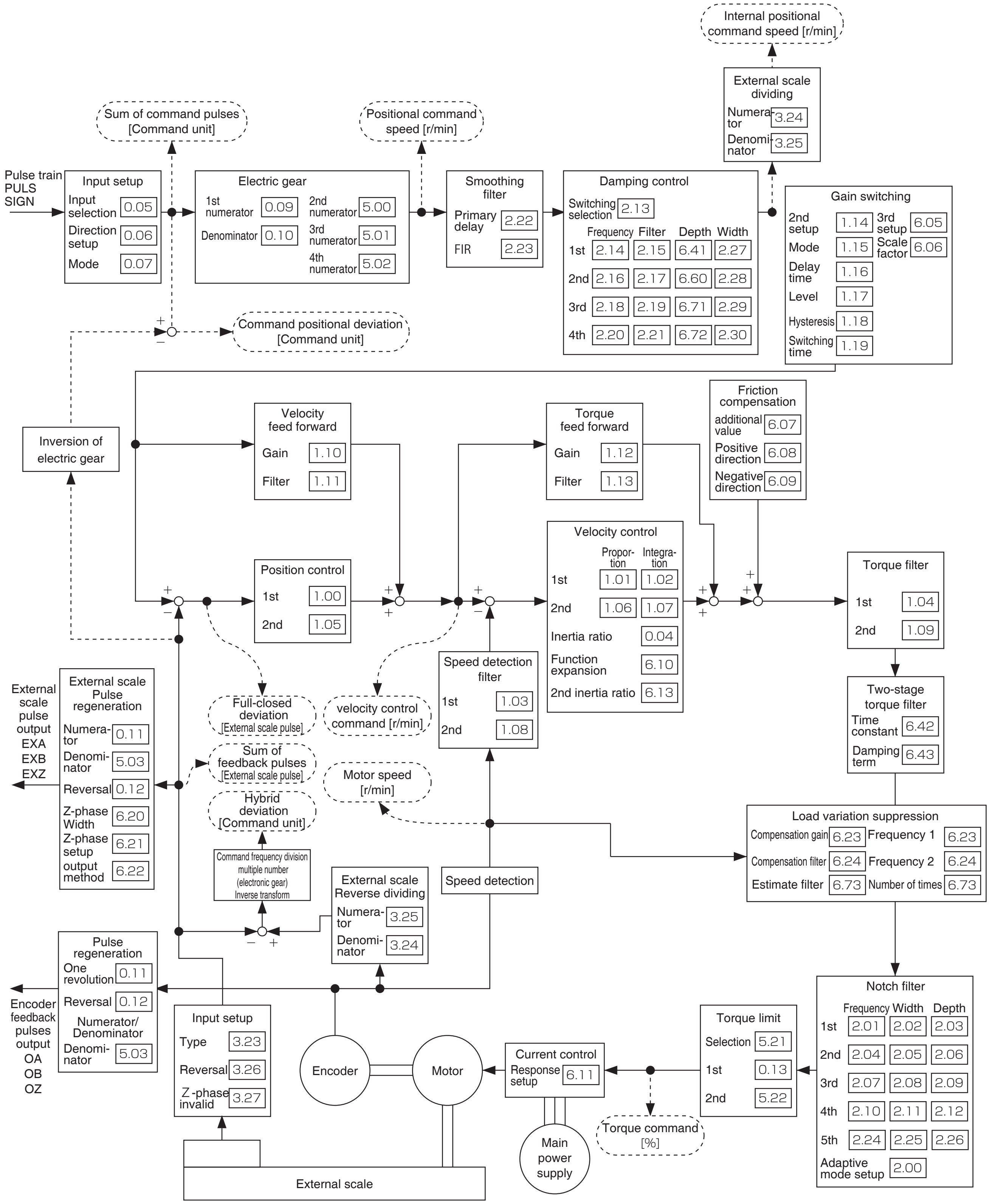


Related page
• P.3-22 "Wiring example of torque control mode"
• P.3-23 "Connecting example to host controller"
• P.3-33 "Inputs and outputs on connector X4" • P.4-2 "List of Parameters"

2. Control Block Diagram

Full-closed Control Mode (Two-degree-of-freedom control noneffective)

SE	SG	SF
		○

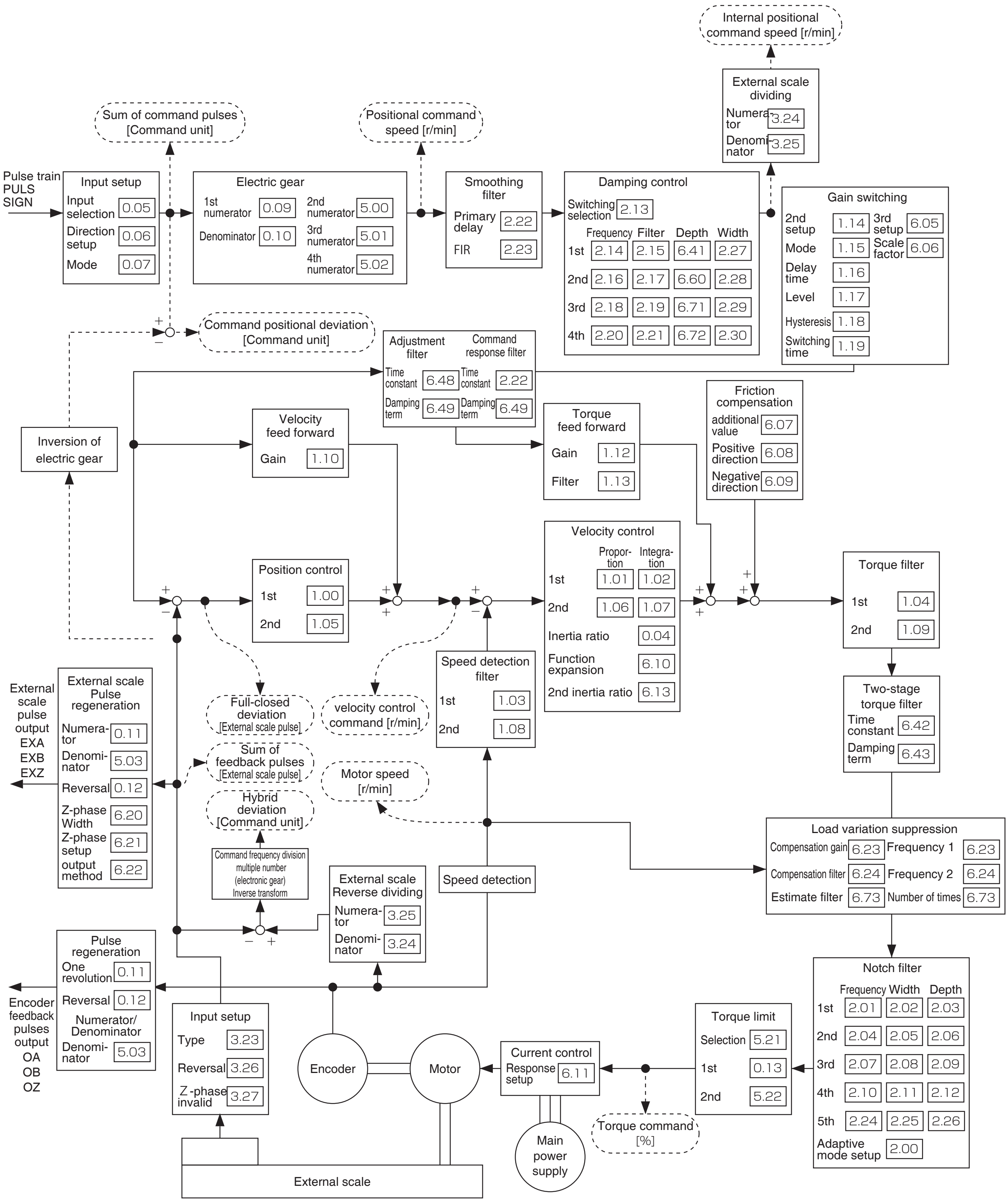


Related page
• P.3-22 “Wiring example of full-closed control mode”
• P.3-23 “Connecting example to host controller”
• P.3-33 “Inputs and outputs on connector X4” • P.4-2 “List of Parameters”

2. Control Block Diagram

Full-closed Control Mode (Two-degree-of-freedom control effective)

SE	SG	SF
		○



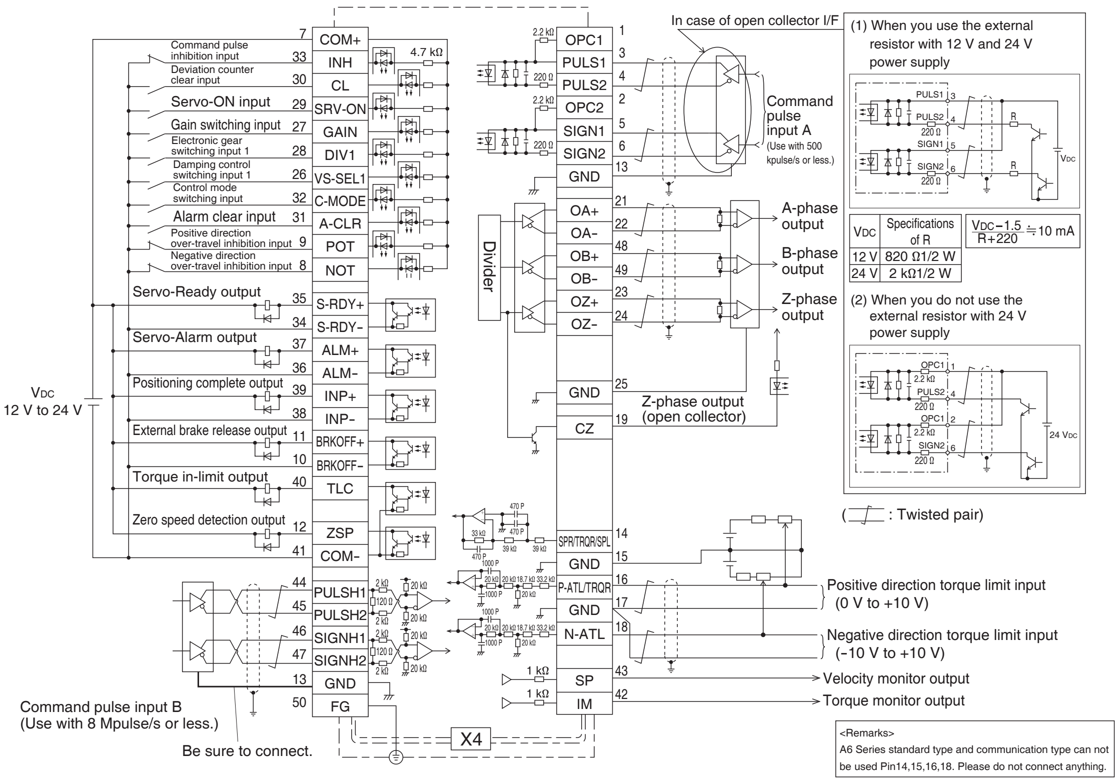
Related page
• P.3-22 "Wiring example of full-closed control mode"
• P.3-23 "Connecting example to host controller"
• P.3-33 "Inputs and outputs on connector X4" • P.4-2 "List of Parameters"

3. Wiring Diagram to the connector, X4

Example of control mode specific wiring

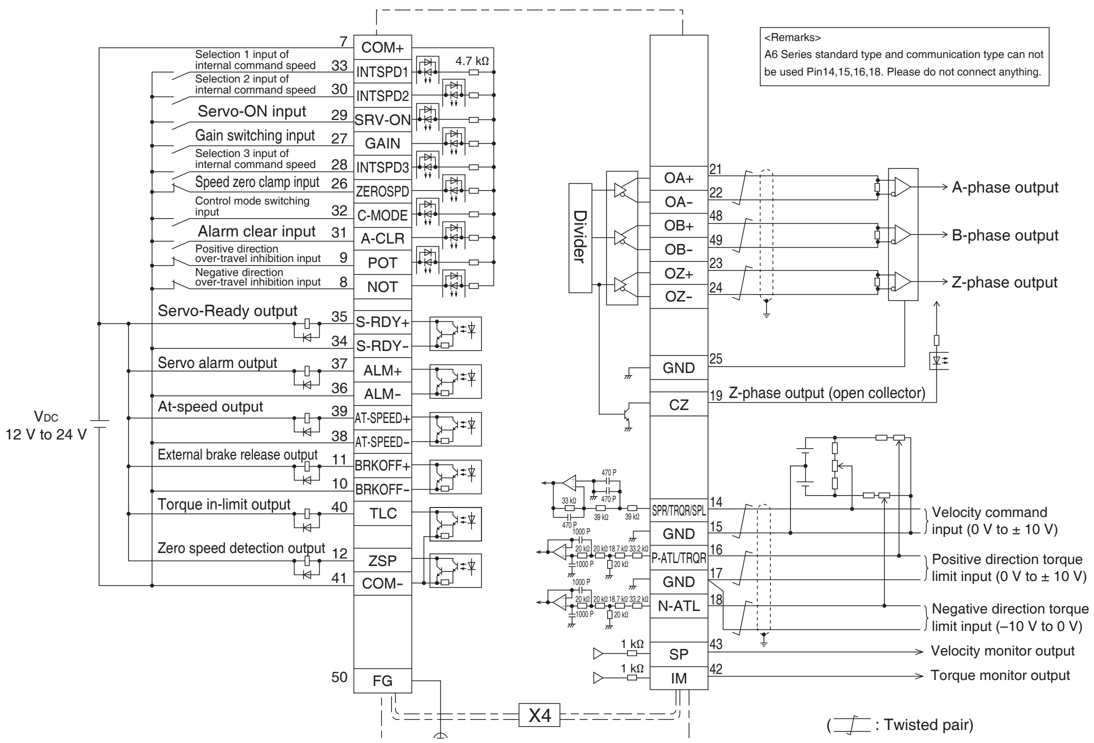
Wiring Example of Position Control Mode

SE	SG	SF
○	○	○



Wiring Example of Velocity Control Mode

SE	SG	SF
○	○	○



Note

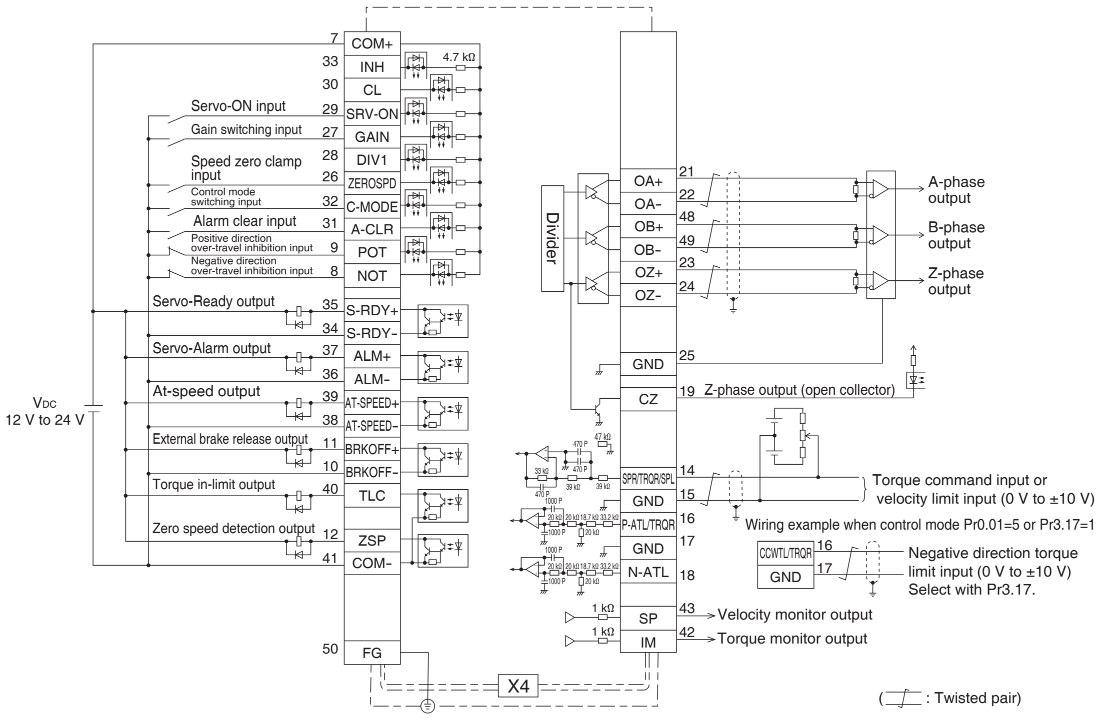
- The functions of the following pin can be changed using parameters. (Refer to P.4-38)
  Input(Position): 8, 9, 26, 27, 28, 29, 31, 32 Output: 10-11, 12, 34-35, 36-37, 38-39, 40
  Input(Velocity): 8, 9, 26, 27, 28, 29, 30, 31, 32, 33 Output: 10-11, 12, 34-35, 36-37, 38-39, 40
  * Pins in the figure above represent default parameter values.

Caution

- With the standard type and communication type do not connect analog input on pins 14, 16 and 18 to SG of pin 15.

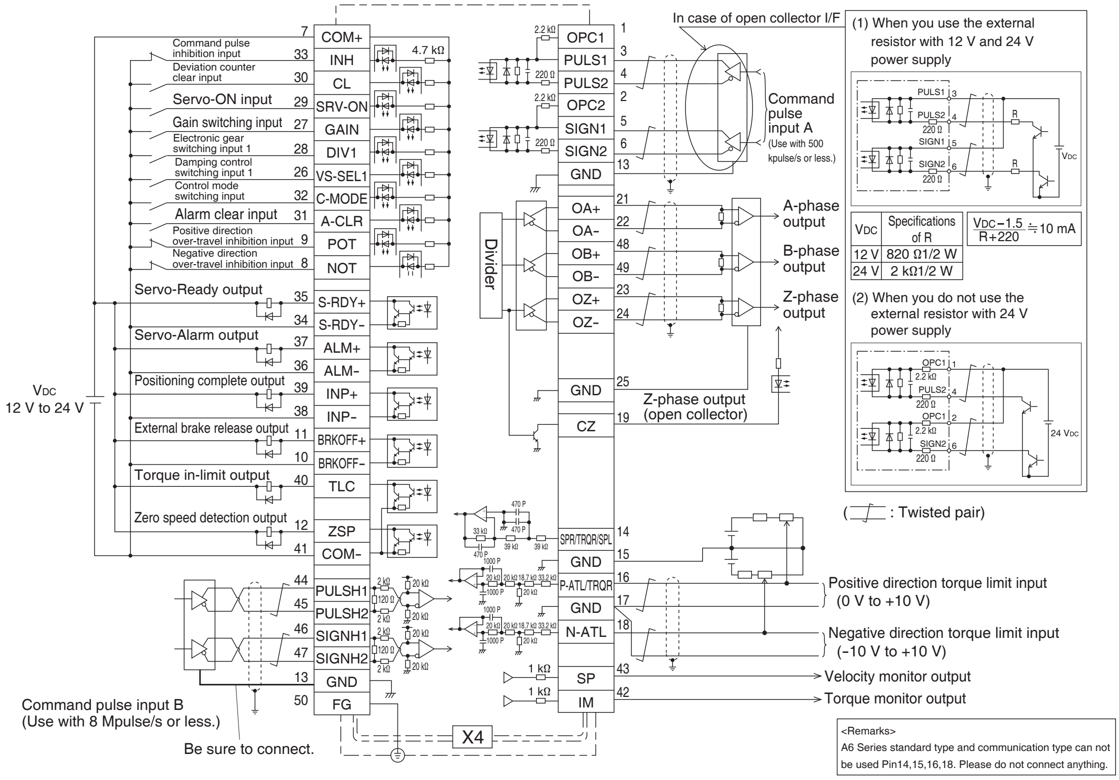
Wiring Example of Torque Control Mode

SE	SG	SF
		○



Wiring Example of Full-closed Control Mode

SE	SG	SF
		○



VDC	Specifications of R
12 V	820 Ω1/2 W
24 V	2 kΩ1/2 W

$\frac{V_{DC}-1.5}{R+220} \doteqdot 10\ mA$

Note

- The functions of the following pin can be changed using parameters. (Refer to P.4-38)
  Input(Torque): 8, 9, 26, 27, 28, 29, 30, 31, 32, 33　Output: 10-11, 12, 34-35, 36-37, 38-39, 40
  Input(Full-closed): 8, 9, 26, 27, 28, 29, 31, 32　Output: 10-11, 12, 34-35, 36-37, 38-39, 40
  * Pins in the figure above represent default parameter values.

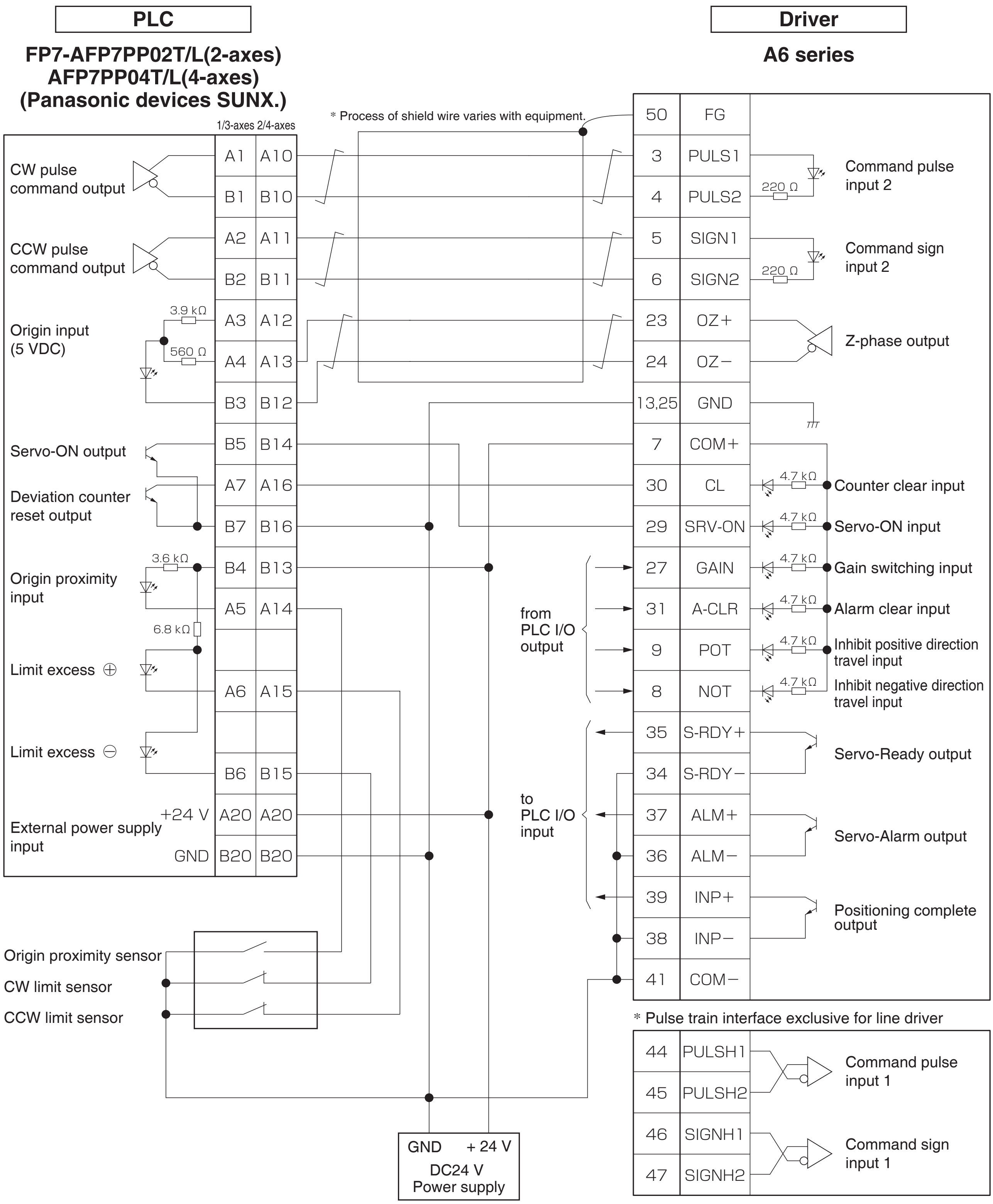
Caution

- With the standard type and communication type do not connect analog input on pins 14, 16 and 18 to SG of pin 15.

3. Wiring Diagram to the connector, X4

Connecting Example to Host Controller

Connection between MINAS A6 and FP7-AFP7PP02T/L(2-axes) AFP7PP04T/L(4-axes) Panasonic devices SUNX.



* When connecting, please make sure to use twisted-pair cable.
* The internal circuit of the host controller may be changed. About the latest information please confirm to host controller maker.

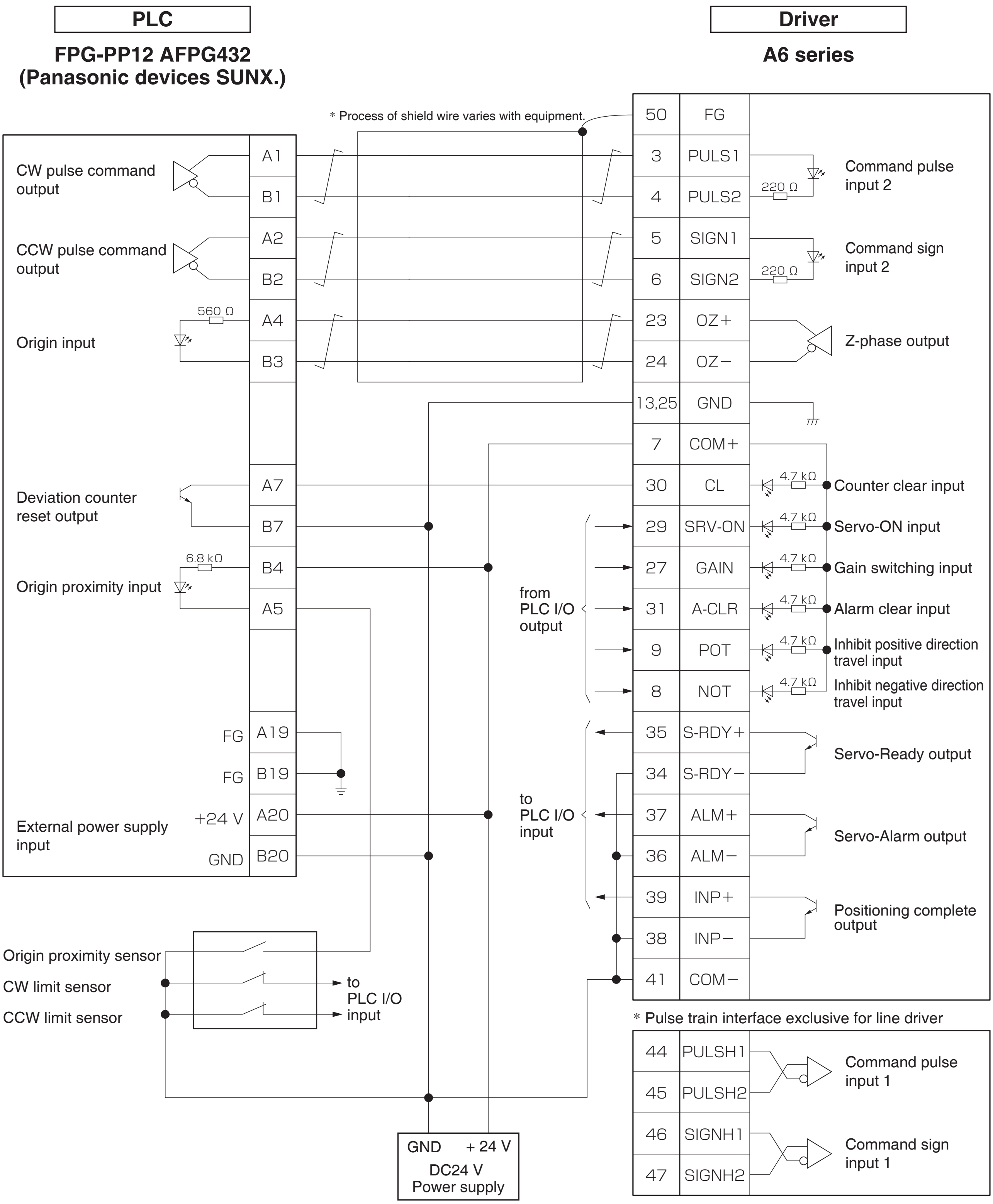
Pulse train interface exclusive for line driver.
Use this interface when you use pulse command frequency between 500 kpulse/s and 8 Mpulse/s

Note ⌿ represents twisted pair wire.

Related page

• P.3-33 “Inputs and outputs on connector X4”

Connection between MINAS A6 and FPG-PP12 AFPG432 Panasonic devices SUNX.



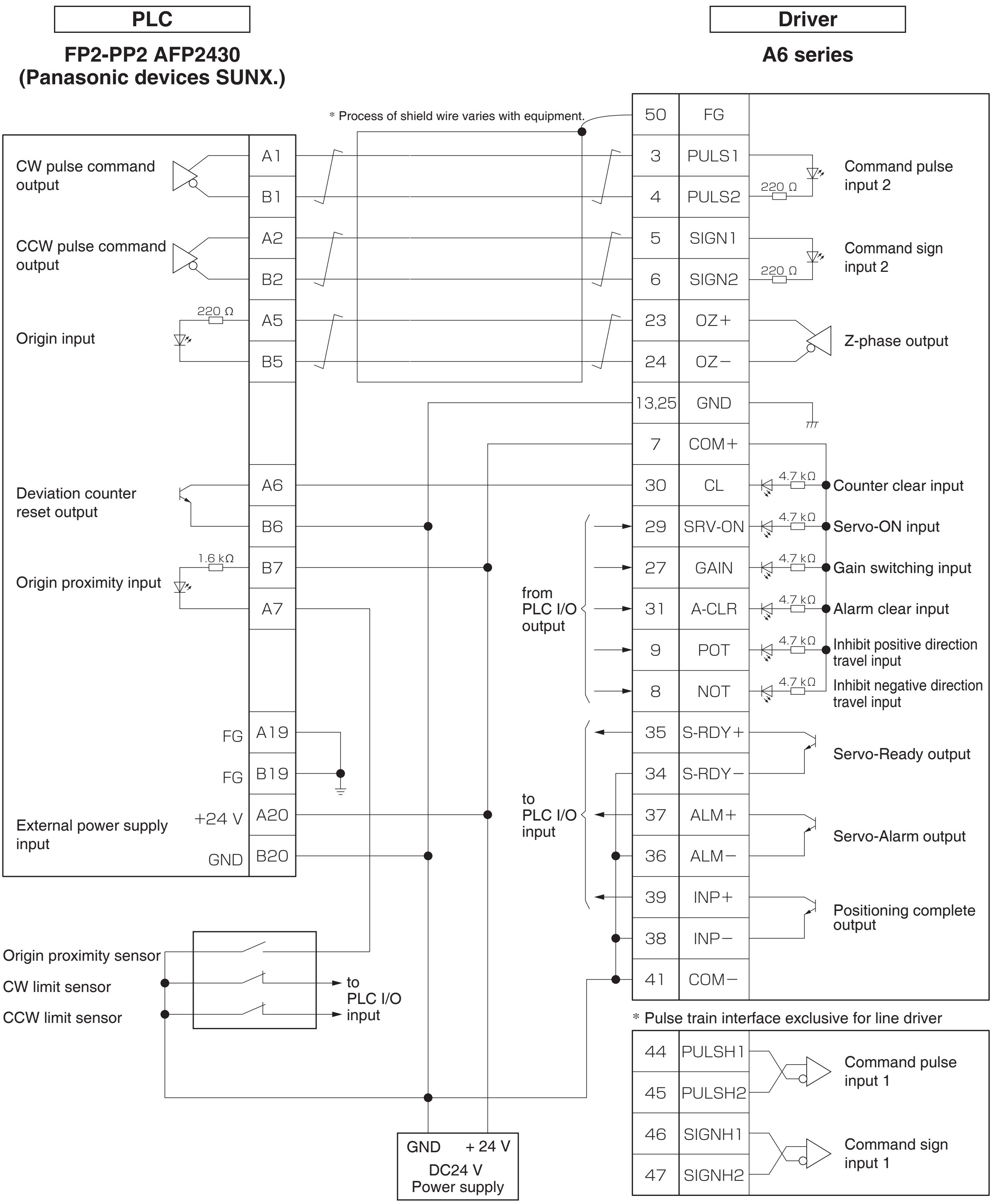
* When connecting, please make sure to use twisted-pair cable.
* The internal circuit of the host controller may be changed. About the latest information please confirm to host controller maker.

Pulse train interface exclusive for line driver.
Use this interface when you use pulse command frequency between 500 kpulse/s and 8 Mpulse/s.

Note represents twisted pair wire.

Related page • P.3-33 “Inputs and outputs on connector X4”

Connection between MINAS A6 and FP2-PP2 AFP2430 Panasonic devices SUNX.



* When connecting, please make sure to use twisted-pair cable.
* The internal circuit of the host controller may be changed. About the latest information please confirm to host controller maker.

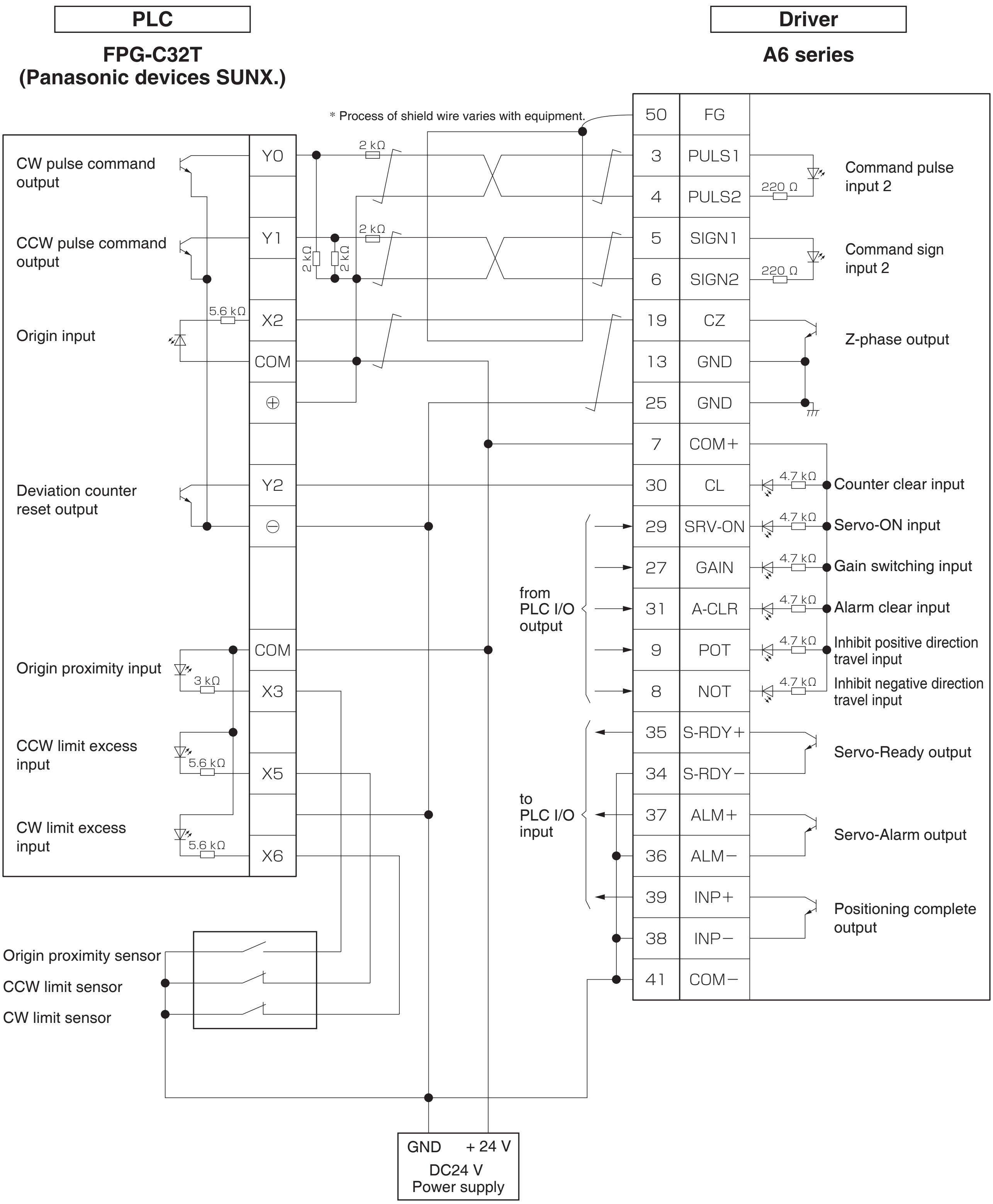
Pulse train interface exclusive for line driver.
Use this interface when you use pulse command frequency between 500 kpulse/s and 8 Mpulse/s

Note — represents twisted pair wire.

Related page

• P.3-33 “Inputs and outputs on connector X4”

Connection between MINAS A6 and FPG-C32T Panasonic devices SUNX.



* When connecting, please make sure to use twisted-pair cable.

* The internal circuit of the host controller may be changed. About the latest information please confirm to host controller maker.

