Panasonic[®]

Operating Instructions (Overall) AC Servo Motor & Driver MINAS 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 ·∻

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

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.

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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 instruc- tion could result in fire, electrical	
	Do not place combustibles near by the motor, driverd regenerative resistor and dynamic brake resister	shocks, damages and break- downs.	
	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.	
\bigcirc	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	
	Never connect the motor directly to the commercial power supply.	breakdowns.	
	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.	

Supplement

In the case of the motor with shaft end keyway, do not touch the keyway with bare hands.		
Do not touch the rotating portion of the motor while it is running.	Failure to observe this instruc- tion could result in personal	
Failure to observe this instruction could result in damages and breakdowns.	injury.	
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, per-	
Install an emergency stop circuit externally so that you can stop the operation and shut off the power immediately.	sonal injury, fire, malfunction or damage.	
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	
Check and confirm the safety of the operation after the earthquake.	shock, personal injury or fire.	
Before transporting, wiring and inspecting the		
driver, turn off power and wait for a time longer	Energized circuit will cause	
than that specified on the name plate on the side	Energized circuit will cause electric shock.	
panel of the product; and make sure that there is		
no risk of electrical 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.	
\Diamond	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 instruc-	
	Never run or stop the motor with the electro-magnetic contactor installed in the main power side.	tion could result in breakdowns.	
	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 transporta- tion 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.	
0	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 electro- magnetic 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 appliinsulating them with tape.	icable regulations or laws after	
	This Product shall be treated as Industrial Waste w	hen you dispose.	













Conformed Standards

		Driver Motor	
	EMC Directives	EN55011 EN61000-6-2 EN61000-6-4 EN61800-3	_
EC Direc-	Low-Voltage Directives	EN61800-5-1 EN50178	EN60034-1 EN60034-5
tives	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 $^{\circ}$ C (annual average), load factor of 80 $^{\circ}$ C or lower, operating hours of 20 hours or less per day.

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

Туре	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.



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

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

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1. Before Using the Products

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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 significantly reduced short period of time.

Besides, we have ensured the compatibility betweeth 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 specifications 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.

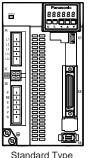
Yet, we have prepared standard type ,communication type and multi-function type of MINAS A6 series. This manual has been guiding based on featuers of multi-function type model. Please be aware that some specified features of the multi-function type might not be available in the standard type.

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).

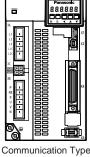
1. Introduction

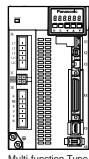
Outline

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



(SE)





communication Type (SG)

Multi-function Type (SF)

	Function	Standard Type	Communication Type	Multi-function Type
USB communication		0	0	0
Absolute system			0	0
RS232/485 comm	unication		0	0
Modbus communic	cation*1		0	0
Die als On a vetic ant	By Modbus communication		0	0
Block Operation*1	By input signal	0	0	0
Safety function				0
Command pulse input		0	0	0
Analog voltage input				0
Feedback scale connect				0
	Connector	Standard Type	Communication Type	Multi-function Type
X1: USB connec	tor	0	0	0
X2: Serial communi	cation connector		0	0
X3: Safety function connector				0
X4: I/O connecto	r	0	0	0
X5: Feedback sca	le connector			0
X6: Encoder con	nector	0	0	0

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

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.)

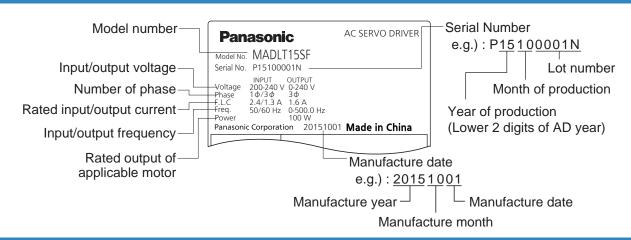
Contact to a dealer if you find any failures.

^{*1}The 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.

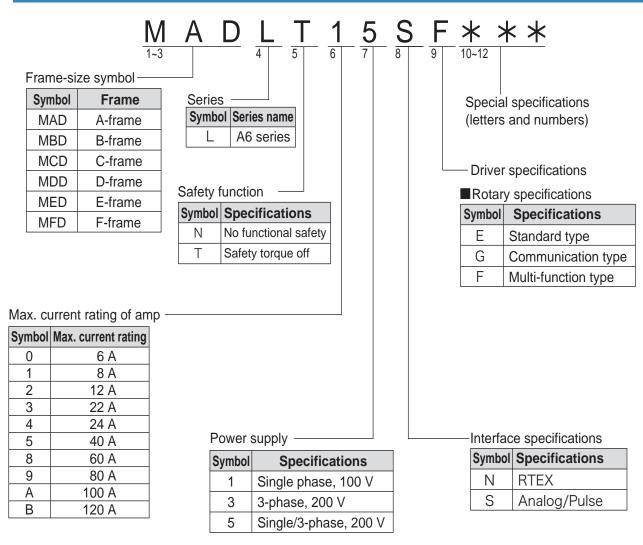
2. Driver

Check of the Model

Contents of Name Plate



Model Designation

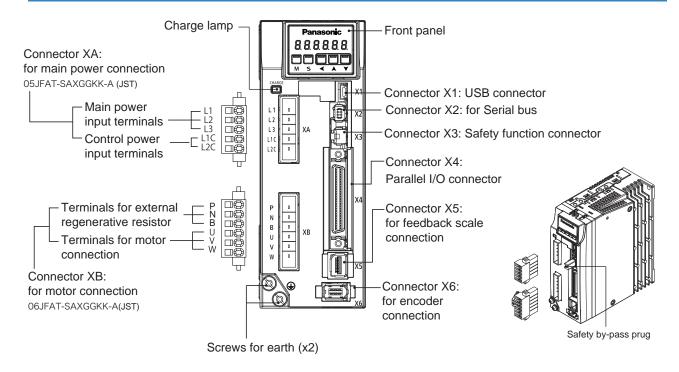


Related page :: P.1-19 "Check of the Combination of the Driver and the Motor"

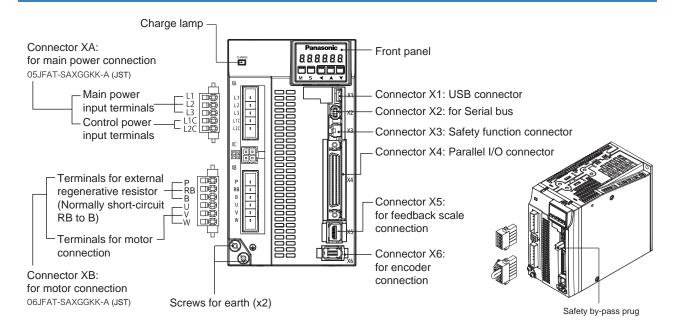
2. Driver

Parts Description

A to B-frame



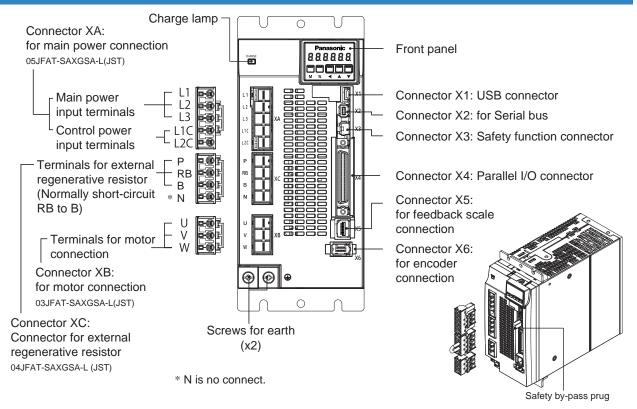
C to D-frame



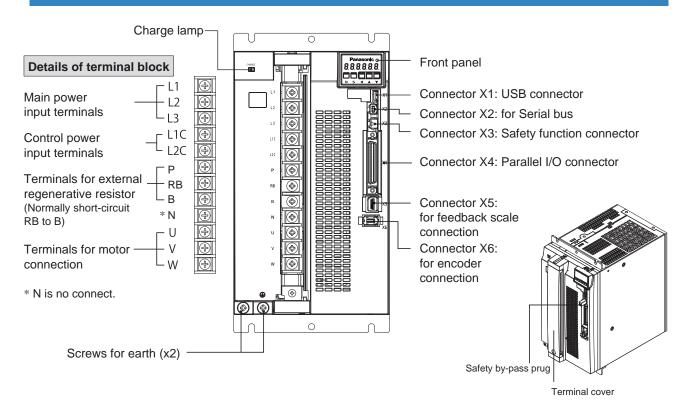
Note

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)

	-									
		100 V	Mair	circuit	Single phase, 100 V to 120 V					
	ln l	100 V	Contr	ol circuit	Single phase, 100 V to 120 V					
	Input power		Main	A to D-frame	Single/3-phase, 200 V to 240 V15 % 50 Hz/60 Hz					
	wer	200 V	circuit	E to F-frame	3-phase, 200 V to 240 V +10 % 50 Hz/60 Hz					
			Control circuit	A to F-frame	Single phase, 200 V to 240 V					
	With	stand volta	age		Primary to earth: withstand 1500 VAC, 1 min, (sensed current: 20 mA) [100 V/200 V]					
	F		temp	erature	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)					
	Envi	ronment	hur	midity	Both operating and storage: 20 % to 85 %RH or less (free from condensation*1)					
			Alt	itude	Lower than 1000 m					
				ration	5.88 m/s ² or less, 10 Hz to 60 Hz					
-	0	4 l 4 l		Tallon						
-		trol metho			IGBT PWM Sinusoidal wave drive					
	⊢nc	oder feedb	аск		23-bit (8388608 resolution) absolute encoder, 7-wire serial					
Basic	Fee	dback sca	le feedba	ck	A/B phase, initialization signal defferential input. Manufacturers that support serial communication scale(*2) Increment type Absolute type					
Specif	Control		Input		General purpose 10 inputs The function of general-purpose input is selected by parameters.					
Specifications	Pg	signal	O	utput	General purpose 6 outputs The function of general-purpose input is selected by parameters.					
S	ara	A1	Ir	nput	3 inputs (16-bit A/D: 1 input, 12-bit A/D: 2 inputs)					
	llel I/C	Analog signal	O	utput	2 outputs (Analog monitor: 2 output) Output from I/F connector pin 42, pin 43.					
	Parallel I/O connector	Pulse signal	lr	nput	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.					
	or		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.					
F			1	JSB	Connection with PC etc.					
	0			S232						
		munication			1 : 1 communication to a host.					
	funct	ion		S485	1 : n communication to a host.					
			Modb	us-RTU	1:1 communication to a host(RS232 communication) or 1: n communication to a host(RS485 communication).					
	Safe	ety function	1		Used for functional safety.					
	Fror	nt panel			(1) 5 keys (2) LED (6-digit)					
	Reg	eneration			A, B-frame: No built-in regenerative resistor (external resistor only) C to F-frame: Built-in regenerative resistor (external resistor is also enabled.)					
	Dyn	amic brake	9		A to F-frame: Built-in					
ı					Switching among the following 7 mode is enabled,					
	Control mode				(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					
		Auto tuni	ng		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.					
	ŀ	Division of	encoder fee	edback pulse	Set up of any value is enabled (encoder feedback pulses count is the max.).					
ח	ဂ္ဂါ	Protective		Hard error	Over-voltage, under-voltage, over-speed, over-load, over-heat, over-current and encoder error etc.					
Ĭ	Commor	function		Soft error	Excess position deviation, command pulse division error, EEPROM error etc.					
Function	핑									
ź	ă	Traceabil	-		The alarm data history can be referred to.					
- 1		Infinite ro	ation absolute		Available					
	ļ	Deterioration diagnosis waring function								



^{*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"

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

			Deviation counter clear, command pulse input inhibition, command division/multiplication				
	Control	input	Deviation counter clear, command pulse input inhibition, command division/multiplication switching, vibration suppression control switching, etc.				
	Control	output	Positioning complete, etc.				
		Max. command pulse frequency	Exclusive interface for Photocoupler and line driver: 500 kpulse/s Exclusive interface for line receiver: 8 Mpulse/s				
	Pulse	Input pulse signal format	Differential input. Selectable with parameter. ((1) Positive and Negative direction, (2) A and B-phase, (3) Command and direction)				
	input	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.				
1_		Smoothing filter	Primary delay filter or FIR type filter is adaptable to the command input				
Position control	Analog	Torque limit command input	Individual torque limit for both positive and negative direction is enabled.				
n	input	Torque feed forward input	Analog voltage can be used as torque feed forward input.				
nt of	Vibratio	n suppression control	Maximum of 3 may be used simultaneously				
으	Model-ty	pe damping filter	Maximum of 2 may be used simultaneously				
	Two-degre system	ee-of-freedom control	Available				
	Load var function	ation suppression	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				
	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.				
		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)				
	Analog	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.				
/elc	Internal	velocity command	Switching the internal 8speed is enabled by command input.				
Velocity con	Soft-sta	rt/down function	0 to 10s/1000 r/min r/min Setting is possible for acceleration and deceleration respectively. S shaped acceleration/deceleration is possible.				
onti	Zero-sp	eed clamp	Internal velocity command can be clamped to 0 with speed zero clamp input.				
trol		command filter	Available				
	system	ee-of-freedom control	Available				
	function	ation suppression	Available				
	Position function	compare output	Unavailable				
		scale position ion monitor function	Available				
	under se	emi-closed control					



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

2. Driver

Specifications (The Mutifuction type)

	\neg							
		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)				
	Ī	Speed li	mit function	Speed limit value with parameter t is enabled.				
l orqu	Toral	Two-degre system	ee-of-freedom control	Unavailable				
l orque contro	9 000	Load vari	ation suppression	Unavailable				
	5	Position function	compare output	Unavailable				
		informat	I scale position ion monitor function emi-closed control	Available				
	Ī	Block op	peration	Unavailable				
	Ì	Control	input	Deviation counter clear, command pulse input inhibition, command division/multiplication switching, vibration suppression control switching, etc.				
	Ì	Control	output	Positioning complete, etc.				
	Ì		Max. command pulse frequency	Exclusive interface for Photocoupler and line driver: 500 kpulse/s Exclusive interface for line receiver: 8 Mpulse/s				
Function		Pulse input	Input pulse signal format	Differential input. Selectable with parameter. ((1) Positive and Negative direction, (2) A and B-phase, (3) Command and direction)				
tion			Electronic gear (Division/Multiplica- tion 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				
Full-α	E	Analog input	Torque limit command input	Individual torque limit for both positive and negative direction is enabled.				
Full-closed contro	non hon		ange of division/ ation of feedback	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.				
	7	Vibratio	n suppression control	Maximum of 2 may be used simultaneously				
		Model d	amping filter	Unavailable				
		Two-degre system	ee-of-freedom control	Available				
		Load vari	ation suppression	Unavailable				
		Position function	compare output	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)				
		informat	l scale position ion monitor function emi-closed control	Unavailable				
	Block operation		peration	Available*1				



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

2. Driver

Specifications (Communication type)

		100 V	Main	circuit	Single phase, 100 V to 120 V +10 % 50 Hz/60 Hz				
	lnp	100 V	Contro	ol circuit	Single phase, 100 V to 120 V +10 % 50 Hz/60 Hz				
	Input power		Main	A to D-frame	Single/3-phase, 200 V to 240 V +10 % 50 Hz/60 Hz				
	/er	200 V	circuit	E to F-frame	3-phase, 200 V to 240 V +10 % 50 Hz/60 Hz				
			Control circuit	A to F-frame	Single phase, 200 V to 240 V +10 % 50 Hz/60 Hz				
	Wit	hstand vo	ltage		Primary to earth: withstand 1500 VAC, 1 min, (sensed current: 20 mA) [100 V/200 V]				
			tempe	erature	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)				
	Environment		hum	nidity	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)				
_	Cor	ntrol meth	nod		IGBT PWM Sinusoidal wave drive				
Basi	Encoder feedback				23-bit (8388608 resolution) absolute encoder, 7-wire serial				
Basic Specifications		Control	Input		General purpose 10 inputs The function of general-purpose input is selected by parameters.				
offic		signal			General purpose 6 outputs				
atior	Parallel		Ou	tput	The function of general-purpose input is selected by parameters.				
าร	allel I/O	Analog signal	Ou	tput	2 outputs (Analog monitor: 2 output) Output from I/F connector pin 42, pin 43.				
	connector	Pulse	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.				
) ¥	signal	Ou	tput	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.				
			U:	SB	Connection with PC etc.				
	0		RS	232	1 : 1 communication to a host.				
	func	munication tion	RS	485	1 : n communication to a host.				
			Modbu	ıs-RTU	1 : 1 communication to a host(RS232 communication) or 1 : n communication to a host(RS485 communication).				
	Fro	nt panel			(1) 5 keys (2) LED (6-digit)				
	Reg	generatio	n		A, B-frame: No built-in regenerative resistor (external resistor only) C to F-frame: Built-in regenerative resistor (external resistor is also enabled.)				
	Dyr	namic bra	ke		A to F-frame: Built-in				
	Cor	ntrol mode	е		(1) Position control (2) Internal velocity control (3) Position/ Internal velocity control				
Funtion	Common	Auto tun	ning		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.				
)n	non	Division of encoder feedback pulse			Set up of any value is enabled (encoder pulses count is the max.).				



^{*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"

2. Driver

Specifications (The Communication type)

Figure Control input Excess position deviation, command pulse division error, EEPROM error etc.			Protective	Hard error	Over-voltage, under-voltage, over-speed, over-load, over-heat, over-current and encoder error etc.				
Infinite rotation absolute function Deterioration disgnosis waring function Deterioration disgnosis waring function Control input Control input Max. command pulse frequency Input pulse signal format Format Devision Destriction disgnosis waring function Pulse Input pulse signal format Input pulse signal formation monitor function under semi-closed control Input pulse signal formation monitor function Individual setup of acceleration and deceleration is also enabled. Available Input pulse signal formation monitor function Individual setup of acceleration and deceleration is enabled, with 0 s/1000 r/min to 10 s/1000 r/min. Signoid acceleration/deceleration is enabled. Available Input pulse signal formation pulse signal formation monitor function Input pulse signal formation suppression function Input pulse signa		0	function	Soft error	Excess position deviation, command pulse division error, EEPROM error etc.				
Infinite rotation absolute function Deterioration diagnosis waring function Deterioration diagnosis waring function Deterioration diagnosis waring function Deterioration diagnosis waring function Deviation counter clear, command pulse input inhibition, command division/ multiplication switching, vibration suppression control switching, etc. Control output Positioning complete, etc. Max. command pulse frequency Positioning complete, etc.		omm	Traceabilit	y of alarm data	The alarm data history can be referred to.				
Control input Control output Deviation counter clear, command pulse input inhibition, command division/ multiplication switching, vibration suppression control switching, etc. Positioning complete, etc. Exclusive interface for Photocoupler and line driver: 500 kpulse/s Exclusive interface for line receiver: 8 Mpulse/s Input pulse signal format (In) Positive and Negative direction, (2) A and B-phase, (3) Command and direction) Multiplication of command pulse) Process command pulse frequency x electronic gear ratio [\frac{1\text{in} 2\text{ 2\tex		on	Infinite rota	tion absolute function	Available				
Position of put Max. command Positioning complete, etc.			Deterioration	diagnosis waring function	Available				
Max. command pulse frequency Exclusive interface for Photocoupler and line driver: 500 kpulse/s			Control inp	out					
Pulse Input pulse signal format Differential input ((1) Positive and Negative direction, (2) A and B-phase, (3) Command and direction) Pulse input Electronic gear (Division/ Multiplication of command pulse) Process command pulse frequency × electronic gear ratio (\frac{1 \text{ to 2} \text{ to 2}}{1 \text{ to 2}}) as positional command pulse) Process command pulse frequency × 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 Maximum of 2 may be used simultaneously Available Available 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) Position compare output function Available 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 Two-degree-of-freedom control system Available Candition Sigmoid acceleration is enabled, with 0 s/1000 r/min to 10 s/1000 r/min. Sigmoid acceleration valid setting Position compare output function Available Candition Block operation valid setting Return to origin completed state in increment mode (when block operation origin return invalidation setting is set to invalid) Position compare output function Available Available Candition 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 momotior function under semi-closed control Unavailable Candition Block operation valid setting Return to origin completed state in increment mode (when block operation origin return invalidation setting is set to invalid) Candition Candition Can			Control ou	tput	Positioning complete, etc.				
Policy of command pulse igner (Input place signated format (Input pulse)									
Process command pulse frequency x electronic gear ratio (1 10 2 m) as positional command input. Use electronic gear ratio in the range 1/1000 times to 8000 times. Smoothing filter			Pulse		((1) Positive and Negative direction, (2) A and B-phase, (3) Command and				
Vibration suppression control Maximum of 3 may be used simultaneously Model-type damping filter Two-degree-of-freedom control system Load variation suppression function Available 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) Unavailable Un		Position co	input	(Division/ Multiplication of	command input. Use electronic gear ratio in the range 1/1000 times to 8000				
Model-type damping filter Two-degree-of-freedom control system Available Load variation suppression function Available Position compare output function Available Return to origin completed state in increment mode (when block operation origin return invalidation setting is set to invalid) Unavailable Una		ontrol		Smoothing filter	Primary delay filter or FIR type filter is adaptable to the command input				
Two-degree-of-freedom control system Load variation suppression function Position compare output function External scale position information monitor function under semi-closed control Block operation Position compare output function information monitor function under semi-closed control Block operation Available (Individual setting is set to invalid) Tontrol 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 O-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 External scale position information monitor function under semi-closed control Unavailable Unavailable Unavailable Unavailable Unavailable Unavailable Unavailable Unavailable									
Position compare output function External scale position information monitor function under semi-closed control Block operation valid setting Return to origin completed state in increment mode (when block operation origin return invalidation setting is set to invalid) Unavailable Unavailable Control input 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 O-clamp of internal velocity command with speed zero clamp input is enabled. Two-degree-of-freedom control system Available Load variation suppression function Available External scale position information monitor function under semi-closed control Unavailable Unavailable Unavailable Unavailable Unavailable Unavailable Unavailable Unavailable Unavailable	핕				·				
Position compare output function External scale position information monitor function under semi-closed control Block operation valid setting Return to origin completed state in increment mode (when block operation origin return invalidation setting is set to invalid) Unavailable Unavailable Control input Control output Speed arrival, etc. Internal velocity command Switching the internal 8speed is enabled by command input. 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 O-clamp of internal velocity command with speed zero clamp input is enabled. Two-degree-of-freedom control system Available Load variation suppression function External scale position information monitor function under semi-closed control Unavailable	ntic								
External scale position information monitor function under semi-closed control Block operation Available '1 Control input Control output Speed arrival, etc. Internal velocity command Switching the internal 8speed is enabled by command input. Soft-start/down function Zero-speed clamp Two-degree-of-freedom control system Load variation suppression function External scale position information monitor function under semi-closed control Unavailable	ň				Available [Condition] Block operation valid setting Return to origin completed state in increment mode (when block operation origin				
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 O-clamp of internal velocity command with speed zero clamp input is enabled. Two-degree-of-freedom control system Load variation suppression function Position compare output function External scale position information monitor function under semi-closed control Unavailable Unavailable Unavailable Unavailable			information	n monitor function					
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 O-clamp of internal velocity command with speed zero clamp input is enabled. Two-degree-of-freedom control system Available Load variation suppression function Position compare output function External scale position information monitor function under semi-closed control Unavailable Unavailable Unavailable			Block oper	ation	Available*1				
Internal velocity command Switching the internal 8speed is enabled by command input. Soft-start/down function Zero-speed clamp Two-degree-of-freedom control system Load variation suppression function Position compare output function External scale position information monitor function under semi-closed control 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. O-clamp of internal velocity command with speed zero clamp input is enabled. Available 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) Unavailable			Control inp	out	(1) Selection of internal velocity setup (2) Speed zero clamp, etc.				
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 Two-degree-of-freedom control system Load variation suppression function Position compare output function External scale position information monitor function under semi-closed control 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. Available Co-clamp of internal velocity command with speed zero clamp input is enabled. Available Load variation suppression function Return to origin completed state in increment mode (when block operation origin return invalidation setting is set to invalid) Unavailable Unavailable			Control ou	tput	Speed arrival, etc.				
Two-degree-of-freedom control system Load variation suppression function External scale position information monitor function under semi-closed control to 10 s/1000 r/min. Sigmoid acceleration/deceleration is also enabled. To 10 s/1000 r/min. Sigmoid acceleration/deceleration is also enabled. Declamp of internal velocity command with speed zero clamp input is enabled. Available Load variation suppression 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			Internal ve	locity command	Switching the internal 8speed is enabled by command input.				
Position compare output function 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		Intern	Soft-start/d	down function					
Position compare output function 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		ıal vel	Zero-spee	d clamp	0-clamp of internal velocity command with speed zero clamp input is enabled.				
Position compare output function 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		ocity	Two-degree-	of-freedom control system	Available				
Position compare output function 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		contr	Load variati	on suppression function	Available				
information monitor function Unavailable under semi-closed control		<u>o</u>	Position cor	npare output function	Return to origin completed state in increment mode (when block operation origin				
Block operation Available*1			information	n monitor function	Unavailable				
			Block oper	ration	Available ¹				

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

2. Driver

Specifications (Standard type)

		400 \/	Main	circuit	Single phase, 100 V to 120 V +10 % 50 Hz/60 Hz			
	lnp	100 V	Contro	ol circuit	Single phase, 100 V to 120 V +10 % 50 Hz/60 Hz			
	Input power		Main	A to D-frame	Single/3-phase, 200 V to 240 V +10 % 50 Hz/60 Hz			
	er	200 V	circuit	E to F-frame	3-phase, 200 V to 240 V +10 % 50 Hz/60 Hz			
			Control circuit	A to F-frame	Single phase, 200 V to 240 V +10 % 50 Hz/60 Hz			
	Witl	hstand vo	ltage		Primary to earth: withstand 1500 VAC, 1 min, (sensed current: 20 mA) [100 V/200 V]			
			tempe	erature	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)			
	Env	ironment	hum	nidity	Both operating and storage : 20 % to 85 %RH or less (free from condensation)			
			Altitude		Lower than 1000 m			
			Vibration		5.88 m/s² or less, 10 Hz to 60 Hz (No continuous use at resonance frequency)			
asic	Cor	ntrol meth	nod		IGBT PWM Sinusoidal wave drive			
Sp	Encoder feedback			23-bit (8388608 resolution) absolute encoder, 7-wire serial				
Basic Specifications		0	Input		General purpose 10 inputs The function of general-purpose input is selected by parameters.			
tions	Pa	Control	signai	Output	General purpose 6 outputs The function of general-purpose input is selected by parameters.			
	rallel I	Analog	Analog signal		2 outputs (Analog monitor: 2 output) Output from I/F connector pin 42, pin 43.			
	Parallel I/O connector		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.			
	tor	Pulse signal		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.			
		nmunicat	ion	USB	Connection with PC etc.			
	Fro	nt 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 tur	ning		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.			
ă	on	Division pulse	of encoder	feedback	Set up of any value is enabled (encoder pulses count is the max.).			



^{*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"

2. Driver

Specifications (The Standard type)

Pulse input Pulse input Electronic gear Division/Multiplication of command pulse Process command pulse Process command pulse Process command pulse Process command input. Use electronic gear ratio (1 to 2 in the range 1/1000 times to command pulse)								
Soft error Excess position deviation, command pulse division error, EEPROM error etc.			Hard error					
Infinite rotation absolute function Deterioration diagnosis waring function Available	င္ပ	function	Soft error	Excess position deviation, command pulse division error, EEPROM error etc.				
Infinite rotation absolute function Deterioration diagnosis waring function Available	mmo	Traceability	of alarm data	The alarm data history can be referred to.				
Control input Control output Deviation counter clear, command pulse input inhibition, command division/ multiplication switching, vibration suppression control switching, etc. Max. command pulse frequency Input pulse signal format pulse input (1) Positive and Negative direction, (2) A and B-phase, (3) Command direction) Position (2) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Positive and Negative direction, (2) A and B-phase, (3) Command input (1) Posi		Infinite rotat	tion absolute function	Available				
Control output Positioning complete, etc. Max. command pulse frequency Exclusive interface for Photocoupler and line driver: 500 kpulse/s Exclusive interface for Inie receiver: 8 Mpulse/s Exclusive interface for Inie		Deterioration	diagnosis waring function	Available				
Max. command pulse frequency Exclusive interface for Photocoupler and line driver: 500 kpulse/s		Control inp	ut					
Pulse input Input pulse signal format Differential input ((1) Positive and Negative direction, (2) A and B-phase, (3) Command pulse input Electronic gear ((0) insion/Multiplication of command pulse) Process command pulse frequency × electronic gear ratio in the range 1/1000 times to times.		Control out	put	Positioning complete, etc.				
Pulse input Pulse input Electronic gear (Division/Multiplication of command pulse) Process command pulse frequency x electronic gear ratio (\frac{1 \text{ to 2^{28}}}{1 \text{ to 2^{28}}}) as portion command pulse)				Exclusive interface for Photocoupler and line driver: 500 kpulse/s Exclusive interface for line receiver: 8 Mpulse/s				
Process command pulse frequency x electronic gear ratio (110 2m) as port command pulse from pulse frequency x electronic gear ratio (110 2m) as port command pulse)				((1) Positive and Negative direction, (2) A and B-phase, (3) Command and				
Vibration suppression control Maximum of 3 may be used simultaneously Model-type damping filter Two-degree-of-freedom control system Load variation suppression function Available Avail	Position c	input	(Division/Multiplication	Process command pulse frequency \times 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.				
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 Load variation suppression function Available	ontro		Smoothing filter	Primary delay filter or FIR type filter is adaptable to the command input				
Two-degree-of-freedom control system Available Load variation suppression function Available Condition Block operation valid setting Return to origin completed state in increment mode (when block operation return invalidation setting is set to invalid) External scale position information monitor function under semi-closed control Unavailable Unavailable Unavailable Unavailable Control input 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/100 to 10 s/1000 r/min. Sigmoid acceleration/deceleration is also enabled. Two-degree-of-freedom control system Available Load variation suppression function Available Load variation suppression function Available Condition Block operation valid setting Return to origin completed state in increment mode (when block operation return invalidation setting is set to invalid)	-	Vibration s	suppression control	Maximum of 3 may be used simultaneously				
Position compare output function External scale position information monitor function under semi-closed control Block operation Available Control input 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 to 10 s/1000 r/min. Sigmoid acceleration/deceleration is also enabled. Zero-speed clamp O-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 return invalidation setting is set to invalid)	ן בַּן	Model-type	e damping filter	Maximum of 2 may be used simultaneously				
Position compare output function Return to origin completed state in increment mode (when block operation return invalidation setting is set to invalid) External scale position information monitor function under semi-closed control Block operation Control input 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 to 10 s/1000 r/min. Sigmoid acceleration/deceleration is also enabled. Zero-speed clamp O-clamp of internal velocity command with speed zero clamp input is enabled. Two-degree-of-freedom control system 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 return invalidation setting is set to invalid)	l no	Two-degree-	of-freedom control system	Available				
Position compare output function Return to origin completed state in increment mode (when block operation return invalidation setting is set to invalid) External scale position information monitor function under semi-closed control Block operation Control input 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 to 10 s/1000 r/min. Sigmoid acceleration/deceleration is also enabled. Zero-speed clamp O-clamp of internal velocity command with speed zero clamp input is enabled. Two-degree-of-freedom control system 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 return invalidation setting is set to invalid)	tio	Load variation	on suppression function	Available				
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Block operation Available*1		Block oper	ration	Available*1				

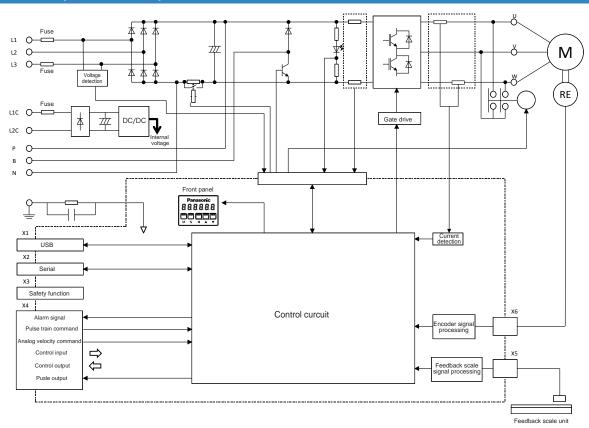


^{*1} For details of block operation functions, please refer to Technical reference (Modbus communication and Block operation Specification).

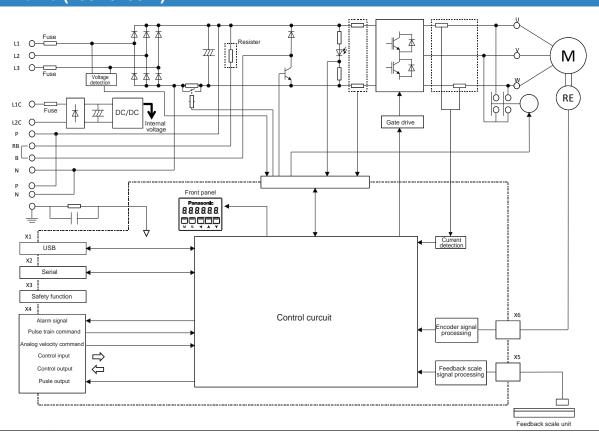
2. Driver

Block Diagram

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



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

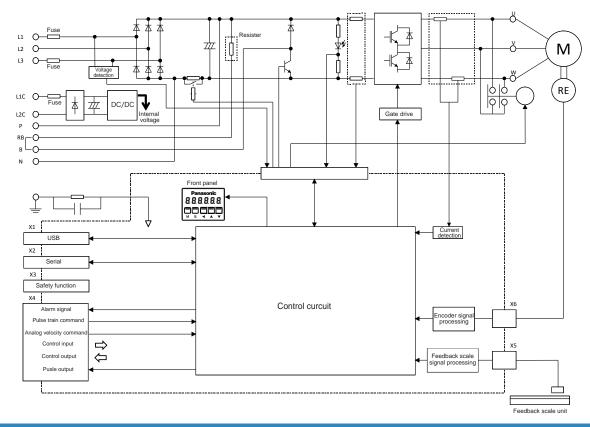


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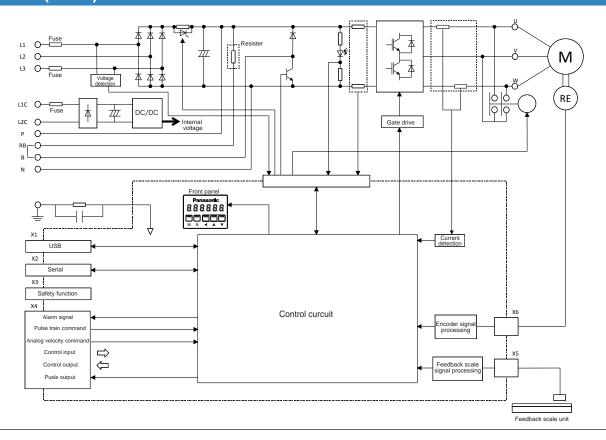
2. Driver

Block Diagram

E-frame (200 V)



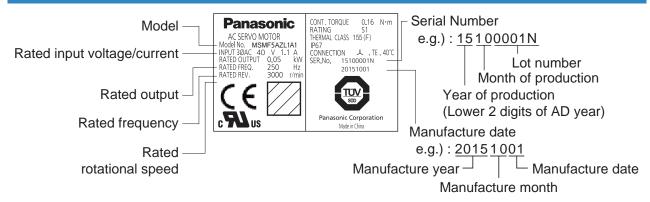
F-frame (200 V)



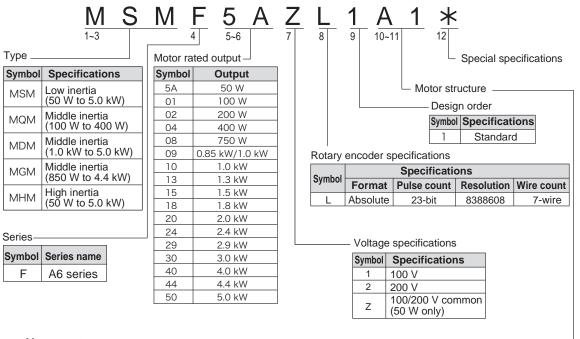
3. Motor

Check of the Model

Contents of Name Plate



Model Designation



Motor structure

MSMF(Below □80)

Syn	nbol	Sh	naft	Holding	Holding brake		seal	Moto	r I/F
10 dig	11 dig	Round	Key way Threaded	Without	With	Without	With	Connector type	Leadwire type
Α	1					•		•	
Α	2	•		•		•			•
В	1					•		•	
В	2	•			•	•			•
С	1	•		•			•	•	
С	2	•		•			•		•
D	1	•			•		•	•	
D	2	•			•		•		•
S	1		•	•		•		•	
S	2		•	•		•			•
Т	1		•		•	•		•	
Т	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)

Syn	nbol	Sł	naft	Holding	brake	Oil seal			Motor I/F	
10	11	Round	Key way	Without	With	Without	With	With	Connector	Leadwire
dig	aig	Round	Threaded	Without	******	Without	******	(Protective lip)	type	type
Α	1								•	
Α	2									
В	1									
В	2									
С	1									
С	2									
С	3									
С	4	•		•	•			•		•
D	1	•			•		•		•	
D	2	•			•		•			•
D	3	•						•	•	
D	4	•						•		•
S	1		•	•					•	
S	2									•
T	1				•				•	
Т	2				•					
Ü	1		•				•		•	
Ū	2		•				•			•
Ū	3		•						•	
Ū	4									
V	1			Ū	•		•	T -	•	
V	2						•			•
V	3								•	
V	4									

MSMF、MDMF、MGMF、MHMF(Above □100)

					· · ·				
Syr	nbol	Si	naft	Holding	g brake	Oil seal		Mote	or I/F
10 dig	11 dig	Round	Key way Threaded	Without	With	With	With (Protective lip)	Connector JN2	Connector JL10
C	5	•		•		•	(1 10100 iii 7 iii p)	•	
С	6	•		•		•			•
С	7	•		•			•	•	
С	8	•		•			•		•
D	5	•			•	•		•	
D	6	•			•	•			•
D	7	•			•		•	•	
D	8	•			•		•		•
G	5		•	•		•		•	
G	6		•	•		•			•
G	7		•	•			•	•	
G	8		•	•			•		•
Н	5		•		•	•		•	
Н	6		•		•	•			•
Н	7		•		•		•	•	
Н	8		•						•

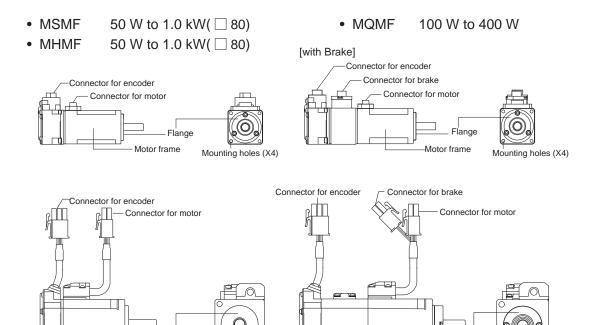


• For details of specific model, refer to the Dimensions of Supplement.

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



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

Mounting holes (X2)

Motor frame

Mounting holes (X2)

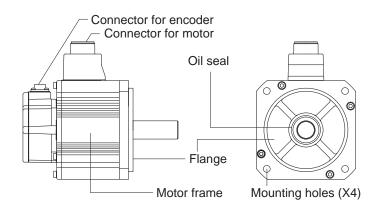
• MSMF 1.0 kW(□ 100) to 5.0 kW

Motor frame

Flange

MDMF 1.0 kW to 5.0 kWMGMF 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)

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.

		Mo	tor		Driver		
Power supply	Туре	Rated rotational speed	Model *1	Rated output	Model of type *1	Frame	
			MSMF5AZL1□□□	50 W	MADL□01S□	A frame	
Single			MSMF011L1□□□	100 W	MADL□11S□		
100 V			MSMF021L1	200 W	MBDL 21S	B frame	
			MSMF041L1	400 W	MCDL□31S□	C frame	
			MSMF5AZL1	50 W	MADL⊡05S⊡		
		_	MSMF012L1	100 W		A frame	
Single/	MOME		MSMF022L1	200 W	MADL 15S		
3-phase,	MSMF	3000 r/min	MSMF042L1	400 W	MBDL 25S	B frame	
200 V	Low inertia		MSMF082L1	750 W	MCDL 35S	C frame	
			MSMF092L1	1.0 kW	MDDL□45S□	D frame	
			MSMF102L1 \Boxed	1.0 kW 1.5 kW	MDDL□55S□	D frame	
	-				MEDL 83S	E frame	
2 nhooo			MSMF202L1	2.0 kW 3.0 kW	MFDL_A3S_	Ellame	
3-phase, 200 V			MSMF402L1	4.0 kW	WIFDL_A35_	F frame	
200 V		-	MSMF502L1	5.0 kW	MFDL B3S	Filame	
			MQMF011L1	100 W	MADL 11S	A frame	
Single			MQMF021L1	200 W	MBDL 21S	B frame	
100 V	MQMF	3000 r/min	MQMF041L1	400 W	MCDL 31S	C frame	
Single/	Middle inertia		MQMF012L1	100 W	MADL 05S	A frame	
3-phase,	Wildule Inertia		MQMF022L1	200 W	MADL 15S		
200 V			MQMF042L1	400 W	MBDL 25S	B frame	
Single/			MDMF102L1	1.0 kW	MDDL 45S		
3-phase, 200 V		2000 r/min	MDMF152L1	1.5 kW	MDDL□55S□	D frame	
	MDMF Middle inertia		MDMF202L1	2.0 kW	MEDL□83S□	E frame	
3-phase,			MDMF302L1	3.0 kW	MFDL A3S		
200 V			MDMF402L1□□□	4.0 kW	MEDI DOCO	F frame	
			MDMF502L1□□□	5.0 kW	MFDL□B3S□		
Single/ 3-phase,			MGMF092L1□□□	850 W	MDDL□45S□	D frame	
200 V	MOME		MGMF132L1□□□	1.3 kW	MDDL□55S□	D mame	
	MGMF	1500 r/min	MGMF182L1□□□	1.8 kW	MEDL□83S□	E frame	
3-phase,	Middle inertia		MGMF242L1□□□	2.4 kW	MEDL□93S□	Lilaille	
200 V			MGMF292L1□□□	2.9 kW	MEDI DOOD	F.(
			MGMF442L1	4.4 kW	MFDL□B3S□	F frame	
			MHMF5AZL1	50 W	MADL 01S	Α	
Single			MHMF011L1	100 W	MADL□11S□	A frame	
100 V			MHMF021L1□□□	200 W	MBDL□21S□	B frame	
]		MHMF041L1	400 W	MCDL□31S□	C frame	
			MHMF5AZL1	50 W	MADL□05S□		
			MHMF012L1	100 W	INIADE 039	A frame	
0'			MHMF022L1□□□	200 W	MADL□15S□		
Single/	MHMF		MHMF042L1□□□	400 W	MBDL□25S□	B frame	
3-phase, 200 V	High inertia	3000 r/min	MHMF082L1□□□	750 W	MCDL□35S□	C frame	
	Ingilificitia		MHMF092L1	1.0 kW	MDDL□55S□		
			MHMF102L1□□□ 1.0 kW MDI		MDDL□45S□	D frame	
			MHMF152L1□□□	1.5 kW	MDDL□55S□		
]		MHMF202L1	2.0 kW	MEDL□83S□	E frame	
3-phase,			MHMF302L1	3.0 kW	MFDL A3S	Litatio	
3-phase, 200 V			MHMF402L1	4.0 kW		F frame	
				11.011.44	MFDL B3S	F frame	

Note

Related page : For details of cable and connector kit, refer to P.7-108 the Options of Supplement.

^{*1} Suffix of " \square " in the applicable model represents the structure.

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

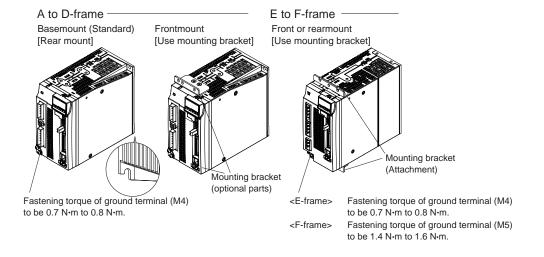
Item	Conditions
Ambient temperature	0 °C to 55 °C*1 (free from freezing)
Ambient humidity	20 % to 85 % RH (free from condensation)
Storage temperature*1	-20 °C to 65 °C (Max. temperature guarantee: 80 °C for 72 hours free from condensation*2)
Storage humidity	20 % to 85 % RH (free from condensation*2)
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

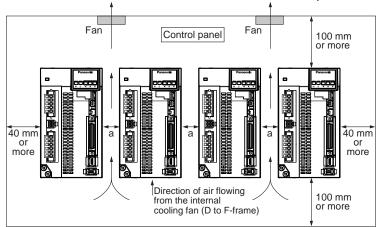


5. Installation

Driver

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.



	а
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 100Ω 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/s² 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 (H₂S, SO₂, NO₂, Cl₂, 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.

5. Installation

Driver

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 \diamondsuit 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

 $= 37 \times 0.7 \times 1.414$

= 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)	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:

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

Caution 🔅

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.

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

Current reduction coefficient

	No. of wires in a tube	Coefficient		
0	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					Max.		Minimum	(Reference)	
Nominal cross section (mm²)	Structure or shape (wires/mm²)	Outside diameter (mm)	Insulation thickness (mm)	Sheath thickness (mm)	(Reference) Finish O.D. (mm)	conductor resistance (20 °C) (W/km)	Test voltage (V/1 min.)	insulation resistance (MW•km)	Approx. mass (kg/km)
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)			
	Motor only	IP67 (except rotating portion of output shaft and connecting pin			
Enclosure	(Connector type)	part of the motor connector and the encoder connector)*3			
rating Motor only IP65 (except rotati		IP65 (except rotating portion of output shaft and connecting pin			
	(Leadwire type)	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.

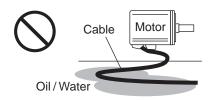
- 1) Horizontal mounting
 - Mount the motor with cable outlet facing downward for water/oil countermeasure.
- 2) Vertical mounting
 - Use the motor with oil seal when mounting the motor with gear reducer to prevent the reducer oil/grease from entering to the motor.

5. Installation

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 selfweight.
- 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

- 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

- 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"

Wiring Precautions on Movable Section

When wiring cable bear, take the following precautions:

Cable bear wiring

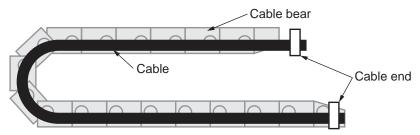
The bend radius of the cable must be 10 times or more its finish outside diameter.

(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]



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.

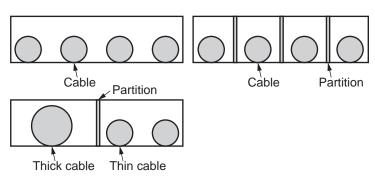
Lamination factor of cable in cable bear

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]

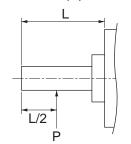


1 Before Using the Products

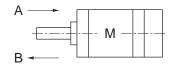
6. Permissible Load at Output Shaft

Motor

Radial load (P) direction



Thrust load (A and B) direction

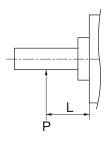


Unit: N (1 kgf=9.8 N)

		Α	t assembly	During running			
Motor	Motor output		Thrus	t load		Thrust load A	
series	ост сафа	Radial thrust	A-direction	B-direction	Radial thrust	and B-direction	
	50 W, 100 W	147	88	117.6	68.6	58.8	
	200 W, 400 W	392	147	196	245	98	
MSMF	750 W, 1.0 kW(□80)	686	294	392	392	147	
	1.0 kW(□100) to 3.0 kW	980	588	686	490	196	
	4.0 kW, 5.0 kW				784	343	
MQMF	100 W	147	88	117.6	68.6	58.8	
IVIQIVIF	200 W, 400 W	392	147	196	245	98	
	1.0 kW to 2.0 kW	980	588	686	490	196	
MDMF	3.0 kW	960			784	242	
	4.0 kW,5.0 kW	1666	784	980	704	343	
	850 W to 1.8 kW	980	588	686	686	196	
MGMF	2.4 kW			980	4470		
IVIGIVIE	2.9 kW	1666	784		1176	490	
	4.4 kW				1470		
	50 W	147	88	117.6	68.6	49	
	100 W	147	00	117.0	00.0	58.8	
	200 W, 400 W	392	147	196	245	98	
MHMF	750 W,1.0 kW(□80)	686	294	392	392	147	
	1.0 kW(□130), 1.5kW	980	588	686	490	196	
	2.0 kW to 5.0 kW	1666	784	980	784	343	

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
	50 W	$P = \frac{3533}{L+39}$
	100 W	$P = \frac{4905}{L+59}$
	200 W	$P = \frac{14945}{L+46}$
MSMF	400 W	$P = \frac{19723}{L + 66.5}$
INIOINIE	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	$P = \frac{36848}{L + 14.5}$
	100 W	$P = \frac{3420}{L + 28.8}$
MQMF	200 W	P= 14639 L+36
	400 W	P= 17579 L+48
	1.0 kW~2.0 kW	$P = \frac{19110}{L + 11.5}$
MDMF	3.0 kW	$P = \frac{34496}{L + 11.5}$
	4.0 kW, 5.0 kW	P= 42336 L+19

Motor series	Motor output	Formula of Load and load point relation
	850 W~1.8 kW	$P = \frac{26754}{L + 11.5}$
MGMF	2.4 kW	P= $\frac{63504}{L+19}$
IVIGIVIF	2.9 kW	P= $\frac{63504}{L+19}$
	4.4 kW	P= $\frac{79380}{L+19}$
	50 W	$P = \frac{3240}{L+29}$
	100 W	$P = \frac{4380}{L+43}$
	200 W	$P = \frac{15741}{L+41}$
MHMF	400 W	$P = \frac{20176}{L+59}$
IVITIVIE	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= 46256 L+19

1. Conformance to standards	
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1. Conformance to international standards

About confomance to internation! 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.



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 Electrical 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).



For rated current of circuit breaker and fuse, refer to P.2-10 "Driver and List of Applicable Peripheral Equipments".

For Overload protection time characteristics, refer to P.6-17

1. Conformance to international standards

About conformance to international standards

SEMIF47

- 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.



- (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
	EMC Directives	EN55011 EN61000-6-2 EN61000-6-4 EN61800-3	_
EC Direc-	Low-Voltage Directives	EN61800-5-1	EN60034-1 EN60034-5
tives	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 Standard	ds	UL508C (E164620)	UL1004-1, UL1004-6 (E327868)
CSA Standards		C22.2 No.14	C22.2 No.100-04
Radio Wave (South Kore		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.

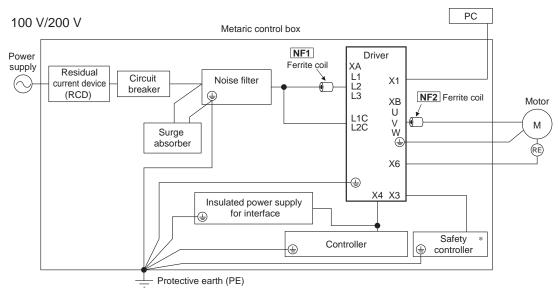
(대상기종: Servo Driver)

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).

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 completing installation.

^{*} The standard type and communication type are not provided with X3 terminal.

1. Conformance to international standards

Composition of Peripheral Equipment

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				0
NF1		(100 V)A, B (200 V)A, B, E	DV0P1460	ZCAT3035-1330	TDK Corp.	1
NF2	Motor cable	(100 V)A, B, C (200 V)A, B, C, D, E	DV0P1460			1
		(200 V)F				2

^{*1} For symbols, refer to the Block Diagram "Installation Environment" (P.2-4).

To connect the noise filter to the connector XB connection cable, adjust the sheath length Remarks 🔆 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.

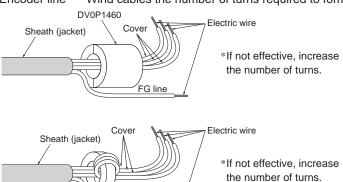
If not effective, increase the number of signal noise filters (including power line dedicated filters). (See figure below.)

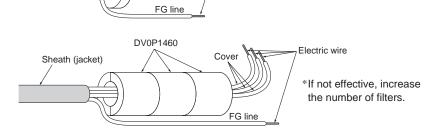
Motor line When installing the ferrite coil (including motor line dedicated filter) to our optional cable, remove the sheath (jacket) to the length so that wires can be wound on the ferrite coil (including power line dedicated filter). For effective noise reduction

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.





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} The number of turns are 0.

Composition of Peripheral Equipments

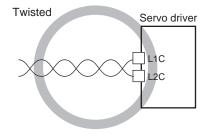
Power Supply

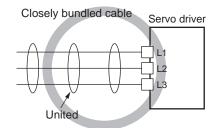
100 V type: (A to C-frame)	Single phase, 100 V $^{+10}_{-15}\%$ to 120 V $^{+10}_{-15}\%$	50 Hz/60 Hz
200 V type: (A to D-frame)	Single/3-phase, 200 V $^{+10~\%}_{-15~\%}$ to 240 V $^{+10~\%}_{-15~\%}$	50 Hz/60 Hz
200 V type: (E to F-frame)	3-phase, 200 V $^{+10}_{-15}\%$ to 240 V $^{+10}_{-15}\%$	50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

- (1) This product is designed to be used in over-voltage category (installation category) III of EN 61800-5-1:2007.
- (2) Use an insulated power supply of DC12 to 24 V which has CE marking or complies with EN60950.



- 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.

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

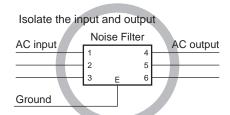
Composition of Peripheral Equipments

Noise Filter

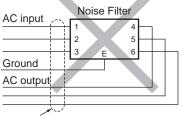
Option part No.	Voltage specifications for driver			Manufacturer
DV0P4170	Single phase 100 V/200 V	SUP-EK5-ER-6	A, B-frame	
	3-phase 200 V		A, B-frame	
DV0PM20042	Single phase 100 V/200 V 3-phase 200 V	3SUP-HU10-ER-6	C-frame	Okaya Electric Ind.
DV0P4220	Single/ 3-phase 200 V	3SUP-HU30-ER-6	D-frame	
DV0PM20043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



The effect of the noise filter is a little.



Do not place the input and output lines in the same duct or do not tie both in a bundle.

Composition of Peripheral Equipments

Surge Absorber

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



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"

3

1. Conformance to international standards

Composition of Peripheral Equipments

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 conflactor Contact configuration *2			
	Single phase, 100 V	50 W to 100 W	approx. 0.4 kVA		DV0P4170	DV0P4190					
MADL	Single/3-phase, 200 V	50 W to 200 W	approx. 0.5 kVA	10 A	DV0P4170 DV0PM20042	DV0P4190 DV0P1450					
	Single 100 V	200 W	approx. 0.5 kVA	10 A	DV0P4170	DV0P4190		20 A			
MBDL	Single/3-phase, 200 V	400 W	approx. 0.9 kVA		DV0P4170 DV0PM20042	DV0P4190 DV0P1450		(3P+1a)			
MCDL	Single 100 V	400 W	approx. 0.9 kVA	15 A	DV0PM20042	DV0P4190	DV0P1460	DV0P1460	DV0P1460		
MCDL	Single/3-phase, 200 V	750 W	approx. 1.3 kVA	15 A	DV0PW20042	DV0PM20042	DV0FW20042				
	3-phase, 200 V	1.0 kW	approx. 1.8 kVA		DV0P4220	DV0P4190 DV0P1450		30 A (3P+1a)			
MDDL		0.9 kW	approx. 1.8 kVA	20 A							
MIDDELLLLLL		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	RJ8035 60 A			
WEDL	3-priase, 200 v	2.5 kW	approx. 3.8 kVA	30 A	30 A DV0PM20043		(Recommended component *4	(3P+1a)			
		2.0 kW	approx. 3.8 kVA					60 A			
		3.0 kW	approx. 4.5 kVA				DV0P1460	(3P+1a)			
MFDL	3-phase, 200 V	4.0 kW	approx. 6.0 kVA	50 A	DV0P3410	DV0P1450	RJ8035 (Recommended component *4				
		4.5 kW	approx. 6.8 kVA					100 A (3P+1a)			
		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							
WADL	Single/3-phase, 200 V	50 W to 200 W	approx. 0.5 kVA		Connection to exclusive connector	0.75 mm²/ AWG18 600 VAC	Connection to exclusive connector		0.28 mm ² /	
MBDL	Single phase, 100 V	200 W	approx. 0.5 kVA	0.75 mm²/ AWG18 600 VAC or more					AWG22 to 0.75 mm ² /	
WIDDL	Single/3-phase, 200 V	400 W	approx. 0.9 kVA						AWG18 100 VAC	
MCDL	Single phase, 100 V	400 W	approx. 0.9 kVA						or more	
WCDL	Single/3-phase, 200 V	750 W	approx. 1.8 kVA		Connector	or more				
		0.9 kW	approx. 2.3 kVA	2.0 mm²/ AWG14 600 VAC or more					2.0 mm ² /	0.75 mm²/
MDDL	Single/3-phase, 200 V	1.0 kW	approx. 2.4 kVA					AWG14 600 VAC	AWG18 100 VAC	
		1.5 kW	approx. 2.9 kVA					or more	or more	

Note

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

2. System Configuration and Wiring

Driver and List of Applicable Peripheral Equipments

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	exclusive	Connection to exclusive connector 2.0 mm²/ AWG14 600 VAC or more			
		2.4 kW	approx. 4.5 kVA		connector					
MFDL	3-phase, 200 V	3.0 kW	approx. 4.5 kVA	3.5 mm²/ AWG12 600 VAC or more	AWG12 500 VAC 55.3	smaller AWG18 600 VAC or more	AWG18	11 mm or smaller		0.75 mm ² / AWG18
		4.0 kW	approx. 6.4 kVA				3.5 mm²/ AWG12 600 VAC Terminal or more	100 VAC or more		
		4.5 kW	approx. 6.8 kVA			Terminal block				
		5.0 kW	approx. 7.8 kVA				block M5			

- *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 (4) 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.

Select a circuit breaker and noise filter which match to the capacity of power Remarks 🔆 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	ame Terminal name		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)			
briver frame	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	IVIZ.0	

Caution ...

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

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

2. System Configuration and Wiring

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

Mains

Residual

current device

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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 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.

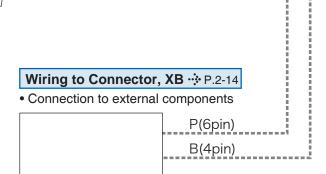
Use coil surge suppression units together with this.

 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, XA · ∴ P.2-14

L1 (5pin)

L2(4pin)

L3(3pin)

L1C(2pin)

L2C(1pin)

· Connection to input power

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



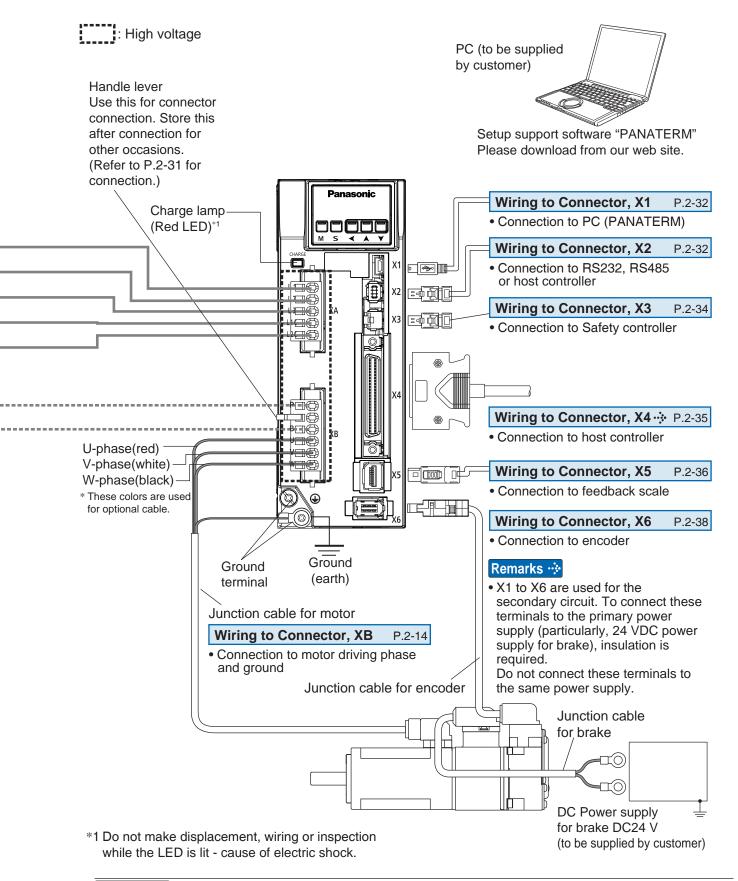
This overall wiring diagram is a typical one. The pages that follow show wiring for specific application. The wiring indicated with the broken line shall be provided only when required.

Related page ..:

• P.7-108... "Options"



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



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

2. System Configuration and Wiring

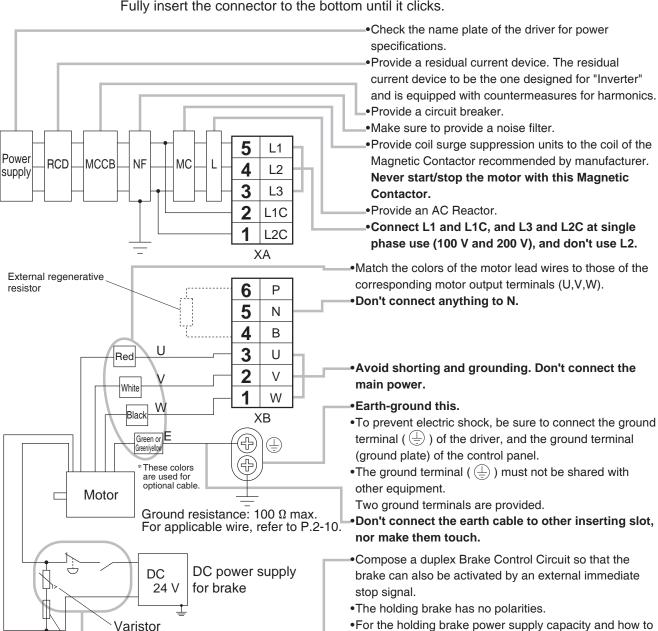
Wiring of the Main Circuit (A to B-frame, 100 V/200 V type)

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.



Connect a 10 A fuse in series with the varistor.

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

Note Related page ..: Varistor

Fuse (125 V 10 A)

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

Brake" on P.2-45. Provide a varistor.

use the brake, refer to "Specifications of Built-in Holding

• P.7-132 "Connector kit for XA" • P.7-133 "Connector kit for XB"

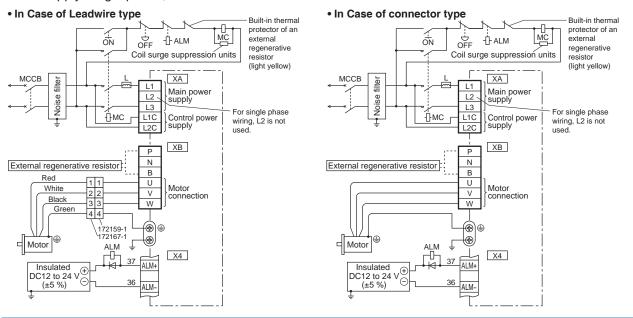
2. System Configuration and Wiring

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".

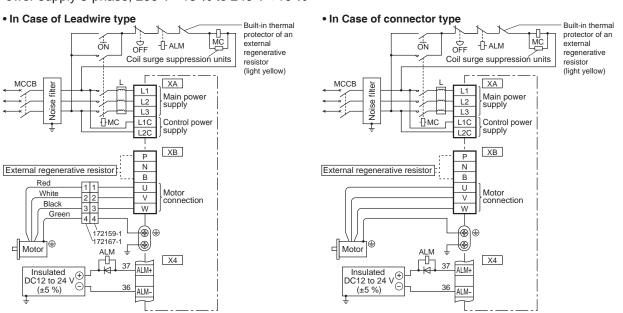
In Case of Single Phase, A to B-frame, 100 V / 200 V type

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



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

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



Note.1)

	Short wire	Built-in	Connection of the connector XB		
Frame No. (Accessory)		regenerative resistor	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"

Preparation

2. System Configuration and Wiring

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)

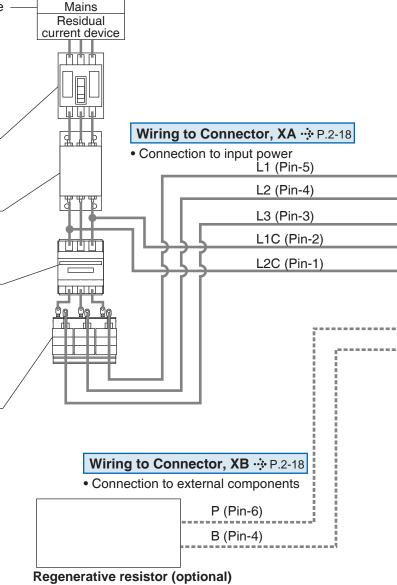
Turns on/off the main power of the servo driver.

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 ..:

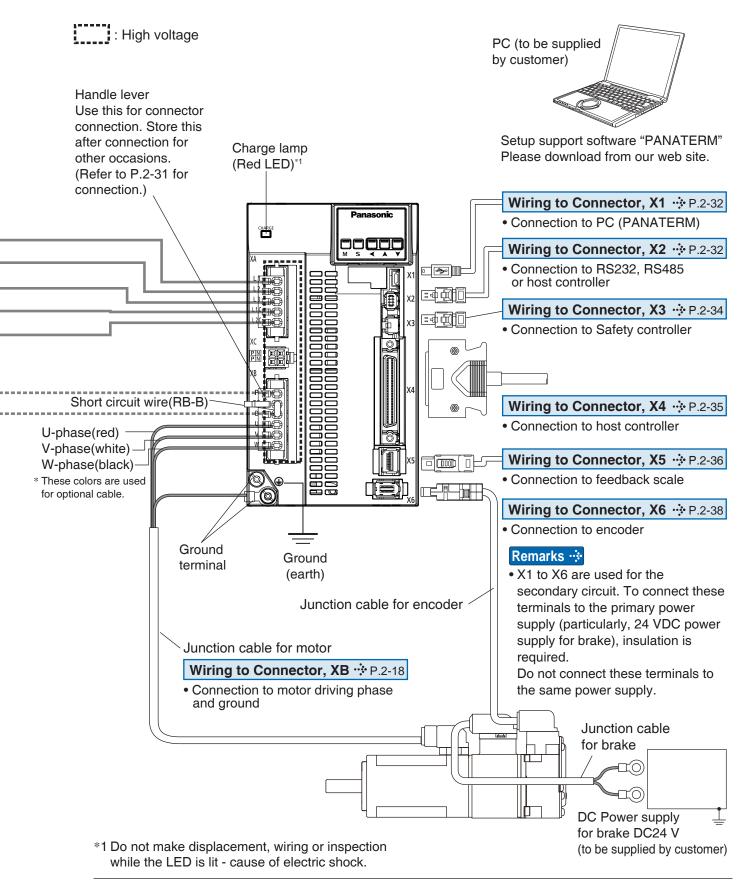
• P.7-108... "Options"

4

When in Trouble

2. System Configuration and Wiring

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



• 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

2. System Configuration and Wiring

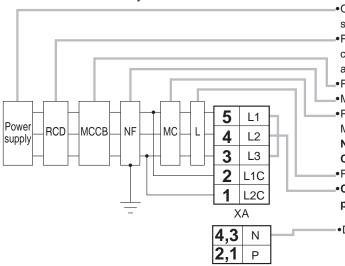
Wiring of the Main Circuit (C to D-frame, 100 V/200 V type)

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).
- 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.
- External regenerative resistor 6 Ρ 5 RB 4 В 3 U Red 2 ٧ White 1 W Black XΒ 4 These colors optional cable. Motor Ground resistance: 100 Ω max. For applicable wire, refer to P.2-10. DC power supply DC for brake 24 V

Varistor

Fuse (125 V 10 A)

- •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.
- \bullet The ground terminal ($\begin{tabular}{l} \textcircled{\ } \end{tabular}$) 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 Preparation

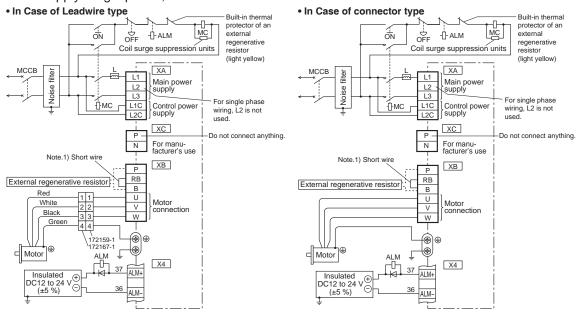
2. System Configuration and Wiring

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".

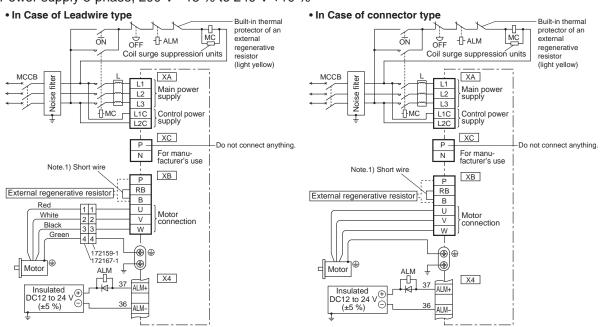
In Case of Single Phase, C to D-frame, 100 V / 200 V type

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



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

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



Note.1)

	Short wire	Built-in	Connection of the	connector XB
Frame No.	(Accessory)	regenerative resistor	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"

2. System Configuration and Wiring

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)

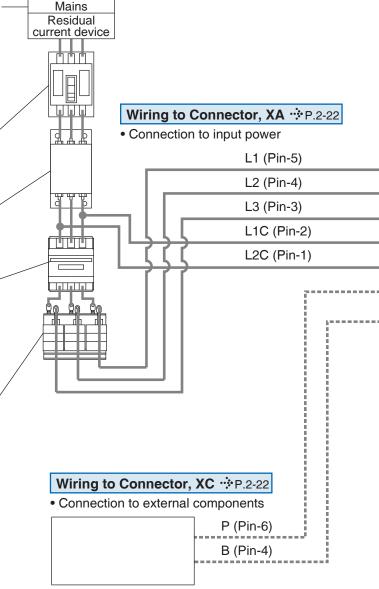
Turns on/off the main power of the servo driver.

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.

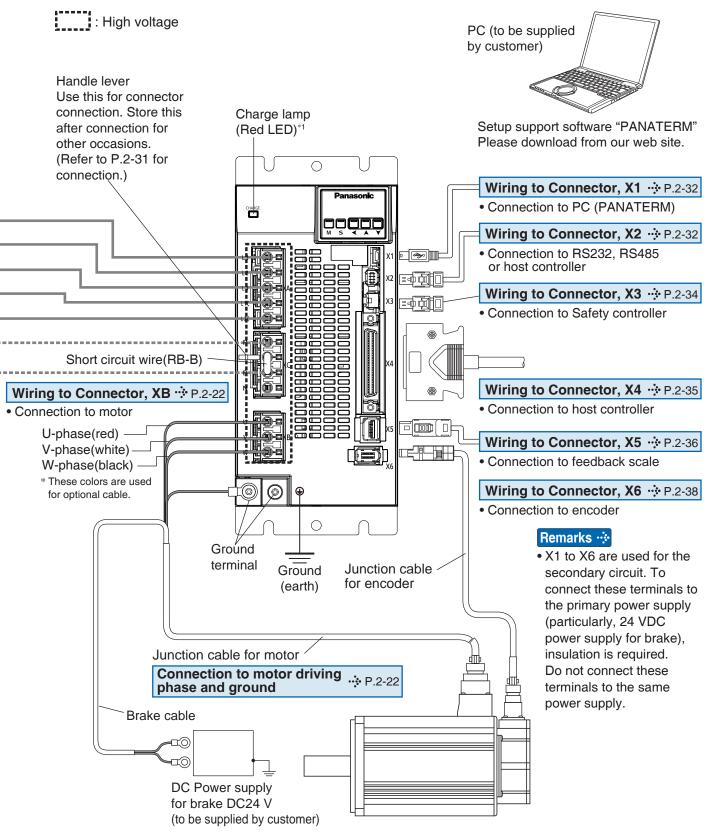


This overall wiring diagram is a typical one. The pages that follow show wiring for specific application. The wiring indicated with the broken line shall be provided only when required.

Related page ...

• P.7-108... "Options"

2. System Configuration and Wiring
Overall Wiring (E-frame, 200 V type)



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



- $\ensuremath{\bullet}$ 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

2. System Configuration and Wiring

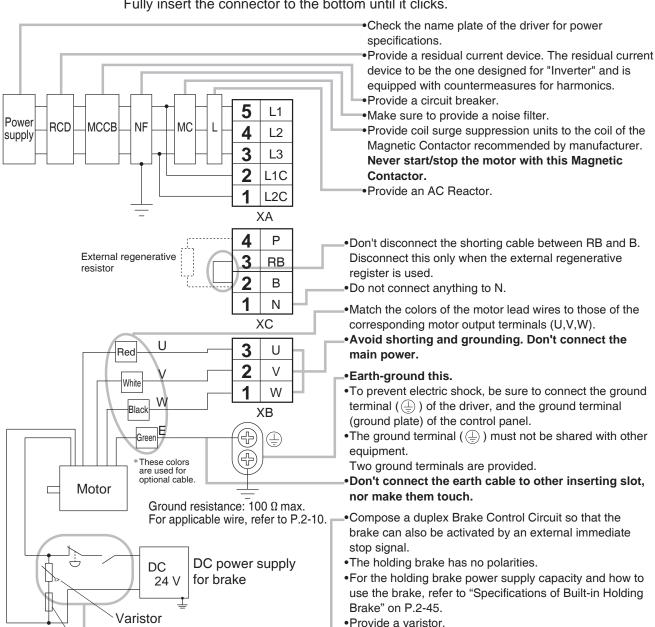
Wiring of the Main Circuit (E-frame, 200 V type)

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).
- Connect the wired connector to the driver.Fully insert the connector to the bottom until it clicks.





Fuse (125 V 10 A)

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

Connect a 10 A fuse in series with the varistor.

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"

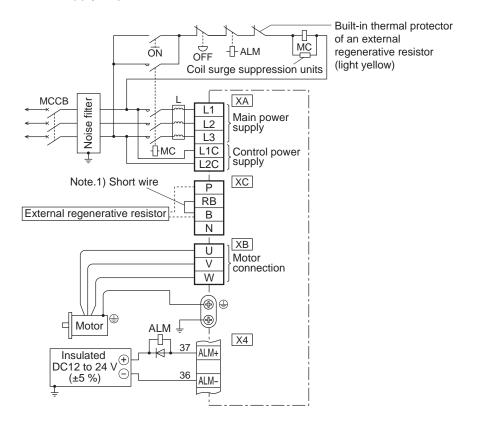
2. System Configuration and Wiring

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	Short wire	Built-in	Connection of the connector XC		
No.	Short wire (Accessory)	regenerative resistor	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"

2. System Configuration and Wiring

Overall Wiring (F-frame, 200 V type)

Mains

Residual current device

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.

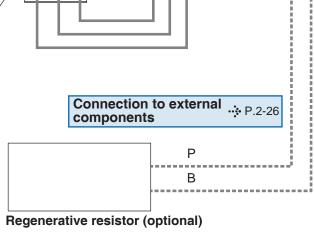
Reactor (L) (to be supplied by customer) Reduces harmonic current of the main power.

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.



Connection with input P.2-26

L1

L2

L3

L1C

L2C

power supply

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.



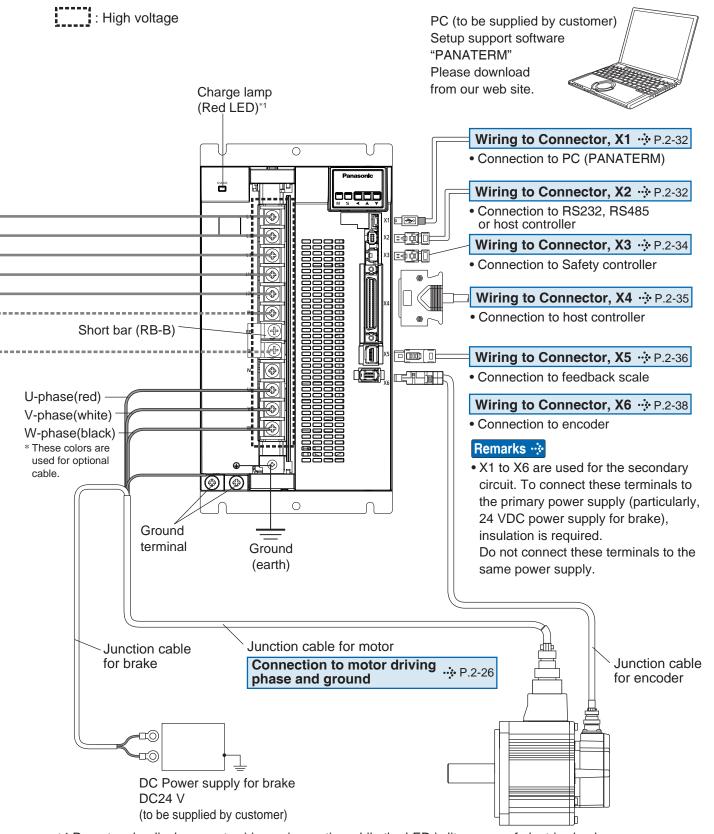
This overall wiring diagram is a typical one. The pages that follow show wiring for specific application. The wiring indicated with the broken line shall be provided only when required.

Related page ..:

• P.7-108... "Options"

2. System Configuration and Wiring

Overall Wiring (F-frame, 200 V type)



*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

Power

supply

RCD

MCCB

resistor

Motor

NF

External regenerative

Red

White

Green

DC

Varistor

Fuse (125 V 10 A)

24 V

These colors are used for

optional cable

Ground resistance: $1\overline{00} \Omega$ max.

For applicable wire, refer to P.2-10.

DC power

supply

for brake

MC

2. System Configuration and Wiring

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

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.

L1

L2

L3

L₁C

L₂C

Р

RB

В

Ν

U

٧

W

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.



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

Related page …

• P.2-28 "Specifications of Motor connector"

2 Preparation

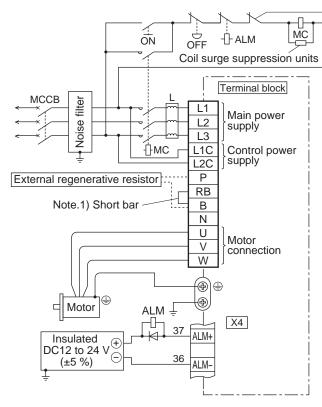
2. System Configuration and Wiring

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 %



Built-in thermal protector
 of an external
 regenerative resistor
 (light yellow)

Note.1)

Eromo	Short bar	Built-in	Connection of terminal block			
No (Accessory) regener		regenerative resistor	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 …

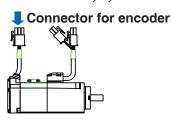
• P.2-28 "Specifications of Motor connector"

2. System Configuration and Wiring

Specifications of Motor connector

When leadwire type was be used

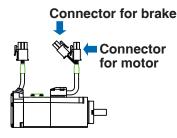
• When the motors of <MSMF, MQMF, MHMF> are used, they are connected as shown below. Connector: Made by Tyco Electronics k.k, (The figures below show connectors for the motor.)

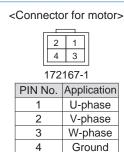


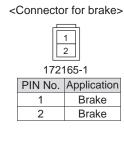
			1	_
	3	2	1	
	6	5	4	
	9	8	7	
172169-1				

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

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







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.





JN6CR07PM2 JN6CR07PM4

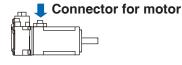
PIN No.	Application
1	FG(SHIELD)
2*	BAT-
3	E0V
4	PS
5*	BAT+
6	E5V
7	PS

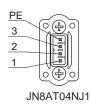
*When use absolut encoder (multi-turn data is not used). do not connect to 2-pin and 5-pin.

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))



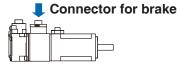


PIN No.	Application
1	U-phase
2	V-phase
3	W-phase
PE	Ground

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]





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

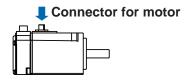
*Be sure to use only the screw supplied with the connector, to avoid damage.

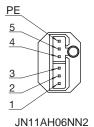
Remarks : Do not connect anything to NC.

2. System Configuration and Wiring

Specifications of Motor connector

MHMF(50 W, 100 W)





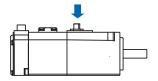
PIN No.	Application
1	U-phase
2	V-phase
3	W-phase
4	NC
5	NC
PE	Ground

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]

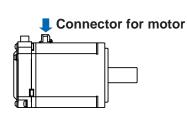
Connector for motor and brake

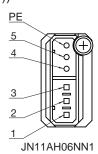


PIN No.	Application	
1	U-phase	
2	V-phase	
3	W-phase	
4	Brake	
5	Brake	
PF	Ground	

^{*} Electromagnetic brake is a nonpolar device.

MQMF, MHMF(200 W to 1.0 kW(□80))





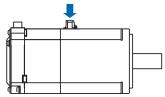
PIN No.	Application
1	U-phase
2	V-phase
3	W-phase
4	NC
5	NC
PE	Ground

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.

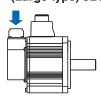
Remarks : Do not connect anything to NC.

• When the motors of <MSME(1.0 kW(\square 100) to 5.0 kW), MDMF, MGMF, MHMF(1.0 kW(\square 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
Α	NC
B C	NC
С	NC
D	NC
Е	NC
F	NC
G	E0V
Н	E5V
J	FG(SHIELD)
K	PS
L	PS
M	NC
N	NC
Р	NC
R	NC
R S* T*	BAT-
Τ*	BAT+

<Encoder connector JN2>



JN2AS10ML3-R

PIN No.	Application	
1	E0V	
2	NC	
3	PS	
4	E5V	
5*	BAT-	
6*	BAT+	
7	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.

 $\ensuremath{\,\times\,}$ When use absolut encoder(multi-turn data is not used), do not connect to S-pin and T-pin.

Connector for motor/brake

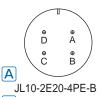
Table of Connector for motor and Connector for brake

Motor	Meter conseity	200 V	
model	Motor capacity	with Brake	without Brake
MSMF	1.0 kW(□100) to 2.0 kW	Α	С
MISIME	3.0 kW to 5.0 kW	В	D
MOME	1.0 kW to 2.0 kW	Α	С
MDMF	3.0 kW to 5.0 kW	В	D

Motor	Matayaanaity	200 V	
model	Motor capacity	with Brake	without Brake
MGMF	850 W to 1.8 kW	Α	С
IVIGIVIE	2.9 kW, 4.4 kW	В	D
MHMF	1.0 kW(□130) to 1.5 kW	Α	С
INITIME	2.0 kW to 5.0 kW	В	D

Connector for motor





B JL10-2E22-22PE-B

0210 2222 221 2 3		
PIN No.	Application	
Α	U-phase	
В	V-phase	
С	W-phase	
D	Ground	



JL10-2E20-18PE-B

PIN No.	Application
G	with Brake: Brake
G	without Brake: NC
Н	with Brake: Brake
П	without Brake: NC
Α	NC
F	U-phase
I	V-phase
В	W-phase
Е	Ground
D	Ground
С	NC



JL10-2E24-11PE-B

**		
PIN No.	Application	
А	with Brake: Brake	
А	without Brake: NC	
В	with Brake: Brake	
ь	without Brake: NC	
С	NC	
D	U-phase	
Е	V-phase	
F	W-phase	
G	Ground	
Н	Ground	
i	NC	



Do not connect anything to NC.

2. System Configuration and Wiring

Wiring method to connector

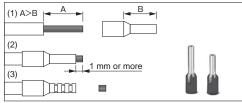
• Follow the procedures below for the wiring connection to the Connector XA, XB, XC and XD.

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 (Al series, Phoenix Contact, Ltd.)

- 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.

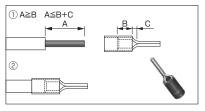




on the ferrule.

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
- 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).

1

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).

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



Release the lever.

Proce the corow

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.

- 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
0	0	0

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.

Z Preparation

4. Wiring to the connector, X2

Connecting communication connector

SE	SG	SF
	0	0

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]

86427531

(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)"

4. Wiring to the connector, X2

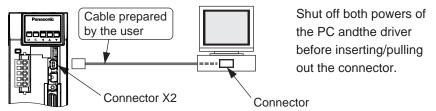
Connecting host computer

• 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

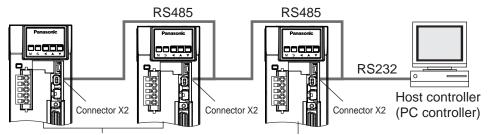
Connect the host (PC or controller) to an driver through RS232.

[How to connect]



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.

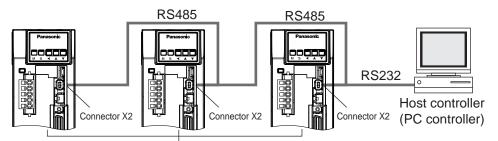
Set the axis number (Pr5.31) of driver to be connected to the host through RS232 to 0.

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.



 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.

ZPreparation

5. Wiring to the connector, X3

Safety function connector

SE	SG	SF
		0

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
INC.	_	2	Do not connect.
Cofety input 1	SF1-	3	
Safety input 1	SF1+	4	These are two independent circuits that
Cofety input 2	SF2-		turn off the operation signal to the power module to shut off the motor current.
Safety input 2	SF2+	6	
EDM output	EDM-	7	This is an output for monitoring the failure
EDM output	EDM+	8	of the safety function.
Frame ground	FG	Shell	Connected with protective earth terminal in the servo driver.

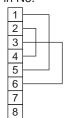
Connector (plug): 2201855-1 or 2013595-1 (optional, available from Tyco Electronics) [Connector pin assignment]



(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.



• Disconnecting this connector during operation results in immediate stop.

Related page ..:

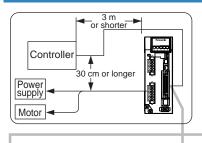
P.7-130 "Connector Kit for Safety"

6. Wiring to the connector, X4

Connection to Host Controller

Tips on wiring

Preparation



COM+

COM-

Connector X4

□1

GND

- 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 prep	Connecter to be prepared by customer							
Part name	Part No.	- Manufacturer						
Connecter (soldering type)	DF02P050F22A1	Japan Aviation Elec-						
Connector cover	DF02P050B22A1	tronics Ind.						
	or							
Connecter (soldering type)	54306-5019	Molex Inc.						
Connector cover	54331-0501	- Molex Inc.						
	or							
Connecter (soldering type)	10150-3000PE	Sumitama 2M						
Connector cover	10350-52A0-008	Sumilomo sivi						
	10.000 0000. =	- Sumitomo 3M						

or equivalent.



• For details, refer to P.7-108, "Options" of Supplement.



• 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.



 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.

Preparation

7. Wiring to the connector, X5

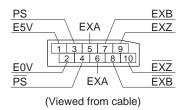
Connect on to External Scale

SE	SG	SF
		0

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	EX5V	1	Supply the power of external scale or A, B, Z phase encoder.
output	EX0V	2	Connected to ground of control circuit.
I/F of external	EXPS	3	Serial signal
scale signals	/EXPS	4	The transmission / reception method.
	EXA	5	
	/EXA	6	Parallel signal
A, B, Z phase	EXB	7	reception
Endoder signal input	/EXB	8	Correspondence speed :
·	EXZ	9	4 Mpps (after quadruple)
	/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.)



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.

Recommended external scale ratio is $1/40 \le \text{External scale ratio} \le 1280$

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.



 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.

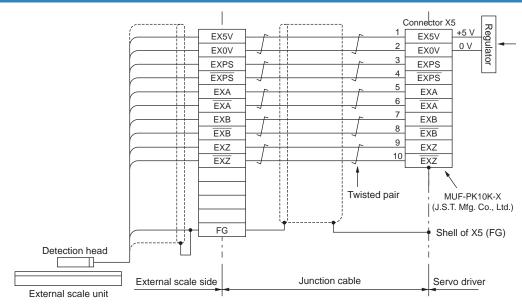


Related page •• P.4-6 "Details of Parameter" • P.7-131 "Connector Kit for External Scale"

7. Wiring to the connector, X5

Connect on to Feedback Scale

Wiring Diagram of X5



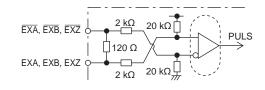
How to Wiring

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 mm².
- 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





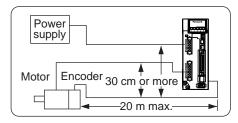
 X1 to X6 are used for the secondary circuit. To connect these terminals to the primary power supply (particularly, the 24 VDC power supply for brake), insulation is required.
 Do not connect these terminals to the same power supply.

8. Wiring to the connector, X6

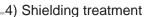
Connection to Encoder

SE	SG	SF
0	0	0

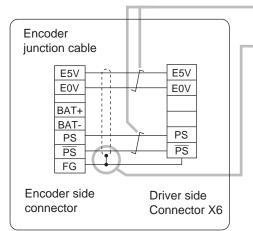
Tips on Wiring



- o 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.
- $_{\circ}$ 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 mm² or larger (AWG24), and with higher bending resistance.
- 3) Use twisted pair cable for corresponding signal/power wiring.



- 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.





 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.



• P.7-131 "Connector Kit for Encoder"

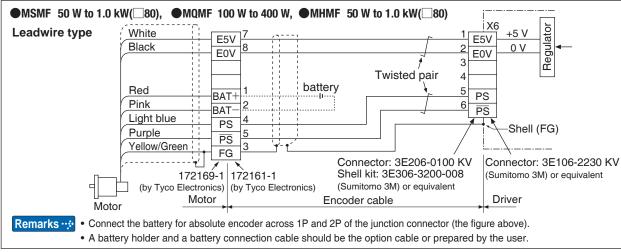
in Trouble

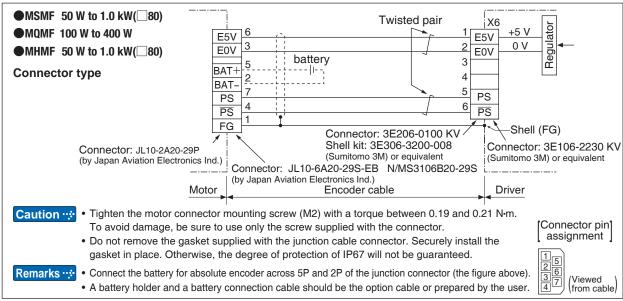
Wiring Diagram

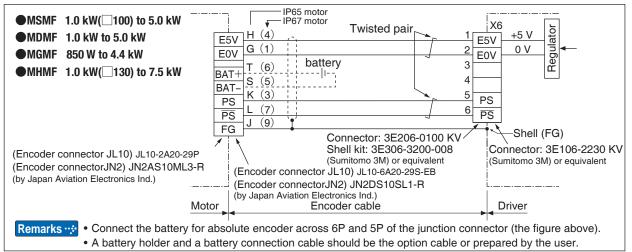
Connection to Encoder

8. Wiring to the connector, X6

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





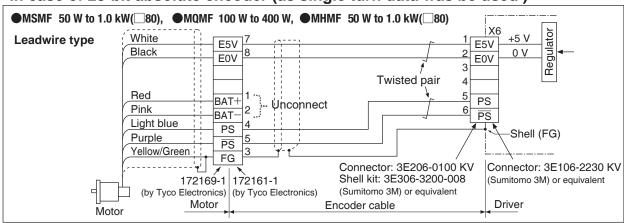


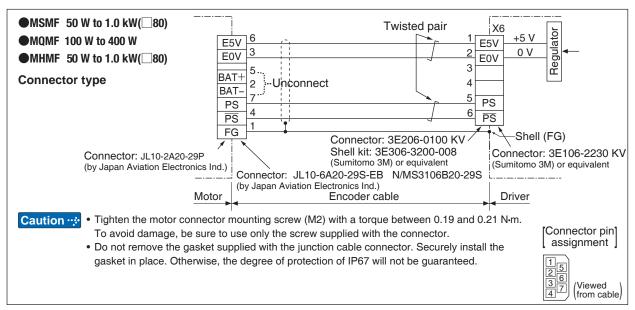
Remarks ...

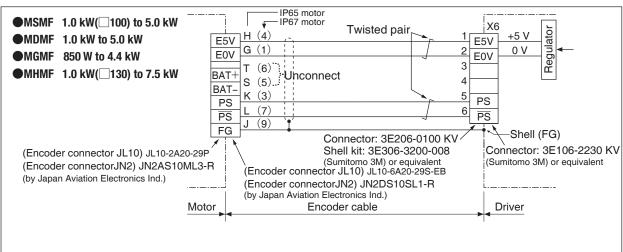
• X1 to X6 are used for the secondary circuit. To connect these terminals to the primary power supply (particularly, the 24 VDC power supply for brake), insulation is required. Do not connect these terminals to the same power supply.

Wiring Diagram

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







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.

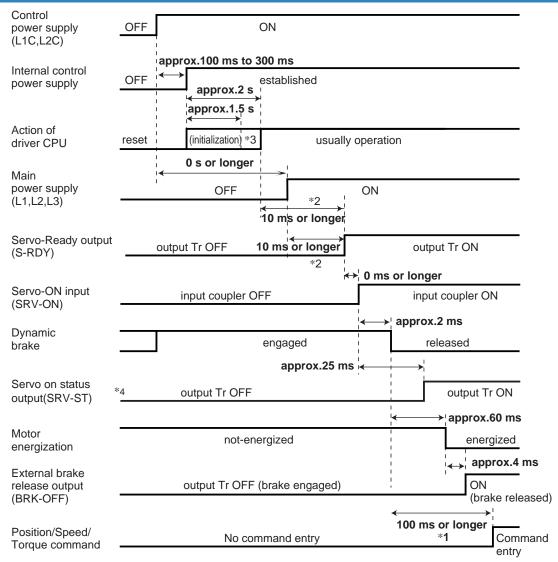
Do not connect these terminals to the same power supply.

2 Preparation

9. Timing Chart

Timing on power-up

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.

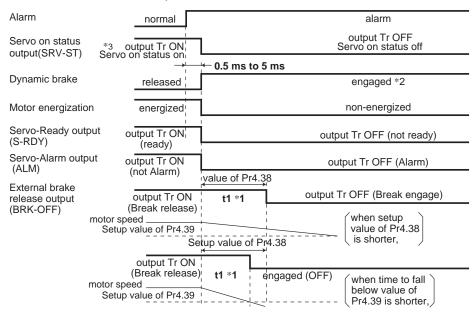
Preparation

9. Timing Chart

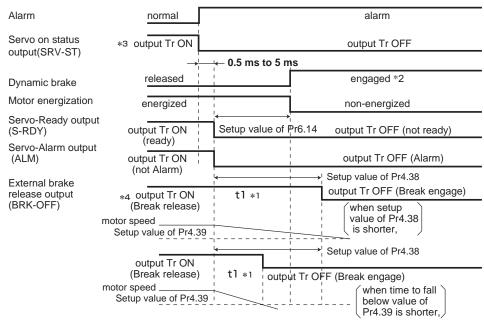
Alarm

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

DB/Free run deceleration operation



Immediate stop operation

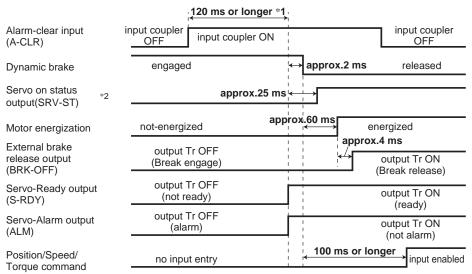


Caution ...

- *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.

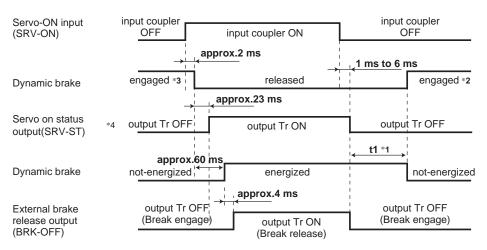
Z Preparation

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"

Preparation

3

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Adjustment

6

When in Trouble

7

Supplement

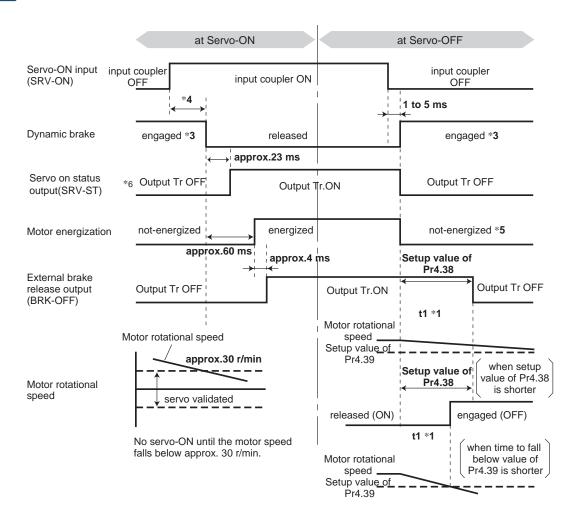
9. Timing Chart

Servo-ON/OFF

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"

4

10. Built-in Holding Brake

Preparation

Outline

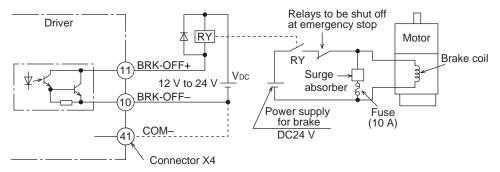
In the applications where the motor drives the vertical axis, this brake would be used to hold and prevent the work (moving load) from falling by gravity while the power to the servo is shut off.

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

1. The brake coil has no polarity.

Caution 🔅

- 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.
- 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.
- 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.

Preparation

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/s ²	
	50 W, 100 W	0.294 or more	0.002	35 or less	20 or less	0.30		39.2	4.9		
	200 W, 400 W	1.27 or more	0.018	50 or less	15 or less	0.36	DC1 V	137	44.1	30000	
	750 W	2.45 or more	0.075	70 or less	20 or less	0.42	or more	196	147	30000	
	1.0 kW(□80)	3.80 or more	0.075	70 01 1688	20 01 1688	0.42		185	80.0		
MSMF	1.0 kW(□100), 1.5 kW, 2.0 kW	8.0 or more	0.175	50 or less	15 or less	0.81		600	50		
	3.0 kW	12.0 or more		80 or less			DC2 V		900	10000	
	4.0 kW	16.2 or more	1.12	110 or loss	FO or loss	0.00	or more	1470	2160		
	5.0 kW	22.0 or more	1.12	110 or less	50 or less	0.90		1545	2000		
MQMF	100 W	0.39 or more	0.018	15 or less	20 or less	0.30	DC1 V	105	44.1	30000	
IVIQIVIF	200 W, 400 W	1.6 or more	0.075	70 or less	20 01 1688	0.36	or more	185	80.0	30000	
	1.0 kW, 1.5 kW, 2.0 kW	13.7 or more	1.12	100 or less	50 or less	0.79		1470	2160	10000	
MDMF	3.0 kW	22.0 or more		110 or less		0.90	DC2 V	1545	2000		
	4.0 kW	25.0 or more	4.7	80 or less	25 or less	1.29	or more	1800	3000	5440	
	5.0 kW	44.1 or more	4.1	150 or less	30 or less	1.29		1000	3100	5108	
	850 W, 1.3 kW, 1.8 kW	13.7 or more	1.12	100 or less	50 or less	0.79		1470	2160	10000	
MGMF	2.4 kW	25.0 or more	4.7	80 or less	25 or less		DC2 V or more		3000	5440	
	2.9 kW	25.0 01 111016	4.7	00 01 1633	25 01 1655	1.29	or more	1800	3000	3440	
	4.4 kW	44.1 or more	3.93	150 or less	30 or less				3100	5108	
	50 W, 100 W	0.38 or more	0.002	35 or less		0.30		39.2	4.9		
	200 W, 400 W	1.6 or more	0.018	50 or less	20 or less	0.36	DC1 V	105	44.1	30000	
	750 W, 1.0 kW(<u></u> 80)	3.8 or more	0.075	70 or less		0.42	or more	185	80.0		
MHMF	1.0 kW(□130), 1.5 kW	13.7 or more	1.12	100 or less	50 or less	0.79		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	DC2 V or more	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.)

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.

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.

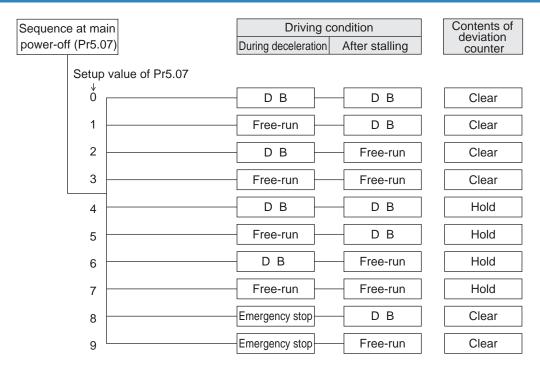
Before Using the Products

- 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

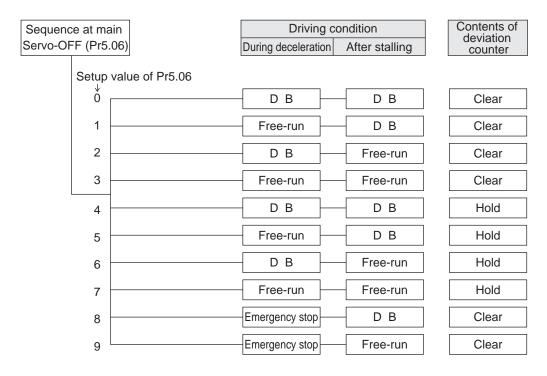
Condition setting chart

1) Setup of driving condition from deceleration to after stop by main power-off (Pr5.07)



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)



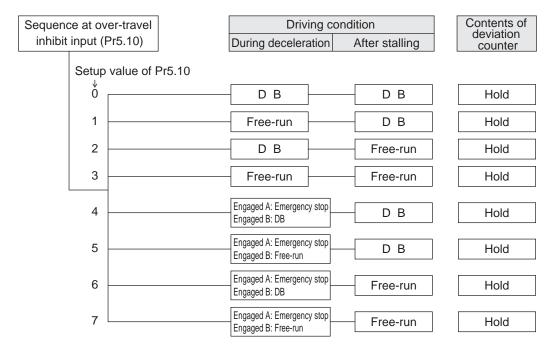
Torque limit value at emergency stop will be that of Pr5.11 (Setup of torque at emergency stop) when the setup value is 8 or 9.

4

12. Dynamic Brake

Condition setting chart

3) Setup of driving condition from deceleration to after stop by activation of protective function (Pr5.10)

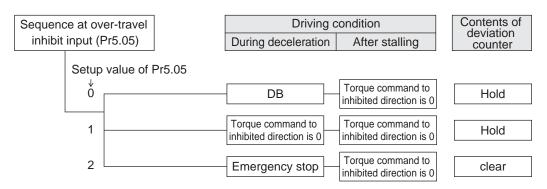


When setup value is within the range 4 and 7, the protection function that supports immediate stop acts according to operation A and the function that does not support acts according to operation B.

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)



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.

Preparation

12. Setup of Parameter and Mode

Outline / Setup / Connection

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

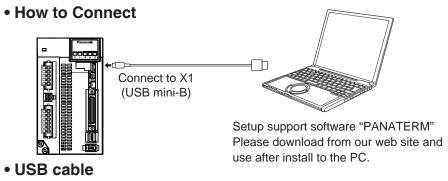
It is possible to connect your personal computer to connector X1 of MINAS A6 using a USB cable for personal computer connection. Downloading the setup support software "PANATERM" from our web site and installing it on your personal computer will allow you to perform the following easily.

• 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.



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]"

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".

Parar	metr No.	Class name	Group	nago
Class	No.*	Class Hallle	Group	page
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.

Preparation

• In this document, following symbols represent each mode.

Symbol	Control mode	Setup value of Pr0.01
Р	Position control	0
S	Velocity control	1
Т	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.

Preparation

12. Setup of Parameter and Mode

List of Parameters

[Class 0] Basic setting

Para No		Title	Dange	[Defaul	lt	Unit	Turning on of	Related Control Mode				Dottuii
Class	No.	ritie	Range	A,B -frame	C -frame	D,E,F -frame	Unit	power supply	Р	s	т	F	page
0	00	Rotational direction setup	0 to 1		1		_	0	0	0	0	0	4-6
0	01	Control mode setup	0 to 6		0		-	0	0	0	0	0	4-0
0	02	Real-time auto-gain tuning setup	0 to 6		1		_		0	0	0	0	4-7
0	03	Selection of machine stiffness at real-time auto-gain tuning	0 to 31	1	3	11	-		0	0	0	0	4-8
0	04	Inertia ratio	0 to 10000		250		%		0	0	0	0	4-9
0	05	Selection of command pulse input	0 to 2		0		_	0	0			0	4-3
0	06	Command pulse rotational direction setup	0 to 1		0		_	0	0			0	4-10
0	07	Command pulse input mode setup	0 to 3		1		-	0	0			0	4-10
0	08	Command pulse counts per one motor revolution	0 to 2 ²³		10000		pulse	0	0				
0	09	1st numerator of electronic gear	0 to 2 ³⁰		0		-		0			0	4-11
0	10	Denominator of electronic gear	0 to 2 ³⁰		10000)	-		0			0	
0	11	Output pulse counts per one motor revolution	1 to 2097152		2500		P/r	0	0	0	0	0	4-12
0	12	Reversal of pulse output logic	0 to 3		0		-	0	0	0	0	0	
0	13	1st torque limit	0 to 500		500 *1	1	%		0	0	0	0	4-14
0	14	Position deviation excess setup	0 to 2 ³⁰	1	100000		Command unit		0			0	4-14
0	15	Absolute encoder setup	0 to 4	1		-	0	0	0	0	0		
0	16	External regenerative resistor setup	0 to 3	3	()	_	0	0	0	0	0	
0	17	Load factor of external regenerative resistor selection	0 to 4	0		-	0	0	0	0	0	4-15	
0	18	For manufactuer's use	_		0		_						

[Class 1] Gain adjustment

Parametr No.		Title	Panga	Default			Unit	Turning on of	Related Control Mode				Detail
Class	No.	ritie	Range	A,B -frame -	C frame	D,E,F -frame	Onn	power supply	Р	S	Т	F	page
1	00	1st gain of position loop	0 to 30000	48	0	320	0.1 /s*		0			0	
1	01	1st gain of velocity loop	1 to 32767	27	0	180	0.1 Hz*		0	0	0	0	4-16
1	02	1st time constant of velocity loop integration	1 to 10000	21	0	310	0.1 ms*		0	0	0	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
- *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

List of Parameters

Para No		Tisla	Damma	Defau	lt	I I m i t	Turning on of		Rela			Detail
Class	No.	Title	Range	A,B C -frame -frame	D,E,F -frame	Unit	power supply	Р	S	Т	F	page
1	03	1st filter of speed detection	0 to 5	0		_		0	0	0	0	4-16
1	04	1st time constant of torque filter	0 to 2500	84	126	0.01 ms		0	0	0	0	4-10
1	05	2nd gain of position loop	0 to 30000	480	320	0.1 /s*		0			0	
1	06	2nd gain of velocity loop	1 to 32767	270	180	0.1 Hz*		0	0	0	0	
1	07	2nd time constant of velocity loop integration	1 to 10000	210	310	0.1 ms*		0	0	0	0	
1	80	2nd filter of speed detection	0 to 5	0		-		0	0	0	0	4-17
1	09	2nd time constant of torque filter	0 to 2500	84	126	0.01 ms*		0	0	0	0	
1	10	Velocity feed forward gain	0 to 4000	1000		0.10 %*		0			0	
1	11	Velocity feed forward filter	0 to 6400	0		0.01 ms*		0			0	
1	12	Torque feed forward gain	0 to 2000	1000	١	0.10%*		0	0		0	
1	13	Torque feed forward filter	0 to 6400	0		0.01 ms*		0	0		0	4-18
1	14	2nd gain setup	0 to 1	1		_		0	0	0	0	
1	15	Mode of position control switching	0 to 10	0		_		0			0	4-19
1	16	Delay time of position control switching	0 to 10000	10		0.1 ms*		0			0	4-19
1	17	Level of position control switching	0 to 20000	0		_		0			0	
1	18	Hysteresis at position control switching	0 to 20000	0		-		0			0	4-20
1	19	Position gain switching time	0 to 10000	10		0.1 ms*		0			0	
1	20	Mode of velocity control switching	0 to 5	0		_			0			
1	21	Delay time of velocity control switching	0 to 10000	0		0.1 ms*			0			4-21
1	22	Level of velocity control switching	0 to 20000	0		-			0			
1	23	Hysteresis at velocity control switching	0 to 20000	0		-			0			
1	24	Mode of torque control switching	0 to 3	0		-				0		
1	25	Delay time of torque control switching	0 to 10000	0		0.1 ms*				0		
1	26	Level of torque control switching	0 to 20000	0		_				0		4.00
1	27	Hysteresis at torque control switching	0 to 20000	0		-				0		4-22
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 🗼

List of Parameters

Para N	metr o.	Title	Donne	Defau	lt	Unit	Turning on of		Rela			Detail
Class	No.	Title	Range	A,B C -frame -frame	D,E,F -frame	Unit	power supply	Р	S	Т	F	page
1	31	For manufactuer's use	_	480	320	-						
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)	-						4-22
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 " \ast " attached to "Unit". indicates that the digits of setting unit will change if the parameter is set by using the setup support software PANATERM.

List of Parameters

	metr o.	Title	Range	Defau	lt	Unit	Turning on of		Rela			Detail
Class	No.	Title	Kange	A,B C -frame -frame	D,E,F -frame	Oilit	power supply	Р	s	Т	F	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

Parai No		T'0.	D	Default		11-16	Turning on of	Со	Rela	ated I Mo	ode	Detail
Class	No.	Title	Range	A,B C D),E,F rame	Unit	power supply	Р	s	Т	F	page
2	00	Adaptive filter mode setup	0 to 6	0		-		0	0		0	
2	01	1st notch frequency	50 to 5000	5000		Hz		0	0	0	0	
2	02	1st notch width selection	0 to 20	2		-		0	0	0	0	4-23
2	03	1st notch depth selection	0 to 99	0		-		0	0	0	0	
2	04	2nd notch frequency	50 to 5000	5000		Hz		0	0	0	0	
2	05	2nd notch width selection	0 to 20	2		-		0	0	0	0	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

The symbol " \ast " 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

List of Parameters

Para No			_	Defaul	t		Turning on of		Rela			Detail
Class	No.	Title	Range	A,B C -frame -frame	D,E,F -frame	Unit	power supply	Р	S	Т	F	page
2	06	2nd notch depth selection	0 to 99	0		_		0	0	0	0	
2	07	3rd notch frequency	50 to 5000	5000		Hz		0	0	0	0	
2	08	3rd notch width selection	0 to 20	2		-		0	0	0	0	4 24
2	09	3rd notch depth selection	0 to 99	0		-		0	0	0	0	4-24
2	10	4th notch frequency	50 to 5000	5000		Hz		0	0	0	0	
2	11	4th notch width selection	0 to 20	2		_		0	0	0	0	
2	12	4th notch depth selection	0 to 99	0		_		0	0	0	0	4.25
2	13	Selection of damping filter switching	0 to 6	0		-		0			0	4-25
2	14	1st damping frequency	0 to 3000	0		0.1 Hz*		0			0	
2	15	1st damping filter setup	0 to 1500	0		0.1 Hz*		0			0	
2	16	2nd damping frequency	0 to 3000	0		0.1 Hz*		0			0	
2	17	2nd damping filter setup	0 to 1500	0		0.1 Hz*		0			0	4.00
2	18	3rd damping frequency	0 to 3000	0		0.1 Hz*		0			0	4-26
2	19	3rd damping filter setup	0 to 1500	0		0.1 Hz*		0			0	
2	20	4th damping frequency	0 to 3000	0		0.1 Hz*		0			0	
2	21	4th damping filter setup	0 to 1500	0		0.1 Hz*		0			0	
2	22	Positional command smoothing filter	0 to 10000	92	139	0.1 ms*		0	0		0	4-27
2	23	Positional command FIR filter	0 to 10000	10		0.1 ms*		0			0	4-28
2	24	5th notch frequency	50 to 5000	5000		Hz		0	0	0	0	
2	25	5th notch width selection	0 to 20	2		_		0	0	0	0	
2	26	5th notch depth selection	0 to 99	0		_		0	0	0	0	
2	27	1st damping width setting	0 to 1000	0		_		0			0	4-29
2	28	2nd damping width setting	0 to 1000	0		-		0			0	
2	29	3rd damping width setting	0 to 1000	0		-		0			0	
2	30	4th damping width setting	0 to 1000	0		_		0			0	
2	31	For manufactuer's use	_	0		-						
2	32	For manufactuer's use	_	0		_						4 00
2	33	For manufactuer's use	-	0		-						4-30
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.

List of Parameters

Para No		Title	Range	Default	Unit	Turning on of	Со	Rela	ated I Mo	ode	Detail
Class	No.	Title	Range	A,B C D,E,F -frame	Offic	power supply	Р	S	Т	F	page
2	35	For manufactuer's use	-	0	-						
2	36	For manufactuer's use	-	0	-						4-30
2	37	For manufactuer's use	-	0	-						

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

Para No		Title	Panga	Default	Unit	Turning on of			ated I Mo	de	Detail
Class	No.	riue	Range	A,B C D,E,F -frame	Onit	power supply	Р	s	Т	F	page
3	00	Speed setup, Internal/External switching	0 to 3	0	_			0			
3	01	Speed command rotational direction selection	0 to 1	0	_			0			4-31
3	02	Input gain of speed command	10 to 2000	500	(r/min)/ V			0	0		4-32
3	03	Reversal of speed command input	0 to 1	1	_			0			7 02
3	04	1st speed of speed setup	-20000 to 20000	0	r/min			0			
3	05	2nd speed of speed setup	-20000 to 20000	0	r/min			0			
3	06	3rd speed of speed setup	-20000 to 20000	0	r/min			0			
3	07	4th speed of speed setup	-20000 to 20000	0	r/min			0			
3	80	5th speed of speed setup	-20000 to 20000	0	r/min			0			4.00
3	09	6th speed of speed setup	-20000 to 20000	0	r/min			0			4-33
3	10	7th speed of speed setup	-20000 to 20000	0	r/min			0			
3	11	8th speed of speed setup	-20000 to 20000	0	r/min			0			
3	12	Acceleration time setup	0 to 10000	0	ms/ (1000 r/min)			0			
3	13	Deceleration time setup	0 to 10000	0	ms/ (1000 r/min)			0			
3	14	Sigmoid acceleration/ deceleration time setup	0 to 1000	0	ms			0			
3	15	Speed zero-clamp function selection	0 to 3	0	-			0	0		4-34
3	16	Speed zero clamp level	10 to 20000	30	r/min			0	0		
3	17	Selection of torque command	0 to 2	0	_				0		
3	18	Torque command direction selection	0 to 1	0	_				0		4-35
3	19	Input gain of torque command	10 to 100	30	0.1 V/ 100 %*				0		
3	20	Input reversal of torque command	0 to 1	0	_				\circ		4-36
3	21	Speed limit value 1	0 to 20000	0	r/min				\circ		4-30

- 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

List of Parameters

Para No		Title	Range	Default	Unit	Turning on of		Rela			Detail
Class	No.	Title	range	A,B C D,E,F -frame		power supply	Р	S	Т	F	page
3	22	Speed limit value 2	0 to 20000	0	r/min				\circ		4-36
3	23	External scale selection	0 to 6	0	-	0				0	
3	24	Numerator of external scale division	0 to 2 ²³	0	-	0				0	4-37
3	25	Denominator of external scale division	1 to 2 ²³	10000	-	0				0	
3	26	Reversal of direction of external scale	0 to 3	0	-	0				0	
3	27	External scale Z phase disconnection detection disable	0 to 1	0	_	0				0	4-38
3	28	Hybrid deviation excess setup	1 to 2 ²⁷	16000	Command unit	0				0	4-30
3	29	Hybrid deviation clear setup	0 to 100	0	Revolution	0				0	

[Class 4] I/F monitor setting

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

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

List of Parameters

Para No		Title	Range	Default	Unit	Turning on of	of Control Mode		Detail		
Class	No.	Title	Range	A,B C D,E,F -frame -frame	Offic	power supply	Р	s	Т	F	page
4	16	Type of analog monitor 1	0 to 28	0	_		0	0	0	0	
4	17	Analog monitor 1 output gain	0 to 214748364	0	_		0	0	0	0	
4	18	Type of analog monitor 2	0 to 28	4	_		0	0	0	0	4-42
4	19	Analog monitor 2 output gain	0 to 214748364	0	_		0	0	0	0	
4	20	For manufactuer's use	_	0	_						
4	21	Analog monitor output setup	0 to 2	0	-		0	0	0	0	
4	22	Analog input 1 (Al1) offset setup	-5578 to 5578	0	0.366 mV		0	0	0	0	
4	23	Analog input 1 (Al1) filter	0 to 6400	0	0.01 ms*		0	0	0	0	
4	24	Analog input 1 (Al1) overvoltage setup	0 to 100	0	0.1 V*		0	0	0	0	
4	25	Analog input 2 (AI2) offset setup	-342 to 342	0	5.86 mV		0	0	0	0	4-44
4	26	Analog input 2 (AI2) filter	0 to 6400	0	0.01 ms*		0	0	0	0	
4	27	Analog input 2 (AI2) overvoltage setup	0 to 100	0	0.1 V*		0	0	0	0	
4	28	Analog input 3 (AI3) offset setup	-342 to 342	0	5.86 mV		0	0	0	0	
4	29	Analog input 3 (AI3) filter	0 to 6400	0	0.01 ms*		0	0	0	0	
4	30	Analog input 3 (AI3) overvoltage setup	0 to 100	0	0.1 V*		0	0	0	0	
4	31	Positioning complete (In-position) range	0 to 2097152	10	Command unit		0			0	4-45
4	32	Positioning complete (In-position) output setup	0 to 10	0	_		0			0	
4	33	INP hold time	0 to 30000	0	1 ms		0			0	
4	34	Zero-speed	10 to 20000	50	r/min		0	0	0	0	4-46
4	35	Speed coincidence range	10 to 20000	50	r/min			0	0		
4	36	At-speed (Speed arrival)	10 to 20000	1000	r/min			0	0		
4	37	Mechanical brake action at stalling setup	0 to 10000	0	1 ms		0	0	0	0	4-47
4	38	Mechanical brake action at running setup	0 to 10000	0	1 ms		0	0	0	0	
4	39	Brake release speed setup	30 to 3000	30	r/min	0	0	0	0	0	
4	40	Selection of alarm output 1	0 to 28	0	_		0	0	0	0	
4	41	Selection of alarm output 2	0 to 28	0	-		0	0	0	0	4-48
4	42	2nd Positioning complete (In-position) range	0 to 2097152	10	Command unit		0			0	
4	44	Position compare output pulse width setting	0 to 32767	0	0.1ms	0	0			0	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".



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

List of Parameters

Para N		Title	Range	Default	Unit	Turning on of	Со	Rela			Detail
Class	No.	THIC	Range	A,B C D,E,F -frame		power supply	Р	s	Т	F	page
4	45	Position compare output polarity select	0 to 63	0	_	0	0			0	
4	47	Pulse output select	0 to 7	0	_	0	0	0	0	0	4-49
4	48	Position compare value 1	-2147483648 to 2147483647	0	Command unit		0			0	
4	49	Position compare value 2	-2147483648 to 2147483647	0	Command unit		0			0	
4	50	Position compare value 3	-2147483648 to 2147483647	0	Command unit		0			0	
4	51	Position compare value 4	-2147483648 to 2147483647	0	Command unit		0			0	
4	52	Position compare value 5	-2147483648 to 2147483647	0	Command unit		0			0	4.50
4	53	Position compare value 6	-2147483648 to 2147483647	0	Command unit		0			0	4-50
4	54	Position compare value 7	-2147483648 to 2147483647	0	Command unit		0			0	
4	55	Position compare value 8	-2147483648 to 2147483647	0	Command unit		0			0	
4	56	Position compare output delay compensation amount	-32768 to 32767	0	0.1µs	0	0			0	
4	57	Position compare output assignment setting	-2147483648 to 2147483647	0	_	0	0			0	4-51

[Class 5] Enhancing setting

Para N		Title	Range	Default	Unit	Turning on of		Rela			Detail
Class	No.	Title	Range	A,B C D,E,F -frame		power supply	Р	s	Т	F	page
5	00	2nd numerator of electronic gear	0 to 2 ³⁰	0	-		0			0	
5	01	3rd numerator of electronic gear	0 to 2 ³⁰	0	_		0			0	
5	02	4th numerator of electronic gear	0 to 2 ³⁰	0	_		0			0	4-52
5	03	Denominator of pulse output division	0 to 8388608	0	_	0	0	0	0	0	
5	04	Over-travel inhibit input setup	0 to 2	1	_	0	0	0	0	0	
5	05	Sequence at over-travel inhibit	0 to 2	0	-	0	0	0	0	0	4-53
5	06	Sequence at Servo-Off	0 to 9	0	-		0	0	0	0	4-54
5	07	Sequence at main power OFF	0 to 9	0	-		0	0	0	0	4-04
5	08	LV trip selection at main power OFF	0 to 3	1	-		0	0	0	0	
5	09	Detection time of main power off	20 to 2000	70	1 ms	0	0	0	0	0	4-55
5	10	Sequence at alarm	0 to 7	0	_		0	0	0	0	
5	11	Torque setup for emergency stop	0 to 500	0	%		0	0	0	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

List of Parameters

Para No		Title	Range	Default	Unit	Turning on of	Со	Rela	ated	ode	Detail
Class	No.	Title	Kange	A,B C D,E,F -frame -frame	Offic	power supply	Р	S	Т	F	page
5	12	Over-load level setup	0 to 500	0	%		0	0	0	0	
5	13	Over-speed level setup	0 to 20000	0	r/min		0	0	0	0	
5	14	Motor working range setup	0 to 1000	10	0.1 revolution*		0			0	4-56
5	15	I/F reading filter	0 to 3	0	ı	0	0	0	0	0	
5	16	Alarm clear input setup	0 to 1	0	-	0	0	0	0	0	
5	17	Counter clear input mode	0 to 4	3	-		0			0	
5	18	Invalidation of command pulse inhibit input	0 to 1	1	-		0			0	4-57
5	19	Command pulse inhibit input reading setup	0 to 5	0	_	0	0			0	
5	20	Position setup unit select	0 to 1	0	_	0	0			0	
5	21	Selection of torque limit	0 to 6	1	-		0	0		0	4-58
5	22	2nd torque limit	0 to 500	500 *1	%		0	0		0	4-30
5	23	Torque limit switching setup 1	0 to 4000	0	ms/100 %		0	0		0	
5	24	Torque limit switching setup 2	0 to 4000	0	ms/100 %		0	0		0	
5	25	External input positive direction torque limit	0 to 500	500 *1	%		0	0		0	4-59
5	26	External input negative direction torque limit	0 to 500	500 *1	%		0	0		0	4-55
5	27	Input gain of analog torque limit	10 to 100	30	0.1 V/100 %*		0	0		0	
5	28	LED initial status	0 to 42	1	_	0	0	0	0	0	
5	29	RS232 baud rate setup	0 to 7	2	-	0	0	0	0	0	4-60
5	30	RS485 baud rate setup	0 to 7	2	_	0	0	0	0	0	
5	31	Axis address	0 to 127	1	-	0	0	0	0	0	
5	32	Command pulse input maximum setup	250 to 8000	4000	kpulse/s	0	0			0	
5	33	Pulse regenerative output limit setup	0 to 1	0	-	0	0	0	0	0	4-61
5	34	For manufactuer's use		4	-						
5	35	Front panel lock setup	0 to 1	0	-	0	0	0	0	0	
5	36	For manufactuer's use	_	0	-						
5	37	Modbus connection setting	0 to 2	0	-	0	0	0	0	0	
5	38	Modbus communication setting	0 to 5	0	-	0	0	0	0	0	4-62
5	39	Modbus response waiting time	0 to 10000	0	ms		0	0	0	0	
5	40	Modbus communication timeout time	0 to 10000	0	ms		0	0	0	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 " \ast " 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

List of Parameters

	metr o.	Title	Damas	Default	Unit	Turning on of			ated		Detail
Class	No.	Title	Range	A,B C D,E,F -frame -frame	Unit	power supply	Р	s	Т	F	page
5	41	For manufactuer's use	_	0	_						4-62
5	42	Modbus broadcast setting	-32768 to 32767	0	_		0	0	0	0	
5	45	Quadrant projection positive direction compensation value	-1000 to 1000	0	0.1%		0			0	
5	46	Quadrant projection negative direction compensation value	-1000 to 1000	0	0.1%		0			0	4-63
5	47	Quadrant projection compensation delay time	0 to 1000	0	ms		0			0	4-03
5	48	Quadrant projection compensation filter setting L	0 to 6400	0	0.01 ms		0			0	
5	49	Quadrant projection compensation filter setting H	0 to 10000	0	0.1 ms		0			0	
5	50	For manufactuer's use	_	0	_						
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)		0				4-64
5	57	Slow stop S-shape acceleration and deceleration setting	0 to 1000	0	ms		0				
5	58	Modbus mirror register setting 1"1	-32768 to 32767	24591	-	0	0	0	0	0	
5	59	Modbus mirror register setting 2"1	-32768 to 32767	24592	-	0	0	0	0	0	
5	60	Modbus mirror register setting 3"1	-32768 to 32767	16421	_	0	0	0	0	0	
5	61	Modbus mirror register setting 4*1	-32768 to 32767	24613	_	0	0	0	0	0	
5	62	Modbus mirror register setting 5"1	-32768 to 32767	17429	_	0	0	0	0	0	
5	63	Modbus mirror register setting 6"1	-32768 to 32767	17418	_	0	0	0	0	0	
5	64	Modbus mirror register setting 7"1	-32768 to 32767	17427	_	0	0	0	0	0	4-65
5	65	Modbus mirror register setting 8"1	-32768 to 32767	17419	-	0	0	0	0	0	4-00
5	66	Deterioration diagnosis convergence judgment time	0 to 10000	0	0.1s	0	0	0	0	0	
5	67	Deterioration diagnosis inertia ratio upper limit	0 to 10000	0	%	0	0	0	0	0	
5	68	Deterioration diagnosis inertia ratio lower limit	0 to 10000	0	%	0	0	0	0	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 " \ast " 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 ·

List of Parameters

	metr o.	Title	Range	Default	Unit	Turning on of	Со	Rela	ated	de	Detail
Class	No.	THE	Range	A,B C D,E,F -frame -frame	Oilit	power supply	Р	S	Т	F	page
5	69	Deterioration diagnosis unbalanced load upper limit	-1000 to 1000	0	0.1%	0	0	0	0	0	4-65
5	70	Deterioration diagnosis unbalanced load lower limit	-1000 to 1000	0	0.1%	0	0	0	0	0	4-05
5	71	Deterioration diagnosis dynamic friction upper limit	-1000 to 1000	0	0.1%	0	0	0	0	0	
5	72	Deterioration diagnosis dynamic friction lower limit	-1000 to 1000	0	0.1%	0	0	0	0	0	
5	73	Deterioration diagnosis viscous friction upper limit	0 to 10000	0	0.1%/ (10000r/min)	0	0	0	0	0	
5	74	Deterioration diagnosis viscous friction lower limit	0 to 10000	0	0.1%/ (10000r/min)	0	0	0	0	0	4-66
5	75	Deterioration diagnosis velocity setting	-20000 to 20000	0	r/min	0	0	0	0	0	. 55
5	76	Deterioration diagnosis torque average time	0 to 10000	0	ms	0	0	0	0	0	
5	77	Deterioration diagnosis torque upper limit	-1000 to 1000	0	0.1%	0	0	0	0	0	
5	78	Deterioration diagnosis torque lower limit	-1000 to 1000	0	0.1%	0	0	0	0	0	
5	79	Modbus mirror register setting 9 *1	-32768 to 32767	17410	-	0	0	0	0	0	
5	80	Modbus mirror register setting 10 *1	-32768 to 32767	17411	_	0	0	0	0	0	
5	81	Modbus mirror register setting 11 *1	-32768 to 32767	16398	I	0	0	0	0	0	
5	82	Modbus mirror register setting 12 *1	-32768 to 32767	16402	ı	0	0	0	0	0	4-67
5	83	Modbus mirror register setting 13 *1	-32768 to 32767	16411	-	0	0	0	0	0	4-07
5	84	Modbus mirror register setting 14 *1	-32768 to 32767	16405	_	0	0	0	0	0	
5	85	Modbus mirror register setting 15 *1	-32768 to 32767	16406	_	0	0	0	0	0	
5	86	Modbus mirror register setting 16 *1	-32768 to 32767	0	_	0	0	0	0	0	

[Class 6] Special setting

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

Para		Tial-	Denne	Default	l lee!4	Turning on of		Rela			Detail
Class	No.	Title	Range	A,B C D,E,F -frame -frame	Unit	power	Р	S	T	F	page
6	06	Position control 3rd gain scale factor	50 to 1000	100	%		0			0	4-68
6	07	Additional value to torque command	-100 to 100	0	%		0	0		0	
6	08	Torque compensation value in positive direction	-100 to 100	0	%		0			0	4.00
6	09	Torque compensation value in negative direction	-100 to 100	0	%		0			0	4-69
6	10	Function expansion setup	-32768 to 32767	16	_		0	0	0	0	
6	11	Current response setup	10 to 100	100	%						
6	13	Second inertia ratio	0 to 10000	250	%		0	0	0	0	
6	14	Immediate stop time at the time of alarming	0 to 1000	200	1 ms		0	0	0	0	
6	15	2nd over-speed level setup	0 to 20000	0	r/min		0	0	0	0	4-70
6	16	For manufacturer's use	-	0	_		0	0	0	0	
6	17	Front panel parameter writing selection	0 to 1	0	_	0	0	0	0	0	
6	18	Power turn-on wait time	0 to 100	0	0.1 s*	0	0	0	0	0	
6	19	Encoder Z phase setup	0 to 32767	0	pulse	0	0	0	0	0	
6	20	Z-phase setup of external scale	0 to 400	0	μs	0				0	4-71
6	21	Serial absolute external scale Z phase setup	0 to 2 ²⁸	0	pulse	0				0	
6	22	A, B phase external scale pulse output method selection	0 to 1	0	-	0				0	
6	23	Load fluctuation correction gain	-100 to 100	0	%		0	0			
6	24	Load fluctuation correction filter	10 to 2500	53	0.01 ms*		0	0			4-72
6	27	Alarm latch time selection	0 to 10	5	s	0	0	0	0	0	
6	28	Special function selection	0 to 1	0	_	0	0				
6	30	For manufacturer's use	_	0	_						4.70
6	31	Real time auto tuning estimation speed	0 to 3	1	-		0	0	0	0	4-73
6	32	Real time auto tuning custom setup	-32768 to 32767	0	_		0	0	0	0	4-74
6	33	For manufacturer's use	-	1000	-						
6	34	Hybrid vibration suppression gain	0 to 30000	0	0.1 /s*					0	
6	35	Hybrid vibration suppression filter	0 to 32000	10	0.01 ms*					0	4-76
6	36	Dynamic brake operation input	0 to 1	0	_	0	0	0	0	0	
6	37	Oscillation detecting level	0 to 1000	0	0.1 %*		0	0	0	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.