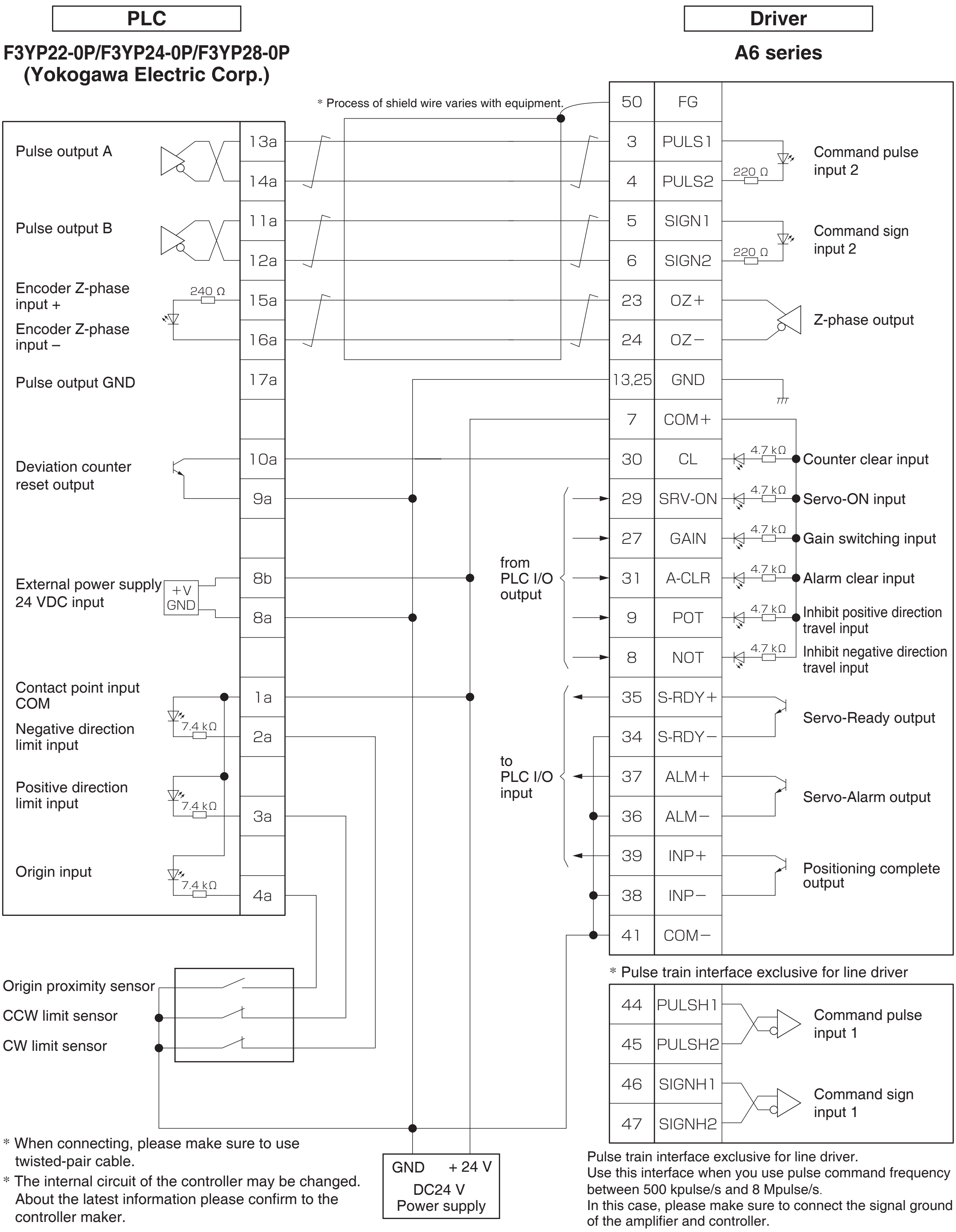
Note represents twisted pair wire.

Related page • P.3-33 “Inputs and outputs on connector X4”

3. Wiring Diagram to the connector, X4

Connecting Example to Host Controller

Connection between MINAS A6 and F3YP22-0P/F3YP24-0P/F3YP28-0P Yokogawa Electric Corp.



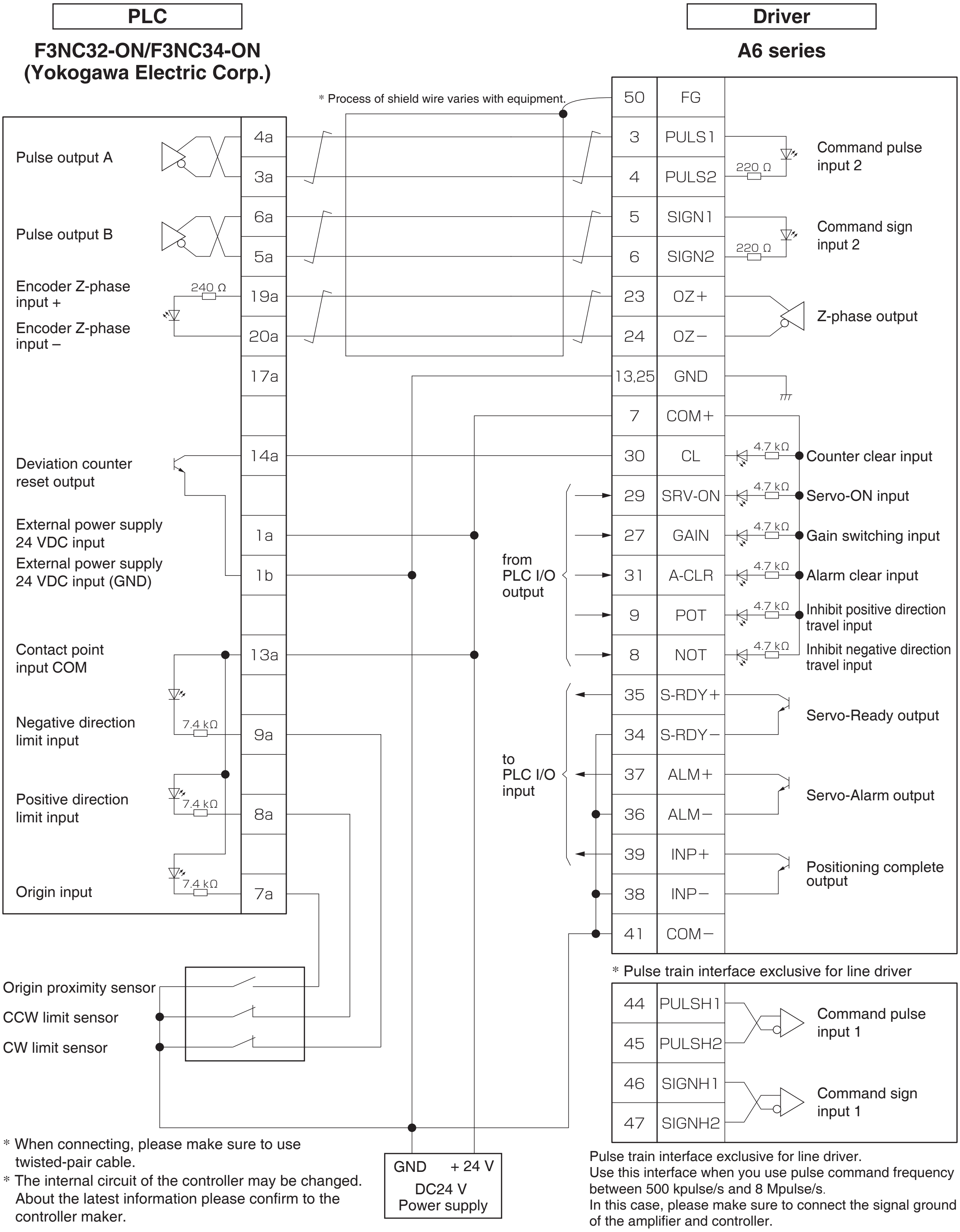
* When connecting, please make sure to use twisted-pair cable.
* The internal circuit of the controller may be changed. About the latest information please confirm to the controller maker.

Pulse train interface exclusive for line driver.
Use this interface when you use pulse command frequency between 500 kpulse/s and 8 Mpulse/s.
In this case, please make sure to connect the signal ground of the amplifier and controller.

Note — represents twisted pair wire.

Related page • P.3-32 “Inputs and outputs on connector X4”

Connection between MINAS A6 and F3NC32-ON/F3NC34-ON Yokogawa Electric Corp.



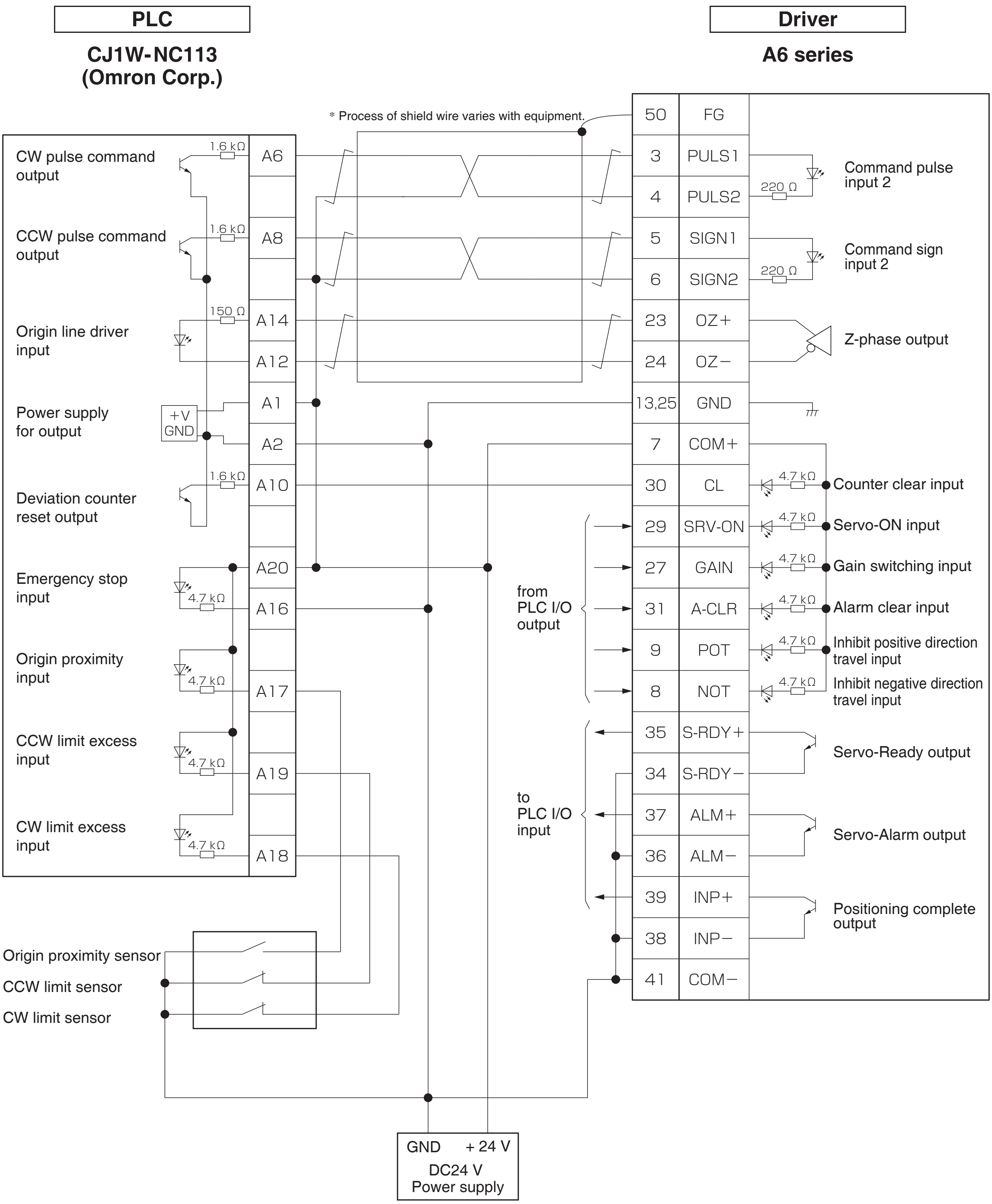
* When connecting, please make sure to use twisted-pair cable.
* The internal circuit of the controller may be changed. About the latest information please confirm to the controller maker.

Pulse train interface exclusive for line driver.
Use this interface when you use pulse command frequency between 500 kpulse/s and 8 Mpulse/s.
In this case, please make sure to connect the signal ground of the amplifier and controller.

Note — represents twisted pair wire.

Related page • P.3-33 “Inputs and outputs on connector X4”

Connection between MINAS A6 and CJ1W-NC113 Omron Corp.

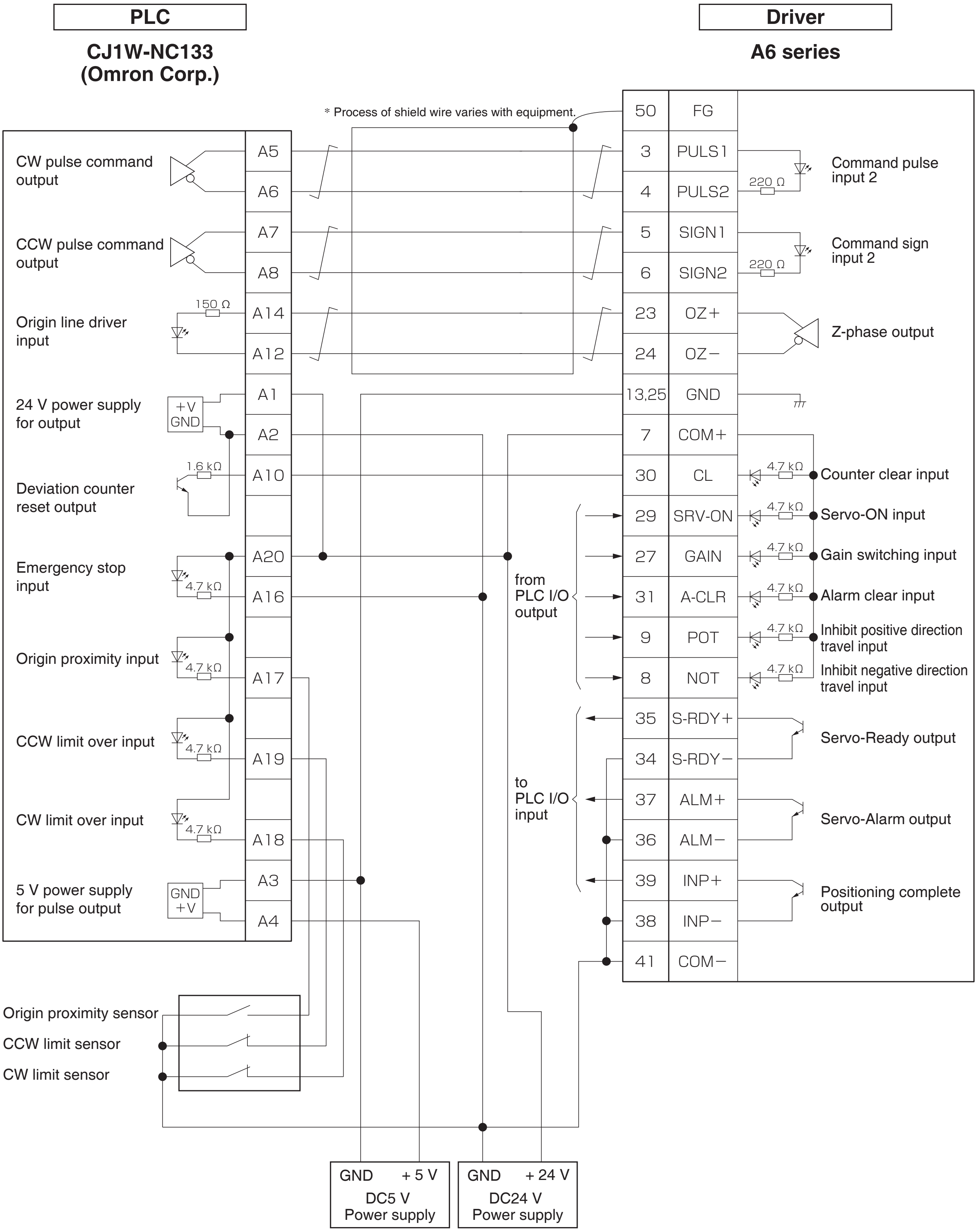


* When connecting, please make sure to use twisted-pair cable.
* The internal circuit of the host controller may be changed. About the latest information please confirm to host controller maker.

Note represents twisted pair wire.

Related page • P.3-32 “Inputs and outputs on connector X4”

Connection between MINAS A6 and CJ1W-NC133 Omron Corp.



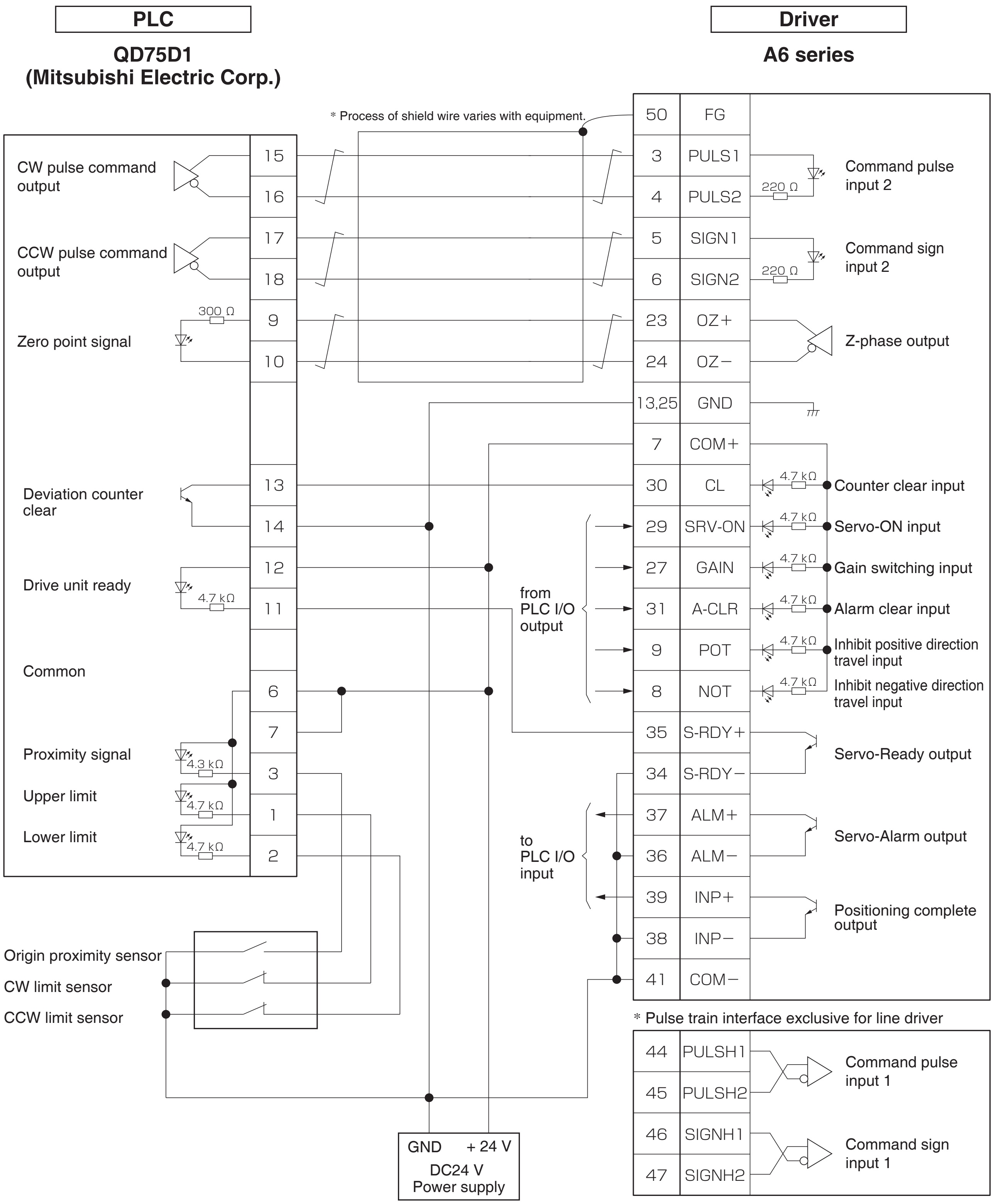
* When connecting, please make sure to use twisted-pair cable.

* The internal circuit of the host controller may be changed. About the latest information please confirm to host controller maker.

Note represents twisted pair wire.

Related page • P.3-33 “Inputs and outputs on connector X4”

Connection between MINAS A6 and QD75D1 Mitsubishi Electric Corp.



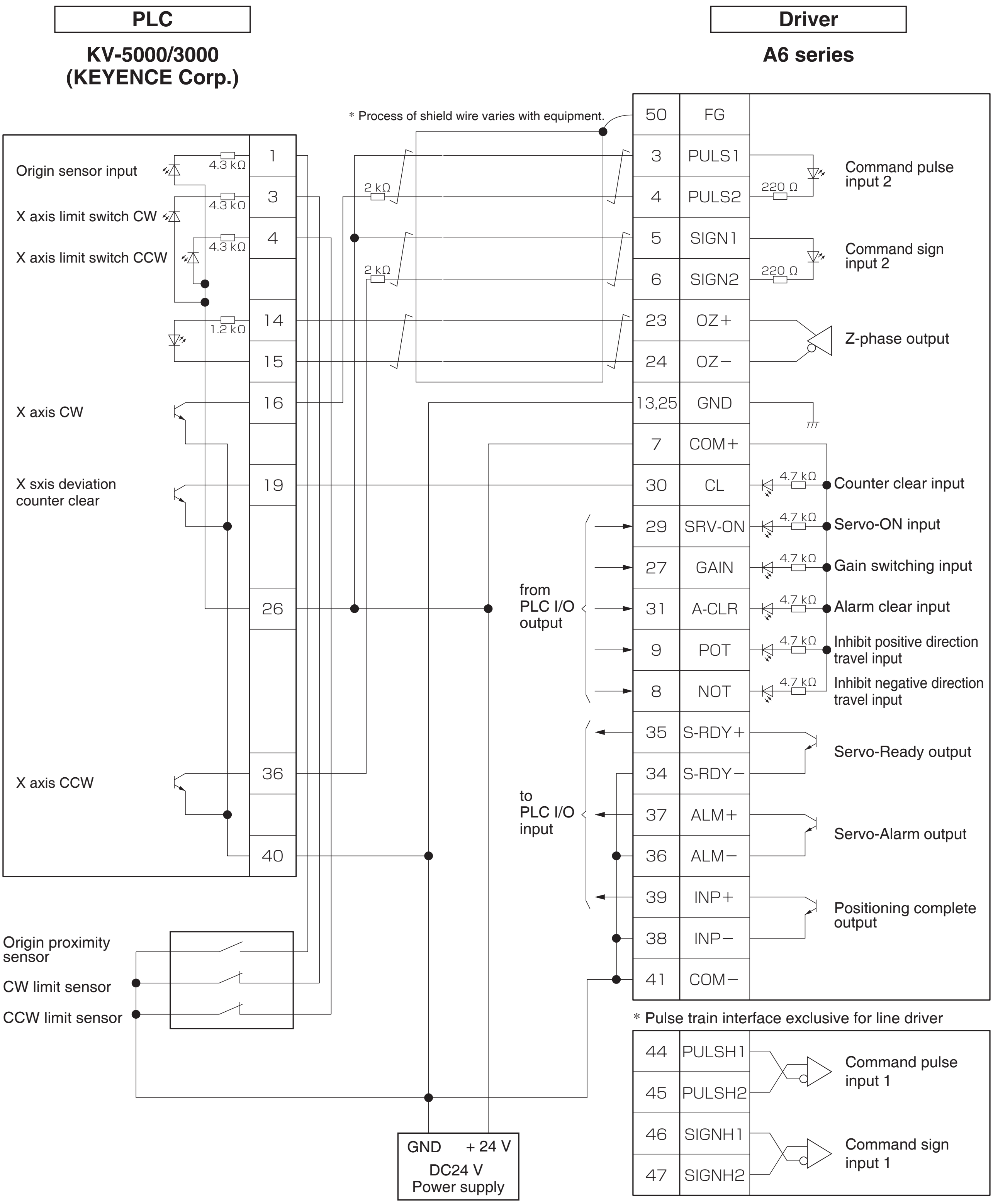
* When connecting, please make sure to use twisted-pair cable.
* The internal circuit of the host controller may be changed. About the latest information please confirm to host controller maker.

Pulse train interface exclusive for line driver.
Use this interface when you use pulse command frequency between 500 kpulse/s and 8 Mpulse/s

Note represents twisted pair wire.

Related page
• P.3-33 “Inputs and outputs on connector X4”

Connection between MINAS A6 and KV-5000/3000 KEYENCE Corp.



* When connecting, please make sure to use twisted-pair cable.
* The internal circuit of the host controller may be changed. About the latest information please confirm to host controller maker.

Pulse train interface exclusive for line driver.
Use this interface when you use pulse command frequency between 500 kpulse/s and 8 Mpulse/s

Note represents twisted pair wire.

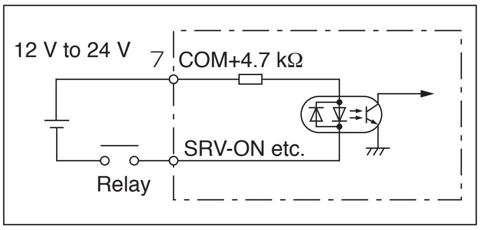
Related page • P.3-33 “Inputs and outputs on connector X4”

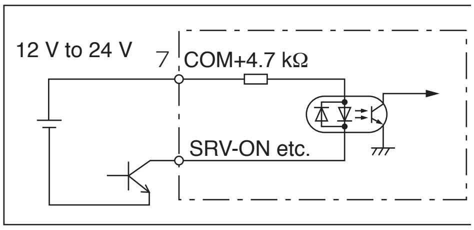
Interface Circuit (Input)

Input Circuit

SI	Connection to sequence input signals	Related control mode	P	S	T	F

- 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.





- 10 systems: SI1 to SI10. For assign and function, refer to P.3-40 to P.3-45.

Note Related page P.3-54

PI1	Connection to sequence input signals (Pulse train interface)	Related control mode	P	S	T	F

(1) Line driver I/F (Permissible max. input frequency of command pulse input signal.: 500 kpulse/s)

- This signal transmission method has better noise immunity.
  We recommend this to secure the signal transmission.

(2) Open collector I/F (Permissible max. input frequency of command pulse input signal.: 200 kpulse/s)

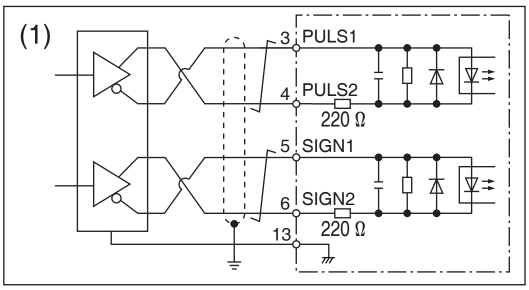
- The method which uses an external control signal power supply (VDC)
- Current regulating resistor (R) corresponding to V_{DC} is required in this case.
- Connect the specified resister as below.
- (R) should be placed close to the driver for effective noise reduction.

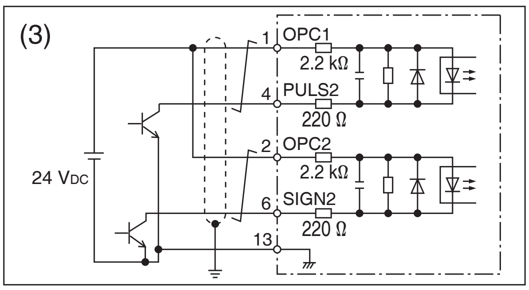
V_{DC}	Specifications
12 V	820 Ω1/2 W
24 V	2 kΩ1/2 W

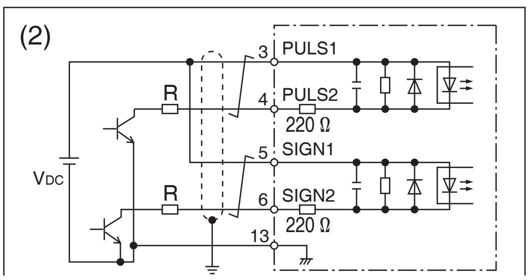
$$\frac{V_{DC}-1.5}{R+220} \fallingdotseq 10 \text{ mA}$$

(3) Open collector I/F (Permissible max. input frequency of command pulse input signal.: 200 kpulse/s)

- Connecting diagram when a current regulating resistor is not used with 24 V power supply.







＊ Keep the length of wiring short (1 m or less).

Max.input voltage :
DC24 V, Rated current : 10 mA

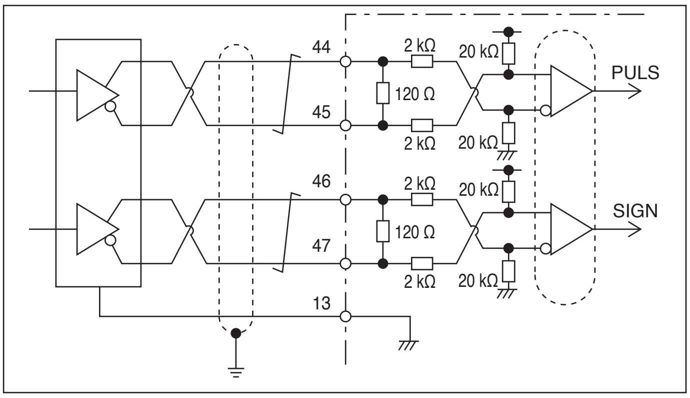
represents twisted pair.

When using open collector interface, it is recommended to set Pr0.05 to 2.

- 1 system: PI1. For function, refer to P.3-38, P.3-39.

PI2	Connection to sequence input signals (Pulse train interface exclusive to line driver)	Related control mode	P	S	T	F

Line driver I/F (Permissible max. input frequency of command pulse input signal.: 8 Mpulse/s)
- This signal transmission method has better noise immunity.
  We recommend this to secure the signal transmission when line driver I/F is used.

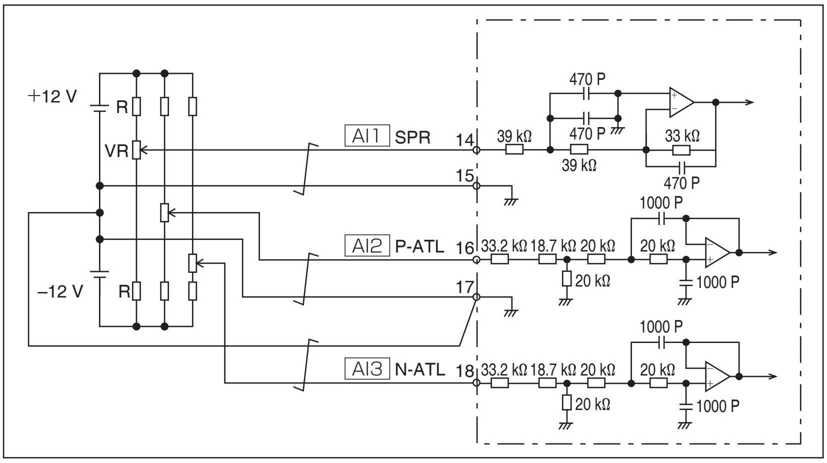


represents twisted pair.

- 1 system: PI2. For function, refer to P.3-38, P.3-39.

AI	Analog command input	Related control mode	P	S	T	F

- It goes through 3 systems, AI1 to AI3.
- Max. permissible input voltage to each input is ±10 V.
  For input impedance of each input, refer to the right Fig.
- When you compose a simple command circuit using variable resistor(VR) and register R, connect as the right Fig. shows. When the variable range of each input is made as –10 V to +10 V, use VR with 2 kΩ, B-characteristics, 1/2 W or larger, R with 200 Ω, 1/2 W or larger.
- A/D converter resolution of each command input is as follows.
  (1)ADC1 : 16-bit (AI1)
  (2)ADC2 : 12-bit (AI2, AI3)



- For function, refer to P.3-46, P.3-47.

represents twisted pair.

Note Only for the standard type and communication type are not provided with analog input.

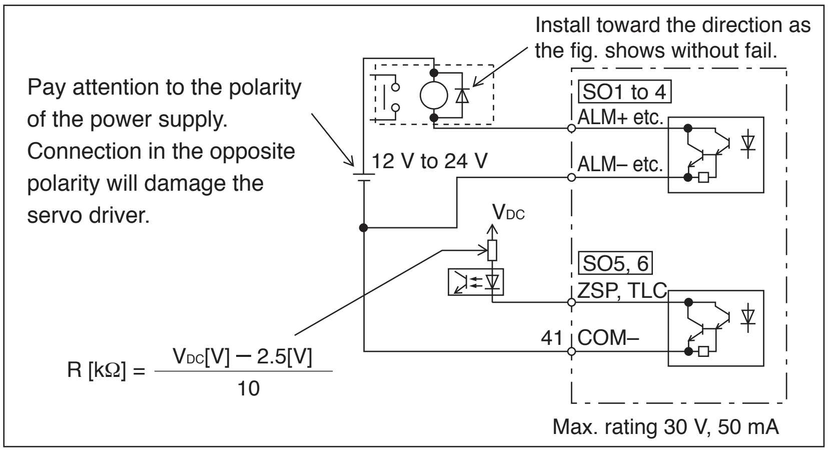
Interface Circuit (Output)

Output Circuit

SO	Sequence output circuit	Related control mode	P	S	T	F

- 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.
- There are two types of output, one (2 systems of SO5, SO6) which emitter side of the output transistor is independent and is connectable individually, and the one (4 systems of SI1 to SI4) which is common to – side of the control power supply (COM–).
- If a recommended primary current value of the photocoupler is 10 mA, decide the resistor value using the formula of the below figure.
- When accepting the output signal through a logic circuit, e.g. gate, influence from noises should be prevented.

For the recommended primary current value, refer to the data sheet of the equipment and photocoupler to be used.

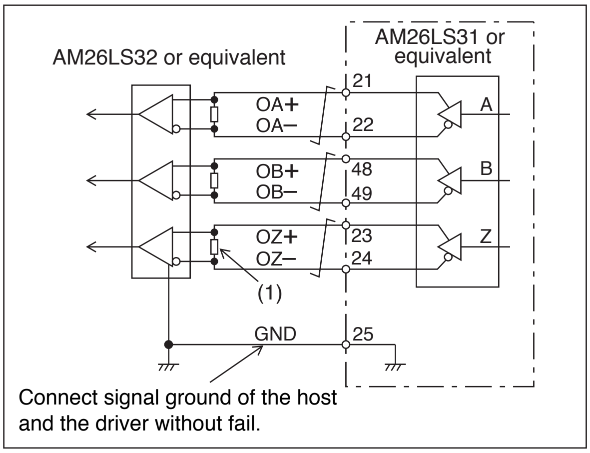


Note
- For function, refer to P.3-48 to P.3-52.

Related page P.3-55

PO1	Line driver (Differential output) output	Related control mode	P	S	T	F

- Feeds out the divided encoder outputs (A, B and Z-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.

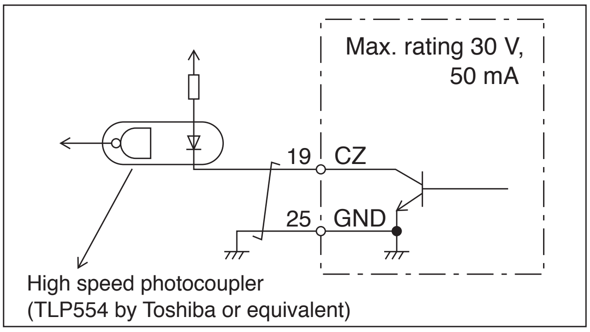


represents twisted pair.

- For function, refer to P.3-51.

PO2	Open collector output	Related control mode	P	S	T	F

- Feeds out the Z-phase signal among the encoder signals in open collector. This output is not insulated.
- Receive this output with high-speed photocouplers at the host side, since the pulse width of the Z-phase signal is narrow.



represents twisted pair.

- For function, refer to P.3-51.

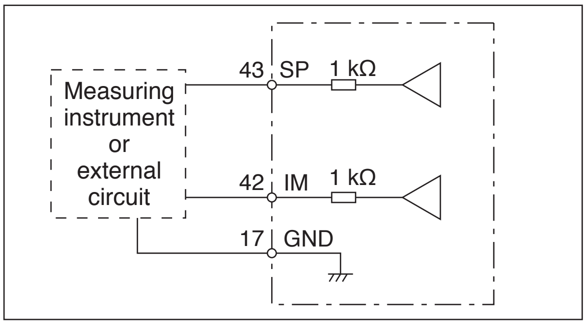
AO	Analog monitor output	Related control mode	P	S	T	F

- There are two outputs, the speed monitor signal output (SP) and the torque monitor signal output (IM)
- Output signal width is ±10 V.
- The output impedance is 1 kΩ. Pay an attention to the input impedance of the measuring instrument or the external circuit to be connected.

<Resolution>

(1) Speed monitor output (SP)
With a setup of 6 V/3000 r/min, the resolution converted to speed is 4 r/min/8 mV.

(2) Torque monitor output (IM)
With a relation of 2 V/rated torque (100 %), the resolution converted to torque is 0.4 %/8 mV.



- For function, refer to P.3-52.

4. Inputs and outputs on connector X4

Input Signal and Pin No.