List of Parameters

Para		Title	Range	Defaul	lt	Unit	Turning on of	Со	Rela	ated I Mo	ode	Detail
Class	No.	riue	Kange	A,B C -frame -frame	D,E,F -frame	Offic	power supply	Р	s	Т	F	page
6	38	Alarm mask setup	-32768 to 32767	4		_	0	0	0	0	0	
6	39	For manufactuer's use	-	0		-						
6	41	1st damping depth	0 to 1000	0		_		0			0	4-77
6	42	Two-stage torque filter time constant	0 to 2500	0		0.01 ms		0	0	0	0	
6	43	Two-stage torque filter damping term	0 to 1000	0		_		0	0	0	0	
6	47	Function expansion settings 2	-32768 to 32767	1		_	0	0	0	0	0	
6	48	Adjustment filter	0 to 2000	A:11 B,C:12	17	0.1 ms		0	0		0	4-78
6	49	Command response filter/adjustment filter damping term setting	0 to 99	15		-		0			0	
6	50	Viscous friction compensation gain	0 to 10000	0		O.1 %/ (10000 r/min)		0	0		0	
6	51	Immediate stop completion wait time	0 to 10000	0		ms		0	\circ	0	0	
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		0	0		0	
6	58	Serial absolute external scale Z phase shift amount *1	-2147483648 to 2147483647	0		pulse	0	0	0	0	0	4-80
6	60	2nd damping depth	0 to 1000	0		-		0			0	
6	61	1st resonance frequency	0 to 3000	0		0.1Hz		0				
6	62	1st resonance damping ratio	0 to 1000	0		ı		0				
6	63	1st anti-resonance frequency	0 to 3000	0		0.1Hz		0				
6	64	1st anti-resonance damping ratio	0 to 1000	0		ı		0				
6	65	1st response frequency	0 to 3000	0		0.1Hz		0				4-81
6	66	2nd resonance frequency	0 to 3000	0		0.1Hz		0				
6	67	2nd resonance damping ratio	0 to 1000	0		_		0				
6	68	2nd anti-resonance frequency	0 to 3000	0		0.1Hz		0				
6	69	2nd anti-resonance damping ratio	0 to 1000	0		_		0				
6	70	2nd response frequency	0 to 3000	0		0.1 Hz		0				
6	71	3rd damping depth	0 to 1000	0		-		0			0	4-82
6	72	4th damping depth	0 to 1000	0		-		0			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.

List of Parameters

Para No		Title	Range	Default	Unit	Turning on of		Rela			
Class	No.	Thie	range	A,B C D,E, -frame -frame -fram	F	power supply	Р	S	Т	F	page
6	73	Load estimation filter	0 to 2500	0	0.01 ms		0	0		0	
6	74	Torque compensation frequency 1	0 to 5000	0	0.1 Hz		0	0		0	
6	75	Torque compensation frequency 2	0 to 5000	0	0.1 Hz		0	0		0	4-82
6	76	Load estimation count	0 to 8	0	-		0	0		0	
6	87	For manufacturer's use	_	0	_						
6	88	Absolute multi-rotation data upper limit	0 to 65534	0	-	0	0	0	0	0	
6	97	Function expansion setting 3	-2147483648 to 2147483647	0	_		0	0	0	0	4-83
6	98	Function expansion setting 4	-2147483648 to 2147483647	0	-	0	0	0	0	0	

[Class 7] Special setting

Para N		Title	Range	Default	Unit	Turning on of		Rela			Detail
Class	No.	riue	Kange	A,B C D,E,F -frame	Onit	power supply	Р	s	Т	F	page
7	00	For manufacturer's use	ı	0	-						
7	01	For manufacturer's use	ı	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	ı	0	-						
7	08	For manufacturer's use	ı	0	-						
7	09	For manufacturer's use	ı	0	-						4-84
7	10	For manufacturer's use	ı	0	-						
7	11	For manufacturer's use	-	0	-						
7	12	For manufacturer's use	ı	0	-						
7	13	For manufacturer's use	1	0	-						
7	14	Main power turn-off warning detection time	0 to 2000	0	ms	0	0	0	0	0	
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.

List of Parameters

Para N	metr o.	Title	Dange	Default	Unit	Turning on of	Со	Rela	ated I Mo	ode	Detail
Class	No.	i itie	Range	A,B C D,E,F -frame -frame	Unit	power supply	Р	s	Т	F	page
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

Para N	metr o.	Title	Panga	Defa	ult	Unit	Turning on of	Со	Rela	ated I Mo	ode	Detail
Class	No.	riue	Range	A,B C		,F	power supply	Р	S	Т	F	page
8	00	For manufacturer's use	-	0		-						4-85
8	01	For manufacturer's use	-	10	0	_						4-00

- $\bullet \ {\sf Partial} \ {\sf parameter} \ {\sf of} \ {\sf standard} \ {\sf type} \ {\sf and} \ {\sf communication} \ {\sf type} \ {\sf are} \ {\sf different} \ {\sf from} \ {\sf a} \ {\sf table} \ {\sf in} \ {\sf a} \ {\sf shipment} \ {\sf parameter}. \\$
- 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.

List of Parameters

Para No		Title	Range	Default	Unit	Turning on of	Со	Rela	ated I Mo	ode	Detail
Class	No.	Title	Kange	A,B C D,E,F -frame	Onit	power supply	Р	s	Т	F	page
8	02	For manufacturer's use	_	0	_						
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	1	0	-						4-84
8	12	For manufacturer's use	-	0	-						4-04
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

Para N		Title	Range	Default	Unit	Turning on of			ated I Mo		Detail
Class	No.	Title		A,B C D,E,F -frame -frame	Offic	power supply	Р	s	Т	F	page
9	00	For manufacturer's use	_	0	_						
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	-						4-84
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.

12. Setup of Parameter and Mode

List of Parameters

Para N		Title	Demme	Default	Unit	Turning on of					Detail
Class	No.	Title	Range A,B C D,E,F -frame -frame -frame		power		Р	s	Т	F	page
9	17	For manufacturer's use	_	0	-						
9	18	For manufacturer's use	_	0	-						
9	19	For manufacturer's use	_	0	-						
9	20	For manufacturer's use	_	0	_						
9	21	For manufacturer's use	_	0	-						
9	22	For manufacturer's use	_	200	-						
9	23	For manufacturer's use	-	50	-						
9	24	For manufacturer's use	_	100	-						
9	25	For manufacturer's use	_	40	-						4-84
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

Para N	metr o.	Title	Range	Default	Unit	Turning on of			ated I Mo		Detail
Class	No.	Tiue	Kange	A,B C D,E,F -frame -frame		power supply	Р	S	Т	F	page
15	00	For manufacturer's use	-	0	-						
15	16	For manufacturer's use	-	2	-						
15	17	For manufacturer's use	-	4	-						
15	30	For manufacturer's use	-	6	-						4-84
15	31	For manufacturer's use	_	5	-						4-04
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.

ZPreparation

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
	MADL 01 0	MHMF5AZL1	350
	MADL□ 11□□	MQMF011L1□□	350
		MHMF011L1	350
А		MHMF5AZL1	350
	MADL□ 05□□	MQMF012L1□□	350
		MHMF012L1□□	350
	MADI - 15	MQMF022L1□□	350
	MADL 15	MHMF022L1□□	350
	MBDL□ 21□□	MQMF021L1□□	350
В	WIDDL 21	MHMF021L1□□	350
6	MBDL□ 25□□	MQMF042L1□□	350
		MHMF042L1□□	350
	MCDL 31	MQMF041L1	350
С		MHMF041L1□□	350
	MCDL□ 35□□	MHMF082L1□□	350
	MDDL□ 45□□	MGMF092L1□□	264
D	MDDL□ 55□□	MHMF092L1□□	350
		MGMF132L1□□	281
Е	MEDL□ 83□□	MGMF182L1 □□	251
	MEDL□ 93□□	MGMF242L1 □□	296
F	MFDL□ B3□□	MGMF292L1 □□	245
Г	INITULL BOLL	MGMF442L1 🗆 🗆	250



• 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.

2

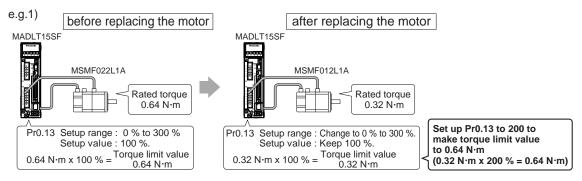
When in Trouble

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.

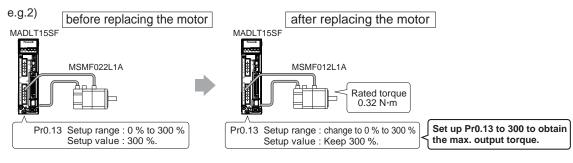
1. When the motor torque is limited,

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)



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)



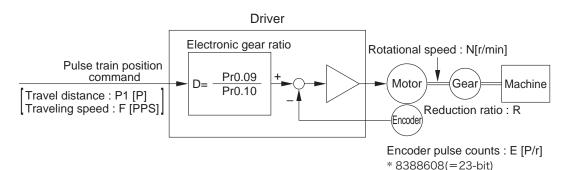
<Note>

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".

13 Setup of command division and multiplication ratio (electronic gear ratio)

Relation between Electronic Gear and Position Resolution or Traveling Speed



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]

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

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

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

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

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

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).

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

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

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

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



- 1) Make a position resolution, Δ M as approx. 1/5 to 1/10 of the machine positioning accuracy, $\Delta \varepsilon$, considering a mechanical error.
- 2) Set up Pr0.09 and Pr0.10 to any values between 1 to 230.
- 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
	20	1	2 ¹²	4096
	2 ¹	2	2 ¹³	8192
	2 ²	4	2 ¹⁴	16384
	2 ³	8	2 ¹⁵	32768
	24	16	2 ¹⁶	65536
	2 ⁵	32	2 ¹⁷	131072
	2 ⁶	64	2 ¹⁸	262144
	27	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

13. Setup of command division and multiplication ratio (electronic gear ratio)

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

	Motor rotational speed (r/min), $N = F \times \frac{D}{E} \times 60$			
Lead of ball screw, L =20 mm Gear reduction ratio, R = 1 Position resolution, $\Delta M = 0.0005$ mm Line driver pulse input, 500 kpps Encoder, 23-bit	$500000 \times \frac{0.0005 \times 2^{23} \times 1}{20} \times \frac{1}{2^{23}} \times 60$ $= 750$			
	Electronic gear ratio $D = \frac{N \times E}{F \times 60}$	$D = \frac{Pr0.09}{Pr0.10}$		
Ditto	$D = \frac{2000 \times 2^{23}}{500000 \times 60} = \frac{2000 \times 2^{23}}{2000 \times 500 \times 30} = \frac{8388608}{15000}$	Pr0.09 = 8388608 Pr0.10 = 15000		
To make it to 2000 r/min.	Travel distance per command pulse (mm) (Position resolution) $\Delta M = \frac{D}{E} \times \frac{1}{R} \times L$			
	$\frac{2000 \times 2^{23}}{500000 \times 60} \times \frac{1}{2^{23}} \times \frac{1}{1} \times 20 = 0.00133 \text{ mm}$			

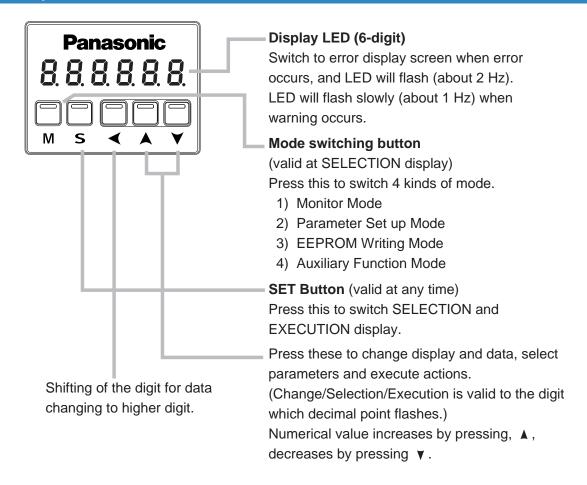
2

Preparation

14. How to Use the Front Panel

Setup

Setup with the Front Panel

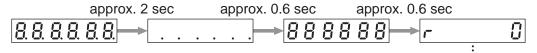


Setup

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.



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.



Repeatedly(during continuous alarm)

Below shows possible cause of an alarm.

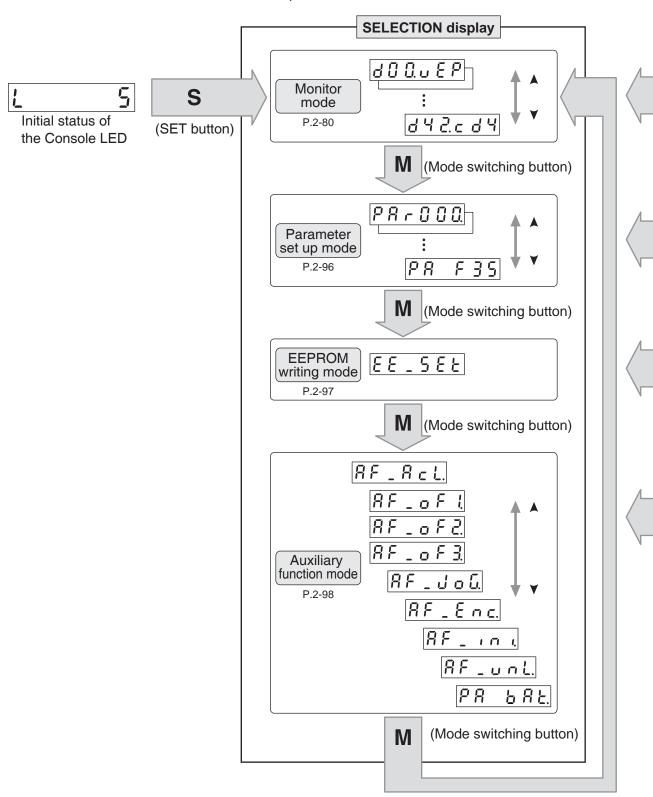
alarm No.	Alarm	Content
A0	Overload protection	Load factor is 85 % or more the protection level.
A1	Over-regeneration alarm	Regenerative load factor is 85 % or more the protection level.
A2	Battery alarm	Battery voltage is 3.2 V or lower.
А3	Fan alarm	Fan has stopped for 1 sec.
A4	Encoder communication 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.

2 Preparation

14. How to Use the Front Panel

Structure of Each Mode

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





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

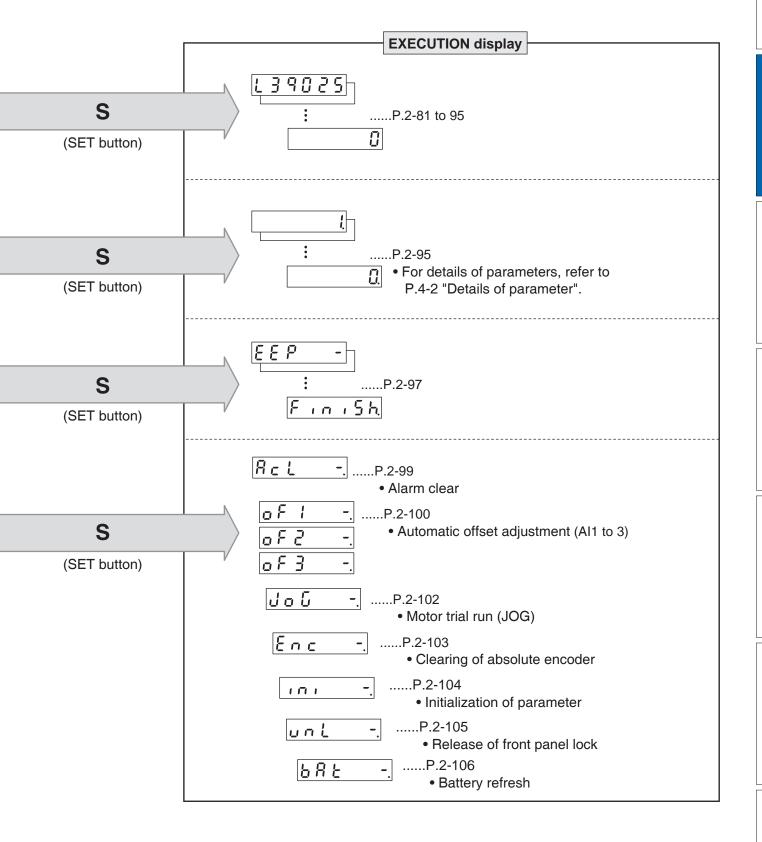
Caution ·*

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

2

14. How to Use the Front Panel

Structure of Each Mode



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

Parame	eter No.	Title	Function
Class	No.	ritie	Function
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, a(2) Turn on power to the driver.(3) The front panel is locked.	and writ the setting to EEPROM.
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.

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
Set-up support software (PANATERM) (USB communication) is connected.	No operations other than monitor mode can be made from the front panel.

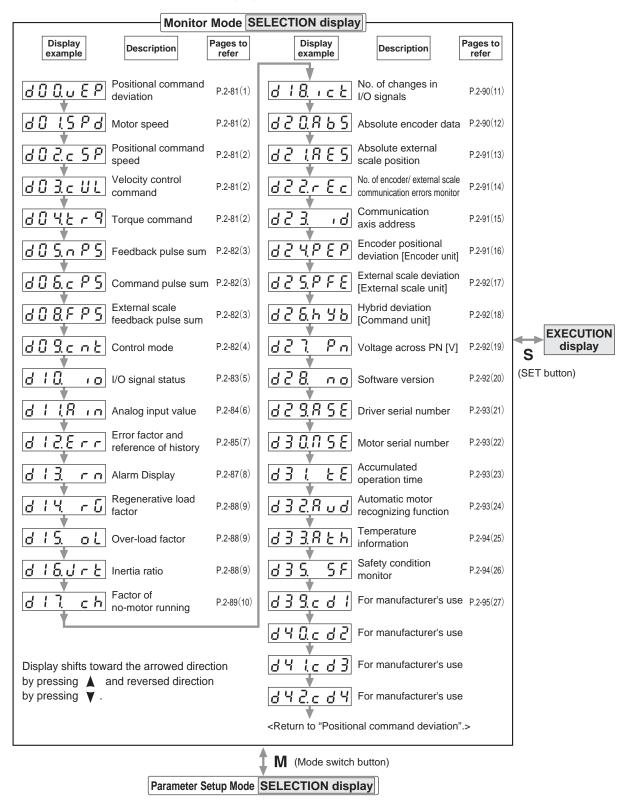
Please refer to P.7-27 "Communication" for RS232/RS485 communications and to Technical reference (Modbus communication and Block operation Specification) for Modbus communications.

2 Preparation

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,



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

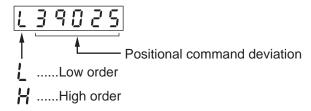
Z Preparation

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.



 \bullet To switch between Low order (L) and High order (H), press \blacktriangleleft . eg. Positional command deviation=10339025



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

Motor speed (r/min)

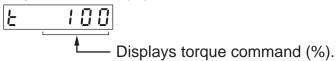


Positional command speed (r/min)



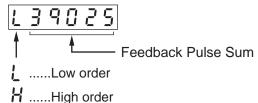
Velocity control command (r/min)

• Torque command (%)



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

• Feedback Pulse Sum [Encoder feedback pulse]



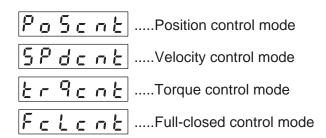
ullet To switch between Low order (L) and High order (H), press ullet .

• Command Pulse Sum [Command Pulse]

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

• External Scale Feedback Pulse Sum

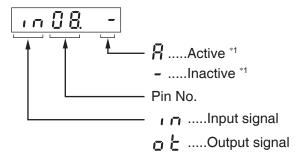
(4) Display of Control Mode



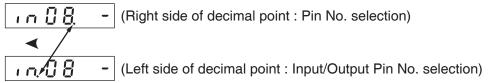
Monitor Mode (EXECUTION display)

(5) Display of I/O Signal Status

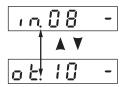
Displays the control input and output signal to be connected to connector X4. Use this function to check if the wiring is correct or not.



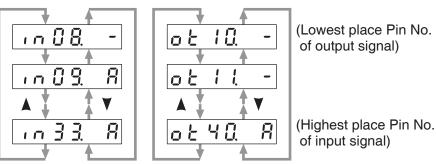
Shift the flashing decimal point with ◀.



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



 \bullet Select the Pin No. to be monitored by pressing $\, \blacktriangle \, \, \blacktriangledown \,\,$.



*1 When input signal Active: Input signal photocoupler is ON.

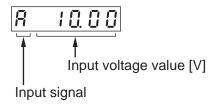
Inactive: Input signal photocoupler is OFF.

When output signal Active : Output signal transistor is ON.

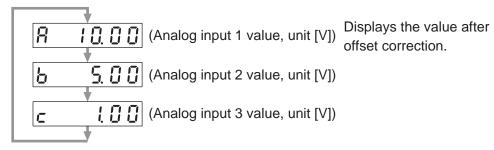
Inactive: Output signal transistor is OFF.



(6) Display of Analog Input Value



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



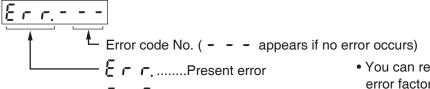
Caution

Voltage exceeding ± 10 V can not be displayed correctly.

Monitor Mode (EXECUTION display)

<List of error code No.>

(7) Display of Error Factor and Reference of History



ξ - 🗓History 0 (latest error)

E 13......History 13 (oldest error)

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

the factor to be referred.

Main Sub Protective function History Can be cleared stop	Error code				Attribute				
12 0 Over-voltage protection 13 1 Main power supply under-voltage protection (between P to N) 14 Main power supply under-voltage protection (AC interception detection) 15 1 Main power supply under-voltage protection (AC interception detection) 16 1 O Over-current protection 17 1 IPM error protection 18 0 Over-least protection 18 1 Over-least protection 19 0 Over-least protection 19 0 Over-generation load protection 19 1 Torque saturation anomaly protection 10 0 Over-regeneration load protection 10 0 Over-generation for reror protection 11 1 Torque saturation anomaly protection 12 1 Over-regeneration for protection 13 1 Over-regeneration for protection 14 1 Denoder communication disconnect error protection 15 1 Over-regeneration disconnect error protection 16 1 Denoder communication disconnect error protection 17 1 Encoder communication data error protection 18 1 Over-regeneration excess protection 19 20 Desition deviation excess protection 20 Desition deviation excess protection 21 1 Velocity deviation excess protection 22 0 Position deviation excess protection 23 0 Encoder communication data error protection 24 1 Velocity deviation excess protection 25 0 Hybrid deviation excess protection 26 1 2nd over-speed protection 27 1 Absolute clear abnormal protection 28 0 Limit of pulse input frequency error protection 29 1 Command pulse multiplier error protection 20 Deviation counter overflow abnormality protection 21 1 Deviation counter overflow abnormality protection 22 Deviation counter overflow abnormality protection 23 1 Foverlaps allocation error 1 protection 24 1 Foverlaps allocation error 2 protection 25 1 Fi output function number error 1 protection 26 1 Fi output function number error 1 protection 27 1 If input function number error 2 protection 28 1 Fi input function number error 2 protection 29 2 Foverlaps allocation error 2 protection 30 3 Fi Fi output function number error 1 protection 31 4 Fi output function number error 2 protection 32 5 Fi output function number error 1 protection 33 6 Fi output func	Main	Sub							
13 0 Main power supply under-voltage protection (between P to N) 1 1 Main power supply under-voltage protection (AC interception detection) 1 1 IPM error protection 2 Over-heat protection 3 I Encoders abnormal over-heat protection 4 I Torque saturation anomaly protection 5 I Torque saturation anomaly protection 6 I Torque saturation anomaly protection 7 Over-regeneration load protection 8 Over-regeneration load protection 9 I Encoder communication disconnect error protection 1 Encoder communication data error protection 2 Encoder communication data error protection 2 Encoder communication data error protection 3 Encoder communication data error protection 4 Velocity deviation excess protection 5 Encoder communication excess protection 6 I Velocity deviation excess protection 7 Event deviation excess protection 9 Over-speed protection 1 Ov	11	0	Control power supply under- voltage protection		0				
13	12	0	Over-voltage protection	0	0				
1 Main power supply under-voltage protection (AC interception detection) 10 Over-current protection 11 IPM error protection 12 IPM error protection 13 1 Encoders abnormal over-heat protection 14 1 Torque saturation anomaly protection 15 1 Torque saturation anomaly protection 16 1 Torque saturation anomaly protection 17 1 Over-regeneration I error protection 18 1 Over-regeneration Tierror protection 19 1 Cencoder communication disconnect error protection 10 Encoder communication disconnect error protection 11 Encoder communication data error protection 12 Encoder communication data error protection 13 O Encoder communication data error protection 14 Velocity deviation excess protection 15 O Hybrid deviation excess protection 16 O Ver-speed protection 17 IV Velocity deviation excess protection 18 O Over-speed protection 19 O Over-speed protection 20 Over-speed protection 21 Absolute clear abnormal protection 22 Command pulse input frequency error protection 23 O Encoder communication data error protection 24 Deviation error protection 25 O Hybrid deviation excess protection 26 O Over-speed protection 27 Deviation observable input frequency error protection 28 O Limit of pulse replay error protection 29 Deviation counter overflow abnormality protection 20 Deviation counter overflow abnormality protection 21 Finput function error protection 22 Deviation counter overflow abnormality protection 23 Ale Finput function number error 1 protection 24 IF input function number error 1 protection 25 IF input function number error 1 protection 26 CL fitting error protection 27 INH fitting error protection 38 O Software limit protection	12	0	Main power supply under-voltage protection (between P to N)		0				
14	13	1	Main power supply under-voltage protection (AC interception detection)		0	0			
1 IPM error protection	1.1	0	Over-current protection	0					
15 1 Encoders abnormal over-heat protection	14	1	IPM error protection	0					
1	15	0	Over-heat protection	0		0			
1 Torque saturation anomaly protection 1 Over-regeneration load protection 1 Over-regeneration Trierror protection 2 DEncoder communication disconnect error protection 2 DEncoder communication data error protection 2 DEncoder communication data error protection 2 DEncoder communication data error protection 2 DENCOMENTAL STATES S	15	1	Encoders abnormal over-heat protection	0		0			
1 Torque saturation anomaly protection 0 Over-regeneration load protection 1 Over-regeneration load protection 2 Defracementation of second communication disconnect error protection 2 Defraced communication disconnect error protection 2 Defraced communication data error protection 2 Desition deviation excess protection 3 Desition deviation excess protection 4 Desition deviation excess protection 5 Desition deviation excess protection 6 Desition deviation excess protection 7 Desition deviation excess protection 8 Desition deviation excess protection 9 Desition deviation excess protection 1 Desition desition excess protection 2 Desition desition excess protection 1 Desition excess	16	0	Over-load protection	0	0	Switchable			
1 Over-regeneration Tr error protection 2 Encoder communication disconnect error protection 3 Encoder communication error protection 2 Desistion deviation excess protection 2 Desistion deviation excess protection 3 Desistion deviation excess protection 4 Desistion deviation excess protection 5 Desistion deviation excess protection 6 Desistion deviation excess protection 7 Desistion deviation error protection 7 Desistion de	10	1	Torque saturation anomaly protection	0	0				
1 Over-regeneration Tr error protection O Encoder communication disconnect error protection O Encoder communication disconnect error protection O Encoder communication error protection O Encoder communication excess error protection O Encoder communication excess error protection O Encoder communication excess error protection O Encoder communication Encoder Encod	40	0	Over-regeneration load protection	0		0			
21	18	1	Over-regeneration Tr error protection	0					
1	04	0	Encoder communication disconnect error protection	0					
1	21	1	Encoder communication error protection	0					
1	23	0	Encoder communication data error protection	0					
1 Velocity deviation excess protection	0.4	0	Position deviation excess protection	0	0	0			
26 0 Over-speed protection	24	1	Velocity deviation excess protection	0	0	0			
1	25	0	Hybrid deviation excess error protection	0		0			
1		0	Over-speed protection	0	0	0			
27	26	1	2nd over-speed protection	0	0				
2 Command pulse multiplier error protection 28 0 Limit of pulse replay error protection 0 Deviation counter overflow abnormality protection 29 1 Counter overflow protection 1 2 Deviation counter overflow abnormality protection 2 31 2 Safety function error protection 1 2 Safety function error protection 2 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		0	Command pulse input frequency error protection	0	0	0			
28 0 Limit of pulse replay error protection 0 Deviation counter overflow abnormality protection 29 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 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 2 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	27	1	Absolute clear abnormal protection	0					
1		2	Command pulse multiplier error protection	0	0	0			
29 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 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	28	0	Limit of pulse replay error protection	0	0	0			
2 Deviation counter overflow abnormality protection 2		0	Deviation counter overflow abnormality protection	0	0				
31 0 Safety function error protection 1 2 Safety function error protection 2 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 35 0 to 1 EEPROM parameter error protection	29	1	Counter overflow protection 1	0					
2 Safety function error protection 2 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		2	Deviation counter overflow abnormality protection 2	0					
2 Safety function error protection 2 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	0.4	0	Safety function error protection 1	0					
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	31	2	Safety function error protection 2	0					
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		0	IF overlaps allocation error 1 protection	0					
3 IF input function number error 2 protection		1	IF overlaps allocation error 2 protection	0					
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		2	IF input function number error 1 protection	0					
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	00	3	IF input function number error 2 protection	0					
6 CL fitting error protection 7 INH fitting error protection 34 0 Software limit protection 36 0 to 1 EEPROM parameter error protection	33	4	IF output function number error 1 protection	0					
7 INH fitting error protection 34 0 Software limit protection 36 0 to 1 EEPROM parameter error protection		5	IF output function number error 2 protection	0					
34 0 Software limit protection		6	CL fitting error protection	0					
36 0 to 1 EEPROM parameter error protection		7	INH fitting error protection	0					
	34	0	Software limit protection	0	0				
OZ OLIO FERROM LIVINIA III	36	0 to 1	EEPROM parameter error protection						
3/ U to 2 EEPRUM check code error protection	37	0 to 2	EEPROM check code error protection						

Monitor Mode (EXECUTION display)

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

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.

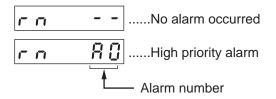
Immediate stop...Instantaneous controlled stop upon occurrence of an error. (Setting of "Pr.5.10 Sequence at alarm" is also required.)



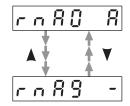
- Certain alarms are not included in the history. For detailed information on alarms e.g. alarm numbers, refer to P.6-2.
- 2) When one of the errors which are listed in error history occurs, this error and history o shows the same error No.

Monitor Mode (EXECUTION display)

(8) Alarm Display



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 ∞
А3	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	error The external scale detects the alarm.	
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 ∞

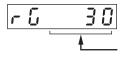
^{*1} Alarms can be cleared by using the alarm clear. Because the all existing alarms are kept cleared while the alarm clear input (A-CLR) is kept ON, be sure to turn it OFF during normal operation. Either 1 s to 10 s or ∞ can be selected by using user parameter.

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

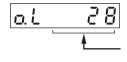
• Regenerative Load Factor



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

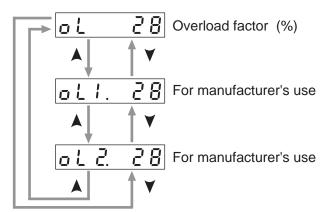


Displays the ratio (%) against the rated load.

Refer to P.6-14, "Overload Protection Time Characteristics" of When in Trouble.

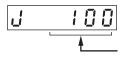
Overload factor (%)

Displays Overload factor by pressing ▲ or ▼ button.



Displays the Overload factor witch is bigger in Overload factor 1 and 2.

• Inertia Ratio



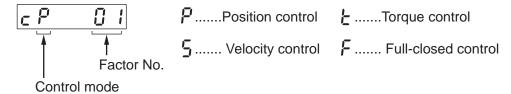
Displays the inertia ratio (%).

Value of Pr0.04 (Inertia Ratio) will be displayed as it is.

Monitor Mode (EXECUTION display)

10) Display of the Factor of No-Motor Running

Displays the factor of no-motor running in number.



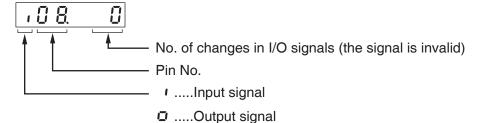
• Explanation of factor No.

Factor	Factor	Related Control Mode			de	Content	
No.	lactor		S	Т	F		
flashing	Occurrence of error/alarm		0	0	0	An error is occurring, and an alarm is triggered.	
00	00 No particular factor		0	0	0	No factor is detected for No-motor run. The motor runs in normal case.	
01	01 Main power shutoff		0	0	0	The main power of the driver is not turned on.	
02	No entry of SRV-ON input		0	0	0	The Servo-ON input (SRV-ON) is not connected to COM	
03	Over-travel inhibition input is valid		0	0	0	 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		0	0	0	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	05 Analog torque limit input is valid.		0		0	 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	6 INH input is valid.				0	Pr5.18 is 0 (Command pulse inhibition input is valid.), and INH is open.	
07	Command pulse input frequency is low.				0	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.				0	While Pr5.17 is 0 (Deviation counter clear at level), the deviation counter clear input (CL) is connected to COM–.	
09	09 ZEROSPD input is valid.		0	0		While Pr3.15 is 1 (Speed zero clamp is valid.), the speed zero clamp input (ZEROSPD) is open.	
10	External speed command is small.		0			While the analog speed command is selected, the analog speed command is smaller than 0.06[V].	
11	Internal speed command is 0.		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.			0		The analog torque command input (SPR or P-ATL) is smaller than 5 [%] of the rating.	
13	Speed limit is small.			0		 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	14 Other factor		0	0	0	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.)	

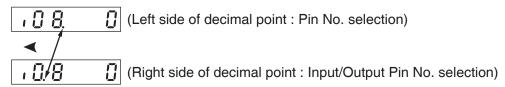
Note

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

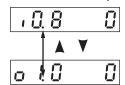
(11) Display of No. of changes in I/O signals



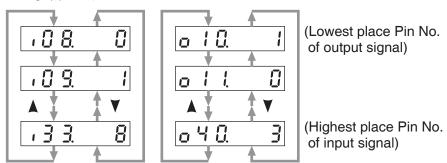
• Shift the flashing decimal point with ◀ .



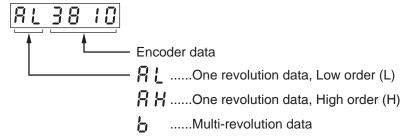
• The switch of input/output, by pressing ▲ or ▼ button.

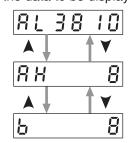


 Select the No. of pin, the number of changes on that pin should be displayed, by pressing ▲ or ▼ button.



(12) Display of absolute encoder data

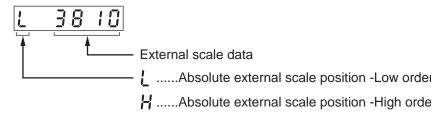




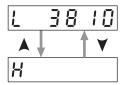
Monitor Mode (EXECUTION display)

(13) Display of absolute external scale position

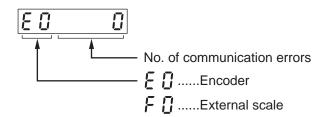
- Displays the absolute position of serial absolute scale.
- If a serial incremental scale, displays the scale position relative to the power on position which is defined as 0.



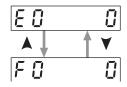
Select encoder or external scale by pressing ▲ or ▼ button.



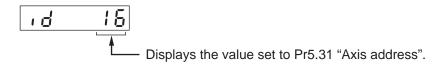
(14) Display of No. of encoder/ external scale communication errors monitor



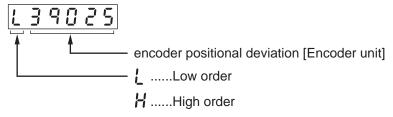
Select encoder or external scale by pressing ▲ or ▼ button



(15) Display of communication axis address



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

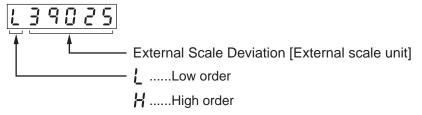


• To switch between Low order (L) and High order (H), press ◀ .



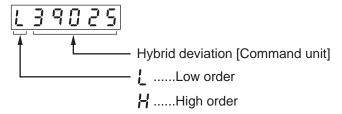
Monitor Mode (EXECUTION display)

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



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

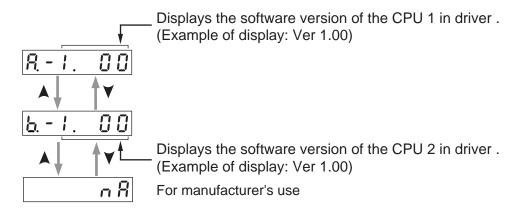
(18) Display of hybrid deviation [Command unit]



ullet To switch between Low order (L) and High order (H), press \blacksquare .

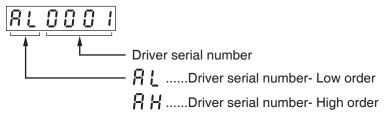
(19) Display of voltage across PN [V]

(20) Display of Software Version

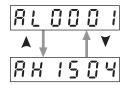


Monitor Mode (EXECUTION display)

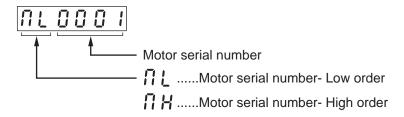
(21) Display of driver serial number



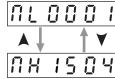
To switch between Low order (L) and High order (H), press ▲ or ▼.
 (Example of display: Serial number P15040001N)



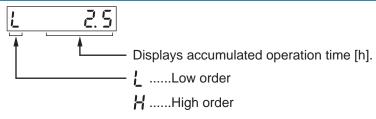
(22) Display of motor serial number



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



(23) Display of accumulated operation time



 \bullet To switch between Low order (L) and High order (H), press \blacktriangleleft .

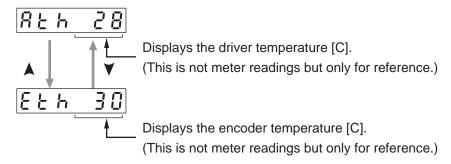
(24) Automatic Motor Recognizing Function

R ∪ d o nAutomatic recognition is valid.

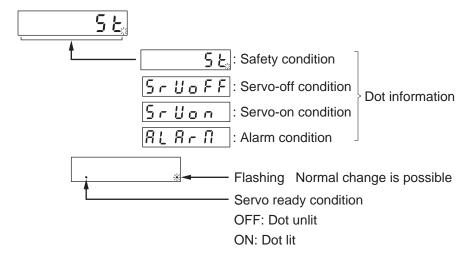
R ∪ d o F FAutomatic recognition is invalid.

Monitor Mode (EXECUTION display)

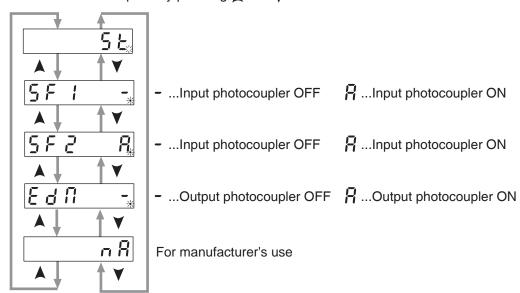
(25) Display of temperature



(26) Display of safety condition monitor



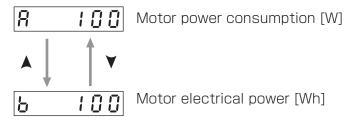
• Select desired monitor option by pressing ▲ or ▼ button.



Related page :: P.7-2 "safety".

Monitor Mode (EXECUTION display)

(27) Motor power consumption



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 Lchang to L'

2

Preparation

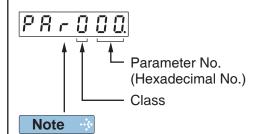
14. How to Use the Front Panel

Parameter Setup Mode

Monitor Mode SELECTION display

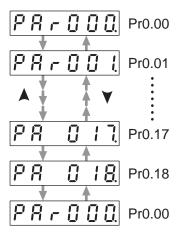
M (Mode switch button)

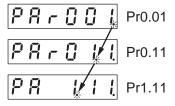
Parameter Setup Mode SELECTION display



For parameters which place is displayed with " $\bar{\iota}$ ", the content changed and written to EEPROM becomes valid after turning off the power once.

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



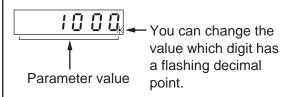


 Display the No. of parameter to be changed and press \$ to change to EXECUTION display.

(Mode switch button)

EEPROM Writing Mode SELECTION display

EXECUTION display



- Press ▲ or ▼ to set up the value of parameter. (Value increases with ▲ decreases with ▼ .)
- 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

S (SET button)

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).

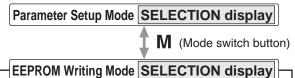


- After setting up parameters, return to SELECT mode, referring to structure of each mode (P.4-42).
- Each parameter has a limit in number of places for upper-shifting.

Preparation

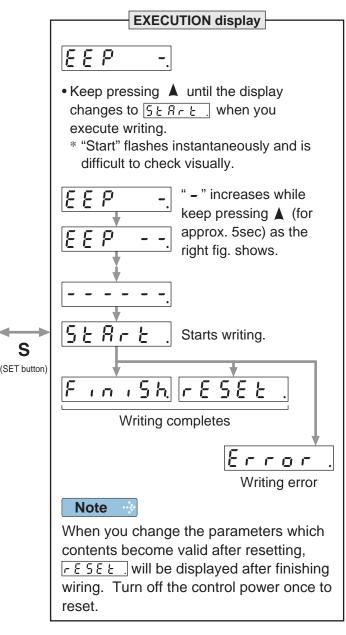
14. How to Use the Front Panel

EEPROM Writing Mode



88.588

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



M (Mode switch button)

Auxiliary Function Mode SELECTION display

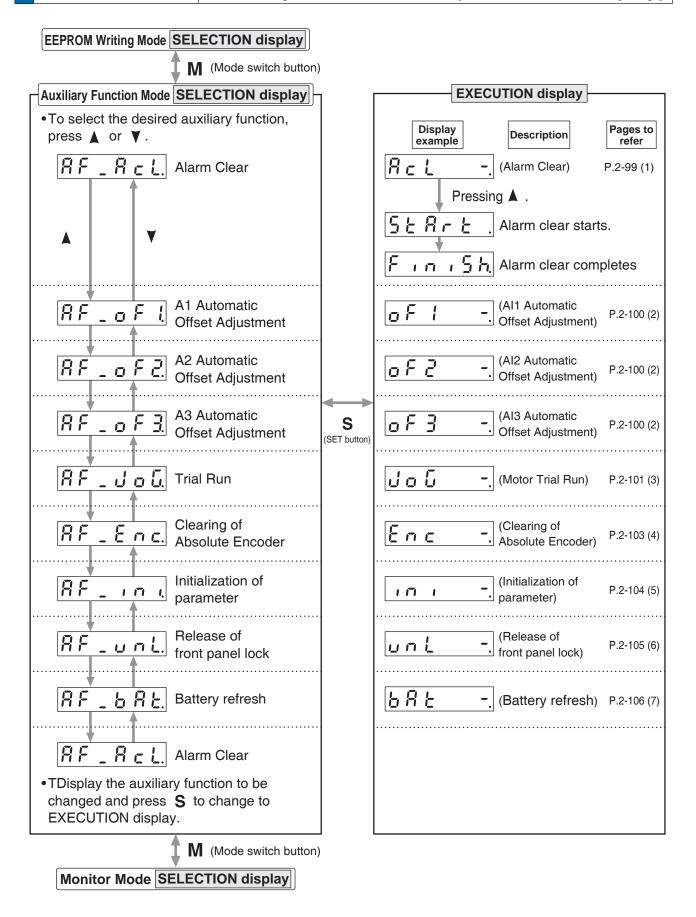
Caution ...

- 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.

2 Preparation

14. How to Use the Front Panel

Auxiliary Function Mode (SELECTION display)



2

ZPreparation

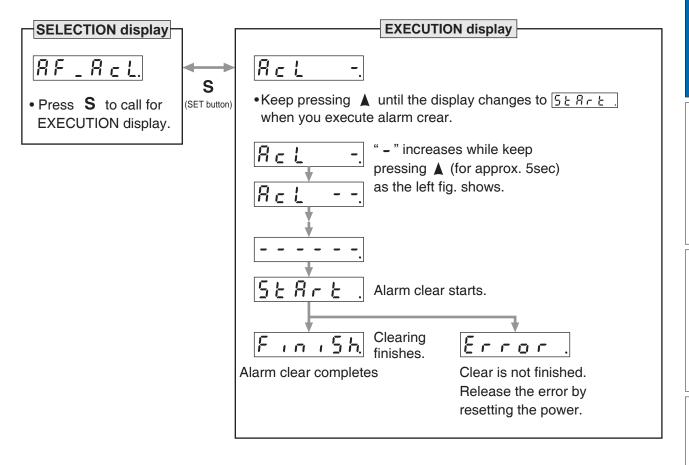
14. How to Use the Front Panel

Auxiliary Function Mode (EXECUTION display)

1) Alarm Clear Screen

This function releases the current alarm status.

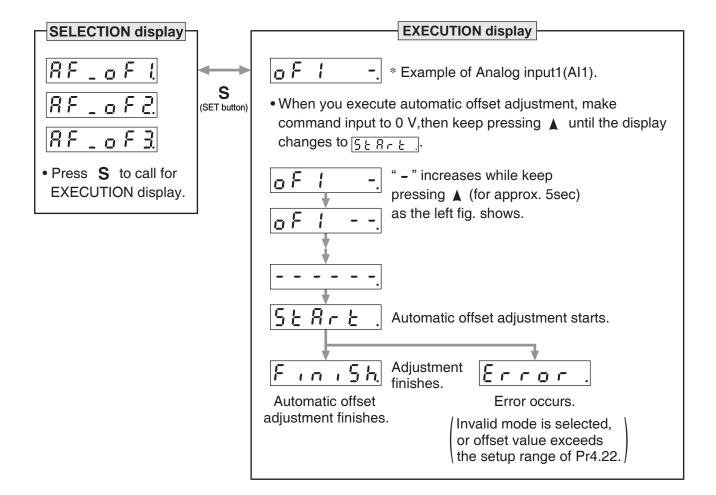
Certain alarms will persist. If this is the case, refer to P.6-2 "When in Trouble - Protective Function".



[•] 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 (Al1).....Pr4.22 (Analog input 1 (Al1) offset setup) Analog input 2 (Al2).....Pr4.25 (Analog input 2 (Al2) offset setup) Analog input 3 (Al3).....Pr4.28 (Analog input 3 (Al3) offset setup)





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



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

2

4

14. How to Use the Front Panel

Auxiliary Function Mode (EXECUTION display)

(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 🔆

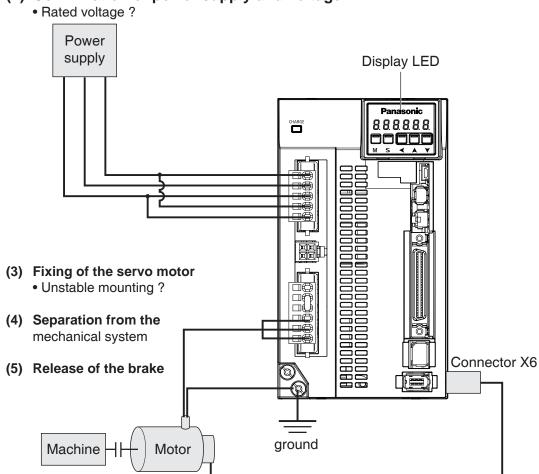
- Separate the motor from the load, detach the Connector, Connector X4 before the trial run.
- Bring the user parameter setups (especially Pr0.04 and Pr1.01 to 1.04) to defaults, to avoid oscillation or other failure.

Inspection Before Trial Run

(1) Inspection on wiring

- Miswiring ? (Especially power input and motor output)
- Short or arounded?
- Loose connection ?

(2) Confirmation of power supply and voltage

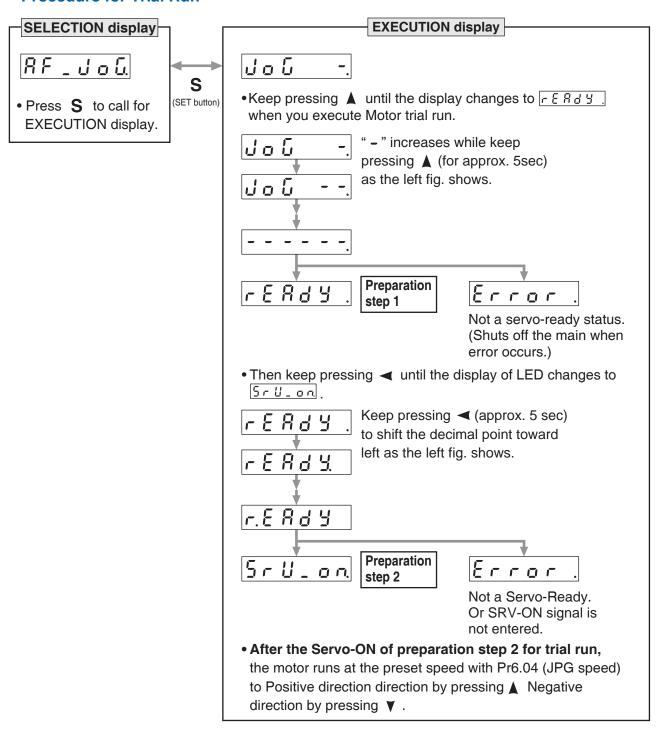


(6) Turn to Servo-OFF after finishing the trial run by pressing S.

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





- 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).

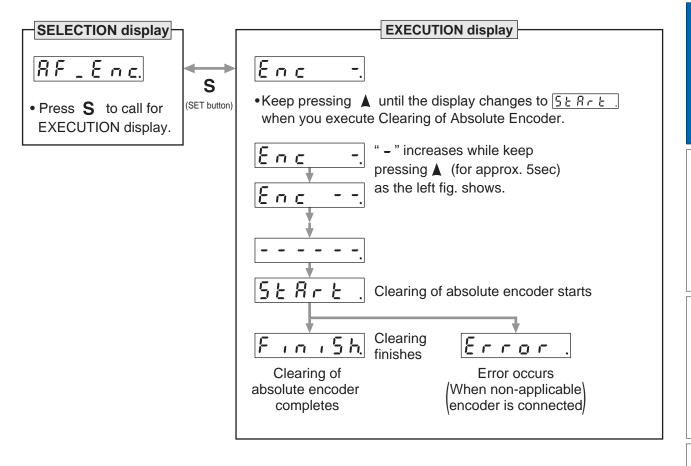
2

14. How to Use the Front Panel

Auxiliary Function Mode (EXECUTION display)

4) Clearing of Absolute Encoder

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



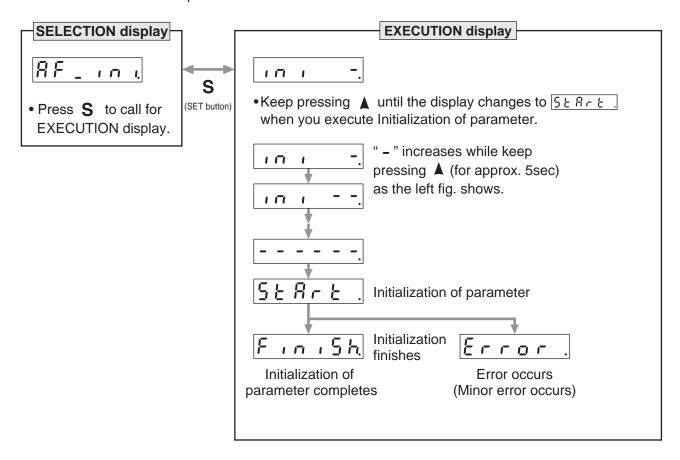
Note

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

Auxiliary Function Mode (EXECUTION display)

(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.



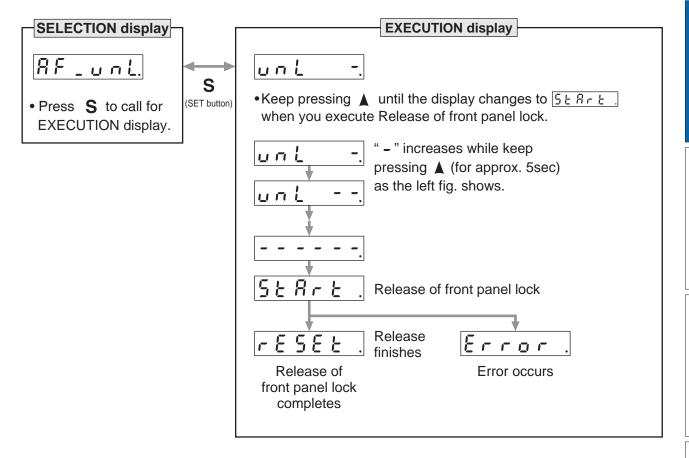
· After initialization of parameter finishes, return to SELECTION display, referring to structure of each mode (P.2-76).

14. How to Use the Front Panel

Auxiliary Function Mode (EXECUTION display)

(6) Release of front panel lock

Release the front panel lock setting.

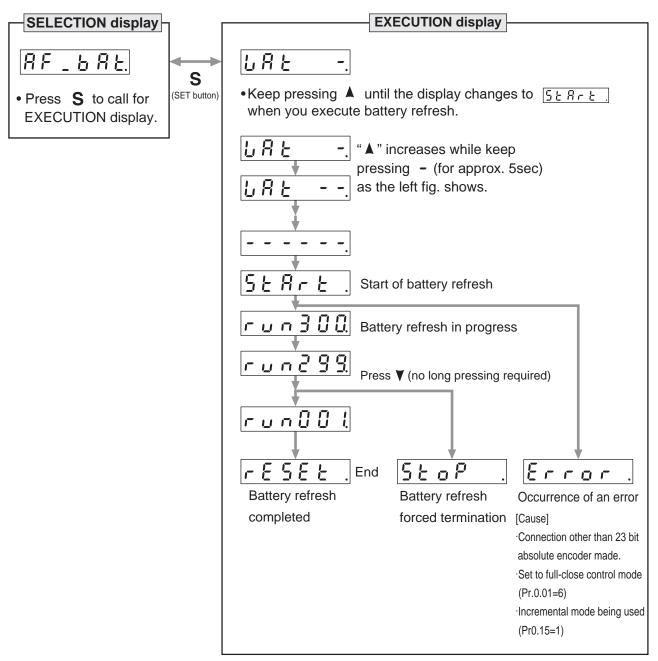


Note

[•] 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).

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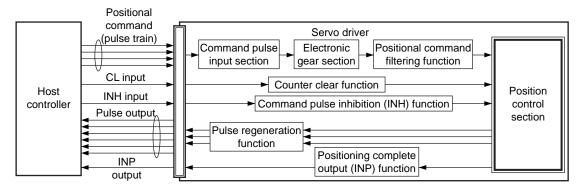
Position Control Mode

SE	SG	SF
0	0	0

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"

1. Outline of mode
Position Control Mode

(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.



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.



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	ı	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.



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".

Position Control Mode

(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.



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.



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

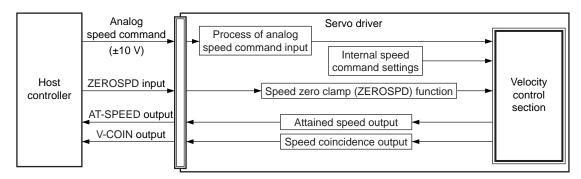
When INH input is ON, the deviation will be caused between the positional command administrated by controller and internal positional command from the fliter that receives the positional command from servo drivers, and orginal location before being input INH positional command will be lost. Therefore,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

Velocity Control Mode

SE	SG	SF
0	0	0

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 (Al1) 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 (Al1) 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.

P.3-14 "Control Block Diagram"

[•] P.3-21 "Wiring Diagram to the connector, X4"

Velocity Control Mode

(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		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		r/min	Set up internal command speeds, 1st to 4th.					
Pr3.08	5th speed of speed setup	20000	1/111111	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).



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.



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.



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



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
		0

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)

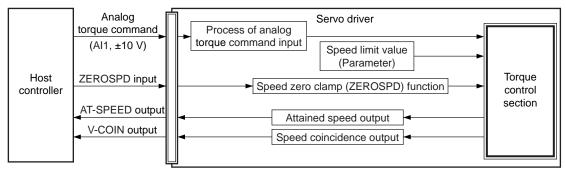
Setup value		Torque command input	Velocity limit input
0	Selection of torque command 1	Analog input 1 *1 (Al1, 16-bit resolution)	Parameter value (Pr3.21)
1	Selection of torque command 2	Analog input 2 (Al2, 12-bit resolution)	Analog input 1 (Al1, 16-bit resolution)
2	Selection of torque command 3	Analog input 1 *1 (Al1, 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 (Al2, 12-bit resolution).

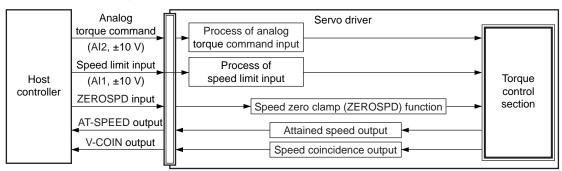


For details of these parameters, refer to P.4-35 "Details of parameter".

<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 (Al1) 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 (Al1) 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 (Al2) 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 (Al2) 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".

Torque Control Mode

(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
Pr3.22	Speed limit value 2	0 to 20000	r/min	controlling.
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 (Al1) 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.



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

1. Outline of mode

Full-closed Control Mode

SE	SG	SF
		0

Outline

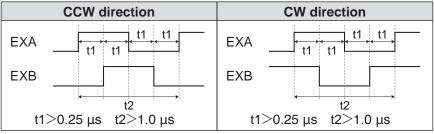
In this full-closed control, you can make a position control by using a external scale mounted externally which detects the position directly and feeds it back. With this control, you can control without being affected by the positional variation due to the ball screw error or temperature and you can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



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

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.

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"

Full-closed Control Mode

- 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.

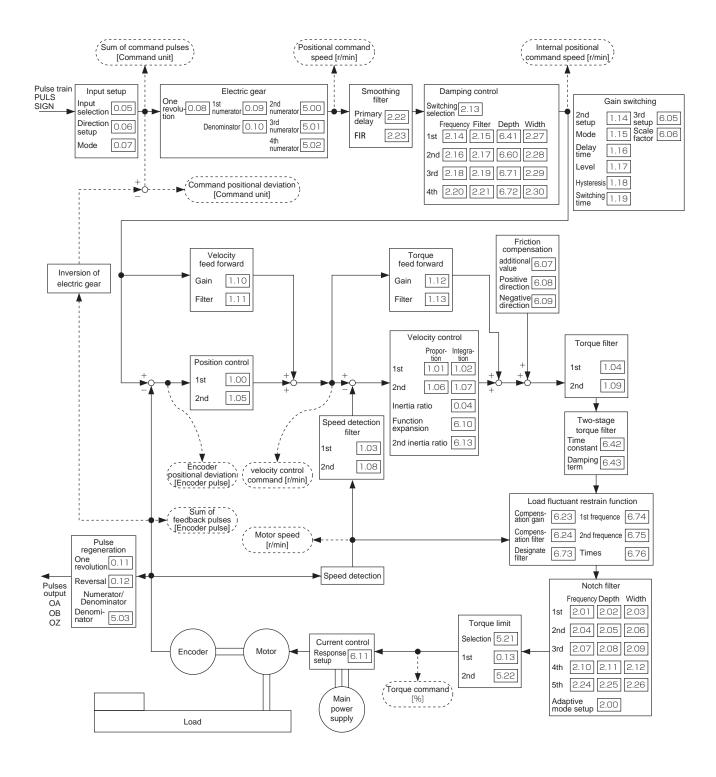


For details of these parameters, refer to P.4-6 to P.4-85 "Details of parameter".

2. Control Block Diagram

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

SE	SG	SF
0	0	0



Related page · ∴

P.3-21 "Wiring example of position control mode"

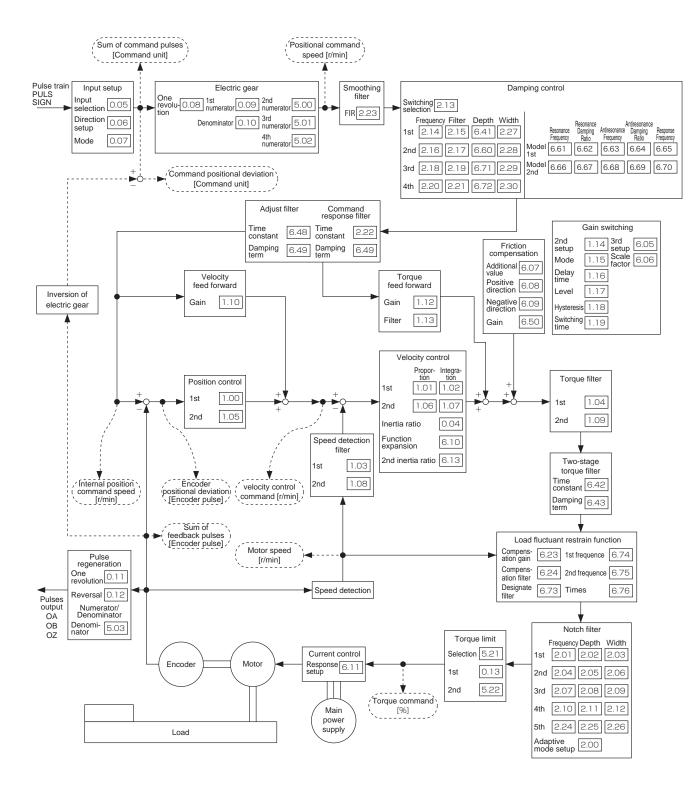
P.3-23 "Connecting example to host controller"

[•] 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)





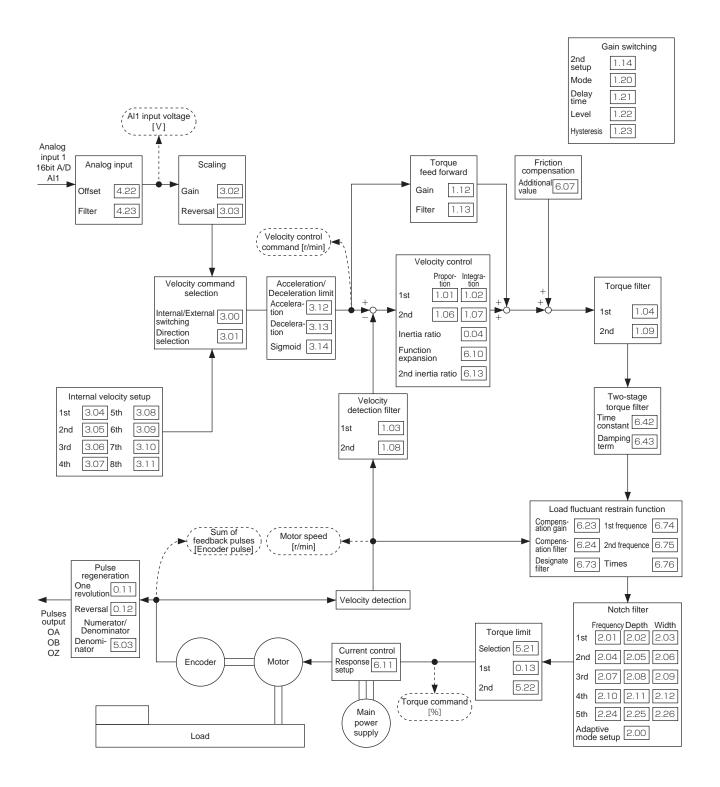
Related page · ∵

Connection

- 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 (200F control noneffective) Internal speed SE SG SF Analog SE SG SF Command O O O input



Related page ...

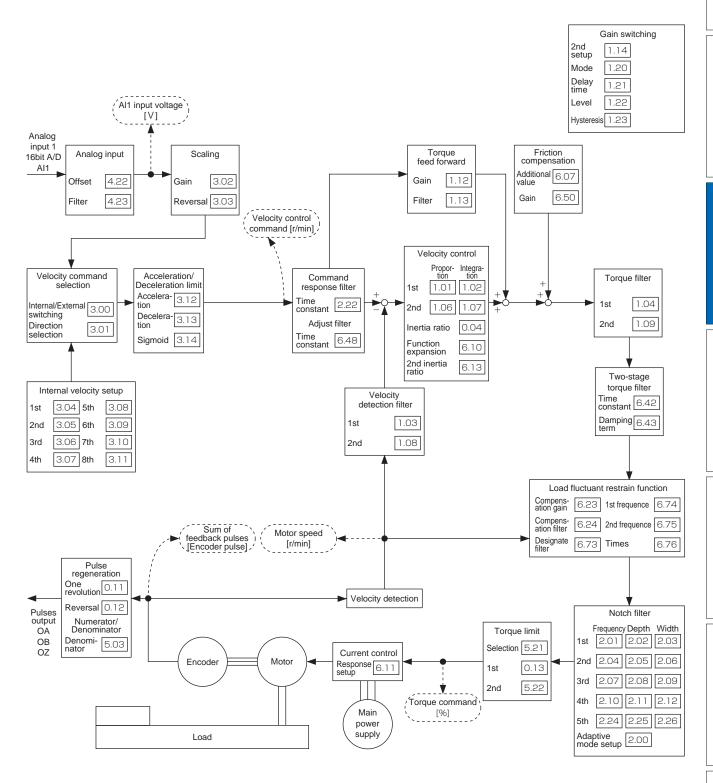
P.3-21 "Wiring example of velocity control mode"

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

Velocity Control Mode (2D0F control effective) Command OOOO input

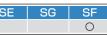


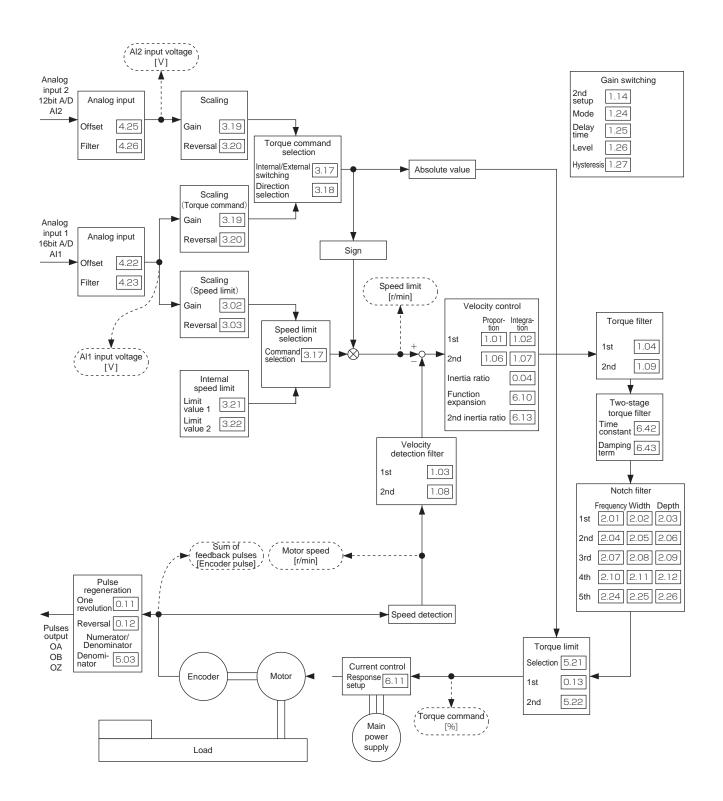
Related page · ∵

- 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





Related page …

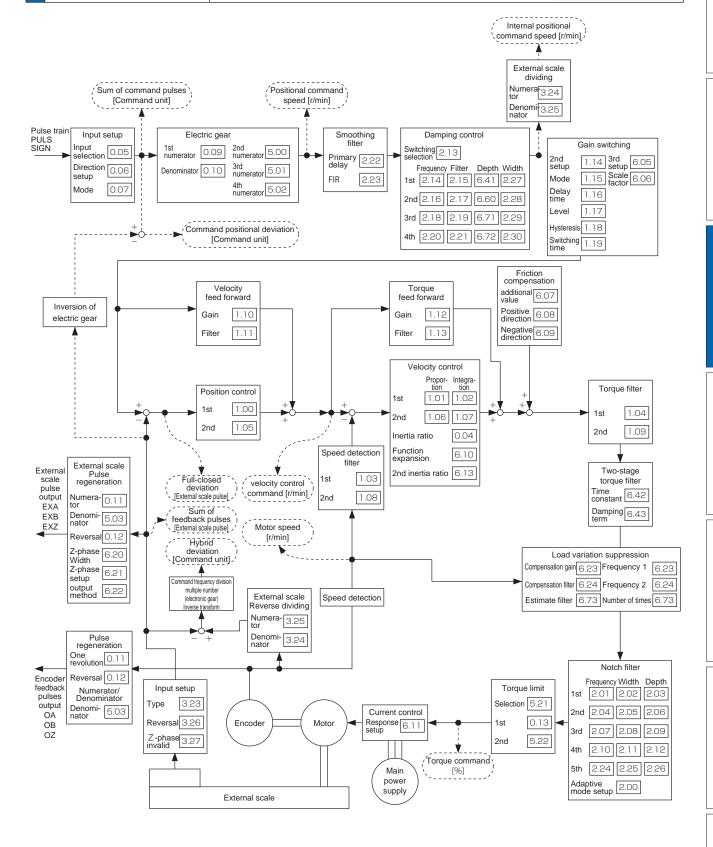
- P.3-22 "Wiring example of torque control mode"
- P.3-23 "Connecting example to host controller"
- P.3-33 "Inputs and outputs on connector X4" P.4-2 "List of Parameters"

0

3 Connection

2. Control Block Diagram

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



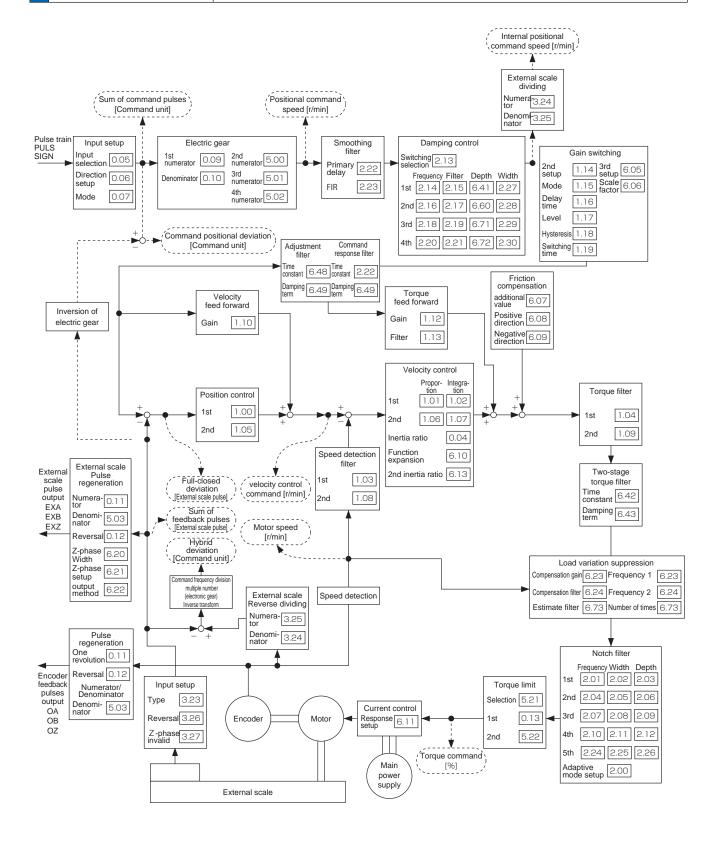
Related page · ∴

- 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)



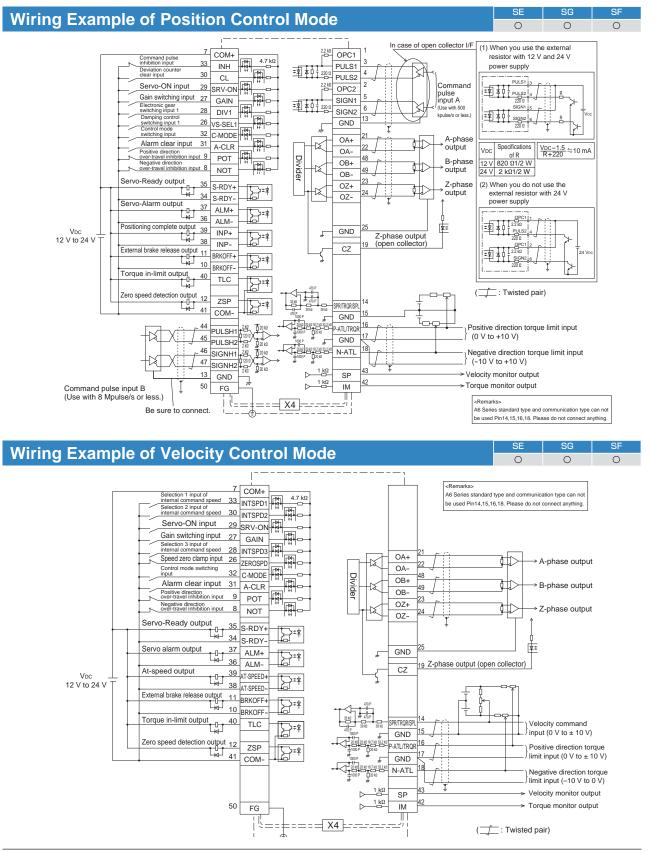


Related page ...:

- 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

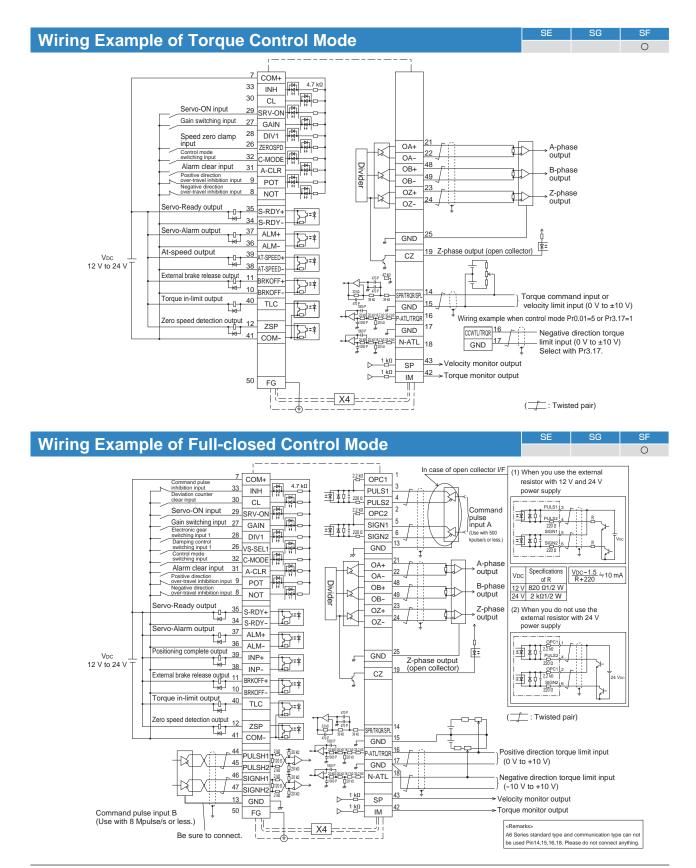


Note

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.





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.

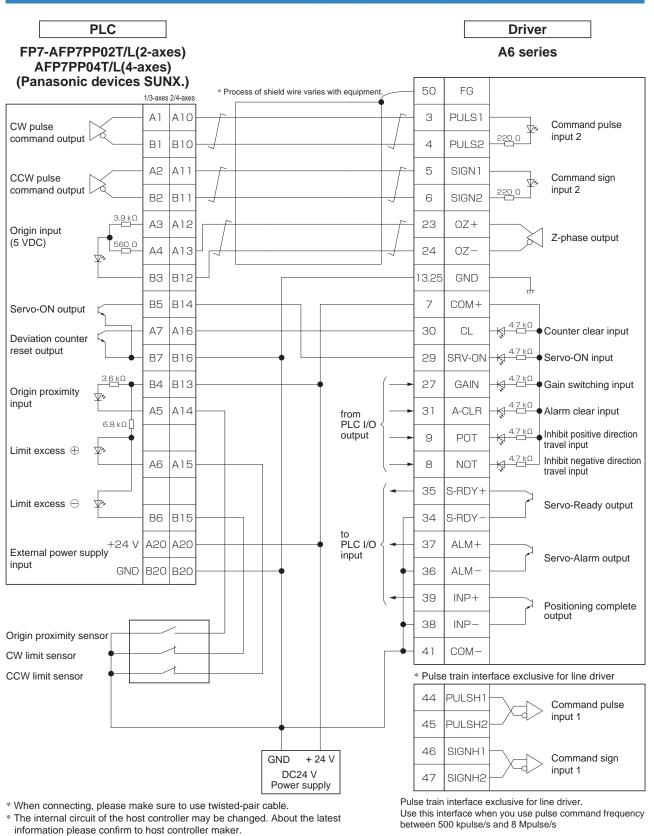
Caution ...

• 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.

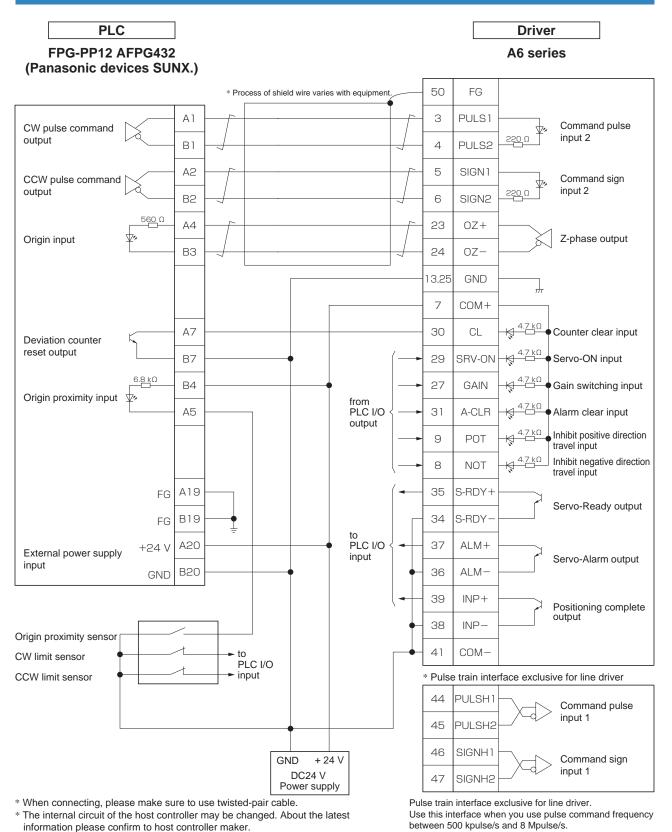




represents twisted pair wire.

Related page …:

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



Note

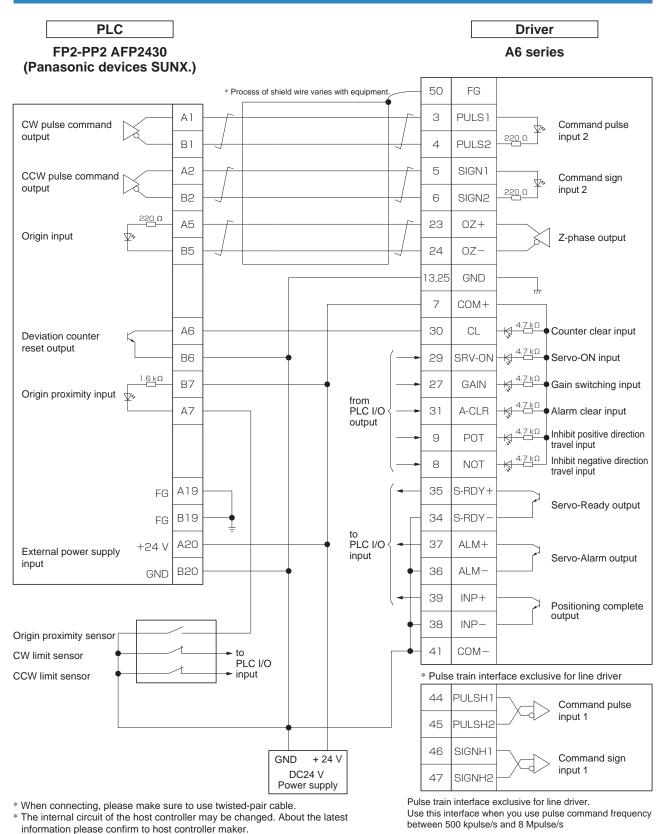
_____ represents twisted pair wire.

elated 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 FP2-PP2 AFP2430 Panasonic devices SUNX.

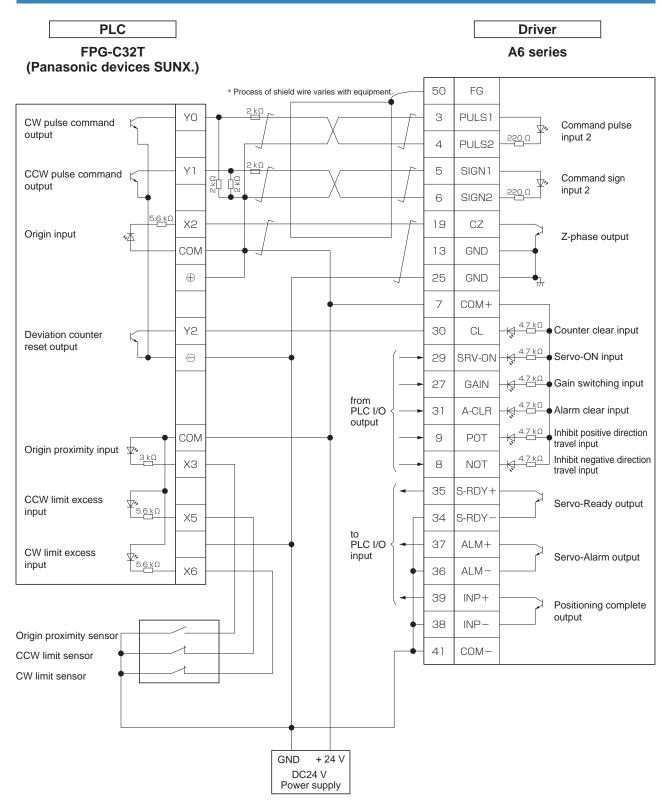


Note

represents twisted pair wire.

Related page …:

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.

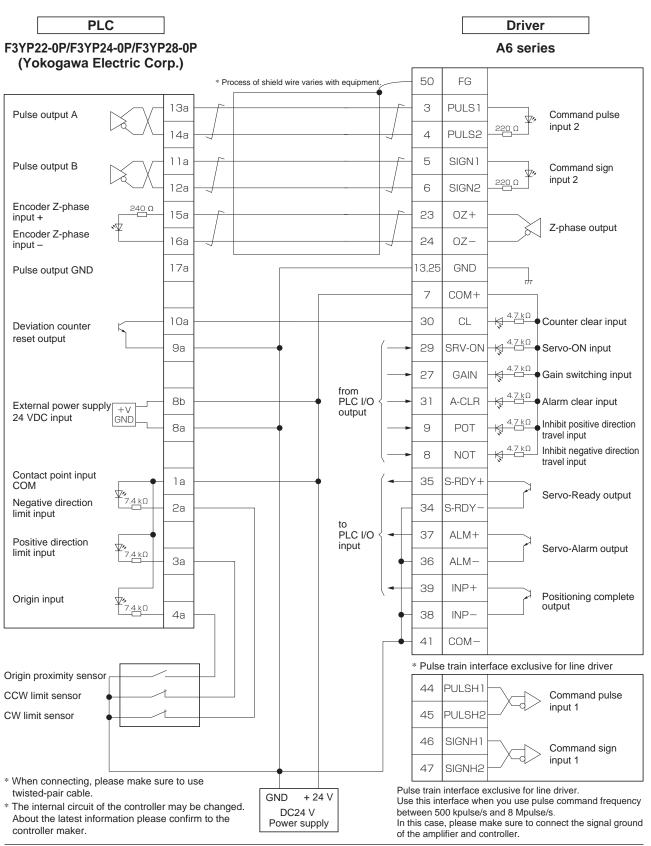
Note · represents twisted pair wire.

4

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.

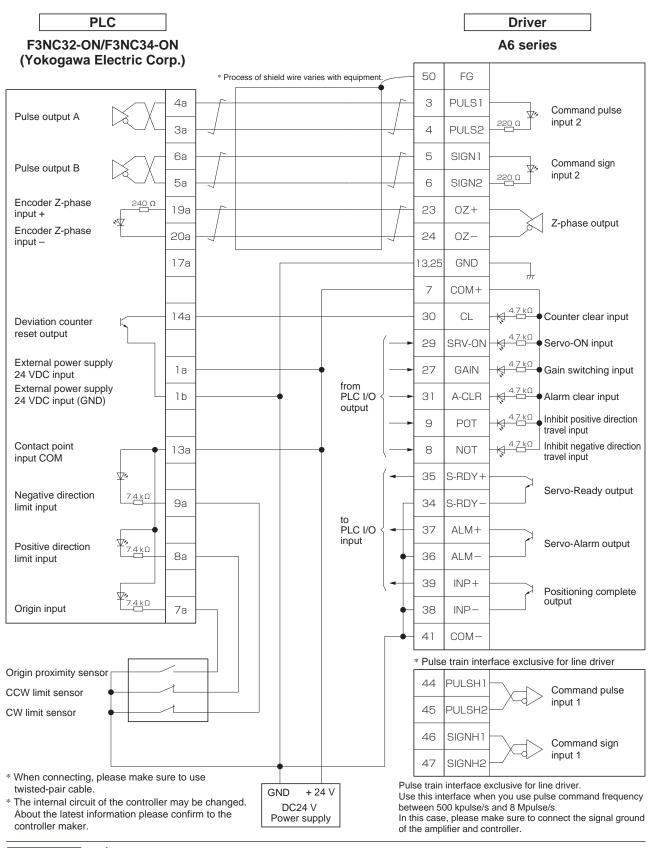


Note -

represents twisted pair wire.

Related page …

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



Note

represents twisted pair wire.

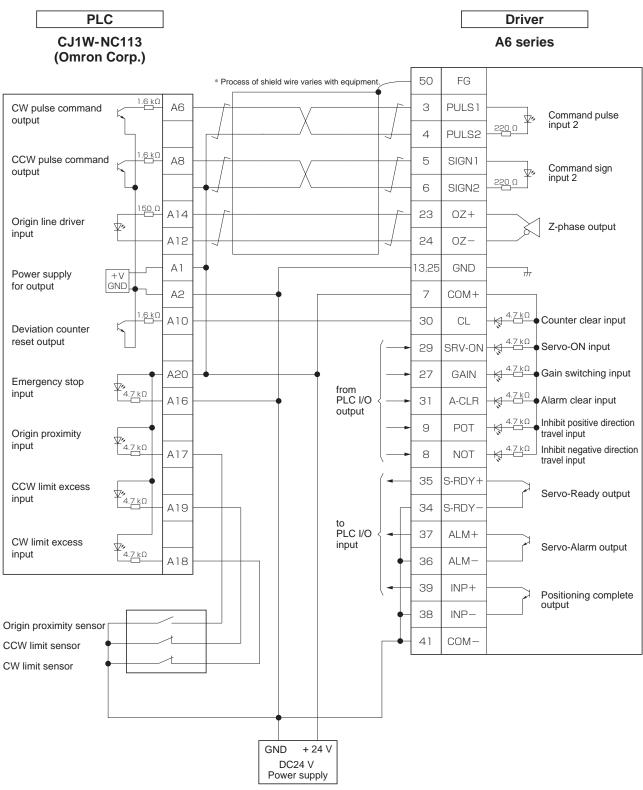
Related page

4

3. Wiring Diagram to the connector, X4

Connecting Example to Host Controller

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.



represents twisted pair wire.

Related page · ∴ P.

Connection between MINAS A6 and CJ1W-NC133 Omron Corp. **PLC Driver CJ1W-NC133** A6 series (Omron Corp.) 50 FG * Process of shield wire varies with equipment А5 3 PULS 1 CW pulse command Command pulse input 2 output Α6 4 PULS2 5 SIGN1 Α7 Command sign CCW pulse command input 2 output 6 SIGN2 Α8 A14 23 OZ+ Origin line driver Z-phase output input A12 24 OZ-3,25 GND 24 V power supply for output GND 7 COM+ Α2 $4.7 \text{ k}\Omega$ Counter clear input A10 30 Deviation counter reset output Servo-ON input 29 SRV-ON Gain switching input A20 27 GAIN Emergency stop from PLC I/O input 4.7 kΩ A16 A-CLR Alarm clear input 31 output Inhibit positive direction 9 POT travel input Origin proximity input Inhibit negative direction A17 8 NOT travel input 35 S-RDY+ Servo-Ready output CCW limit over input A19 34 S-RDYto PLC I/O 37 ALM+ input Servo-Alarm output CW limit over input A18 ALM-36 АЗ 39 INP+ 5 V power supply Positioning complete GND +V for pulse output Α4 INP-38 41 COM-Origin proximity sensor CCW limit sensor CW limit sensor GND + 5 V GND + 24 V DC5 V DC24 V Power supply Power supply

Note ·

represents twisted pair wire.

Related page ·

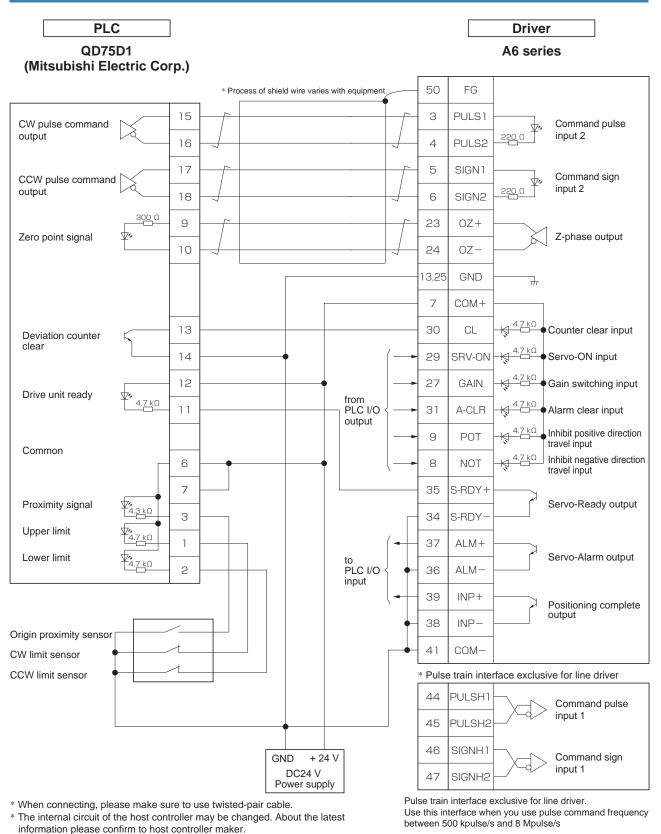
^{*} When connecting, please make sure to use twisted-pair cable. * The internal circuit of the host controller may be changed. About the latest information please confirm to host controller maker.

3

3. Wiring Diagram to the connector, X4

Connecting Example to Host Controller

Connection between MINAS A6 and QD75D1 Mitsubishi Electric Corp.

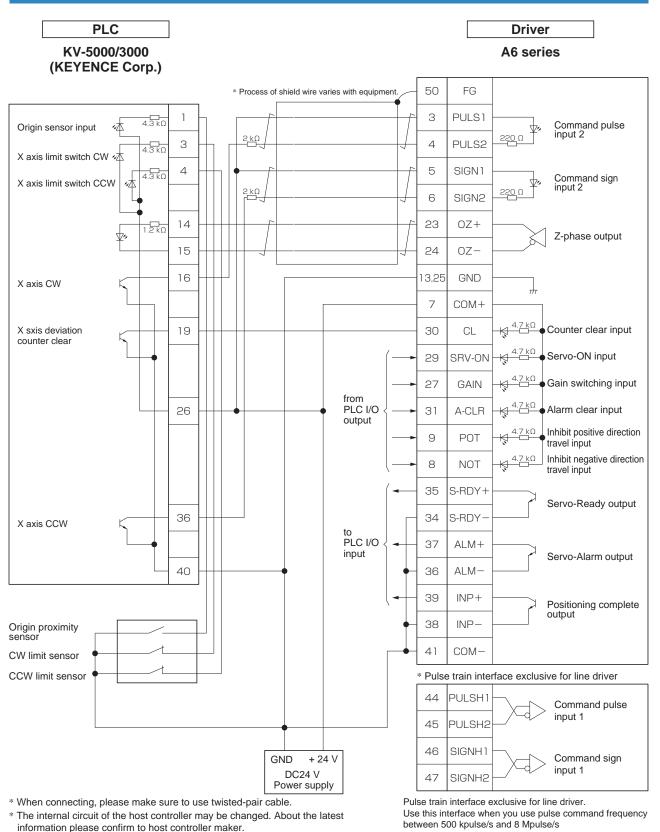




represents twisted pair wire.

Related page

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



Note

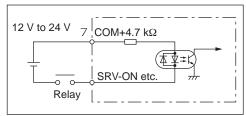
____ represents twisted pair wire.

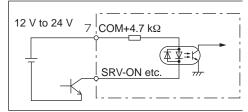
Related page

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)

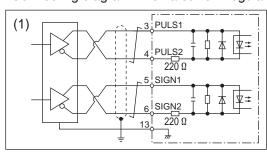
Related P S T

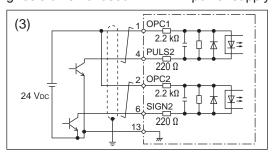


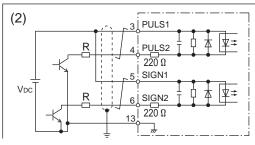
- (1) Line driver I/F (Permissible max. input frequency of command pulse input signal.: 500 kpulse/s)
- This signal transmission method has better noise immunity. We recommend this to secure the signal transmission.
- (2) Open collector I/F (Permissible max. input frequency of command pulse input signal.: 200 kpulse/s)

 The method which were an external control signal reverse command (VPC) Vpc Specifications
- The method which uses an external control signal power supply (VDC)
- ullet Current regulating resistor (R) corresponding to V_{DC} is required in this case.
- 12 V 820 Ω1/2 W 24 V 2 kΩ1/2 W
- $\frac{\text{VDC}-1.5}{\text{R}+220} \doteq 10 \text{ mA}$

- Connect the specified resister as below.
- (R) should be placed close to the driver for effective noise reduction.
- (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.

4. Inputs and outputs on connector X4

Interface Circuit (Input)

Connection to sequence input signals Related PI2 F control mode (Pulse train interface exclusive to line driver) 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. 20 kΩ **PULS** 120 Ω 45 20 kΩ L $2 k\Omega$ 46 $2 k\Omega$ 20 kΩ SIGN 120 Ω 47 2 kΩ 13 $\frac{1}{2}$ represents twisted pair.

Al Analog command input

Related control mode

S

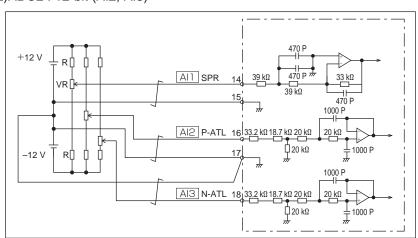
F

- It goes through 3 systems, Al1 to Al3.
- Max. permissible input voltage to each input is ±10 V.
 For input impedance of each input, refer to the right Fig.

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

- 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 k Ω , 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 (Al1) (2)ADC2 : 12-bit (Al2, Al3)



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

represents twisted pair.

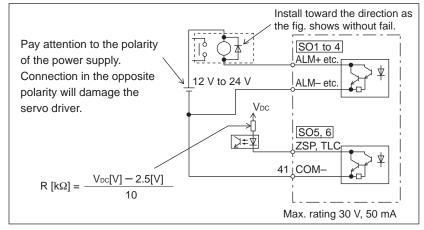
Note

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

SO Sequence output circuit

- Related control mode P S T
- 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, VCE (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

- 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.

Related

S

• For function, refer to P.3-51.

Related P₀2 S Open collector output control mode • Feeds out the Z-phase signal among the encoder signals in open collector. This output is • Receive this output with high-speed photocouplers at the host side, since the pulse width of the Z-phase signal is narrow. Max. rating 30 V, 50 mA 19 CZ **GND** High speed photocoupler (TLP554 by Toshiba or equivalent) represents twisted pair.

AO Analog monitor output

Related P S T F

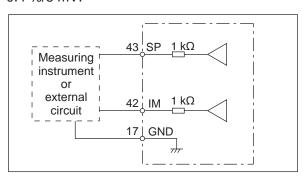
- There are two outputs, the speed monitor signal output (SP) and the torque monitor signal output (IM)
- Output signal width is ±10 V.

• For function, refer to P.3-51.

• The output impedance is 1 k Ω . 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.

3 Connection

4. Inputs and outputs on connector X4 Input Signal and Pin No.

Input Signals (common) and Their Functions

Pin	7	Title of signal	Power supply for control signal (+)	Related control mode	Р	S	Т	F
No.		Symbol	COM+	I/F circuit		_	_	
			+ of the external DC power supply (12 V to 24 V). power supply voltage of 12 V \pm 5 % to 24 V \pm 5 %					

Pin	41	Title of signal	Power supply for control signal (–)	Related control mode	Р	S	Т	F
No.	41	Symbol	COM-	I/F circuit		-	_	
			 of the external DC power supply (12 V to 24 V). er capacity varies depending on a composition of I/C ended. 	circuit. 0.5	A or r	nore	is	

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	44	Title of signal	Command pulse input 1	Related control mode	Р	S	Т	F
No.	45	Symbol	Pin No.44: PULSH1 Pin No.45: PULSH2	I/F circuit	PI2	P.3	-34	
Pin	46	Title of signal	Command pulse sign input 1	Related control mode	Р	S	Т	F

- 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)

	1	Title of signal	Command pulse input 2	Related control mode	Р	S	Τ	F
Pin No.	No. 3 Symbol		Pin No.1: OPC1 Pin No.3: PULS1 Pin No.4: PULS2	I/F circuit	PI1	P.3	-33	
	2	Title of signal	Command pulse sign input 2	Related control mode	Р	S	Т	F
Pin No.	5 6	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 Signal and Pin No.

• 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 or 2	90° phase difference 2-phase pulse (A + B-phase)	PULS SIGN	A-phase B-phase t1 t1 B-phase advances to A by 90°.	t1 t
0	1	Positive direction pulse train + Negative direction pulse train	PULS SIGN	13	t2 t2
	3	pulse train + Signal	PULS SIGN	t4 t5	t4 t5 t6 t6
	0 or 2	90° phase difference 2-phase pulse (A + B-phase)	PULS SIGN	A-phase B-phase t1 t1 B-phase delays from A by 90°.	t1 t
1	1	Positive direction pulse train + Negative direction pulse train	PULS SIGN	t2 t2	t2 t2
	3		PULS SIGN	t4 t5 "L" +6 t6	14 t5 H" t6

- 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.

Innut I/E of E	NIII C/CICN cianal	Permissible max.	N	/lin. ned	essary	time w	idth (µs	5)
iliput i/F oi F	PULS/SIGN signal	input frequency	t1	t ₂	tз	t4	t 5	t ₆
Pulse train interface exclusive to line driver	A,B-phase Input, multiple of 4	8 Mpulse/s	0.125	0.125	0.125	0.125	0.125	0.125
PULSH1,2,SIGNH1,2	Not A,B-phase Input	4 Mpulse/s	0.25	0.125	0.125	0.125	0.125	0.125
Pulse train interface	Line driver interface	200 kpulse/s	2	1	1	1	1	1
PULS1,2,SIGN1,2	Open collector interface	200 kpulse/s	5	2.5	2.5	2.5	2.5	2.5

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

					Default			Default	Setup		
				Applicable parameter	parameter setting	Position/ Full-cl	osed control	Verocity	control	Torque o	ontrol
				parameter	(): decimal notation	Signal	Logic *1	Signal	Logic *1	Signal	Logic *1
Pin		Title of	SI1 input		00828282h		Normal		Normal		Normal
No.	8	signal Symbol	SI1	Pr4.00	(8553090)	NOT	Colse	NOT	Colse	NOT	Colse
		,	311				00.00		00.00		00:00
Pin	9	Title of signal	SI2 input	Pr4.01	00818181h	POT	Normal	POT	Normal	POT	Normal
No.	3	Symbol	SI2	114.01	(8487297)	101	Colse	101	Colse	101	Colse
Pin	200	Title of signal	SI3 input	Pr4.02	0091910Ah	V0.0514	Normal	ZEROSPD	Normal	7ED00DD	Normal
No.	26	Symbol	SI3	Pr4.02	(9539850)	VS-SEL1	Open	ZEROSPD	Colse	ZEROSPD	Colse
Pin	0.7	Title of signal	SI4 input	D. 4.05	00060606h	- AINI	Normal	0.4181	Normal	0.4181	Normal
No.	27	Symbol	SI4	Pr4.03	(394758)	GAIN	Open	GAIN	Open	GAIN	Open
Pin		Title of signal	SI5 input		0000100Ch		Normal		Normal		
No.	28	Symbol	SI5	Pr4.04	(4108)	DIV1	Open	INTSPD3	Open	_	_
Pin		Title of signal	SI6 input		00030303h		Normal		Normal		Normal
No.	29	Symbol	SI6	Pr4.05	(197379)	SRV-ON	Open	SRV-ON	Open	SRV-ON	Open
Pin		Title of signal	SI7 input		00000f07h		Normal		Normal		
No.	30	Symbol	SI7	Pr4.06	(3847)	CL	Open	INTSPD2	Open	_	_
Pin		Title of signal	SI8 input		00040404h		Normal		Normal		Normal
No.	31	Symbol	SI8	Pr4.07	(263172)	A-CLR	Open	A-CLR	Open	A-CLR	Open
Pin		Title of signal	SI9 input	_	00050505h		Normal		Normal		Normal
No.	32	Symbol	SI9	Pr4.08	(328965)	C-MODE	Open	C-MODE	Open	C-MODE	Open
Pin		Title of signal	SI10 input		00000E88h		Normal		Normal		
No.	33	Symbol	SI10	Pr4.09	(3720)	INH	Colse	INTSPD1	Open	_	_

• 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.

Input Signal and Pin No.

Function allocatable to control input

Title of signal	Servo-ON input			Related control mode	Р	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	Р	S	Т	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 								

Title of signal	Negative direction over-trave	gative direction over-travel inhibition input			Р	S	Ţ	F
Symbol	NOT	Default assignment	8 (SI1)	I/F circuit	SI	P.3	-33	

• Negative direction over-travel inhibit input.

toward positive direction.

- 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	eviation counter clear input			Р	S	Т	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
2	1 ms or more	clear input is ON. *1
3	100 µs or more	Only once clear the counter at OFF to ON edge of the
4	1 ms or more	deviation counter clear input signal. *1

^{*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"

Input Signal and Pin No.

Title of signal	Alarm clear input			Related control mode	Р	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	Р	S	Т	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 original location when it needs to restart return to origin action.

Title of signal	Control mode switching input		Related control mode	Р	S	Т	F		
Symbol	C-MODE	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/mul	Electronic gear (division/multiplication) switching input 1			Р	S	Т	F
Symbol	DIV1	I/F circuit	SI	P.3	-33			
	Electronic gear (division/multiplication) switching input 2							
Title of signal	Electronic gear (division/mul	tiplication) switc	ching input 2	Related control mode	Р	S	Т	F

• 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 proce					
DIVI	DIVZ	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 original location when it needs to restart return to origin action.

Input Signal and Pin No.

Title of signal	Damping control switching input 1		Related control mode	Р	ST	F	
Symbol	VS-SEL1	Default assignment	26 (SI3)	I/F circuit	SI	P.3-33	
Title of signal	Damping control switching in	Damping control switching input 2			Р	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	Title of signal Gain switching input			Related control mode	Р	S	T	F
Symbol	GAIN	27 (SI4)	I/F circuit	SI	P.3	-33		
	Select 1st or 2nd gain.							

Title of signal	Torque limit switching input		Related control mode	Р	S	Т	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	PrO	.13		
3	ON	valiu	Pr5.22			
4			Analog	innut *1		
5		_	Analog	IIIput ·		
6	OFF		Pr0.13 Pr5.22			
0	ON	<u>—</u>	Pr5.25	Pr5.26		

^{*1} To specify the torque limit value by an analog input, refer to Pr5.21 "Analog torque limit function".

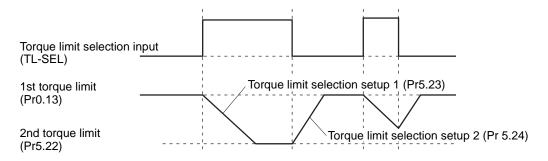
• Setup of rate of change after torque limit switchover

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.

Input Signal and Pin No.



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 of	ommand 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 of	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

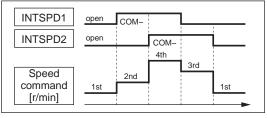
• Select one of 8 internal command speeds.

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

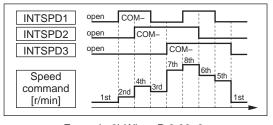
Pr3.00	Selection 1 of internal command speed (INTSPD1)	Selection 2 of internal command speed (INTSPD2)	Selection 3 of internal command speed (INTSPD3)	Selection of speed command
	OFF	OFF		1st speed
	ON	OFF	No effect	2nd speed
1	OFF	ON	No effect	3rd speed
	ON	ON		4th speed
	OFF	OFF		1st speed
	ON	OFF		2nd speed
2	OFF	ON	No effect	3rd speed
	ON	ON		Analog speed command
	The same a	as Pr3.00=1	OFF	1st to 4th speed
	OFF	OFF	ON	5th speed
3	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

Input Signal and Pin No.

Title of signal	Fitle of signal Speed zero clamp input		Related control mode	Р	S	Т	F
Symbol	ZEROSPD	26 (SI3)	I/F circuit	SI] P.3	-33	
	Set the speed command to						

• 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	Р	S	Т	F
Symbol	VC-SIGN	Default assignment		I/F circuit	SI] P.3	-33	
	Specify the sign of speed or Refer to P 4-31 "Pr3 01 Speed	·	•	selection"				

Title of signal	Torque command sign	input			Related control mode	P S	S T	F
Symbol	TC-SIGN		Default assignment		I/F circuit	SIF	P.3-33	
	Specify the sign of to	orque co	ommand input at	torque control.				
	ON	Nega	tive direction					
	OFF	Posit	tive direction					
	Refer to P.4-35 "Pr3.	.18 Tord	que command di	rection selection	,,			

Title of signal	le of gnal Forced alarm input		Related control mode	Р	S	Т	F	
Symbol	E-STOP	Default assignment		I/F circuit	SI	P.3	-33	
	Generates Err87.0 "Forced	alarm input error	, .					

Title of signal	Ine	rtia ratio switching input			Related control mode	Р	S	Т	F
Symbol	J-S	EL	Default assignment	_	I/F circuit	SI] P.3	-33	
	•	Selects 1st inertia ratio or	2nd inertia ratio ad	cording to the	inertia ratio se	lect i	nput	(J-SE	EL).
		Inertia ratio switching input (J-SEL)	Applicable ine	rtia ratio					
		OFF	1st Inertia ratio	(Pr0.04)					
		ON	2nd Inertia ratio	(Pr6.12)					

Title of signal	Dynamic brake (DB) switch in	` ' '		Related control mode	Р	S	Т	F
Symbol	DB-SEL		I/F circuit	SI] P.3	-33		
	This signal is used to switchSwitching is only possible w	•	,	ected.				

Note

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

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

Input Signals (Analog Command)

Pin	14	Title of signal	Al1 input	Correspondence function		
No.	Syml		Al1	SPR, TRQR, SPL		
Pin	16	Title of signal	AI2 input	Correspondence function		
No.	10	Symbol	AI2	TRQR, P-ATL		
Pin	18	Title of signal	Al3 input	Correspondence function		
No.	10	Symbol	Al3	N-ATL		

Function allocatable to Input Signals (Analog Command)

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

• 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 Negative direction Torque limit Torque limit		
0	0 V to 10 V	-10 V to 0 V	P-ATL N-ATL		
1					
2	_	_	Set up through	n parameter. *1	
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 p	arameter *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.

Input Signal and Pin No.

	Title of signal	Speed command input	Related control mode	Р	S	Т	F
	Symbol	SPR	I/F circuit	Al	P.3-	34	
ſ							

- 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	+Voltage (0 V to 10 V)	No effect	Positive direction
	0	0	-Voltage (-10 V to 0 V)	No effect	Negative direction
0	0	4	+Voltage (0 V to 10 V)	No effect	Negative direction
(2)*			-Voltage (-10 V to 0 V)	No effect	Positive direction
			+Voltage (0 V to 10 V)	OFF	Positive
	1	No effect	-Voltage (-10 V to 0 V)	- OFF	direction
	ı	ino ellect	+Voltage (0 V to 10 V)	ON	Negative
			-Voltage (-10 V to 0 V)	ON	direction

^{*} When internal command speed select 1 and 2 are ON.

Title of signal	Torque command input	Related control mode	Р	S	T	F
Symbol	TRQR	I/F circuit	Al	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	+Voltage (0 V to 10 V)	No effect	Positive direction		
	0	0		0	-Voltage (-10 V to 0 V)	No effect	Negative direction
			4	+Voltage (0 V to 10 V)	No effect	Negative direction	
0		1	-Voltage (-10 V to 0 V)	No effect	Positive direction		
			+Voltage (0 V to 10 V)	OFF	Positive		
	1	No effect	-Voltage (-10 V to 0 V)	OFF	direction		
	'	ino ellect	+Voltage (0 V to 10 V)	ON	Negative		
			-Voltage (-10 V to 0 V)	ON	direction		

Title of signal	Speed limit input	Related control mode	Р	S	Т	F
Symbol	SPL	I/F circuit	Al	P.3	-34	

 When setting Pr3.17 "Torque command selection" to 1, input the speed limit value in the form of analog voltage.

4. Inputs and outputs on connector X4 Output Signal and Pin No.

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.

		•	ŭ		Default		Default Setup	
				Applicable parameter	parameter setting (): decimal	Position/ Full- closed control	Verocity control	Torque control
					notation	Signal	Signal	Signal
Pin	10	Title of signal	SO1 output		00030303h			
No.	11	Symbol	Pin No.10: SO1 – Pin No.11: SO1 +	Pr4.10	(197379)	BRK-OFF	BRK-OFF	BRK-OFF
Pin	34	Title of signal	SO2 output		00020202h			
No.	35	Symbol	Pin No.34: \$02 – Pin No.35: \$02 +	Pr4.11	(131586)	S-RDY	S-RDY	S-RDY
Pin	36	Title of signal	SO3 output		00010101h			
No.	37	Symbol	Pin No.36: SO3 – Pin No.37: SO3+	Pr4.12	(65793)	ALM	ALM	ALM
Pin	38	Title of signal	SO4 output		00050504h			
No.	39	Symbol	Pin No.38: SO4 – Pin No.39: SO4 +	Pr4.13	(328964)	INP	AT-SPEED	AT-SPEED
Pin	12	Title of signal	SO5 output	Pr4.14	00070707h	ZSP	ZSP	ZSP
No.		Symbol	SO5		(460551)			
Pin	40	Title of signal	SO6 output	- Pr4.15	00060606h	TLC	TLC	TLC
No.	-10	Symbol	SO6		(394758)		. 20	

• 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.

Note

[—]: No function assigned

Related page

P.3-56

Function allocatable to control input

Title of signal	Servo-Alarm output			Related control mode	Р	S	Т	F		
Symbol	ALM	36, 37 (SO3)	I/F circuit	SC	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	Р	S	T	F
Symbol	S-RDY	Default assignment	34, 35 (SO2)	I/F circuit	SC	P.	.3-35	
	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.

Output Signal and Pin No.

Title of signal	External brake release signal			Related control mode	Р	S	Ţ	F
Symbol	BRK-OFF	10, 11 (SO1)						
	Feeds out the timing signal	which activates t	he holding brake	of the moto	r.			

• Turns the output transistor ON at the release timing of the holding brake.

Title of signal	Positioning complete			Related control mode	Р	S	Т	F
Symbol	INP	Default assignment 38, 39 (SO4)			SO) P.	3-35	
Title of signal	Positioning complete 2			Related control mode	Р	S	Т	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	P	S T	F
Symbol	AT-SPEED	Default assignment	38, 39 (SO4)	I/F circuit	SC	P.3-3	5
	Outputs the speed arrival si						

• Turns ON the output transistor upon arrive of speed.

Title of signal	Torque in-limit signal output			Related control mode	Р	S	Т	F
Symbol	TLC	C Default assignment 40 (SO6)) 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	Р	S	T	F
Symbol	ZSP	Default assignment 12 (SO5)) 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	Р	S T	F
Symbol	V-COIN	Default assignment	_	I/F circuit	SO	P.3-35	
	Outputs the speed coincide						
	 Turns ON the output transis 	ence of speed.					

Title of signal	Alarm output 1			Related control mode	Р	S	Ţ	F
Symbol	WARN1	Default assignment —					3-35	
	Outputs the warning output Turns ON the output transis	•	•	•	•			

Title of signal	Alarm output 2			Related control mode	Р	S	Т	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.							

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.	0	1	bit7
A1	Over-regeneration alarm	Regenerative load factor is 85 % or more the protection level.	0	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	0	4	bit6
A4	Encoder communication alarm	The number of successive encoder communication errors exceeds the specified value.	0	5	bit4
A5	Encoder overheat alarm	The encoder detects overheat alarm.	0	6	bit3
A6	Oscillation detection alarm	Oscillation or vibration is detected.	0	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.	0	9	bit8
A9	External scale communication alarm	The number of successive feedback scale communication errors exceeds the specified value.	0	10	bit10
AC	Deterioration diagnosis warning*5	Load characteristic estimates and torque command under constant speed has exceeded the set range.	0	22	bit7
С3	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.	0	14	bit14

- *1 The "O" 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	Р	S	Т	F
Symbol					SO] P.	3-35	
	Turns on output transistor with positional command applied.							

Title of signal	Speed in-limit output			Related control mode	Р	S	T	F	
Symbol	V-LIMIT	Default assignment		I/F circuit	SO	P.3	3-35		
	Turns on output transistor when the speed is limited by torque controlling function.								

Title of signal					Р	S	T	F		
Symbol	ALM-ATB		I/F circuit	SC) P.	3-35				
Turns on output transistor when an alarm that can be cleared generates.										

Output Signal and Pin No.

Title of signal	Speed command ON/OFF out	tput		Related control mode	P S	Т	F			
Symbol	V-CMD	_	I/F circuit	SO	P.3-35					
	Towns an autout translation when the aread command is confied while the aread is controlled									

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

Title of signal					Р	S	T	F		
Symbol	SRV-ST	SRV-ST Default assignment —					3-34			
	Turns on output transistor when servo is on.									

Output Signals (Pulse Train) and Their Functions

Pin	21	Title of signal	A-phase output/Position compare output 1	Related control mode	Р	S	Ţ	F
No.	22	Symbol	Pin No.21: OA+/OCMP1+ Pin No.22: OA-/OCMP1-	I/F circuit	РО	1 P.	3-35	
Pin	48	Title of signal	B-phase output/Position compare output 2	Related control mode	Р	S	T	F
No.	48 49	Symbol	Pin No.48: OB+/OCMP2+ Pin No.49: OB-/OCMP2-	I/F circuit	РО	1 P.	3-35	
Pin	23	Title of signal	Z-phase output/Position compare output 3	Related control mode	Р	S	Т	F
No.	24	Symbol	Pin No.23: OZ+/OCMP3+ Pin No.24: OZ-/OCMP3 -	I/F circuit	РО	1 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	19	Title of signal	Z-phase output/Position compare output 4	Related control mode	Р	S	T	F
No.	19	Symbol	CZ/OCMP4	I/F circuit	PO	2 P.	3-36	

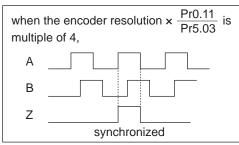
- Open collector output of Z-phase signal
- The emitter side of the transistor of the output circuit is connected to the signal ground (GND) and is not insulated.
- When using the CZ signal, isolate it from external noise.
- Note that the logic of Z phase open collector output (CZ) is a reversal of the line driver output (OZ) logic.

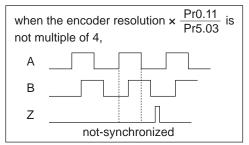
Output Signal and Pin No.

Note

• When the output source is the encoder

• If the encoder resolution $\times \frac{\text{Pr}0.11}{\text{Pr}5.03}$ 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.





Pin	Title of signal	Deterioration diagnosis velocity output	Related control mode	Р	S	Т	F
No.	Symbol	V-DIAG	I/F circuit	PO	2 P	.3-36	
	velocity:	out transistor is turned ON when motor velocity of Fetting) is within the range of PR4.35 (velocity concurs a hysteresis of 10 r/min in concurrence judgme	rence width)				

Pin	Title of signal	Position compare output	Related control mode	Р	S	T	F
No.	Symbol	CMP-OUT	I/F circuit	PO	2 P.	.3-36	
No	the para Setting for In case	out transistor is turned ON when the actual position meter. or all control modes is required when using the positio setting is made only to one or two control modes, E rotection" or Err33.5 "Output function number error 2	n compare o rr33.4 "Outpo	utput, ut fun	(CM ction	P-OL	JT).

Output Signal and Pin No.

Output Signals (Analog) and Their Functions

Pin	42	Title of signal	Analog monitor output 2	Related control mode	Р	S	T	F	
No.	42	Symbol	IM	I/F circuit	АО	P.3	-36		
	Definition of the output signal varies with the output of Pr4.18 (analog monitor 2 type).								

- the output signal varies with the output of Pr4.18 (anal
- 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	43	Title of signal	Analog monitor output 1	Related control mode	Р	S	T	F
No.	43	Symbol	SP	I/F circuit	АО	P.3	-36	
		5 (1 111					,	

- 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	13, 15	Title of signal	Signal ground	Related control mode	Р	S	Т	F				
No.	17, 25	Symbol	GND	I/F circuit		_	_					
	a Cinnal granned											

- Signal ground
- This output is insulated from the control signal power (COM-) inside of the driver.

Pir	50	50	litle of signal	Frame ground	control mode	Р	S	T	F	
No	30		Symbol	FG	I/F circuit		_	_		
	This output is connected to the earth terminal inside of the driver.									

5. IF Monitor Settings

How to Assign Various I/O Functions to the I/F

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.

T:41a	Cumbal	Setup	value
Title	Symbol	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

On 82 82 82 h (Hexadecimal numbers)

Position/ Full-closed Control (Negative direction over-travel inhibition input; b-contact)

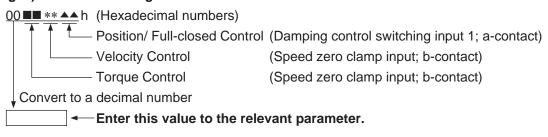
Velocity Control (Negative direction over-travel inhibition input; b-contact)

Torque Control (Negative direction over-travel inhibition input; b-contact)

Convert to a decimal number

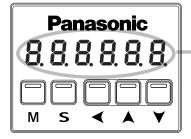
8553090 ← Enter this value to the relevant parameter.

(e.g. 2) Parameter setting



5. IF Monitor Settings

How to Assign Various I/O Functions to the I/F



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".



- 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.



• 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.

- 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.