Input Signals (common) and Their Functions

Pin No.	7	Title of signal	Power supply for control signal (+)	Related control mode	P	S	T	F
		Symbol	COM+	I/F circuit	—			

- Connect + of the external DC power supply (12 V to 24 V).
- Use the power supply voltage of 12 V ± 5 % to 24 V ± 5 %

Pin No.	41	Title of signal	Power supply for control signal (–)	Related control mode	P	S	T	F
		Symbol	COM–	I/F circuit	—			

- Connect – of the external DC power supply (12 V to 24 V).
- The power capacity varies depending on a composition of I/O circuit. 0.5 A or more is recommended.

Input Signals (Pulse Train) and Their Functions

You can select appropriate interface out of two kinds, depending on the command pulse specifications.

• Pulse train interface exclusive for line driver

Pin No.	44 45	Title of signal	Command pulse input 1	Related control mode	P	S	T	F
		Symbol	Pin No.44: **PULSH1** Pin No.45: **PULSH2**	I/F circuit	PI2 P.3-34			

Pin No.	46 47	Title of signal	Command pulse sign input 1	Related control mode	P	S	T	F
		Symbol	Pin No.46: **SIGNH1** Pin No.47: **SIGNH2**	I/F circuit	PI2 P.3-34			

- Input terminal for position command pulse. You can select by setting up Pr0.05 (Selection of command pulse input) to 1.
- This input becomes invalid at such control mode as velocity control or torque control, where no position command is required.
- Permissible max. input frequency is 8 Mpulse/s (After quadruple).
- You can select up to 6 command pulse input formats with Pr0.06 (Setup of command pulse rotational direction) and Pr0.07 (Setup of command pulse input mode).
  For details, refer to the table next page, "Command pulse input format".

• Pulse train interface (supports both line driver and open collector)

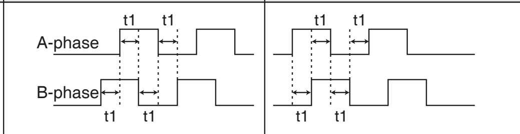
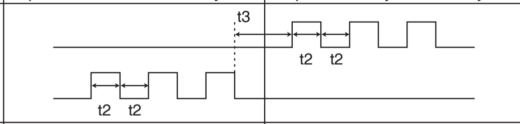
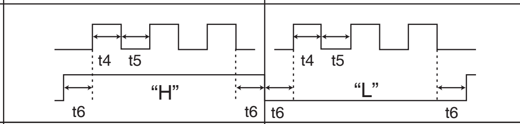
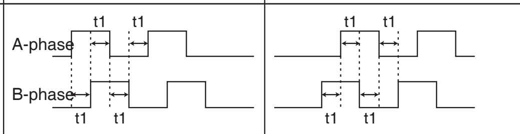
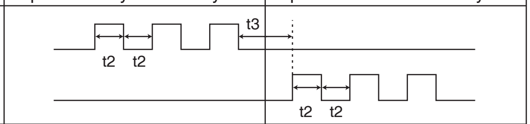
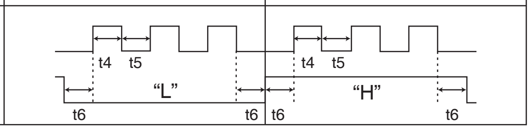
Pin No.	1 3 4	Title of signal	Command pulse input 2	Related control mode	P	S	T	F
		Symbol	Pin No.1: **OPC1** Pin No.3: **PULS1** Pin No.4: **PULS2**	I/F circuit	PI1 P.3-33			

Pin No.	2 5 6	Title of signal	Command pulse sign input 2	Related control mode	P	S	T	F
		Symbol	Pin No.2: **OPC2** Pin No.5: **SIGN1** Pin No.6: **SIGN2**	I/F circuit	PI1 P.3-33			

- Input terminal for the position command. You can select by setting up Pr0.05 (Selection of command pulse input) to 0.
  When using open collector interface, it is recommended to set Pr0.05 to 2.
- This input becomes invalid at such control mode as the velocity control or torque control, where no position command is required.
- Permissible max. input frequency is 500 kpulse/s at line driver input and 200 kpulse/s at open collector input.
- You can select up to 6 command pulse input formats with Pr0.06 (Setup of command pulse rotational direction) and Pr0.07 (Setup of command pulse input mode).
  For details, refer to the table next page, "Command pulse input format".

Related page
• P.3-33 “Inputs and outputs on connector X4”
• P.4-10 “Details of parameter”

• Input format command pulse

Pr0.06 setup value (Command pulse rotational direction setup)	Pr0.07 setup value (Command pulse input mode setup)	Command pulse format	Signal title	Positive direction command	Negative direction command
0	0 or 2	90˚ phase difference 2-phase pulse (A + B-phase)	PULS SIGN	 B-phase advances to A by 90˚.	B-phase delays from A by 90˚.
	1	Positive direction pulse train + Negative direction pulse train	PULS SIGN		
	3	pulse train + Signal	PULS SIGN		
1	0 or 2	90˚ phase difference 2-phase pulse (A + B-phase)	PULS SIGN	 B-phase delays from A by 90˚.	B-phase advances to A by 90˚.
	1	Positive direction pulse train + Negative direction pulse train	PULS SIGN		
	3	pulse train + Signal	PULS SIGN		

- PULS and SIGN represents the outputs of pulse train in put circuit. Refer to the fig. of P.3-33, "Input Circuit".
- In case of negative direction pulse train + positive direction pulse train and pulse train + sign, pulse train will be cap tured at the rising edge.
- In case of 2-phase pulse, pulse train will be captured at each edge.

• Permissible max. input frequency, and min. necessary time width of command pulse input signal.

Input I/F of PULS/SIGN signal		Permissible max. input frequency	Min. necessary time width (μs)					
			t1	t2	t3	t4	t5	t6
Pulse train interface exclusive to line driver PULSH1,2,SIGNH1,2	A,B-phase Input, multiple of 4	8 Mpulse/s	0.125	0.125	0.125	0.125	0.125	0.125
	Not A,B-phase Input	4 Mpulse/s	0.25	0.125	0.125	0.125	0.125	0.125
Pulse train interface PULS1,2,SIGN1,2	Line driver interface	200 kpulse/s	2	1	1	1	1	1
	Open collector interface	200 kpulse/s	5	2.5	2.5	2.5	2.5	2.5

Related page • P.4-10 “Details of Parameter”

Control Input

Control signal having the desired function can be applied to any input pin of I/F connector.
The logic can be changed.

• Default assignment

Pin No.	Title of signal	Symbol	Applicable parameter	Default parameter setting ( ): decimal notation	Default Setup: Position/ Full-closed control Signal	Position/ Full-closed control Logic *1	Verocity control Signal	Verocity control Logic *1	Torque control Signal	Torque control Logic *1
8	SI1 input	SI1	Pr4.00	00828282h (8553090)	NOT	Normal Colse	NOT	Normal Colse	NOT	Normal Colse
9	SI2 input	SI2	Pr4.01	00818181h (8487297)	POT	Normal Colse	POT	Normal Colse	POT	Normal Colse
26	SI3 input	SI3	Pr4.02	0091910Ah (9539850)	VS-SEL1	Normal Open	ZEROSPD	Normal Colse	ZEROSPD	Normal Colse
27	SI4 input	SI4	Pr4.03	00060606h (394758)	GAIN	Normal Open	GAIN	Normal Open	GAIN	Normal Open
28	SI5 input	SI5	Pr4.04	0000100Ch (4108)	DIV1	Normal Open	INTSPD3	Normal Open	—	—
29	SI6 input	SI6	Pr4.05	00030303h (197379)	SRV-ON	Normal Open	SRV-ON	Normal Open	SRV-ON	Normal Open
30	SI7 input	SI7	Pr4.06	00000f07h (3847)	CL	Normal Open	INTSPD2	Normal Open	—	—
31	SI8 input	SI8	Pr4.07	00040404h (263172)	A-CLR	Normal Open	A-CLR	Normal Open	A-CLR	Normal Open
32	SI9 input	SI9	Pr4.08	00050505h (328965)	C-MODE	Normal Open	C-MODE	Normal Open	C-MODE	Normal Open
33	SI10 input	SI10	Pr4.09	00000E88h (3720)	INH	Normal Colse	INTSPD1	Normal Open	—	—

Note

• The function depends on parameter setup. Refer to P.4-6 to P.4-85.
Refer to the next section “Function assignable to general purpose input”.

*1 Operation of Normal Open and Normal Colse:
Normal Open: Input signal disconnected from COM– function disabled (OFF state)
Input signal connected to COM– function enabled (ON state)
Normal Colse: Input signal disconnected from COM– function enabled (ON state)
Input signal connected to COM function disabled (OFF state)

[—]: No function assigned

Related page P.3-54

Caution

• Safety Precautions

Usually, please set drive inhibit input (POT, NOT) and forced alarm input (ESTOP) to Normal Colse that is used to stop upon disconnection of cable. When setting the drive inhibit input to Normal Open, verify that the setting will not cause safety problem.
For the same reason as described above, it is recommended to set servo-on input (SRV-ON) to Normal Open.
When setting the input to Normal Colse, verify that the setting will not cause safety problem.

Function allocatable to control input

Title of signal	**Servo-ON input**			Related control mode	P S T F
Symbol	**SRV-ON**	Default assignment	**29 (SI6)**	I/F circuit	SI P.3-33

• This signal turns on/off the servo (motor).

Title of signal	**Positive direction over-travel inhibition input**			Related control mode	P S T F
Symbol	**POT**	Default assignment	**9 (SI2)**	I/F circuit	SI P.3-33

• 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 this input, set Pr5.04 “Setup of over-travel inhibit input” to a value other than 1 so that the input is OFF when the moving portion of the machine exceeds this signal range toward positive direction.

Title of signal	**Negative direction over-travel inhibition input**			Related control mode	P S T F
Symbol	**NOT**	Default assignment	**8 (SI1)**	I/F circuit	SI P.3-33

• Negative 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 this function, set Pr5.04 “Setup of over-travel inhibit input” to a value other than 1 so that the input is OFF when the moving portion of the machine exceeds this signal range toward negative direction.

Title of signal	**Deviation counter clear input**			Related control mode	P S T F
Symbol	**CL**	Default assignment	**30 (SI7)**	I/F circuit	SI P.3-33

• Clears the positional deviation counter.
• Default setup clears the counter at the rising edge of the clear input, To change the setup, modify it in the Pr5.17 “Counter clear input mode”.

<Signal width and clear timing>

Pr5.17	CL signal width	Deviation clear timing
1	500 μs or more	Continually clear the counter while the deviation counter clear input is ON. *1
2	1 ms or more	
3	100 μs or more	Only once clear the counter at OFF to ON edge of the deviation counter clear input signal. *1
4	1 ms or more	

*1 Deviation counter clear input ON/OFF = input photocoupler ON/OFF

Caution This function can be assigned to only SI7. Allocation of this function to any other pin will cause an error.

Related page • P.4-52, 57 “Details of Parameter”

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Title of signal	Alarm clear input			Related control mode	P S T F
Symbol	A-CLR	Default assignment	31 (SI8)	I/F circuit	SI P.3-33

- Clears the alarm condition.
- This input cannot clear some alarms.
- For details, refer to P.6-3 When in Trouble “Protective function”, P.2-86 “(8) Alarm Display” and P.7-25 “Display of Battery Alarm”.

Caution When alarm clear input (A-CLR) is kept enabled, all potential alarms and warnings will be prevented.

Title of signal	Command pulse inhibition input			Related control mode	P S T F
Symbol	INH	Default assignment	33 (SI10)	I/F circuit	SI P.3-33

- Ignores the positional command pulse.
- When using this feature, set Pr5.18 “Invalidation of command pulse inhibition input” to 0.

Caution This function can be assigned to only SI10. Allocation of this function to any other pin will cause an error.

When INH input is ON, the deviation will be caused between the positional command administrated by controller and internal positional command from the fliter that receives the positional command from servo drivers, and orginal location before being input INH positional command will be lost. Therefore, it is supposed to reset the orignial location when it needs to restart return to origin action.

Title of signal	Control mode switching input			Related control mode	P S T F
Symbol	C-MODE	Default assignment	32 (SI9)	I/F circuit	SI P.3-33

- Selects a control mode.

Caution
- This signal is required in all control modes. No setting will cause an error.
- Do not input any command 10 ms before and after changing the control mode.

Title of signal	Electronic gear (division/multiplication) switching input 1			Related control mode	P S T F
Symbol	DIV1	Default assignment	28 (SI5)	I/F circuit	SI P.3-33
Title of signal	Electronic gear (division/multiplication) switching input 2			Related control mode	P S T F
Symbol	DIV2	Default assignment	—	I/F circuit	SI P.3-33

- Up to 4 numerators can be used for command dividing/multiplying by using DIV1 and DIV2.

<DIV1 and DIV2 vs numerator/denominator of selected command dividing/multiplying process>

DIV1	DIV2	Selected command dividing/multiplying process	
		Numerator	Denominator
OFF	OFF	Pr0.09	Pr0.10
ON	OFF	Pr5.00	Pr0.10
OFF	ON	Pr5.01	Pr0.10
ON	ON	Pr5.02	Pr0.10

The numerator of command division can be changed by using DIV1 and DIV2 can be switched, the relationship of the positional command that send from servo drivers and internal positional command will be change. Therefore, it is supposed to reset the orignial location when it needs to restart return to origin action.

Title of signal	Damping control switching input 1			Related control mode	P	S	T	F
Symbol	VS-SEL1	Default assignment	26 (SI3)	I/F circuit	SI	P.3-33		

Title of signal	Damping control switching input 2			Related control mode	P	S	T	F
Symbol	VS-SEL2	Default assignment	—	I/F circuit	SI	P.3-33		

- Selects applicable frequency for damping control.
  Combination of damping control input changeover 1 and 2 (VS-SEL1, VS-SEL2) enables select of max. 4 options.

Note Also refer to P.4-25 “Pr2.13 [Damping filter switching selection]”.

Title of signal	Gain switching input			Related control mode	P	S	T	F
Symbol	GAIN	Default assignment	27 (SI4)	I/F circuit	SI	P.3-33		

- Select 1st or 2nd gain.

Title of signal	Torque limit switching input			Related control mode	P	S	T	F
Symbol	TL-SEL	Default assignment	—	I/F circuit	SI	P.3-33		

- Select 1st or 2nd torque limit.

Pr5.21	Torque limit switching input (TL-SEL)	Torque limit switching setup (Pr5.23, Pr5.24)	Positive direction Torque limit	Negative direction Torque limit
0			Analog input *1	
1	—	—	Pr0.13	
2	—	—	Pr0.13	Pr5.22
3	OFF	Valid	Pr0.13	
	ON		Pr5.22	
4			Analog input *1	
5				
6	OFF	—	Pr0.13	Pr5.22
	ON		Pr5.25	Pr5.26

*1 To specify the torque limit value by an analog input, refer to Pr5.21 “Analog torque limit function”.

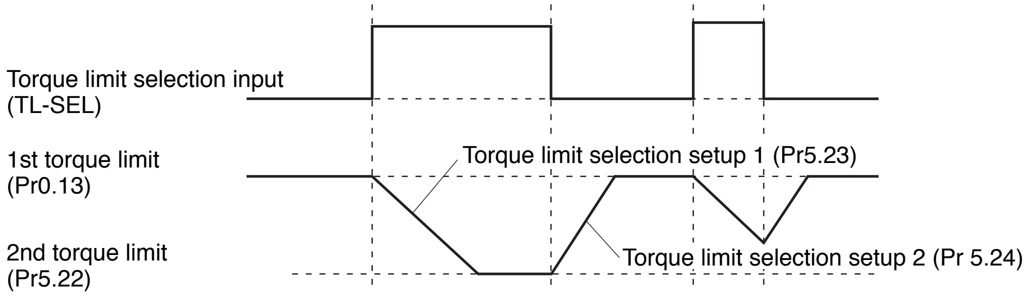
• Setup of rate of change after torque limit switchover

When applying Pr5.21 “Torque limit selection” = 3, changing rate of torque (slope) after selecting new torque limit can be changed.

When changing from the 1st torque limit to 2nd torque limit, the changing rate (slope) set at Pr5.23 “Torque limit selection setup 1” is applied; after changing from the 2nd torque limit to 1st torque limit, the changing rate (slope) set at Pr5.24 “Torque limit selection setup 2” is applied. The sign of the changing rate is automatically selected by the driver according to the difference in value between the 1st and 2nd torque limit.

If Pr5.23 “Torque limit selection setup 1” and Pr5.24 “Torque limit selection setup 2” are set to 0, switchover is instantaneous.

Related page • P.4-6 to P.4-85 “Details of Parameter”



Caution When the 1st torque limit (Pr0.13) and 2nd torque limit (Pr5.22) are changed from the front panel or through communication, the changing rate setup is ignored and the new torque limit value is immediately and directly applied. That is, changing rate setting is effective only when the selection is made by using the torque limit select input (TL-SEL).

Title of signal	**Selection 1 input of internal command speed**			Related control mode	P	**S**	T	F
Symbol	**INTSPD1**	Default assignment	**33 (SI10)**	I/F circuit	SI	P.3-33		

Title of signal	**Selection 2 input of internal command speed**			Related control mode	P	**S**	T	F
Symbol	**INTSPD2**	Default assignment	**30 (SI7)**	I/F circuit	SI	P.3-33		

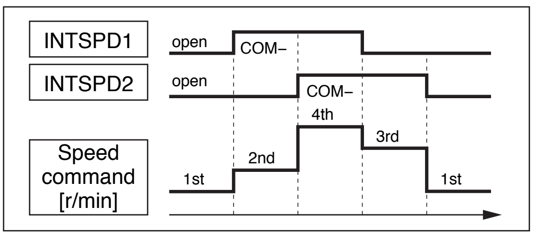
Title of signal	**Selection 3 input of internal command speed**			Related control mode	P	**S**	T	F
Symbol	**INTSPD3**	Default assignment	**28 (SI5)**	I/F circuit	SI	P.3-33		

- Select one of 8 internal command speeds.

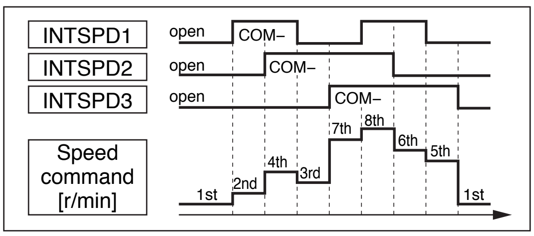
<Relationship between Pr3.00 “Switching between internal and external speed setup” and internal command speed selection 1-3 and the speed command selected>.

<table>
<tr><th>Pr3.00</th><th>Selection 1 of internal command speed (INTSPD1)</th><th>Selection 2 of internal command speed (INTSPD2)</th><th>Selection 3 of internal command speed (INTSPD3)</th><th>Selection of speed command</th></tr>
<tr><td rowspan="4">1</td><td>OFF</td><td>OFF</td><td rowspan="4">No effect</td><td>1st speed</td></tr>
<tr><td>ON</td><td>OFF</td><td>2nd speed</td></tr>
<tr><td>OFF</td><td>ON</td><td>3rd speed</td></tr>
<tr><td>ON</td><td>ON</td><td>4th speed</td></tr>
<tr><td rowspan="4">2</td><td>OFF</td><td>OFF</td><td rowspan="4">No effect</td><td>1st speed</td></tr>
<tr><td>ON</td><td>OFF</td><td>2nd speed</td></tr>
<tr><td>OFF</td><td>ON</td><td>3rd speed</td></tr>
<tr><td>ON</td><td>ON</td><td>Analog speed command</td></tr>
<tr><td rowspan="5">3</td><td colspan="2">The same as Pr3.00=1</td><td>OFF</td><td>1st to 4th speed</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>5th speed</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>6th speed</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>7th speed</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>8th speed</td></tr>
</table>

Caution Internal command speed switching pattern should be so arranged as shown below that single input signals are selected alternately. If 2 or more input signals are selected simultaneously, unspecified internal command speed may be advertently selected, whose setting value and acceleration/deceleration setting will cause unexpected operation.



Example 1) When Pr3.00=1 or 2



Example 2) When Pr3.00=3

Title of signal	Speed zero clamp input			Related control mode	P	S	T	F
Symbol	ZEROSPD	Default assignment	26 (SI3)	I/F circuit	SI	P.3-33		

- Set the speed command to 0.
- When using, set Pr3.15 “Speed zero clamp function selection” to a value other than 0.

Title of signal	Speed command sign input			Related control mode	P	S	T	F
Symbol	VC-SIGN	Default assignment	—	I/F circuit	SI	P.3-33		

- Specify the sign of speed command input at velocity control.
  Refer to P.4-31 “Pr3.01 Speed command rotational direction selection”

Title of signal	Torque command sign input			Related control mode	P	S	T	F
Symbol	TC-SIGN	Default assignment	—	I/F circuit	SI	P.3-33		

- Specify the sign of torque command input at torque control.

ON	Negative direction
OFF	Positive direction

Refer to P.4-35 “Pr3.18 Torque command direction selection”

Title of signal	Forced alarm input			Related control mode	P	S	T	F
Symbol	E-STOP	Default assignment	—	I/F circuit	SI	P.3-33		

- Generates Err87.0 “Forced alarm input error”.

Title of signal	Inertia ratio switching input			Related control mode	P	S	T	F
Symbol	J-SEL	Default assignment	—	I/F circuit	SI	P.3-33		

- Selects 1st inertia ratio or 2nd inertia ratio according to the inertia ratio select input (J-SEL).

Inertia ratio switching input (J-SEL)	Applicable inertia ratio
OFF	1st Inertia ratio (Pr0.04)
ON	2nd Inertia ratio (Pr6.12)

Refer to P.4-69 “Pr6.10 Function expansion setup”

Title of signal	Dynamic brake (DB) switch input			Related control mode	P	S	T	F
Symbol	DB-SEL	Default assignment	—	I/F circuit	SI	P.3-33		

- This signal is used to switch dynamic brake (DB) On/Off.
- Switching is only possible when main power supply Off is detected.

Note Only for position control type is not provided with analog input.

Input Signals (Analog Command)

Pin No.				
14	Title of signal	AI1 input	Correspondence function
	Symbol	AI1	SPR, TRQR, SPL
16	Title of signal	AI2 input	Correspondence function
	Symbol	AI2	TRQR, P-ATL
18	Title of signal	AI3 input	Correspondence function
	Symbol	AI3	N-ATL

Function allocatable to Input Signals (Analog Command)

Title of signal	Positive direction Torque limit input	Related control mode	P	S	T	F
Symbol	P-ATL	I/F circuit	AI P.3-34			
Title of signal	Negative direction Torque limit input	Related control mode	P	S	T	F
Symbol	N-ATL	I/F circuit	AI P.3-34			

• Specify the torque limit for each direction value by the analog voltage.

Pr5.21	Positive direction Torque limit input (P-ATL)	Negative direction Torque limit input (N-ATL)	Positive direction Torque limit	Negative direction Torque limit
0	0 V to 10 V	–10 V to 0 V	P-ATL	N-ATL
1	—		Set up through parameter. *1	
2				
3				
4	0 V to 10 V	0 V to 10 V	P-ATL	N-ATL
5	0 V to 10 V	No effect	P-ATL	
6	—		Setup by parameter *1	

*1 When specifying the torque limit value through the parameter, refer to P.4-58 “Torque limit select function”

Note Only for the standard type is not provided with analog input.

Title of signal	Speed command input	Related control mode	P S T F
Symbol	SPR	I/F circuit	AI P.3-34

- Input the speed command in the form of analog voltage.
- The table below shows relationship between the combination of Pr3.00 “Switching between internal and external speed setup”, Pr3.01 “Speed command direction selection”, Pr3.03 “Speed command input inversion”, analog speed command (SPR) of I/F connector and speed command sign selection (VC-SIGN) and the motor rotational direction; and the conversion graph of analog speed command input voltage to the speed command.

Pr3.00	Pr3.01	Pr3.03	Speed command input (SPR)	Speed command sign selection (VC-SIGN)	Motor rotational direction
0 (2)*	0	0	+Voltage (0 V to 10 V)	No effect	Positive direction
			−Voltage (−10 V to 0 V)	No effect	Negative direction
		1	+Voltage (0 V to 10 V)	No effect	Negative direction
			−Voltage (−10 V to 0 V)	No effect	Positive direction
	1	No effect	+Voltage (0 V to 10 V)	OFF	Positive direction
			−Voltage (−10 V to 0 V)		
			+Voltage (0 V to 10 V)	ON	Negative direction
			−Voltage (−10 V to 0 V)		

* When internal command speed select 1 and 2 are ON.

Title of signal	Torque command input	Related control mode	P S T F
Symbol	TRQR	I/F circuit	AI P.3-34

- Input the torque command in the form of analog voltage.
  When Pr3.17 “Torque command selection” = 0, pin No.14
  When Pr3.17 “Torque command selection” = 1, pin No.16

Pr3.17	Pr3.18	Pr3.20	Torque command input (TRQR)	Torque command sign selection (TC-SIGN)	Motor rotational direction
0	0	0	+Voltage (0 V to 10 V)	No effect	Positive direction
			−Voltage (−10 V to 0 V)	No effect	Negative direction
		1	+Voltage (0 V to 10 V)	No effect	Negative direction
			−Voltage (−10 V to 0 V)	No effect	Positive direction
	1	No effect	+Voltage (0 V to 10 V)	OFF	Positive direction
			−Voltage (−10 V to 0 V)		
			+Voltage (0 V to 10 V)	ON	Negative direction
			−Voltage (−10 V to 0 V)		

Title of signal	Speed limit input	Related control mode	P S T F
Symbol	SPL	I/F circuit	AI P.3-34

- When setting Pr3.17 “Torque command selection” to 1, input the speed limit value in the form of analog voltage.

Output Signals (Common) and Their Functions

Control output signal of desired function can be assigned to I/F connector. Logic of the output pin cannot be changed.

Pin No.	Title of signal	Symbol	Applicable parameter	Default parameter setting ( ): decimal notation	Default Setup: Position/ Full-closed control Signal	Default Setup: Verocity control Signal	Default Setup: Torque control Signal
10, 11	**SO1 output**	Pin No.10: **SO1–** Pin No.11: **SO1+**	Pr4.10	00030303h (197379)	BRK-OFF	BRK-OFF	BRK-OFF
34, 35	**SO2 output**	Pin No.34: **SO2–** Pin No.35: **SO2+**	Pr4.11	00020202h (131586)	S-RDY	S-RDY	S-RDY
36, 37	**SO3 output**	Pin No.36: **SO3–** Pin No.37: **SO3+**	Pr4.12	00010101h (65793)	ALM	ALM	ALM
38, 39	**SO4 output**	Pin No.38: **SO4–** Pin No.39: **SO4+**	Pr4.13	00050504h (328964)	INP	AT-SPEED	AT-SPEED
12	**SO5 output**	**SO5**	Pr4.14	00070707h (460551)	ZSP	ZSP	ZSP
40	**SO6 output**	**SO6**	Pr4.15	00060606h (394758)	TLC	TLC	TLC

Note

- The function is changed by the setting of parameter. For details, refer to P.4-39.
  See "Functions assignable to control output" as shown below.

[—]: No function assigned

Related page P.3-56

Function allocatable to control input

Title of signal	**Servo-Alarm output**			Related control mode	P	S	T	F
Symbol	**ALM**	Default assignment	**36, 37 (SO3)**	I/F circuit	SO	P.3-35		

- 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	P	S	T	F
Symbol	**S-RDY**	Default assignment	**34, 35 (SO2)**	I/F circuit	SO	P.3-35		

- This signal shows that the driver is ready to be activated.
- Output transistor turns ON when both control and main power are ON but not at alarm status.

Title of signal	External brake release signal			Related control mode	P S T F
Symbol	BRK-OFF	Default assignment	10, 11 (SO1)	I/F circuit	SO P.3-35

- Feeds out the timing signal which activates the holding brake of the motor.
- Turns the output transistor ON at the release timing of the holding brake.

Title of signal	Positioning complete			Related control mode	P F
Symbol	INP	Default assignment	38, 39 (SO4)	I/F circuit	SO P.3-35
Title of signal	Positioning complete 2			Related control mode	P F
Symbol	INP2	Default assignment	—	I/F circuit	SO P.3-35

- Outputs the positioning complete signal/positioning complete signal 2.
- Turns ON the output transistor upon completion of positioning.

Title of signal	Speed arrival output			Related control mode	S T
Symbol	AT-SPEED	Default assignment	38, 39 (SO4)	I/F circuit	SO P.3-35

- Outputs the speed arrival signal.
- Turns ON the output transistor upon arrive of speed.

Title of signal	Torque in-limit signal output			Related control mode	P S T F
Symbol	TLC	Default assignment	40 (SO6)	I/F circuit	SO P.3-35

- 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	P S T F
Symbol	ZSP	Default assignment	12 (SO5)	I/F circuit	SO P.3-35

- 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	S T
Symbol	V-COIN	Default assignment	—	I/F circuit	SO P.3-35

- Outputs the speed coincidence signal.
- Turns ON the output transistor upon coincidence of speed.

Title of signal	Alarm output 1			Related control mode	P S T F
Symbol	WARN1	Default assignment	—	I/F circuit	SO P.3-35

- 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	P S T F
Symbol	WARN2	Default assignment	—	I/F circuit	SO P.3-35

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

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• Selection of alarm 1 output and 2 output

Alarm No.	Alarm	Content	Pr6.27 *1	Pr4.40/ Pr4.41 *2	Pr6.38 Corresponding bit *3
A0	Overload protection	Load factor is 85 % or more the protection level.	○	1	bit7
A1	Over-regeneration alarm	Regenerative load factor is 85 % or more the protection level.	○	2	bit5
A2	Battery alarm	Battery voltage is 3.2 V or lower.	Fixed at no time limit.	3	bit0
A3	Fan alarm	Fan has stopped for 1 sec. *4	○	4	bit6
A4	Encoder communication alarm	The number of successive encoder communication errors exceeds the specified value.	○	5	bit4
A5	Encoder overheat alarm	The encoder detects overheat alarm.	○	6	bit3
A6	Oscillation detection alarm	Oscillation or vibration is detected.	○	7	bit9
A7	Lifetime detection alarm	The life expectancy of capacity or fan becomes shorter than the specified time.	Fixed at no time limit.	8	bit2
A8	External scale error alarm	The feedback scale detects the alarm.	○	9	bit8
A9	External scale communication alarm	The number of successive feedback scale communication errors exceeds the specified value.	○	10	bit10
AC	Deterioration diagnosis warning *5	Load characteristic estimates and torque command under constant speed has exceeded the set range.	○	22	bit7
C3	Main power off warning	In case that Pr7.14 (Detection time of main power off warning) is 10 to 1999, the mains power between L1 and L3 has stopped instantaneously for more than the time prescribed in Pr7.14.	○	14	bit14

*1 The “○” means that a time in the range 1 s to 10 s or no time limit can be selected through Pr6.27 “Warning latching time”. Note that the battery warning and the end of life warning have no time limit.

*2 Select the warning output signal 1 (WARN1) or warning output signal 2 (WARN2) through Pr4.40 “Warning output select 1” or Pr4.41 “Warning output select 2”. When the set value is 0, all warnings are ORed before being output. Do not set to any value other than those specified in the table above.

*3 A warning detection can be masked by Pr6.38 “Warning mask setup” Corresponding bits are shown in the table. Warning is masked with bit = 1.

*4 The upper fan on the H-frame driver stops during servo OFF to save energy. This is normal and no fan alarm is displayed.

*5 Invalidated when Pr6.97 “Function expansion setting 3” bit1 = 0.

Title of signal	Positional command ON/OFF output			Related control mode	P	S	T	F
Symbol	P-CMD	Default assignment	—	I/F circuit	SO	P.3-35		

• Turns on output transistor with positional command applied.

Title of signal	Speed in-limit output			Related control mode	P	S	T	F
Symbol	V-LIMIT	Default assignment	—	I/F circuit	SO	P.3-35		

• Turns on output transistor when the speed is limited by torque controlling function.

Title of signal	Alarm attribute output			Related control mode	P	S	T	F
Symbol	ALM-ATB	Default assignment	—	I/F circuit	SO	P.3-35		

• Turns on output transistor when an alarm that can be cleared generates.

Title of signal	Speed command ON/OFF output			Related control mode	P	S	T	F
Symbol	V-CMD	Default assignment	—	I/F circuit	SO	P.3-35		

• Turns on output transistor when the speed command is applied while the speed is controlled.

Title of signal	Servo on status output			Related control mode	P	S	T	F
Symbol	SRV-ST	Default assignment	—	I/F circuit	SO	P.3-34		

• Turns on output transistor when servo is on.

Output Signals (Pulse Train) and Their Functions

Pin No.		Title of signal		Related control mode	P	S	T	F
Pin No.	21 22	Title of signal	A-phase output/Position compare output 1	Related control mode	P	S	T	F
		Symbol	Pin No.21: **OA+/OCMP1+** Pin No.22: **OA–/OCMP1–**	I/F circuit	PO1	P.3-35		
Pin No.	48 49	Title of signal	B-phase output/Position compare output 2	Related control mode	P	S	T	F
		Symbol	Pin No.48: **OB+/OCMP2+** Pin No.49: **OB–/OCMP2–**	I/F circuit	PO1	P.3-35		
Pin No.	23 24	Title of signal	Z-phase output/Position compare output 3	Related control mode	P	S	T	F
		Symbol	Pin No.23: **OZ+/OCMP3+** Pin No.24: **OZ–/OCMP3–**	I/F circuit	PO1	P.3-35		

• Feeds out the divided encoder signal or feedback scale signal (A, B, Z-phase) in differential. (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)
• Can be used as position compare output, by setting bits 0 to 2 of Pr4.47 “Pulse output select” to 1.

Pin No.	19	Title of signal	Z-phase output/Position compare output 4	Related control mode	P	S	T	F
		Symbol	CZ/OCMP4	I/F circuit	PO2	P.3-36		

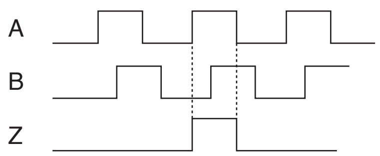
• Open collector output of Z-phase signal
• The emitter side of the transistor of the output circuit is connected to the signal ground (GND) and is not insulated.
• When using the CZ signal, isolate it from external noise.
• Note that the logic of Z phase open collector output (CZ) is a reversal of the line driver output (OZ) logic.

Note

• **When the output source is the encoder**

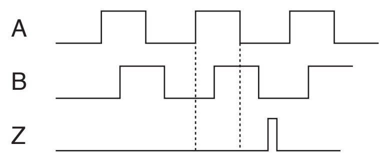
• If the encoder resolution $\times \frac{\text{Pr0.11}}{\text{Pr5.03}}$ is multiple of 4, Z-phase will be fed out synchronizing with A-phase. In other case, the Z-phase width will be equal to the encoder resolution, and will not synchronize with A-phase because of narrower width than that of A-phase.

when the encoder resolution $\times \frac{\text{Pr0.11}}{\text{Pr5.03}}$ is multiple of 4,



synchronized

when the encoder resolution $\times \frac{\text{Pr0.11}}{\text{Pr5.03}}$ is not multiple of 4,



not-synchronized

Pin No.	–	Title of signal	**Deterioration diagnosis velocity output**	Related control mode	P	S	T	F
		Symbol	**V-DIAG**	I/F circuit	PO2 P.3-36			

• The output transistor is turned ON when motor velocity of Pr5.75 (Deterioration diagnosis velocity setting) is within the range of PR4.35 (velocity concurrence width).
• There is a hysteresis of 10 r/min in concurrence judgment for deterioration diagnosis velocity.

Pin No.	–	Title of signal	**Position compare output**	Related control mode	P	S	T	F
		Symbol	**CMP-OUT**	I/F circuit	PO2 P.3-36			

• The output transistor is turned ON when the actual position has passed the position set by the parameter.

Note

Setting for all control modes is required when using the position compare output, (CMP-OUT). In case setting is made only to one or two control modes, Err33.4 “Output function number error 1 protection” or Err33.5 “Output function number error 2 protection” will occur.

Output Signals (Analog) and Their Functions

Pin No.	42	Title of signal	Analog monitor output 2	Related control mode	P	S	T	F
		Symbol	IM	I/F circuit	AO P.3-36			

- Definition of the output signal varies with the output of Pr4.18 (analog monitor 2 type).
- The output signal is identical to the analog monitor 2 on the front monitor.
- For output setting, refer to P.4-42 “Details of parameter”

Pin No.	43	Title of signal	Analog monitor output 1	Related control mode	P	S	T	F
		Symbol	SP	I/F circuit	AO P.3-36			

- Definition of the output signal varies with the output of Pr4.16 (analog monitor 1 type).
- The output signal is identical to the analog monitor 1 on the front monitor.
- For output setting, refer to P.4-42 “Details of parameter”

Output Signals (Others) and Their Functions

Pin No.	13, 15 17, 25	Title of signal	Signal ground	Related control mode	P	S	T	F
		Symbol	GND	I/F circuit	—			

- Signal ground
- This output is insulated from the control signal power (COM–) inside of the driver.

Pin No.	50	Title of signal	Frame ground	Related control mode	P	S	T	F
		Symbol	FG	I/F circuit	—			

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

Control Input Settings

Title of signal	Connector X4 Pin No.	Parameter No.
SI1 input selection	8	Pr4.00
SI2 input selection	9	Pr4.01
SI3 input selection	26	Pr4.02
SI4 input selection	27	Pr4.03
SI5 input selection	28	Pr4.04
SI6 input selection	29	Pr4.05
SI7 input selection	30	Pr4.06
SI8 input selection	31	Pr4.07
SI9 input selection	32	Pr4.08
SI10 input selection	33	Pr4.09

These parameters shall be set by using hexadecimal numbers. Setting shall be made for each control mode as shown in examples below.