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

4. Setup

1.	Details	of	param	eter
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List of Pa	rameters	4-2
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[Class 6]	Special setting	4-68
[Class 7]	Special setting	4-84
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4

Setup

1. Details of parameter

List of Parameters

• A parameter is designated as follows:

Pr0.00 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.		Title				Rela	Related Control Mode					
Class	No.			Title		Р	S	Т	F	page		
	00	Rota	tional	direction se	tup	0	0	0	0	4-6		
	01	Cont	rol mo	de setup		0	0	0	0	4-0		
	02	Real	-time	setup		0	0	0	0	4-7		
	03	auto- tunin		Selection of stiffness	of machine	0	0	0	0	4-8		
	04	Inerti	ia ratio)		0	0	0	0	4-9		
	05	0		input selec	ction	0	_	_	0	4-9		
	06	pulse	mand	otational d	irection setup	0	_	_	0	4-10		
[CI:	07	puise	-	input mode	e setup	0	_	_	0	4-10		
[Class 0] Basic setting	08			pulse count otor revolution		0	_	_	_			
Bas	09	1st n	umera	tor of electi	onic gear	0	_	_	0	4-11		
sic s	10	Deno	ominat	or of electro	nic gear	0	_	_	0			
setting	11		ut puls lution	se counts p	er one motor	0	0	0	0	4-12		
	12	Reve	ersal o	f pulse outp	ut logic	0	0	0	0			
	13	1st to	orque l	imit		0	0	0	0	4-14		
	14	Posit	tion de	viation exce	ess setup	0	_	_	0	4-14		
	15	Absc	lute ei	ncoder setu	р	0	0	0	0			
	16	Exte	rnal re	generative	resistor setup	0	0	0	0			
	17		l factor tor sel	of external	0	0	0	0	4-15			
	18	For r	manuf	acturer's u	<u> </u>	_	_	_				
	00			-f!!: I						1		
	00		_	of position l		0	0		0			
	01		gain of velocity loop time constant of velocity loop					0	0			
	02	1st	integr	ation	0	0	0	0	4-16			
	03		filter of speed detection time constant of torque filter					0	0			
	04				0	0	0	0				
	05			of position le		0	_	_	0			
	06			of velocity lo		0	0	0	0			
[Class 1] Gain adjustmer	07	2nd	time constant of v integration			0	0	0	0	4-17		
=	08			of speed de		0	0	0	0	· ··		
Ga	09				torque filter	0	0	0	0			
in a	10			ed-forward (0	_	_	0			
djus	11	Velo	city fee	ed-forward f	ilter	0	_	_	0			
itme	12	Tora	ue fee	d forward	gain	0	0	_	0			
ent	13	. 514	20 100	. 101 Haid	filter	0	0	_	0	4-18		
	14	2nd	gain se	etup		0	0	0	0			
	15	D		mode		0	_	_	0	4-19		
	16	Posit		delay time		0	_	_	0	7 13		
	17	switc		level		0	_	<u> </u>	0			
	18			hysteresis		0	_	L-	0	4-20		
						1	1			1		
	19	Posit	tion ga	in switching	j time	0	_	-	0			
	19 20			in switching ntrol switch	·	<u> </u>	0	<u> </u>	<u> </u>	4-21		

Parametr No			Relat	Detail			
Class	No.	Title	Р	S	Т	F	page
	22	Velocity control switching level		0	_	_	4-21
	23	Velocity control switching hysteresis	1_	0	_	_	
	24	Torque control switching mode	1_		0	_	
	25	Torque control switching delay time	1_		0	_	
	26	Torque control switching level	1_		0	_	
	27	Torque control switching hysteresis	<u> </u>	_	0	_	
	28	For manufacturer's use			_		
	29	For manufacturer's use					
	30	For manufacturer's use				\equiv	
	31	For manufacturer's use				\equiv	
	32	For manufacturer's use					
	33	For manufacturer's use	+			_	
			1		_	_	
	34	For manufacturer's use	 -		_	_	
	35	For manufacturer's use	_		_	_	
	36	For manufacturer's use	-	_	_	_	
	37	For manufacturer's use	<u> -</u>	_	_	_	
	38	For manufacturer's use	-	_	_	_	
	39	For manufacturer's use	-	_	_	_	
	40	For manufacturer's use	-	_	_	_	
	41	For manufacturer's use	<u> -</u>	_	_	_	
	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	-	_	_	_	
[Cla	47	For manufacturer's use	-	_	_	_	
SS	48	For manufacturer's use	_	_	_	_	
	49	For manufacturer's use	-	_	_	_	
[Class 1] Gain adjustment	50	For manufacturer's use	1-	_	_	_	
adj	51	For manufacturer's use	1-	_	_	_	4-22
usti	52	For manufacturer's use	<u> </u>	_	_	_	
mer	53	For manufacturer's use	1-	_	_	_	
7	54	For manufacturer's use	1_	_	_	_	
	55	For manufacturer's use	1-	_	_	_	
	56	For manufacturer's use	1_	_	_	_	
	57	For manufacturer's use	1_	_	_	_	
	58	For manufacturer's use	1_		_		
	59	For manufacturer's use	1_	_	_	_	
	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	H			\equiv	
		For manufacturer's use					
	66 67		+-	_	_	_	
	-	For manufacturer's use	\vdash	_		_	
	68	For manufacturer's use	+	_	_	_	
	69	For manufacturer's use	\vdash	_	_	_	
	70	For manufacturer's use	+	_	_	_	
	71	For manufacturer's use	 -	_	_	_	
	72	For manufacturer's use	1-	_	_	_	
	73	For manufacturer's use	-	_	_	_	
	74	For manufacturer's use	1-	_	_	_	
	75	For manufacturer's use	-	_	_	_	
	76	For manufacturer's use	-	_	_	_	
	77	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.

1. Details of parameter List of Parameters

Paramo	etr No.		Title	Rela	ted Co	ntrol	Mode	Detail		
Class	No.		Title	Р	s	Т	F	page		
	00	Adaptive fi	0	0	_	0				
	01		frequency	0	0	0	0			
	02	1st notch	width selection	0	0	0	0	4-23		
	03		depth selection	0	0	0	0			
	04		frequency	0	0	0	0			
	05	2nd notch	width selection	0	0	0	0			
	06		depth selection	0	0	0	0			
	07		frequency	0	0	0	0			
	08	3rd notch	width selection	0	0	0	0	4-24		
	09	ord floton	depth selection	0	0	0	0	7 27		
	10		frequency	0	0	0	0			
	11	4th notch	width selection	0	0	0	0			
	12	4111101011	depth selection	0	0	0	0			
	13	Colootion		0	_		0	4-25		
	_		of damping filter switching	-	_	\vdash	-			
[Class 2] Damping contro	14	1st	frequency	0	_	_	0			
	15	damping	filter setup	0	_	_	0			
	16	2nd	frequency	0	_	_	0			
	17	damping	filter setup	0	_	_	0	4-26		
Dar	18	3rd	frequency	0	_	_	0			
npir	19	damping	filter setup	0	_	_	0			
o gn	20		g frequency	0	_	_	0			
ŏn	21	4th dampir	ng filter setting	0	_	_	0			
trol	22	command	smoothing filter	0	0		0	4-27		
	23	command	FIR filter	0	_	_	0	4-28		
	24		frequency	0	0	0	0			
	25	5th notch	width selection	0	0	0	0			
	26		depth selection	0	0	0	0			
	27	1st vibratio	n control width setting	0	_	_	Ō	4-29		
	28		n control width setting	0			0			
	29		n control width setting	0			0			
	30		on control width setting	0			0			
	31	For manuf								
	_		acturer's use			F	_			
	32		_	_		_				
	33	For manuf	_	_	_	_				
	34	For manuf	_	_	_	_	4-30			
	35	For manuf	_	_	_	_				
	36	For manuf	acturer's use	_	_	_	_			
	37	For manuf	acturer's use	_	-	-	_			
	00	0	a latemat/F to col 2011							
	00	Speed setu	p, Internal/External switching	_	0	_	_	4-31		
	01	Speed	rotational direction selection	_	0	-	_			
	02	command	input gain	_	0	0	_	4-32		
	03	Communa	reversal input	_	0	_	_	4-32		
<u>ত</u>	04		1st	_	0	_	_			
ass	05		2nd	_	0	_	_	1		
<u>3</u>	06		3rd	_	0	_	_			
<u>←</u>	07	Speed	4th		0					
oci.	08	setup	5th	Ė	0	Ė	Ė			
¥		Jorap		_	<u> </u>	F	F	4-33		
orc	09		6th	_	0	F	_			
lue	10		7th	_	0	_	二			
Ę.	11		8th	_	0	-	_			
문	12		n time setting	_	0	_	_			
lose	13	Deceleration	on time setting	_	0	_	_	L		
[Class 3] Velocity/Torque/Full-closed control	14	Sigmoid ad	cceleration/ deceleration							
è	14	time setup			0		\Box			
tro	15	Speed zero	clamp function selection	-	0	0	-	4-34		
	16		level speed setting	_	0	0	_			
	17	Torque command selection —					<u> </u>			
	18	_	and direction designation selection	_	_	0	_	4-35		
	19		nmandinput gain			0	-	. 55		
	13	Li orque col	iiiiaiiuiiiput yaiii	二	二	$^{\scriptscriptstyle{\perp}}$	二			

Param	etr No.					Relat	ted Co	ntrol l	Mode	Detail	
Class	No.		1	Γitle	e	Р	S	Т	F	page	
[Cla	20	Torque com	mand	in	put reversal	Ξ	_	0	_		
ss 3]	21	Speed limit				_	_	0	_	4-36	
Velo	22	Speed limit				_	_	0	_		
ocity	23		selection			_	_	_	0		
/Tor	24				ator of division	_	_	_	0	4-37	
que/	25	External scale			ninator of division		_	_	0		
Ē	26	Scale			al of direction	_	_	_	0		
clos	27				se disconnection ion disable	_	_	_	0	4 20	
ed co	28	Hybrid devia					_			4-38	
[Class 3] Velocity/ Torque/ Full-closed control	29	Hybrid devia				_	_	_	0		
							_	_	_		
	00	l —			1 No.8)	0	0	0	0	4-39	
	01			SI2 (Pin No.9)				0	0		
	02	l ⊢			n No.26) n No.27)	0	0	0	0		
	03 04 Input				1 No.28)	0	0	0	0		
	05				1 No.29)	0	0	0	0	4-40	
	06				No.30)	0	0	0	0	4-40	
	07	l —			n No.31)	0	0	0	0		
	08	l ⊢			1 No.32)	0	0	0	0		
	09	_	(n No.33)	Ō	0	0	0		
	10		SO1 (Pir	n No.10, 11)	0	0	0	0		
	11	5	SO2 (Pir	n No.34, 35)	0	0	0	0		
	12				n No.36, 37)	0	0	0	0		
	13	–			n No.38, 39)	0	0	0	0	4-41	
	14	5	SO5 (Pir	n No.12)	0	0	0	0		
	15	5	SO6 (Pir	n No.40)	0	0	0	0		
	16	Analog mon	itor 1		type	0	0	0	0		
	17	Analog mon	101 1		output gain	0	0	0	0		
	18	Analog mon	itor 2		type	0	0	0	0	4-42	
	19				output gain	0	0	0	0		
[Cla	20		manufacturer use								
[Class 4] I/F monitor se	21	Analog mon	analog monitor output setup						0		
] [/F	22	Analog inpu	t 1	\vdash	ffset setup	0	0	0			
mo	23	(Al1)		-	ter	0	0	0	0		
nito	24				vervoltage setup ffset setup	0	0	0	0	4-44	
	25 26	Analog inpu	t 2		ter						
tting	27	(Al2)		_	vervoltage setup	0	0	0	0		
.	28			-	ffset setup	0	0	0	0		
	29	Analog inpu	t 3	_	ter	0	0	0	0		
	30	(AI3)		_	vervoltage setup	0	0	0	0	١	
	31	Positioning (compl	_		0	_	_	0	4-45	
	32				on output setting	0	_	_	0		
	33	INP hold tim				0	_	_	0		
	34	Zero-speed				0	0	0	0	4-46	
	35	Speed coind	cidenc	e	range	_	0	0	_		
	36	At-speed (S				_	0	0	_		
	37	Mechanical			<u> </u>	0	0	0	0	4-47	
	38				ction in motion	0	0	0	0		
	39			acti	ion at running setup	0	0	0	0		
	40	Selection of alarm outpu				0	0	0	0	4-48	
	41				oto (In position)	0	0	0	0		
	42 44			_	ete (In-position) range		\vdash	_	0		
	44	-		_	ut pulse width setting ut polarity select	0	_	_	0		
	45	Pulse output s		ıμ	ut polarity select	0	Ε			4-49	
	48	Position comp		lue	<u> </u>	0			0		
	49	Position con				0		_	0	4-50	
	.5	. 5516571 501	·puio							. 50	

1. Details of parameter List of Parameters

raram	etr No.	etr No.			Related Control Mo			Mode	Detai	
Class	No.			Title		Р	S	Т	F	page
1	50	Posit	tion compa	re value 3		0	_	_	0	
Clas	51	Posit	tion compa	re value 4		0	_	_	0	
[Class 4] I/F monitor setting	52		tion compa			0	_	_	0	
JF -	53			re value 6		0	_	_	0	4-50
mon	54		tion compa			0	_	_	0	
itor	55			re value 8		0	_	_	0	
sett	56				ensation amount	0		_	0	
ing	57		Position compare output delay compensation amount Position compare output assignment setting							4-51
	31	1 0311		output assig	griment setting	0			\subseteq	4-01
	00	2nd				0	_	_	0	
	01	3rd	numerato	r of electro	nic gear	0	_	—	0	
	02	4th				0	_	_	0	4-52
	03	Deno	ominator o	f pulse out	out division	0	0	0	0	
	04	Over	-travel inh	ibit input se	etup	0	0	0	0	
	05			ver-travel ir	•	0	0	0	0	4-53
	06		ience at S			0	0	0	0	
	07	Ooqu	201100 41 0	sequence		0	0	0	0	4-54
	_	main	power			0	0	0	0	
	08	OFF		LV trip se detection		0	0	_	0	4-55
	09	_			time	-	-	0	-	4-55
	10		uence at al			0	0	0	0	
	11			or emerger	icy stop	0	0	0	0	
	12	Over	-load level	setup		0	0	0	0	
	13	Over	-speed lev	el setup		0	0	0	0	4-56
	14	Moto	r working	range setu	p	0	_	_	0	4-56
	15	I/F reading filter			0	0	0	0		
	16		n clear inp				0	0	0	
	17		nter clear i			0	_	_	0	
	18				ut (INH) disable	0		_	0	4-57
	19			<u> </u>	INH) read setting	0		_	0	. 07
	20		tion setup	. ,	initi) read setting	0			0	
	21		ction of tor			0	0	_	0	
	22			-		0	0	_	0	4-58
	_		torque limi		1	<u> </u>	0	_	-	
[Class 5] Enhancing	23		ue limit sw	ritching	1	0	_	_	0	
ss !	24	setu		. Posterio	2	0	0	_	0	
<u> </u>	25				torque limit	0	0	_	0	4-59
nha	26	input			n torque limit	0	0	_	0	
anc	27	_		nalog torqu	e limit	0	0	_	0	
ing	28		initial statu	-		0	0	0	0	
set	29		32 baud ra			0	0	0	0	4-60
setting	30		85 baud ra	te setup		0	0		0	
	31		address					-	_	
	32	Com				0	0	0	0	
	33				kimum setup	0	0 —	0 —	0	
		Pulse	e regenera	tive output	kimum setup limit setup	-	0 - 0	0 -	-	4-61
	34	Pulse For r	e regenera nanufactui	tive output er's use		0	_	_	0	4-61
	34 35	Pulse For r	e regenera	tive output er's use		0	_	_	0	4-61
	-	Pulse For r	e regenera nanufactui	tive output er's use k setup		0	_ 0 _	_ O _	0	4-61
	35	For r Fron	e regenera manufactui t panel loc manufactu	tive output er's use k setup	limit setup	0	_ 0 _	_ O _	0	4-61
	35 36	For r Fron For r Modi	e regenera manufactui t panel loc manufactu bus conne	tive output er's use k setup ırer's use	limit setup	0 0 - 0 -	_ 0 _ 0	- 0 - 0	0 0 - 0	
	35 36 37	For r Fron For r Modl Modl	e regenera manufactur t panel loc manufactu bus conne bus comm	tive output rer's use k setup ırer's use ction settin	limit setup g etting	0 0 - 0	- 0 - 0 -	- 0 - 0 -	0 0 - 0	4-61
	35 36 37 38	For r Fron For I Modl Modl Modl	e regenera manufactui t panel loc manufactu bus conne bus comm bus respor	tive output rer's use k setup Irer's use ction settin unication s	limit setup g etting	0 0 - 0	 0 0 0	- 0 - 0 -	0 0 - 0 0	
	35 36 37 38 39	For r Fron For r Modl Modl Modl Modl	e regenera manufactui t panel loc manufactu bus conne bus comm bus respor	tive output rer's use k setup urer's use ction settin unication s nse waiting unication ti	g etting time	0 0 - 0 0 0	 0 0 0	- 0 - 0 - 0	0 0 0 0 0	
	35 36 37 38 39 40	For r Fron For I Modl Modl Modl For r	e regenera manufactui t panel loc manufactu bus conne bus comm bus respor bus comm manufactui	tive output rer's use k setup urer's use ction settin unication s nse waiting unication ti	g etting time meout time	0 0 - 0 0 0	 0 0 0	- 0 - 0 - 0	0 0 0 0 0	
	35 36 37 38 39 40 41 42	For r For I Modl Modl Modl For r Modl Quadr	e regenera manufactui t panel loc manufactu bus conne bus comm bus respor bus comm manufactui bus broadd rant projectior	tive output rer's use k setup urer's use ction settin unication s nse waiting unication ti rer use cast setting	g etting time meout time	0 0 - 0 - 0 0 0 - 0	- 0 - 0 0 0		0 0 - 0 0 0 0 - 0	
	35 36 37 38 39 40 41	For r For I Modl Modl Modl For r Modl Quadr compe	e regenera manufactur t panel loc manufactubus conne bus comm bus respor bus comm manufactur bus broadd rant projectior ensation value	tive output rer's use k setup urer's use ction settin unication s ase waiting unication ti rer use cast setting positive direct	g etting time meout time	0 0 - 0 0 0 -	- 0 - 0 0 0		0 0 - 0 0 0 0 -	
	35 36 37 38 39 40 41 42	For r Fron Modl Modl Modl Modl Modl Quadr Quadr	e regenera manufactur t panel loc manufactur bus conne bus comm bus respor bus comm manufactur bus broadd bus broadd ant projectior ensation value ant projectior	tive output rer's use k setup urer's use ction settin unication s ase waiting unication ti rer use cast setting a positive direct	g etting time meout time	0 0 - 0 - 0 0 0 - 0	- 0 - 0 0 0		0 0 - 0 0 0 0 - 0	4-62
	35 36 37 38 39 40 41 42 45	For r For I Modl Modl Modl For r Modl Quadr compe	e regenera manufactur t panel loc manufactur bus conne bus comm bus respor bus comm manufactur bus broado rensation value rant projectior ensation value	tive output rer's use k setup urer's use ction settin unication s ase waiting unication ti rer use cast setting a positive direct	g etting time meout time	00 - 0 - 0 0 0 0 0	- 0 - 0 0 0			4-62
	35 36 37 38 39 40 41 42 45 46 47	For r Fron Modl Modl Modl Modl Compe Quadr Compe Quadr	e regenera manufactur t panel loc manufactur bus conne bus comm bus respor bus comm manufactur bus broadd bus broadd ant projectior ensation value ant projectior	tive output rer's use k setup urer's use ction settin unication s ase waiting unication ti rer use cast setting a positive direct on negative direct	g etting time meout time ction ection		- 0 - 0 0 0			4-62
	35 36 37 38 39 40 41 42 45 46 47	Pulse For r Fron Modl Modl Modl Modl For r Modl Quadr compe Quadr Quadr	e regenera manufactur t panel loc manufactur bus conne bus comm bus respor bus comm manufactur bus broadd rant projectior ensation value rant projectior ensation value rant projectior	tive output rer's use k setup urer's use ction settin unication s ase waiting unication ti rer use cast setting a positive direct on compensation a compensation	g etting time meout time ction adday time n filter setting L		- 0 - 0 0 0			4-62
	35 36 37 38 39 40 41 42 45 46 47 48	Pulsa For r Fron Modl Modl Modl Modl Modl Quadro Compe Quadro Person Note Pulsa Por r Pulsa Por r Pulsa Puls	e regenera manufactur t panel loc manufactur bus comm bus respor bus comm manufactur bus broadd bus broadd ant projectior ensation value ant projectior ent projectior ant projectior ant projectior	tive output rer's use k setup urer's use ction settin unication s ase waiting unication ti rer use cast setting a positive direct on compensation a compensation of compensation	g etting time meout time ction ection		- 0 - 0 0 0			4-62
	35 36 37 38 39 40 41 42 45 46 47 48 49 50	Pulsar For r Fron Modl Modl Modl Modl For r Modl Quadr compe Quadr Quadr Quadr Quadr For r	e regenera manufactur t panel loc manufactur bus comm bus respor bus comm manufactur bus broadd ant projectior ensation value ant projectior ant projectior ant projectior ant projectior ant projectior ant projectior	tive output rer's use k setup Irer's use ction settin unication s ase waiting unication ti rer use cast setting positive direct an negative direct on compensation of compensation of compensation of compensation of compensation	g etting time meout time ction adday time n filter setting L		- 0 - 0 0 0			4-62
	35 36 37 38 39 40 41 42 45 46 47 48	Pulsar For r Fron Modl Modl Modl Modl For r Modl Quadr compe Quadr Quadr Quadr Quadr For r	e regenera manufactur t panel loc manufactur bus comm bus respor bus comm manufactur bus broadd bus broadd ant projectior ensation value ant projectior ent projectior ant projectior ant projectior	tive output rer's use k setup Irer's use ction settin unication s ase waiting unication ti rer use cast setting positive direct an negative direct on compensation of compensation of compensation of compensation of compensation	g etting time meout time ction adday time n filter setting L		- 0 - 0 0 0			4-62
	35 36 37 38 39 40 41 42 45 46 47 48 49 50	Pulsa For r Fron Modl Modl Modl Modl Quadro Compe Quadro Quadro For r Guadro For r For r For r	e regenera manufactur t panel loc manufactur bus comm bus respor bus comm manufactur bus broadd ant projectior ensation value ant projectior ant projectior ant projectior ant projectior ant projectior ant projectior	tive output rer's use k setup urer's use ction settin unication s nse waiting unication ti rer use cast setting n positive direct n compensation compensation unication ti rer's use	g etting time meout time ction adday time n filter setting L		- 0 - 0 0 0			4-62
	35 36 37 38 39 40 41 42 45 46 47 48 49 50	Pulse For r Fron Modl Modl Modl For r Modl Quadricompe Quadricompe Quadricompe Guadricompe For r For r For r For r Modl For r Modl Modl Modl Modl Modl Modl Modl Modl	e regenera manufactur t panel loc manufactur bus conne bus comm bus respor bus comm manufactur bus broade rant projectior rensation value rant projectior rant projectior rant projectior rant projectior manufactur manufactur	tive output rer's use k setup urer's use ction settin unication s nse waiting unication ti rer use cast setting n positive direct n compensation n compensation urer's use urer's use urer's use	g etting time meout time ction adday time n filter setting L		- 0 - 0 0 0			4-62
	35 36 37 38 39 40 41 42 45 46 47 48 49 50 51 52	Pulse For I Fron Model Model Model For I Model Quadrice Quadrice Quadrice For I For	e regenera manufactur t panel loc manufactur bus conne bus comm bus respor bus comm manufactur bus broadd ant projectior ensation value ant projectior ant projectior ant projectior ant projectior ant projectior manufactur manufactur	tive output rer's use k setup urer's use ction settin unication s nse waiting unication ti rer use cast setting n positive direct n compensation n compensation n compensation urer's use urer's use urer's use urer's use	g etting time meout time ction adday time n filter setting L		- 0 - 0 0 0			

etr No.	- 2.11	Relat	ated Control Mode			Detail
No.	Title	Р	S	Т	F	page
56	Slow stop deceleration time setting	0	_	_	_	
57		0	_	_	_	
58		0	0	0	0	4-64
59		0	0	0	0	
		0	_	_	0	
		-		_	<u> </u>	
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		-	<u> </u>	-	-	
		-	-	<u> </u>	_	4-65
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		-	-	_	_	4-66
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		<u> </u>	-	_	-	
77	<u> </u>	-		_		
78		0			0	
79	Modbus mirror register setting 9	0	0	0	0	
80	Modbus mirror register setting 10	0	0	0	0	
81	Modbus mirror register setting 11	0	0	0	0	
82	Modbus mirror register setting 12	0	0	0	0	4-67
83	Modbus mirror register setting 13	0	0	0	0	4-07
84	Modbus mirror register setting 14	0	0	0	0	
85	Modbus mirror register setting 15	0	0	0	0	
86	Modbus mirror register setting 16	0	0	0	0	
00	Analog torque feed forward gain setting					1
		_				
	·	-				4-68
	·	-			-	4-00
		<u> </u>			-	
	4					
06	compensation	-	_	_		4-69
09	Negative direction value	0	_	-	0	
10	Function expansion setup	0	0	0	0	
11	Current response setup	0	0	0	0	
13	2nd Inertia ratio	0	0	0	0	
14	Emergency stop time at alarm	0	0	0	0	
15	2nd over-speed level setup	0	0	0	0	4-70
16	For manufacturer's use	_	_		_	
17	Front panel parameter writing selection	0	0	0	0	
18	Power-up wait time	0	0	0	0	
19	Encoder Z phase setup	_	_		0	
20	Z-phase setup of external scale	E		E	0	4-71
21	Serial absolute external scale					4-71
21	Z phase setup					
22	A, B phase external scale pulse	_	_	_		
		_	_		Ľ	
		_	_	_	_	4-72
		_	_	_	_	
27	Warning latch time	0	0	0	0	
28	Special function selection	0	_	_	_	
	For manufacturer use	_	I —	I —	I —	l
30						4-73
31	Real-time auto tuning estimation speed	0	0	0	0	
31 32	Real-time auto tuning estimation speed Real-time auto tuning custom setting		0	0	0	4-73 4-74
31	Real-time auto tuning estimation speed	0	_	_	-	
	56 57 58 59 60 61 62 63 64 65 66 67 73 74 75 76 77 78 79 80 81 82 83 84 85 86 00 02 04 05 06 07 07 11 11 11 11 11 11 11 11 11 1	Slow stop deceleration time setting Slow stop Sshape acceleration and deceleration setting Modbus mirror register setting 1 Modbus mirror register setting 2 Modbus mirror register setting 3 Modbus mirror register setting 4 Modbus mirror register setting 5 Modbus mirror register setting 5 Modbus mirror register setting 6 Modbus mirror register setting 7 Modbus mirror register setting 7 Modbus mirror register setting 7 Modbus mirror register setting 8 Deterioration diagnosis convergence judgment time Deterioration diagnosis inertia ratio upper limit Deterioration diagnosis inertia ratio lower limit Deterioration diagnosis unbalanced load upper limit Deterioration diagnosis unbalanced load upper limit Deterioration diagnosis dynamic friction upper limit Deterioration diagnosis viscous friction upper limit Deterioration diagnosis viscous friction upper limit Deterioration diagnosis viscous friction lower limit Deterioration diagnosis viscous friction lower limit Deterioration diagnosis viscous friction upper limit Modelmost setting 10 Deterioration diagnosis torque average time Deterioration diagnosis torque average time Modbus mirror register setting 9 Modbus mirror register setting 10 Modbus mirror register setting 11 Modbus mirror register setting 11 Modbus mirror register setting 12 Modbus mirror register setting 13 Modbus mirror register setting 14 Modbus mirror register setting 15 Modbus mirror register setting 16 Analog torque feed forward gain setting Speed deviation excess setting Analog torque feed forward gain setting Speed deviation excess setting Analog torque feed forward gain setting Corporation 3rd gain valid time Function expansion setup Current response setup Current panel parameter writing selection Rever-up wait time Current panel parameter writing selection Current response setup Current re	Slow stop deceleration time setting 5 Slow stop S-shape acceleration and deceleration setting 5 Slow stop S-shape acceleration and deceleration setting 6 Slow stop S-shape acceleration and deceleration setting 7 Slow stop S-shape acceleration and deceleration setting 9 Modbus mirror register setting 2 Slow stop S-shape acceleration and deceleration setting 9 Modbus mirror register setting 4 Slow stop S-shape acceleration 4 Slow stop S-shape acceleration 4 Slow stop S-shape acceleration 5 Slow stop S-shape acceleration 6 Slow stop S-shape accelera	Slow stop deceleration time setting 57 Slow stop S-shape acceleration and deceleration setting 58 Modbus mirror register setting 1 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 5 64 Modbus mirror register setting 6 64 Modbus mirror register setting 7 65 Modbus mirror register setting 7 65 Modbus mirror register setting 8 66 Deterioration diagnosis convergence judgment time 67 Deterioration diagnosis inertia ratio upper limit 69 Deterioration diagnosis unbalanced load upper limit 69 Deterioration diagnosis unbalanced load upper limit 70 Deterioration diagnosis dynamic friction upper limit 71 Deterioration diagnosis dynamic friction upper limit 72 Deterioration diagnosis dynamic friction upper limit 73 Deterioration diagnosis viscous friction lower limit 74 Deterioration diagnosis viscous friction upper limit 75 Deterioration diagnosis viscous friction upper limit 76 Deterioration diagnosis torque average time 76 Deterioration diagnosis torque upper limit 79 Modbus mirror register setting 9 0 0 0 0 0 0 0 0 0	Slow stop deceleration time setting	Slow stop deceleration time setting

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1. Details of parameter List of Parameters

Clee-	etr No.	Title			_	Mode	Dota
Class	No.		Р	S	Т	F	page
	36	Dynamic brake operation input	0	0	0	0	4-76
	37	Oscillation detection threshold value	0	0	0	0	4-70
	38	Warning mask setting	0	0	0	0	
	39	Manufacturer use	_	_	_	_	
	41	1st damping depth	0	_	_	0	4-77
	42	Two-stage torque filter time constant	0	0	0	0	
	43	Two-stage torque filter damping term	0	0	0	0	
	47	Function expansion setting	0	0	0	0	
	48	Adjustment filter	0	0	_	_	4-78
	49	Command response filter/adjustment filter damping term setting	0	_			7 / 0
	50	Viscous friction compensation gain	0	0	_	0	
	51		0	0	0	0	
	\vdash	Immediate stop completion wait time				\vdash	4-79
	52	Manufacturer use	_	_	_	_	4-78
	53	Manufacturer use	_	_	_	_	
	54	Manufacturer use	_	_	_	_	
[0]	57	Torque saturation error protection detection time	0	0	_	0	
[Class 6] Special setting	58	Serial absolute external scale Z phase shift amount	0	0	0	0	4-80
6]	60	2nd damping depth	0	—	_	0	
Sp	61	1st resonance frequency	0	—	_	_	
ecia	62	1st resonance damping ratio	0	—	_	_	
al S	63	1st anti-resonance frequency	0	_	_	-	
ettii	64	1st anti-resonance damping ratio	0	_	_	_	
<u> </u>	65	1st response frequency	0	_	_	_	4-81
	66	2nd resonance frequency	0	_	_	_	
	67	2nd resonance damping ratio	0	_	_	_	
	68	2nd anti-resonance frequency	0	_	_	_	
	69	2nd antiresonance damping ratio	0	_	_	_	
	70	2nd response frequency	0				
	71	3rd damping filter depth	0		_		1
	72	4th damping filter depth	0		_	0	
	73	Load estimation filter	0	0	_	\vdash	4-82
	-		0	0	_	F	
	74	Torque compensating frequency 1	_	_	_	_	
	75	Torque compensating frequency 2	0	0	_	_	
	76	Number of load estimation	0	0	_	_	
	87	For manufacturer use	0	0	0	0	
	88	Absolute multi-rotation data upper limit	0	0	0	0	
	97	Function expansion setting 3	0	0	0	0	4-83
	98	Function expansion setting 4	0	0	0	0	
	00	For manufacturer's use		_	_	_	
	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		$\dot{-}$	Ë		Ė	
	U/	For manufacturor's uso	l - '		_	-	
	Λo	For manufacturer's use	_	_			
	08	For manufacturer's use	_	_	_	_	
	09	For manufacturer's use For manufacturer's use		_ _	_	_	
	09 10	For manufacturer's use For manufacturer's use For manufacturer's use		_ _ _	_ _ _	_ _ _	
[C]	09 10 11	For manufacturer's use For manufacturer's use For manufacturer's use For manufacturer's use		_ _ _ _		_ _ _	
[Class	09 10 11 12	For manufacturer's use				_ _ _ _	
[Class 7]	09 10 11 12 13	For manufacturer's use				_ _ _ _ _	
[Class 7] Sp	09 10 11 12 13 14	For manufacturer's use Main power turn-off warning detection time					4-84
[Class 7] Speci	09 10 11 12 13	For manufacturer's use					4-84
[Class 7] Special s	09 10 11 12 13 14	For manufacturer's use Main power turn-off warning detection time					4-84
[Class 7] Special setti	09 10 11 12 13 14 15	For manufacturer's use Main power turn-off warning detection time For manufacturer's use					4-84
[Class 7] Special settin	09 10 11 12 13 14 15 16	For manufacturer's use Main power turn-off warning detection time For manufacturer's use For manufacturer's use					4-84
[Class 7] Special settin	09 10 11 12 13 14 15 16 20	For manufacturer's use Main power turn-off warning detection time For manufacturer's use For manufacturer's use For manufacturer's use					4-84
[Class 7] Special settin	09 10 11 12 13 14 15 16 20 21	For manufacturer's use Main power turn-off warning detection time For manufacturer's use Special function enhancement setting 1				_ _ _ _	4-84
[Class 7] Special settin	09 10 11 12 13 14 15 16 20 21 22 23	For manufacturer's use Main power turn-off warning detection time For manufacturer's use Special function enhancement setting 1 For manufacturer's use				_ _ _ _	4-84
[Class 7] Special settin	09 10 11 12 13 14 15 16 20 21 22 23 24	For manufacturer's use Main power turn-off warning detection time For manufacturer's use				_ _ _ _	4-84
[Class 7] Special settin	09 10 11 12 13 14 15 16 20 21 22 23 24 25	For manufacturer's use Main power turn-off warning detection time For manufacturer's use				_ _ _ _	4-84
[Class 7] Special settin	09 10 11 12 13 14 15 16 20 21 22 23 24 25 26	For manufacturer's use Main power turn-off warning detection time For manufacturer's use				_ _ _ _	4-844
[Class 7] Special settin	09 10 11 12 13 14 15 16 20 21 22 23 24 25 26 27	For manufacturer's use Main power turn-off warning detection time For manufacturer's use				_ _ _ _	4-844
[Class 7] Special settin	09 10 11 12 13 14 15 16 20 21 22 23 24 25 26 27 28	For manufacturer's use Main power turn-off warning detection time For manufacturer's use				_ _ _ _	4-84
[Class 7] Special settin	09 10 11 12 13 14 15 16 20 21 22 23 24 25 26 27	For manufacturer's use Main power turn-off warning detection time For manufacturer's use				_ _ _ _	4-844

aram	etr No.	Title	Rela	ted Co	ntrol	Mode	Deta
Class	No.	Titlo	Р	S	Т	F	pag
	32	For manufacturer's use		_	_	_	
	33	For manufacturer's use	_	_	_	_	1
_	34	For manufacturer's use		_	_	_	
Cla	35	For manufacturer's use	_	_	_	_	
SS	36	For manufacturer's use	1-	_		_	
<u>ا</u>	37	For manufacturer's use	-	_	=	_	
) pe	38	For manufacturer's use	_	_	_	_	4-8
cia i	39	For manufacturer's use	_	_		_	
[Class 7] Special settin	87	For manufacturer's use	_	_	 	_	
≣:	91	For manufacturer's use	_	_			
	92	For manufacturer's use	_	_	<u> </u>	_	
	93	For manufacturer's use	1_	_	 	_	
			_		_		
	00	For manufacturer's use		_	_	_	
_	01	For manufacturer's use		_	_	_	ļ
Cla	02	For manufacturer's use		_		_	ļ
ss 8	03	For manufacturer's use		_	_	_	
<u></u>	04	For manufacturer's use		_	_	_	
/an	05	For manufacturer's use		_	_	_	4-8
ufac	10	For manufacturer's use		-	<u> </u>	_	
[Class 8] Manufacturer use	12	For manufacturer's use	1-	_	-	_	
er c	13	For manufacturer's use	-	_	_	_	
Ise	14	For manufacturer's use		_	_	_	
	15	For manufacturer's use		_	_	_	
	19	For manufacturer's use	-	_	_	_	
	00	For manufacturer's use	1_	<u> </u>	Ι_	_	
	01	For manufacturer's use	+-			_	
	02	For manufacturer's use	+				
	03	For manufacturer's use	Æ		H		
	03	For manufacturer's use	H	E		Е	
	05	For manufacturer's use	+	\vdash	F	\equiv	
	06	For manufacturer's use	+	-	⊨	_	1
	07	For manufacturer's use	+	_	-	_	
	08	For manufacturer's use	+	H	F	_	
			+	_	_	_	
	09	For manufacturer's use	+	F	F	\vdash	
	10 11	For manufacturer's use	-	_	-	_	
7	12	For manufacturer's use	+	_	_	_	
lass		For manufacturer's use	+	_	_	_	
s 9]	13	For manufacturer's use		_	_	_	
_ _	14	For manufacturer's use		_	_		
Manufacturer use	17	For manufacturer's use	+-	_	_	_	4-8
ıfac	18	For manufacturer's use		_	_	_	ļ
Ë	19	For manufacturer's use		_	_	_	
er u	20	For manufacturer's use		_	_	_	
Se	21	For manufacturer's use	1-	_	-	_	
	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	1-	-	-	-	
	28	For manufacturer's use		-	_	_	
	29	For manufacturer's use	1-	-	-	_	-
	30	For manufacturer's use		-	_	_	
	48	For manufacturer's use		-	-	_	
	49	For manufacturer's use		_	_	_	
	50	For manufacturer's use	-	-	<u> </u>	_	
ົດ	00	For manufacturer's use	1-	_	<u> </u>	_	
ass	16	For manufacturer's use	1-	_	_	_	
15	17	For manufacturer's use	+-	_			
N N	30	For manufacturer's use	+-	_		_	
Class 15] Manufacturer use	31	For manufacturer's use	+	_		_	4-8
fact	33	For manufacturer's use	+	_			
ure	34	For manufacturer's use	+	_	\vdash		
-			1	1			

Setup

1. Details of parameter

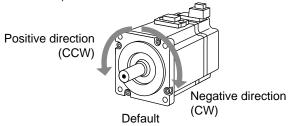
[Class 0] Basic setting

Default: []

Pr0.00 *	Potational direction setup	Range	Unit	Default	Related control mode
	Rotational direction setup	0 to 1	_	1	PSTF

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	Command direction Motor rotational direction drive inhibit input		Negative direction drive inhibit input
0	Positive direction	CW	Valid	_
0	Negative direction	CCW	_	Valid
F41	Positive direction	CCW	Valid	_
[1]	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	Content				
value	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	_			

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.

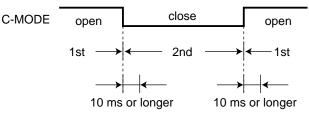
When C-MODE is shorted, the 2nd mode will be selected.

Don't enter commands 10 ms before/after switching.



Two-degree-of-freedom control can be selected with Pr6.47.

For details, refer to Pr6.47 (P.4-64).



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 Pro.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"

[Class 0] Basic setting

Default: []

Pr0.02	Real-time auto-gain tuning setup	Range	Unit	Default	Related control mode
		0 to 6		1	PSTF

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 Pro.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 D to F-f

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

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.



- A parameter is designated as follows: Class Pro.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"

[Class 0] Basic setting

Default: []

Pr0.04	Inertia ratio	Range	Unit	Default	Related control mode				
P10.04		0 to 10000	%	250 *	PSTF				
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 w its result will be saved to EEPROM every 30 m		e auto-gai	n tuning is v	alid, and				
Caution ··*	If the inertia ratio is correctly set, the setup un the inertia ratio of Pr0.04 is larger than the a becomes larger, and when the inertia ratio of F of the velocity loop gain becomes smaller.	ctual, the setup	unit of th	ne velocity lo	oop gain				

		ity loop gain becomes smaller.					
D-0.05 *	0.1		Range	Unit	Default	Related control mode	
Pr0.05 *	Selection	of command pulse input	0 to 2		0	PF	
	interface fro When using For comma	ng to pulse specifications, you ca om the two interfaces. I open collerctor I/F,Pr0.05=2 that is and pulse input, you can select either or as the command pulse input.	s recommende	ed.		·	
	Setup value	Content		PIN NO.	Sigr	al name	
	[0]	Photocoupler input Both line driver and open collector Line driver (Permissible max frequency inputs:50 Open collector (Permissible max. input frequency:20		No.1 No.3 No.4 No.2 No.5 No.6	F F (OPC1 PULS1 PULS2 OPC2 SIGN1 SIGN2	
	1	Exclusive input for line driver • Line driver (Permissible max. input frequency:8 I	Mpps)	No.44 No.45 No.46 No.47	PU	ULSH1 ULSH2 IGNH1 IGNH2	
	2	Photocoupler inputs Open collector (Permissible max. input frequency:20	0 kpps)	No.1 No.3 No.4 No.2 No.5 No.6	F F (DPC1 PULS1 PULS2 DPC2 SIGN1 SIGN2	

Pelese refer to P.3-37 and P.3-38.

[Class 0] Basic setting

Default: []

	Pr0.06 *	Command pulse rotational direction setup	Range	Unit	Default	Related control mode
			0 to 1	_	0	P F
	Pr0.07 *	Command pulse input mode setup	Range	Unit	Default	Related control mode
	P10.07		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 or 2	90° phase difference 2-phase pulse (A + B-phase)	PULS SIGN	A-phase B-phase t1 t1 t1 B-phase advances to A by 90°.	t1 t
[0]	[1]	Positive direction pulse train + Negative direction pulse train	PULS SIGN	13	12 12
	3	pulse train + Signal	PULS SIGN	t4 t5 "H" t6	14 t5 "L" 16 t6
	0 or 2	90° phase difference 2-phase pulse (A + B-phase)	PULS SIGN	A-phase B-phase t1 t1 B-phase delays from A by 90°.	t1 t
1	1	Positive direction pulse train + Negative direction pulse train	PULS SIGN	t2 t2	12 12
	3	pulse train + Signal	PULS SIGN	t4 t5 "L"	t4 t5 "H" t6

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

le.	nput I/F of PULS/SIGN signal	Permissible max.	N	/lin. nec	essary	time w	idth (µs	s)
	iput i/F oi Pols/sign signal	input frequency	t 1	t2	tз	t4	t ₅	t ₆
PULSH1,2	A,B-phase input,afer multiplied by 4	8 Mpps	0.125	0.125	0.125	0.125	0.125	0.125
SIGNH1,2	A,B-phase input except	4 Mpps	0.25	0.125	0.125	0.125	0.125	0.125
PULS1,2	Line driver interface	500 kpps	2	1	1	1	1	1
SIGN1,2	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 $\ensuremath{\mu s}$ 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.



- A parameter is designated as follows: Class Pro.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"

[Class 0] Basic setting

Default: []

Pr0.08 *	Command pulse counts per one motor	Range	Unit	Default	Related control mode
	revolution	0 to 8388608	pulse	10000	P
	0.44	6.0			

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 goor	Range	Unit	Default	Re	lated ol mo	
F10.09	1st numerator of electronic gear	0 to 2 ³⁰	_	0	Р		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	Relate control m		
F10.10	Denominator of electronic gear	1 to 2 ³⁰		10000	Р	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>

Pr0.08	Pr0.09	Pr0.10	Command division/multiplication operation
			Command pulse input Encoder resolution Command
1 to 8388608	— (Not effect)	(Not effect)	 [Pr0.08 setup value] * Regardless of setup of Pr0.09 and Pr0.10, this operation is processed according to setup value of Pr0.08.
	0	0 to 1073741824	Command pulse input Encoder resolution [Pr0.10 setup value] * When both Pr0.08 and Pr0.09 are set to 0, this operation is processed according to setup value of Pr0.10.
0	1 to 1073741824	1 to 1073741824	Command pulse input [Pr0.09 setting] [Pr0.10 setting] * 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.

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)"

[Class 0] Basic setting

Default: []

\blacksquare Pr0.08 = 0 \ Pr0.09 \neq 0

Position command of division and multiplication (F)is setting Pr0.10 Pr0.09 such as encoder resolution (2^{23}). F = fxPr0.09/Pr0.10 = 2^{23} (8388608)

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

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

Setting example

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

< Interrelationship between Pr0.08, Pr0.09 and Pr0.10 during full closed control>

Pr0.08	Pr0.09	Pr0.10	Command division/multiplication operation				
(Involid)	0	1 to 1073741824	* If Pr0.09 is 0 during full closed controlling, the process as shown above is performed with both numerator and denominator set to 1.				
(Invalid)	1 to 1073741824	1 to 1073741824	* 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	Range	Unit	Default	Related control mode
	F10.11	per one motor revolution	0 to 2097152	P/r	2500	PSTF
	Caution ·❖	You can set up the output pulse counts per on		on for eac	h OA and O	В.
Ľ	Caution ***	For details of setup, refer to description in Pr5.	03.			



- A parameter is designated as follows: Class Pro.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)"

[Class 0] Basic setting

Default: []

Pr5.03 * Denominator of pulse output division	Range	Unit	Default	Related control mode
	Denominator of pulse output division	0 to 8388608		0

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>

Pr0.11	Pr5.03	Pulse reproducing process				
		When the output source is encoder				
	[0]	Encoder feedback pulse [Pr0.11 setup value]x4 [pulse] Encoder resolution				
		 * 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] 1 * Division ratio is 1:1.				
1 to 2097152		Encoder feedback pulse or external scale pulse [Pr0.11 setup value] [Pr5.03 setup value] * If Pr5.03 is not equal to 0, then the above process is performed based on setup value of Pr0.11 and Pr5.03.				
	1 to 8388608	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.				

[Class 0] Basic setting

Default: []

Pr0.12 *	Povercel of pulse output legic	Range	Unit	Default	Related control mode
P10.12	Reversal of pulse output logic	0 to 3	_	0	PSTF

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	A-phase		
2		External scale	B-phase	B-phase		
1	Reversal	Encoder	A-phase	A-phase		
3		External scale	B-phase	B-phase		

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 mo	
		1st torque illilit	0 to 500	%	500	Р	ST	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						

Dr0 14	Desition deviation evenes actum	Range	Unit Default		Related control mode		
Pr0.14 Position deviation excess setup	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 e	ncoder setup	Range	Unit	Default	contro	ol m	ode
	F10.13	Absolute e	ncoder setup	0 to 2	_	1	PS	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.					i.			
	3 Used as a single-turn absolute mode.								
	Used as an absolute system(absolute mode);however,any value can be set for th upper limit of the multi-turn counter.(continuous rotating absolute encoder mode)				the	Э			

[Class 0] Basic setting

					Default: []
D 0 40 *		Range	Unit	Default	Related control mode
Pr0.16 *	External regenerative resistor setup	0 to 3	_	A,B-frame: 3 C,D,E,F-frame: 0	PSTF

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.

Install an external protection such as thermal fuse when you use the external regenerative resistor.

Remarks ·∵

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 control mode 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	lated ol mode
F10.10	For manufacturer's use	_	_	0	

Pleses fixed to 0.



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- 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"

Setup

1. Details of parameter

[Class 1] Gain adjustment

Default: [

					Doiaut. [LJ
D-4 00		Range	Unit	Default	Related control mod	
Pr1.00	1st gain of position loop	0 to 30000	0.1 /s	A,B,C-frame: 480 D to F-frame: 320		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 D to -fra

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).

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
P11.03	ist filter of speed detection	0 to 5	_	0	PSTF

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.

D-4 04	4-4 (***********************************	Range	Unit		cont	trol		
Pr1.04	1st time constant of torque filter	0 to 2500	0.01 ms	A,B,C-frame: 84 D to H-frame: 126	Р	s	т	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).



• For parameters which No. have a suffix of " * ", changed contents will be validated when you turn on the control power.

Related page

[Class 1] Gain adjustment

D 4 05		Range	Unit	Default _{co}	Related ontrol mode
Pr1.05	2nd gain of position loop	0 to 30000	0.1 /s	A,B,C-frame: 480 D to F-frame: 320	F
D 4 00		Range	Unit	Default co	Related ontrol mode
Pr1.06	2nd gain of velocity loop	1 to 32767	0.1 Hz	A,B,C-frame: 270 D to F-frame: 180	STF
D 4 0=	2nd time constant of velocity loop	Range	Unit		Related ontrol mode
Pr1.07	integration	1 to 10000	0.1 ms	A,B,C-frame: 210 D to F-frame: 310	STF
Pr1.08	2nd filter of anodd detection	Range	Unit	Default co	Related ontrol mode
P11.00	2nd filter of speed detection	0 to 5	_	0 P	STF
D 4 00		Range	Unit		Related ontrol mode
Pr1.09	2nd time constant of torque filter	0 to 2500	0.01 ms	A,B,C-frame: 84 D to F-frame: 126	STF

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.

Pr1.10	Velocity feed forward gain	Range	Unit	Default	con	Relate trol r		le
P11.10	velocity leed forward gain	0 to 4000	0.1 %	1000	Р		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.

Pr1 11	Velocity feed forward filter	Range	Unit	Default	contr	elated ol m	
PII.II	velocity feed forward filter	0 to 6400	0.01 ms	0	Р		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 Pro.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 ..:

control process.

[Class 1] Gain adjustment

Default: []

Pr1.12	Torque feed forward gain	Range	Unit	Default		ed node	
	Torque leed forward gain	0 to 2000	0.1 %	1000	Р	S	F
	Multiply the torque command calculated acc ratio of this parameter and add the result to the second command calculated accurate.	•	•			•	

• 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
P11.13	Torque leed forward filter	0 to 6400	0.01 ms	0	PS 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).

<us>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 cotun	Range	Unit	Default	conf	elat trol r		
P11.14	2nd gain setup	0 to 1	_	1	Р	s -	Т	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.

[Class 1] Gain adjustment

Default: []

Pr1.15	Mode of position control switching	Range	Unit	Default	Contr	elated rol m	-
Pr1.15	wode of position control switching	0 to 10		0	Р		F

Set up the triggering condition of gain switching for position control.

Setup	Switching	Gain switching condition
value	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.

Dr1 16	Delay time of position central awitching	Range	Unit	Default	Relate control m	
Pr1.16	Delay time of position control switching	0 to 10000	0.1 ms	10	Р	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 Pro.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 ...:

[Class 1] Gain adjustment

Pr1.17	Level of position control ewitching	Range	Unit	Default	Related control mode			
Pri.i/	Level of position control switching	0 to 20000	Mode- dependent	0	PF			
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	Hyptoropic at position control awitching	Range	Unit	Default	Related control mode			
P11.10	Hysteresis at position control switching	0 to 20000	Mode- dependent	0	P F			
For position controlling: Set up triggering hysteresis when Pr1.15 Position control switchin mode is set at 3, 5, 6, 9 or 10. Unit of setting varies with switching mode.								
Caution 🔆	When level < hysteresis, the hysteresis is inter	nally adjusted s	o that it is	equal to lev	el.			

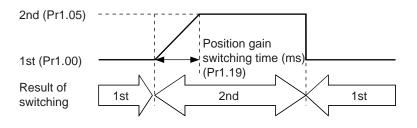
Pr1.19	Position gain switching time	Range	Unit	Default	Related control mode		
P11.19	Position gain switching time	0 to 10000	0.1 ms	10	P F		
For position controlling: If the difference between Pr1.00 1st gain of position loop and Pr1.05 2nd gain of poison loop is large, the increasing rate of position loop gain can be limited by							
	this parameter. The position loop gain will increase over the time set.						
	<position gain="" switching="" time=""></position>						

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 Pro.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 ..:

[Class 1] Gain adjustment

Default: []

P11.20 Mode of velocity control switching 0 to 5 - 0 S	Dr1 20	Mode of velocity control switching	Range	Unit	Default	Related control mode
	Pr1.20	mode of velocity control switching	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.

Pr1.21Delay time of velocity control switchingRangeUnitDefaultRelated control mode0 to 100000.1 ms0S

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 valocity control ewitching	Range	Unit	Default	control mode	ı
P11.22	Level of velocity control switching	0 to 20000	Mode- dependent	0	S	
						Ĺ

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 Pro.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 ..:

operation.

Default: []

Pr1.23	Hysteresis at velocity control switching		Unit	Default	Related control mode		
P11.23	0 to 20000	Mode- dependent	0	S			
For velocity controlling: Set up triggering hysteresis when Pr1.20 Velocity control gai switching mode is set at 3, 4 or 5.							
Caution ·• •	Unit of setting varies with switching mode. When level < hysteresis, the hysteresis is interest.	rnally adjusted s	o that it is	equal to lev	el.		

Pr1.24	Mode of to	rque control switchin	.a	Range	Unit	Default		ated I mode
F11.24	IVIOGE OF LO	rque control switchin	iy ————————————————————————————————————	0 to 3	_	0		Т
	For torque co	ontrolling: Set the cond	ition to trig	ger gain switchir	ng.			
	Setup value	Switching condition		Gain switc	hing condi	tion		
	[0]	Fixed to the 1st gain.	Fixed to the	e 1st gain (Pr1.00 to	o Pr1.04).			
	1	Fixed to the 2nd gain.	Fixed to the	e 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 t					
	3	Torque command	Shift to the 2nd gain when the absolute value of the to command exceeded (level + hysteresis) (%) previously the 1st gain. Return to the 1st gain when the absolute value of the to command was kept below (level - hysteresis) (%) previously				usly w	ith ue

Pr1.25	Delay time of torque control switching	Range	Unit	Default	Relat trol r	ed mode
	Delay time of torque control switching	0 to 10000	0.1 ms	0	-	Г
	For torque controlling: When shifting from the control switching mode set at 3, set up the de	•	•		•	

during delay time with the 2nd gain.

Pr1.26	Level of torque control switching	Range	Unit	Default	Related control mode			
P11.20	Level of torque control switching	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			
		Hysteresis at torque control switching	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.

4 Setup

1. Details of parameter

[Class 2] Damping control

					Dei	auii.	L
		Range	Unit	Default	Re	elated ol mo	
Pr2.00	Adaptive filter mode setup	0 to 6	l	Basic type:1 Communication type:1 Multifunction typ:0	P S	8	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.

Dr2 04	1st notch frequency	Range	Unit	Default	Related control mode
Pr2.01	ist noten nequency	50 to 5000	Hz	5000	PSTF

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				
	Ist noten width selection	0 to 20	2	PSTF					
	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	PSTF		
	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	Relate control m			
F12.04	Zna noten nequency	50 to 5000	Hz	5000	PST	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".							

[Class 2] Damping control

Pr2.05	2nd notch width selection	Range	Unit	Default	Related control mode			
P12.03	Zila Hoteli wiath selection	0 to 20	_	2	PSTF			
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 mod		
F12.00	Zilu notch depth selection	0 to 99	_	0 P S	S	Т	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 fraguency	Range	Unit	Default	R	elated rol mo	
F12.07	Pr2.07 3rd notch frequency		Hz	5000	P	ST	F
	Notch frequency is automatically set to the 1st reso		estimated	by the adap	tive f	ilter.	
Caution	aution 🔆 In no resonance point is found, the frequency is set to 5000.						

Pr2.08	3rd notch width selection	Range	Unit	Default	Related control mode
F12.00	Sid Hotell width selection	0 to 20	_	2	PSTF
	Set the width of notch at the center frequency	of the 3rd notch	filter.		
Caution ·❖	Higher the setup, larger the notch width you can of When the applicable filter function is used, part			•	peration.

Dr2 00	3rd notch donth coloction	Range	Unit	Default	Related control mode
F12.09	Pr2.09 3rd notch depth selection		_	0	PSTF
	Set the depth of notch at the center frequency	of the 3rd notch	filter.		
Caution ·*	Higher the setup, shallower the notch depth as When the applicable filter function is used, past	•	-		tain.

Dr2 10	4th notch fraguency	Range	Unit	Default	Related control mode
Pr2.10 4th notch frequency		50 to 5000	Hz	5000	PSTF
Caution 🔆	Notch frequency is automatically set to the 2nd res The notch filter function will be invalidated by s	•	•	, ,	otive filter.

Pr2.11 4th notch width selection		Range	Unit	Default	Related control mode
F12.11	4th hoten width selection	0 to 20		2	PSTF
	Set the width of notch at the center frequency	of the 4th notch	filter.		
	Higher the setup, larger the notch width you can of When the applicable filter function is used, part			•	peration.

Note

• A parameter is designated as follows: Class Pro.00 Parameter No.
• For parameters which No. have a suffix of " * ", changed contents will be validated when you turn on the control power.
• P 3-32 "Inputs and or the transfer of the sufficient of

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

[Class 2] Damping control

Default: []

Dr2 1	12	4th notch depth selection	Range	Unit	Default	Related control mode
Pr2.12		4th notch depth selection	0 to 99	_	0	PSTF
		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	Soloation of damping filter awitching	Range	Unit	Default	Re	lated ol mo	
P12.13	Selection of damping filter switching	0 to 6		0	Р		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]	_	_	0	0		
4	_	OFF	0		0	
l I	_	ON		0		0
	OFF	OFF	0			
	OFF	ON		0		
2	ON	OFF			0	
	ON	ON				0

With setup value 3: Select the filter with command direction.

Setup value	Position command direction	1st damping	2nd damping	3rd damping	4th damping
2	Positive direction	0		0	
3	Negative direction		0		0

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	_	0	0	0	
5,6			Same action a	as set value 0	

• Position control (Two degree-of-freedom control mode enabled).

Setup value	VS-SEL1	1st model	2nd model
4	_	0	0
E	OFF	0	
5	ON		0

Setup value	Position command direction	1st model	2nd model
6	Positive direction	0	
0	Negative direction		0

full-close control

Setup value	1st model	2nd model	3st model	4st model
4 to 6	0	0		

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.

[Class 2] Damping control

Default: []

Pr2.14	1st damping frequency	Range	Unit	Default	Related control mode
F12.14	ist damping frequency	0 to 3000	0.1 Hz	0	P F
Pr2.16	2nd damping frequency	Range	Unit	Default	Related control mode
P12.10	Zild damping frequency	0 to 3000	0.1 Hz	0	P F
D#2 40	Pr2.18 3rd damping frequency	Range	Unit	Default	Related control mode
P12.10		0 to 3000	0.1 Hz	0	PF
Dr2 20	2.20 4th damping frequency	Range	Unit	Default	Related control mode
Pr2.20		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		
F12.13	ist damping inter setup	0 to 1500	0.1 Hz	0	P F		
Pr2.17	2nd domning filter cetup	Range	Unit	Default	Related control mode		
P12.17	2nd damping filter setup	0 to 1500	0.1 Hz	0	P F		
Dr2 10	3rd damping filter setup	Range	Unit	Default	Related control mode		
Pr2.19	ord damping inter setup	0 to 1500	0.1 Hz	0	P F		
Pr2.21	4th damping filter setup	Range	Unit	Default	Related control mode		
PIZ.ZI		0 to 1500	0.1 Hz	0	PF		
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.							

Refer to P.5-41, "Damping control" as well before using this parameter.

Note

• A parameter is designated as follows: Class Pro. • 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"

[Class 2] Damping control

Default: []

Pr2.22	Command smoothing filter	Range	Unit Default		Related control mode	
Pr2.22	Command smoothing filter	0 to 10000		A,B,C-frame: 92 D to F-frame: 139		

[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

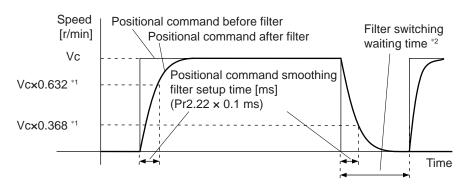
The maximum value is limited by 640 (= 64.0 ms).*

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 Pro.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

Default: []

Pr2.23	Command FIR filter	Range	Unit	Default		ated I mode
		0 to 10000	0.1 ms	10	Р	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.

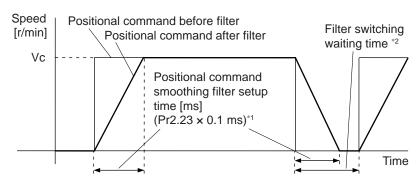
• In the two-degree-of-freedom control mode (Pr6.47 bit0 = 1)
Time constant of the command response filter

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 pulseless 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.



- A parameter is designated as follows: Class Pro.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 …

[Class 2] Damping control

Default: []

Pr2.24	5th notch frequency	Range	Unit	Default	con	Rela itrol		de
	Stil Hotel frequency	50 to 5000	Hz	5000	Р	S	Т	Ŧ
	Set the center frequency of the 5th notch filter.							
Caution ·∻	ion 🔆 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		
	Stil Hotell width selection	0 to 20		2	PSTF		
	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 norm operation.							

	Pr2.26	5th notch depth selection	Range	Unit	Default	Related control mode			
		Sui noton depui selection	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.								
L	Aution : 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			
	Pf2.21	ist vibration control width setting	0 to 1000		0	Р		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	1	0	Р	F	
	To conduct fine tuning of 2nd vibration suppression control function.							

Pr2.29	3rd vibration control width setting	Range	Unit	Default		Related control mode		
P12.29		0 to 1000	_	0	Р		F	
To conduct fine tuning of 3rd vibration suppression control function.								

Pr2.30	Dr2 20	4th vibration control width setting	Range	Unit	Default		lated ol mode
	F12.30	4th vibration control width setting	0 to 1000	_	0	Р	F
To conduct fine tuning of 4th vibration suppression control function.							

Note

- A parameter is designated as follows: Class Pr.0.00 Parameter No.
 For parameters which No. have a suffix of " * ", changed contents will be validated when you turn on the control power.

Related page …:

[Class 2] Damping control

Default: []

Pr2.31	For manufacturer use	Range	Unit	Default	Related control mode	
F12.31	For manufacturer use	_	_	0		
Pr2.32	For manufacturer use	Range	Unit	Default	Related control mode	
F12.32	1 of manufacturer use	_	_	0		
Dr2 22	Pr2.33 For manufacturer use	Range	Unit	Default	Related control mode	
F12.33		_		0		
Pr2.34	For manufacturer use	Range	Unit	Default	Related control mode	
F12.34		_	_	0		
Pr2.34	For manufacturer use	Range	Unit	Default	Related control mode	
F12.34			_	0		
Pr2.36	For manufacturer use	Range	Unit	Default	Related control mode	
F12.30	1 of manufacturer use	_	_	0		
Pr2.37	For manufacturer's use	Range	Unit	Default	Related control mode	
F12.31	For manufacturer's use	_		0		
	Pleses fixed to 0.					

Note

Related page ... P.3-32... "Inputs and outputs on connector X4"

[•] A parameter is designated as follows: Class Pro. Parameter No.
• For parameters which No. have a suffix of " * ", changed contents will be validated when you turn on the control power.

4 Setup

1. Details of parameter

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

Default: []

		Range	Unit	Default	Related control mod	
Pr3.00	Speed setup, Internal/External switching	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.

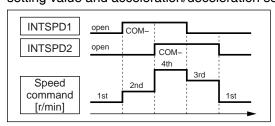
Setup value	Speed setup method		
[0] Analog speed command (SPR)			
1 Internal speed command 1st to 4th speed (Pr3.04 to Pr3.07)			
2	Internal speed command 1st to 3rd speed (Pr3.04 to Pr3.06), Analog speed command (SPR)		
3 Internal speed command 1st to 8th speed (Pr3.04 to Pr3.11)			

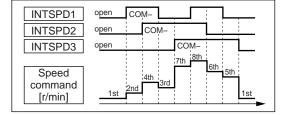
<Relationship between Pr3.00 Internal/external switching speed setup and the internal command speed selection 1, 2 and 3, and speed command to be selected>

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
	OFF	OFF		1st speed
1	ON	OFF	No effect	2nd speed
'	OFF	ON	ino effect	3rd speed
	ON	ON		4th speed
	OFF	OFF		1st speed
	ON	OFF		2nd speed
2	OFF	ON	No effect	3rd speed
	ON	ON		Analog speed command
	The same a	as Pr3.00=1	OFF	1st to 4th speed
	OFF	OFF	ON	5th speed
3	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	Range	Unit	Default	Related control mode
	selection	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
[0]	_	No effect	Negative direction
1	Sign has no effect.	OFF	Positive direction
'	Sign has no effect.	ON	Negative direction

Default: []

Pr3.02	Input gain of speed command	Range	Unit	Default	Related control mode
		10 to 2000	(r/min)/V	500	ST

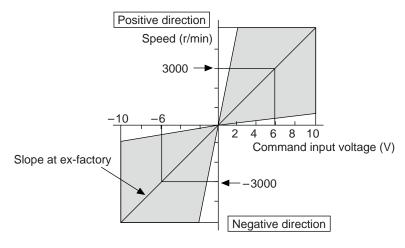
Based on the voltage applied to the analog speed command (SPR), set up the conversion gain to motor command speed.

- 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 $\pm 10 \text{ V}$ 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	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.



- A parameter is designated as follows: Class Pro.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 ..:

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

Default: []

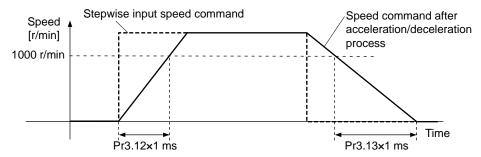
Dr2 04	Pr3.04 1st speed of speed setup	Range	Unit	Default	Related control mode
F13.04		-20000 to 20000	r/min	0	S
Pr3.05	2nd spood of spood sotup	Range	Unit	Default	Related control mode
F13.03	2nd speed of speed setup	-20000 to 20000	r/min	0	S
Pr3.06	3rd speed of speed setup	Range	Unit	Default	Related control mode
F13.00	Sid speed of speed setup	-20000 to 20000	r/min	0	S
Dr2 07	Pr3.07 4th speed of speed setup	Range	Unit	Default	Related control mode
F13.07		-20000 to 20000	r/min	0	S
Pr3.08	Eth speed of speed setup	Range	Unit	Default	Related control mode
P13.00	5th speed of speed setup	-20000 to 20000	r/min	0	S
Pr3.09	6th speed of speed setup	Range	Unit	Default	Related control mode
P13.09	our speed or speed setup	-20000 to 20000	r/min	0	S
Dr2 10	7th speed of speed setup	Range	Unit	Default	Related control mode
Pr3.10	7th speed of speed setup	-20000 to 20000	r/min	0	S
Dr2 11	9th speed of speed setup	Range	Unit	Default	Related control mode
Pr3.11	8th speed of speed setup	-20000 to 20000	r/min	0	S
	Set up internal command speeds, 1st to 8th.				

Pr3.12	Acceleration time setup	Range	Unit	Default	Related control mode
P13.12	Acceleration time setup	0 to 10000	ms/ (1000 r/min)	0	S
Pr3.13	B Deceleration time setup	Range	Unit	Default	Related control mode
P13.13		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) = $Vc/1000 \times Pr3.12 \times 1$ ms Deceleration time (ms) = $Vc/1000 \times Pr3.13 \times 1$ 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 Pro.00 Parameter No.
- For parameters which No. have a suffix of " * ", changed contents will be validated when you turn on the control power.

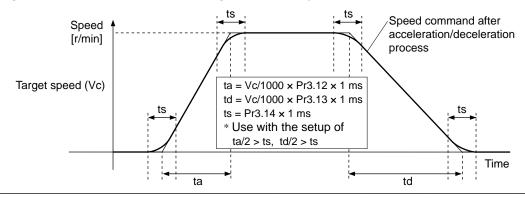
Related page ..:

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

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 coloction	Range	Unit	Default	Related control mode
F13.15	Speed zero-clamp function selection	0 to 3	_	0	ST

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 Defa		Related control mode		
		10 to 20000	r/min	30	ST		
Select the timing at which the position control is activated as the Pr3 15 Speed zero-clamp							

function selection is set to 2.

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

Default: []

713.17 Selection of torque command 0 to 2 — 0 T	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 (Al1, 16-bit resolution)	Parameter value (Pr3.25)
1	Analog input 2 (Al2, 12-bit resolution)	Analog input 1 (Al1, 16-bit resolution)
2	Analog input 1 *1 (Al1, 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 (Al2, 12-bit resolution).

Pr3.18 Torque comman	Torque command direction colection	Range	Unit	Default	Related control mode
	Torque command direction selection	0 to 1	_	0	T

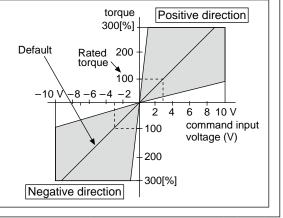
Select the direction positive/negative direction of torque command.

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 %.



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

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
	Speed limit value 1	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 ntrol mode		
F13.22	Speed IIIIIt value 2	0 to 20000	r/min	0		Т	

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	No effect		Pr3.21 setup value
0	0 to 20000	No effect	1 to 3	OFF	No effect	Pr3.21 setup value
			1103	ON		0
	0 to 20000	0.1- 00000 0.1- 00000 0 No office		No effect	Positive direction	Pr3.21 setup value
	0 10 20000	0 to 20000	0	No effect	Negative direction	Pr3.22 setup value
2	0 to 20000	0 to 20000	1 to 3	OFF	Positive direction	Pr3.21 setup value
	0 to 20000 0 to 20000 1 to 3		OFF	Negative direction	Pr3.22 setup value	
	0 to 20000	0 to 20000	1 to 3	ON	No effect	0

Note

Related page ··

[•] A parameter is designated as follows: Class Pro.00 Parameter No.

[•] For parameters which No. have a suffix of " * ", changed contents will be validated when you turn on the control power.

[•] P.3-32... "Inputs and outputs on connector X4" • P.6-2 "Protective Function"

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

Default: []

Dr2 22 *	External coals coloction	Range	Unit	Default	Related control mode
P13.23	External scale selection	0 to 6	_	0	PSTF

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.

Dr2 24 *	Pr3.24 * Numerator of external scale division	Range	Unit	Default	Related control mode
P13.24		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
Pr3.25		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);

Pr3.24 8388608 = Encoder resolution per one motor revolution [pulse]

Pr3.25 100000 = 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.

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

Default: []

Pr3.26 *	Reversal of direction of external scale	Range	Unit	Default	Rela control		
Pro.26 Reversal of direction of external scale	0 to 3	_	0	PS	Т	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 | Control mode | Range | Unit | Default | Related control mode | Factor | Factor | Range | Unit | Default | Related control mode | Factor | Factor | Range | Unit | Default | Range | Unit | Unit | Default | Range | Unit |

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 setupRangeUnitDefaultRelated control mode1 to 134217728Command unit16000F

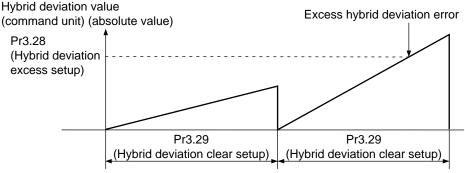
You can setup the permissible gap (hybrid deviation) between the present motor position and the present external scale position.

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.



No. of motor revolutions [rev]

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.

[Class 4] I/F monitor setting

Default: []

	D 4 00 *		Range	Unit	Default	Related control mode
Pr4.00 Si1 input selection 0 to 00FFFFFFh - 00828282h (8553090) P S	Pr4.00 *	SI1 input selection	0 to 00FFFFFh			PSTF

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

00 - ** - h: velocity control 00 ** - - h: torque control Replace ** with the function number.

For the function number see the table below. Logical setup is also a function number.

Title	Complete	Setup value		
Title	Symbol	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 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.

F

4

Before Using the Products

tion

Connect

4

Adjustment

6

When in Trouble

7

Supplement

[Class 4] I/F monitor setting

D-4 04 *	Olo immediately	Range	Unit	Default	Related control mode	
Pr4.01 *	SI2 input selection	0 to 00FFFFFFh	_	00818181h (8487297)	PSTF	
D::4 00 *	Olo import and actions	Range	Unit	Default	Related control mode	
Pr4.02 *	SI3 input selection	0 to 00FFFFFFh	_	0091910Ah (9539850)	PSTF	
Pr4.03 *	CIA input calcation	Range	Unit	Default	Related control mode	
P14.03	SI4 input selection	0 to 00FFFFFh	_	00060606h (394758)	PSTF	
D=4 04 *	OIS invest coloration	Range	Unit	Default	Related control mode	
Pr4.04 *	SI5 input selection	0 to 00FFFFFFh	_	0000100Ch (4108)	P S T F	
Pr4.05 *	CIG input calcation	Range	Unit	Default	Related control mode	
Pr4.05	SI6 input selection	0 to 00FFFFFh		00030303h (197379)	PSTF	
D::4 0C *	Ol7 invest calcation	Range	Unit	Default	Related control mode	
Pr4.06 *	SI7 input selection	0 to 00FFFFFFh	_	00000f07h (3847)	PSTF	
Caution ·*	Deviation counter clear (CL) can be set up or is used for this purpose, Err33.6 Counter clear				arameter 	
Pr4.07 *	SI8 input selection	Range	Unit	Default	Related control mode	
P14.07	Sio input selection	0 to 00FFFFFh	_	00040404h (263172)	PSTF	
Pr4.08 *	CIO input calcation	Range	Unit	Default	Related control mode	
P14.06	SI9 input selection	0 to 00FFFFFh	_	00050505h (328965)	P S T F	
Pr4.09 *	SI40 innut coloction	Range	Unit	Default	Related control mode	
Pr4.09	SI10 input selection	0 to 00FFFFFh	_	00000E88h (3720)	PSTF	
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, a	also refer to P.3-	39 Contro	ol 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 IN	U accianment a	ror will be	viceued.		

Note

[•] A parameter is designated as follows: Class Pro. 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"

[Class 4] I/F monitor setting

Default: []

D 4 40 *		Range	Unit	Default	Related control mode
Pr4.10 *	SO1 output selection	0 to 00FFFFFh	_	00030303h (197379)	PSTF

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

00--**--h : velocity control 00**---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.

	Range	Unit	Default Related control mode		
Pr4.11 *	SO2 output selection	0 to 00FFFFFh	_	00020202h (131586)	
D 4 40 *		Range	Unit	Default Related control mode	
Pr4.12 *	Pr4.12 * SO3 output selection	0 to 00FFFFFh	_	00010101h (65793)	
	SO4 output selection	Range	Unit	Default Related control mode	
Pr4.13 *		0 to 00FFFFFh	_	00050504h (328964)	
D 4 4 4 *	SO5 output selection	Range	Unit	Default Related control mode	
Pr4.14 *		0 to 00FFFFFh	_	00070707h (460551)	
·	SO6 output selection	Range	Unit	Default Related control mode	
Pr4.15 *		0 to 00FFFFFh	_	00060606h (394758) PSTF	
Assign functions to SO2 to SO6 outputs.					

These parameters are presented in hexadecimals.

Setup procedure is the same as described for Pr4.10.

[Class 4] I/F monitor setting

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
			[Monitor unit in Pr4.16] / V	0	PSTF

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		
	Type of analog monitor 2	0 to 28	_	4	PSTF		
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	PSTF
	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.

D::4.00 E	For wow of atomorphisms	Range	Unit	Default	Related control mo	
Pr4.20	For manufacturer's use	_	_	0		

Plese fixed to 0.

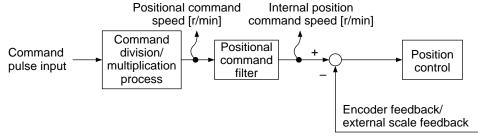
Pr4.16/Pr4.18	Type of monitor	Unit	Output gain for setting Pr4.17/Pr4.19 = 0
0	Motor speed	r/min	500
1	Positional command speed *4	r/min	500
2	Internal positional command speed *4	r/min	500
3	Velocity control command	r/min	500
4	Torque command	%	33
5	Command positional deviation *5	pulse (Command unit)	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

[Class 4] I/F monitor setting

Default: []

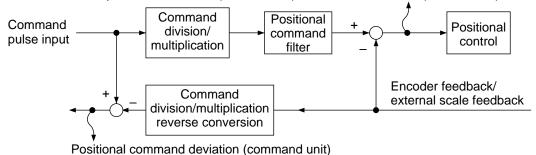
Pr4.16/Pr4.18	Type of monitor	Unit	Output gain for setting Pr4.17/Pr4.19 = 0
17	Analog input 2 *2	V	1
18	Analog input 3 *2	V	1
19	Encoder temperature *3	°C	10
20	Driver temperature	C	10
21	Encoder single-turn data *1	pulse (Encoder unit)	110000
23	Command input state	0: No command 1: With command	*6
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.

Encoder positional deviation (encoder unit)/ Full-closed deviation (external unit)



*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.

[Class 4] I/F monitor setting

 Pr4.21
 Analog monitor output setup
 Range
 Unit
 Default: []

 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 (Al1) 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 (Al1) 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 (Al1) 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 (Al2) 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 (Al2) 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 (Al2) 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 (Al3) 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: []

When in Trouble

1. Details of parameter

[Class 4] I/F monitor setting

Pr4.29	Analog input 3 (Al3) filter	Range Unit Default		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 (Al3) overvoltage setup	Range	Unit Default		Related control mode	
		0 to 100	0.1 V	0	PSTF	

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	Relat control r	
		0 to 2097152	Command unit	10	Р	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)	Range	Unit	Default	Re	lated ol mo	
F14.32	output setup	0 to 10	_	0	Р		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.

[Class 4] I/F monitor setting

Default: []

	Pr4.33	INP hold time	Range	Unit	Default		lated ol mode
			0 to 30000	1 ms	0	Р	F

Set up the hold time when Pr4.32 Positioning complete output setup = 3.

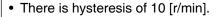
Setup value	State of positioning complete signal
[0] The hold time is maintained definitely, keeping ON state until the next positional command is received.	
1 to 30000	ON state is maintained for setup time (ms) but switched to OFF state as the positional command is received during hold time.

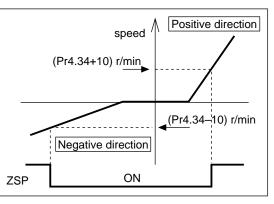
Pr4.34	Zero-speed	Range	Unit	Default	Related control mode	е
		10 to 20000	r/min	50	PSTF	=]

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.

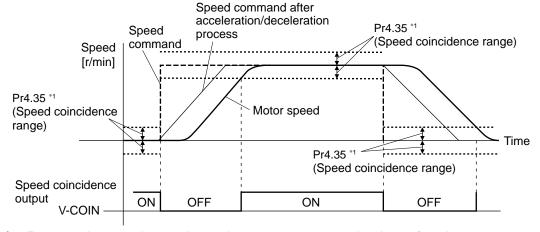




Pr4.35	Speed coincidence range	Range	Unit	Default	control mode
F14.33		10 to 20000	r/min	50	ST

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.

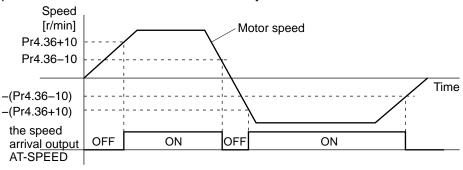


*1 Because the speed coincidence detection is associated with 10 r/min hysteresis, actual detection range is as shown below.

Speed coincidence output OFF \rightarrow ON timing (Pr4.35 - 10) r/min Speed coincidence output ON \rightarrow OFF timing (Pr4.35 + 10) r/min

[Class 4] I/F monitor setting

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.

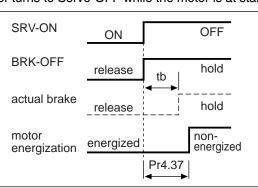


Pr4.37 Mechanical brake action at stalling setup Range Unit Default Related control mode 0 to 10000 1 ms 0 P S T F

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.

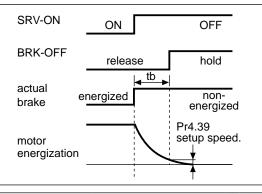


Pr4.38 Mechanical brake action at running setup Range Unit Default Related control mode 0 to 32000 1 ms 0 P S T F

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.

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.

Set up to prevent the brake deterioration



Note

- A parameter is designated as follows: Class Pro.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 ..:

[Class 4] I/F monitor setting

Default: []

Pr4.39	Brake release speed setup	Range	Unit	Default			ated	d ode
Pr4.39		30 to 3000	r/min	30	Р	S	Т	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
P14.40	Selection of alarm output 1	0 to 40	_	0	PSTF
Dr.4.44	Selection of alarm output 2	Range	Unit	Default	Related control mode
Pr4.41		0 to 40	_	0	PSTF

Select the type of alarm issued as the alarm output 1 or 2.

Setup value Alarm Content		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.

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 Por description of "command unit" and "encoder unit", refer to P.4-52 "Pr5.20".

- Note
- A parameter is designated as follows: Class Pro.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 ..:

[Class 4] I/F monitor setting

Default: []

Pr4.44	Position compare output pulse width setting	Range	Unit	Default	Related control mode
	3	0~32767	0.1 ms	0	PSTF

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
F14.45		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
()	Output photocoupler for SO 1 to 6 will turn ON during pulse output and OCMP 1 to 4
· ·	will be L level respectively.
	Output photocoupler for SO1 to 6 will turn OFF during pulse output and OCMP 1 to 4
1	will be H level respectively,
	Use 0 normally.

Pr4.47	Pulse output select	Range	Unit	Default	Related control mode
P14.41	Pulse output select	0~7	_	0	PSTF

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.

		Range	Unit	Default	Rela	ated I mod	е
Pr4.48	Position compare value 1	-2147483648 to 2147483647	Command unit	0	Р	F	=

Sets comparison value for position compare 1.

[Class 4] I/F monitor setting

Default: []

Р			Range	Unit	Default	Relate control m	
	Pr4.49	Position compare value 2	-2147483648 to 2147483647	Command	0	Р	F
		Sets comparison value for position compare 2.	21111100011			1 1 1	

	4.50 Position compare value 3	Range	Unit	Default	Related control mode	
Pr4.50		-2147483648 to 2147483647	Command unit	0	Р	F
	Sets comparison value for position compare 3.					

	Position compare value 4	Range	Unit	Default	Relate control m	
Pr4.51		-2147483648 to 2147483647	Command unit	0	Р	F
	Sets comparison value for position compare 4.					

	Position compare value 5	Range	Unit	Default	Relat	
Pr4.52		-2147483648 to 2147483647	Command unit	0	Р	F
	Sets comparison value for position compare 5.					

		Range	Unit	Default	Relat control r	
Pr4.53	Position compare value 6	-2147483648 to 2147483647	Command unit	0	Р	F
	Sets comparison value for position compare 6.					

	Position compare value 7	Range	Unit	Default	Related control mo		de
Pr4.54		-2147483648 to 2147483647	Command unit	0	Р		F
	Sets comparison value for position compare 7.						

	Position compare value 8	Range	Unit	Default		Related control mode	
Pr4.55		-2147483648 to 2147483647	Command unit	0	Р		=
	Sets comparison value for position compare 8.				. ,		

D=4.50	Position compare output delay compensation amount	Range	Unit	Default		elate rol m	ed node
Pr4.56		-32768 to 32767	0.1us	0	Р		F
Compensates position compare output delay caused by the circuit.							

1. Details of parameter [Class 4] I/F monitor setting

Pr4.57	Position compare output assignment setting	Range	Unit	Default	R cont	elate rol m	
		-2147483648 to 2147483647	Command unit	0	Р		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)

4

Setup

1. Details of parameter

[Class 5] Enhancing setting

Default: []

	Pr5.00	2nd numerator of electronic goor	Range	Unit	Default	Related control mode
		2nd numerator of electronic gear	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	
	P15.03	Denominator of pulse output division	0 to 8388608		0	PSTF
	For details, refer to P.4-11.					

	Pr5.04 * Over-travel inhibit input setup		Range	Unit	Default	Related control mod			
	113.04	Over-traver initibit input setup		0 to 2	_	1	PSTF		
	Set up the operation of the run-inhibition (POT, NOT) inputs.								
		Setup value	Operation						
		0	POT → Inhibit positive direction tr						
	NOT → Inhibit negative direction travel								
ĺ		[1]	Disable POT, NOT						
ĺ		2	POT or NOT input activates Err38	.0 Run-inhibition in	nout protec	tion.			

[Class 5] Enhancing setting

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]	Dynamic brake action	Torque command=0 towards inhibited direction	Hold*2
0	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.

[Class 5] Enhancing setting

Default: []

Pr5.06	Sequence at Servo-Off	Range	Unit	Default	Related control mode
		0 to 9		0	PSTF

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	PSTF

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.

[Class 5] Enhancing setting

Pr5.08	LV trip selection at main power OFF	Range	Unit	Default	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.
hit 4	0	Main power supply Off warning detects only on Servo On conditions.
bit 1	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
F13.09	Detection time of main power on	20 to 2000	1 ms	70	PSTF

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 of clarm	Range	Unit	Default	Related control mode
P15.10	Sequence at alarm	0 to 7	_	0	PSTF

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.

[Class 5] Enhancing setting

Default: []

Pr5.11	Torque setup for emergency stop	Range	Unit	Default	cont	elated rol m		
F13.11	Torque setup for emergency stop	0 to 500	%	0	PS	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
F15.12	Over-load level setup	0 to 500	%	0	PSTF
Deleted new *a	 You can set up the over-load level of effective by setting up this to 0. Use this with 0 setup in normal operation. Set the over-load level. The setup value of this parameter is limited by the control of the setup value of this parameter is limited by the control of the setup value of this parameter is limited by the control of the setup value of this parameter is limited by the control of the setup value of this parameter is limited by the control of the setup value of this parameter is limited by the control of the setup value of this parameter is limited by the control of the setup value of the setup value of this parameter is limited by the control of the setup value of this parameter is limited by the setup value of the setup value v	et up other value by 115[%] of the	e only whe	en you need	
Related page ·:	The over-load protection time characteristics	are described o	n P.6-17.		

	Pr5.13	Over speed level setup	Range	Unit	Default	Related control mode					
	F13.13	Over-speed level setup	0 to 20000	r/min	0	PSTF					
 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		trol n	ed node
P13.14	working range setup	0 to 1000	0.1 revolution	10	Р	S 1	ГГ
	 You can set up the movable range of the mot When the motor movement exceeds the set will be triggered. 			•		•	

Pr5.15 *	I/E roading	filtor	Range	Unit	Default	Related control mode
P15.15	Pr5.15 * I/F reading filter		0 to 3	_	0	P S T F
	Select readin	g period of the control input signa	al.			
	Setup value	Reading period of the signal.				
	[0]	0.25 ms				
	1	0.5 ms				
	2	1 ms				
	3	2 ms				
	Exclude devia	ation counter clear input (CL) and	I command pulse	e inhibit in	put (INH).	

Pr5.16 *	Alarm clear input setup	Range	Unit	Default	Related control mode
	Alarm Clear input Setup	0 to 1	_	0	PSTF

Setup value	Recognition time
[0]	120 ms
1	To Pr5.15 IF reading filter

When in Trouble

1. Details of parameter

[Class 5] Enhancing setting

Default: []

P13.17 Counter clear input mode 0 to 4 — 3 P	Pr5.17	Counter clear input mode	Range	Unit	Default	Rela control	
	P15.17	Counter clear input mode	0 to 4	_	3	Р	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	Range	Unit	Default	Rela contro	ated I mode
	input	0 to 1		1	Р	F

Select command pulse inhibit input enable/disable.

Setup value	INH input
0	Valid
[1]	Invalid

Pr5.19 *	Command pulse inhibit input reading	Range	Unit	Default	Relate control n			
	setup	0 to 5	_	0	Р		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 Pro.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 ..:

Default: []

Pr5.20 *	Position setup unit coloct	Range	Unit Defa	Default	Related control mode			
	Position setup unit select	0 to 1		0	Р		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 $\times \frac{2^{23}}{10000}$ = encoder unit.

Pr5.21	Selection of torque limit	Range	Unit	Default	Related control mode
		0 to 6	_	1	PS 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 li	mit (Pr0.13)		
2	1st torque limit (Pr0.13)	2nd torque limit (Pr5.22)		
3	•	SEL OFF → 1st torque limit (Pr0.13) 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)		
	TL-SE	L OFF		
	1st torque limit (Pr0.13)	2nd torque limit (Pr5.22)		
6	TL-SE	EL 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
	2nd torque limit	0 to 500	%	500	PS 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	Rela control	
		0 to 4000	ms/100 %	0	PS	F

Specify the rate of change (slope) from 1st to 2nd during torque limit switching.

[Class 5] Enhancing setting

Default: []

	Pr5.24	Torque limit switching setup 2	Range	Unit	Default		Relate trol m	
			0 to 4000	ms/100 %	0	Р	S	F
	Specify the rate of change (slope) from 2nd to 1st during torque limit switching.							

F	Pr5.25	External input positive direction	Range	Unit	Default		elate trol m	
	FIJ.2J	torque limit	0 to 500	%	500	P	S	F
		Set up positive direction torque limit upon recollimit set at 6. The value of parameter is limited to the maxim	J			of to	rqu	Э

Note For details of torque limit value, refer to P.2-84.

Pr5.26	External input negative direction	Range	Unit	Default	Related control mode		
113.20	torque limit	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	1.					

Pr5.27	Input gain of analog torque limit	Range	Unit	Default		Relate itrol m	ed node	
	Pro.27 Input gain of analog torque limit		10 to 100	0.1 V/100 %	30	Р	S	F
		From the voltage [V] applied to the analog torgain to torque limit [%].	que limit input (F	P-ATL, N-/	ATL), set cor	nve	rsio	n

Note

- A parameter is designated as follows: Class Pro. 00 Parameter No. For parameters which No. have a suffix of " * ", changed contents will be validated when you turn on the control power.

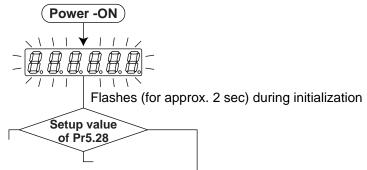
Related page .:

[Class 5] Enhancing setting

Default: []

Pr5.28 *	LED initial status	Range	Unit	Default	Rel contro		
P13.20	LED IIIItiai Status	0 to 42	_	1	PS	Т	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	Lontent	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	Range	Unit	Default	Related control mode
P15.29	RS232 communication	0 to 7	_	2	PSTF

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	Range	Unit	Default	Related control mode
P13.30	RS485 communication	0 to 7	_	2	PSTF

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.

[Class 5] Enhancing setting

Default: []

Pr5.31 *	Axis address	Range	Unit	Default	Related control mode
F13.31		0 to 127	_	1	PSTF

During communication with the host (e.g. PC) to control multiple shafts, the shaft being accessed by the host should be identified.

Note V

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 mod	
P13.32	Command puise input maximum setup	250 to 4000	k pulse/s	4000	Р	F

Set the maximum number of pulses to be used as command pulse input. If the number of input pulses exceeds the setup value \times 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.

Dr.E. 22 cotting rongs	Digita	al filter
Pr5.32 setting range	Pr0.05=0,2	Pr0.05=1
250	400 ns 2-time reading	400 ns 2-time reading
251 to 499	2	200 ns 2-time reading
500 to 999	200 ns 2-time reading	100 ns 2-time reading
1000 to 2999	200 fis 2-time reading	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
	1 13.33	l disc regenerative output inint setup	0 to 1	_	0	PSTF
Enable/disable detection of Err28.0 Pulse		Setup value		Content		
		regenerative limit protection.	[0]	Invalid		
			1	Valid		

Pr5.34	For manufacturer's use	Range	Unit	Default	lated ol mod
		_		4	
	Fixed to 4.				

	Pr5.35 *	Front panel lock setup	Range	Unit	Default	Related control mode
			0 to 1	_	0	PSTF
		Lock the operation on the front panel.	Setup value	ue Content		
			[0]	No limit on the front panel operation		eration
			1	Lock the operation on the front panel		
L	,					

Note

- A parameter is designated as follows: Class Pro.00 Parameter No.
- For parameters which No. have a suffix of " * ", changed contents will be validated when you turn on the control power.

[Class 5] Enhancing setting

Default: []

	Pr5.36 For manufacturer's use	Range	Unit	Default	Related control mode	
		For illanulacturer's use	_		0	
	Fixed to 0.					

Pr5.37 *	Modbus connection setting	Range	Unit	Default	Related control mode
	F13.31	modbus connection setting	0 to 2	_	0

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
F15.39	woodbus response waiting time	0 to 10000	ms	0	PSTF

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).

Dr.E. 40	r5.40 Modbus communication timeout time	Range	Unit	Default	Related control mode
Pr5.40		0 to 10000	ms	0	PSTF

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.					

[Class 5] Enhancing setting

Default: []

Pr5.42 Modbus broadcast setting	Modbus broadcast sotting	Range	Unit	Default	Related control mode
	Modbus broadcast setting	-32768 to 3276	ms	0	PSTF

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 $5.31 \times Pr 5.39$ [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	Range	Unit	Default		Related control mode	
P15.45	compensation value	-1000 to 1000	0.1%	0	Р	F	

To set positive direction high-precision torque compensation value for quadrant projection.

Pr5.46	Quadrant projection negative direction	Range	Unit	Default	Rela contro	ated mode
F15.40	compensation value	-1000 to 1000	0.1%	0	Р	F

To set negative direction high-precision torque compensation value for quadrant projection.

Pr5.47	Quadrant projection compensation delay	Range	Unit	Default	Rel	ated I mode
P15.47	time	0 to 1000	ms	0	Р	F

To set compensation timing delay time for quadrant projection.

	Pr5.48	Quadrant projection compensation filter	Range	Unit	Default	Related control mode	е
	Pr3.46	setting L	0 to 6400	0.01 ms	0	PF	-
Г							П

To set compensation value LPF time constant for quadrant projection.

Pr5.49	Quadrant projection compensation filter	Range	Unit	Default		lated ol mode	4
P13.49	setting H	0 to 1000	0.1 ms	0	Р	F	

To set compensation value HPF time constant for quadrant projection.

[Class 5] Enhancing setting

Default: []

					Doladii. []
Pr5.50	For manufacturer use	Range	Unit	Default	Related control mode
F13.30	For manufacturer use	_	_	0	
Dr.E. 54	For manufacturer use	Range	Unit	Default	Related control mode
Pr5.51	For manufacturer use	_	_	0	
D*E 50	For manufacturer use	Range	Unit	Default	Related control mode
Pr5.52	For manufacturer use	_	_	0	
D=E E2	For manufacturer use	Range	Unit	Default	Related control mode
Pr5.53		_	_	0	
Pr5.54	For manufacturer use	Range	Unit	Default	Related control mode
P13.34	For illaliulacturer use	_	_	0	
Pr5.55	For monufacturer's use	Range	Unit	Default	Related control mode
P10.00	For manufacturer's use	_	_	0	
	Pleses fixed to 0.				

	Pr5.56	Slow stop deceleration time setting	Range	Unit	Default	Related control mode
			0~10000	ms/ (1000r/min)	0	P
		Sets deceleration time for immediate stop dece This parameter will become valid when Pr6.10	•			

	Pr5.57	Slow stop S-shape acceleration and	Range	Unit	Default	Related control mode	
Pro.57	Pro.57	deceleration setting	0~1000	ms	0	P	
		Sets the S-shape time for immediate stop dece This parameter will become valid when Pr6.10	•				

	Pr5.58	Modbus mirror register setting 1	Range	Unit	Default _c		Related control mode		
			-32768 to 32767		24591	Р	S	Т	F
	Sets register address linked to Modbus register address 4418h "Mirror register 1."								

	Pr5.59	Modbus mirror register setting 2	Range	Unit	Default	Related control mode			
			-32768 to 32767	_	24592	PSTF			
	Sets register address linked to Modbus register address 4419h "Mirror register 2."								

DE. 00	Modbus mirror register setting 3	Range	Unit	Default	Related control mode			
Pr5.60		-32768 to 32767	_	16421	PSTF			
Sets register address linked to Modbus register address 441Ah "Mirror register 3."								

Note Related page ·:

• A parameter is designated as follows: Class Pro. 00 Parameter No.
• For parameters which No. have a suffix of " * ", changed contents will be validated when you turn on the control power.

[Class 5] Enhancing setting

Default: []

D=5 C4	Modbus mirror register setting 4	Range	Unit	Default	Related control mode				
Pr5.61		-32768 to 32767	_	24613	PSTF				
	Sets register address linked to Modbus register address 441Bh "Mirror register 4."								

DE. CO	Modbus mirror register setting 5	Range	Unit	Default	Related control mode				
Pr5.62		-32768 to 32767		17429	PSTF				
	Sets register address linked to Modbus register address 441Ch "Mirror register 5."								

DE CO	Madhua miman na miatan aattin m C	Range	Unit	Default	Related control mode
Pr5.63	Modbus mirror register setting 6	-32768 to 32767	_	17418	PSTF
	Sets register address linked to Modbus register	r address 441Dh	"Mirror re	egister 6."	

	Pr5.64 Modbus mirror register setting 7	Modbus mirror register setting 7	Range	Unit	Default	con	trol r		e
		-32768 to 32767	_	17427	Р	s	T	:	
		Sets register address linked to Modbus registe	r address 441Eh	"Mirror re	egister 7."				

DE CE		Range	Unit	Default	Related control mode
-3	-32768 to 32767	_	17419	PSTF	
	Sets register address linked to Modbus register	r address 441Fh	"Mirror re	egister 8."	

DE CC	Deterioration diagnosis convergence	Range	Unit	Default	control mode
Pr5.66	judgment time	0 to 10000	0.1s	0	PSTF
	Sets time for deemed convergence of real-tir	me auto tuning	load char	acteristics	estimate
	when deterioration diagnosis warning function	is valid (Pr6.97 b	oit 1 = 1)		

DC 07	Deterioration diamento in ortic metic more limit	Range	Unit	Default	Related control mode
Pr5.67	Deterioration diagnosis inertia ratio upper limit	0 to 10000 % 0 P S T	PSTF		
DE 00	Barata di Araba di Ar	Range	Unit	Default	Related control mode
Pr5.68	Deterioration diagnosis inertia ratio lower limit	0 to 10000	%	0	PSTF

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).

D=5 00	Deterioration diagnosis unbalanced load	Range	Unit	Default	Related control mode
Pr5.69	upper limit	-1000 to 1000	0.1%	0	PSTF
D. 5 70	Deterioration diagnosis unbalanced load	Range	Unit	Default	Related control mode
Pr5.70	lower limit	-1000 to 1000	0.1%	0	PSTF

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).

[Class 5] Enhancing setting

Default: []

D#E 74	Deterioration diagnosis dynamic friction	Range	Unit	Default	Related control mode
Pr5.71	upper limit	-1000 to 1000	0.1%	0	PSTF
D=F 70	Deterioration diagnosis dynamic friction	Range	Unit	Default	Related control mode
Pr5.72	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).

	Deterioration diagnosis viscous friction	Range	Unit	Default	Related control mode
Pr5.73	upper limit	0~10000	ms/ (10000r/min)	0	PSTF
	Deterioration diagnosis viscous friction	Range	Unit	Default	Related control mode
Pr5.74	lower limit	0~10000	ms/ (10000r/min)	0	PSTF

Sets the upper and lower limit values for viscous friction coefficient estimate in deterioration diagnosis judgment of load characteristics estimate after completion of convergence, when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1).

Pr5.75 Deterioration diagnosis velocity setting Range Unit Default Related control mode -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 $Pr5.75\pm Pr4.35$ (velocity coinciding width), when deterioration diagnosis warning is valid (Pr6.97 bit 1 =1).

D 5 70		Range	Unit	Default	Related control mode
Pr5.76	Deterioration diagnosis torque average time	0~10000	ms	0	PSTF

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.

D=5 77	Dataria antica di anno ain tanno a sun an limit	Range	Unit	Default	Related control mod	de
Pr5.77	Deterioration diagnosis torque upper limit	-1000 to 1000	0.1%	0	PSTF	F
D.:E 70	Dataria rationalia managia taman di la	Range	Unit	Default	Related control mod	ek
Pr5.78	Deterioration diagnosis torque lower limit	-1000 to 1000	0.1%	0	PSTF	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 Pro.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 …

[Class 5] Enhancing setting

Default: []

D=5 70	Madhaa miman na miatan a attina 0	Range	Unit	Default	Related control mode
Pr5.79	Modbus mirror register setting 9	-32768 to 32767	to 32767 — 17410	PSTF	
	Sets register address linked to Modbus registe	r address 4420h	"Mirror re	gister 9."	

DE 00		Range	Unit	Default	Related control mode
Pr5.80		-32768 to 32767	_	17411	PSTF
	Sets register address linked to Modbus register	r address 4421h	"Mirror re	egister 10."	

D-5 04	Pr5.81 Modbus mirror register setting 11	Range	Unit	Default	cor		ated mo		
Pr5.81		-32768 to 32767	_	16398	Р	S	Т	F	
Sets register address linked to Modbus register address 4422h "Mirror register 11."									

DE 00	.82 Modbus mirror register setting 12	Range	Unit	Default	R	elate rol m		
Pr5.82		-32768 to 32767	_	16402	P	зТ	F	
Sets register address linked to Modbus register address 4423h "Mirror register 12."								

D#E 02	Modbus mirror register setting 13	Range	Unit	Default	Relate control m				
Pr5.83		-32768 to 32767		16411	PST	F			
Sets register address linked to Modbus register address 4424h "Mirror register 13."									

D-5 04	Modbus mirror register setting 14	Range	Unit	Default	Related control mode			
Pr5.84		-32768 to 32767		16405	PSTF			
Sets register address linked to Modbus register address 4425h "Mirror register 14."								

DE 05	Modbus mirror register setting 15	Range	Unit	Default			ated mo	
Pr5.85		-32768 to 32767	_	16406	Р	S	Т	F
Sets register address linked to Modbus register address 4426h "Mirror register 15."								

D.: 5 00	M - II	Range	Unit	Default	Related control mode				
Pr5.86 Modbus mirror register setting 16	-32768 to 32767	_	0	PSTF					
Sets register address linked to Modbus register address 4427h "Mirror register 16."									

Note

- A parameter is designated as follows: Class Pro. 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"

Setup

1. Details of parameter

[Class 6] Special setting

Default: []

Pr6.00	Analog torque feed forward conversion	Range	Unit	Default	Related control mode
F10.00	gain	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 (%) = $100 \times \text{input voltage (V)} / (\text{Pr}6.00 \text{ setup value} \times 0.1)$

Pr6.02	Velocity deviation excess setup	Range	Unit	Default	Related control mode
P10.02		0 to 20000	r/min	0	Р

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				
	F10.04	Jog thai run command speed	0 to 500	r/min	300	PSTF				
	Set up the command speed used for JOG trial run (velocity control).									

Before using, refer to P.4-66 Preparation Trial Run.

Pr6.05	Position 3rd gain valid time	Range	Unit	Default	Relate control m	
F10.05	Position 3rd gain valid time	0 to 10000	0.1 ms	0	P	F
	 Set up the time at which 3rd gain becomes value. When not using this parameter, set Pr6.05 to This is valid for only position control/full-close. 	0 and Pr6.06 to	100.			

Pr6.06 Position 3rd gain scale factor	Range	Unit	Default	Related control mode				
	Fosition 3rd gain scale factor	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 								



- A parameter is designated as follows: Class Pro.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"

[Class 6] Special setting

Default: []

Pr6.07	Torque command additional value	Range	Unit	Default	Related control mode				
P10.07		-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	Range	Unit	Default		ated I mode
F10.00		value	-100 to 100	%	0	Р	F
		 Set up the dynamic friction compensation va forward positional command is fed. 	lue to be added	to the tor	que commai	nd wł	nen

• Update this parameter when the friction compensation mode for real time auto-tuning is valid.

Pr6.09		Negative direction torque compensation	Range	Unit	Default	contr	rol mo	de	
110.09		value	-100 to 100	%	0	Р		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	
	Function expansion setup	-32768 to 32767	_	16	PSTF

Set up the function in unit of bit.

	Function	Setup	value
	Function	[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).

[Class 6] Special setting

Default: []

Pr6.11	Current response setup	Range	Unit	Default	Related control mode
P10.11	Current response setup	10 to 100	%	100	PSTF

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.

 $Pr6.13 = (load inertia/rotor inertia) \times 100 [%]$

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 selectionRangeUnitDefaultRelated control mode0 to 1-0P 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 *	Dower up weit time	Range	Unit	Default	Related control mode	
	P10.10	Power-up wait time	0 to 100	0.1s	0	PSTF

Set up the standard initialization time (1.5 s + α) after power-up.

For example, when setup value is 10, then 1.5 s + $(10 \times 0.1 \text{ s})$ = approx. 2.5 s.

[Class 6] Special setting

Default: []

Ore 10 * Encoder 7 phase setup	e Unit	Default	control mode
Pr6.19 * Encoder Z phase setup 0 to 327	767 pulse	0	PSTF

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.

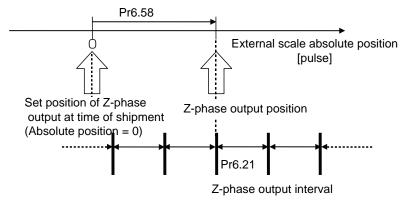
Pr6.21 *Serial absolute external scale Z phase setupRangeUnitDefaultRelated control mode0 to 228pulse0F

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 \neq 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.



[Class 6] Special setting

Default: []

Pr6.22 *	A, B phase external scale pulse output	Range	Unit	Default	cont	elate rol m	-
	method selection	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	PS F	
Sets the compensation gain for the load fluctuation.						

Pr6.24	Load fluctuation compensating filter	Range Unit	Default	Related control mode			
	Load nucluation compensating inter	10 to 2500	0.01 ms	53	Р	S	F
	Sets the filter time constant for the load fluctuation.						

Pr6.27 *	Alarm latch time selection	Range	Unit	Default	Related control mode	
	Alarm latch time selection	0 to 10	_	5	PSTF	

Set up the latch time.

Setup value	Conte	nt	
0	Latch time: infinite		
1		1 [s]	
2		2 [s]	
3		3 [s]	
4		4 [s]	
[5]	Latch time	5 [s]	
6	Latentime	6 [s]	
7		7 [s]	
8		8 [s]	
9		9 [s]	
10		10 [s]	

Pr6.28 *	Special function selection	Range	ge Unit Default	Default	control mode		
	Special function selection	0 to 1 — 0	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 Pro. 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"

[Class 6] Special setting

Default: []

	Pr6.30	For manufacturer's use	Range	Unit	Default	Related control mode	
		FOI IIIdiiuidCturer 5 use	<u> </u>	_	0		
	Fixed to 0.						

Pr6.31 R	Bool time oute tuning actimation and	Range	Unit	Default	Related control mode
	Real time auto tuning estimation speed	0 to 3	_	1	PSTF

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

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Related page ..:

Default: []

Pr6.32 Real time auto tuning custom setup	Range	Unit	Default	Related control mode
	Real time auto turning custom setup	-32768 to 32767	_	0

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.

Bit	Content		Description			
		Enable/disabl	e the load characteristics estir	nation fu	nction.	
		Setup value	Function			
		[0]	Disable			
		1	Enable			
1 to 0	Load char- acteristics estimation *	 * 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). Set up update to be made based on result of the load characteristics 				
	Set up update to be made based on result of the load characteristics estimation of Pr0.04 Inertia ratio.					eristics
		Setup value	Function			
3 to 2	Inertia ratio	[0]	Use the current setup.			
3 10 2	update	1 Update by the estimated value.				
		measurem	the inertia ratio update, set Eent) to 1 (enable). The inertins settings are made valid.		•	
		characteristi value, Pr6.08	update to be made accordics estimation of Pr6.07 Too positive direction torque compensation value.	rque cor pensatio	mmand a	dditional
		Setup value	Function	Comp	ensation	setup
		[0]	Use current setup	Pr6.07	Pr6.08	Pr6.09
		1	Disable torque compensation		0 clear	0 clear
6 to 4	Torque	2	Vertical axis mode	Update	0 clear	0 clear
	compensation	3	Friction compensation (low)	Update	Low	Low
		4	Friction compensation (middle)	Update	Middle	Middle
		5	Friction compensation (high)	Update	High	High
			the torque compensation (set te) to 1 (enable). It is not po pensation.			

(continued)



- A parameter is designated as follows: Class Pro. 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"

[Class 6] Special setting

Default: []

			e the basic gain setup to be made a o tuning mechanical stiffness select	-
		Setup value	Function	
7	Stiffness	[0]	Disable	
,	setup	1	Enable	
		* To set this	setting to a value other than 0, se	t Bits 3-2 (Inertia ratio
		update) to	1 (enable). Inertia ratio is enabled/o	disabled by the setting
		of Bits 1 an	d 0 (load characteristics measurem	ent).
		Enable/disable	the change of parameter that is norm	ally set at a fixed value.
		Setup value	Function	
	Fixed	[0]	Use the current setup.	
8	parameter	1	Set to a fixed value.	
	setup	* To set this	setting to a value other than 0, se	t Bits 3-2 (Inertia ratio
		update) to	1 (enable). Inertia ratio is enabled/o	disabled by the setting
		of Bits 1 an	d 0 (load characteristics measurem	ent).
			n switching related parameter to be	used when the real
		time auto tuni	ng is enabled.	
		Setup value	Function	
	Gain	[0]	Use the current setup.	
10 to 9	switching	1	Disable gain switching.	
	setup	2	Enable gain switching.	
		* To set this	setting to a value other than 0, set	t Bits 3-2 (Inertia ratio
		update) to	1 (enable). Inertia ratio is enabled/o	disabled by the setting
		of Bits 1 an	d 0 (load characteristics measurem	ent).



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 Pro.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 .:

[Class 6] Special setting

Default: []

Pr6.33	For manufacturer's use	Range	Unit	Default	Rel	lated ol mo	
Pr6.33	i oi illallulactulei s use	<u> </u>	1000				
	Fixed to 1000.						

Pr6.34	Hybrid vibration cumproccion gain	Range	Unit	Default	Related control mode
P10.34	Hybrid vibration suppression gain	0 to 30000	0.1 /s	Default 0	F
	<u> </u>			•	

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	Rela contro	elat trol r		e
F10.33	Hybrid vibration suppression filter	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	
	Dynamic brake operation input	0 to 1	_	0	PSTF

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
F10.37	Oscillation detecting level	0 to 1000	0.1 %	0	PSTF

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 Pro.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"

[Class 6] Special setting

Default: []

Pr6.38 *	Alarm mask setup	Range Unit	Default	Related control mode	
	Alami mask setup	-32768 to 32767	_	4	PSTF
Pr6.39	Alarm mask setup 2	Range	Unit	Default	Related control mode
F10.39	Alailii illask setup 2	-32768 to 32767	_	0	PSTF

Set up the alarm detection mask. Placing 1 to the corresponding bit position disables detection of the alarm condition.

Warning	Marning name	bit	
number	Warning name	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		Relate trol r	ed node
F10.41	And-vibration depth 1	0 to 1000	_	0	Р		F

Set the anti-vibration depth of 1st damping function.

Pr6.42	Two-stage torque filter time constant	Range	Unit	Unit Default	
P10.42	Two-stage torque inter time constant	0 to 2500	0.01 ms	0	PSTF

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
	Two-stage torque filter attenuation term	0 to 1000		0	PSTF
	Set the attenuation term of 2-stage torque filte	r.			

Note

- A parameter is designated as follows: Class Pro.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 …

[Class 6] Special setting

Default: []

Pr6.47*	Function expansion settings 2	Range	Unit	Default	Related control mode
	runction expansion settings 2	-32768 to 32767 — 1	1	PSTF	

Set up the function in unit of bit.

		Setup	value	
	Function	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 bitO.

^{*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).

		Range	Unit	Default	Related control mode
Pr6.48	Adjust filter	0 to 2000	0.1 ms	Size A:11 Size B,C:12 Size D,E,F:17	PS 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	Unit	Default		Related control mode	
F10.49	Aujustriorque commanu attenuation term	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 $\ \square$ 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 $\mathbb{I} = 1.0$, adjustment filter 1 = 0.71:

Setup value = 75 1st digit = 5 (\mathbb{I} = 1.0), 2nd digit = 7 (\mathbb{I} = 0.71)

Pr2.22 Command smoothing filter is applied as time constant of command filter.



- A parameter is designated as follows: Class Pro.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"

^{*}Regarding bit3 (two-degree-of-freedom control real-time auto tuning selection), the function is available only when bitO is set to 1: Enabled.

When in Trouble

1. Details of parameter

[Class 6] Special setting

Default: []

Pr6.50	Range	Range	Unit	Default	Related control mode
	Viscous friction compensation gain	0 to 10000	0.1 %/ (10000 r/min)	0	P S F
	Command velocity is multiplied by this se command as compensation value.	tting and the r	esult is a	dded to the	torque
The unit is [Rated torque 0.1 %/(10000 r/min)].					

Pr6.51	Immediate cessation completion wait time	Range	Unit	Default	control mode
F10.31	ininediate cessation completion wait time	0 to 10000	ms	0	P S T F
	When immediate stop alarm is occurs, turn of	f brake release	output (E	BRK-OFF) and	d set the

time during which the current flows through the motor.

Pr6.52	For manufacturer's use	Range	Unit	Default	Related control mode
Pro.52	FOI Illanulactuler's use	_	_	0	
	Fixed to 0.				

	Pr6.53	For manufacturer's use	Range	Unit Default			Related control mode		
		For illalitiacturer's use	_	- - 0	0				
		Fixed to 0.							

Pr6.54	For manufacturer's use	Range	Unit	Default	Related control mode
Pro.54		1	_	0	
	Fixed to 0.				

Note

- A parameter is designated as follows: Class Pro. 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 ..:

[Class 6] Special setting

Default: []

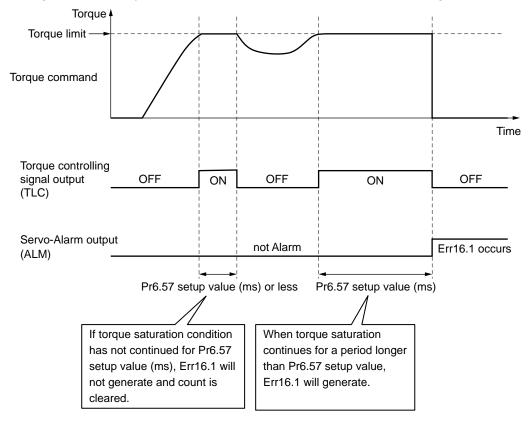
Pr6.57	Torque saturation anomaly detection time	Range	Unit	Default	Related control mod	е
F10.57	Torque Saturation anomaly detection time	0 to 5000	ms	0	P S F	=

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.



D 0 50	Serial absolute external scale Z phase	Range	Unit	Default	Related control mode
Pr6.58	shift amoun	-2147483648 to 2147483647	_	0	PSTF

Sets the absolute position to output external scale Z-phase when serial absolute external scale is used.

Dr6 60	2nd damping filter depth	Range	Unit	Default		lated ol mode
Pr6.60		0 to 1000	_	0	Р	F

Sets the damping depth of the 2nd resonance oppression notch filter.

Note

- A parameter is designated as follows: Class Pro.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 ..:

filter.

[Class 6] Special setting

Default: []

Pr6.61	1st resonance frequency	Range	Unit			ated mode			
		0 to 3000	0.1 Hz	0	Р				
	Sets the resonance frequency for the load of model 1 type vibration control filter.								

Pr6.621st resonance damping ratioRangeUnitDefaultRelated control mode0 to 1000—0P

Sets the resonance damping ratio of the 1st model type resonance oppression notch filter.

	Pr6.63	1st antiresonance frequency	Range	Unit	Default	Rela	ated I mode	,		
			0 to 3000	0.1Hz	0	Р				
	Sets the antiresonance frequency of the 1st model type resonance oppression notch filter.									

Pr6.64	1st antiresonance damping ratio	Range	Unit	Default	contro	ated I mod	е	
		0 to 1000	_	0	Р			
Sets the antiresonance damping ratio of the 1st model type resonance oppression notch								

 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	Р			
	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					
	F10.09	Zilu alitilesolialice dallipilig latio	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 Pro.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 ..:

[Class 6] Special setting

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 mo	
		0 to 1000	_	0	Р	F
			·	`		

Sets the damping depth of the 3rd resonance oppression notch filter.

Pr6.72	4th damping filter depth	Range	Unit	Default	Rel contro	ated I mode		
		0 to 1000		0	Р	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	PS	
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	PS				
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. $(Pr6.75\times32) \ge Pr6.74 > Pr6.75 \ge 1.0 \text{ Hz}$

Pr6.75	Torque compensating frequency 2	Range	Unit	Default		Relate itrol n	ed node
	Torque compensating frequency 2	0 to 5000	0.1Hz	0	Р	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.

 $(Pr6.75\times32) \ge Pr6.74 > Pr6.75 \ge 1.0 \text{ Hz}$

Pr6.76	Number of load estimation	Range	Unit	Default	Related control mode
F10.70		0 to 8	_	0	PS
	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 Pro.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"

When in Trouble

1. Details of parameter

[Class 6] Special setting

Default: []

Pr6.88	Absolute multi-rotation data upper limit	Range	Unit	Default	Related control mode		
		0 to 65534	_	0	PSTF		
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).							

Function ex	xpansion setting 3				control mode
Function expansion setting 3	-2147483648 214748364		0	PSTF	
Sets various function in bit units:					
function			Setup	value	
bit0	Quadrant projection compensation fenhancement	function	0:Invalid	1:valid	
bit1	Deterioration diagnosis warning fund	ction	0:Invalid	1:valid	
bit2	Expansion of Allowable motor opera abnormal protection	ating range	0:Invalid	1:valid	
bit3-31	For manufacturer use. Please set		fixed	to 0.	
	bit0 bit1 bit2 bit3-31	bit0 Quadrant projection compensation of enhancement bit1 Deterioration diagnosis warning fun bit2 Expansion of Allowable motor opera	bit0 Quadrant projection compensation function enhancement bit1 Deterioration diagnosis warning function bit2 Expansion of Allowable motor operating range abnormal protection bit3-31 For manufacturer use. Please set	function Setup bit0 Quadrant projection compensation function enhancement 0:Invalid bit1 Deterioration diagnosis warning function 0:Invalid bit2 Expansion of Allowable motor operating range abnormal protection 0:Invalid bit3-31 For manufacturer use. Please set fixed	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.

			Range	Unit	Default	Related control mode
Pr6.98	Function expansion setting 4	-2147483648 to 2147483647		PSTF		
	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 Pr.0.00 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 7] Special setting

Default: []

Pr7.14	Main newer turn off warning detection time	Range	Unit	Default	Related control mode
P17.14	Main power turn-off warning detection time	0 to 2000	ms	0	PSTF

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
P17.22	Special function enhancement setting 1	-32768 to 32767	_	0	PSTF

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 O is the least significant bit.

All other parameters will be manufacturers use. Please do not change the default parameters.



[•] A parameter is designated as follows: Class Pro.00 Parameter No.

Related page …

^{*}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.

[•] For parameters which No. have a suffix of " * ", changed contents will be validated when you turn on the control power.

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.

Setup

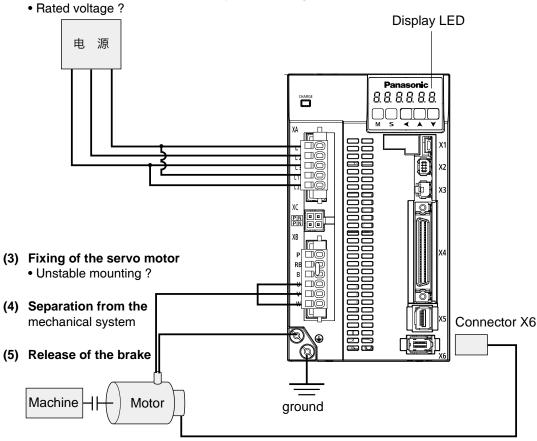
2.Trial Run (JOG run)

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



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



[•] 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.

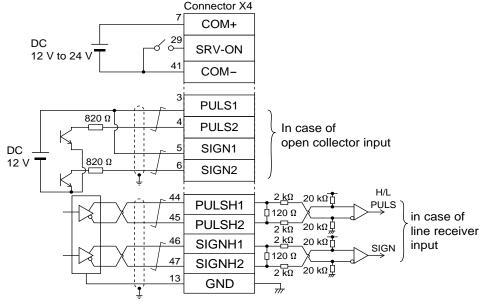
2.Trial Run (JOG run)

Trial Run by Connecting the Connector X4

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

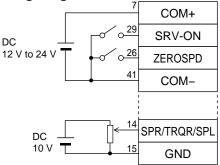
- 1) Connect the Connector X4.
- 2) Enter the power (DC12 V to 24 V) to control signal (COM+, COM-)
- 3) Enter the power to the driver.
- 4) Confirm the default values of parameters.
- 5) Connect the Servo-ON input (SRV-ON, Connector X4, Pin-29) and COM- (Connector X4, Pin-14) to turn to Servo-ON and 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 ├─ eter Setup" (Parameters for Pr3.03: Reversal of speed command input

Refer to P.4-29, 30 "Param-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	
3.01	Speed command rotational direction selection	
3.02	Input gain of speed command Set up as	
3.03	Reversal of speed command input	required
4.22	Analog input 1 (Al1) offset setup	
4.23	Analog input 1 (Al1) 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

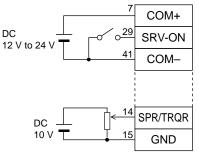
- 1) Connect the Connector X4.
- 2) Enter the power (DC12 V to 24 V) to control signal (COM+, COM-)
- 3) Enter the power to the driver.
- 4) Confirm the default values of parameters.
- 5) Set a lower value to Pr3.07 (4th speed of speed setup).
- 6) Energize the motor by connecting the Servo-ON input (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)

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
3.20	Input reversal of torque command	required
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

2.Trial Run (JOG run)

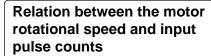
Setup of Motor Rotational Speed and Input Pulse Frequency

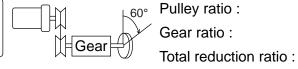
Input pulse frequency	Motor rotational speed	Pr0.08
(pps)	(pps) (r/min)	
2 M	3000	2 ²³ 40000
500 K	3000	2 ²³ 10000
250 K	3000	2 ²³ 5000
100 K	3000	2 ²³ 2000
500 K	1500	2 ²³ 20000

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.

- 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.





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
Pr0.09 Pr0.10	9568256 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^{\circ}}{360^{\circ}} $ $ = \frac{9568256}{3375} $

2 ⁿ	Decimal figure	2 ⁿ	Decimal figures
2 ⁰	1	2 ¹²	4096
2 ¹	2	2 ¹³	8192
2 ²	4	214	16384
2 ³	8	2 ¹⁵	32768
2 ⁴	16	2 ¹⁶	65536
2 ⁵	32	217	131072
2 ⁶	64	218	262144
27	128	2 ¹⁹	524288
2 ⁸	256	220	1048576
2 ⁹	512	2 ²¹	2097152
2 ¹⁰	1024	222	4194304
211	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

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5

Adjustment

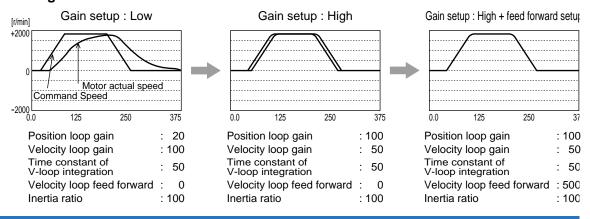
1. Gain Adjustment

Outline

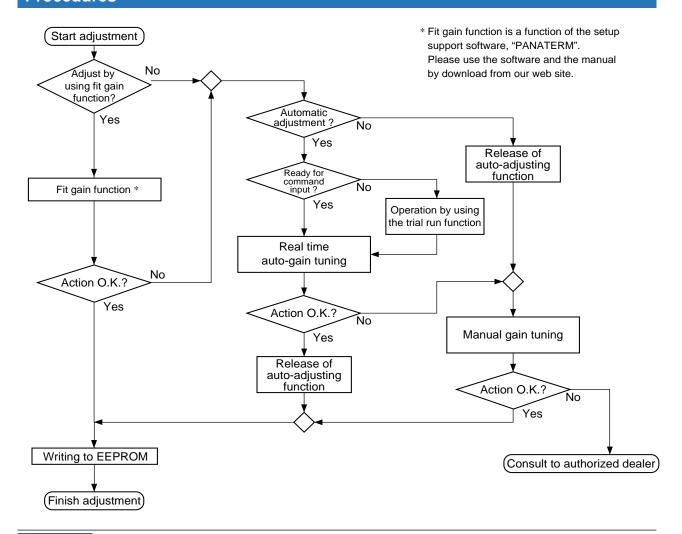
Purpose

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>



Procedures



Note

For safety operation, first adjust the gain by referring to P.6-29 Setup of gain pre-adjustment protection.

1. Gain Adjustment

Outline

Type

Function		Function	Explanation	Pages to refer
	Re	eal-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
Automatic adjustment	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
atic nent	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
	Ma	anual 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
			Adjustment in position control mode	P.5-31
		Pagia procedura	Adjustment in velocity control mode	P.5-32
		Basic procedure	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
Ma		Domning control	Damping control	P.5-41
nue		Damping control	Model-type damping filter	P.5-43
Manual adjustment		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
lent		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.

5

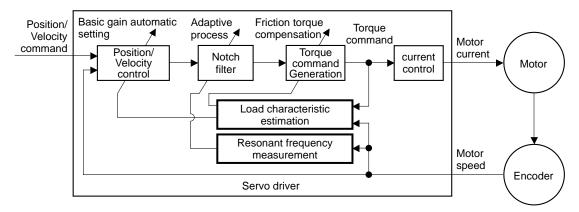
Adjustment

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]. 			

Basic

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.

Real-time auto-gain tuning			
Invalid			
Standard			
Positioning *1			
Vertical axis *2			
Friction compensation *3			
Load characteristic measurement			
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.



• While the auto-tuning is valid, parameters that are to be automatically adjusted cannot be changed.



• 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	
1	01	1st gain of velocity loop	
1	02	1st time constant of velocity loop integration	When stiffness setup is valid, updates the
1	04	1st time constant of torque filter	parameter based on the setup value.
1	05	2nd gain of position loop	Refer to P.5-9 Basic gain parameter setup table.
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	0		
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"

Basic

• 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	maintained.			
1	18	Hysteresis at position control switching	Sets to 33 if the current setting is not			
1	19	Position gain switching time	maintained.			
1	20	Mode of velocity control switching				
1	21	Delay time of velocity control switching				
1	22	Level of velocity control switching				
1	23	Hysteresis at velocity control switching	Sets to 0 if the current setting is not maintained.			
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%.

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 EE-PROM 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.

Basic

Invalidation of Real-Time Auto-Gain Tuning

You can stop the automatic calculation of Pr0.04 (Inertial ratio) and invalidate the realtime auto-gain tuning by setting up Pr0.02 (Real-time auto-gain tuning setup) to 0. Since the estimation result of Pr0.04 "Inertia ratio" remains, and if this parameter becomes clearly abnormal value, manually set to the appropriate value which is obtained from suitable formula or calculation.