00 ––––▲▲ h: Position/Full-closed control

00 ––＊＊–– h: Speed control

00 ■■–––– h: Torque control

Set an appropriate function number in place of "■■", "＊＊" and "▲▲". For the function number, see the table on the below.

Title	Symbol	Setup value	
		Normal Open	Normal Colse
Invalid	–	00h	Do not setup.
Positive direction over-travel inhibition input	POT	01h	81h
Negative direction over-travel inhibition input	NOT	02h	82h
Servo-ON input *1	SRV-ON	03h	83h
Alarm clear input	A-CLR	04h	Do not setup.
Control mode switching input *2	C-MODE	05h	85h
Gain switching input	GAIN	06h	86h
Deviation counter clear input *3	CL	07h	Do not setup.
Command pulse inhibition input *4	INH	08h	88h
Torque limit switching input	TL-SEL	09h	89h
Damping control switching input 1	VS-SEL1	0Ah	8Ah
Damping control switching input 2	VS-SEL2	0Bh	8Bh
Electronic gear switching input 1	DIV1	0Ch	8Ch
Electronic gear switching input 2	DIV2	0Dh	8Dh
Selection 1 input of internal command speed	INTSPD1	0Eh	8Eh
Selection 2 input of internal command speed	INTSPD2	0Fh	8Fh
Selection 3 input of internal command speed	INTSPD3	10h	90h
Speed zero clamp input	ZEROSPD	11h	91h
Speed command sign input	VC-SIGN	12h	92h
Torque command sign input	TC-SIGN	13h	93h
Forced alarm input	E-STOP	14h	94h
Inertia ratio switching input	J-SEL	15h	95h
Dynamic brake (DB) switch input	DB-SEL	16h	Do not setup.

(e.g. 1) Parameter setting

00 82 82 82 h (Hexadecimal numbers)

Position/ Full-closed Control (Negative direction over-travel inhibition input; b-contact)

Velocity Control (Negative direction over-travel inhibition input; b-contact)

Torque Control (Negative direction over-travel inhibition input; b-contact)

Convert to a decimal number

8553090 ← **Enter this value to the relevant parameter.**

(e.g. 2) Parameter setting

00■■＊＊▲▲h (Hexadecimal numbers)

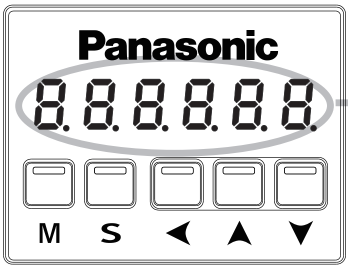
Position/ Full-closed Control (Damping control switching input 1; a-contact)

Velocity Control (Speed zero clamp input; b-contact)

Torque Control (Speed zero clamp input; b-contact)

Convert to a decimal number

← **Enter this value to the relevant parameter.**



The front panel display is in decimal (six digits).
For setting functions and parameters, hexadecimal and decimal numbers should be used respectively.

The expression of “00■■**▲▲h” indicates that the number is hexadecimal.

The SI1 input (connector X4, pin No. 8) means that the negative direction over-travel inhibition input is set to b-contact as a factory default.
For using the device in the position or full-closed control mode, the negative direction over-travel inhibition input is set to b-contact by setting “8” and “2” in the seventh and eighth digits from the left respectively. The settings in the first to sixth digits from the left do not matter.
For the hexadecimal value “00000082h” or simply “82h”, enter “130” (decimal) to the parameter Pr4.00.
To make multiple settings, enter the function number in the first eight digits from the left and then enter a parameter in a decimal number after converting it from a hexadecimal number.
An example of this is shown in example 1 (the case on the left side).
Similarly, the SI3 input (connector X4, pin No. 26) has a function of damping control switching input 1 as a default when used in the position control mode.
Also, if the speed control is used, it is set to the function of speed zero clamp input.
Therefore, in order to set it to the damping control switching input in the position control mode, enter the value of “10” (decimal) in the parameter Pr4.02 meaning the hexadecimal number “0Ah”, or “Ah”.
To change the speed zero clamp of pin No. 26 from b-contact to a-contact in the speed control mode, enter the decimal number of “4352” in the parameter Pr4.02 meaning the hexadecimal number of “00001100h”, or “1100h”.

Caution

- Do not setup to a value other than that specified in the table.
- Do not assign specific function to 2 or more signals. Duplicated assignment will cause Err33.0 I/F input multiple assignment error 1 or Err33.1 I/F input multiple assignment error 2.

*1 Servo-on input signal (SRV-ON) must be used to enable servo-on.
*2 When using control mode switching input (C-MODE), set the signal to all control modes. If the signal is set to only 1 or 2 control modes, Err33.2 I/F input function number error 1 or Err33.3 I/F input function number error 2 will be generated.
- The control input pin set to invalid state does not affect any operation.
- Function (servo-on input, alarm clear, etc.) to be used in multiple control modes must be assigned to the same pin with correct logical arrangement. Incorrect setting will cause Err33.0 I/F input multiple assignment error 1 or Err33.1 I/F input multiple assignment error 2.

*3 Deviation counter clear input (CL) can be assigned only to SI7 input. Wrong assignment will cause Err33.6 Counter clear assignment error.
*4 Command pulse inhibit input (INH) can be assigned only to SI10 input. Wrong assignment will cause Err33.7 Command pulse input inhibit input.

Note

- Input circuit, refer to P.3-33 and function, refer to P.3-40 to P.3-45.

Related page P.4-39 to P.4-40

Control Output Settings

Title of signal	Connector X4 Pin No.	Parameter No.
SO1 output	10, 11	Pr4.10
SO2 output	34, 35	Pr4.11
SO3 output	36, 37	Pr4.12
SO4 output	38, 39	Pr4.13
SO5 output	12	Pr4.14
SO6 output	40	Pr4.15

These parameters shall be set by using hexadecimal numbers. Setting shall be made for each control mode as shown in examples below.

00 ————▲▲ h: Position/Full-closed control
00 ——＊＊—— h: Speed control
00 ■■———— h: Torque control

Set an appropriate function number in place of "■■", "＊＊" and "▲▲". For the function number, see the table on the right.

Setup value	Title	Symbol
00h	Invalid	–
01h	Servo alarm output	ALM
02h	Servo-Ready output	S-RDY
03h	External brake release signal	BRK-OFF
04h	Positioning complete output	INP
05h	At-speed output	AT-SPEED
06h	Torque in-limit signal output	TLC
07h	Zero-speed detection output signal	ZSP
08h	Speed coincidence output	V-COIN
09h	Alarm output 1	WARN1
0Ah	Alarm output 2	WARN2
0Bh	Positional command ON/OFF output	P-CMD
0Ch	Positioning complete 2	INP2
0Dh	Speed in-limit output	V-LIMIT
0Eh	Alarm attribute output	ALM-ATB
0Fh	Speed command ON/OFF output	V-CMD
10h	Servo on status output	SRV-ST
14h	Position compare output	CMD-OUT
15h	Deterioration diagnosis velocity output	V-DIAG

(e.g. 1) Parameter setting

00 03 03 03 h (Hexadecimal numbers)
Position/ Full-closed Control (External brake release signal)
Velocity Control (External brake release signal)
Torque Control (External brake release signal)
Convert to a decimal number
197379 ← **Enter this value to the relevant parameter.**

(e.g. 2) Parameter setting

00 05 05 04 h (Hexadecimal numbers)
Position/ Full-closed Control (Positioning complete)
Velocity Control (Speed arrival output)
Torque Control (Speed zero clamp input; b-contact)
Convert to a decimal number
328964 ← **Enter this value to the relevant parameter.**

Caution
- 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.

＊1 Note that the setup values are displayed in decimal on the front panel.

Note
- Output circuit, refer to P.3-35, 36 and function, refer to P.3-48 to P.3-51.

Related page P.4-41

4. Setup

1. Details of parameter

2.Trial Run (JOG run)

1. Details of parameter

List of Parameters

- A parameter is designated as follows:

  Pr0.00
  Class ─┘ └─ Parameter No.

- Definition of symbols under "Related mode" -
  P: position control, S: velocity control,
  T: torque control, F: full closed control

- Basic Type, General communication can not use part prameter.

Parametr No. Class	No.	Title	Related Control Mode P	S	T	F	Detail page
[Class 0] Basic setting	00	Rotational direction setup	○	○	○	○	4-6
	01	Control mode setup	○	○	○	○	
	02	Real-time auto-gain tuning setup	○	○	○	○	4-7
	03	Real-time auto-gain tuning Selection of machine stiffness	○	○	○	○	4-8
	04	Inertia ratio	○	○	○	○	4-9
	05	Command pulse input selection	○	—	—	○	
	06	Command pulse otational direction setup	○	—	—	○	4-10
	07	Command pulse input mode setup	○	—	—	○	
	08	Command pulse counts per one motor revolution	○	—	—	—	4-11
	09	1st numerator of electronic gear	○	—	—	○	
	10	Denominator of electronic gear	○	—	—	○	
	11	Output pulse counts per one motor revolution	○	○	○	○	4-12
	12	Reversal of pulse output logic	○	○	○	○	4-14
	13	1st torque limit	○	○	○	○	
	14	Position deviation excess setup	○	—	—	○	
	15	Absolute encoder setup	○	○	○	○	
	16	External regenerative resistor setup	○	○	○	○	4-15
	17	Load factor of external regenerative resistor selection	○	○	○	○	
	18	For manufacturer's use	—	—	—	—	
[Class 1] Gain adjustment	00	1st gain of position loop	○	—	—	○	4-16
	01	1st gain of velocity loop	○	○	○	○	
	02	1st time constant of velocity loop integration	○	○	○	○	
	03	1st filter of speed detection	○	○	○	○	
	04	1st time constant of torque filter	○	○	○	○	
	05	2nd gain of position loop	○	—	—	○	4-17
	06	2nd gain of velocity loop	○	○	○	○	
	07	2nd time constant of velocity loop integration	○	○	○	○	
	08	2nd filter of speed detection	○	○	○	○	
	09	2nd time constant of torque filter	○	○	○	○	
	10	Velocity feed-forward gain	○	—	—	○	
	11	Velocity feed-forward filter	○	—	—	○	
	12	Torque feed forward gain	○	○	—	○	4-18
	13	Torque feed forward filter	○	○	—	○	
	14	2nd gain setup	○	○	○	○	
	15	Position control switching mode	○	—	—	○	4-19
	16	Position control switching delay time	○	—	—	○	
	17	Position control switching level	○	—	—	○	4-20
	18	Position control switching hysteresis	○	—	—	○	
	19	Position gain switching time	○	—	—	○	
	20	Velocity control switching mode	—	○	—	—	4-21
	21	Velocity control switching delay time	—	○	—	—	
	22	Velocity control switching level	—	○	—	—	4-21
	23	Velocity control switching hysteresis	—	○	—	—	4-22
	24	Torque control switching mode	—	—	○	—	
	25	Torque control switching delay time	—	—	○	—	
	26	Torque control switching level	—	—	○	—	
	27	Torque control switching hysteresis	—	—	○	—	
	28	For manufacturer's use	—	—	—	—	
	29	For manufacturer's use	—	—	—	—	
	30	For manufacturer's use	—	—	—	—	
	31	For manufacturer's use	—	—	—	—	
	32	For manufacturer's use	—	—	—	—	
	33	For manufacturer's use	—	—	—	—	
	34	For manufacturer's use	—	—	—	—	
	35	For manufacturer's use	—	—	—	—	
	36	For manufacturer's use	—	—	—	—	
	37	For manufacturer's use	—	—	—	—	
	38	For manufacturer's use	—	—	—	—	
	39	For manufacturer's use	—	—	—	—	
	40	For manufacturer's use	—	—	—	—	
	41	For manufacturer's use	—	—	—	—	
	42	For manufacturer's use	—	—	—	—	
	43	For manufacturer's use	—	—	—	—	
	44	For manufacturer's use	—	—	—	—	
	45	For manufacturer's use	—	—	—	—	
	46	For manufacturer's use	—	—	—	—	
	47	For manufacturer's use	—	—	—	—	
	48	For manufacturer's use	—	—	—	—	
	49	For manufacturer's use	—	—	—	—	
	50	For manufacturer's use	—	—	—	—	
	51	For manufacturer's use	—	—	—	—	
	52	For manufacturer's use	—	—	—	—	
	53	For manufacturer's use	—	—	—	—	
	54	For manufacturer's use	—	—	—	—	
	55	For manufacturer's use	—	—	—	—	
	56	For manufacturer's use	—	—	—	—	
	57	For manufacturer's use	—	—	—	—	
	58	For manufacturer's use	—	—	—	—	
	59	For manufacturer's use	—	—	—	—	
	60	For manufacturer's use	—	—	—	—	
	61	For manufacturer's use	—	—	—	—	
	62	For manufacturer's use	—	—	—	—	
	63	For manufacturer's use	—	—	—	—	
	64	For manufacturer's use	—	—	—	—	
	65	For manufacturer's use	—	—	—	—	
	66	For manufacturer's use	—	—	—	—	
	67	For manufacturer's use	—	—	—	—	
	68	For manufacturer's use	—	—	—	—	
	69	For manufacturer's use	—	—	—	—	
	70	For manufacturer's use	—	—	—	—	
	71	For manufacturer's use	—	—	—	—	
	72	For manufacturer's use	—	—	—	—	
	73	For manufacturer's use	—	—	—	—	
	74	For manufacturer's use	—	—	—	—	
	75	For manufacturer's use	—	—	—	—	
	76	For manufacturer's use	—	—	—	—	
	77	For manufacturer's use	—	—	—	—	
	78	For manufacturer's use	—	—	—	—	

Note

- Only for basic type is not provided with X2 (Communication connector), X3 (Safety function connector), X5 (External scale connector) and analog input.

Class	No.	Title		P	S	T	F	Detail page
[Class 2] Damping control	00	Adaptive filter mode setup		○	○	—	○	
	01	1st notch	frequency	○	○	○	○	
	02		width selection	○	○	○	○	4-23
	03		depth selection	○	○	○	○	
	04	2nd notch	frequency	○	○	○	○	
	05		width selection	○	○	○	○	
	06		depth selection	○	○	○	○	
	07	3rd notch	frequency	○	○	○	○	
	08		width selection	○	○	○	○	4-24
	09		depth selection	○	○	○	○	
	10	4th notch	frequency	○	○	○	○	
	11		width selection	○	○	○	○	
	12		depth selection	○	○	○	○	4-25
	13	Selection of damping filter switching		○	—	—	○	
	14	1st damping	frequency	○	—	—	○	
	15		filter setup	○	—	—	○	
	16	2nd damping	frequency	○	—	—	○	
	17		filter setup	○	—	—	○	
	18	3rd damping	frequency	○	—	—	○	4-26
	19		filter setup	○	—	—	○	
	20	4th damping frequency		○	—	—	○	
	21	4th damping filter setting		○	—	—	○	
	22	command smoothing filter		○	○	—	○	4-27
	23	command FIR filter		○	—	—	○	4-28
	24	5th notch	frequency	○	○	○	○	
	25		width selection	○	○	○	○	
	26		depth selection	○	○	○	○	
	27	1st vibration control width setting		○	—	—	○	4-29
	28	2st vibration control width setting		○	—	—	○	
	29	3st vibration control width setting		○	—	—	○	
	30	4st vibration control width setting		○	—	—	○	
	31	For manufacturer's use		—	—	—	—	
	32	For manufacturer's use		—	—	—	—	
	33	For manufacturer's use		—	—	—	—	
	34	For manufacturer's use		—	—	—	—	4-30
	35	For manufacturer's use		—	—	—	—	
	36	For manufacturer's use		—	—	—	—	
	37	For manufacturer's use		—	—	—	—	
[Class 3] Velocity/ Torque/ Full-closed control	00	Speed setup, Internal/External switching		—	○	—	—	4-31
	01	Speed command	rotational direction selection	—	○	—	—	
	02		input gain	—	○	○	—	4-32
	03		reversal input	—	○	—	—	
	04	Speed setup	1st	—	○	—	—	
	05		2nd	—	○	—	—	
	06		3rd	—	○	—	—	
	07		4th	—	○	—	—	
	08		5th	—	○	—	—	4-33
	09		6th	—	○	—	—	
	10		7th	—	○	—	—	
	11		8th	—	○	—	—	
	12	Acceleration time setting		—	○	—	—	
	13	Deceleration time setting		—	○	—	—	
	14	Sigmoid acceleration/ deceleration time setup		—	○	—	—	
	15	Speed zero clamp function selection		—	○	○	—	4-34
	16	Zero clamp level speed setting		—	○	○	—	
	17	Torque command selection		—	—	○	—	
	18	Torque command direction designation selection		—	—	○	—	4-35
	19	Torque commandinput gain		—	—	○	—	

Class	No.	Title		P	S	T	F	Detail page
[Class 3] Velocity/ Torque/ Full-closed control	20	Torque command input reversal		—	—	○	—	
	21	Speed limit value 1		—	—	○	—	4-36
	22	Speed limit value 2		—	—	○	—	
	23	External scale	selection	—	—	—	○	
	24		numerator of division	—	—	—	○	4-37
	25		denominator of division	—	—	—	○	
	26		reversal of direction	—	—	—	○	
	27		Z phase disconnection detection disable	—	—	—	○	4-38
	28	Hybrid deviation excess setting		—	—	—	○	
	29	Hybrid deviation clear setting		—	—	—	○	
[Class 4] I/F monitor setting	00	Input selection	SI1 (Pin No.8)	○	○	○	○	4-39
	01		SI2 (Pin No.9)	○	○	○	○	
	02		SI3 (Pin No.26)	○	○	○	○	
	03		SI4 (Pin No.27)	○	○	○	○	
	04		SI5 (Pin No.28)	○	○	○	○	
	05		SI6 (Pin No.29)	○	○	○	○	4-40
	06		SI7 (Pin No.30)	○	○	○	○	
	07		SI8 (Pin No.31)	○	○	○	○	
	08		SI9 (Pin No.32)	○	○	○	○	
	09		SI10 (Pin No.33)	○	○	○	○	
	10	Output selection	SO1 (Pin No.10, 11)	○	○	○	○	
	11		SO2 (Pin No.34, 35)	○	○	○	○	
	12		SO3 (Pin No.36, 37)	○	○	○	○	4-41
	13		SO4 (Pin No.38, 39)	○	○	○	○	
	14		SO5 (Pin No.12)	○	○	○	○	
	15		SO6 (Pin No.40)	○	○	○	○	
	16	Analog monitor 1	type	○	○	○	○	
	17		output gain	○	○	○	○	
	18	Analog monitor 2	type	○	○	○	○	4-42
	19		output gain	○	○	○	○	
	20	For manufacturer use		—	—	—	—	
	21	Analog monitor output setup		○	○	○	○	
	22	Analog input 1 (AI1)	offset setup	○	○	○	○	
	23		filter	○	○	○	○	
	24		overvoltage setup	○	○	○	○	4-44
	25	Analog input 2 (AI2)	offset setup	○	○	○	○	
	26		filter	○	○	○	○	
	27		overvoltage setup	○	○	○	○	
	28	Analog input 3 (AI3)	offset setup	○	○	○	○	
	29		filter	○	○	○	○	
	30		overvoltage setup	○	○	○	○	4-45
	31	Positioning completion range		○	—	—	○	
	32	Positioning completion output setting		○	—	—	○	
	33	INP hold time		○	—	—	○	
	34	Zero-speed		○	○	○	○	4-46
	35	Speed coincidence range		—	○	○	—	
	36	At-speed (Speed arrival)		—	○	○	—	
	37	Mechanical brake action in stop		○	○	○	○	4-47
	38	Mechanical brake action in motion		○	○	○	○	
	39	Mechanical brake action at running setup		○	○	○	○	
	40	Selection of alarm output	1	○	○	○	○	4-48
	41		2	○	○	○	○	
	42	2nd Positioning complete (In-position) range		○	—	—	○	
	44	Position compare output pulse width setting		○	—	—	○	
	45	Position compare output polarity select		○	—	—	○	
	47	Pulse output select		○	—	—	○	4-49
	48	Position compare value 1		○	—	—	○	
	49	Position compare value 2		○	—	—	○	4-50

1. Details of parameter

List of Parameters

Parametr No. Class	No.	Title	Related Control Mode P	S	T	F	Detail page
[Class 4] I/F monitor setting	50	Position compare value 3	○	—	—	○	
	51	Position compare value 4	○	—	—	○	
	52	Position compare value 5	○	—	—	○	
	53	Position compare value 6	○	—	—	○	4-50
	54	Position compare value 7	○	—	—	○	
	55	Position compare value 8	○	—	—	○	
	56	Position compare output delay compensation amount	○	—	—	○	
	57	Position compare output assignment setting	○	—	—	○	4-51
[Class 5] Enhancing setting	00	2nd numerator of electronic gear	○	—	—	○	
	01	3rd numerator of electronic gear	○	—	—	○	
	02	4th numerator of electronic gear	○	—	—	○	4-52
	03	Denominator of pulse output division	○	○	○	○	
	04	Over-travel inhibit input setup	○	○	○	○	
	05	Sequence at over-travel inhibit	○	○	○	○	4-53
	06	Sequence at Servo-Off	○	○	○	○	4-54
	07	main power OFF sequence	○	○	○	○	
	08	main power OFF LV trip selection	○	○	○	○	
	09	main power OFF detection time	○	○	○	○	4-55
	10	Sequence at alarm	○	○	○	○	
	11	Torque setup for emergency stop	○	○	○	○	
	12	Over-load level setup	○	○	○	○	
	13	Over-speed level setup	○	○	○	○	
	14	Motor working range setup	○	—	—	○	4-56
	15	I/F reading filter	○	○	○	○	
	16	Alarm clear input setup	○	○	○	○	
	17	Counter clear input mode	○	—	—	○	
	18	Command pulse prohibition input (INH) disable	○	—	—	○	4-57
	19	Command pulse prohibition input (INH) read setting	○	—	—	○	
	20	Position setup unit select	○	—	—	○	
	21	Selection of torque limit	○	○	—	○	4-58
	22	2nd torque limit	○	○	—	○	
	23	Torque limit switching setup 1	○	○	—	○	
	24	Torque limit switching setup 2	○	○	—	○	
	25	External input positive direction torque limit	○	○	—	○	4-59
	26	External input negative direction torque limit	○	○	—	○	
	27	Input gain of analog torque limit	○	○	—	○	
	28	LED initial status	○	○	○	○	
	29	RS232 baud rate setup	○	○	○	○	4-60
	30	RS485 baud rate setup	○	○	○	○	
	31	Axis address	○	○	○	○	
	32	Command pulse input maximum setup	○	—	—	○	
	33	Pulse regenerative output limit setup	○	○	○	○	4-61
	34	For manufacturer's use	—	—	—	—	
	35	Front panel lock setup	○	○	○	○	
	36	For manufacturer's use	—	—	—	—	
	37	Modbus connection setting	○	○	○	○	
	38	Modbus communication setting	○	○	○	○	
	39	Modbus response waiting time	○	○	○	○	4-62
	40	Modbus communication timeout time	○	○	○	○	
	41	For manufacturer use	—	—	—	—	
	42	Modbus broadcast setting	○	○	○	○	
	45	Quadrant projection positive direction compensation value	○	—	—	○	
	46	Quadrant projection negative direction compensation value	○	—	—	○	4-63
	47	Quadrant projection compensation delay time	○	—	—	○	
	48	Quadrant projection compensation filter setting L	○	—	—	○	
	49	Quadrant projection compensation filter setting H	○	—	—	○	
	50	For manufacturer's use	—	—	—	—	
	51	For manufacturer's use	—	—	—	—	
	52	For manufacturer's use	—	—	—	—	
	53	For manufacturer's use	—	—	—	—	4-64
	54	For manufacturer's use	—	—	—	—	
	55	For manufacturer's use	—	—	—	—	

Parametr No. Class	No.	Title	Related Control Mode P	S	T	F	Detail page
[Class 5] Enhancing setting	56	Slow stop deceleration time setting	○	—	—	—	
	57	Slow stop S-shape acceleration and deceleration setting	○	—	—	—	
	58	Modbus mirror register setting 1	○	○	○	○	4-64
	59	Modbus mirror register setting 2	○	○	○	○	
	60	Modbus mirror register setting 3	○	○	○	○	
	61	Modbus mirror register setting 4	○	○	○	○	
	62	Modbus mirror register setting 5	○	○	○	○	
	63	Modbus mirror register setting 6	○	○	○	○	
	64	Modbus mirror register setting 7	○	○	○	○	
	65	Modbus mirror register setting 8	○	○	○	○	
	66	Deterioration diagnosis convergence judgment time	○	○	○	○	4-65
	67	Deterioration diagnosis inertia ratio upper limit	○	○	○	○	
	68	Deterioration diagnosis inertia ratio lower limit	○	○	○	○	
	69	Deterioration diagnosis unbalanced load upper limit	○	○	○	○	
	70	Deterioration diagnosis unbalanced load lower limit	○	○	○	○	
	71	Deterioration diagnosis dynamic friction upper limit	○	○	○	○	
	72	Deterioration diagnosis dynamic friction lower limit	○	○	○	○	
	73	Deterioration diagnosis viscous friction upper limit	○	○	○	○	
	74	Deterioration diagnosis viscous friction lower limit	○	○	○	○	
	75	Deterioration diagnosis velocity setting	○	○	○	○	4-66
	76	Deterioration diagnosis torque average time	○	○	○	○	
	77	Deterioration diagnosis torque upper limit	○	○	○	○	
	78	Deterioration diagnosis torque lower limit	○	○	○	○	
	79	Modbus mirror register setting 9	○	○	○	○	
	80	Modbus mirror register setting 10	○	○	○	○	
	81	Modbus mirror register setting 11	○	○	○	○	
	82	Modbus mirror register setting 12	○	○	○	○	4-67
	83	Modbus mirror register setting 13	○	○	○	○	
	84	Modbus mirror register setting 14	○	○	○	○	
	85	Modbus mirror register setting 15	○	○	○	○	
	86	Modbus mirror register setting 16	○	○	○	○	
[Class 6] Special setting	00	Analog torque feed forward gain setting	○	○	—	○	
	02	Speed deviation excess setting	○	—	—	—	
	04	JOG trial run command speed	○	○	○	○	4-68
	05	Position 3rd gain valid time	○	—	—	○	
	06	Position 3rd gain scaling factor	○	—	—	○	
	07	Torque command additional value	○	○	—	○	
	08	Positive direction torque compensation value	○	—	—	○	4-69
	09	Negative direction torque compensation value	○	—	—	○	
	10	Function expansion setup	○	○	○	○	
	11	Current response setup	○	○	○	○	
	13	2nd Inertia ratio	○	○	○	○	
	14	Emergency stop time at alarm	○	○	○	○	
	15	2nd over-speed level setup	○	○	○	○	4-70
	16	For manufacturer's use	—	—	—	—	
	17	Front panel parameter writing selection	○	○	○	○	
	18	Power-up wait time	○	○	○	○	
	19	Encoder Z phase setup	—	—	—	○	
	20	Z-phase setup of external scale	—	—	—	○	4-71
	21	Serial absolute external scale Z phase setup	—	—	—	○	
	22	A, B phase external scale pulse output method selection	—	—	—	○	
	23	Disturbance torque compensating	○	○	—	—	4-72
	24	Disturbance observer filter	○	○	—	—	
	27	Warning latch time	○	○	○	○	
	28	Special function selection	○	—	—	—	
	30	For manufacturer use	—	—	—	—	4-73
	31	Real-time auto tuning estimation speed	○	○	○	○	
	32	Real-time auto tuning custom setting	○	○	○	○	4-74
	33	Manufacturer use	—	—	—	—	
	34	Hybrid vibration suppression gain	—	—	—	○	4-76
	35	Hybrid vibration suppression filter	—	—	—	○	

1. Details of parameter

List of Parameters

Class	No.	Title	P	S	T	F	Detail page
[Class 6] Special setting	36	Dynamic brake operation input	○	○	○	○	4-76
	37	Oscillation detection threshold value	○	○	○	○	
	38	Warning mask setting	○	○	○	○	4-77
	39	Manufacturer use	—	—	—	—	
	41	1st damping depth	○	—	—	○	
	42	Two-stage torque filter time constant	○	○	○	○	
	43	Two-stage torque filter damping term	○	○	○	○	
	47	Function expansion setting	○	○	○	○	4-78
	48	Adjustment filter	○	○	—	—	
	49	Command response filter/adjustment filter damping term setting	○	—	—	—	
	50	Viscous friction compensation gain	○	○	—	○	4-79
	51	Immediate stop completion wait time	○	○	○	○	
	52	Manufacturer use	—	—	—	—	
	53	Manufacturer use	—	—	—	—	
	54	Manufacturer use	—	—	—	—	
	57	Torque saturation error protection detection time	○	○	—	○	4-80
	58	Serial absolute external scale Z phase shift amount	○	○	○	○	
	60	2nd damping depth	○	—	—	○	
	61	1st resonance frequency	○	—	—	—	4-81
	62	1st resonance damping ratio	○	—	—	—	
	63	1st anti-resonance frequency	○	—	—	—	
	64	1st anti-resonance damping ratio	○	—	—	—	
	65	1st response frequency	○	—	—	—	
	66	2nd resonance frequency	○	—	—	—	
	67	2nd resonance damping ratio	○	—	—	—	
	68	2nd anti-resonance frequency	○	—	—	—	
	69	2nd antiresonance damping ratio	○	—	—	—	
	70	2nd response frequency	○	—	—	—	4-82
	71	3rd damping filter depth	○	—	—	○	
	72	4th damping filter depth	○	—	—	○	
	73	Load estimation filter	○	○	—	—	
	74	Torque compensating frequency 1	○	○	—	—	
	75	Torque compensating frequency 2	○	○	—	—	
	76	Number of load estimation	○	○	—	—	
	87	For manufacturer use	○	○	○	○	4-83
	88	Absolute multi-rotation data upper limit	○	○	○	○	
	97	Function expansion setting 3	○	○	○	○	
	98	Function expansion setting 4	○	○	○	○	
[Class 7] Special settin	00	For manufacturer's use	—	—	—	—	4-84
	01	For manufacturer's use	—	—	—	—	
	03	For manufacturer's use	—	—	—	—	
	04	For manufacturer's use	—	—	—	—	
	05	For manufacturer's use	—	—	—	—	
	06	For manufacturer's use	—	—	—	—	
	07	For manufacturer's use	—	—	—	—	
	08	For manufacturer's use	—	—	—	—	
	09	For manufacturer's use	—	—	—	—	
	10	For manufacturer's use	—	—	—	—	
	11	For manufacturer's use	—	—	—	—	
	12	For manufacturer's use	—	—	—	—	
	13	For manufacturer's use	—	—	—	—	
	14	Main power turn-off warning detection time	○	○	○	○	
	15	For manufacturer's use	—	—	—	—	
	16	For manufacturer's use	—	—	—	—	
	20	For manufacturer's use	—	—	—	—	
	21	For manufacturer's use	—	—	—	—	
	22	Special function enhancement setting 1	○	○	○	○	
	23	For manufacturer's use	—	—	—	—	
	24	For manufacturer's use	—	—	—	—	
	25	For manufacturer's use	—	—	—	—	
	26	For manufacturer's use	—	—	—	—	
	27	For manufacturer's use	—	—	—	—	
	28	For manufacturer's use	—	—	—	—	
	29	For manufacturer's use	—	—	—	—	
	30	For manufacturer's use	—	—	—	—	
	31	For manufacturer's use	—	—	—	—	

Class	No.	Title	P	S	T	F	Detail page
[Class 7] Special settin	32	For manufacturer's use	—	—	—	—	4-84
	33	For manufacturer's use	—	—	—	—	
	34	For manufacturer's use	—	—	—	—	
	35	For manufacturer's use	—	—	—	—	
	36	For manufacturer's use	—	—	—	—	
	37	For manufacturer's use	—	—	—	—	
	38	For manufacturer's use	—	—	—	—	
	39	For manufacturer's use	—	—	—	—	
	87	For manufacturer's use	—	—	—	—	
	91	For manufacturer's use	—	—	—	—	
	92	For manufacturer's use	—	—	—	—	
	93	For manufacturer's use	—	—	—	—	
[Class 8] Manufacturer use	00	For manufacturer's use	—	—	—	—	4-85
	01	For manufacturer's use	—	—	—	—	
	02	For manufacturer's use	—	—	—	—	
	03	For manufacturer's use	—	—	—	—	
	04	For manufacturer's use	—	—	—	—	
	05	For manufacturer's use	—	—	—	—	
	10	For manufacturer's use	—	—	—	—	
	12	For manufacturer's use	—	—	—	—	
	13	For manufacturer's use	—	—	—	—	
	14	For manufacturer's use	—	—	—	—	
	15	For manufacturer's use	—	—	—	—	
	19	For manufacturer's use	—	—	—	—	
[Class 9] Manufacturer use	00	For manufacturer's use	—	—	—	—	4-85
	01	For manufacturer's use	—	—	—	—	
	02	For manufacturer's use	—	—	—	—	
	03	For manufacturer's use	—	—	—	—	
	04	For manufacturer's use	—	—	—	—	
	05	For manufacturer's use	—	—	—	—	
	06	For manufacturer's use	—	—	—	—	
	07	For manufacturer's use	—	—	—	—	
	08	For manufacturer's use	—	—	—	—	
	09	For manufacturer's use	—	—	—	—	
	10	For manufacturer's use	—	—	—	—	
	11	For manufacturer's use	—	—	—	—	
	12	For manufacturer's use	—	—	—	—	
	13	For manufacturer's use	—	—	—	—	
	14	For manufacturer's use	—	—	—	—	
	17	For manufacturer's use	—	—	—	—	
	18	For manufacturer's use	—	—	—	—	
	19	For manufacturer's use	—	—	—	—	
	20	For manufacturer's use	—	—	—	—	
	21	For manufacturer's use	—	—	—	—	
	22	For manufacturer's use	—	—	—	—	
	23	For manufacturer's use	—	—	—	—	
	24	For manufacturer's use	—	—	—	—	
	25	For manufacturer's use	—	—	—	—	
	26	For manufacturer's use	—	—	—	—	
	27	For manufacturer's use	—	—	—	—	
	28	For manufacturer's use	—	—	—	—	
	29	For manufacturer's use	—	—	—	—	
	30	For manufacturer's use	—	—	—	—	
	48	For manufacturer's use	—	—	—	—	
	49	For manufacturer's use	—	—	—	—	
	50	For manufacturer's use	—	—	—	—	
[Class 15] Manufacturer use	00	For manufacturer's use	—	—	—	—	4-85
	16	For manufacturer's use	—	—	—	—	
	17	For manufacturer's use	—	—	—	—	
	30	For manufacturer's use	—	—	—	—	
	31	For manufacturer's use	—	—	—	—	
	33	For manufacturer's use	—	—	—	—	
	34	For manufacturer's use	—	—	—	—	
	35	For manufacturer's use	—	—	—	—	

1. Details of parameter

[Class 0] Basic setting

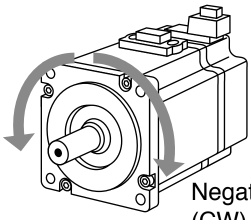
Default: [ ]

Pr0.00 *	Rotational direction setup	Range	Unit	Default	Related control mode
		0 to 1	—	1	P S T F

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)



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	Default	Related control mode
		0 to 6	—	0	P S T F

You can set up the control mode to be used.

Standard type and Communication type setting range is 0,1,3.

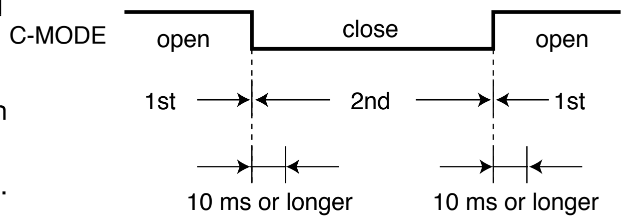
Setup value	Content	
	1st mode	2st mode
[0]	Position	—
1	Velocity	—
2	Torque	—
3 *1	Position	Velocity
4 *1	Position	Torque
5 *1	Velocity	Torque
6	Full-closed	—

Note

Two-degree-of-freedom control can be selected with Pr6.47.

For details, refer to Pr6.47 (P.4-64).

*1) When you set up the combination mode of 3, 4 or 5, you can select either the 1st or the 2nd with control mode switching input (C-MODE).
When C-MODE is open, the 1st mode will be selected.
When C-MODE is shorted, the 2nd mode will be selected.
Don't enter commands 10 ms before/after switching.



The waveform above shows when logical setting of C-MODE input is a-contact. When b-contact is used, open and short is reversed.

Note

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

• **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

• P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

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

You can 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	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.4-64).
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)

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of “ * ”**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... “Inputs and outputs on connector X4”

Default: [ ]

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

For Two-degree-of-freedom control mode, refer to Pr6.47 (P.4-64).
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	Default	Related control mode			
		0 to 31	—	A,B,C-frame: 13 D to F-frame: 11	P	S	T	F

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 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr0.04	Inertia ratio	Range	Unit	Default	Related control mode
		0 to 10000	%	250 *	P S T F

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.

Pr0.05 *	Selection of command pulse input	Range	Unit	Default	Related control mode
		0 to 2	—	0	P F

A6 according to pulse specifications,you can choose any one of the most appropriate interface from the two interfaces.
When using open collerctor I/F,Pr0.05=2 that is recommended.
For command pulse input ,you can select either the photocoupler input or the exclusive input for line driver as the command pulse input.

Setup value	Content	PIN NO.	Signal name
[0]	Photocoupler input Both line driver and open collector ・Line driver (Permissible max frequency inputs:500 kpps) ・Open collector (Permissible max. input frequency:200 kpps)	No.1 No.3 No.4 No.2 No.5 No.6	OPC1 PULS1 PULS2 OPC2 SIGN1 SIGN2
1	Exclusive input for line driver ・Line driver (Permissible max. input frequency:8 Mpps)	No.44 No.45 No.46 No.47	PULSH1 PULSH2 SIGNH1 SIGNH2
2	Photocoupler inputs ・Open collector (Permissible max. input frequency:200 kpps)	No.1 No.3 No.4 No.2 No.5 No.6	OPC1 PULS1 PULS2 OPC2 SIGN1 SIGN2

Pelese refer to P.3-37 and P.3-38.

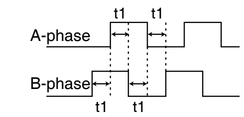
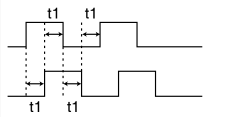
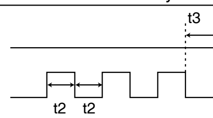
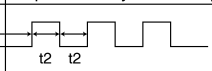
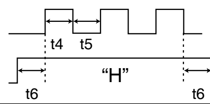
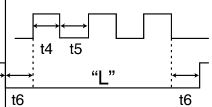
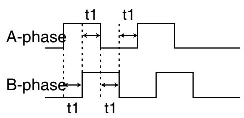
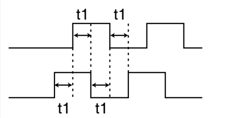
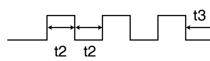
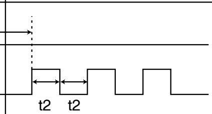
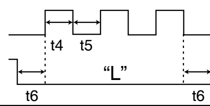
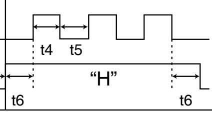
Default: [ ]

		Range	Unit	Default	Related control mode
Pr0.06 *	**Command pulse rotational direction setup**	0 to 1	—	0	P F
Pr0.07 *	**Command pulse input mode setup**	0 to 3	—	1	P F

You can set up the rotational direction against the command pulse input, and the command pulse input format.

The table below shows combinations of Pr0.06 Command pulse rotational direction setup and Pr0.07 Command pulse input mode setup.
Pulses are counted at edges indicated by the arrows as shown in the table.

• Input format command pulse

Pr0.06 setup value (Command pulse rotational direction setup)	Pr0.07 setup value (Command pulse input mode setup)	Command pulse format	Signal title	Positive direction command	Negative direction command
[0]	0 or 2	90˚ phase difference 2-phase pulse (A + B-phase)	PULS SIGN	 B-phase advances to A by 90˚.	 B-phase delays from A by 90˚.
	[1]	Positive direction pulse train + Negative direction pulse train	PULS SIGN		
	3	pulse train + Signal	PULS SIGN		
1	0 or 2	90˚ phase difference 2-phase pulse (A + B-phase)	PULS SIGN	 B-phase delays from A by 90˚.	 B-phase advances to A by 90˚.
	1	Positive direction pulse train + Negative direction pulse train	PULS SIGN		
	3	pulse train + Signal	PULS SIGN		

• Permissible max. input frequency, and min. necessary time width of command pulse input signal.

Input I/F of PULS/SIGN signal		Permissible max. input frequency	Min. necessary time width (μs)					
			t_1	t_2	t_3	t_4	t_5	t_6
PULSH1,2 SIGNH1,2	A,B-phase input,afer multiplied by 4	8 Mpps	0.125	0.125	0.125	0.125	0.125	0.125
	A,B-phase input except	4 Mpps	0.25	0.125	0.125	0.125	0.125	0.125
PULS1,2 SIGN1,2	Line driver interface	500 kpps	2	1	1	1	1	1
	Open collector interface	200 kpps	5	2.5	2.5	2.5	2.5	2.5

Make the rising/falling time of the command pulse input signal to 0.1 μs or smaller.
When parameter Pr0.07=0 or 2,if parameter Pr0.08=10000,2 phase pulse input 2500 pulse per one motor revolution.
When parameter Pr0.07=1 or 3,if parameter Pr0.08=10000,because of the rotation of a single pulse,so input 10000 pulse per one motor revolution.

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

1. Details of parameter

[Class 0] Basic setting

Default: [ ]

Pr0.08 *	Command pulse counts per one motor revolution	Range	Unit	Default	Related control mode			
		0 to 8388608	pulse	10000	P			

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.

Pr0.09	1st numerator of electronic gear	Range	Unit	Default	Related control mode			
		0 to 2^{30}	—	0	P			F

Set the numerator of division/multiplication operation made according to the command pulse input.
This setup is enabled when Pr0.08 command pulse counts per one motor revolution = 0.

Pr0.10	Denominator of electronic gear	Range	Unit	Default	Related control mode			
		1 to 2^{30}	—	10000	P			F

Set the Denominator of division/multiplication operation made according to the command pulse input.
This setup is enabled when Pr0.08 command pulse counts per one motor revolution = 0.

<Interrelationship between Pr0.08, Pr0.09 and Pr0.10 during Position control>

<table>
<tr><th>Pr0.08</th><th>Pr0.09</th><th>Pr0.10</th><th>Command division/multiplication operation</th></tr>
<tr><td>1 to 8388608</td><td>—
(Not effect)</td><td>—
(Not effect)</td><td>Command pulse input $\rightarrow \frac{\text{Encoder resolution}}{[\text{Pr0.08 setup value}]} \rightarrow$ Positional command
* Regardless of setup of Pr0.09 and Pr0.10, this operation is processed according to setup value of Pr0.08.</td></tr>
<tr><td rowspan="2">0</td><td>0</td><td>0 to 1073741824</td><td>Command pulse input $\rightarrow \frac{\text{Encoder resolution}}{[\text{Pr0.10 setup value}]} \rightarrow$ Positional command
* When both Pr0.08 and Pr0.09 are set to 0, this operation is processed according to setup value of Pr0.10.</td></tr>
<tr><td>1 to 1073741824</td><td>1 to 1073741824</td><td>Command pulse input $\rightarrow \frac{[\text{Pr0.09 setting}]}{[\text{Pr0.10 setting}]} \rightarrow$ Positional command
* When setup value of Pr0.08 is 0, and Pr0.09≠0, this operation is processed according to setup value of Pr0.09 and Pr0.10.</td></tr>
</table>

Related page
• P.4-90... “Setup of Motor Rotational Speed and Input Pulse Frequency”
• P.6-7, P.6-8... “Protective function (Detail of error code)”

Default: [ ]

■ 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 $\boxed{8388608}$	
	Pr0.10 $\boxed{5000}$	

<Interrelationship between Pr0.08, Pr0.09 and Pr0.10 during full closed control>

Pr0.08	Pr0.09	Pr0.10	Command division/multiplication operation
(Invalid)	**0**	**1 to 1073741824**	Command pulse input → $\frac{1}{1}$ → Positional command * If Pr0.09 is 0 during full closed controlling, the process as shown above is performed with both numerator and denominator set to 1.
	1 to 1073741824	**1 to 1073741824**	Command pulse input → $\frac{\text{[Pr0.09 setting]}}{\text{[Pr0.10 setting]}}$ → Positional command * When setup value of Pr0.09≠0, this operation is processed according to setup value of Pr0.09 and Pr0.10.

Caution 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.
During full closed controlling, do not change command division and multiplication ratio. Otherwise, Err25.0 (Hybrid over deviation alarm) will be generated.

Pr0.11 *	Output pulse counts per one motor revolution	Range	Unit	Default	Related control mode
		0 to 2097152	P/r	2500	P S T F

Caution You can set up the output pulse counts per one motor revolution for each OA and OB .
For details of setup, refer to description in Pr5.03.

Note
- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.4-90... "Setup of Motor Rotational Speed and Input Pulse Frequency"
- P.6-7, P.6-8... "Protective function (Detail of error code)"

Default: [ ]

Pr5.03 *	Denominator of pulse output division	Range	Unit	Default	Related control mode
		0 to 8388608	—	0	P S T F

For an application where the number of output pulses per one motor revolution is not an integer, set this parameter to a value other than 0; and the dividing ratio can be set by using Pr0.11 as the numerator and Pr5.03 as the denominator.

Output pulse counts per one revolution
= (Pr0.11 setup value / Pr5.03 setup value) × Encoder resolution × $\frac{1}{4}$

<Combination of Pr0.11 Output pulse counts per one motor revolution and Pr5.03 Denominator of pulse output division>

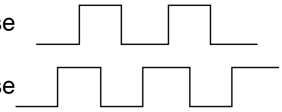
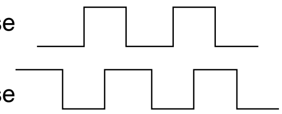
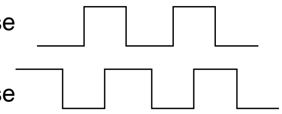
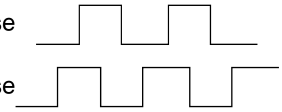
<table>
<tr><th>Pr0.11</th><th>Pr5.03</th><th>Pulse reproducing process</th></tr>
<tr><td rowspan="2">1 to 2097152</td><td>[0]</td><td>When the output source is encoder
Encoder feedback pulse [pulse] → $\frac{\text{[Pr0.11 setup value]×4}}{\text{Encoder resolution}}$ → Output pulse [pulse]
* When Pr5.03 = 0, the above process is made according to Pr0.11 setup value.
The number of pulses of reproduced pulse output OA and OB are the number of pulses set in Pr0.11. The resolution of pulse output per one revolution is equal to or less the encoder resolution.
When the output source is external scale
External scale pulse [pulse] → $\frac{1}{1}$ → Output pulse [pulse]
* Division ratio is 1:1.</td></tr>
<tr><td>1 to 8388608</td><td>Encoder feedback pulse or external scale pulse [pulse] → $\frac{\text{[Pr0.11 setup value]}}{\text{[Pr5.03 setup value]}}$ → Output pulse [pulse]
* If Pr5.03 is not equal to 0, then the above process is performed based on setup value of Pr0.11 and Pr5.03.
When the output source is encoder
The number of reproduced pulses (OA, OB) per one motor revolution is not an integer.
Note that when the number of pulses per one motor revolution is not an integer, Z-phase output is not synchronized with that of A-phase, reducing pulse width. The pulse output resolution per one revolution cannot become higher than the encoder resolution.
When output source is external scale
Setting:
numerator (Pr0.11 setting) ≦ denominator (Pr.5.03 setting).
No multiplication
per one revolution cannot become higher than the external scale resolution.</td></tr>
</table>

Default: [ ]

Pr0.12 *	Reversal of pulse output logic	Range	Unit	Default	Related control mode
		0 to 3	—	0	P S T F

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. Encoder or external scale can be selected as the output source for full-closed control. The encoder is selected as the source if not for full-closed control.

<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 
2		External scale		
1	Reversal	Encoder	A-phase B-phase 	A-phase B-phase 
3		External scale		

Caution

Setup value 2 and 3 are valid only for full-closed control. Setting must be 0 or 1 if not for full-closed control.
The selection of the output source of Z-phase is held concurrently.
Setup value 0 and 1 are Z-phase output of encoder.
Setup value 2 and 3 are Z-phase output of external scale.

Pr0.13	1st torque limit	Range	Unit	Default	Related control mode
		0 to 500	%	500	P S T F

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

Note

For details of torque limit value, refer to P.2-84.

Pr0.14	Position deviation excess setup	Range	Unit	Default	Related control mode
		0 to 1073741824	Command unit	100000	P F

- 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 and with the external scale pulse counts at the full-closed 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.4-58 “Pr5.20”.

Pr0.15 *	Absolute encoder setup	Range	Unit	Default	Related control mode
		0 to 2	—	1	P S T F

You can set up the using method of 23-bit absolute encoder.

Setup value	Function
0	Used as absolute system .
[1]	Used as incremental system .
2	Used as absolute system (absolute mode), but multirotation counter over is ignored.
3	Used as 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)

Default: [ ]

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

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 P and B of Connector XB in case of A to D-frame, between P and B of Connector XC in case of E-frame, between P and B of terminal block in case of F-frame).
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, never to set up other value than 0. Don't 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	Default	Related control mode			
		0 to 4	—	0	P	S	T	F

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

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	Default	Related control mode			
		—	—	0				

Pleses fixed to 0.

Note

• A parameter is designated as follows: Class Pr0.00 Parameter No.
• **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

• P.2-12... "System Configuration and Wiring" • P.3-32... "Inputs and outputs on connector X4"

1. Details of parameter

[Class 1] Gain adjustment

Default: [ ]

Pr1.00	1st gain of position loop	Range	Unit	Default	Related control mode			
		0 to 30000	0.1 /s	A,B,C-frame: 480 D to F-frame: 320	P			F

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	Default	Related control mode			
		1 to 32767	0.1 Hz	A,B,C-frame: 270 D to -frame: 180	P	S	T	F

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	Default	Related control mode			
		1 to 10000	0.1 ms	A,B,C-frame: 210 D to F-frame: 310	P	S	T	F

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	Default	Related control mode			
		0 to 5	—	0	P	S	T	F

You can set up the time constant of the low pass filter (LPF) after the speed detection, in 6 steps.
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	Default	Related control mode			
		0 to 2500	0.01 ms	A,B,C-frame: 84 D to H-frame: 126	P	S	T	F

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
  CAUTION: Parameter settings shown in this manual may differ from those applied to your product (s).

Note
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page
- P.3-32... "Inputs and outputs on connector X4"

Parameter	Name	Range	Unit	Default	Related control mode
Pr1.05	2nd gain of position loop	0 to 30000	0.1 /s	A,B,C-frame: 480 D to F-frame: 320	P F
Pr1.06	2nd gain of velocity loop	1 to 32767	0.1 Hz	A,B,C-frame: 270 D to F-frame: 180	P S T F
Pr1.07	2nd time constant of velocity loop integration	1 to 10000	0.1 ms	A,B,C-frame: 210 D to F-frame: 310	P S T F
Pr1.08	2nd filter of speed detection	0 to 5	—	0	P S T F
Pr1.09	2nd time constant of torque filter	0 to 2500	0.01 ms	A,B,C-frame: 84 D to F-frame: 126	P S T F

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.5-34 "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	Default	Related control mode
Pr1.10	Velocity feed forward gain	0 to 4000	0.1 %	1000	P F

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.

Parameter	Name	Range	Unit	Default	Related control mode
Pr1.11	Velocity feed forward filter	0 to 6400	0.01 ms	0	P F

Set the time constant of 1st delay filter which affects the input of velocity feed forward.

<Usage example of velocity feed forward>

The velocity feed forward will become effective as the velocity feed forward gain is gradually increased with the velocity feed forward filter set at approx. 50 (0.5 ms). 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

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr1.12	Torque feed forward gain	Range	Unit	Default	Related control mode
		0 to 2000	0.1 %	1000	P S F

- 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.
- 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.

Pr1.13	Torque feed forward filter	Range	Unit	Default	Related control mode
		0 to 6400	0.01 ms	0	P S F

- Set up the time constant of 1st delay filter which affects the input of torque feed forward.
- 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).

<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 Pr0.04 Inertia ratio.
- 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).
- 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 .

Caution: Zero positional deviation is impossible in actual situation because of disturbance torque.
As with the velocity feed forward, large torque feed forward filter time constant decreases the operating noise but increases positional deviation at acceleration change point.

Pr1.14	2nd gain setup	Range	Unit	Default	Related control mode
		0 to 1	—	1	P S T F

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 the gain switching input (GAIN), change the velocity loop operation from PI to P. GAIN input photocoupler OFF → PI operation GAIN input photocoupler ON → P operation * The above description applies when the logical setting of GAIN input is a-contact. ON/OFF of photocoupler is reversed when b-contact.
[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.5-31 "Gain Switching Function" of Adjustment.

Default: [ ]

Pr1.15	Mode of position control switching	Range	Unit	Default	Related control mode
		0 to 10	—	0	P F

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	With gain switching input	• 1st gain when the gain switching input (GAIN) is open. • 2nd gain when the gain switching input (GAIN) is connected to COM-. * If no input signal is allocated to the gain switching input (GAIN), the 1st gain is fixed.
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	• Valid for position and full-closed controls. • 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	• Valid for position and full-closed controls. • 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	• Valid for position and full-closed controls. • 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	• Valid for position and full-closed controls. • 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	• Valid for position and full-closed controls. • 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	• Valid for position and full-closed controls. • 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.

Pr1.16	Delay time of position control switching	Range	Unit	Default	Related control mode
		0 to 10000	0.1 ms	10	P F

For position controlling : When shifting from the 2nd gain to the 1st gain with Pr1.15 Position control switching mode set at 3, 5, 6, 7, 8, 9 or 10, set up the delay time from trigger detection to the switching operation.

Note

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

• **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

• P.3-32... "Inputs and outputs on connector X4"

Pr1.17	Level of position control switching	Range	Unit	Default	Related control mode		
		0 to 20000	Mode-dependent	0	P		F

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.

Pr1.18	Hysteresis at position control switching	Range	Unit	Default	Related control mode		
		0 to 20000	Mode-dependent	0	P		F

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.

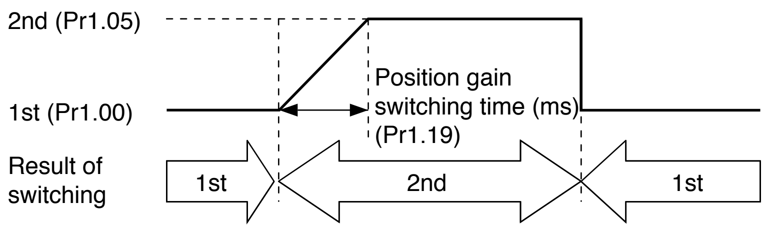
Pr1.19	Position gain switching time	Range	Unit	Default	Related control mode		
		0 to 10000	0.1 ms	10	P		F

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)



Note
- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page
- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr1.20	Mode of velocity control switching	Range	Unit	Default	Related control mode
		0 to 5	—	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	Gain switching input	• 1st gain when the gain switching input (GAIN) is open. • 2nd gain when the gain switching input (GAIN) is connected to COM–. * If no input signal is allocated to the gain switching input (GAIN), the 1st gain is fixed.
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.	• Valid only during velocity control. • 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	• Valid for velocity controls. • 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 For the switching level and timing, refer to P.5-32, "Setup of Gain Switching Condition" of Adjustment.

Pr1.21	Delay time of velocity control switching	Range	Unit	Default	Related control mode
		0 to 10000	0.1 ms	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, 4 or 5, set the delay time from trigger detection to the switching operation.

Pr1.22	Level of velocity control switching	Range	Unit	Default	Related control mode
		0 to 20000	Mode-dependent	0	S

For velocity controlling: Set up triggering level when Pr1.20 Velocity control gain switching mode is set at 3, 4 or 5.

Caution

Unit of setting varies with switching mode.
Set the level equal to or higher than the hysteresis.

Note

• A parameter is designated as follows: Class Pr0.00 Parameter No.
• **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page
• P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr1.23	Hysteresis at velocity control switching	Range	Unit	Default	Related control mode
		0 to 20000	Mode-dependent	0	S

For velocity controlling: Set up triggering hysteresis when Pr1.20 Velocity control gain switching mode is set at 3, 4 or 5.

Caution: Unit of setting varies with switching mode.
When level < hysteresis, the hysteresis is internally adjusted so that it is equal to level.

Pr1.24	Mode of torque control switching	Range	Unit	Default	Related control mode
		0 to 3	—	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	Gain switching input	• 1st gain when the gain switching input (GAIN) is open. • 2nd gain when the gain switching input (GAIN) is connected to COM–. * If no input signal is allocated to the gain switching input (GAIN), the 1st gain is fixed.
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.

Pr1.25	Delay time of torque control switching	Range	Unit	Default	Related control mode
		0 to 10000	0.1 ms	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.

Pr1.26	Level of torque control switching	Range	Unit	Default	Related control mode
		0 to 20000	Mode-dependent	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.

Pr1.27	Hysteresis at torque control switching	Range	Unit	Default	Related control mode
		0 to 20000	Mode-dependent	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.

From Pr1.28 toPr1.78 are all parameters for manufacturer's use.Please do not change the default parameters.

[Class 2] Damping control

Default: [ ]

Pr2.00	Adaptive filter mode setup	Range	Unit	Default	Related control mode
		0 to 6	—	Basic type:1 Communication type:1 Multifunction typ:0	P S F

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.

Pr2.01	1st notch frequency	Range	Unit	Default	Related control mode
		50 to 5000	Hz	5000	P S T F

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	Default	Related control mode
		0 to 20	—	2	P S T F

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	Default	Related control mode
		0 to 99	—	0	P S T F

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.

Pr2.04	2nd notch frequency	Range	Unit	Default	Related control mode
		50 to 5000	Hz	5000	P S T F

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	Default	Related control mode
		0 to 20	—	2	P S T F

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	Default	Related control mode
		0 to 99	—	0	P S T F

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	Default	Related control mode
		50 to 5000	Hz	5000	P S T F

Notch frequency is automatically set to the 1st resonance frequency estimated by the adaptive filter.

Caution: In no resonance point is found, the frequency is set to 5000.

Pr2.08	3rd notch width selection	Range	Unit	Default	Related control mode
		0 to 20	—	2	P S T F

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	Default	Related control mode
		0 to 99	—	0	P S T F

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.

Pr2.10	4th notch frequency	Range	Unit	Default	Related control mode
		50 to 5000	Hz	5000	P S T F

Notch frequency is automatically set to the 2nd resonance frequency estimated by the adaptive filter.

Caution: The notch filter function will be invalidated by setting up this parameter to "5000".

Pr2.11	4th notch width selection	Range	Unit	Default	Related control mode
		0 to 20	—	2	P S T F

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.

Note
- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page
- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr2.12	4th notch depth selection	Range	Unit	Default	Related control mode
		0 to 99	—	0	P S T F

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.

Pr2.13	Selection of damping filter switching	Range	Unit	Default	Related control mode
		0 to 6	—	0	P F

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.
- When setup value is 1 or 2: Select the filter with external input(s) (VS-SEL1 and/or VS-SEL2).

Setup value	VS-SEL2	VS-SEL1	1st damping	2nd damping	3rd damping	4th damping
[0]	—	—	○	○		
1	—	OFF	○		○	
	—	ON		○		○
2	OFF	OFF	○			
	OFF	ON		○		
	ON	OFF			○	
	ON	ON				○

- 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	VS-SEL1	1st model	2nd model	3st model	4st model
4	—	○	○	○	
5,6		Same action as set value 0			

- Position control (Two degree-of-freedom control mode enabled).

Setup value	VS-SEL1	1st model	2nd model
4	—	○	○
5	OFF	○	
	ON		○

Setup value	Position command direction	1st model	2nd model
6	Positive direction	○	
	Negative direction		○

- full-close control

Setup value	1st model	2nd model	3st model	4st model
4 to 6	○	○		

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.

Default: [ ]

Pr2.14	1st damping frequency	Range	Unit	Default	Related control mode			
		0 to 3000	0.1 Hz	0	P			F

Pr2.16	2nd damping frequency	Range	Unit	Default	Related control mode			
		0 to 3000	0.1 Hz	0	P			F

Pr2.18	3rd damping frequency	Range	Unit	Default	Related control mode			
		0 to 3000	0.1 Hz	0	P			F

Pr2.20	4th damping frequency	Range	Unit	Default	Related control mode			
		0 to 3000	0.1 Hz	0	P			F

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 1.0 to 300.0[Hz]. Setup of 0 to 9 becomes invalid.

Related page Refer to P.5-37, "Suppression of Machine Resonance" as well before using this parameter.

Pr2.15	1st damping filter setup	Range	Unit	Default	Related control mode			
		0 to 1500	0.1 Hz	0	P			F

Pr2.17	2nd damping filter setup	Range	Unit	Default	Related control mode			
		0 to 1500	0.1 Hz	0	P			F

Pr2.19	3rd damping filter setup	Range	Unit	Default	Related control mode			
		0 to 1500	0.1 Hz	0	P			F

Pr2.21	4th damping filter setup	Range	Unit	Default	Related control mode			
		0 to 1500	0.1 Hz	0	P			F

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.5-41, "Damping control" as well before using this parameter.

Note
- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page
- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

		Range	Unit	Default	Related control mode			
Pr2.22	Command smoothing filter	0 to 10000	0.1 ms	A,B,C-frame: 92 D to F-frame: 139	P			F

[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).*

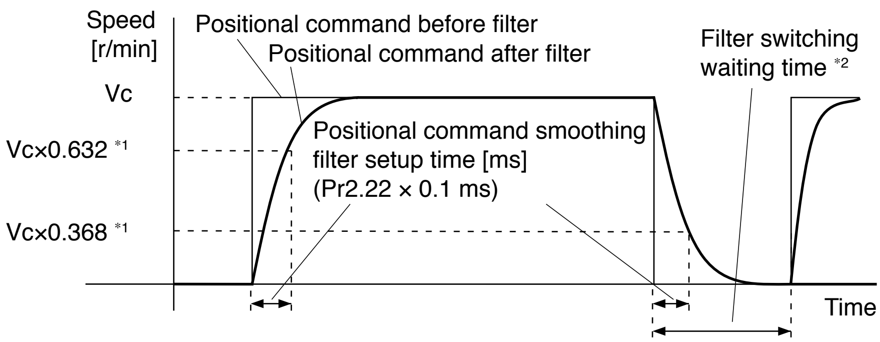
Related page For Two-degree-of-freedom control mode, refer to Pr6.47 (P.4-78).

[Full-closed control mode]

- Always set the time constant of the 1st delay filter in response to the positional command.

* 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 Parameter No.
- **For parameters which No. have a suffix of “ * ”**, changed contents will be validated when you turn on the control power.

Related page
- P.3-32... “Inputs and outputs on connector X4”

Default: [ ]

Pr2.23	Command FIR filter	Range	Unit	Default	Related control mode
		0 to 10000	0.1 ms	10	P F

[Position control mode / Full-closed control mode]

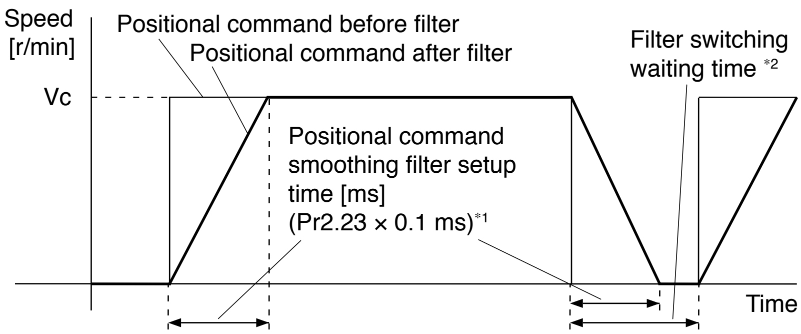
- Set up the time constant of FIR filter in response to the command.

[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.4-78).

- 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.

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page
• P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr2.24	5th notch frequency	Range	Unit	Default	Related control mode
		50 to 5000	Hz	5000	P S T F

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	Default	Related control mode
		0 to 20	—	2	P S T F

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	Default	Related control mode
		0 to 99	—	0	P S T F

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	Default	Related control mode
		0 to 1000	—	0	P F

To conduct fine tuning of 1st vibration suppression control function.

Pr2.28	2nd vibration control width setting	Range	Unit	Default	Related control mode
		0 to 1000	—	0	P F

To conduct fine tuning of 2nd vibration suppression control function.

Pr2.29	3rd vibration control width setting	Range	Unit	Default	Related control mode
		0 to 1000	—	0	P F

To conduct fine tuning of 3rd vibration suppression control function.

Pr2.30	4th vibration control width setting	Range	Unit	Default	Related control mode
		0 to 1000	—	0	P F

To conduct fine tuning of 4th vibration suppression control function.

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

		Range	Unit	Default	Related control mode
Pr2.31	**For manufacturer use**	—	—	0	
Pr2.32	**For manufacturer use**	—	—	0	
Pr2.33	**For manufacturer use**	—	—	0	
Pr2.34	**For manufacturer use**	—	—	0	
Pr2.34	**For manufacturer use**	—	—	0	
Pr2.36	**For manufacturer use**	—	—	0	
Pr2.37	**For manufacturer's use**	—	—	0	

Pleses fixed to 0.

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

1. Details of parameter

[Class 3] Velocity/ Torque/ Full-closed control

Default: [ ]

Pr3.00	Speed setup, Internal/External switching	Range	Unit	Default	Related control mode		
		0 to 3	—	Basic type:1 Communication type:1 Multifunction typ:0	S		

This driver is equipped with internal speed setup function so that you can control the speed with contact inputs only.

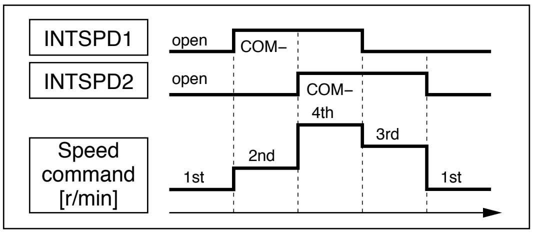
Setup value	Speed setup method
[0]	Analog speed command (SPR)
1	Internal speed command 1st to 4th speed (Pr3.04 to Pr3.07)
2	Internal speed command 1st to 3rd speed (Pr3.04 to Pr3.06), Analog speed command (SPR)
3	Internal speed command 1st to 8th speed (Pr3.04 to Pr3.11)

<Relationship between Pr3.00 Internal/external switching speed setup and the internal command speed selection 1, 2 and 3, and speed command to be selected>

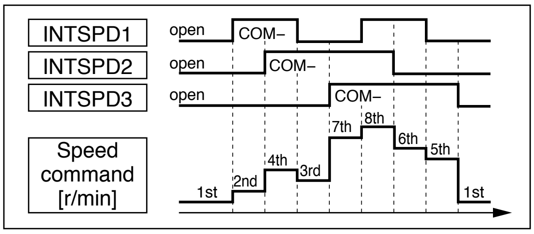
Setup value	Selection 1 of internal command speed (INTSPD1)	Selection 2 of internal command speed (INTSPD2)	Selection 3 of internal command speed (INTSPD3)	Selection of Speed command
1	OFF	OFF	No effect	1st speed
	ON	OFF		2nd speed
	OFF	ON		3rd speed
	ON	ON		4th speed
2	OFF	OFF	No effect	1st speed
	ON	OFF		2nd speed
	OFF	ON		3rd speed
	ON	ON		Analog speed command
3	The same as Pr3.00=1		OFF	1st to 4th speed
	OFF	OFF	ON	5th speed
	ON	OFF	ON	6th speed
	OFF	ON	ON	7th speed
	ON	ON	ON	8th speed

Caution

Internal command speed switching pattern should be so arranged as shown below that single input signals are selected alternately. If 2 or more input signals are selected simultaneously, unspecified internal command speed may be advertently selected, whose setting value and acceleration/deceleration setting will cause unexpected operation.



Example 1) When Pr3.00=1 or 2



Example 2) When Pr3.00=3

Pr3.01	Speed command rotational direction selection	Range	Unit	Default	Related control mode		
		0 to 1	—	0		S	

Select the Positive/Negative direction specifying method.

Setup value	Select speed command sign (1st to 8th speed)	Speed command direction (VC-SIGN)	Position command direction
[0]	+	No effect	Positive direction
	–	No effect	Negative direction
1	Sign has no effect.	OFF	Positive direction
	Sign has no effect.	ON	Negative direction

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

Default: [ ]

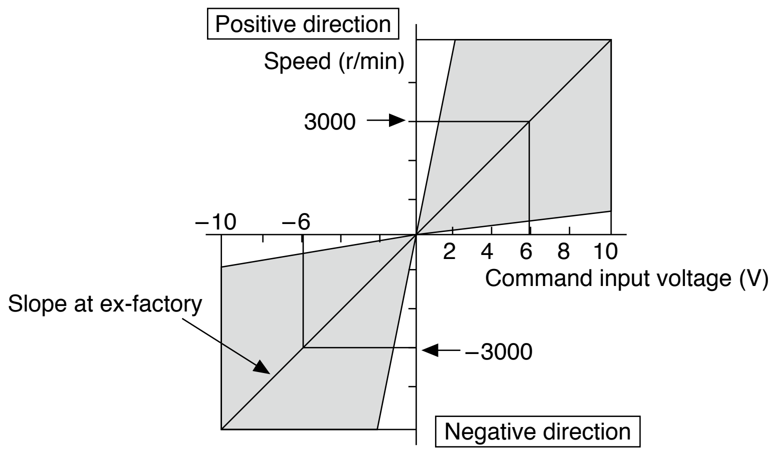
Pr3.02	Input gain of speed command	Range	Unit	Default	Related control mode
		10 to 2000	(r/min)/V	500	S T

Based on the voltage applied to the analog speed command (SPR), set up the conversion gain to motor command speed.

- You can set up a "slope" of the relation between the command input voltage and the motor speed, with Pr3.02.
- Default is set to Pr3.02=500 [r/min], hence input of 6V becomes 3000 r/min.

Caution

1. Do not apply more than ±10 V to the speed command input (SPR).
2. When you compose a position loop outside of the driver while you use the driver in velocity control mode, the setup of Pr3.02 gives larger variance to the overall servo system.
   Pay an extra attention to oscillation caused by larger setup of Pr3.02.



Pr3.03	Reversal of speed command input	Range	Unit	Default	Related control mode
		0 to 1	—	1	S

Specify the polarity of the voltage applied to the analog speed command (SPR).

Setup value	Motor rotating direction	
0	Non-reversal	“+Voltage” → “Positive direction”, “–Voltage” → “Negative direction”
[1]	Reversal	“+Voltage” → “Negative direction”, “–Voltage” → “Positive direction”

Note: Default of this parameter is 1, and the motor turns to CW with (+) signal, this has compatibility to existing MINAS series driver.

Caution: When you compose the servo drive system with this driver set to velocity control mode and external positioning unit, the motor might perform an abnormal action if the polarity of the speed command signal from the unit and the polarity of this parameter setup does not match.

Note
- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of “ * ”**, changed contents will be validated when you turn on the control power.

Related page
- P.3-32... “Inputs and outputs on connector X4”

Default: [ ]

Parameter	Name	Range	Unit	Default	Related control mode
Pr3.04	**1st speed of speed setup**	–20000 to 20000	r/min	0	S
Pr3.05	**2nd speed of speed setup**	–20000 to 20000	r/min	0	S
Pr3.06	**3rd speed of speed setup**	–20000 to 20000	r/min	0	S
Pr3.07	**4th speed of speed setup**	–20000 to 20000	r/min	0	S
Pr3.08	**5th speed of speed setup**	–20000 to 20000	r/min	0	S
Pr3.09	**6th speed of speed setup**	–20000 to 20000	r/min	0	S
Pr3.10	**7th speed of speed setup**	–20000 to 20000	r/min	0	S
Pr3.11	**8th speed of speed setup**	–20000 to 20000	r/min	0	S

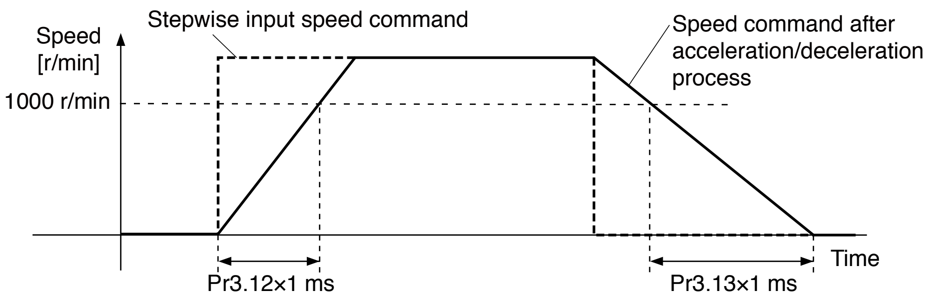
Set up internal command speeds, 1st to 8th.

Parameter	Name	Range	Unit	Default	Related control mode
Pr3.12	**Acceleration time setup**	0 to 10000	ms/ (1000 r/min)	0	S
Pr3.13	**Deceleration time setup**	0 to 10000	ms/ (1000 r/min)	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



Caution When the speed difference between the speed command being selected and the speed command after acceleration/deceleration indicates the same direction as that of the speed command applied after acceleration/deceleration, result is “acceleration” and if the reverse direction, the result is “deceleration”.

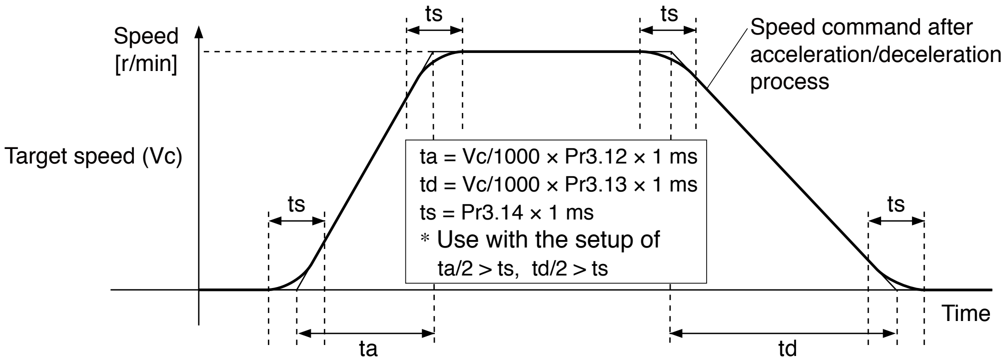
Note
- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of “ * ”**, changed contents will be validated when you turn on the control power.