Caution : If power is turned off within 30 minutes after the end of tuning process, the result of the real-time auto-tuning is not saved. If the result is not saved, manually write parameters to EEPROM and then turn off power.

Basic gain parameter setup table

		1st	gain		2nd gain				load variation suppression function
	Pr1.00	Pr1.01	Pr1.02	Pr1.04	Pr1.05	Pr1.06	Pr1.07 *2	Pr1.09	Pr6.24
Stiffness	Gain of position loop [0.1 /s]	Gain of velocity loop [0.1 Hz]	Time constant of velocity loop integration [0.1 ms]	Time constant of torque filter [0.01 ms]	Gain of position loop [0.1 /s]	Gain of velocity loop [0.1 Hz]	Time constant of velocity loop integration [0.1 ms]	Time constant of torque filter [0.01 ms]	Load fluctuation compensation filter [0.01 ms]
0	20	15	3700	1500	25	15	10000	1500	2500
1	25	20	2800	1100	30	20	10000	1100	2500
2	30	25	2200	900	40	25	10000	900	2500
3	40	30	1900	800	45	30	10000	800	2500
4	45	35	1600	600	55	35	10000	600	2500
5	55	45	1200	500	70	45	10000	500	2500
6	75	60	900	400	95	60	10000	400	2500
7	95	75	700	300	120	75	10000	300	2120
8	115	90	600	300	140	90	10000	300	1770
9	140	110	500	200	175	110	10000	200	1450
10	175	140	400	200	220	140	10000	200	1140
11 *1	320	180	310	126	380	180	10000	126	880
12	390	220	250	103	460	220	10000	103	720
13 *1	480	270	210	84	570	270	10000	84	590
14	630	350	160	65	730	350	10000	65	450
15	720	400	140	57	840	400	10000	57	400
16	900	500	120	45	1050	500	10000	45	320
17	1080	600	110	38	1260	600	10000	38	270
18	1350	750	90	30	1570	750	10000	30	210
19	1620	900	80	25	1880	900	10000	25	180
20	2060	1150	70	20	2410	1150	10000	20	140
21	2510	1400	60	16	2930	1400	10000	16	110
22	3050	1700	50	13	3560	1700	10000	13	90
23	3770	2100	40	11	4400	2100	10000	11	80
24	4490	2500	40	9	5240	2500	10000	9	60
25	5000	2800	35	8	5900	2800	10000	8	60
26	5600	3100	30	7	6500	3100	10000	7	50
27	6100	3400	30	7	7100	3400	10000	7	50
28	6600	3700	25	6	7700	3700	10000	6	40
29	7200	4000	25	6	8400	4000	10000	6	40
30	8100	4500	20	5	9400	4500	10000	5	40
31	9000	5000	20	5	10500	5000	10000	5	40

^{*1} Default stiffness setting: 13 for frames A, B and C, 11 for frames D, E, F.

^{*2} In the vertical axis mode or friction compensation mode (Pr0.02 = 3, 4), Pr1.07 keeps 9999 (hold) until load characteristics estimation completes.

Note • For details of parameters, refer to P.4-16... "Details of parameter".

Two-degree-of-freedom control mode - Standard type

Outline

In this auto-tuning mode, two-degree-of-freedom control is available in addition to real-time auto tuning basic function.

The standard type is a mode that is suitable for positioning, and the 3rd gain switching and viscous friction compensation are enabled.

The two-degree-of-freedom control mode, standard type, can be used by setting Pr6.47 Function expansion setup 2 to bit 0 = 1 and bit 3 = 0.

Applicable Range

	Real-time auto-tuning condition			
Control Mode Real-time auto-tuning, two-degree-of-freedom control mode, standard can be applied for position control and speed control.				
Others	 Should be in servo-on condition. Input signals, such as deviation counter clear and command input inhibit, and parameters, except for controls such as torque limit setup, are correctly set, assuming that the motor can run smoothly. 			

Caution

Real-time auto-gain tuning may not be executed properly under the conditions described below.

Under these conditions, change the load conditions or operation patterns, or start manual gain tuning (refer to P.5-27 and subsequent).

	Conditions which obstruct real-time auto-gain tuning					
Load inertia	 Load is small or large compared with the rotor inertia (less than 3 times more than 20 times). The load inertia changes. 					
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/1[s] or low). Acceleration/deceleration torque is smaller than unbalanced weighted/ viscous torque. When speed condition of 100 [r/min] or more and acceleration/deceleration condition of 2000 [r/min]/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 other than 0, 6.

Setup value	Real-time auto-gain tuning	Explanation
0	Invalid	Real-time auto-gain tuning function is disabled.
1	Standard response mode	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.



Control parameter is automatically set according to Pr0.03 Real-time auto-tuning stiffness setup.

[Example of real-time auto-tuning setup]

- 1) When performing adjustment focusing on settling time by using PTP control.
 - It is recommended to use quick response mode (Pr0.02 = 2-4). When friction has large effect, use quick response mode 3 (Pr0.02 = 4).
 - The 3rd gain of quick response mode 2 and 3 (Pr0.02 = 3-4) should be doubled for a short time to damp vibration during settling.
 - If Pr0.03 (stiffness setting) is too high, it may cause oscillation during settling time. Observe the settled waveform.
- 2) When locus accuracy is necessary in CP control of machine e.g. processing machine, use the standard mode (Pr0.02 = 1) or quick response mode 1 (Pr0.02 = 2) if higher accuracy is required.
 - When 2 or more axes must be synchronized together, coordinate the stiffness setting (Pr0.03) so that Pr2.22 (command smoothing filter) of all axes have the same value.



 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"

Two-degree-of-freedom control mode - Standard type

- *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.
- 3) When the servo is tuned on, input the action command.
- 4) As the load characteristics are correctly estimated, Pr0.04 Inertia ratio will be 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
 - Pr6.50 Viscous friction compensation gain
 - 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 date to EEPROM.

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.



• 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 by using the load characteristic estimate values.

Class	No.	Title	Function	
0	04	Inertia ratio	Updates this parameter when the real-time auto-tuning is enabled (Pr0.02 = 1 to 4).	
6	07	Torque command additional value	Updates this parameter when the real-time auto-tuning is in the quick response mode 2, 3 (Pr0.02 = 3, 4).	
6	08	Positive direction torque compensation value	Updates this parameter when the real-time	
6	09	Negative direction torque compensation value	·	
6	50	Viscous friction compensation gain		

• Parameters which are updated to setup value corresponding to stiffness setup. The real-time auto-tuning function updates the following basic gain setup parameters according to Pr0.03 Real-time auto-tuning stiffness setup.

Class	No.	Title	Function
1	00	1st gain of position loop	
1	01	1st gain of velocity loop	
1	02	1st time constant of velocity loop integration	When real-time auto-tuning is valid (Pr0.02
1	04	1st time constant of torque filter	= 1 to 4), updates the setup value according
1	05	2nd gain of position loop	to the stiffness. Refer to P.5-9 Basic gain parameter setup
1	06	2nd gain of velocity loop	table.
1	07	2nd time constant of velocity loop integration	
1	09	2nd time constant of torque filter	
2	22	Command smoothing filter	When real-time auto-tuning is valid (Pr0.02
6	48	Adjust filter	= 1 to 4), updates the setup value according to the stiffness. * For velocity control, primary filter is fixed.

Parameters which are set to fixed value

Real-time auto-tuning function sets the following parameters to fixed value.

Class	No.	Title	Setup value
1	03	1st filter of speed detection	
1	08	2nd filter of speed detection	0
1	10	Velocity feed forward gain	1000 (100 %)
1	11	Velocity feed forward filter	0
1	12	Torque feed forward gain 1000 (100 %)	
1	13	Torque feed forward filter	0
6	10	Function expansion setup 2 bit4=1	
6	49	Adjust/Torque command attenuation term	15

6

2. Real-Time Auto-Gain Tuning

Two-degree-of-freedom control mode – Standard type

• Parameters which are set in respons 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 real-time auto-tuning is valid (Pr0.02 = 1 to 4).
1	15	Mode of position control switching	Sets to 0 when in standard response mode (Pr0.02 = 1); or to 7 when in quick response mode 1 to 3 (Pr0.02 = 2 to 4).
1	16	Delay time of position control switching	Sets to 10 if real-time auto-tuning is valid (Pr0.02 = 1 to 4).
1	17	Level of position control switching	Sets to 0 if real-time auto-tuning is valid
1	18	Hysteresis at position control switching	(Pr0.02 = 1 to 4).
1	19	Position gain switching time	Sets to 10 if real-time auto-tuning is valid (Pr0.02 = 1 to 4).
1	20	Mode of velocity control switching	Sets to 0 if real-time auto-tuning is valid
1	21	Delay time of velocity control switching	(Pr0.02 = 1 to 4).
1	22	Level of velocity control switching	Sets to 10 if real-time auto-tuning is valid (Pr0.02 = 1 to 4).
1	23	Hysteresis at velocity control switching	Sets to 0 if real-time auto-tuning is valid
1	24	Mode of torque control switching	(Pr0.02 = 1 to 4).
1	25	Delay time of torque control switching	Sets to 10 if real-time auto-tuning is valid (Pr0.02 = 1 to 4).
1	26	Level of torque control switching	Sets to 0 if real-time auto-tuning is valid
1	27	Hysteresis at torque control switching	(Pr0.02 = 1 to 4).
6	05	Position 3rd gain valid time	Sets to 0 (invalid) when in standard response mode or high speed response mode 1 (Pr0.02 = 1, 2). When in high speed response mode 2 or 3 (Pr0.02 = 3, 4), sets to Pr2.22 x 20 (max. value is limited to 10000).
6	06	Position 3rd gain scale factor	When in standard mode or high speed response mode 1, (Pr0.02 = 1, 2), sets to 100 (100 %). When in high speed response mode 2 or 3, (Pr0.02 = 3, 4), sets to 200 (200 %).

• 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	Instantaneous speed observer function enable bit (bit 0), disturbance observer function enable bit (bit 1) and inertia ratio switching function enable bit (bit 3) are internally disabled.
6	13	2nd Inertia ratio	Parameter setup can be changed, but inertia ration switching function is disabled.

The following settings and parameters are set automatic for enable/disable state of Pr 6.10 "Function expansion setting" load variation suppression function automatic adjustment.

Class	No.	Title	Function
6	10	Function extension setting	When set to Pr 6.10 bit14=1 in case of stiffness setting is enabled, load variation suppression function will become enabled (bit1 = 1). When set to Pr 6.10 bit14=0,it is disabled(bit1 = 1).
6	23	Load variation compensation gain	When set to Pr 6.10 bit14=1 in case of stiffness setting is enabled, sets to 90%. When set to Pr 6.10 bit14=0, set to 0%. When set to Pr 6.10 bit14=1 in case of stiffness setting is enabled, sets to 90%. When set to Pr 6.10 bit14=0, set to 0%.
6	24	Load variation compensation filter	When set to Pr 6.10 bit14=1 in case of stiffness setting is enabled, updates to match rigidity. When set to Pr 6.10 bit14=0, value is held.
6	73	Load estimation filter	When set to Pr 6.10 bit14=1 in case of stiffness setting is enabled, sets to 0.13 ms. When set to Pr 6.10 bit14=0, set to 0 ms.
6	74	Torque compensation frequency 1	Regardless value of the Pr 6.10 bit 14, sets to 0.
6	75	Torque compensation frequency 2	Regardless value of the Pr 6.10 bit 14, sets to 0.
6	76	Load estimation numbers	When set to Pr 6.10 bit14=1 in case of stiffness setting is enabled, sets to 4. When set to Pr 6.10 bit14=0, set to 0.

Two-degree-of-freedom control mode - Standard type

Caution

- (1) Immediately after the first servo-on upon start up; or after increasing Pr0.03 Real-time auto-tuning stiffness setup, abnormal sound or oscillation may be generated until the load characteristics estimation is stabilized. If such abnormality lasts or repeats for 3 or more reciprocating operations, take the following countermeasures.
 - 1) Lower the setup of Pr0.03 (Selection of machine stiffness at real-time auto-gain tuning).
 - 2) Set Pr0.02 Real-time auto-tuning setup to 0 to disable the real-time auto-tuning.
 - 3) Set Pr0.04 Inertial ratio to the calculational value of the equipment and set Pr6.07 (Torque command addition value), Pr6.08 (Positive direction compensation value), Pr6.09 (Negative direction compensation value) and Pr6.50 (Viscous friction compensation gain) to 0.
 - 4) Disabale load variation suppression function. (bit1=0 after Pr 6.10 bit14=0)
- (2) When abnormal noise and oscillation occur, Pr0.04 (Inertia ratio) or Pr6.07 (Torque command additional value), Pr6.08 (Positive direction torque compensation value), Pr6.09 (Negative direction compensation value), Pr6.50 (Viscous friction compensation gain) might have changed extreme value. 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 compensation value), Pr6.50 (Viscous friction compensation gain) will be written to EE-PROM 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

Invalidation of Real-Time Auto-Gain Tuning

setting is made effective.

You can stop the automatic calculation of Pr0.04 (Inertial ratio) and invalidate the real-time auto-gain tuning by setting up Pr0.02 (Real-time auto-gain tuning setup) to 0. Because the estimation result of Pr0.04 Inertia ratio is recorded, if this parameter becomes abnormal value, manually set to the appropriate value which is obtained from suitable formula or calculation.

Caution ...

If power is turned off within 30 minutes after the end of tuning process, the result of the real-time auto-tuning is not saved. If the result is not saved, manually write parameters to EEPROM and then turn off power.

Basic gain parameter setup table

		1st gain/	2nd gain		Comman	d response	Adjustment filter	load variation suppression function
	Pr1.00 Pr1.05	Pr1.01 Pr1.06	Pr1.02 Pr1.07	Pr1.04 Pr1.09	Pr	2.22	Pr6.48*1	Pr6.24
Stiffness			Velocity			ime it [0.1 ms]		
	Position loop [0.1 /s]	Velocity loop [0.1 Hz]	loop integration [0.1 ms]	Torque [0.01 ms]	Standard response mode	Quick response mode 1 to 3	Time constant [0.1 ms]	Load fiuctuation compensation filter [0.01 ms]
0	20	15	3700	1500	1919	764	155	2500
1	25	20	2800	1100	1487	595	115	2500
2	30	25	2200	900	1214	486	94	2500
3	40	30	1900	800	960	384	84	2500
4	45	35	1600	600	838	335	64	2500
5	55	45	1200	500	668	267	54	2500
6	75	60	900	400	496	198	44	2500
7	95	75	700	300	394	158	34	2120
8	115	90	600	300	327	131	34	1770
9	140	110	500	200	268	107	24	1450
10	175	140	400	200	212	85	23	1140
11	320	180	310	126	139	55	16	880
12	390	220	250	103	113	45	13	720
13	480	270	210	84	92	37	11	590
14	630	350	160	65	71	28	9	450
15	720	400	140	57	62	25	8	400
16	900	500	120	45	50	20	7	320
17	1080	600	110	38	41	17	6	270
18	1350	750	90	30	33	13	5	210
19	1620	900	80	25	28	11	5	180
20	2060	1150	70	20	22	9	4	140
21	2510	1400	60	16	18	7	4	110
22	3050	1700	50	13	15	6	3	90
23	3770	2100	40	11	12	5	3	80
24	4490	2500	40	9	10	4	3	60
25	5000	2800	35	8	9	4	2	60
26	5600	3100	30	7	8	3	2	50
27	6100	3400	30	7	7	3	2	50
28	6600	3700	25	6	7	3	2	40
29	7200	4000	25	6	6	2	2	40
30	8100	4500	20	5	6	2	2	40
31	9000	5000	20	5	5	2	2	40

^{*1} The value of Pr6.48 Adjustment filter has additional value 1 for B to F frames.

Note

[•] For details of parameters, refer to P.4-16 "Details of parameter".

Two-degree-of-freedom control mode - Synchronous type

Outline

In this auto-tuning mode, two-degree-of-freedom control is available in addition to real-time auto tuning basic function.

The synchronous type is a mode suitable for locus control of multi axes such as multijoint robot. It is different from other types in individual setting of command response and invalidation of unbalanced load (mass) compensation.

The two-degree-of-freedom control mode, standard type, can be used by setting Pr6.47 Function expansion setup 2 to bit 0 = 1 and bit 3 = 0.

Applicable Range

	Real-time auto-tuning condition	
Control Mode Real-time auto-tuning, two-degree-of-freedom control mode, sy typ, can be applied for only position control mode.		
Others	 Should be in servo-on condition. Input signals, such as deviation counter clear and command input inhibit, and parameters, except for controls such as torque limit setup, are correctly set, assuming that the motor can run smoothly. 	

Caution

Real-time auto-gain tuning may not be executed properly under the conditions described below.

Under these conditions, change the load conditions or operation patterns, or start manual gain tuning (refer to P.5-27 and subsequent).

	Conditions which obstruct real-time auto-gain tuning
Load inertia	 Load is small or large compared with the rotor inertia (less than 3 times or more than 20 times). The load inertia changes.
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/1[s] or low). Acceleration/deceleration torque is smaller than unbalanced weighted/ viscous torque. When speed condition of 100 [r/min] or more and acceleration/deceleration condition of 2000 [r/min]/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 other than 0, 6.

Setup value	Real-time auto-gain tuning	Explanation
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.



Control parameter is automatically set according to Pr0.03 Real-time auto-tuning stiffness setup.

[Example of real-time auto-tuning setup]

When using this function for the first time with multijoint robot, set initial stiffness to a lower value in accordance with the load capacity in the synchronous friction compensation mode (Pr0.02 = 2), and incline the arm by 45 degrees, and then estimate the load characteristics with short distance reciprocating running (1-2 rotations of motor shaft).

To see effects of quadrant switching due to friction compensation, try Pr0.02 = 1.

To perform only load characteristics estimation, use the load characteristic update Pr0.02 = 4.

Because the inertia ratio and resonance characteristic of multijoint robot vary with orientation, disable the auto-tuning (Pr2.00 = 0) after estimation of load characteristics. In the load characteristic measurement mode (Pr0.02 = 5), the load characteristic change due to arm orientation can be observed without affecting operation.

When adjusting during operation, enter the stiffness setup mode (Pr0.02 = 3). While holding load characteristic compensation, change the stiffness setting and check locus accuracy and positioning performance.



• While the auto-tuning is valid, parameters that are to be automatically adjusted cannot be changed.

Related page ..:

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

Two-degree-of-freedom control mode - Synchronous type

- 3) When the servo is tuned on, input the action command.
- 4) As the load characteristics are correctly estimated, Pr0.04 Inertia ratio will be 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
 - Pr6.50 Viscous friction compensation gain
 - 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 date 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.



• 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 by using the load characteristic estimate values.

Class	No.	Title	Function
0	04	Inertia ratio	In the synchronous mode (Pr0.02 = 1), synchronous friction compensation mode (Pr0.02 = 2) and load characteristic update mode (Pr0.02 = 4), this parameter will be updated.
6	08	Positive direction torque compensation value	In the synchronous friction compensation
6	09	Negative direction torque compensation value	mode (Pr0.02 = 2) and load characteristic update mode (Pr0.02 = 4), this parameter will be updated.
6	50	Viscous friction compensation gain	will be apaated.

• 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			
1	01	1st gain of velocity loop			
1	02	1st time constant of velocity loop integration	When real-time auto-tuning is valid (Pr0.02		
1	04	1st time constant of torque filter	= 1-4), updates the setup value according to		
1	05	2nd gain of position loop	the stiffness. Refer to P.5-9 Basic gain parameter setup table.		
1	06	2nd gain of velocity loop			
1	07	2nd time constant of velocity loop integration			
1	09	2nd time constant of torque filter			
6	48	Adjust filter	In the synchronous mode, synchronous friction compensation mode and stiffness setup mode (Pr0.02 = 1-3), the setting will be updated according to stiffness.		

• Parameters which are set to fixed value

The real-time auto-tuning function sets the following parameters to fixed values or uses the current setup values.

Class	No.	Title	Setup value when fixed parameter setup is valid.
1	03	1st filter of speed detection	0
1	80	2nd filter of speed detection	0
1	10	Velocity feed forward gain	1000 (100 %)
1	11	Velocity feed forward filter	0
1	12	Torque feed forward gain	1000 (100 %)
1	13	Torque feed forward filter	0
2	22	Command smoothing filter	Holds the current setup value. *1
6	07	Torque command additional value	0
6	10	Function expansion setup	bit4=1
6	49	Adjust/Torque command attenuation term	Tens digit set as 1 and ones digit is kept as is.

^{*1} If noise generates, change the setting to appropriate value (e.g. 3 ms = setup value: 30).

Two-degree-of-freedom control mode – Synchronous type

• Parameters which are set in respons to gain switching setup

The real-time auto-tuning function sets the following parameters according to Pr0.02 Real-time auto-tuning setup, or uses current setup values.

Class	No.	Title	Function		
1	14	2nd gain setup	In the synchronous mode, synchronous friction compensation mode or stiffness setup mode (Pr0.02 = 1 to 3), sets to 1.		
1	15	Mode of position control switching	In the synchronous mode, synchronous friction compensation mode or stiffness setup mode (Pr0.02 = 1 to 3), sets to 0.		
1	16	Delay time of position control switching	In the synchronous mode, synchronous friction compensation mode or stiffness setup mode (Pr0.02 = 1 to 3), sets to 10.		
1	17	Level of position control switching	In the synchronous mode, synchronous		
1	18	Hysteresis at position control switching	friction compensation mode or stiffness setup mode (Pr0.02 = 1 to 3), sets to 0.		
1	19	Position gain switching time	In the synchronous mode, synchronous friction compensation mode or stiffness setup mode (Pr0.02 = 1 to 3), sets to 10.		
1	20	Mode of velocity control switching			
1	21	Delay time of velocity control switching			
1	22	Level of velocity control switching			
1	23	Hysteresis at velocity control switching	Sets to 0 if real-time auto-tuning is valid		
1	24	Mode of torque control switching	(Pr0.02 = 1 to 4).		
1	25	Delay time of torque control switching			
1	26	Level of torque control switching			
1	27	Hysteresis at torque control switching			
6	05	Position 3rd gain valid time	When the real-time auto-tuning remains		
6	06	Position 3rd gain scale factor	valid (Pr0.02 = 1 to 4), uses the current setup value.		

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. Note that setup values of parameters remain unchanged.

Class	No.	Title	Function
6	10	Function expansion setup	Instantaneous speed observer function enable bit (bit 0), disturbance observer function enable bit (bit 1) and inertia ratio switching function enable bit (bit 3) are internally disabled.
6	13	2nd Inertia ratio	Parameter setup can be changed, but inertia ration switching function is disabled.

The following settings and parameters are set automatic for enable/disable state of Pr 6.10 "Function expansion setting" load variation suppression function automatic adjustment.

Class	No.	Title	Function
6	10	Function expansion setup	When set to Pr 6.10 bit14=1 in case of stiffness setting is enabled, load variation suppression function will become enabled (bit1 = 1). When set to Pr 6.10 bit14=0,it is disabled(bit1 = 1).

Class	No.	Title	Function
			When set to Pr 6.10 bit14=1 in case of stiffness
6	23	Load fluctuation compensation gain	setting is enabled, sets to 90%.
		compensation gain	When set to Pr 6.10 bit14=0, set to 0%.
		l and floor to the a	When set to Pr 6.10 bit14=1 in case of stiffness
6	24	Load fluctuation compensation filter	setting is enabled, updates to match rigidity.
		compensation inter	When set to Pr 6.10 bit14=0, value is held.
		Load estimation filter	When set to Pr 6.10 bit14=1 in case of stiffness
6	73		setting is enabled, sets to 0.13 ms.
			When set to Pr 6.10 bit14=0, set to 0 ms.
6	74	Torque compensation frequency 1	Regardless value of the Pr 6.10 bit 14, sets to 0.
6	75	Torque compensation frequency 2	Regardless value of the Pr 6.10 bit 14, sets to 0.
			When set to Pr 6.10 bit14=1 in case of stiffness
6	76	Load estimate numbers	setting is enabled, sets to 4.
			When set to Pr 6.10 bit14=0, set to 0.

In case Pr 0.02 "Real-time automatic tuning mode setting" = 6, (load fluctuation response mode), the setting will be changed to the following.

Class	No.	Title	Function
6	10	Function expansion setup	Load fluctuation suppression function always become enabled (bit1 = 1)
6	23	Load fluctuation compensation gain	Sets to 100%.
6	24	Load fluctuation compensation filter	Updates to match rigidity.
6	73	Load estimation filter	Sets to 0.13 ms.
6	74	Torque compensation frequency 1	Updates to match rigidity.
6	75	Torque compensation frequency 2	Updates to match rigidity.
6	76	Load estimate numbers	Sets to 4.

4

Two-degree-of-freedom control mode - Synchronous type

Caution

- (1) Immediately after the first servo-on upon start up; or after increasing Pr0.03 Real-time auto-tuning stiffness setup, abnormal sound or oscillation may be generated until the load characteristics estimation is stabilized. If such abnormality lasts or repeats for 3 or more reciprocating operations, take the following countermeasures.
 - 1) Lower the setup of Pr0.03 (Selection of machine stiffness at real-time auto-gain tuning).
 - 2) Set Pr0.02 Real-time auto-tuning setup to 0 to disable the real-time auto-tuning.
 - 3) Set Pr0.04 Inertial ratio to the calculational value of the equipment and set Pr6.07 (Torque command addition value), Pr6.08 (Positive direction compensation value), Pr6.09 (Negative direction compensation value) and Pr6.50 (Viscous friction compensation gain) to 0.
 - 4) Disabale load variation suppression function. (bit1=0 after Pr 6.10 bit14=0).
- (2) When abnormal noise and oscillation occur, Pr0.04 (Inertia ratio) or Pr6.07 (Torque command additional value), Pr6.08 (Positive direction torque compensation value), Pr6.09 (Negative direction compensation value), Pr6.50 (Viscous friction compensation gain) might have changed extreme value. 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 compensation value), Pr6.50 (Viscous friction compensation gain) will be written to EE-PROM 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
 - After changing stiffness, stop the motor and check to see that the new stiffness setting is made effective.

Invalidation of Real-Time Auto-Gain Tuning

You can stop the automatic calculation of Pr0.04 (Inertial ratio) and invalidate the real-time auto-gain tuning by setting up Pr0.02 (Real-time auto-gain tuning setup) to 0. Because the estimation result of Pr0.04 Inertia ratio is recorded, if this parameter becomes abnormal value, manually set to the appropriate value which is obtained from suitable formula or calculation.

Caution 🔆

If power is turned off within 30 minutes after the end of tuning process, the result of the real-time auto-tuning is not saved. If the result is not saved, manually write parameters to EEPROM and then turn off power.

Basic gain parameter setup table

	1st gain/2nd gain				Adjustment filter	load variation suppression function	on For load variation support mode (Pr0.02 =			0.02 = 6) only
Stiffness	Pr1.00 Pr1.05	Pr1.01 Pr1.06	Pr1.02 Pr1.07	Pr1.04 Pr1.09	Pr6.48*1	Pr6.24	Pr1.00 Pr1.05	Pr6.24	Pr6.74	Pr6.75
ounios .	Position loop [0.1 /s]	Velocity loop [0.1 Hz]	Velocity loop integration [0.1 ms]	Torque [0.01 ms]	Time constant [0.1 ms]	Load fiuctuation compensation filter [0.01 ms]	Position loop [0.1 /s]	Load fiuctuation compensation filter [0.01 ms]	Torque compensation ferquecy1 [0.1 Hz]	Torque compensation ferquecy2 [0.1 Hz]
0	20	15	3700	1500	155	2500	15	2500	25	7
1	25	20	2800	1100	115	2500	20	2500	34	10
2	30	25	2200	900	94	2500	25	2500	42	12
3	40	30	1900	800	84	2500	30	2500	51	15
4	45	35	1600	600	64	2500	35	2500	59	17
5	55	45	1200	500	54	2500	45	2500	76	22
6	75	60	900	400	44	2500	60	2500	104	30
7	95	75	700	300	34	2120	75	2120	129	37
8	115	90	600	300	34	1770	90	1770	153	44
9	140	110	500	200	24	1450	110	1450	184	53
10	175	140	400	200	23	1140	140	1140	231	66
11	320	180	310	126	16	880	180	880	290	83
12	390	220	250	103	13	720	220	720	346	99
13	480	270	210	84	11	590	270	590	413	118
14	630	350	160	65	9	450	350	450	512	146
15	720	400	140	57	8	400	400	400	570	163
16	900	500	120	45	7	320	500	320	678	194
17	1080	600	110	38	6	270	600	270	678	194
18	1350	750	90	30	5	210	750	210	678	194
19	1620	900	80	25	5	180	900	180	678	194
20	2060	1150	70	20	4	140	1150	140	678	194
21	2510	1400	60	16	4	110	1400	110	678	194
22	3050	1700	50	13	3	90	1700	90	678	194
23	3770	2100	40	11	3	80	2100	80	678	194
24	4490	2500	40	9	3	60	2500	60	678	194
25	5000	2800	35	8	2	60	2800	60	678	194
26	5600	3100	30	7	2	50	3100	50	678	194
27	6100	3400	30	7	2	50	3400	50	678	194
28	6600	3700	25	6	2	40	3700	40	678	194
29	7200	4000	25	6	2	40	4000	40	678	194
30	8100	4500	20	5	2	40	4500	40	678	194
31	9000	5000	20	5	2	40	5000	40	678	194

^{*1} The value of Pr6.48 Adjustment filter has additional value 1 for B to F frames.

Note

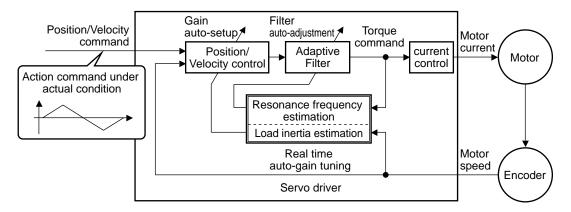
[•] For details of parameters, refer to P.4-16 "Details of parameter".

3. Adaptive filter

Adaptive filter

Outline

Estimates the resonance frequency out of vibration component presented in the motor speed in motion, then removes the resonance component from the torque command by setting up the notch filter coefficient automatically, hence reduces the resonance vibration.



Applicable Range

This function works under the following condition.

	Conditions under which the Adaptive filter is activated				
Control Mode	Applies to other control modes than torque control.				
Others	 Should be servo-on status. Elements other than control parameters, such as deviation counter clear command inhibit and torque limit are appropriately set, enabling the motor to run normally. 				

Caution

In the following condition, normal operation may not be expected - manually set the notch filter to prevent resonance.

	Conditions which obstruct adaptive filter action				
Resonance point	 Resonance frequency is lower than 3 times. Resonance peak is low, or control gain is low where the motor speed is not affected by this. Multiple resonance of 3 or more points exist. 				
Load	Motor speed variation with high harmonic component is generated due to non-linear factors such as backlash.				
Command pattern	Acceleration/deceleration is rapid such as 30000[r/min] per 1[s].				

How to Operate

Enter the action command with Pr2.00 Adaptive filter mode set to a value other than 0. If the resonance point affects the motor speed, parameters of 3rd notch filter and/or 4th notch filters are automatically set according to the number of adaptive filters.

Set the operation of the adaptive filter to the following parameter.

Class	No.	Title	Setup value	Function									
		Adaptive filter mode setup	0	[Adaptive filter: invalid] The adaptive filter is disabled. Parameters related to the 3rd and 4th notch filter hold the current value.									
2	00		•									1	[Adaptive filter: 1 filter is valid] One adaptive filter is enabled. Parameters related to the 3rd notch filter will be updated based on adaptive performance.
				2	[Adaptive filter: 2 filters are valid] Two adaptive filters are enabled. Parameters related to the 3rd and 4th notch filters will be updated based on adaptive performance.								
				•	3	[Resonance frequency measurement mode] Measure the resonance frequency. Result of measurement can be checked with PANATERM. Parameters related to the 3rd and 4th notch filter hold the current value.							
						4	[Clear result of adaptation] Parameters related to the 3rd and 4th notch filter are disabled and results of adaptive operation are cleared.						
			5	[High-precision adaptive filter] Two adaptive filters are enabled. Parameters related to the 3rd and 4th notch filters will be updated based on the results of adaptive performance. Use of this setup value is recommended when using 2 adaptive filters.									
			6	[For manufacturer's use] PANATERM's fit gain function used internally. Do not use this setup value in the normal condition.									

At the same time, the following parameters are automatically set.

Class	No.	Title	Function		
2	07	3rd notch frequency	In no resonance point is found, the frequency is set to 5000.		
2	80	3rd notch width selection	Automatically set when the adaptive filter is active.		
2	09	3rd notch depth selection	Automatically set when the adaptive litter is active.		
2	10	4th notch frequency	Notch frequency is automatically set to the 2nd resonance frequency estimated by the adaptive filter. In no resonance point is found, the frequency is set to 5000.		
2	11	4th notch width selection	Automotically act when 2 adaptive filters are active		
2	12	4th notch depth selection	Automatically set when 2 adaptive filters are active.		

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

Caution

- (1) Immediately after the first servo-on at start up; or after increasing stiffness setting with the real-time auto-tuning enabled, abnormal sound or oscillation may be generated until the adaptive filter stabilizes. If such abnormality lasts or repeats for 3 or more reciprocating operations, take the following countermeasures.
 - 1) Write the parameters which have given the normal operation into EEPROM.
 - 2) Lower the setup of Pr0.03 (Selection of machine stiffness at real-time auto-gain tuning).
 - 3) Invalidate the adaptive filter by setting up Pr2.00 (Setup of adaptive filter mode) to0. (Reset of inertia calculation and adaptive action)
 - 4) Set up the notch filter manually.
- (2) Abnormal sound or oscillation may excessively change the setup value of 3rd and 4th notch filters. If such change occurs, disable the adaptive filter as described in step 3) above, change setup value of Pr2.07 3rd notch frequency and Pr2.10 4th notch frequency to 5000 (disable), and then enable the adaptive filter again.
- (3) The 3rd filters (Pr2.07-Pr2.09) and 4th notch filters (Pr2.10-Pr2.12) are written to EE-PROM every 30 minutes. Upon power up, these data are used as default values during adaptive process.

Adjustment

4. Manual Gain Tuning (Basic)

Outline

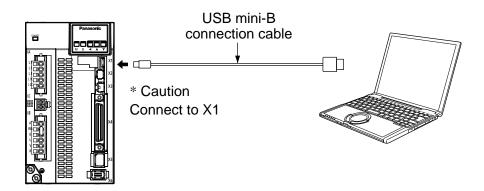
As explained previously, MINAS-A6 series features the automatic gain tuning function, however, there might be some cases where this automatic gain tuning cannot be adjusted properly depending on the limitation on load conditions. Or you might need to readjust the tuning to obtain the optimum response or stability corresponding to each load. Here we explain this manual gain tuning method by each control mode and function.

Before Making a Manual Adjustment

By monitoring waveforms using the waveform graphic function of the setup support software PANATERM installed on the PC, accurate adjustment can be positively, quickly and easily done when compared with that performed on the front panel.

Waveform graphic function of the PANATERM

You can display the command to the motor, motor movement (speed, torque command and deviation pulses) as a waveform graphic on PC display. Refer to P.7-26, "Outline of the Setup Support Software, PANATERM" of Supplement.



Please download the Setup support software "PANATERM" from our web site anduse after install to the PC.

Related page ...

• P.7-26 "Outline of Setup support software "PANATERM"

4. Manual Gain Tuning (Basic)

Adjustment in Position Control Mode

Position control of MINAS-A6 series is described in Block diagram of P.3-14. Make adjustment in position control per the following procedures.

(1) Set up the following parameters to the values of the table below.

Parameter No. (Pr □□)	Title of parameter	Standard value
1.00	1st gain of position loop	270
1.01	1st gain of velocity loop	150
1.02	1st time constant of velocity loop integration	370
1.03	1st filter of velocity detection	0
1.04	04 1st time constant of torque filter time	
1.10	Velocity feed forward	0
1.11	1.11 Time constant of feed forward filter	
1.05	2nd gain of position loop	
1.06	1.06 2nd gain of velocity loop	
1.07	1.07 2nd time constant of velocity loop integration	
1.08	1.08 2nd filter of speed detection	
1.09	1.09 2nd time constant of torque filter	
2.01	2.01 1st notch frequency	
2.02 1st notch width selection		2

	Parameter No. (Pr □□)	Title of parameter	Standard value	
	0.04	Inertia ratio	100	
	0.02	0.02 Setup of real time auto-gain tuning mode		
	2.00	2.00 Adaptive filter setup mode		
	2.14	2.14 1st damping frequency2.15 Setup of 1st damping filter		
	2.15			
	2.16 2nd damping frequency		0	
	2.17	 2.17 Setup of 2nd damping filter 1.14 2nd gain setup 1.15 Mode of position control switching 1.16 Delay time of position control switching delay 1.17 Level of position control switching 1.18 Hysteresis at position control switching 		
	1.14			
	1.15			
	1.16			
	1.17			
	1.18			
	1.19	1.19 Position gain switching time		
	2.22	2.22 Positional command smoothing filter		
-	2.23	0		

- (2) Enter the inertia ratio of Pr0.04. Measure the ratio or setup the calculated value.
- (3) Make adjustment using the standard values below.

Order	Parameter No. (Pr□□)	Title	Standard value	How to adjust
1	Pr1.01	1st gain of	300	Increase the value within the range where no abnormal noise and no
		velocity loop		vibration occur. If they occur, lower the value.
	Pr1.04	1st time constant of torque filter	50	When vibration occurs by changing Pr1.01, change this value.
2				Setup so as to make Pr1.01 x Pr1.04 becomes smaller than 10000.
				If you want to suppress vibration at stopping, setup larger value to
				Pr1.04 and smaller value to Pr1.01. If you experience too large
				vibration right before stopping, lower than value of Pr1.04.
3	Pr1.00	1st gain of position loop	500	Adjust this observing the positioning time. Larger the setup, faster
				the positioning time you can obtain, but too large setup may cause
				oscillation.
	Pr1.02	1st time constant of velocity loop integration	250	Setup this value within the range where no problem occurs. If you
				setup smaller value, you can obtain a shorter positioning time, but
				too small value may cause oscillation. If you setup too large value,
4				deviation pulses do not converge and will be remained.
				Increase the value within the range where no abnormal noise
				occurs.
5	Pr1.10	Velocity feed forward gain	300	Too large setup may result in overshoot or chattering of position
				complete signal, hence does not shorten the settling time. If the
				command pulse is not even, you can improve by setting up Pr1.11
				(Feed forward filter) to larger value.

Related page : P.4-6 to P.4-85... "Details of parameter" • P.3-14... "Control Block Diagram"

Preparatio

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5 Adjustment

4. Manual Gain Tuning (Basic)

Adjustment in Velocity Control Mode

Velocity control of MINAS-A6 series is described in Block Diagram of P.3-16 of Velocity Control Mode.

Adjustment in velocity control is almost same as that in position control described in "Adjustment in Position Control Mode", and make adjustments of parameters per the procedures except the gain setup of position loop gain (Pr1.00, Pr1.05) and the setup of velocity feed forward gain (Pr1.10).

5

Adjustment

4. Manual Gain Tuning (Basic)

Adjustment in Torque Control Mode

Torque control of MINAS-A6 series is described in P.3-18, "Block Diagram" of Torque Control Mode.

This torque control is based on velocity control while making Pr3.21 [Speed limit value 1], Pr3.22 [Speed limit value 2] or SPL input as a speed limit. Here we explain the setup of speed limiting value.

Setup of speed limiting value

The torque command selection (Pr3.17) specifies the setup method.

Pr3.17 = 0 Set up by using speed limit value 1 (Pr3.21)

Pr3.17 = 1 Set up by using analog input (SPL)

Pr3.17 = 2 For positive direction, set up by using the speed limit value 1(Pr3.21)

For negative direction, set up by using the speed limit value 2(Pr3.22)

- When the motor speed approaches to the speed limiting value, torque control following the analog torque command shifts to velocity control based on the speed limiting value.
- In order to stabilize the movement under the speed limiting, you are required to set up the parameters according to the above-mentioned "Adjustment in Velocity Control Mode".
- When the speed limiting value is too low or the velocity loop gain is too low, or when the time constant of the velocity loop integration is 10000 (invalid), the input to the torque limiting portion of the above fig. becomes small and the output torque may not be generated as the analog torque command.
- When not using the speed limit but using only torque command, disable the torque filter and notch filter, and set speed limit value to the maximum speed and set velocity loop gain to a value as high as possible.



Only for Basic Type is not provided with analog input.

Related page .:

• P.3-45 "Inputs and outputs on connector X4"

Full-closed control of MINAS-A6 series is described in Block diagram of P.3-19 of Full-Closed Control.

Adjustment in full-closed control is almost same as that in position control described in P.5-28 "Adjustment in Position Control Mode", and make adjustments of parameters per the procedures except cautions of P.3-12, "Outline of Full-Closed Control" (difference of command unit and difference of electronic gear).

Here we explain the setup of feedback scale ratio and hybrid deviation excess of fullclosed control.

1) Setup of external scale ratio

Setup the external scale ratio using the numerator of external scale division (Pr3.24) and denominator of external scale division (Pr3.25).

 Check the encoder feedback pulse counts per one motor revolution and the external scale pulse counts per one motor revolution, then set up the numerator of external scale division (Pr3.24), and denominator of external scale division (Pr3.25) so that the following formula can be established.

Number of encoder feedback pulses per motor rotation Pr3.24 Number of external scale pulses per motor rotation Pr3.25

- If this ratio is incorrect, a gap between the position calculated from the encoder feedback pulse counts and that of calculated from the external scale pulse counts will be enlarged and hybrid deviation excess (Err25.0) will be triggered when the work or load travels a long distance.
- When you set up Pr3.24 to 0, the encoder feedback pulse counts will be automatically set up.

2) Setup of hybrid deviation excess

Set up the minimum value of hybrid deviation excess (Pr3.28) within the range where the gap between the motor (encoder) position and the load (feedback scale) position will be considered to be an excess.

 Note that the hybrid deviation excess (Err25.0) may be generated under other conditions than the above 1), such as reversed connection of the external scale or loose connection of the motor and the load.

Caution

- (1) Enter the command pulses based on the feedback scale reference.
- (2) The feedback scales to used for full-closed control are as HP.
- (3) To prevent the runaway and damage of the machine due to the setup of the feedback scale, setup the hybrid deviation excess (Pr3.28) to the appropriate value, in the unit of feedback scale resolution.

(4) We recommend the external scale as $1/40 \le \text{external scale ratio} \le 1280$.

Even within this range, if you setup the external scale ratio to smaller value than 50/position loop gain (Pr1.00 and 1.05), you may not be able to control by one pulse unit. If you set up too large external scale ratio, you may expect larger noise in movement.



Only for Basic Type is not provided with X5 (For external scale connector).

Related page : P.3-32 "Inputs and outputs on connector X4" • P.6-2 "Protective Function"

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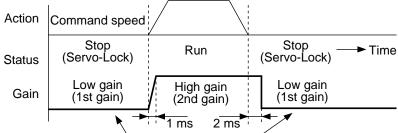
Adjustment

4. Manual Gain Tuning (Basic)

Gain Switching Function

By selecting appropriate gain based on internal data or external signal, the following effects can be obtained.

- Decrease the gain at the time of stoppage (servo lock) to reduce vibration.
- Increase the gain at the time of stoppage (setting) to shorten the settling time.
- Increase the gain during operation to improve command compliance.
- Based on condition of the equipment, change the gain with external signal.



Suppress the vibration by lowering the gain.

<Example>

Following is the example when you want to reduce the noise at motor in stall (Servo-Lock), by setting up to lower gain after the motor stops.

• Make adjustment referring to the basic gain parameter setup table (P.5-9) as well.

Parameter No. (Pr□□)	Title of parameter	Execute manual gain-tuning without gain switching	 	Set up the same value as Pr1.05 to 1.09 (2nd gain) to Pr1.00 to 1.04 (1st gain)	→	Set up Pr1.14 to 1.19 (Gain switching condition)	→	Adjust Pr1.01 and 1.04 at stopping (1st gain)
1.00	1st gain of position loop	630]					
1.01	1st gain of velocity loop	350	1					270
1.02	1st time constant of velocity integration	160	1				Ī	
1.03	1st filter of velocity detection	0	1					
1.04	1st time constant of torque filter	65	1					84
1.10	Velocity feed forward	300	1				Ì	
1.11	Filter of velocity feed forward	50	1					
1.05	2nd gain of position loop			630				
1.06	2nd gain of velocity loop			350				
1.07	2nd time constant of velocity integration			160				
1.08	2nd filter of velocity detection			0				
1.09	2nd time constant of torque filter time			65				
1.14	Action setup of 2nd gain	0				1		
1.15	1st mode of control switching					7		
1.16	1st delay time of control switching					30		
1.17	1st level of control switching					0		
1.18	1st hysteresis of control switching					0		
1.19	Switching time of position gain					0		
0.04	Inertia ration	Enter the known value from load calculation Measure the inertia ratio by executing nor mal auto-gain tuning Default is 250						

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

Gain Switching Function

Setup of Gain Switching Condition

• Positing control mode, Full-closed control mode (O: Corresponding parameter is valid, -: invalid)

Setup of gain switching condition			Setup parameters at position control, full-closed control			
D 4 45	Switching condition to		Delay time *1	Level	Hysteresis *2	
Pr1.15	2nd gain	Fig.	Pr1.16	Pr1.17	Pr1.18	
0	Fixed to 1st gain		-	-	-	
1	Fixed to 2nd gain		-	-	-	
2	Gain switching input		-	-	-	
3	Torque command	Α	0	○[%]	○[%]	
4	Invalid (Fixed to 1st gain)		-	-	-	
5	Speed command	С	0	○ [r/min]	○ [r/min]	
6	Position deviation	D	0	○*³ [pulse]	○*³ [pulse]	
7	Position command exists.	Е	0	-	-	
8	Not in positioning complete	F	0	-	-	
9	Speed	С	0	○ [r/min]	○ [r/min]	
10	Command exists + velocity	G	0	○ [r/min] *5	○ [r/min] *5	

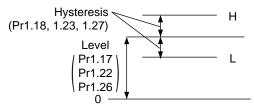
Velocity control mode

Setup of gain switching condition			Setup parameters at velocity control mode			
D 4 00	Switching condition to		Delay time *1	Level	Hysteresis *2	
Pr1.20	2nd gain	Fig.	Pr1.16, 1.21	Pr1.17, 1.22	Pr1.18, 1.23	
0	Fixed to 1st gain		-	_	_	
1	Fixed to 2nd gain		-	_	_	
2	Gain switching input		-	-	_	
3	Torque command	Α	0	○[%]	○[%]	
4	Variation of speed command is large.	В	-	○*4 [10(r/min)/s]	○*4 [10(r/min)/s]	
5	Speed command	С	0	○ [r/min]	○ [r/min]	

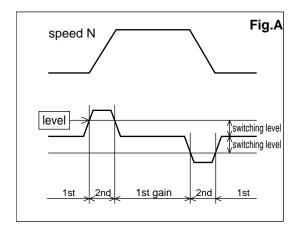
• Torque control mode

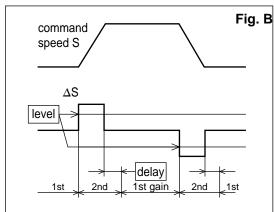
Setup of gain switching condition			Setup parameters at torque control mode			
Switching condition to		T	Delay time *1	Level	Hysteresis *2	
Pr1.24	2nd gain	Fig.	Pr1.16, 1.25	Pr1.17, 1.26	Pr1.18, 1.27	
0	Fixed to 1st gain		-	-	-	
1	Fixed to 2nd gain		-	-	-	
2	Gain switching input, GAIN ON		-	-	-	
3	Variation of torque command is large.	А	0	○[%]	○[%]	

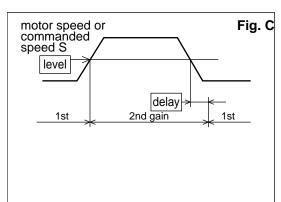
- *1 Delay time (Pr1.16, 1.12 and 1.25) will be valid only when returning from 2nd to 1st gain.
- *2 Hysteresis (Pr1.18, 1.23 and 1.27) is defined as the fig. below shows.
- *3 Designate with either the encoder resolution or the external scale resolution depending on the control mode.
- *4 When you make it a condition that there is speed variation of 10 r/min in 1s, set up the value to 1.
- *5 When Pr1.15=10, the meanings of delay time, level and hysteresis are different from the normal. (refer to Fig. G)

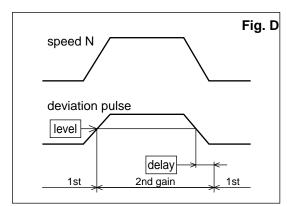


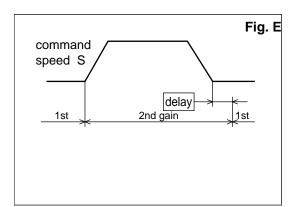
Gain Switching Function

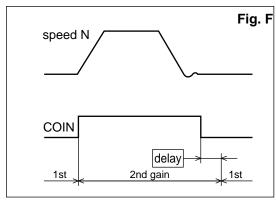


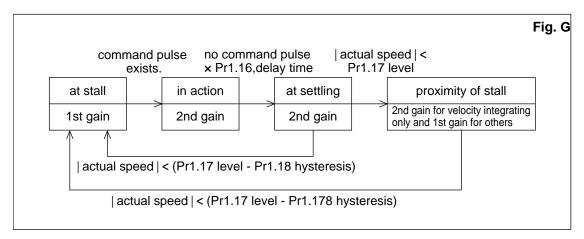












Caution ·∻

Above Fig. does not reflect a timing lag of gain switching due to hysteresis (Pr1.18, 1.23 and 1.27).

Suppression of Machine Resonance

In case of a low machine stiffness, you cannot set up a higher gain because vibration and noise occur due to oscillation caused by axis distortion or other causes. By suppressing the resonance peak at the notch filter, higher gain can be obtained or the level of vibration can be lowered.

1. Torque command filter (Pr1.04 and Pr1.09)

Sets up the filter time constant so as to damp the frequency at vicinity of resonance frequency. You can obtain the cut off frequency of the torque command filter in the following formula.

Cut off frequency (Hz) fc = $1 / (2\pi x \text{ parameter setup value } x 0.00001)$

2. Notch filter (Pr2.00, 2.07 to Pr2.12)

Adaptive filter

MINASA-5 series feature the adaptive filter. With this filter you can control vibration of the load which resonance points vary by machine by machine and normal notch filter or torque filter cannot respond. Enter the action command with Pr2.00 Adaptive filter mode set to a value other than 0.

If the resonance point affects the motor speed, parameters of 3rd notch filter and/ or 4th notch filters are automatically set according to the number of adaptive filters.

D 0 00 A 1 11 11 11		1: Adaptive filter is valid	
Pr2.00	Adaptive filter mode	2: 2 adaptive filters are valid.	
Pr2.07	3rd notch frequency	In no resonance point is found, the frequency is set to 5000.	
Pr2.08	3rd notch width selection	Automotically act when the adaptive filter is active	
Pr2.09	3rd notch depth selection	Automatically set when the adaptive filter is active.	
Pr2.10	4th notch frequency	Notch frequency is automatically set to the 2nd resonance frequency estimated by the adaptive filter. In no resonance point is found, the frequency is set to 5000.	
Pr2.11	4th notch width selection	Automatically set when 2 adaptive filters are active.	
Pr2.12	4th notch depth selection	Automatically set when 2 adaptive litters are active.	

• Notch filter (Pr2.01 to 2.12,Pr2.24 to 2.26)

MINASA-6 series feature 5 normal notch filters. You can adjust frequency and width and depth.

1st notch frequency	Set the center frequency of the 1st notch filter. *1				
1st notch width selection	Set the width of notch at the center frequency of the 1st				
13t Hotell Width Selection	notch filter.				
1st notch donth soloction	Set the depth of notch at the center frequency of the				
13t Hoten depth selection	1st notch filter.				
2nd notch frequency	Set the center frequency of the 2nd notch filter. *1				
2nd notab width coloation	Set the width of notch at the center frequency of the				
Zild flotch width selection	2nd notch filter.				
	Set the depth of notch at the center frequency of the				
2nd notch depth selection	2nd notch filter.				
3rd notch frequency	Set the center frequency of the 3rd notch filter. *1				
2rd notab width poloction	Set the width of notch at the center frequency of the 3rd				
3rd notch width selection	notch filter.				
2rd notab donth coloation	Set the depth of notch at the center frequency of the				
ora noton depth selection	3rd notch filter.				
4th notch frequency	Set the center frequency of the 4th notch filter. *1				
4th notab width coloation	Set the width of notch at the center frequency of the 4th				
4th notch width selection	notch filter.				
4th notab donth coloation	Set the depth of notch at the center frequency of the				
4th notch depth selection	4th notch filter.				
	1st notch width selection 1st notch depth selection 2nd notch frequency 2nd notch width selection 2nd notch depth selection 3rd notch frequency 3rd notch width selection 3rd notch depth selection 3rd notch depth selection				

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Setup

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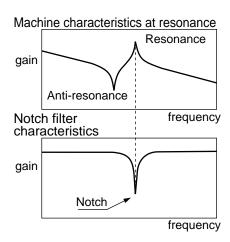
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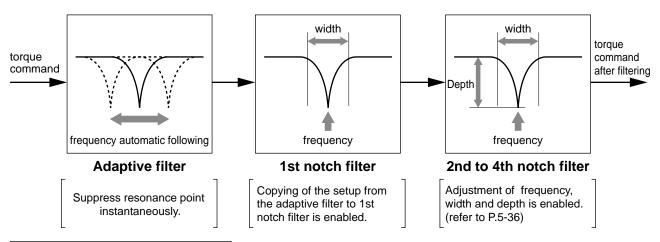
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Supplement

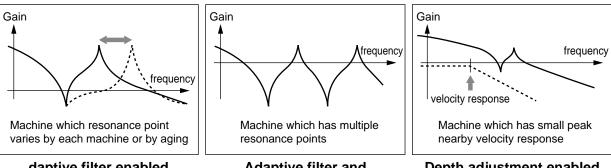
Pr2.24	5th notch frequency	Set the center frequency of the 5th notch filter. *1
Pr2.25	5th notch width selection	Set the width of notch at the center frequency of the 5th
F12.23	Stri floteri width selection	notch filter.
Pr2.26	Eth notab donth coloction	Set the depth of notch at the center frequency of the
P12.20	5th notch depth selection	5th notch filter.

^{*1} The notch filter function will be invalidated by setting up this parameter to "5000".





Example of application machine



daptive filter enabled

Adaptive filter and notch filter enabled

Depth adjustment enabled

Related page ..:

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

Suppression of Machine Resonance

Notch width and depth

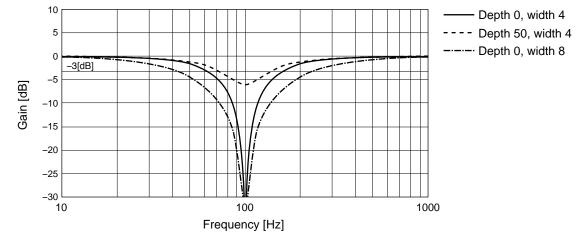
The width of the notch filter is the ratio of the width of –3dB attenuation frequency band with respect to the notch frequency at its center when depth is 0, and the value is as shown in the table below.

The notch filter depth indicates I:O ratio where the input at the center frequency is completely shut with setup value 0 but fully received with setup value 100. The table below shows this value in dB on the right.

	Band width/center frequency
Notch width	A6 series
0	0.5
1	0.59
2	0.71
3	0.84
4	1
5	1.19
6	1.41
7	1.68
8	2
9	2.38
10	2.83
11	3.36
12	4
13	4.76
14	5.66
15	6.73
16	8
17	9.51
18	11.31
19	13.45
20	16

I/O ratio	[dB]
0	-∞
0.01	-40
0.02	-34
0.03	-30.5
0.04	-28
0.05	-26
0.06	-24.4
0.07	-23.1
0.08	-21.9
0.09	-20.9
0.1	-20
0.15	-16.5
0.2	-14
0.25	-12
0.3	-10.5
0.35	-9.1
0.4	-8
0.45	-6.9
0.5	-6
0.6	-4.4
0.7	-3.1
0.8	-1.9
0.9	-0.9
1	0
	0 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.6 0.7

Notch filter frequency characteristics



How to Check the Resonance Frequency of the Machine

- (1) Start up the Setup Support Software, "PANATERM" and bring the frequency characteristics measurement screen.
- (2) Set up the parameters and measurement conditions. (Following values are standard.)
 - Set up Pr1.01 (1st gain of velocity loop) to 25 or so. (to lower the gain and make it easy to identify the resonance frequency)
 - Set up the amplitude to 50 (r/min) or so. (not to saturate the torque)
 - Make the offset to 100 (r/min) or so. (to increase the speed detecting data and to avoid the measurement error in the vicinity of speed-zero)
 - Polarity is made positive direction with "+" and negative direction with "-".
 - Setup the sampling rate to 0. (setup range to be 0 to 7.)
- (3) Execute the frequency characteristic analysis.

Remarks 🔆

• Make sure that the revolution does not exceed the travel limit before the measurement. Standard revolutions are.

Offset $(r/min) \times 0.017 \times (sampling rate +1)$

Larger the offset, better measurement result you can obtain, however, revolutions may be increased.

Set up Pr2.00 (Setup of adaptive filter mode) to 0 while you make measurement.

Note

- When you set a larger value of offset than the amplitude setup and make the motor run to the one direction at all time, you can obtain a better measurement result.
- Set up a smaller sampling rate when you measure a high frequency band, and a larger sampling rate when you measure a low frequency band in order to obtain a better measurement result.
- When you set a larger amplitude, you can obtain a better measurement result, but noise will be larger. Start a measurement from 50 [r/min] and gradually increase it.

Relation of Gain Adjustment and Machine Stiffness

In order to enhance the machine stiffness,

- (1) Install the base of the machine firmly, and assemble them without looseness.
- (2) Use a coupling designed exclusively for servo application with high stiffness.
- (3) Use a wider timing belt. Belt tension to be within the permissible load to the motor shaft.
- (4) Use a gear reducer with small backlash.
 - Inherent vibration (resonance frequency) of the machine system has a large effect to the gain adjustment of the servo.

You cannot setup a higher response of the servo system to the machine with a low resonance frequency (machine stiffness is low).



Please download the Setup support software "PANATERM" from our web site anduse after install to the PC.

http://industrial.panasonic.com/ww/products/motors-compressors/fa-motors/ac-servo-motors/minas-a5-panaterm

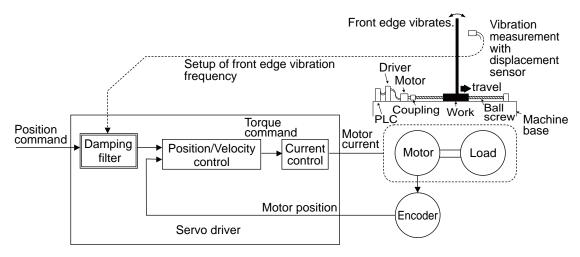
Related page ...

• P.7-26 "Outline of Setup support software "PANATERM"

Damping Control

Outline

This function reduces vibration at the edge or over the entire equipment by removing the vibration frequency components specified by the positional command. Among the four frequency settings, up to three can be used at the same time.



Applicable Range

This function can only be applicable when the following conditions are satisfied.

	Conditions under which the damping control is activated
Control mode	Control mode to be either or both position control or/and full-closed control. Pr0.01 = 0 : Position control Pr0.01 = 3 : 1st control mode of position and velocity control Pr0.01 = 4 : 1st control mode of position control and torque control Pr0.01 = 6 : Full-closed control

Caution

This function does not work properly or no effect is obtained under the following conditions.

	Conditions which obstruct the damping control effect
Load	Vibration is triggered by other factors than command (such as disturbance).
condition	 Ratio of resonance frequency and anti-resonance frequency is large. Vibration frequency is out of the range of 1.0-300.0 [Hz].

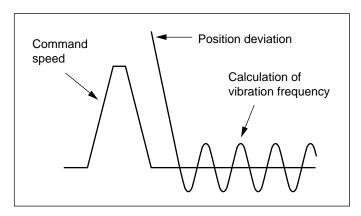
Related page 🔆 • P.4-6 to P.4-85... "Details of parameter" • P.7-26 "Outline of Setup support software "PANATERM"

How to Use

(1) Setup of damping frequency (1st: Pr2.14, 2nd: Pr2.16, 3rd: Pr2.18, 4th: Pr2.20))

Measure the vibration frequency at the top of the equipment. When you can use such instrument as a laser displacement meter to directly measure the top end vibration, read out the vibration frequency from the measured waveform in unit of 0.1[Hz] and set it to the parameter.

If no measuring device is available, measure the frequency based on the residual vibration of the position deviation waveform measured using the vibration frequency monitor or the waveform graphic function of the setup support software (PANATERM).



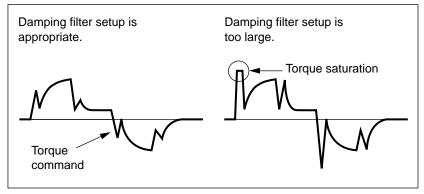
(2) Setup of damping filter (1st: Pr2.15, 2nd: Pr2.17, 3rd: Pr2.19, 4th: Pr2.21))

First set to 0 and check the torque waveform during operation.

Although you can reduce the settling time by specifying a larger value, the torque ripple increases at the command changing point as shown in the following figure. Set up a value within the range where no torque saturation occurs under the actual condition. If torque saturation occurs, the vibration suppression effect will be lost.

Caution 🔆

Setting range of the damping filter should be limited as follows: $10.0 \text{ Hz} - \text{damping frequency} \le \text{damping filter setting} \le \text{damping frequency}$



(3) Damping depth setting (Pr. 6.14, Pr. 6.60, Pr. 6.71, Pr. 6.72) Damping width setting (Pr. 2.27, Pr. 2.28, Pr. 2.29, Pr. 2.30)

If further aims to vibration suppression, set optimum value that most vibration is redused by increase (shallow) depth setting value little by little from 0.

Also if reducing the control delay is desired, reduce (narrow) width setting. When support variation of vibration frequency, increase (widen) width setting.

Model-type damping filter

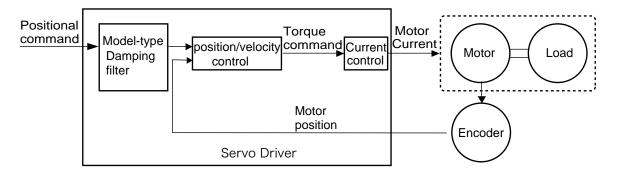
Outline

This function reduces vibration at the edge or over the entire equipment by removing the vibration frequency components specified by the positional command.

The model-type damping filter can also remove resonance frequency components as well as anti-resonance frequency components, enhancing the effect of a conventional damping filter to generate smooth torque commands and offering a better damping effect.

In addition, the removal of anti-resonance frequency components and resonance frequency components can increase the responsiveness of the command response filter, which improves the settling time.