Related page
- P.3-32... “Inputs and outputs on connector X4”

Default: [ ]

Pr3.14	Sigmoid acceleration/ deceleration time setup	Range	Unit	Default	Related control mode
		0 to 1000	ms	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.



Pr3.15	Speed zero-clamp function selection	Range	Unit	Default	Related control mode
		0 to 3	—	0	S T

You can set up the function of the speed zero clamp input.

Setup value	Function of ZEROSPD (Pin-26)
[0]	Invalid: Speed zero-clamp input is ignored.
1	Speed command is forced to 0 when the speed zero clamp (ZEROSPD) input signal is turned ON [*1].
2	Speed command is forced to 0 when the speed zero clamp (ZEROSPD) input signal is turned ON [*1]. And when the actual motor speed drops to Pr3.16 Speed zero clamp level or below, the position control is selected and servo lock is activated at this point. The fundamental operations except for this function (switching to the position control) are identical to those when setup value is 1.

Note

*1 The default logic is b-contact: the function is enabled while the terminal is open (input signal is ON). Refer to P.3-39 Control input.

Pr3.16	Speed zero clamp level	Range	Unit	Default	Related control mode
		10 to 20000	r/min	30	S T

Select the timing at which the position control is activated as the Pr3.15 Speed zero-clamp function selection is set to 2.

Default: [ ]

Pr3.17	Selection of torque command	Range	Unit	Default	Related control mode
		0 to 2	—	0	T

You can select the input of the torque command and the speed limit.

Setup value	Torque command input	Velocity limit input
[0]	Analog input 1 *1 (AI1, 16-bit resolution)	Parameter value (Pr3.25)
1	Analog input 2 (AI2, 12-bit resolution)	Analog input 1 (AI1, 16-bit resolution)
2	Analog input 1 *1 (AI1, 16-bit resolution)	Parameter value (Pr3.21, Pr3.22)

*1 For Pr0.01 Control mode setup = 5 (velocity/torque control), the torque command input is the analog input 2 (AI2, 12-bit resolution).

Pr3.18	Torque command direction selection	Range	Unit	Default	Related control mode
		0 to 1	—	0	T

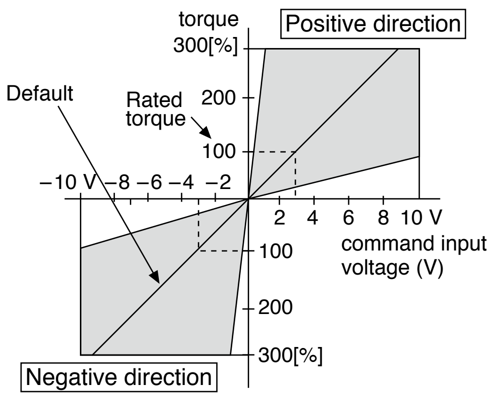
Select the direction positive/negative direction of torque command.

Setup value	Designation
[0]	Specify the direction with the sign of torque command. Example: Torque command input (+) for positive direction, (–) for negative direction
1	Specify the direction with torque command sign (TC-SIGN). OFF: Positive direction, ON: Negative direction

Pr3.19	Input gain of torque command	Range	Unit	Default	Related control mode
		10 to 100	0.1 V/100 %	30	T

Based on the voltage (V) applied to the analog torque command (TRQR), set up the conversion gain to torque command (%).

- Unit of the setup value is [0.1 V/100 %] and set up input voltage necessary to produce the rated torque.
- Default setup of 30 represents 3 V/100 %.



Default: [ ]

Pr3.20	Input reversal of torque command	Range	Unit	Default	Related control mode
		0 to 1	—	0	T

Set up the polarity of the voltage applied to the analog torque command (TRQR).

Setup value	Direction of motor output torque	
[0]	Non-reversal	“+Voltage” → “Positive direction”, “–Voltage” → “Negative direction”
1	Reversal	“+Voltage” → “Negative direction”, “–Voltage” → “Positive direction”

Pr3.21	Speed limit value 1	Range	Unit	Default	Related control mode
		0 to 20000	r/min	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.
When Pr3.17 = 2, the speed limit is applied upon receiving positive direction command.

Pr3.22	Speed limit value 2	Range	Unit	Default	Related control mode
		0 to 20000	r/min	0	T

Speed limit value of negative direction command when Pr3.17 = 2.

Pr3.17	Pr3.21	Pr3.22	Pr3.15	Speed zero clamp (ZEROSPD)	Analog torque command direction	Speed limit value
0	0 to 20000	No effect	0	No effect	No effect	Pr3.21 setup value
			1 to 3	OFF		Pr3.21 setup value
				ON		0
2	**0 to 20000**	**0 to 20000**	**0**	No effect	Positive direction	Pr3.21 setup value
					Negative direction	Pr3.22 setup value
	0 to 20000	0 to 20000	1 to 3	OFF	Positive direction	Pr3.21 setup value
					Negative direction	Pr3.22 setup value
	0 to 20000	0 to 20000	1 to 3	ON	No effect	0

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of “ * ”**, changed contents will be validated when you turn on the control power.

Related page
- P.3-32... “Inputs and outputs on connector X4” • P.6-2 “Protective Function”

Default: [ ]

Pr3.23 *	External scale selection	Range	Unit	Default	Related control mode
		0 to 6	—	0	P S T F

Select the type of external scale.

Setup value	External scale type	Compatible scale	Compatible speed
[0]	A,B phase output type *1	External scale of A, B phase output type	to 4 Mpps (after quadrupled)
1	Serial communication type (incremental version) *1	Magnescale Co., Ltd. NIDEC Sankyo Corporation	to 4 Gpulse/s
2	Serial communication type (absolute version) *1	Mitsutoyo Corporation Magnescale Co., Ltd. Heidenhein Renishaw PLC Fagor Automation S.Coop	to 4 Gpulse/s
3 to 6	For manufacturer use	—	—

*1 Connect the external scale so that it increments the count as the motor shaft turns positive direction, and decrements as the shaft turns negative direction. If this connection arrangement is impossible due to installation condition, etc., use the count reverse function of Pr3.26 Reversal of direction of external scale.

Caution When the setup value is 1 or 2 while the A, B phase output type is connected, Err50.0 External scale wiring error protection occurs, and if the setup value is 0 while the serial communication type is connected, Err55.0, 1 or 2 A phase, B phase or Z phase wiring error protection will occur.

Pr3.24 *	Numerator of external scale division	Range	Unit	Default	Related control mode
		0 to 8388608	—	0	F

Set up the numerator of the external scale dividing setup.
When setup value = 0, encoder resolution is used as numerator of the division.

Pr3.25 *	Denominator of external scale division	Range	Unit	Default	Related control mode
		1 to 8388608	—	10000	F

- Check the number of encoder feedback pluses per one motor revolution and the number of external scale pulses per one motor revolution, and then set up the numerator of external scale division (Pr3.24) and the denominator of external scale division (Pr3.25) to establish the expression shown below.
- With Pr3.24 set at 0, the encoder resolution is automatically used as numerator.

Example: When ball screw pitch is 10 mm, scale 0.1 μm/pulse, encoder resolution 23 bits (8388608 pulses);

$$\frac{\text{Pr3.24 } \boxed{8388608}}{\text{Pr3.25 } \boxed{100000}} = \frac{\text{Encoder resolution per one motor revolution [pulse]}}{\text{External scale resolution per one motor revolution [pulse]}}$$

Caution If this ratio is wrong, the difference between the position calculated based on the encoder pulses and the position calculated based on the external scale pulses becomes large over a long travel distance and will activate the excess hybrid deviation error protection.

Default: [ ]

Pr3.26 *	Reversal of direction of external scale	Range	Unit	Default	Related control mode
		0 to 3	—	0	P S T F

Reverse the direction of external scale, feedback counter.

Setup value	Content
[0]	Count value of external scale can be used as it is.
1	Sign (positive/negative) of count value of external scale should be inverted.
2 to 3	For manufacturer use

Note For setting method of this parameter, refer to P.3-12 Full closed control mode.

Pr3.27 *	External scale Z phase disconnection detection disable	Range	Unit	Default	Related control mode
		0 to 1	—	0	F

Enable/disable Z-phase disconnection detection when A, B phase output type external scale is used.

Setup value	Content
[0]	Valid
1	Invalid

Pr3.28 *	Hybrid deviation excess setup	Range	Unit	Default	Related control mode
		1 to 134217728	Command unit	16000	F

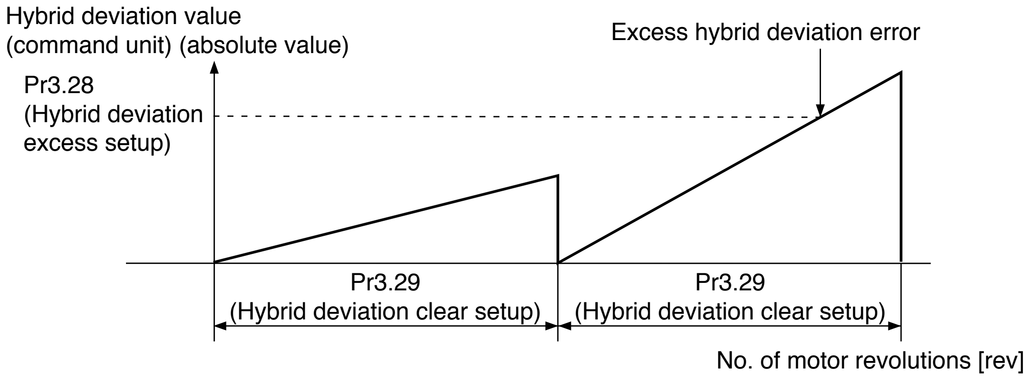
You can setup the permissible gap (hybrid deviation) between the present motor position and the present external scale position.

Pr3.29 *	Hybrid deviation clear setup	Range	Unit	Default	Related control mode
		0 to 100	Revolution	0	F

As the motor turns the number of revolutions set by this parameter, the hybrid deviation is cleared to 0. No clearing is made with setup value 0.

<Hybrid deviation clear feature>

As the motor reaches the number of revolutions set by Pr3.29 Hybrid deviation clear setup, clear the hybrid deviation to 0. This feature allows the motor to be used in an application where hybrid deviation accumulate due to slippage, etc.



Note: Revolution in the hybrid deviation clear setup is counted by using encoder feedback pulses.

Caution To use the hybrid deviation clear, be sure to set Pr3.29 Hybrid deviation clear setup to the appropriate value. If the setup value is too small with respect to the value of Pr3.28 Hybrid deviation excess setup, abnormal operation due to e.g. external scale connection error cannot be protected.

Limit sensor should be used to assure safety.

1. Details of parameter

[Class 4] I/F monitor setting

Default: [ ]

Pr4.00 *	SI1 input selection	Range	Unit	Default	Related control mode			
		0 to 00FFFFFFh	—	00828282h (8553090)	P	S	T	F

Assign functions to SI1 inputs.These parameters are presented in hexadecimals. *5
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
Servo-ON input *1	SRV-ON	03h	83h
Alarm clear input	A-CLR	04h	Do not setup.
Control mode switching input *2	C-MODE	05h	85h
Gain switching input	GAIN	06h	86h
Deviation counter clear input *3	CL	07h	Do not setup.
Command pulse inhibition input *4	INH	08h	88h
Torque limit switching input	TL-SEL	09h	89h
Damping control switching input 1	VS-SEL1	0Ah	8Ah
Damping control switching input 2	VS-SEL2	0Bh	8Bh
Electronic gear switching input 1	DIV1	0Ch	8Ch
Electronic gear switching input 2	DIV2	0Dh	8Dh
Selection 1 input of internal command speed	INTSPD1	0Eh	8Eh
Selection 2 input of internal command speed	INTSPD2	0Fh	8Fh
Selection 3 input of internal command speed	INTSPD3	10h	90h
Speed zero clamp input	ZEROSPD	11h	91h
Speed command sign input	VC-SIGN	12h	92h
Torque command sign input	TC-SIGN	13h	93h
Forced alarm input	E-STOP	14h	94h
Inertia ratio switching input	J-SEL	15h	95h
Dynamic brake switching input*5	DB-SEL	16h	Do not setup.

Note

For input pin assignment with default setting, refer to P.3-39 Control input.

Related page P.3-52

<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.

* For easier setting, use the setup support software PANATERM.

Caution

- Do not setup to a value other than that specified in the table.
- Do not assign specific function to 2 or more signals. Duplicated assignment will cause Err33.0 I/F input multiple assignment error 1 or Err33.1 I/F input multiple assignment error 2.
- When measuring frequency characteristics of PANATERM, as it will automatically switchover to position velocity control inside the driver, please set the same set value for input signal of velocity control to be made abled during the measurement, to the set value for position control.
- Note that the setup values are displayed in decimal on the front panel.

*1 Servo-on input signal (SRV-ON) must be used to enable servo-on.

*2 When using the control mode switch input (C-MODE), all control modes need to be set. If configuration is made only for 1 or 2 modes, Err33.2“I/F input function number error 1 ”or Err33.3“I/F input function number error 2”occurs.
- The control input pin set to invalid state does not affect any operation.
- Function (servo-on input, alarm clear, etc.) to be used in multiple control modes must be assigned to the same pin with correct logical arrangement. Incorrect setting will cause Err33.0 I/F input multiple assignment error 1 or Err33.1 I/F input multiple assignment error 2.

*3 Deviation counter clear input (CL) can be assigned only to SI7 input. Wrong assignment will cause Err33.6 Counter clear assignment error.

*4 Command pulse inhibition input (INH) can only be assigned to SI10 inputs. If the input is assigned to other than that,Err33.7 “Command pulse input inhibition input ”occurs.

*5 When using the Dynamic brake switch input, all control modes need to be set after set Pr 6.36(Dynamic brake operation input) =1.If configurationis mode only for 1 or 2 mode, Err33.2”I/F input function number error 1” or Err33.3”I/F input function number error 2” occurs.For more information.

Parameter	Name	Range	Unit	Default	Related control mode
Pr4.01 *	SI2 input selection	0 to 00FFFFFFh	—	00818181h (8487297)	P S T F
Pr4.02 *	SI3 input selection	0 to 00FFFFFFh	—	0091910Ah (9539850)	P S T F
Pr4.03 *	SI4 input selection	0 to 00FFFFFFh	—	00060606h (394758)	P S T F
Pr4.04 *	SI5 input selection	0 to 00FFFFFFh	—	0000100Ch (4108)	P S T F
Pr4.05 *	SI6 input selection	0 to 00FFFFFFh	—	00030303h (197379)	P S T F
Pr4.06 *	SI7 input selection	0 to 00FFFFFFh	—	00000f07h (3847)	P S T F

Caution Deviation counter clear (CL) can be set up only with this parameter. If any other parameter is used for this purpose, Err33.6 Counter clear assignment error will be issued.

Parameter	Name	Range	Unit	Default	Related control mode
Pr4.07 *	SI8 input selection	0 to 00FFFFFFh	—	00040404h (263172)	P S T F
Pr4.08 *	SI9 input selection	0 to 00FFFFFFh	—	00050505h (328965)	P S T F
Pr4.09 *	SI10 input selection	0 to 00FFFFFFh	—	00000E88h (3720)	P S T F

Assign functions to SI2 to SI10 inputs.
These parameters are presented in hexadecimals.
Setup procedure is the same as described for Pr4.00.

Note For input pin assignment with default setting, also refer to P.3-39 Control input.

Caution Command pulse inhibition input (INH) can be setup only with this parameter. If any other parameter is used for this purpose, Err33.7 INH assignment error will be issued.

Note
- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page
- P.3-32... "Inputs and outputs on connector X4" • P.6-2 "Protective Function"

Default: [ ]

Pr4.10 *	SO1 output selection	Range	Unit	Default	Related control mode
		0 to 00FFFFFFh	—	00030303h (197379)	P S T F

Assign functions to SO1 outputs.
These parameters are presented in hexadecimals. *1
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.

Setup value	Title	Symbol
00h	Invalid	–
01h	Servo alarm output	ALM
02h	Servo-Ready output	S-RDY
03h	External brake release signal	BRK-OFF
04h	Positioning complete output	INP
05h	At-speed output	AT-SPEED
06h	Torque in-limit signal output	TLC
07h	Zero-speed detection output signal	ZSP
08h	Speed coincidence output	V-COIN
09h	Alarm output 1	WARN1
0Ah	Alarm output 2	WARN2
0Bh	Positional command ON/OFF output	P-CMD
0Ch	Positioning complete 2	INP2
0Dh	Speed in-limit output	V-LIMIT
0Eh	Alarm attribute output	ALM-ATB
0Fh	Speed command ON/OFF output	V-CMD
10h	Servo on status output	SRV-ST

Note

For output pin assignment with default setting, also refer to P.3-47 Output signals (common) and their functions.

Related page P.3-54

<Example of change>

To change the default setting "External brake release signal" (in all modes) to "Alarm output 1", set the input to 00090909h.

* For easier setting, use the setup support software 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.

Caution *1 Note that the setup values are displayed in decimal on the front panel.

Pr4.11 *	SO2 output selection	Range	Unit	Default	Related control mode
		0 to 00FFFFFFh	—	00020202h (131586)	P S T F

Pr4.12 *	SO3 output selection	Range	Unit	Default	Related control mode
		0 to 00FFFFFFh	—	00010101h (65793)	P S T F

Pr4.13 *	SO4 output selection	Range	Unit	Default	Related control mode
		0 to 00FFFFFFh	—	00050504h (328964)	P S T F

Pr4.14 *	SO5 output selection	Range	Unit	Default	Related control mode
		0 to 00FFFFFFh	—	00070707h (460551)	P S T F

Pr4.15 *	SO6 output selection	Range	Unit	Default	Related control mode
		0 to 00FFFFFFh	—	00060606h (394758)	P S T F

Assign functions to SO2 to SO6 outputs.
These parameters are presented in hexadecimals.
Setup procedure is the same as described for Pr4.10.

Default: [ ]

Pr4.16	Type of analog monitor 1	Range	Unit	Default	Related control mode
		0 to 28	—	0	P S T F

Select the type of monitor for analog monitor 1. *See the table shown on the next page.

Pr4.17	Analog monitor 1 output gain	Range	Unit	Default	Related control mode
		0 to 214748364	[Monitor unit in Pr4.16] / V	0	P S T F

Set up the output gain of analog monitor 1.
For Pr4.16 = 0 Motor speed, 1 V is output at the motor speed [r/min] = Pr4.17 setup value.

Pr4.18	Type of analog monitor 2	Range	Unit	Default	Related control mode
		0 to 28	—	4	P S T F

Select the type of monitor for analog monitor 2. *See the table shown on the next page.

Pr4.19	Analog monitor 2 output gain	Range	Unit	Default	Related control mode
		0 to 214748364	[Monitor unit in Pr4.16] / V	0	P S T F

Set up the output gain of analog monitor 2.
For Pr4.18 = 4 Torque command, 1 V is output at the torque command [%] = Pr4.19 setup value.

Pr4.20	For manufacturer's use	Range	Unit	Default	Related control mode
		—	—	0	

Plese fixed to 0.

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 *4	r/min	500
2	Internal positional command speed *4	r/min	500
3	Velocity control command	r/min	500
4	Torque command	%	33
5	Command positional deviation *5	pulse (Command unit)	3000
6	Encoder positional deviation *5	pulse (Encoder unit)	3000
7	Full-closed deviation *5	pulse (External scale unit)	3000
8	Hybrid deviation	pulse (Command unit)	3000
9	Voltage across PN	V	80
10	Regenerative load factor	%	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	Analog input 1 *2	V	1

Default: [ ]

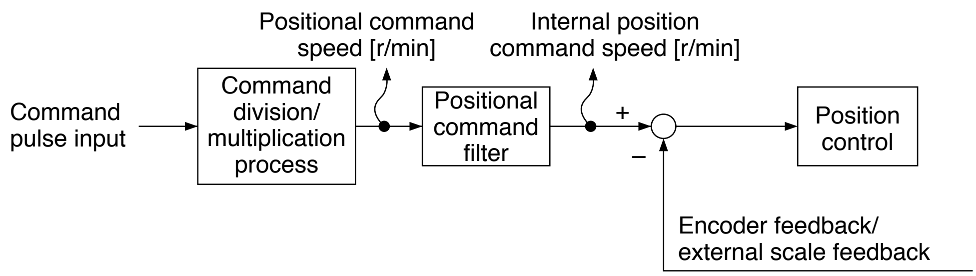
Pr4.16/Pr4.18	Type of monitor	Unit	Output gain for setting Pr4.17/Pr4.19 = 0
17	Analog input 2 *2	V	1
18	Analog input 3 *2	V	1
19	Encoder temperature *3	℃	10
20	Driver temperature	℃	10
21	Encoder single-turn data *1	pulse (Encoder unit)	110000
23	Command input state	0: No command 1: With command	*6
24	Gain selection state	0: 1st gain selected 1: 2nd and 3rd gain selected	*6
25	Positioning complete state	0: Positioning not completed 1: Positioning completed	*6
26	Alarm triggered state	0: Alarm not triggered 1: Alarm triggered	*6
27	Motor power consumption	W	100
28	Motor power electrical energy	Wh	100

*1 The encoder rotation data CCW is always positive value regardless of Pr0.00 Rotational direction setup. The direction of other monitor data basically follows Pr0.00 Rotational direction setup.

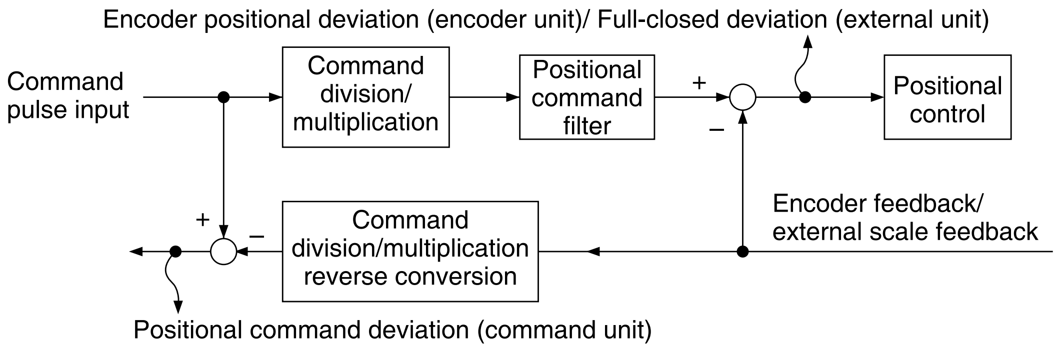
*2 Analog inputs 1, 2 and 3 always output terminal voltage regardless of usage of analog input function. Only for basic type is not provided with analog inputs.

*3 For temperature information from the encoder, a value appears only when 23-bit absolute encoder is used. For other encoders, "0" is always output.

*4 For the command pulse input, the speed before the command filter (smoothing, FIR filter) is defined as positional command speed and speed after filter is defined as internal command speed.



*5 Position command deviation is the deviation from the command pulse input. Encoder position deviation/full-closed position deviation is the deviation at the input portion of position control. The following figure shows details.



*6 Regardless of the setting Pr 4.17 and Pr 4.19, output gain become 0V in unit 0 or become 5V in unit 1.

Default: [ ]

Pr4.21	Analog monitor output setup	Range	Unit	Default	Related control mode
		0 to 2	—	0	P S T F

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)

Pr4.22	Analog input 1 (AI1) offset setup	Range	Unit	Default	Related control mode
		–5578 to 5578	0.359 mV	0	P S T F

Set up the offset correction value applied to the voltage fed to the analog input 1.

Pr4.23	Analog input 1 (AI1) filter	Range	Unit	Default	Related control mode
		0 to 6400	0.01 ms	0	P S T F

Set up the time constant of 1st delay filter that determines the lag time behind the voltage applied to the analog input 1.

Pr4.24	Analog input 1 (AI1) overvoltage setup	Range	Unit	Default	Related control mode
		0 to 100	0.1 V	0	P S T F

Set up the excessive level of the input voltage of analog input 1 by using the voltage associated with offset.

Pr4.25	Analog input 2 (AI2) offset setup	Range	Unit	Default	Related control mode
		–342 to 342	5.86 mV	0	P S T F

Set up the offset correction value applied to the voltage fed to the analog input 2.

Pr4.26	Analog input 2 (AI2) filter	Range	Unit	Default	Related control mode
		0 to 6400	0.01 ms	0	P S T F

Set up the time constant of 1st delay filter that determines the lag time behind the voltage applied to the analog input 2.

Pr4.27	Analog input 2 (AI2) overvoltage setup	Range	Unit	Default	Related control mode
		0 to 100	0.1 V	0	P S T F

Set up the excessive level of the input voltage of analog input 2 by using the voltage associated with offset.

Pr4.28	Analog input 3 (AI3) offset setup	Range	Unit	Default	Related control mode
		–342 to 342	5.86 mV	0	P S T F

Set up the offset correction value applied to the voltage fed to the analog input 3.

Default: [ ]

Pr4.29	Analog input 3 (AI3) filter	Range	Unit	Default	Related control mode			
		0 to 6400	0.01 ms	0	P	S	T	F

Set up the time constant of 1st delay filter that determines the lag time behind the voltage applied to the analog input 3.

Pr4.30	Analog input 3 (AI3) overvoltage setup	Range	Unit	Default	Related control mode			
		0 to 100	0.1 V	0	P	S	T	F

Set up the excessive level of the input voltage of analog input 3 by using the voltage associated with offset.

Pr4.31	Positioning complete (In-position) range	Range	Unit	Default	Related control mode			
		0 to 2097152	Command unit	10	P			F

Set up the timing of positional deviation at which the positioning complete signal (INP1) is output.

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.4-52 “Pr5.20”.

Pr4.32	Positioning complete (In-position) output setup	Range	Unit	Default	Related control mode			
		0 to 10	—	0	P			F

Select the condition to output the positioning complete signal (INP1).

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 Presence/absence of position command can be judged by referring to the command after position command filter when the setup value is 1-5, or the command before position command filter when the setup value is 6-10.

Default: [ ]

Pr4.33	INP hold time	Range	Unit	Default	Related control mode			
		0 to 30000	1 ms	0	P			F

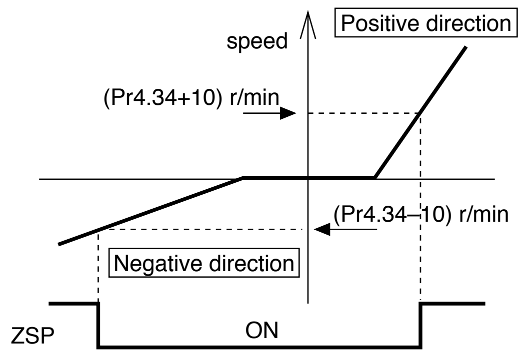
Set up the hold time when Pr4.32 Positioning complete output setup = 3.

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.

Pr4.34	Zero-speed	Range	Unit	Default	Related control mode			
		10 to 20000	r/min	50	P	S	T	F

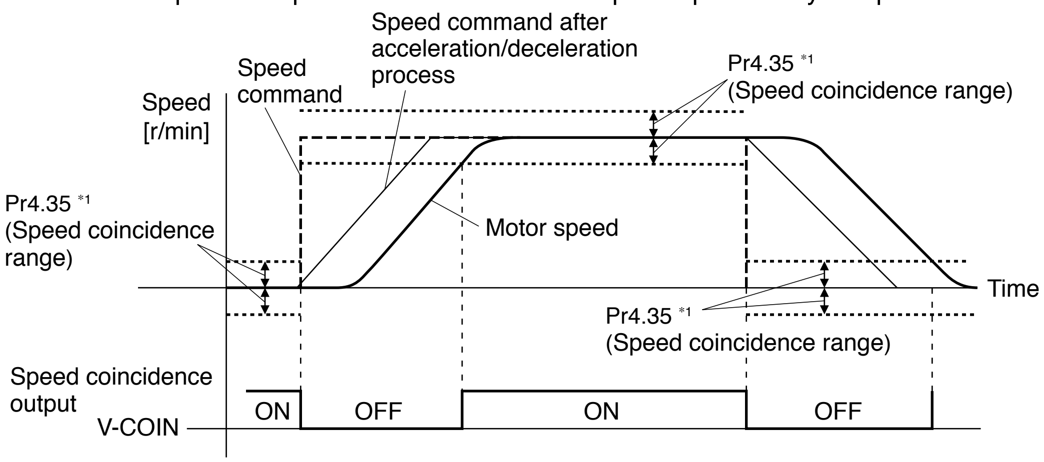
You can set up the timing to feed out the zero-speed detection output signal (ZSP or TCL) in rotational speed [r/min].
The zero-speed detection signal (ZSP) will be fed out when the motor speed falls below the setup of this parameter, Pr4.34.

- 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].



Pr4.35	Speed coincidence range	Range	Unit	Default	Related control mode			
		10 to 20000	r/min	50		S	T	

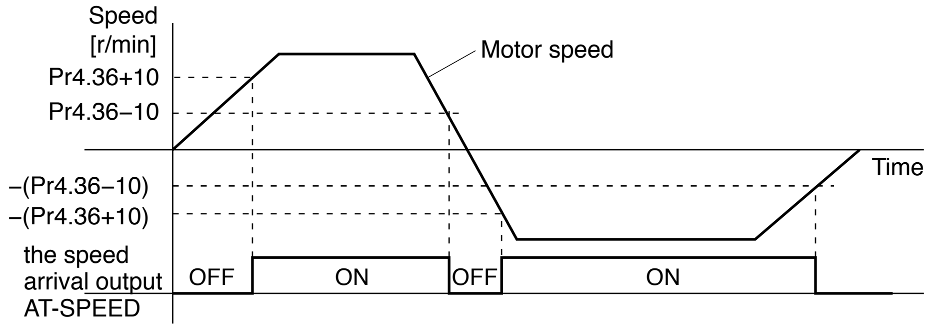
Set the speed coincidence (V-COIN) output detection timing.
Output the speed coincidence (V-COIN) when the difference between the speed command and the motor speed is equal to or smaller than the speed specified by this parameter.



*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	Default	Related control mode
		10 to 20000	r/min	1000	S T

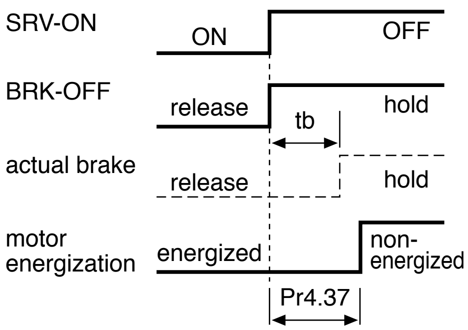
Set the detection timing of the speed arrival output (AT-SPEED).
When the motor speed exceeds this setup value, the speed arrival output (AT-SPEED) is output. Detection is associated with 10 r/min hysteresis.



Pr4.37	Mechanical brake action at stalling setup	Range	Unit	Default	Related control mode
		0 to 10000	1 ms	0	P S T F

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.

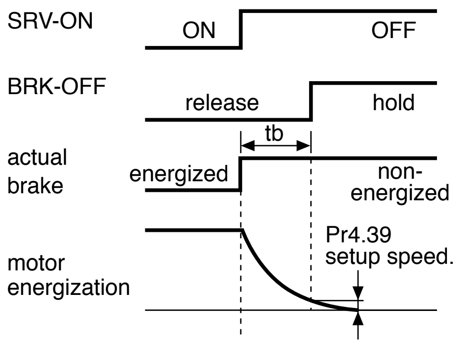
- Set up to prevent a micro-travel/ drop of the motor (work) due to the action delay time (tb) of the brake
- After setting up Pr4.37 ≥ tb, then compose the sequence so as the driver turns to Servo-OFF after the brake is actually activated.



Pr4.38	Mechanical brake action at running setup	Range	Unit	Default	Related control mode
		0 to 32000	1 ms	0	P S T F

You can set up time from when detecting the off of Servo-ON input signal (SRV-ON) is to when external brake release signal (BRK-OFF) turns off, while the motor turns to servo off during the motor in motion.

- 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.



Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr4.39	Brake release speed setup	Range	Unit	Default	Related control mode
		30 to 3000	r/min	30	P S T F

Set up the speed timing of brake output checking during operation.

Pr4.40	Selection of alarm output 1	Range	Unit	Default	Related control mode
		0 to 40	—	0	P S T F

Pr4.41	Selection of alarm output 2	Range	Unit	Default	Related control mode
		0 to 40	—	0	P S T F

Select the type of alarm issued as the alarm output 1 or 2.

Setup value	Alarm	Content
[0]	—	ORed 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	External scale error alarm	The external scale detects the alarm.
10	External scale communication alarm	The number of successive external scale communication errors exceeds the specified value.
11	Velocity command ON/ OFF output	When Pr7.14(main power off alert detection time) is 10 to 1999, L1-L3 Instant stop for the time set at Pr7.14 above.

Related page For detailed description of alarm types, refer to P.3-49.

Pr4.42	2nd Positioning complete (In-position) range	Range	Unit	Default	Related control mode
		0 to 2097152	Command unit	10	P F

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.4-52 "Pr5.20".

Note
- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page
- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr4.44	Position compare output pulse width setting	Range	Unit	Default	Related control mode
		0～32767	0.1 ms	0	P S T F

Sets the signal width of position compare output.
No signal will be output when 0.

Pr4.45	Position compare output polarity select	Range	Unit	Default	Related control mode
		0～63	—	0	P F

Sets polarity of position compare output by bit for each output terminal.

・Set bits

bit	Designation
bit0	SO1 or OCMP1
bit1	SO2 or OCMP2
bit2	SO3 or OCMP3
bit3	SO4 or OCMP4
bit4	SO5
bit5	SO6

・Set value

Setup value	Designation
0	Output photocoupler for SO 1 to 6 will turn ON during pulse output and OCMP 1 to 4 will be L level respectively.
1	Output photocoupler for SO1 to 6 will turn OFF during pulse output and OCMP 1 to 4 will be H level respectively, Use 0 normally.

Pr4.47	Pulse output select	Range	Unit	Default	Related control mode
		0～7	—	0	P S T F

Selects signal to be output from pulse regeneration output / position compare output terminal.

Setup value	Designation
[0]	OA/OB/OZ/CZ
1	OCMP1/OCMP2/OZ/CZ
2	OA/OB/OCMP3/OCMP3
3	OCMP1/OCMP2/OCMP3/OCMP3
4	OA/OB/OZ/OCMP4
5	OCMP1/OCMP2/OZ/OCMP4
6	OA/OB/OCMP3/OCMP4
7	OCMP1/OCMP2/OCMP3/OCMP4

*The signal of OA, OB, OZ, CZ is pulse regeneration output,the signal of OCMP1, OCMP2, OCMP3, OCMP4 is position compare output terminal.

Pr4.48	Position compare value 1	Range	Unit	Default	Related control mode
		-2147483648 to 2147483647	Command unit	0	P F

Sets comparison value for position compare 1.

Default: [ ]

Pr4.49	Position compare value 2	Range	Unit	Default	Related control mode			
		-2147483648 to 2147483647	Command unit	0	P			F

Sets comparison value for position compare 2.

Pr4.50	Position compare value 3	Range	Unit	Default	Related control mode			
		-2147483648 to 2147483647	Command unit	0	P			F

Sets comparison value for position compare 3.

Pr4.51	Position compare value 4	Range	Unit	Default	Related control mode			
		-2147483648 to 2147483647	Command unit	0	P			F

Sets comparison value for position compare 4.

Pr4.52	Position compare value 5	Range	Unit	Default	Related control mode			
		-2147483648 to 2147483647	Command unit	0	P			F

Sets comparison value for position compare 5.

Pr4.53	Position compare value 6	Range	Unit	Default	Related control mode			
		-2147483648 to 2147483647	Command unit	0	P			F

Sets comparison value for position compare 6.

Pr4.54	Position compare value 7	Range	Unit	Default	Related control mode			
		-2147483648 to 2147483647	Command unit	0	P			F

Sets comparison value for position compare 7.

Pr4.55	Position compare value 8	Range	Unit	Default	Related control mode			
		-2147483648 to 2147483647	Command unit	0	P			F

Sets comparison value for position compare 8.

Pr4.56	Position compare output delay compensation amount	Range	Unit	Default	Related control mode			
		-32768 to 32767	0.1us	0	P			F

Compensates position compare output delay caused by the circuit.

Pr4.57	Position compare output assignment setting	Range	Unit	Default	Related control mode			
		-2147483648 to 2147483647	Command unit	0	P			F

Sets output terminal corresponding to position compare 1 to 6 by bit.
Multiple position compare can be set to a single output terminal.

・Set bits

bit	Designation
bit0 ~ 3	Position com 1
bit4 ~ 7	Position com 2
bit8 ~ 11	Position com 3
bit12 ~ 15	Position com 4
bit16 ~ 19	Position com 5
bit20 ~ 23	Position com 6
bit24 ~ 27	Position com 7
bit28 ~ 31	Position com 8

・Set value

Setup value	Designation
0000	Invalid output
0001	Assigned to SO1 or OCMP1
0010	Assigned to SO2 or OCMP2
0011	Assigned to SO3 or OCMP3
0100	Assigned to SO4 or OCMP4
0101	Assigned to SO5
0110	Assigned to SO6
Others	For manufacturer use (do not set)

1. Details of parameter

[Class 5] Enhancing setting

Default: [ ]

Pr5.00	2nd numerator of electronic gear	Range	Unit	Default	Related control mode
		0 to 2^{30}	—	0	P F

Pr5.01	3rd numerator of electronic gear	Range	Unit	Default	Related control mode
		0 to 2^{30}	—	0	P F

Pr5.02	4th numerator of electronic gear	Range	Unit	Default	Related control mode
		0 to 2^{30}	—	0	P F

Set the 2nd to 4th numerator of division/multiplication operation made according to the command pulse input.
This setup is enabled when Pr0.08 command pulse counts per one motor revolution = 0 or full closed controlling.
When the setting value is 0 for positioning controlling, encoder resolution is set as a numerator.
When the setting value is 0 for full closed controlling, both numerator and denominator are set to 1.

Pr5.03 *	Denominator of pulse output division	Range	Unit	Default	Related control mode
		0 to 8388608	—	0	P S T F

For details, refer to P.4-11.

Pr5.04 *	Over-travel inhibit input setup	Range	Unit	Default	Related control mode
		0 to 2	—	1	P S T F

Set up the operation of the run-inhibition (POT, NOT) inputs.

Setup value	Operation
0	POT → Inhibit positive direction travel NOT → Inhibit negative direction travel
[1]	Disable POT, NOT
2	POT or NOT input activates Err38.0 Run-inhibition input protection.

Default: [ ]

Pr5.05 *	Sequence at over-travel inhibit	Range	Unit	Default	Related control mode
		0 to 2	—	0	P S T F

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	Deviation counter content
0	[0]	Dynamic brake action	Torque command=0 towards inhibited direction	Hold*2
	1	Torque command=0 towards inhibited direction	Torque command=0 towards inhibited direction	Hold*2
	2	Emergency stop*5	Command=0 towards inhibited direction*1	Clears before/ after deceleration*3

*1 In the case of position control and full-closed control, position command = 0 state is indicated, in the case of velocity control, speed command = 0 state, and in the case of torque control, speed limit value =0 state.

*2 Continuing giving commands in the drive prohibition direction with drive prohibition input set to ON causes position deviation to accumulate and Err24.0 “Excess position deviation error.” When the drive prohibition input is turned ON, stop giving commands in the drive prohibition direction.

*3 Position deviation and external scale deviation are cleared twice, deceleration start instance and deceleration completion instance.
In the event that the position is controlled in order to clear the position deviation and external scale deviation, home position return action must be conducted to return.

*4 Because in the event that the setting is 2 in Pr5.04 “Drive prohibition input setting,” Err38.0 “Drive prohibition input protection” occurs when either one of POT or NOT turns ON, the motor operates not in accordance with this setting but in accordance with Pr5.10 “Sequence at alarm.” When other error occurs, too, priority is given to Pr5.10 “Sequence at alarm” in the same manner.

*5 Immediate stop means to immediately stop with control applied while servo is turned ON.
The torque command value in such event is restricted by Pr5.11 “Immediate stop torque setting.”
Because an immediate stop abruptly decelerates the motor, in position control, the position deviation may instantaneously increase, and Err24.0 “Position deviation excess protection” or Err34.0 “Allowable motor operating range setting error protection” may occur.
In such event, set Pr0.14 “Position deviation excess setting” and Pr5.14 “Allowable motor operating range” to appropriate values.
To stop with the torque set by “Immediate stop torque setting,” continue to provide normal command for at least 4 ms from signal input.

*6 During deceleration means an interval in which the motor achieves the speed lower than 30 r/min from the condition in which the motor operates. When the motor speed becomes 30 r/min or lower once and then changes after stopping, the motor follows the state after stopping irrespective of the motor speed.

Default: [ ]

Pr5.06	Sequence at Servo-Off	Range	Unit	Default	Related control mode
		0 to 9	—	0	P S T F

Specify the status during deceleration and after stop, after servo-off.

Setup value	During deceleration *3	After stalling	Positional deviation/ external scale deviation
[0]	Dynamic Brake (DB) action	Dynamic Brake (DB) action	Clear *4
1	Free-run (DB OFF)	Dynamic Brake (DB) action	Clear *4
2	Dynamic Brake (DB) action	Free-run (DB OFF)	Clear *4
3	Free-run (DB OFF)	Free-run (DB OFF)	Clear *4
4	Dynamic Brake (DB) action	Dynamic Brake (DB) action	Hold *2
5	Free-run (DB OFF)	Dynamic Brake (DB) action	Hold *2
6	Dynamic Brake (DB) action	Free-run (DB OFF)	Hold *2
7	Free-run (DB OFF)	Free-run (DB OFF)	Hold *2
8	Emergency stop *1	Dynamic Brake (DB) action	Clear *4
9	Emergency stop *1	Free-run (DB OFF)	Clear *4

*1 Emergency stop refers to a controlled immediate stop with servo-on.
The torque command value is limited during this process by Pr5.11 Emergency stop torque setup.

*2 If the positional command is kept applied or the motor is kept running with servo-off condition, positional deviation is accumulated, causing Err24.0 Excess positional deviation protection to be issued. If the servo is turned ON while the position or external scale is significantly deviating, the motor may rapidly operate to reduce the deviation to 0. Remember these requirements if you want to maintain the positional deviation/external scale deviation.

*3 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.

*4 Positional deviation/external scale deviation is always cleared to 0.

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.2-63, "Timing Chart"-Servo-ON/OFF action while the motor is at stall" of Preparation as well.

Pr5.07	Sequence at main power OFF	Range	Unit	Default	Related control mode
		0 to 9	—	0	P S T F

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.

Pr5.08	LV trip selection at main power OFF	Range	Unit	Default	Related control mode
		0 to 3	—	1	P S T F

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	Default	Related control mode
		20 to 2000	1 ms	70	P S T F

You can set up the time to detect the shutoff while the main power is kept shut off continuously.

Caution The main power off detection is invalid when you set up this to 2000.

Pr5.10	Sequence at alarm	Range	Unit	Default	Related control mode
		0 to 7	—	0	P S T F

Specify the status during deceleration and after stop, after occurrence of alarm.

Setup value	During deceleration *3	After stalling	Positional deviation/ external scale deviation
[0]	Dynamic Brake (DB) action	Dynamic Brake (DB) action	Hold *1
1	Free-run (DB OFF)	Dynamic Brake (DB) action	Hold *1
2	Dynamic Brake (DB) action	Free-run (DB OFF)	Hold *1
3	Free-run (DB OFF)	Free-run (DB OFF)	Hold *1
4	Action A: Emergency stop Action B: DB action *2	Dynamic Brake (DB) action	Hold *1
5	Action A: Emergency stop Action B: DB OFF *2	Dynamic Brake (DB) action	Hold *1
6	Action A: Emergency stop Action B: DB action *2	Free-run (DB OFF)	Hold *1
7	Action A: Emergency stop Action B: DB OFF *2	Free-run (DB OFF)	Hold *1

*1 Positional deviation/external scale deviation is maintained during alarm condition and will be cleared when the alarm is cancelled.

*2 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.

*3 Deceleration period is the time required for the running motor to speed down to 30 r/min.

Default: [ ]

Pr5.11	Torque setup for emergency stop	Range	Unit	Default	Related control mode
		0 to 500	%	0	P S T F

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	Default	Related control mode
		0 to 500	%	0	P S T F

- 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.6-17.

Pr5.13	Over-speed level setup	Range	Unit	Default	Related control mode
		0 to 20000	r/min	0	P S T F

- If the motor speed exceeds this setup value, Err26.0 Over-speed protection occurs.
- The over-speed level becomes 1.2 times of the motor max. speed by setting up this to 0.

Pr5.14	Motor working range setup	Range	Unit	Default	Related control mode
		0 to 1000	0.1 revolution	10	P S T F

- You can set up the movable range of the motor against the position command input range.
- When the motor movement exceeds the setup value, software limit protection of Err34.0 will be triggered.

Pr5.15 *	I/F reading filter	Range	Unit	Default	Related control mode
		0 to 3	—	0	P S T F

Select reading period of the control input signal.

Setup value	Reading period of the signal.
[0]	0.25 ms
1	0.5 ms
2	1 ms
3	2 ms

Exclude deviation counter clear input (CL) and command pulse inhibit input (INH).

Pr5.16 *	Alarm clear input setup	Range	Unit	Default	Related control mode
		0 to 1	—	0	P S T F

Select alarm clear input (A-CLR) recognition time.

Setup value	Recognition time
[0]	120 ms
1	To Pr5.15 IF reading filter

Default: [ ]

Pr5.17	Counter clear input mode	Range	Unit	Default	Related control mode
		0 to 4	—	3	P F

You can set up the clearing conditions of the counter clear input signal.

Setup value	Clear condition
0	Invalid
1	Clear at a level (no reading filter)
2	Clear at a level (with reading filter)
[3]	Clear at an edge (no reading filter)
4	Clear at an edge (with reading filter)

Note For signal width/timing requiring the deviation counter input, refer to P.3-40.

Pr5.18	Invalidation of command pulse inhibit input	Range	Unit	Default	Related control mode
		0 to 1	—	1	P F

Select command pulse inhibit input enable/disable.

Setup value	INH input
0	Valid
[1]	Invalid

Pr5.19 *	Command pulse inhibit input reading setup	Range	Unit	Default	Related control mode
		0 to 5	—	0	P F

Select command pulse inhibit input enable/disable signal reading period. When the status of several signals read during the predetermined reading period are same, update the signal status.

Setup value	Signal reading period
[0]	0.250 ms to 3 times continuous
1	0.500 ms to 3 times continuous
2	1.0 ms to 3 times continuous
3	2.0 ms 3 times continuous
4	0.250 ms to read 1 time
5	0.250 ms to 2 times continuous

Caution Longer reading period protects against operation error due to noise but decreases response to input signal.

Note
- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page
- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr5.20 *	Position setup unit select	Range	Unit	Default	Related control mode
		0 to 1	—	0	P F

Specify the unit to determine the range of positioning complete and excessive positional deviation.

Setup value	Unit
[0]	Command unit
1	Encoder unit

Note The command unit defines 1 command pulse from the higher level device as setting value 1, while the encoder unit defines 1 encoder pulse as setting value 1.
When the electronic gear ratio set by using the command division and multiplication function (electronic gear) is R, the following relationship is obtained.

Command unit × R = encoder unit

For example, if 23-bit encoder is used with the default setting,

$R = \frac{2^{23}}{10000}$, then, command unit × $\frac{2^{23}}{10000}$ = encoder unit.

Pr5.21	Selection of torque limit	Range	Unit	Default	Related control mode
		0 to 6	—	1	P S F

You can set up the torque limiting method.

Setup value	Positive direction	Negative direction
0	P-ATL (0 V to 10 V)	N-ATL (–10 V to 0 V)
[1]	1st torque limit (Pr0.13)	
2	1st torque limit (Pr0.13)	2nd torque limit (Pr5.22)
3	TL-SEL OFF → 1st torque limit (Pr0.13) TL-SEL ON → 2nd torque limit (Pr5.22)	
4	P-ATL (0 V to 10 V)	N-ATL (0 V to 10 V)
5	P-ATL (0 V to 10 V)	
6	TL-SEL OFF	
	1st torque limit (Pr0.13)	2nd torque limit (Pr5.22)
	TL-SEL ON	
	External input positive direction torque limit (Pr5.25)	External input negative direction torque limit (Pr5.26)

Pr5.22	2nd torque limit	Range	Unit	Default	Related control mode
		0 to 500	%	500	P S F

You can set up the 2nd limit value of the motor output torque.
The value of parameter is limited to the maximum torque of the applicable motor.

Note For details of torque limit value, refer to P.2-84.

Pr5.23	Torque limit switching setup 1	Range	Unit	Default	Related control mode
		0 to 4000	ms/100 %	0	P S F

Specify the rate of change (slope) from 1st to 2nd during torque limit switching.

Default: [ ]

Pr5.24	Torque limit switching setup 2	Range	Unit	Default	Related control mode
		0 to 4000	ms/100 %	0	P S F

Specify the rate of change (slope) from 2nd to 1st during torque limit switching.

Pr5.25	External input positive direction torque limit	Range	Unit	Default	Related control mode
		0 to 500	%	500	P S F

Set up positive direction torque limit upon receiving TL-SEL with Pr5.21 Selection of torque limit set at 6.
The value of parameter is limited to the maximum torque of the applicable motor.

Note For details of torque limit value, refer to P.2-84.

Pr5.26	External input negative direction torque limit	Range	Unit	Default	Related control mode
		0 to 500	%	500	P S F

Set up negative direction torque limit upon receiving TL-SEL with Pr5.21 Selection of torque limit set at 6.
The value of parameter is limited to the maximum torque of the applicable motor.

Note For details of torque limit value, refer to P.2-84.

Pr5.27	Input gain of analog torque limit	Range	Unit	Default	Related control mode
		10 to 100	0.1 V/100 %	30	P S F

From the voltage [V] applied to the analog torque limit input (P-ATL, N-ATL), set conversion gain to torque limit [%].

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

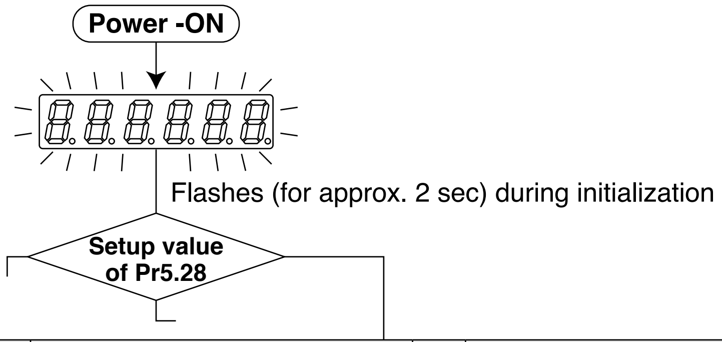
Related page

- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr5.28 *	LED initial status	Range	Unit	Default	Related control mode
		0 to 42	—	1	P S T F

You can select the type of data to be displayed on the front panel LED (7 segment) at the initial status after power-on.



Setup value	Content	Setup value	Content	Setup value	Content
0	Positional command deviation	14	Regenerative load factor	28	Software version
[1]	Motor speed	15	Over-load factor	29	Driver serial number
2	Positional command speed	16	Inertia ratio	30	Motor serial number
3	Velocity control command	17	Factor of no-motor running	31	Accumulated operation time
4	Torque command	18	No. of changes in I/O signals	32	Automatic motor recognizing function
5	Feedback pulse sum	20	Absolute encoder data	33	Temperature information
6	Command pulse sum	21	Absolute external scale position	35	Safety condition monitor
8	External scale feedback pulse sum	22	No. of encoder communication errors monitor	38	Motor power
9	Control mode	23	Communication axis address	39	For manufacturer use
10	I/O signal status	24	Encoder positional deviation [Encoder unit]	40	For manufacturer use
11	Analog input value	25	External scale deviation [External scale unit]	41	For manufacturer use
12	Error factor and reference of history	26	Hybrid deviation [Command unit]	42	For manufacturer use
13	Alarm Display	27	Voltage across PN [V]		

For details of display, refer to P.2-88 "How to Use the Front Panel" of Preparation.

Pr5.29 *	Baud rate setup of RS232 communication	Range	Unit	Default	Related control mode
		0 to 7	—	2	P S T F

You can set up the communication speed of RS232.

Note For baud rate setup value, refer to RS485 setup.

Pr5.30 *	Baud rate setup of RS485 communication	Range	Unit	Default	Related control mode
		0 to 7	—	2	P S T F

You can set up the communication speed of RS485.

Setup value	Baud rate	Setup value	Baud rate
0	2400 bps	4	38400 bps
1	4800 bps	5	57600 bps
[2]	9600 bps	6	115200 bps
3	19200 bps	7	230400 bps

Baud rate error is ±0.5 % for 2400 to 38400 bps, and ±2 % for 57600 to 115200 bps.
*When not modbus communication (Pr5.37=0),if the set value is 7,the internal is 9600bps.

Default: [ ]

Pr5.31 *	Axis address	Range	Unit	Default	Related control mode			
		0 to 127	—	1	P	S	T	F

During communication with the host (e.g. PC) to control multiple shafts, the shaft being accessed by the host should be identified.

Note

When using RS232/RS485, the maximum valid value is 31.

Use within the range of 1 to 127 for Modbus communication. 0 will disable Modbus communication.

Pr5.32 *	Command pulse input maximum setup	Range	Unit	Default	Related control mode			
		250 to 4000	k pulse/s	4000	P			F

Set the maximum number of pulses to be used as command pulse input. If the number of input pulses exceeds the setup value × 1.2, Err27.0 Command pulse input frequency error protection occurs.

Caution

The number of input pulses received by the driver is always checked. If the frequency of the received pulse is higher than the upper limit of the setting, input pulses are not accurately detected.
By selecting a value lower than 1000, a digital filter of the specification shown below is enabled against the command pulse input.

Pr5.32 setting range	Digital filter	
	Pr0.05=0,2	Pr0.05=1
250	400 ns 2-time reading	400 ns 2-time reading
251 to 499	200 ns 2-time reading	200 ns 2-time reading
500 to 999		100 ns 2-time reading
1000 to 2999		25 ns 2-time reading
3000 to 8000		1-time reading (thru)

Pr5.33 *	Pulse regenerative output limit setup	Range	Unit	Default	Related control mode			
		0 to 1	—	0	P	S	T	F

Enable/disable detection of Err28.0 Pulse regenerative limit protection.

Setup value	Content
[0]	Invalid
1	Valid

Pr5.34	For manufacturer's use	Range	Unit	Default	Related control mode			
		—	—	4				

Fixed to 4.

Pr5.35 *	Front panel lock setup	Range	Unit	Default	Related control mode			
		0 to 1	—	0	P	S	T	F

Lock the operation on the front panel.

Setup value	Content
[0]	No limit on the front panel operation
1	Lock the operation on the front panel

Note

• A parameter is designated as follows: Class Pr0.00 Parameter No.
• **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Default: [ ]

Pr5.36	For manufacturer's use	Range	Unit	Default	Related control mode
		—	—	0	

Fixed to 0.

Pr5.37 *	Modbus connection setting	Range	Unit	Default	Related control mode
		0 to 2	—	0	P S T F

To set RS232/RS485 communications protocol.

Setup value	Content
[0]	MINAS standard protocol
1	Modbus-RTU (RS232 communications, only for 1:1)
2	Modbus-RTU (RS485 communications, 1:N capable)

Pr5.38 *	Modbus communication setting	Range	Unit	Default	Related control mode
		0 to 5	—	0	P S T F

To set parity (even, odd, none) and stop bit length (1 bit, 2 bit) of Modbus communications.

Setup value	Content	Setup value	Content
[0]	Even/1 bit	3	Odd/2 bit
1	Even/2 bit	4	None/1 bit
2	Odd/1 bit	5	None/2 bit

Pr5.39	Modbus response waiting time	Range	Unit	Default	Related control mode
		0 to 10000	ms	0	P S T F

To set waiting time to be added from the receipt of Modbus communication request till the transmission of response data.

Note) Delay time will be generated for the creation of response data, even if the value is set to 0 (zero).

Pr5.40	Modbus communication timeout time	Range	Unit	Default	Related control mode
		0 to 10000	ms	0	P S T F

To set the time required to detect Err. 80.0 “Modbus communication timeout protection” in case broadcast designated Modbus communications from own specified axis has not been received exceeding the set time, while maintaining the state where Modbus exercise right is secured.

Err. 80.0 is not detected when set value is set to 0 (zero).

Pr5.41	For manufacturer’s use	Range	Unit	Default	Related control mode
		—	—	0	

Pleses fixed to 0.

Default: [ ]

Pr5.42	Modbus broadcast setting	Range	Unit	Default	Related control mode
		-32768 to 3276	ms	0	P S T F

To set response action and request processing when a request for broadcast mode is received in Modbus communication.

bit	Content	Setup value	
bit0	esponse action	Invalid (none)	1:Valid (yes) *1
bit1	request processing	0:Valid (process)	1:Invalid (no processing)
bit2	Strobe input operation automatic OFF	0:Invalid	1:Valid *2
bit3	Request operation specification switch *1	0:Use Pr5.40	1:Use Pr5.39
bit4-15	Not used	Fixed to 0.	

*Bit 0 is set to be the least significant bit.

*1 When bit 3 = 0, response returned after Pr 5.31 x Pr 5.40 [ms]. When bit 3 =1, response returned after Pr 5.31 × Pr 5.39[ms]. No response returned when bit 1 = 1

*2 Strobe input operation will be automatically switched OFF on the driver side after start of block operations. There is no need to write input OFF.

Pr5.45	Quadrant projection positive direction compensation value	Range	Unit	Default	Related control mode
		-1000 to 1000	0.1%	0	P F

To set positive direction high-precision torque compensation value for quadrant projection.

Pr5.46	Quadrant projection negative direction compensation value	Range	Unit	Default	Related control mode
		-1000 to 1000	0.1%	0	P F

To set negative direction high-precision torque compensation value for quadrant projection.

Pr5.47	Quadrant projection compensation delay time	Range	Unit	Default	Related control mode
		0 to 1000	ms	0	P F

To set compensation timing delay time for quadrant projection.

Pr5.48	Quadrant projection compensation filter setting L	Range	Unit	Default	Related control mode
		0 to 6400	0.01 ms	0	P F

To set compensation value LPF time constant for quadrant projection.

Pr5.49	Quadrant projection compensation filter setting H	Range	Unit	Default	Related control mode
		0 to 1000	0.1 ms	0	P F

To set compensation value HPF time constant for quadrant projection.

Default: [ ]

Parameter	Name	Range	Unit	Default	Related control mode
Pr5.50	For manufacturer use	—	—	0	
Pr5.51	For manufacturer use	—	—	0	
Pr5.52	For manufacturer use	—	—	0	
Pr5.53	For manufacturer use	—	—	0	
Pr5.54	For manufacturer use	—	—	0	
Pr5.55	For manufacturer's use	—	—	0	

Pleses fixed to 0.

Parameter	Name	Range	Unit	Default	Related control mode
Pr5.56	Slow stop deceleration time setting	0～10000	ms/(1000r/min)	0	P

Sets deceleration time for immediate stop deceleration stop deceleration processing.
This parameter will become valid when Pr6.10 "Function enhancement setting" bit 15 = 1.

Parameter	Name	Range	Unit	Default	Related control mode
Pr5.57	Slow stop S-shape acceleration and deceleration setting	0～1000	ms	0	P

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.

Parameter	Name	Range	Unit	Default	Related control mode
Pr5.58	Modbus mirror register setting 1	-32768 to 32767	—	24591	P S T F

Sets register address linked to Modbus register address 4418h "Mirror register 1."

Parameter	Name	Range	Unit	Default	Related control mode
Pr5.59	Modbus mirror register setting 2	-32768 to 32767	—	24592	P S T F

Sets register address linked to Modbus register address 4419h "Mirror register 2."

Parameter	Name	Range	Unit	Default	Related control mode
Pr5.60	Modbus mirror register setting 3	-32768 to 32767	—	16421	P S T F

Sets register address linked to Modbus register address 441Ah "Mirror register 3."

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr5.61	Modbus mirror register setting 4	Range	Unit	Default	Related control mode
		-32768 to 32767	—	24613	P S T F

Sets register address linked to Modbus register address 441Bh “Mirror register 4.”

Pr5.62	Modbus mirror register setting 5	Range	Unit	Default	Related control mode
		-32768 to 32767	—	17429	P S T F

Sets register address linked to Modbus register address 441Ch “Mirror register 5.”

Pr5.63	Modbus mirror register setting 6	Range	Unit	Default	Related control mode
		-32768 to 32767	—	17418	P S T F

Sets register address linked to Modbus register address 441Dh “Mirror register 6.”

Pr5.64	Modbus mirror register setting 7	Range	Unit	Default	Related control mode
		-32768 to 32767	—	17427	P S T F

Sets register address linked to Modbus register address 441Eh “Mirror register 7.”

Pr5.65	Modbus mirror register setting 8	Range	Unit	Default	Related control mode
		-32768 to 32767	—	17419	P S T F

Sets register address linked to Modbus register address 441Fh “Mirror register 8.”

Pr5.66	Deterioration diagnosis convergence judgment time	Range	Unit	Default	Related control mode
		0 to 10000	0.1s	0	P S T F

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 upper limit	Range	Unit	Default	Related control mode
		0 to 10000	%	0	P S T F

Pr5.68	Deterioration diagnosis inertia ratio lower limit	Range	Unit	Default	Related control mode
		0 to 10000	%	0	P S T F

Sets the upper and 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	Default	Related control mode
		-1000 to 1000	0.1%	0	P S T F

Pr5.70	Deterioration diagnosis unbalanced load lower limit	Range	Unit	Default	Related control mode
		-1000 to 1000	0.1%	0	P S T F

Sets the upper and 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).

Default: [ ]

		Range	Unit	Default	Related control mode
Pr5.71	**Deterioration diagnosis dynamic friction upper limit**	-1000 to 1000	0.1%	0	P S T F
Pr5.72	**Deterioration diagnosis dynamic friction lower limit**	-1000 to 1000	0.1%	0	P S T F

Sets the upper and 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).

		Range	Unit	Default	Related control mode
Pr5.73	**Deterioration diagnosis viscous friction upper limit**	0～10000	ms/(10000r/min)	0	P S T F
Pr5.74	**Deterioration diagnosis viscous friction lower limit**	0～10000	ms/(10000r/min)	0	P S T F

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).

		Range	Unit	Default	Related control mode
Pr5.75	**Deterioration diagnosis velocity setting**	-20000 to 20000	r/min	0	P S T F

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).

		Range	Unit	Default	Related control mode
Pr5.76	**Deterioration diagnosis torque average time**	0～10000	ms	0	P S T F

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.

		Range	Unit	Default	Related control mode
Pr5.77	**Deterioration diagnosis torque upper limit**	-1000 to 1000	0.1%	0	P S T F
Pr5.78	**Deterioration diagnosis torque lower limit**	-1000 to 1000	0.1%	0	P S T F

Sets the upper and 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 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr5.79	Modbus mirror register setting 9	Range	Unit	Default	Related control mode
		-32768 to 32767	—	17410	P S T F

Sets register address linked to Modbus register address 4420h “Mirror register 9.”

Pr5.80	Modbus mirror register setting 10	Range	Unit	Default	Related control mode
		-32768 to 32767	—	17411	P S T F

Sets register address linked to Modbus register address 4421h “Mirror register 10.”

Pr5.81	Modbus mirror register setting 11	Range	Unit	Default	Related control mode
		-32768 to 32767	—	16398	P S T F

Sets register address linked to Modbus register address 4422h “Mirror register 11.”

Pr5.82	Modbus mirror register setting 12	Range	Unit	Default	Related control mode
		-32768 to 32767	—	16402	P S T F

Sets register address linked to Modbus register address 4423h “Mirror register 12.”

Pr5.83	Modbus mirror register setting 13	Range	Unit	Default	Related control mode
		-32768 to 32767	—	16411	P S T F

Sets register address linked to Modbus register address 4424h “Mirror register 13.”

Pr5.84	Modbus mirror register setting 14	Range	Unit	Default	Related control mode
		-32768 to 32767	—	16405	P S T F

Sets register address linked to Modbus register address 4425h “Mirror register 14.”

Pr5.85	Modbus mirror register setting 15	Range	Unit	Default	Related control mode
		-32768 to 32767	—	16406	P S T F

Sets register address linked to Modbus register address 4426h “Mirror register 15.”

Pr5.86	Modbus mirror register setting 16	Range	Unit	Default	Related control mode
		-32768 to 32767	—	0	P S T F

Sets register address linked to Modbus register address 4427h “Mirror register 16.”

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of “ * ”**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... “Inputs and outputs on connector X4”

1. Details of parameter

[Class 6] Special setting

Default: [ ]

Pr6.00	Analog torque feed forward conversion gain	Range	Unit	Default	Related control mode			
		0 to 100	0.1 V/100 %	0	P	S		F

- Set the input gain of analog torque feed forward.
  0 to 9 are invalid.

<Usage example of Analog torque feed forward>

- Setting bit 5 place of Pr6.10 Function expansion setup to 1 enables the analog torque feed forward. When the analog input 3 is used by another function (e.g. analog torque limit), the function becomes invalid.
- The voltage (V) applied to the analog input 3 is converted to the torque via Pr6.00 Analog torque feed forward conversion gain setup and added to the torque command (%): in CCW direction if it is positive voltage or in CW direction if negative.
- The conversion of analog input 3, input voltage [V], to the torque command [%] to the motor may be expressed mathematically as follows:

Torque command (%) = 100 × input voltage (V) / (Pr6.00 setup value × 0.1)

Pr6.02	Velocity deviation excess setup	Range	Unit	Default	Related control mode			
		0 to 20000	r/min	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.

Pr6.04	JOG trial run command speed	Range	Unit	Default	Related control mode			
		0 to 500	r/min	300	P	S	T	F

Set up the command speed used for JOG trial run (velocity control).

Related page: Before using, refer to P.4-66 Preparation Trial Run.

Pr6.05	Position 3rd gain valid time	Range	Unit	Default	Related control mode			
		0 to 10000	0.1 ms	0	P			F

- Set up the time at which 3rd gain becomes valid.
- When not using this parameter, set Pr6.05 to 0 and Pr6.06 to 100.
- This is valid for only position control/full-closed control.

Pr6.06	Position 3rd gain scale factor	Range	Unit	Default	Related control mode			
		50 to 1000	%	100	P			F

- Set up the 3rd gain by a multiplying factor of the 1st gain:
- 3rd gain = 1st gain × Pr6.06/100

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page
- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr6.07	Torque command additional value	Range	Unit	Default	Related control mode
		–100 to 100	%	0	P S F

• 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	Default	Related control mode
		–100 to 100	%	0	P F

• Set up the dynamic friction compensation value to be added to the torque command when forward positional command is fed.
• Update this parameter when the friction compensation mode for real time auto-tuning is valid.

Pr6.09	Negative direction torque compensation value	Range	Unit	Default	Related control mode
		–100 to 100	%	0	P F

• Set up the dynamic friction compensation value to be added to the torque command when negative direction positional command is fed.
• Update this parameter when the friction compensation mode for real time auto-tuning is valid.

Pr6.10	Function expansion setup	Range	Unit	Default	Related control mode
		-32768 to 32767	—	16	P S T F

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	Not used	Fixed to 0.	
bit 3	Inertia ratio switching	Invalid	Valid
bit 4	Current response improvement	Invalid	Valid
bit 5	Analog torque FF	Invalid	Valid
bit 6 to 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 (hold)	Valid (clear)
bit 11	Encoder overheat abnormality protectiondetection	Invalid	Valid *1
bit 12	Not used	Fixed to 0.	
bit 13	For manufacturer's use	Fixed to 0.	
bit 14	Load variation suppression functionautomatic adjustment setting	Invalid	Valid
bit 15	Slow stop function.	Invalid	Valid*2

*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 Valid only when position control setting (Pr0.01 = 0) and block operation setting is invalid (Pr6.28 = 0).

Default: [ ]

Pr6.11	Current response setup	Range	Unit	Default	Related control mode
		10 to 100	%	100	P S T F

Fine tune the current response with respect to default setup (100 %).

Pr6.13	2nd Inertia ratio	Range	Unit	Default	Related control mode
		0 to 10000	%	250	P S T F

Set 2nd inertia ratio.
You can set up the ratio of the load inertia against the rotor (of the motor) inertia.

Pr6.13 = (load inertia/ rotor inertia) × 100 [%]

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.

Pr6.14	Emergency stop time at alarm	Range	Unit	Default	Related control mode
		0 to 1000	1 ms	200	P S T F

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	Range	Unit	Default	Related control mode
		0 to 20000	r/min	0	P S T F

When the motor speed exceeds this setup time, Err26.1 2nd over-speed protection will be activated.
The over-speed level becomes 1.2 times of the motor max. speed by setting up this to 0.

Pr6.16	For manufacturer's use	Range	Unit	Default	Related control mode
		—	—	0	

Fixed to 0.

Pr6.17 *	Front panel parameter writing selection	Range	Unit	Default	Related control mode
		0 to 1	—	0	P S T F

Specify the EEPROM writing procedure when parameter is edited form the front panel.

Setup value	Writing
[0]	Do not write to EEPROM at the same time
1	Write to EEPROM at the same time

Pr6.18 *	Power-up wait time	Range	Unit	Default	Related control mode
		0 to 100	0.1s	0	P S T F

Set up the standard initialization time (1.5 s + α) after power-up.
For example, when setup value is 10, then 1.5 s + (10 × 0.1 s) = approx. 2.5 s.

Default: [ ]

Pr6.19 *	Encoder Z phase setup	Range	Unit	Default	Related control mode
		0 to 32767	pulse	0	P S T F

If the number of output pulses per one motor revolution after division of pulse output is not an integer, fine adjust the width of encoder Z phase.

Pr6.20 *	Z-phase setup of external scale	Range	Unit	Default	Related control mode
		0 to 400	μs	0	F

Set up the Z phase regenerative width of external scale in unit of time. Even if the width of Z phase signal cannot be detected because the width equivalent of the travel distance from the external scale is too short, the Z phase signal will be output for at least the period set to this parameter.

Pr6.21 *	Serial absolute external scale Z phase setup	Range	Unit	Default	Related control mode
		0 to 2^{28}	pulse	0	F

Full-closed control using serial absolute external scale. When outputting pulses by using the external scale as the source of the output, set the Z phase output interval in units of A phase output pulses of the external scale (before multiplied by 4).

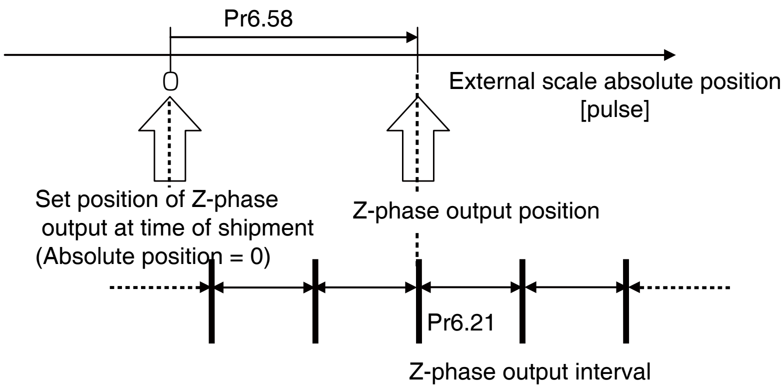
Setup value	Content
[0]	Output Z phase only at absolute 0 position of external scale.
1 to 268435456	After the power is fed to the driver, the Z phase, as it crosses the zero at the absolute position of external scale, is output in synchronous with the A phase. Subsequently, the Z phase is output at the A phase output pulse intervals set to this parameter.

When Pr6.58 ≠ 0, The absolute position output of the external scale is identical to the Z phase of the Pr6.58 setting value.

■ Serial absolute external scale

• After the driver control power supply is turned on, the Z-phase is output for the first time only when the external scale absolute position zero is traversed, and, using this position as a datum, the Z-phase is output with the A-phase pulse interval that is set by Pr6.21. However, when Pr6.21 = 0 is true, the Z-phase is output only at the absolute zero position.

• The first Z-phase output after switching on the driver control power supply can be set to any external scale absolute position by the setting of Pr6.58. This function assumes use in case absolute zero position of external scale does not exist within the movable range of the machine.



Default: [ ]

Pr6.22 *	A, B phase external scale pulse output method selection	Range	Unit	Default	Related control mode
		0 to 1	—	0	F

Select the pulse regeneration method of A, B and Z parallel external scale.

Setup value	Regenerating method
[0]	Directly output the signals from A, B and Z parallel external scales.
1	Output A and B phase signals recovered from A, B and Z parallel external scales. Z-phase is output directly.

Pr6.23	Load fluctuation compensating gain	Range	Unit	Default	Related control mode
		−100 to 100	%	0	P S F

Sets the compensation gain for the load fluctuation.

Pr6.24	Load fluctuation compensating filter	Range	Unit	Default	Related control mode
		10 to 2500	0.01 ms	53	P S F

Sets the filter time constant for the load fluctuation.

Pr6.27 *	Alarm latch time selection	Range	Unit	Default	Related control mode
		0 to 10	—	5	P S T F

Set up the latch time.

Setup value	Content	
0	Latch time: infinite	
1	Latch time	1 [s]
2		2 [s]
3		3 [s]
4		4 [s]
[5]		5 [s]
6		6 [s]
7		7 [s]
8		8 [s]
9		9 [s]
10		10 [s]

Pr6.28 *	Special function selection	Range	Unit	Default	Related control mode
		0 to 1	—	0	P

Selects between enabling and disabling the block operation function.

Setup value	Writing
[0]	Block operation disabled
1	Block operation enabled

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr6.30	For manufacturer's use	Range	Unit	Default	Related control mode
		—	—	0	

Fixed to 0.

Pr6.31	Real time auto tuning estimation speed	Range	Unit	Default	Related control mode
		0 to 3	—	1	P S T F

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 the support software PANATERM, the setup value 3 is used.

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr6.32	Real time auto tuning custom setup	Range	Unit	Default	Related control mode
		–32768 to 32767	—	0	P S T F

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).
* To enable the load characteristics measurement, set Pr6.31 Real time auto tuning estimation speed to a value other than 0 (stop estimation).
</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>
* To enable the inertia ratio update, set Bits 1-0 (load characteristic measurement) to 1 (enable). The inertia ratio will not be updated unless both settings are made valid.
</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><td>[0]</td><td>Use current setup</td><td>Pr6.07</td><td>Pr6.08</td><td>Pr6.09</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>
* To enable the torque compensation (set to 2-5), set Bits 3-2 (Inertia ratio update) to 1 (enable). It is not possible to update only the torque compensation.
</td></tr>
</table>

(continued)

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

7	Stiffness setup	Enable/disable the basic gain setup to be made according to Pr0.03 Real time auto tuning mechanical stiffness selection. Setup value / Function: [0]: Disable 1: Enable * To set this setting to a value other than 0, set Bits 3-2 (Inertia ratio update) to 1 (enable). Inertia ratio is enabled/disabled by the setting of Bits 1 and 0 (load characteristics measurement).
8	Fixed parameter setup	Enable/disable the change of parameter that is normally set at a fixed value. Setup value / Function: [0]: Use the current setup. 1: Set to a fixed value. * To set this setting to a value other than 0, set Bits 3-2 (Inertia ratio update) to 1 (enable). Inertia ratio is enabled/disabled by the setting of Bits 1 and 0 (load characteristics measurement).
10 to 9	Gain switching setup	Select the gain switching related parameter to be used when the real time auto tuning is enabled. Setup value / Function: [0]: Use the current setup. 1: Disable gain switching. 2: Enable gain switching. * To set this setting to a value other than 0, set Bits 3-2 (Inertia ratio update) to 1 (enable). Inertia ratio is enabled/disabled by the setting of Bits 1 and 0 (load characteristics measurement).

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,
   $2^0 \times 1 + 2^2 \times 1 + 2^4 \times 4 + 2^7 \times 1 + 2^8 \times 1 + 2^9 \times 2 = 1477$

Note

• A parameter is designated as follows: Class Pr0.00 Parameter No.
• **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

• P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr6.33	For manufacturer's use	Range	Unit	Default	Related control mode
		—	—	1000	

Fixed to 1000.

Pr6.34	Hybrid vibration suppression gain	Range	Unit	Default	Related control mode
		0 to 30000	0.1 /s	0	F

Set up the hybrid vibration suppression gain for full-closed controlling.
First set it to the value identical to that of poison loop gain, and then fine tune as necessary.

Pr6.35	Hybrid vibration suppression filter	Range	Unit	Default	Related control mode
		0 to 32000	0.01 ms	10	F

Set up the time constant of the hybrid vibration suppression filter for full-closed controlling.
While driving under full-closed control, gradually increase the setup value and check changes in the response.

Pr6.36	Dynamic brake operation input	Range	Unit	Default	Related control mode
		0 to 1	—	0	P S T F

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

Pr6.37	Oscillation detecting level	Range	Unit	Default	Related control mode
		0 to 1000	0.1 %	0	P S T F

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.

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr6.38 *	Alarm mask setup	Range	Unit	Default	Related control mode
		–32768 to 32767	—	4	P S T F

Pr6.39	Alarm mask setup 2	Range	Unit	Default	Related control mode
		–32768 to 32767	—	0	P S T F

Set up the alarm detection mask. Placing 1 to the corresponding bit position disables detection of the alarm condition.

Warning number	Warning name	bit	
		Pr6.38	Pr6.39
A0	Overload warning	bit7	—
A1	Over-regeneration warning	bit5	—
A2	Battery warning	bit0	—
A3	Fan warnin	bit6	—
A4	Encoder communication warning	bit4	—
A5	Encoder overheat warning	bit3	—
A6	Oscillation detection warning	bit9	—
A7	Lifetime detection warning	bit2	
A8	External scale error warning	bit8	—
A9	External scale communication warning	bit10	—
AC	Deterioration diagnosis warning	—	bit7
C3	Main power off warning	bit12	—

Pr6.41	Anti-vibration depth 1	Range	Unit	Default	Related control mode
		0 to 1000	—	0	P F

Set the anti-vibration depth of 1st damping function.

Pr6.42	Two-stage torque filter time constant	Range	Unit	Default	Related control mode
		0 to 2500	0.01 ms	0	P S T F

Set the time constant of the filter according to the torque command. The setup value 0 disables filter. Regardless of gain selecting state, this setting always remains valid.

Pr6.43	Two-stage torque filter attenuation term	Range	Unit	Default	Related control mode
		0 to 1000	—	0	P S T F

Set the attenuation term of 2-stage torque filter.

Note

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

• **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

• P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr6.47 *	Function expansion settings 2	Range	Unit	Default	Related control mode
		–32768 to 32767	—	1	P S T F

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/external scale communication error judgment setting	Compatible with previous setting	Relax error/ alarm judgment.
bit 3	Auto tuning selection *1	Standard type	Synchronous type
bit 4 to 7	Not used	Fixed to 0	
bit 8	For manufacturer's use	Fixed to 0	
bit 9 to 10	Not used	Fixed to 0	
bit 11	Immediate stop alarm extension	Invalid	Valid
bit 12 to 13	Manufacturer use	Fixed to 0	
bit 14	Quadrant projection suppression function	Invalid	Valid
bit 15	Not used Fix at 0.	Fixed to 0	

* The least significant bit is considered as bit0.
*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.5-10 Real time auto tuning (two-degree-of-freedom control, standard type) and P.5-17 Real time auto tuning (two-degree-of-freedom control, synchronous type).

Pr6.48	Adjust filter	Range	Unit	Default	Related control mode
		0 to 2000	0.1 ms	Size A:11 Size B,C:12 Size D,E,F:17	P S F

Set time constant of adjustment filter for two-degree-of-freedom control (position and speed).

Pr6.49	Adjust/Torque command attenuation term	Range	Unit	Default	Related control mode
		0 to 99	—	15	P F

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 ▯ = 1.0, adjustment filter 1 _ = 0.71:
Setup value = 75 1st digit = 5 (▯ = 1.0), 2nd digit = 7 (▯ = 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 Parameter No.
• **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page
• P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr6.50	Viscous friction compensation gain	Range	Unit	Default	Related control mode
		0 to 10000	0.1 %/(10000 r/min)	0	P S F

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	Default	Related control mode
		0 to 10000	ms	0	P S T F

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	Default	Related control mode
		—	—	0	

Fixed to 0.

Pr6.53	For manufacturer's use	Range	Unit	Default	Related control mode
		—	—	0	

Fixed to 0.

Pr6.54	For manufacturer's use	Range	Unit	Default	Related control mode
		—	—	0	

Fixed to 0.

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

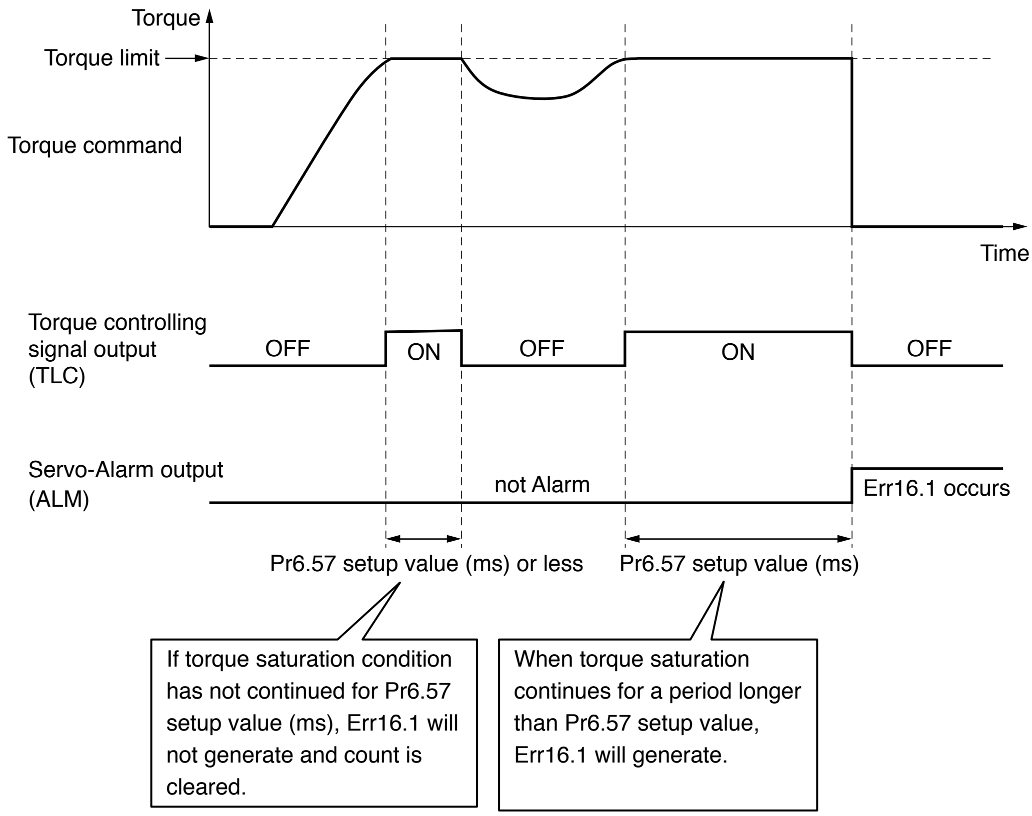
- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr6.57	Torque saturation anomaly detection time	Range	Unit	Default	Related control mode
		0 to 5000	ms	0	P S F

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, this function is disabled and no alarm will generate.

- 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	Serial absolute external scale Z phase shift amoun	Range	Unit	Default	Related control mode
		-2147483648 to 2147483647	—	0	P S T F

Sets the absolute position to output external scale Z-phase when serial absolute external scale is used.

Pr6.60	2nd damping filter depth	Range	Unit	Default	Related control mode
		0 to 1000	—	0	P F

Sets the damping depth of the 2nd resonance oppression notch filter.

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr6.61	1st resonance frequency	Range	Unit	Default	Related control mode
		0 to 3000	0.1 Hz	0	P

Sets the resonance frequency for the load of model 1 type vibration control filter.

Pr6.62	1st resonance damping ratio	Range	Unit	Default	Related control mode
		0 to 1000	—	0	P

Sets the resonance damping ratio of the 1st model type resonance oppression notch filter.

Pr6.63	1st antiresonance frequency	Range	Unit	Default	Related control mode
		0 to 3000	0.1Hz	0	P

Sets the antiresonance frequency of the 1st model type resonance oppression notch filter.

Pr6.64	1st antiresonance damping ratio	Range	Unit	Default	Related control mode
		0 to 1000	—	0	P

Sets the antiresonance damping ratio of the 1st model type resonance oppression notch filter.

Pr6.65	1st response frequency	Range	Unit	Default	Related control mode
		0 to 3000	0.1Hz	0	P

Sets the response frequency of the 1st model type resonance oppression notch filter.

Pr6.66	2nd resonance frequency	Range	Unit	Default	Related control mode
		0 to 3000	0.1Hz	0	P

Sets the resonance frequency of the 2nd model type resonance oppression notch filter.

Pr6.67	2nd resonance damping ratio	Range	Unit	Default	Related control mode
		0 to 1000	—	0	P

Sets the resonance damping ratio of the 2nd model type resonance oppression notch filter.

Pr6.68	2nd antiresonance frequency	Range	Unit	Default	Related control mode
		0 to 3000	0.1Hz	0	P

Sets the antiresonance frequency of the 2nd model type resonance oppression notch filter.

Pr6.69	2nd antiresonance damping ratio	Range	Unit	Default	Related control mode
		0 to 1000	—	0	P

Sets the antiresonance damping ratio of the 2nd model type resonance oppression notch filter.

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr6.70	2nd response frequency	Range	Unit	Default	Related control mode
		0 to 3000	0.1 Hz	0	P

Sets the response frequency of the 2nd model type resonance oppression notch filter.

Pr6.71	3rd damping filter depth	Range	Unit	Default	Related control mode
		0 to 1000	—	0	P F

Sets the damping depth of the 3rd resonance oppression notch filter.

Pr6.72	4th damping filter depth	Range	Unit	Default	Related control mode
		0 to 1000	—	0	P F

Sets the damping depth of the 4th resonance oppression notch filter.

Pr6.73	Load estimation filter	Range	Unit	Default	Related control mode
		0 to 2500	0.01 ms	0	P S

Sets the filter time constant for the load estimation.

Pr6.74	Torque compensating frequency 1	Range	Unit	Default	Related control mode
		0 to 5000	0.1Hz	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	Default	Related control mode
		0 to 5000	0.1Hz	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

Pr6.76	Number of load estimation	Range	Unit	Default	Related control mode
		0 to 8	—	0	P S

Sets the number (N)for the load estimation.

Pr6.87	For manufacturer's use	Range	Unit	Default	Related control mode
		—	—	0	

Fixed to 0.

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

Default: [ ]

Pr6.88	Absolute multi-rotation data upper limit	Range	Unit	Default	Related control mode
		0 to 65534	—	0	P S T F

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).

Pr6.97	Function expansion setting 3	Range	Unit	Default	Related control mode
		-2147483648 to 2147483647	—	0	P S T F

Sets various function in bit units:

	function	Setup value	
bit0	Quadrant projection compensation function enhancement	0:Invalid	1:valid
bit1	Deterioration diagnosis warning function	0:Invalid	1:valid
bit2	Expansion of Allowable motor operating range abnormal protection	0:Invalid	1:valid
bit3-31	For manufacturer use. Please set	fixed to 0.	

*bit 0 is the least significant bit.

Pr6.98	Function expansion setting 4	Range	Unit	Default	Related control mode
		-2147483648 to 2147483647	—	0	P S T F

Sets various function in bit units:
bit 0 to 31: For manufacture use. Please set fixed to 0
*bit 0 is the least significant bit.

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

1. Details of parameter

[Class 7] Special setting

Default: [ ]

Pr7.14	Main power turn-off warning detection time	Range	Unit	Default	Related control mode
		0 to 2000	ms	0	P S T F

Sets the time elapsed before the main power turn-off warning is detected when a main power turn-off state continues.
0 to 9, 2000: Warning detection disabled
10 to 1999: Warning detection enabled (unit shown in ms).
Note) To cause the warning detection to occur earlier than turn-off detection, maintain the relationship "Pr7.14 < Pr5.09" when this parameter is set.
In addition, when the time set for Pr7.14 is long and the P-N voltage at the main power converter area is reduced to the specified value or below before the warning is detected, Err13.0 "Main power insufficient voltage protection" is invoked earlier than the warning.

Pr7.22	Special function enhancement setting 1	Range	Unit	Default	Related control mode
		–32768 to 32767	—	0	P S T F

Sets various function in bit units:

bit	Function	Setup value	
bit0-3	Not used	Fixed to 0.	
bit4	external scale position information monitor function setting under semi-closed control	0:Invalid	1:Valid
bit5-15	Not used	Fixed to 0.	

*bit 0 is the least significant bit.
*For bit 4 (external scale position information monitor function setting under semi-closed control"), external scale position information can be monitored regardless of the setting of this bit, in case of full closed control.

All other parameters will be manufacturers use.Please do not change the default parameters.

Note

- A parameter is designated as follows: Class Pr0.00 Parameter No.
- **For parameters which No. have a suffix of " * "**, changed contents will be validated when you turn on the control power.

Related page

- P.3-32... "Inputs and outputs on connector X4"

4 Setup

1. Details of parameter

[Class 8] Special setting

Parameter is all manufacturers use.Please do not change the default parameters.

4 Setup

1. Details of parameter

[Class 9] Special setting

Parameter is all manufacturers use.Please do not change the default parameters.

4 Setup

1. Details of parameter

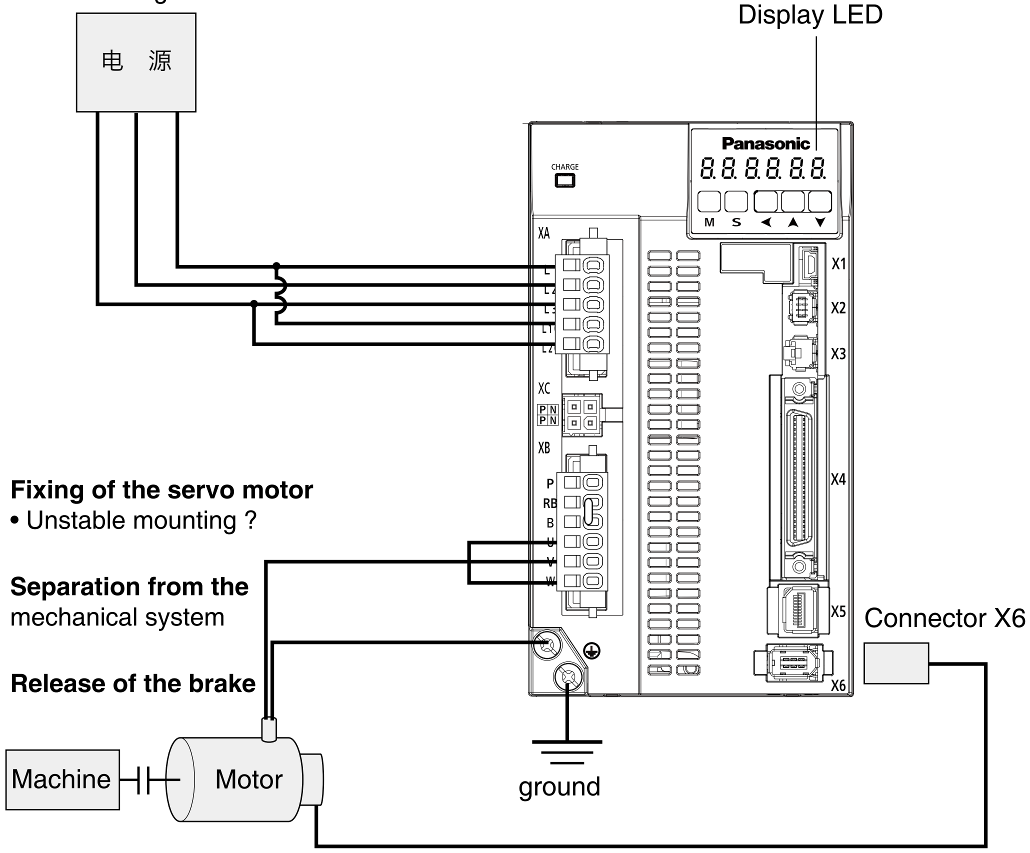
[Class 15] Special setting

Parameter is all manufacturers use.Please do not change the default parameters.

Inspection Before Trial Run

(1) Inspection on wiring
- Miswiring ? (Especially power input and motor output)
- Short or grounded ?
- Loose connection ?

(2) Confirmation of power supply and voltage
- Rated voltage ?



(3) Fixing of the servo motor
- Unstable mounting ?

(4) Separation from the mechanical system

(5) Release of the brake

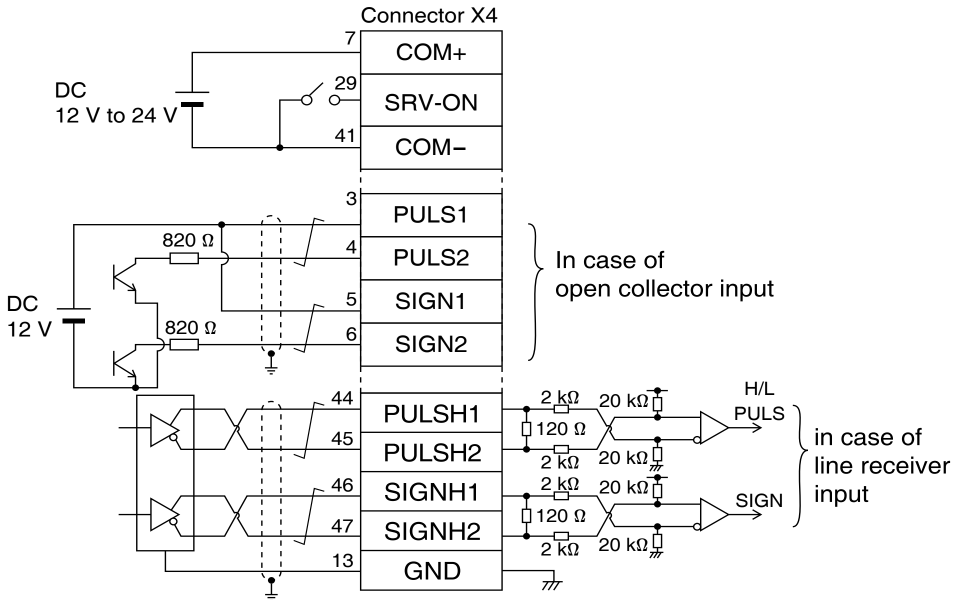
(6) Turn to Servo-OFF after finishing the trial run by pressing S

Note
- Wiring details please refer to P.2-12 ~ "Overall Wiring/ Wiring of the Main Circuit/ Wiring Diagram".
- The drive in the diagram is a multi - functional.

Trial Run (JOG run) at Position Control Mode

1) Connect the Connector X4.
2) Enter the power (DC12 V to 24 V) to control signal (COM+, COM–)
3) Enter the power to the driver.
4) Confirm the default values of parameters.
5) Match to the output format of the host controller with Pr0.07 (Command pulse input mode setup).
6) Write to EEPROM and turn off/on the power (of the driver).
7) Connect the Servo-ON input (SRV-ON) and COM– (Connector X4, Pin-41) to bring the driver to Servo-ON status and energize the motor.
8) Enter low frequency from the host controller to run the motor at low speed.
9) Check the motor rotational speed at monitor mode whether,
   rotational speed is as per the setup or not, and
   the motor stops by stopping the command (pulse) or not.
10) If the motor does not run correctly, refer to P.2-102, "Display of Factor for No-Motor Running" of Preparation.

• Wiring Diagram



• Parameter

Pr No.	Title	Setup value
0.01	Control mode setup	0
5.04	Over-travel inhibit input setup	1
0.05	Selection of command pulse input	arbitrary value
0.07	Command pulse input mode setup	1
5.18	Invalidation of command pulse inhibit input	1
5.17	Counter clear input mode	2

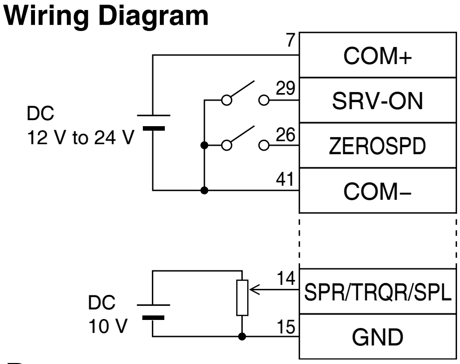
• Input signal status

No.	Title of signal	Monitor display
0	Servo-ON	+A

Trial Run (JOG run) at Velocity Control Mode

1) Connect the Connector X4.
2) Enter the power (DC12 V to 24 V) to control signal (COM+, COM–)
3) Enter the power to the driver.
4) Confirm the default values of parameters.
5) Connect the Servo-ON input (SRV-ON, Connector X4, Pin-29) and COM– (Connector X4, Pin-14) to turn to Servo-ON and energize the motor.
6) Close the speed zero clamp input (ZEROSPD) and apply DC voltage between velocity command input , SPR (Connector X4, Pin-14) and GND (Connector X4, Pin-15), and gradually increase from 0 V to confirm the motor runs.
7) Confirm the motor rotational speed in monitor mode.
   • Whether the rotational speed is per the setup or not.
   • Whether the motor stops with zero command or not.
8) If the motor does rotate at a micro speed with command voltage of 0.
9) When you want to change the rotational speed and direction, set up the following parameters again.
   Pr3.00: Speed setup, Internal/External switching
   Pr3.01: Speed command rotational direction selection
   Pr3.03: Reversal of speed command input
   Refer to P.4-29, 30 "Parameter Setup" (Parameters for Velocity/Torque Control)
10) If the motor does not run correctly, refer to P.2-102, "Display of Factor for No-Motor Running" of Preparation.

• Wiring Diagram



Run with ZEROSPD switch close, and Stop with open

In case of bi-directional operation (Positive/Negative), provide a bipolar power supply.

In case of one-directional operation

• Parameter

Pr No.	Title	Setup value
0.01	Control mode setup	1
5.04	Over-travel inhibit input setup	1
3.15	Speed zero-clamp function selection	1
3.00	Speed setup, Internal/External switching	Set up as required
3.01	Speed command rotational direction selection	
3.02	Input gain of speed command	
3.03	Reversal of speed command input	
4.22	Analog input 1 (AI1) offset setup	
4.23	Analog input 1 (AI1) filter	

• Input signal status

No.	Title of signal	Monitor display
0	Servo-ON	+A
5	Speed zero clamp	—

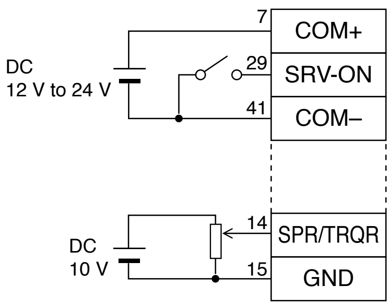
Trial Run (JOG run) at Torque Control Mode

1) Connect the Connector X4.
2) Enter the power (DC12 V to 24 V) to control signal (COM+, COM–)
3) Enter the power to the driver.
4) Confirm the default values of parameters.
5) Set a lower value to Pr3.07 (4th speed of speed setup).
6) Energize the motor by connecting the Servo-ON input (SRV-ON, Connector X4, Pin-29) and COM– (Pin-41 of Connector X4) to turn to Servo-ON status.
7) Confirm that the motor runs as per the setup of Pr3.07 by applying DC voltage (positive/negative) between the torque command input (Pin-14 of Connector X4) and GND (Pin-15 of Connector X4).
8) If you want to change the torque magnitude, direction and velocity limit value against the command voltage, set up the following parameters.

   Pr3.19: Input gain of torque command
   Pr3.20: Input reversal of torque command
   Pr3.21: Speed limit value 1

   Refer to P.4-35, 36, "Parameter Setup" (Parameters for Velocity/Torque Control)
9) If the motor does not run correctly, refer to P.2-102, "Display of factor for No-motor running" of Preparation.

• Wiring Diagram



For bi-directional running (Positive/Negative), provide a bipolar power supply.

In case of one way running

• Parameter

Pr No.	Title	Setup value
0.01	Control mode setup	2
5.04	Over-travel inhibit input setup	1
3.15	Speed zero-clamp function selection	0
3.17	Selection of torque command	0
3.19	Input gain of torque command	Set up as required
3.20	Input reversal of torque command	
3.21	Speed limit value 1	lower value

• Input signal status

No.	Title of signal	Monitor display
0	Servo-ON	+A
5	Speed zero clamp	—

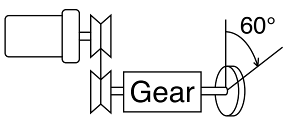
Setup of Motor Rotational Speed and Input Pulse Frequency

Input pulse frequency (pps)	Motor rotational speed (r/min)	$\boxed{\text{Pr0.08}}$ 23-bit
2 M	3000	$\frac{2^{23}}{\boxed{40000}}$
500 K	3000	$\frac{2^{23}}{\boxed{10000}}$
250 K	3000	$\frac{2^{23}}{\boxed{5000}}$
100 K	3000	$\frac{2^{23}}{\boxed{2000}}$
500 K	1500	$\frac{2^{23}}{\boxed{20000}}$

Note When setting Pr0.08, and encoder resolution is automatically set up as numerators. For full closed controlling, setting of Pr0.08 is ignored and settings of Pr0.09 and Pr0.10 are always applied.

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.

Relation between the motor rotational speed and input pulse counts



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. For full closed controlling, setting of Pr0.08 is ignored and settings of Pr0.09 and Pr0.10 are always applied.

e.g.) When you want to rotate the motor by 60° with the load of total reduction ratio of 18/365.

	Encoder 23-bit
$\frac{\boxed{\text{Pr0.09}}}{\boxed{\text{Pr0.10}}}$	$\frac{\boxed{9568256}}{\boxed{3375}}$
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 figures
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

* Refer to P.2-86 “Setup of command division and multiplication ratio (electronic gear ratio)” of Supplement.

5. Adjustment

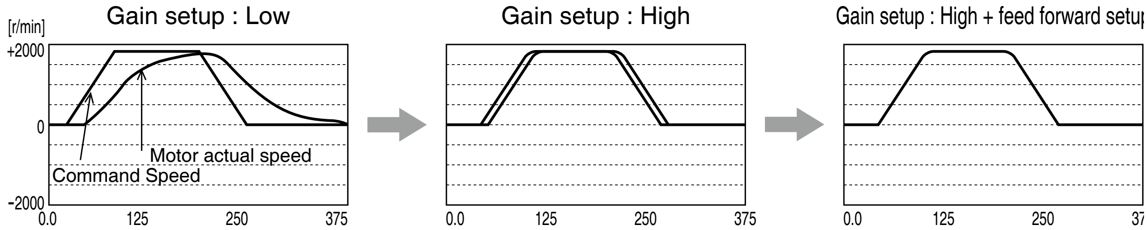
1. Gain Adjustment

Outline

Purpose

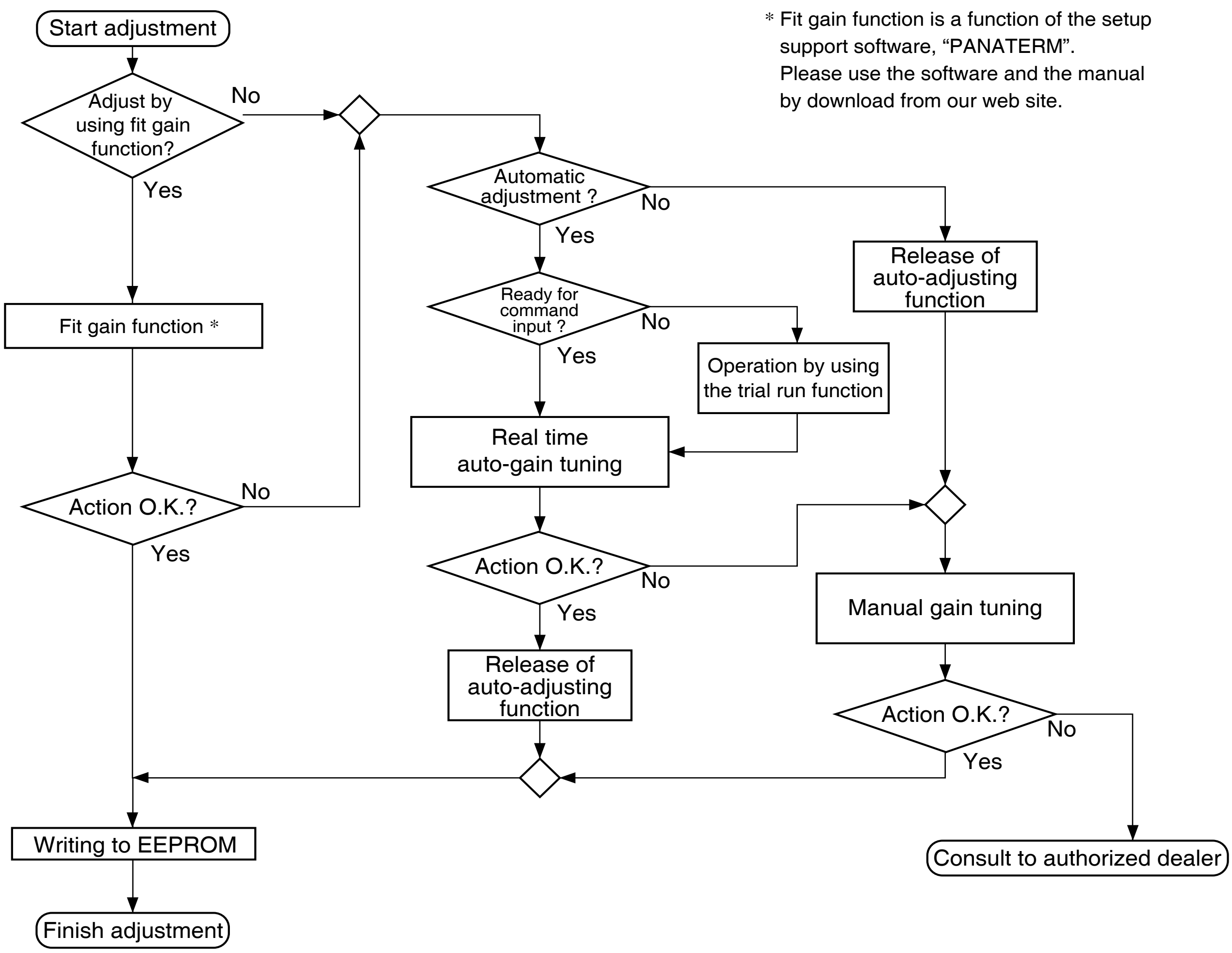
It is required for the servo driver to run the motor in least time delay and as faithful as possible against the commands from the host controller. You can make a gain adjustment so that you can run the motor as closely as possible to the commands and obtain the optimum performance of the machine.

<e.g. : Ball screw>



	Gain setup : Low	Gain setup : High	Gain setup : High + feed forward setup
Position loop gain	20	100	100
Velocity loop gain	100	50	50
Time constant of V-loop integration	50	50	50
Velocity loop feed forward	0	0	500
Inertia ratio	100	100	100

Procedures



Note For safety operation, first adjust the gain by referring to P.6-29 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.5-11
	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.5-27
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.5-30
		Basic procedure	Adjustment in position control mode	P.5-31
			Adjustment in velocity control mode	P.5-32
			Adjustment in torque control mode	P.5-32
			Adjustment in full-closed control mode	P.5-33
		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.5-34
		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.5-37
	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.5-41
		Damping control	Damping control	P.5-41
			Model-type damping filter	P.5-43
		Feed forward function	Velocity feed forward function improves responsiveness during position control and full closed control. Torque feed forward improves the response of velocity control system.	P.5-47
		Load variation suppression function	Function which obtains both reducing motor speed variation and improving stability by changing estimated disturbance torque and load fluctuation.	P.5-50
		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.5-53
		Friction torque compensation	Offset load compensation and dynamic friction compensation are used to reduce effects of mechanical friction.	P.5-55
		Inertia ratio switching function	This function can be used when selectable 2 inertia ratios are provided.	P.5-57
		Hybrid vibration damping function	This function, when used in full closed control mode, prevents vibration resulting from torsion on motor and load.	P.5-59
		Qudrant projecttion suppression function	Control configuration can be switched to suppress quadrant projection occurring during arc interpolation of 2 or more axes.	P.5-60
		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.5-62
		Two-stage torque filter	In addition to 1st and 2nd torque filters (Pr1.04 and Pr1.09), another torque filter can be set.	P.5-67

Remarks

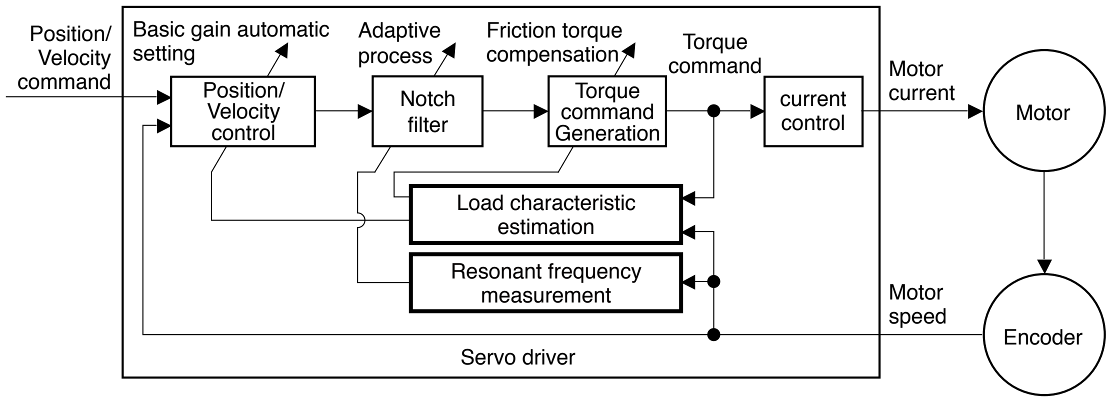
- Pay extra attention to safety, when oscillation (abnormal noise and vibration) occurs, shut off the main power, or turn to Servo-OFF.

2. Real-Time Auto-Gain Tuning

Basic

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 • Input signals such as the deviation counter clear and command input inhibit, and parameters except for controls such as torque limit setup, are correctly set, assuring that the motor can run smoothly.

Caution

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.5-27).

	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
   Load characteristics estimation speed can be set by Pr6.31 Real time auto tuning estimation speed.
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.2-109 "EEPROM Writing Mode" • P.4-6 to P.4-85... "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.4-6 to P.4-85... "Details of parameter"

• 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 maintained.
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 maintained.
1	17	Level of position control switching	
1	18	Hysteresis at position control switching	Sets to 33 if the current setting is not maintained.
1	19	Position gain switching time	
1	20	Mode of velocity control switching	Sets to 0 if the current setting is not maintained.
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 always set to invalid.

The following settings are always set to invalid when Pr0.02 Real-time auto-tuning setup is not 0.

Class	No.	Title	Function
6	10	Function expansion setup	The bit(bit3)for inertia ratio switching function permission is internally invalidated.
6	13	2nd Inertia ratio	Parameter settings can be changed,but the inertia ratio switching function is invalidated.

The following settings are parameters are set automatic for enable/disable of Pr6.10 Function expansion setting 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=1).
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%.

Related page • P.4-6 to P.4-85... "Details of parameter"

Class	No.	Title	Function
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.

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 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.