However, unlike a conventional damping filter, the model-type damping filter cannot obtain vibration components from the position sensor for the measurement of antiresonance frequency components and resonance frequency components, which thus requires frequency characteristics analysis and the setting of optimum parameter values.



Applicable Range

This function can only be applicable when the following conditions are satisfied.

	Conditions under which the Model type resonance oppression notch filter is activated
Control mode	Control mode to be Two-degree-of-freedom control position control.

Caution

This function does not work properly or no effect is obtained under the following conditions.

	Conditions which obstruct the Model type resonance oppression notch
	filter effect
Load condition	 Vibration is triggered by other factors than command (such as disturbance). Resonance frequency and antiresonance frequency is out of the range of 5.0-300.0 [Hz].

Caution

In addition, Previous damping filter is used under the following conditions.

	Conditions of the previous damping filter
Parameter setting	 Resonance frequency and antiresonance frequency is the relation. 300.0[Hz] ≥ Resonance frequency > antiresonance frequency ≥ 5.0[Hz] response frequency and antiresonance frequency is the relation. 300.0[Hz] ≥ antiresonance frequency*4 ≥ Resonance frequency ≥ antiresonance frequency ≥ 5.0[Hz] By setting value of Pr2.13[Selection of damping filter switching] is equalto 4,it is effctive to make the 1st and the 2nd model type resonance oppression notch filter,in addition the 1st and the 2nd response frequency/antiresonance frequency ratio is out of the range of 8.(At this moment,the 2nd model type resonance oppression notch filter become the previous damping filter.)

When the damping filter works in a conventional manner, the three parameters of antiresonance frequency, anti-resonance attenuation ratio and response frequency will be used for damping frequency, damping depth and damping filter setting.

To completely disable this function, all of the five parameters of resonance frequency, resonance attenuation ratio, anti-resonance frequency, anti-resonance attenuation ratio and response frequency should be set to 0.

How to Use

The determination of resonance frequency and anti-resonance frequency is the frequency characteristic analysis. Need to set the appropriate parameters. Model-type damping filter is setted by Pr2.13.

Contents of setup values 4 to 6 will differ with enabled/disabled switching of two degree-of-freedom control mode.

Two degree-of-freedom control mode disabled, set the value as 0.

Pr2.13	VS-SEL1	1st model type damping	2nd model type damping
4	_	Enabled	Enabled
-	OFF	Enabled	Disabled
5	ON	Disabled	Enabled

When set to 6:To be switched by command direction.

	Pr2.13	Position command	1st model type	2nd model type
l		direction	damping	damping
ſ	6	Positive direction	Enabled	Enabled
		Negative direction	Disabled	Enabled

Model type resonance oppression notch filter

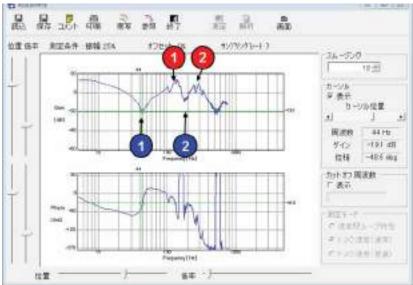
How to Use

Set up the model-type damping filter using the following parameters.

Class	No.	Parameter name	Function
6	61	1st resonance frequency	Defines the resonance frequency of the model-type damping filter's load. The unit is [0.1 Hz].
6	62	1st resonance damping ratio	Defines the resonance attenuation ratio of the model-type damping filter's load. The attenuation ratio can be set as the setup value multiplied by 0.001. The value of 1000 results in an attenuation of 1 (no peak). The smaller the setup value, the smaller the attenuation ratio (higher resonance peak).
6	63	1st anti-resonance frequency	Defines the anti-resonance frequency of the model-type damping filter's load. The unit is [0.1 Hz].
6	64	1st anti-resonance damping ratio	Defines the anti-resonance attenuation ratio of the model-type damping filter's load. The attenuation ratio can be set as the setup value multiplied by 0.001. The value of 1000 results in an attenuation of 1 (no peak). The smaller the setup value, the smaller the attenuation ratio (higher resonance peak).
6	65	1st response frequency	Defines the response frequency of the model-type damping filter's load. The unit is [0.1 Hz].
6	66	2nd resonance frequency	Defines the 2nd resonance frequency of the model-type damping filter's load. The unit is [0.1 Hz].
6	67	2nd resonance damping ratio	Defines the 2nd resonance attenuation ratio of the model-type damping filter's load. The attenuation ratio can be set as the setup value multiplied by 0.001. The value of 1000 results in an attenuation of 1 (no peak). The smaller the setup value, the smaller the attenuation ratio (higher resonance peak).
6	68	2nd anti-resonance frequency	Defines the 2nd anti-resonance frequency of the model-type damping filter's load. The unit is [0.1 Hz].
6	69	2nd anti-resonance damping ratio	Defines the 2nd anti-resonance attenuation ratio of the model-type damping filter's load. The attenuation ratio can be set as the setup value multiplied by 0.001. The value of 1000 results in an attenuation of 1 (no peak). The smaller the setup value, the smaller the attenuation ratio (higher resonance peak).
6	70	2nd response frequency	Defines the 2nd response frequency of the model-type damping filter's load. The unit is [0.1 Hz].

How to Use

- As preparation, measure the resonance frequency and anti-resonance frequency using the frequency characteristic measuring function of PANATERM with torque velocity mode.
 - Ex.) The figure below shows the measurement result with a belt device. Ignoring small resonances, the resonance frequency at the gain peak and the anti-resonance frequency at the gain valley are as follows:
 - 1st resonance frequency = 130 [Hz], 1st anti-resonance frequency = 44 [Hz] 2nd resonance frequency = 285 [Hz], 2nd anti-resonance frequency=180 [Hz]
- 2) The resonance attenuation ratio and anti-resonance attenuation ratio should have initial values of around 50 (0.050).
- 3) The response frequency should start with the same value as the anti-resonance frequency.
- 4) Specify a value of 4 to 6 in Pr. 2.13 "Damping filter switching selection" to enable model-type damping control.
- 5) Activate the motor and fine tune the parameters in the following sequence so that vibration components including command position deviation become small.
 - (1) Anti-resonance frequency
 - (2) Anti-resonance attenuation ratio
 - (3) Resonance frequency
 - (4) Resonance attenuation ratio
- 6) Once the setting where vibration is minimized was found, increase the setup value of response frequency. The response frequency increases from one to four times the anti-resonance frequency, and the higher the frequency, the smaller the delay due to damping control. However, the damping effect decreases gradually, so a balanced setting should be chosen.



Example of frequency characteristic measurement with setup support software PANATERM

Outline

When position control or full closed control is used, positional deviation can be further reduced when compared with deviation where control is made only by feedback, and response is also improved, by calculating the velocity control command necessary for operation based on the internal positional command, and by adding velocity feed forward to the speed command calculated by comparison with position feedback.

The response time of the velocity control system is also improved by calculating torque command necessary for operation based on the velocity control command and by adding torque feed forward calculated by comparison with velocity feedback to the torque command.

Related Parameter

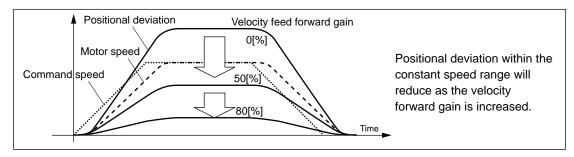
For A6 series, the velocity feed forward and torque feed forward can be used.

Class	No.	Title	Function
1	10	Velocity feed forward gain	Multiply the velocity control command calculated according to the internal positional command by the ratio of this parameter and add the result to the speed command resulting from the positional control process.
1	11	Velocity feed forward filter	Set the time constant of 1st delay filter which affects the input of velocity feed forward.
1	12	Torque feed forward gain	Multiply the torque command calculated according to the velocity control command by the ratio of this parameter and add the result to the torque command resulting from the velocity control process.
1	13	Torque feed forward filter	Set up the time constant of 1st delay filter which affects the input of torque feed forward.
6	0	Analog torque feed forward conversion gain	Set the input gain of analog torque feed forward. 0 to 9 are invalid.
6	10	Function expansion setup	Set up the function in unit of bit. bit5 0: Analog torque feed forward is invalid. 1: Analog torque feed forward is Valid. * bit 0 = LSB

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 $[1/s] \times (100 - velocity feed forward gain [%]) / 100$

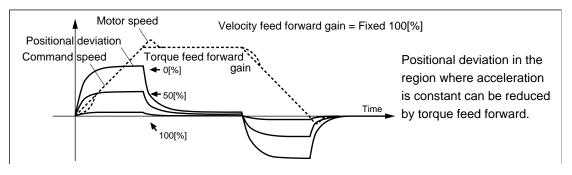


With the gain set at 100 %, calculatory positional deviation is 0, but significant overshoot occurs during acceleration/deceleration.

If the updating cycle of the positional command input is longer than the driver control cycle, or the pulse frequency varies, the operating noise may increase while the velocity feed forward is active. If this is the case, use positional command filter (1st delay or FIR smoothing), or increase the velocity forward filter setup value.

Usage example of torque feed forward

- To use the torque feed forward, correctly set the inertia ratio.
 Use the value that was determined at the start of the real time auto tuning, or set the inertia ratio that can be calculated from the machine specification to 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.



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.

3

Usage example of analog torque feed forward

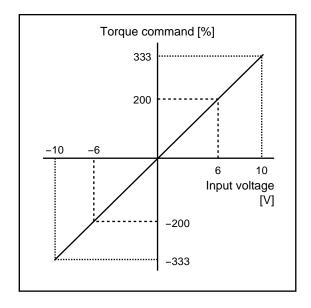
Setting bit 5 place of Pr6.10 Function expansion setup to 1 enables the analog torque feed forward. When the analog input 3 is used by another function (e.g. analog torque limit), the function becomes invalid.

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 voltage (V) applied to the analog input 3 is converted to the motor torque command (%) through the process as shown in the graph below.

The slope represents when Pr6.00 = 30. The slope changes as the setup value changes.

Torque command (%) = $100 \times \text{input voltage (V)} / (\text{Pr}6.00 \text{ setup value} \times 0.1)$



Adjustment

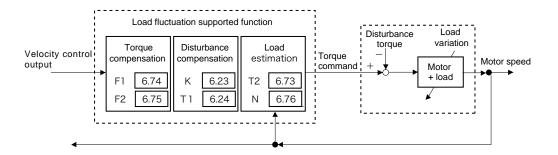
5. Manual Gain Tuning (Application)

Load variation suppression function

Outline

This function uses the disturbance torque determined by the disturbance observer to reduce effect of disturbance torque and vibration.

To cope with the real-time auto-tuning is useful when there is a change of load.



Applicable Range

This function can be applicable only when the following conditions are satisfied.

	Conditions under which the disturbance observer is activated	
Control mode	• Should be either position control, velocity control, or full-closed control.	
Others	 Should be in servo-on condition Elements other than control parameters, such as deviation counter clear command inhibit and torque limit, are appropriately set, enabling the motor to run normally. Real-time automatic tuning is invalid. (Pr0.02=0) 	

Caution

Effect may not be expected in the following condition.

	Conditions which obstruct disturbance observer action	
Load	 The rigidity is low (the anti-resonance point is at low frequency range of 10 Hz or below). The load shows a clear non-linear trend with friction and backlash 	

Load fluctuation control function

Related Parameterctuation

Class	No.	Title	Function
6	10	Function expansion setup	Enables or disables the load variation suppression function. bit1 0: Disables the load variation suppression function 1: Enables the load variation suppression function bit2 0:Disables the load variation stabilization setting 1: Enables the load variation stabilization setting bit14 0: Disables the load variation suppression function automatic adjustment 1: Enables the load variation suppression function automatic adjustment * The least significant bit is bit0
6	23	Load variation compensation gain	Defines the compensation gain against load variation.
6	24	Load variation compensation filter	Defines the filter time constant against load variation.
6	73	Load estimation filter	Defines the filter time constant for load estimation.
6	74	Torque compensating frequency 1	Defines the filter frequency 1 against the velocity control output. Torque compensation is enabled when the relation between Pr. 6.74 "Torque compensation frequency 1" and Pr. 6.75 "Torque compensation frequency 2" satisfies the following formula. (Pr. 6.75 x 32) ≥ Pr. 6.74 > Pr. 6.75 ≥ 1.0 Hz
6	75	Torque compensating frequency 2	Defines the filter frequency 2 against the velocity control output. Torque compensation is enabled when the relation between Pr. 6.74 "Torque compensation frequency 1" and Pr. 6.75 "Torque compensation frequency 2" satisfies the following formula. $(\text{Pr. 6.75} \times 32) \geq \text{Pr. 6.74} > \text{Pr. 6.75} \geq 1.0 \text{ Hz}$
6	76	Load estimation count	Defines the load estimation count.

How to Use

There are two methods below for adjusting the load variation suppression function.

- When there is no load inertia variation (disturbance suppression setting)
- Make normal gain adjustment in advance.
 Use real-time auto tuning (Pr 0.02=1) with the load variation suppression function automatic adjustment disabled (Pr 6.10 bit14=0), and set stiffness (Pr 0.03) as high as possible.
- 2) Set bit14 to 1 in Pr 6.10 "Function expansion setting" to enable the load variation suppression function automatic adjustment, and check disturbance suppression effect with the motor rotate.
 - *Before enabling or disabling the load variation suppression function, turn off the
 - *If this change causes the motor to oscillate or generates an abnormal sound, return to Step [1] and decrease the servo rigidity by one or two levels before repeating the subsequent steps.
- 3) If further aims to adjust, set bit14 to 0 in Pr 6.10 to disable the automatic adjustment of load variation suppression function.
- 4) Specify a small value as possible in Pr 6.24 "Load variation compensation filter."

 Decreasing the filter setup value within the range that does not produce any significant abnormal sound or torque command variation will improve disturbance suppression performance and reduce motor velocity variation and encoder position deviation.
 - *When an abnormal sound at high frequency (1 kHz or above) is generated, increase the value in Pr 6.76 "Load estimation count."
 - *When vibration at low frequency (10 Hz or below) is produced after operation stops, increase the value in Pr 6.23 "Load variation compensation gain".
 - *No change is required for Pr 6.73 "Load estimation filter" in normal cases, but you can set the optimum point by fine-tuning within the range between around 0.00 and 0.20 ms.
- When there is load inertia variation (load variation stabilization setting)
- 1) Turn ON the control power in two-degree-of-freedom position control (synchronization type) (Pr 0.01=0, Pr 6.47 bit0=1 bit3=1).
- 2) Set the command response filter (Pr 2.22) to 10ms.
- 3) Set real-time auto tuning to load variation support mode, and operate the motor in a pattern as large as possible load variation occurs in this state.
- 4) Set the stiffness setting (Pr 0.03) as large as possible.
- 5) Set the command response filter to appropriate value to continue to derease while checking response of the motor. (*In case of need to the multi-axis trajectory control, change all axes Pr 2.22 to the same value and adjust.)

3rd gain switching function

Outline

In addition to the normal gain switching function described on P.5-17, 3rd gain switching function can be set to increase the gain just before stopping. The higher gain shortens positioning adjusting time.

Applicable Range

This function can be applicable only when the following conditions are satisfied.

	Conditions under which the 3rd gain switching function is activated	
Control mode • Control mode to be either or both position control or/and full-closed co		
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. 	

Related Parameter

Class	No.	Title	Function
6	5	Position 3rd gain valid time	Set up the time at which 3rd gain becomes valid.
6	6	Position 3rd gain scale factor	Set up the 3rd gain by a multiplying factor of the 1st gain: 3rd gain = 1st gain × Pr6.06/100

Before Using the Products

How to Use

While in the condition under which the normal gain switching functions, set the 3rd gain application time to Pr6.05 Position 3rd gain enable time, and set the 3rd gain (scale factor with reference to 1st gain) to Pr6.06 Position 3rd gain magnification ratio.

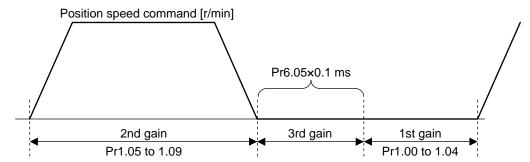
- If 3rd gain is not used, set Pr6.05 to 0 and Pr6.06 to 100.
- The 3rd gain is enabled only for position control or full closed control.
- During the 3rd gain period, only position loop gain/speed proportional gain becomes 3rd gain, during other periods, 1st gain setting is used.
- When the 2nd gain switching condition is established during 3rd gain period, 2nd gain is used.
- During transition from 2nd gain to 3rd gain, Pr1.19 Position gain switching time is applied.



When the gain is switched from 2nd to 1st by the change in parameter, the 3rd gain period appears.

Example)

Pr1.15 Position control switching mode = 7 switching condition: with positional command:



[3rd gain period]

Position loop gain = $Pr1.00 \times Pr6.06/100$ Speed proportional gain = $Pr1.01 \times Pr6.06/100$ Time constant of velocity integration, speed detection filter and torque filter directly use the 1st gain value.

Friction torque compensation

Outline

To reduce effect of friction represented by mechanical system, 2 types of friction torque compensation can be applied: offset load compensation that cancels constant offset torque and the dynamic friction compensation that varies direction as the operating direction varies.

Applicable Range

This function can be applicable only when the following conditions are satisfied.

	Conditions under which the Friction torque compensation is activated
Control mode	• Specific to individual functions. Refer to "Related parameters" shown below.
Others	 Should be in servo-on condition 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.

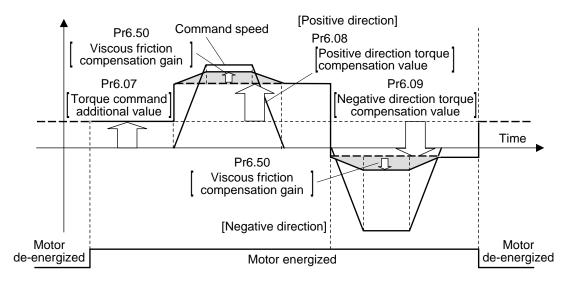
Related Parameter

Combine the following 3 parameters to setup appropriate friction torque compensation.

Class	No.	Title	Function
6	7	Torque command additional value	Set up the offset load compensation value usually added to the torque command in a control mode except for the torque control mode.
6	8	Positive direction torque compensation value	Set up the dynamic friction compensation value to be added to the torque command when forward positional command is fed.
6	9	Negative direction torque compensation value	Set up the dynamic friction compensation value to be added to the torque command when negative direction positional command is fed.
6	50	Viscous friction compensating gain	When the 2 degree of freedom control mode is active, the product of the instruction speed and the setting value is used as the friction torque compensation and the torque command is added to the torque. By setting the value of the viscous friction coefficient estimation of real-time auto-tuning, it can improve the feedback scale position deviation of the settling area.

How to Use

The friction torque compensation will be added in response to the entered positional command direction as shown below.



The friction compensation torque is the sum of the offset load compensation value which is set according to the torque command additional value (always constant) and the dynamic friction compensation torque which is set according to positive/negative direction torque compensation value.

The command speed direction is reset upon power-up or when the motor is de-energized.

- Pr6.07 [Torque command additional value] reduces variations in positioning operation (performance is affected by direction of movement). These variations occur when constant offset torque resulting from weight on vertical axis is applied to the motor.
- Certain loads such as belt driven shaft requires high dynamic friction torque, which lengthens positioning setting time or varies positioning accuracy. These problems can be minimized by setting the friction torque of every rotating direction into individual parameters. Pr6.08 [Positive direction torque compensation value] and Pr6.09 [Negative direction torque compensation value] can be used for this purpose.

The offset load compensation and dynamic friction compensation can be used individually or in combination. However, some control modes impose limit on application.

- For torque control: Offset load compensation and dynamic friction compensation are set at 0 regardless of parameter setting.
- For velocity control with servo-off: Offset load compensation per Pr6.07 is enabled. Dynamic friction compensation is set at 0 regardless of parameter setting.
- For position control or full closed control with servo-on: Previous offset load compensation and dynamic friction compensation values are maintained until the first positional command is applied where the offset load compensation value is updated according to Pr6.07. The dynamic friction compensation value is updated to parameters Pr.6.08 and Pr6.09 depending on command direction.

Inertia ratio switching function

Outline

Inertia ratio can be switched between No.1 and No.2 by the switching input (J-SEL). This feature is useful in application where the load inertia changes in two steps.

Applicable Range

This function can be applicable only when the following conditions are satisfied.

	Conditions under which the Inertia ratio switching function is activated	
Control mode	Can be used in all control modes. Pr0.01 = 0 : Position control Pr0.01 = 1 : Velocity control Pr0.01 = 2 : Torque control Pr0.01 = 3 : Position/Velocity control Pr0.01 = 4 : Position/Torque control Pr0.01 = 5 : Velocity/Torque control Pr0.01 = 6 : Full-closed control	
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. Real-time auto-tuning should be disabled. (Pr0.02=0) Adaptive filter should be disabled. (Pr2.00=0) Instantaneous speed observer should be disabled. (Pr6.10 bit0=0) Disturbance observer should be disabled. (Pr6.24=0 bit1=0) 	

Caution

- Be sure to change the inertia ratio while the motor is in stop state. Otherwise, vibration or oscillation will occur.
- If the difference between the 1st inertia ratio and 2nd inertia ratio is large, vibration, etc., may occur even in stop mode. These potential problems should be identified on the actual model.

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Inertia ratio switching function

Related Parameter

Combine the following 3 parameters to setup appropriate inertia ratio switching function.

Class	No.	Title	Function
6	10	Function expansion setup	Sets bits related to inertia ratio switching function. bit1 0: Invalid 1: Valid bit2 0: Always valid 1: Valid only when 1st gain is selected. * bit 0 = LSB Example) To enable inertial ratio switching Setup value = 8
0	04	Inertia ratio	Set 1st inertia ratio. You can set up the ratio of the load inertia against the rotor (of the motor) inertia.
6	13	2nd Inertia ratio	Set 2nd inertia ratio. You can set up the ratio of the load inertia against the rotor (of the motor) inertia.

How to Use

• Select 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 (Pr6.13)

Outline

This function suppresses vibration due to amount of twist between the motor and load in the full closed control mode. This function enables high gain setting.

Applicable range

This function can be applicable only when the following conditions are satisfied.

	Conditions under which the Hybrid vibration damping function is activated
Control mode	Full-closed control mode
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

The effect of this function will be proportional to the amount of twist between the motor and load.

Related Parameter

Class	No.	Title	Function
6	34	Hybrid vibration suppression gain	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.
6	35	Hybrid vibration suppression filter	Set up the time constant of the hybrid vibration suppression filter for full-closed controlling.

How to Use

- [1] Set Pr6.34 Hybrid vibration suppression gain to the value equal to that of positional loop gain.
- [2] Driving under full closed control, gradually increase the setup value of Pr6.35 Hybrid vibration suppression filter while checking response change. When the response is improved, adjust Pr6.34 and Pr6.35 to determine the combination that provides the best response.

Quadrant projection suppression function

Outline

Control configuration can be switched to suppress quadrant projection occurring during arc interpolation of 2 or more axes. To be used in conjunction with load fluctuation suppression function.

Applicable range

This function can be applicable only when the following conditions are satisfied.

	Conditions under which the Hybrid vibration damping function is activated
Control mode	To be in either position control or full close control mode
Others	 Should be in servo-on condition Elements other than control parameters, such as prohibition of deviation counter clear command input and torque limit, etc. are set appropriately, in a state where there are no obstructions in normal motor revolutions.

Caution

There are cases where effects cannot be observed under the following conditions.

	Conditions which obstruct disturbance observer action	
Load	 When rigidity is low (anti-resonance point exists in the low frequency range of 10 Hz or lower). When non-linearity of load is strong from existence of backlash, etc. When action patterns are changed. 	

Related Parameter

Class	No.	Title	Function
5	45	Quadrant projection positive direction compensation amount	Sets amount of compensation to be added to torque command when the position command is in positive direction and quadrant projection compensation function is enabled.
5	46	Quadrant projection negative direction compensation amount	Sets amount of compensation to be added to torque command when the position command is in negative direction and quadrant projection compensation function is enabled.
5	47	Quadrant projection compensation delay time	Sets the length of delay time for switching of amount of compensation after position command has been reversed, when quadrant projection compensation function is enabled.
5	48	Quadrant projection compensation filter setting L	Sets time constant for low-pass filter on the amount of compensation on torque command when quadrant projection compensation function is enabled.
5	49	Quadrant projection compensation filter setting H	Sets time constant for high-pass filter on the amount of compensation on torque command when quadrant projection compensation function is enabled.

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

Quadrant projection suppression function

Related Parameter

Class	No.	Title	Function
6	47	Function expansion setting 2	Bit14: Enables/disables quadrant projection compensation function. (0: disabled, 1: enabled)
6	97	Function expansion setting 3	Bit 0 : Enables/disables quadrant projection compensation function. (0: disabled, 1: enabled) * Please set to 1 to set the amount of quadrant projection compensation for each reversed direction when traveling direction is reversed.

How to Use

Load fluctuation suppression function is adjusted through disturbance suppression setting to measure quadrant projection.

If the level is unsatisfactory, fine adjustment can be conducted using the quadrant projection suppression function.

- 1) Reclose control power supply after enabling quadrant projection suppression function (Pr 6.47 bit14 = 1)
- 2) Set initial values to: Pr 5.47 = 0, Pr 5.48 = Pr 1.04, Pr 5.49 =0.
- 3) Measure the magnitude of quadrant projection and conduct fine adjustments to Pr 5.45 and Pr 5.46 of each axis.
- * In case of delay in quadrant projection from travelling direction reversing timing, try changing Pr 5.47 and Pr5.48.
- * To set the amount of quadrant projection compensation to the revised direction when the traveling direction is reversed, try chanting Pr6.97 bit 0 to 1 and changing Pr 5.49.

Adjustment

5. Manual Gain Tuning (Application)

Two-degree-of-freedom control mode (Position control mode)

Outline

In the two-degree-of-freedom control mode, command response and servo rigidity can be independently set with improved responsiveness. This mode has enhanced position control functions.

Applicable Range

This function can be applicable only when the following condition are satisfied.

	Conditions under which the Two-degree-of-freedom control mode is activated.	
Control Mode	Position control	
Others	 Should be servo-on condition. Factors other than control parameters such as torque limit should be properly setup, allowing motor to operate normally. 	

Related Parameter

First, set Pr6.47 Function expansion setup 2 to 1 and write the setting to EEPROM. Reset the control power supply to enable the two-degree-of-freedom control mode. Adjust the gain by using the real-time auto-tuning (refer to P.5-10). If further improvement is necessary, manually fine tune the following parameters while checking the response.

Class	No.	Title	Function
6	47	Function expansion settings 2	Set up various functions bit by bit. bit 0 Two-degree-of-freedom control mode 0: Invalid 1: Valid bit 3 Two-degree-of-freedom control real-time auto-tuning select 0: Standard type 1: Synchronous type *The least significant bit is represented by bit0. *For bit3 (two-degree-of-freedom control real time auto tuning select): this is made usable when bit0 is at 1 (valid).
2	22	First order filter time constant for command	While the two-degree-of-freedom control real-time autotuning is selected, time constant of command filter is applied with the maximum value limited to 2000 (= 200.0 ms). (The value of the parameter is not limited but the value to be applied to driver is limited. Set attenuation term in Pr6.49 [Set attenuation term of command filter/adjustment filter].) Decreasing the value of this parameter makes command response fast and large, resulting smooth command response.

(continued)

5

When in Trouble

Supplement

Two-degree-of-freedom control mode (Position control mode)

Class	No.	Title	Function
6	48	Adjust filter	Sets time constant of adjustment filter. When the torque filter setting is changed, set the parameter to a value close to real-time auto-tuning setting. Fine adjustment by checking positional deviation of the encoder near setting point may improve overshoot or oscillatory waveform.
6	49	Adjust/ Torque command attenuation term	Sets attenuation term of command filter and adjustment filter. Decimal notation: 1st digit sets command filter and 2nd digit sets adjustment filter. Value of digit 0 to 4: Without attenuation term (functions as 1st filter). Value of digit 5 to 9: The 2nd filter (attenuation term ζ is 1.0, 0.86, 0.71, 0.50 and 0.35, in that order). <example> To set command filter ζ = 1.0, adjustment filter 1 ζ = 0.71: Setup value = 75 1st digit = 5 (ζ = 1.0), 2nd digit = 7 (ζ = 0.71) Pr2.22 Command smoothing filter is applied as time constant of command filter.</example>
6	50	Viscous friction compensation gain	Adds the result of command speed multiplied by this setup value to torque command as viscous friction torque correction value. By setting the estimate value of viscous friction coefficient of real-time auto-tuning, encoder positional deviation near the setting point may be improved.

Adjustment

5. Manual Gain Tuning (Application)

Two-degree-of-freedom control mode (Velocity control mode)

Outline

In the two-degree-of-freedom control mode, command response and servo rigidity can be independently set with improved responsiveness. This mode has enhanced speed control functions.

Applicable Range

This function can be applicable only when the following condition are satisfied.

	Conditions under which the Two-degree-of-freedom control mode is activated.	
Control Mode	Speed control	
Others	 Should be servo-on condition. Factors other than control parameters such as torque limit should be properly setup, allowing motor to operate normally. 	

Related Parameter

First, set Pr6.47 Function expansion setup 2 to 1 and write the setting to EEPROM. Reset the control power supply to enable the two-degree-of-freedom control mode. Adjust the gain by using the real-time auto-tuning (refer to P.5-10). If further improvement is necessary, manually fine tune the following parameters while checking the response.

Class	No.	Title	Function
6	47	Function expansion settings 2	Set up various functions bit by bit. bit 0 Two-degree-of-freedom control mode 0: Invalid 1: Valid *The least significant bit is represented by bit0.
2	22	First order filter time constant for command	While the two-degree-of-freedom control real-time autotuning is selected, time constant of command filter is applied with the maximum value limited to 640 (= 64.0 ms). (The value of the parameter is not limited but the value to be applied to driver is limited.) Decreasing the value of this parameter makes command response fast and large, resulting smooth command response.
6	48	Adjust filter	To set the time constant of adjustment filter. When the torque filter setting is changed, set the adjustment filter to a near value while referring to setting of real-time auto-tuning. In addition, by finely adjusting the adjustment filter while monitoring the encoder position deviation in the vicinity of steady state, overshoot or vibration waveforms may be sometimes improved.

Two-degree-of-freedom control mode (full-close control)

Outline

The two degree-of-freedom control mode is an extended function of full-close control mode to improve the responsiveness by making it possible to independently set the command response and servo rigidity.

Applicable Range

This function can be applicable only when the following condition are satisfied.

	Conditions under which the Two-degree-of-freedom control mode is activated.	
Control Mode	•Full-close control	
Others	 Should be servo-on condition. Elements other than control parameters, such as torque limit, etc. are properly set and the motor is free of obstacle to normal motor rotation. 	

Related Parameter

First of all, with Pr6.47 write "Function expansion setting 2" = 1 into EEPROM, and then, make the two degree-of-freedom control mode enabled by resetting the control power supply.

Thereafter, adjust by the real-time auto-tuning (refer to 5-1-3). Only when further improvement is required, finely adjust the following parameters manually while checking the responses.

Class	No.	Title	Function
6	47	Function expansion settings 2	Set up various functions bit by bit. bit 0 Two-degree-of-freedom control mode 0: Invalid 1: Valid bit 3 Two degree-of-freedom control real-time auto-tuning select 0: Standard type 1: Synchronous type *The least significant bit is represented by bit0. *bit 3 (two-degree-of-freedom control real-time auto-tuning chosen) becomes enabled only when bit 0 is set to 1: Enabled.
2	22	First order filter time constant for command	While the two-degree-of-freedom control real-time auto-tuning is selected, time constant of command filter is applied with the maximum value limited to 640 (= 64.0 ms). (The value of the parameter is not limited but the value to be applied to driver is limited.) Decreasing the value of this parameter makes command response fast and large, resulting smooth command response.
6	48	Adjust filter	Sets time constant of adjustment filter. When the torque filter setting is changed, set the parameter to a value close to real-time auto-tuning setting. Fine adjustment by checking positional deviation of the encoder near setting point may improve overshoot or oscillatory waveform.

5

Adjustment

5. Manual Gain Tuning (Application)

Two-degree-of-freedom control mode (full-close control)

Related Parameter

Class	No.	Title	Function
6	49	Command response filter / adjustment filter damping term setting	Sets the damping term of command response filter and adjustment filter. In the decimal number system, the first digit indicates the command response filter setting and the second digit the adjustment filter setting. Target digits: 0-4: No damping term (operates as a primary filter). 5-9: Secondary filter (damping term ζ becomes 1.0, 0.86, 0.71, 0.50, and 0.35 in sequence). However, when Pr 2.13 "Damping filter switching select" is 4 (when two of model type damping controls are valid), the damping ratio is fixed to 1.0 when the secondary filter is chosen. Ex.) In the event that you want to have $\zeta=1.0$ for the command response filter and $\zeta=0.71$ for the adjustment filter 1, the setting value is 75 (5 for the first digit ($\zeta=1.0$) and 7 for the second digit ($\zeta=0.71$)). Pr 2.22 "Command smoothing filter" is applied for the time constant of command response filter,
6	50	Viscosity friction compensation gain	Adds the result of multiplying the command speed by this setting to the torque command as the viscous friction torque compensation value. Setting the estimated value of viscous friction coefficient of real time auto-tuning may sometimes improve the encoder position deviation near the steady state.

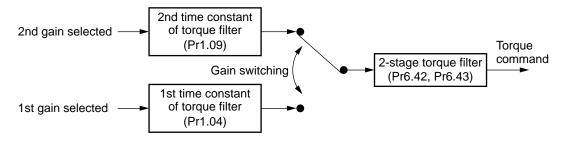
Adjustment

5. Manual Gain Tuning (Application)

Two-stage torque filter

Outline

In addition to existing 1st and 2nd torque filter (Pr1.04 and Pr1.09), the 3rd torque filter can be set. This 2-stage torque filter will effectively suppress oscillating component in high frequency range.



Applicable Range

This function can be applicable only when the following condition are satisfied.

	2-stage torque filter operating condition
Control Mode Can be used in any control mode.	
Others	 Should be servo-on condition. Factors other than control parameters such as torque limit should be properly setup, allowing motor to operate normally.

Caution

- Excessively high setup value makes control unstable and may cause oscillation.
- Set to an appropriate value by checking condition of the device.
- Changing Pr6.43 2-stage torque filter attenuation term during operation may cause oscillation. Stop operation before changing the term.

Before Using the Products

Two-stage torque filter

Related Parameter

Class	No.	Title	Function
6	42	Two-stage torque filter time constant	[Setting range: 0 to 2500] Sets time constant of 2-stage torque filter. Setup value 0: invalid [When using in 2nd filter with Pr6.43≥50] Compatible time constant range is 5 to 159 (0.05 ms to 1.59 ms) (corresponding frequency range: 100 Hz to 3000 Hz) Setup values 1 to 4 function as 5 (3000 Hz) and 159 to 2500 as 159 (100 Hz).
6	43	Two-stage torque filter Attenuation term	[Setting range: 0 to 1000] Set the attenuation term of 2-stage torque filter. This setup value is used to switchover between 1st and 2nd filter of 2-stage filter. 0 to 49: Operates as 1st filter. 50 to 1000: Operates as 2nd filter with $\zeta=1.0$ when setup value is 1000. Standard value is 1000; smaller setup value will cause oscillation.

How to Operate

When high frequency oscillation cannot be completely prevented by 1st and 2nd torque filter, setup the 2-stage torque filter. Set Pr6.43 2-stage torque filter attenuation term to 1000 ($\zeta = 1.0$) and adjust Pr6.42 2-stage torque filter time constant.

Adjustment

6. About Homing Operation

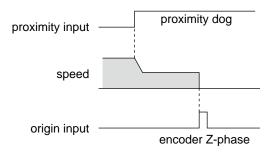
Caution on Homing Operation

• In homing action by using the host controller, stop position might not be stabilized if the origin input (Z-phase of the encoder) is entered while the motor is not decelerated enough after the proximity input is turned on. Set up the ON-positions of proximity input and the position of origin point, considering the necessary pulse counts for deceleration. Take the positioning action and homing action into account when you set put acceleration/deceleration time with parameter, since this affect these action as well.

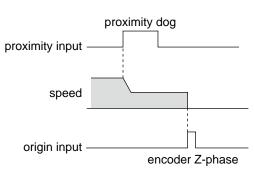
For the details of homing, observe the instruction manual of the host controller.

• Example of Homing Action

Proximity dog on... .Decelerates at an entry of the proximity input, and stops at an entry of the first origin input (Z-phase)



Proximity dog off... .Decelerates at an entry of the proximity input, and stops at an entry of the first origin input (Z-phase) after the input is tuned off



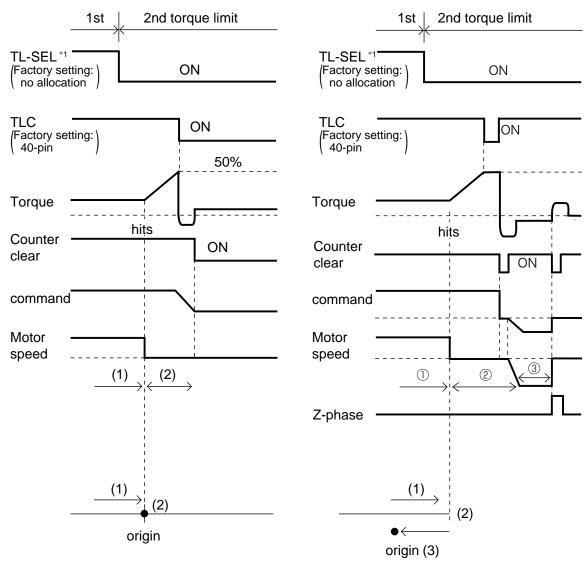
3

6. About Homing Operation

Homing with Hit & Stop

You can set up the homing position with "Hit & Stop" where it is not easy to install a sensor due to environment.

- (1) when you make a point where the work (load) hits as an origin
- (2) when you stop the work (load) using Z-phase after making a hitting point as a starting point, then make that stopping point as an origin.



Parameter No.	Title	Setup example
5.22	Setup of 2nd torque limit	50 (Set up to less than 100 %)
0.14	Excess setup of position deviation	25000
5.13	Setup of over-speed level	0 (6000 r/min)
5.21	Selection of torque limit	3

Remarks · ❖

Assign TL-SEL to the input signal.

Upon completion of the homing with hit and stop, turn off TL-SEL (open if logical setting is a-contact; close if b-contact).

Related page .:

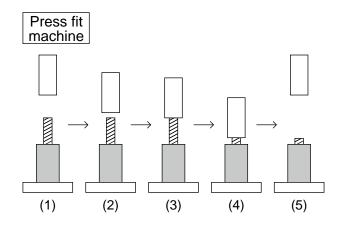
• P.4-6 to P.4-85... "Details of parameter"

Adjustment

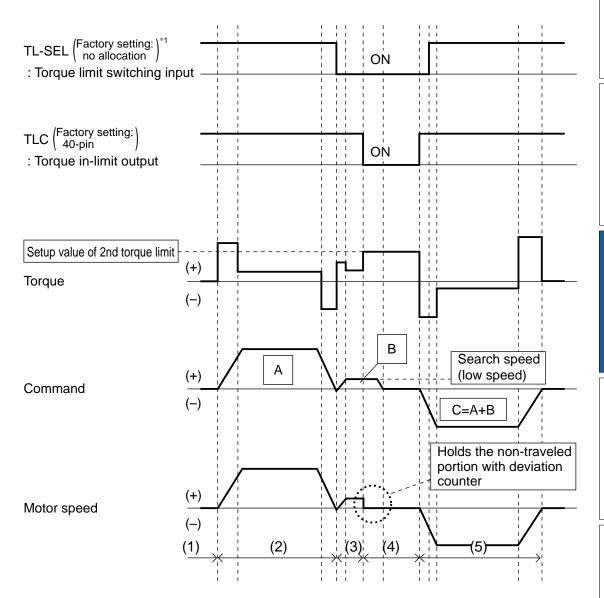
6. About Homing Operation

Press & Hold Control

Application example



Parameter No.	Title	Setup example
5.21	Selection of torque limit	3
0.13	Setup of 1st torque limit	200
5.22	Setup of 2nd torque limit	50
0.14	Excess setup of position deviation	25000
5.13	Setup of over-speed level	0



Remarks 🔆

Assign TL-SEL to the input signal.

Adjustment

7. Applied functions

Position compare output function

Outline

A pulse signal can be output from the generic output or the position compare output when the actual position has passed the position set in the parameter.

Specification

Trigger output	I/F	[Generic output] 6 output (SO1 to 6) : Photocoupler (Open collector) [Position compare output] 1 output (OCMP4): Open collector 3 output (OCMP1 to 3): Line driver			
	Logic	Parameter set (Polarity can be set for each output)			
	Pulse width	Parameter set 0.1 to 3276.7 ms (in 0.1 ms units)			
	Delay compensation	Available			
	Encoder (comms)	Available			
Compare source	External scale (comms)	Available			
	External scale (A, B phase)	Available			
Compare value	Set quantity	8 points			
Compare value	Set range	32-bit with sign			

Applicable range

This function is available only when the following conditions are satisfied:

, , , , , , , , , , , , , , , , , , , ,								
	Conditions where position compare output function are valid							
Control Mode	Either position control or full-closed control							
Others	 Block operation set to valid (Pr6.28 ≠ 0) Return to origin operation completed state if in incremental mode. (In case block operation return to origin invalid setting is set to invalid). All parameters except for the control parameters are set appropriately and there are nothing to obstruct the normal rotation of the motor. 							

7. Applied functions

Position compare output function

Related parameters

Class	No.	Title	Function							
4	44	Position compare output pulse width setting	Sets pulse width of position compare output No pulse output when 0 (zero)							
4	45	Position compare output polarity select	Polarity of position compare output can be set by bit for each output terminal. • Set bits bit0: SO1 or OCMP1 bit1: SO2 or OCMP2 bit2: SO3 or OCMP3 bit3: SO4 or OCMP4 bit4: SO5 bit5: SO6 • Set value 0: Sets output photocoupler to ON for SO1 to 6, during pulse output and to L level for OCMP 1 to 4. 1: Sets output photocoupler to OFF for SO1 to 6, during pulse output and to H level for OCMP 1 to 4. Basically to be used set to 0.							
4	47	Pulse output select	Selects signal to be output from pulse output/position compare output terminal: Set							
4	48	Position compare output polarity select 1	Sets position compare 1 comparison value							
4	49	Position compare output polarity select 2	Sets position compare 2 comparison value							
4	50	Position compare output polarity select 3	Sets position compare 3 comparison value							
4	51	Position compare output polarity select 4	Sets position compare 4 comparison value							
4	52	Position compare output polarity select 5	Sets position compare 5 comparison value							
4	53	Position compare output polarity select 6	Sets position compare 6 comparison value							
4	54	Position compare output polarity select 7	Sets position compare 7 comparison value							

Class	No.	Title	Function
4	55	Position compare output polarity select 8	Sets position compare 8 comparison value
4	56	Position compare output delay compensation amount	Compensates circuit delay of position compare
4	57	Position compare output assignment setting	Sets output terminal corresponding to position compare 1 to 8 by bit. Multiple position compare values can be set to a single output Set bits bit0 ~ 3 : Position compare 1 bit4 ~ 7 : Position compare 2 bit8 ~ 11 : Position compare 3 bit12 ~ 15 : Position compare 4 bit16 ~ 19 : Position compare 5 bit20 ~ 23 : Position compare 6 bit24 ~ 27 : Position compare 7 bit28 ~ 31 : Position compare 8 Set value 0000 : Output invalid 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 Other than above: For manufacturer use (please do not use)

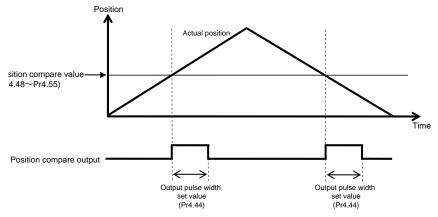
4

7. Applied functions

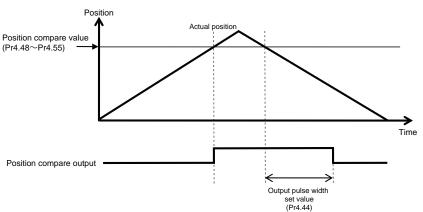
Position compare output function

Operation

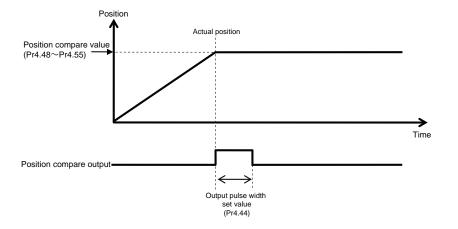
• A time width pulse set in Pr4.44 "Position compare output pulse width setting" will be output, when the actual position of the encoder passes over the position compare value (Pr4.48 to Pr4.55),



- Regardless of the direction of encoder position travel, a pulse will be output when the magnitude correlation changes as it passes over the position compare value.
- Multiple position compare value can be set to one position compare output.
- When the operation direction has been reversed, or when the external scale position has
 passed the position compare value, a state where pulse output is ON will continue from
 the time of the most recent passing until the output pulse width set value is reached.



• When stopped at the same position as the position compare value, a single pulse will be output, similar to the case of passing over.



7. Applied functions

Position compare output function

- When using generic outputs (SO1 to SO6) as position compare output (CMP-OUT), assign position compare output to Pr4.40 to 4.15 under all control mode.
- Position compare output function automatically compensates the output for errors caused by time delay of encoder serial communications, etc., taking reference on the previous motor velocity. Furthermore, the amount of compensation can be set by adjustment of Pr4.56 "Position compare output delay compensation amount".

7. Applied functions

Infinite rotation absolute function

Outline

Function to set the upper limit value of absolute encoder multi-rotation data to any arbitrary value.

Related parameters

Class	No.	Title	Function
0	15	Absolute encoder setting	Sets the method of using the absolute encoder. 0: Use under absolute system (Absolute mode). 1: Use under incremental system (Incremental mode). 2: Use under absolute system (Absolute mode) but multirotation counter overflow is ignored 3: For manufacturer use (please do not set) 4: Used under absolute system (Absolute mode) but the upper limit value of the multi-rotation counter can be set to any value. Multi-rotation counter overflow is also ignored. (Infinite rotation absolute mode)
6	88	Absolute multi- rotation upper limit value	Sets the upper limit value for absolute multi-rotation data. When the multi-rotation data exceeds this set value, the multi-rotation data will turn to 0. Inversely, if it goes less than 0, it will change to the set value. When Pr0.15 is set to 0 or 2 (absolute mode), the upper limit value for the absolute multi-rotation data shall be 65535, regardless of the set value

Notes

- •This setting will become effective when PR0.15 "Absolute encoder setting" is set to 4 and the control power supply is reclosed.
- •In case of discrepancy in the encoder multi-rotation data upper limit value and the driver parameter multi-rotation data upper limit value when the control power supply is reclosed, Err92.3 "Multi-rotation data upper limit value mismatch error protection" will always be triggered, however this is not an abnormal condition.

By reclosing the driver control power supply, the phenomenon will not reappear again.

•Please refer to 4-7-1-1 for Absolute system configuration.

5

Adjustment

7. Applied functions

Deterioration diagnosis warning function

Outline

This is a function to check the changes in motor and connected equipment characteristics to output deterioration diagnosis warning.

Related parameters

Class	No.	Title	Function			
5	66	Deterioration diagnosis convergence judgment time	Sets the time required to deem that real-time auto tuning load characteristics estimate has converged when deterioration diagnosis warning function is activated (Pr6.97 bit 1 = 1). When the set value is 0, it will be set automatically inside the driver in accordance with Pr6.31 (real-time auto tuning convergence velocity). * When Pr6.31 (real-time auto tuning convergence velocity) = 0, the deterioration diagnosis warning judgment for load characteristics estimate will be invalid.			
5	67	Deterioration diagnosis inertia ratio upper limit value	Sets the upper and lower limit values for inertia ratio estimate in deterioration diagnosis judgment when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1)			
5	68	Deterioration diagnosis inertia ratio lower limit value	and load characteristics estimate convergence has been completed. * The set resolution shall be in units of 0.2%.			
5	69	Deterioration diagnosis unbalanced load upper limit value	Sets the upper and lower limit values for unbalanced load estimate in deterioration diagnosis judgment when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1)			
5	70	Deterioration diagnosis unbalanced load lower limit value	and load characteristics estimate convergence has b			
5	71	Deterioration diagnosis dynamic friction upper limit value	Sets the upper and lower limit values for dynamic friction estimate in deterioration diagnosis judgment when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1)			
5	72	Deterioration diagnosis dynamic friction lower limit value	and load characteristics estimate convergence has been completed. * The set resolution shall be in units of 0.2%.			
5	73	Deterioration diagnosis viscous friction upper limit value	Sets the upper and lower limit values for viscous friction coefficient estimate in deterioration diagnosis judgment when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1) and			
5	74	Deterioration diagnosis viscous friction lower limit value	load characteristics estimate convergence has been completed. * The set resolution shall be in units of 0.2%.			

5

7. Applied functions

Deterioration diagnosis warning function

Class	No.	Title	Function				
5	75	Deterioration diagnosis velocity setting	Outputs deterioration diagnosis velocity output (V-DIAG) when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1) and the motor velocity is within the range of Pr5.75 ± Pr4.35 (velocity coinciding width). * Deterioration diagnosis velocity output has a 10 [r/min] hysteresis.				
5	76	Deterioration diagnosis torque average time	Sets time required to calculate the torque command average value when deterioration diagnosis warning is valid (Pr6.97 bit 1 = 1) and diagnosis velocity output (V-DIAG) is ON. * Time from diagnosis velocity output (V-DIAG) ON to the start judgment for upper and lower value of torque command average value is also a part of the set time for this parameter.				
5	77	Deterioration diagnosis torque upper limit value	Sets the upper and lower limit values of torque command average value when deterioration diagnosis warning				
5	78	Deterioration diagnosis torque lower limit value	is valid (Pr6.97 bit 1 = 1) and deterioration diagnosis velocity output (V-DIAG) is ON.				
6	97	Function expansion setting 3	Bit 1 to set the deterioration diagnosis warning function to valid or invalid 0: invalid, 1: valid				

Precautions

- When the upper limit value is set to the maximum value, the upper limit judgment will become invalid.
- · When the lower limit value is set to the minimum value, the lower limit judgment will become invalid.
- In case upper limit value ≤ lower limit value, then both the upper limit and lower limit judgment will become invalid

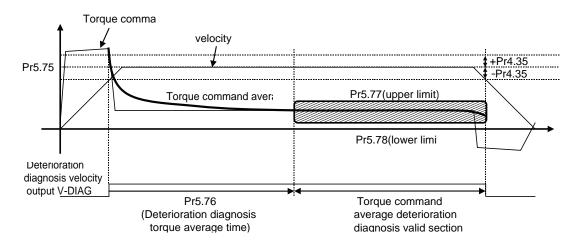
Contents

- The following deterioration diagnosis warning functions can be used by setting bit 1 of Pr6.97 (Function expansion setting 3) to 1.
- (1) Deterioration diagnosis warning for load characteristic estimates
 - Deterioration diagnosis warning judgment for four load characteristics estimates (inertia ratio, unbalanced load, dynamic friction, and viscous friction coefficient) can be used in case real-time auto tuning load characteristics estimate is valid.
 - The abovementioned deterioration diagnosis warning judgment will become effective when the required operational conditions for load characteristics estimate has continued in total for Pr5.66 (deterioration diagnosis convergence judgment time) or more, and the load characteristics estimate has converged. Once it has become effective, it will remain in effect until Pr6.97 bit 1 is set to 0 (invalid) or the real-time auto tuning load characteristics estimate is invalidated.

• For each load characteristics estimate value, its upper and lower limit value can be set by the parameters as indicated in the following table. In case the load characteristic estimates has exceeded the upper or lower limit values for changes in load characteristics estimate, it generates deterioration diagnostic warning number AC.

	Inertia ratio	Unbalanced load	Dynamic friction	Viscous fric
Upper limit value	Pr5.67	Pr5.69	Pr5.71	Pr5.73
Lower limit value	Pr5.68	Pr5.70	Pr5.72	Pr5.74

- *Set resolution for the upper and lower limit of friction torque estimates (unbalanced load, dynamic friction, and viscous friction coefficient) shall be in units of 0.2%.
- ※In case Pr6.31 (real-time auto-tuning convergence velocity) is set to 0 and is estimate stopped from the start or before the load characteristics estimate results has been confirmed, deterioration diagnosis warning judgment will become invalid even if real-time auto tuning load characteristics estimate is valid.
- (2) Deterioration diagnosis warning for constant velocity torque command average value
 - Deterioration diagnosis velocity output (V-DIAG) is ON when the motor velocity is within the range of Pr4.35 (Velocity coinciding width) of Pr5.75 (deterioration diagnosis set velocity).
 - When deterioration diagnosis velocity output (V-DIAG) is turned ON, torque command average calculation will start and after lapse of the set time of Pr5.76, deterioration diagnosis judgment by torque command average will become effective. This will continue while deterioration diagnosis velocity output (V-DIAG) remains ON, however will return to invalid condition when the output is turned OFF.
 - The upper limit and lower limit values for torque command average can be set by parameters Pr5.77 and 5.78 respectively. Deterioration diagnostic warning number AC is generated in case these upper or lower limit values have been exceeded for changes in the load characteristic estimates.



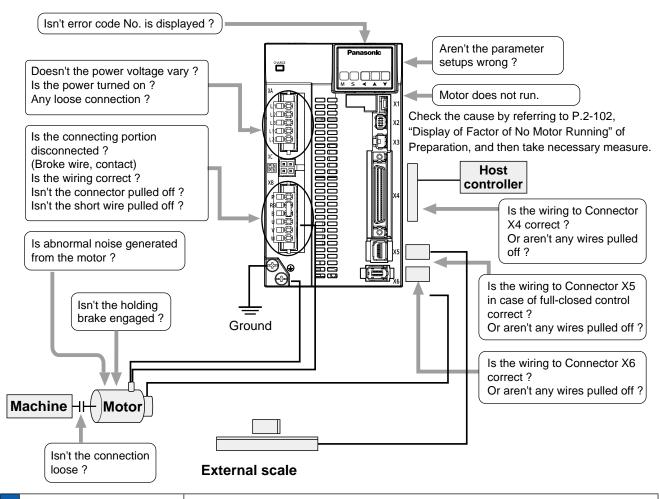
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6

1. When in Trouble

When in Trouble

What to Check?



6

1. When in Trouble

When in Trouble

Protective Function (What is Error Code?)

- Various protective functions are equipped in the driver. When these are triggered, the motor will stall due to error, the driver will turn the Servo-Alarm output (ALM) to off (open).
- Error status and their measures
 - During the error status, the error code No. will be displayed on the front panel LED, and you cannot turn Servo-ON.
 - You can clear the error status by Alarm clear input(A-CLR) in 120 ms or longer.
 - When overload protection is triggered, you can clear it by Alarm clear input (A-CLR) in 10sec or longer after the error occurs. (*1 Table below) You can clear the Overload protection time characteristics (refer to P.6-17) by turning off the control power supply between L1C and L2C (100 V, 200 V) of the driver.
 - You can clear the above error by operating the front panel keys and setup support softwear "PANATERM". Refer to P.2-111 "Alarm Clear Screen" of Preparation.
 - Be sure to clear the alarm during stop after removing the cause of the error and securing safety.



• The figure above shows connections on velocity, position, torque and full-closed mode driver.

Related page …

- P.2-88 ... "How to Use the Front Panel" P.3-32 "Inputs and outputs on connector X4"
- P.7-26 "Outline of Setup support software "PANATERM"

Protective Function (What is Error Code ?)

<List of error code No.>

Error	code		A	ttribut	te	D-4-ii	Error	code			Attribute		Datail
Main	Sub	Protective function	History	Can be cleared	Immediate stop*3	Detail page	Main	Sub	Protective function	History	Can be cleared		Detail page
11	0	Under voltage protection of control power supply		0				0	Analog input1 excess protection	0	0	0	
12	0	Over-voltage protection	0	0			39	1	Analog input2 excess protection	0	0	0	
	0	Main power supply under-voltage				6-4		2	Analog input3 excess protection	0	0	0	
13		protection (between P and N)					40	0	Absolute system down error protection	0	O*4		6-11
	1	Main power supply under-voltage protection (AC interception detection)		0	0		41	0	Absolute counter over error protection	0			
	0	Over-current protection	0				42	0	Absolute over-speed error protection	0	O*4		
14	1	IPM error protection	Ö				43	0	Incremental encoder initialization error protection	0			
	0	Over-heat protection	Ö		0	6-5			Absolute single turn counter error protection	0			
15	1	Encoders abnormal overheat protection	0		0		45	0	Absolute multi-turn counter error protection	0			
	0	Over-load protection	Ō	O*1	Switchable 2		47	0	Absolute status error protection	0			
16	1	Torque saturation error protection	0	0		6-6	48	0	Increment encoder Z-phase error protection	0			
	0	Over-regeneration load protection	Ō		0		49	0	Increment encoder CS-phase error protection	0			
18	1	Regeneration Tr error protection	Ō				50	0	External scale connection error protection	0			6 40
	0	Encoder communication disconnect error protection	Ō					1	External scale communication error protection	0			6-12
21	1	Encoder communication error protection	Ō					0	External scale status 0 error protection	0			
23	0	Encoder communication data error protection	0			6-7	7	1	External scale status 1 error protection	0			
	0	Position deviation excess protection	Ō	0	0		51	2	External scale status 2 error protection	0			
24	1	Speed deviation excess protection	0	Ō	0			3	External scale status 3 error protection	0			
25	0	Hybrid deviation excess error protection	Ō		0		$\dashv \mid \mid$	4 5	External scale status 4 error protection	0			
	0	Over-speed protection	Ō	0	0		55	0	External scale status 5 error protection A-phase connection error protection	0			
26	1	2nd over-speed protection	0	0				1	B-phase connection error protection	0			
	0	Command pulse input frequency error protection	Ō	Ō	0	6-8	33	2	Z-phase connection error protection	0			
27	1	Absolute clear abnormal protection	0					0	U-phase current detector error protection	0			
	2	Command pulse multiplier error protection	Ŏ	0	0		70	1	W-phase current detector error protection	0			
28	0	Limit of pulse replay error protection	0	0	0		72	0	Thermal protector error	0			
	0	Deviation counter overflow protection	0	0			80	0	Modbus communication timeout protection	Ō			6-13
29	1	counter overflow protection 1	0				87	0	Compulsory alarm input protection	-	0	0	
	2	Counter overflow error protection 2	0					0	Encoder data recovery abnormal protection	0			
31	0	Safety function error protection 1	0				92	1	External scale data recovery error protection	0			
31	2	Safety function error protection 2	0			6-9	92	3	Multi-turn data upper-limit value disagreement	0			
	0	IF overlaps allocation error 1 protection	0						error protection				
	1	IF overlaps allocation error 2 protection	0					0	Parameter setup error protection 1	0			
	2	IF input function number error 1 protection	0					1	Block data setting error protection	0	0		
33	3	IF input function number error 2 protection	0				93	2	Parameter setup error protection 2	0			
33	4	IF output function number error 1 protection	0					3	External scale connection error protection				
	5	IF output function number error 2 protection	0					8	Parameter setup error protection 6				
	6	Counter clear allocation error	0				94	0	Block operation error protection	0	0		6-14
	7	Command pulse inhibition input allocation error	0			6-10		2	Return to origin error protection	0	0		
34	0	Motor working range setup error protection	0	0		10			Motor automatic recognition error protection				
36	0 to 1	EEPROM parameter error protection					97	0	Other error				
37	0 to 2	EEPROM check code error protection					Oth		Oulei elloi	0			
38	0	Drive prohibition input protection		0			Liuii						

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.)

- *1 : When Err16.0 "Overload Protection 1" is activated, error can be cleared about 10 seconds after the occurrence.
- *2: When Err40.0 "Absolute System Down Error protection," or Err42.0 "Absolute Overspeed Protection" occurs, the error is unable to be cleared unless Absolute Clear is performed.
- *3: Immediate stop refers to alarms which result in an immediate stop when setting is made to 4 to 7 in Pr5.10 "Sequence at alarm" are shown. For the detail of an immediate stop, see 6-5-4 "Sequence at alarm."
- *4 : Err 16.0 "Overload protection," can be switched to responsive/non-responsive by switching bit 11 of "Function expansion setting 2" of Pr 6.47. Set to non-responsive at time of shipment.

6

When in Trouble

1. When in Trouble

Protective function (Detail of error code)

Protective function	Error c		Causes	Measures
Under voltage protection of control power supply	11	0	Voltage between P and N of converting unit of control power supply has fallen down and dropped below specified value. 100 V version: approx. 200 VDC (approx. 140 VAC) 200 V version: approx. 400 VDC (approx. 280 VAC) 1) Low power supply voltage. Occurrence of momentary power failure. 2) Power capacity shortageDue to rush current at the main power-on, power supply voltage has fallen down. 3) Servo driver failure (circuit failure)	Measure L1C-L2C line voltage of connector and terminal block 1) Increase the capacity of power supply voltage. Change the power supply. 2) Increase the power capacity. 3) Replace with new servo driver.
Over-voltage protection	12	0	Voltage between P and N of the converter portion of the control power supply has exceeded the specified value 100 V version: approx. 200 VDC (approx. 140 VAC) 200 V version: approx. 400 VDC (approx. 280 VAC) 1) Power supply voltage has exceeded the permissible input voltage. Voltage surge due to the phase-advancing capacitor or UPS (Uninterruptible Power Supply) have occurred. 2) Disconnection of the regeneration discharge resistor 3)External regeneration resistor is not appropriate and could not absorb the regenerative energy. 4) External regeneration discharge resistor is not appropriate and could not absorb the regeneration energy. 5) Failure of servo driver (failure of the circuit)	 Measure the voltage between lines of connector (L1, L2 and L3). Enter correct voltage. Remove a phase-advancing capacitor. Measure the resistance of the external resistor connected between terminal P - B of the driver. Replace the external resistor if the value is ∞. Change the specified regeneration resistance value to wattage. Change to the one with specified resistance and wattage. Check that Pr0.16.
Main power supply under-voltage protection (PN) Main power supply under-voltage protection (AC)	13	1	Instantaneous power failure has occurred between L1 and L3 for longer period than the preset time with Pr5.09 (Main power off detecting time) while Pr5.08 (LV trip selection at the main power-off) is set to 1. Or the voltage between P and N of the converter portion of the main power supply has fallen below the specified value during Servo-ON. 100 V version: approx. 80 VDC (approx. 55 VAC) 200 V version: approx. 110 VDC (approx. 75 VAC) 1) Power supply voltage is low. Instantaneous power failure has occurred 2) Instantaneous power failure has occurred. 3) Lack of power capacityPower supply voltage has fallen down due to inrush current at the main power-on. 4) Phase lack3-phase input driver has been operated with single phase input.	Measure the voltage between lines of connector (L1, L2 and L3). 1) Increase the power capacity. Change the power supply. Remove the causes of the shutdown of the magnetic contactor or the main power supply, then re-enter the power. 2) Set up the longer time to Pr5.09 (Main power off detecting time). Set up each phase of the power correctly. 3) Increase the power capacity. For the capacity, refer to P.2-10, "Driver and List of Applicable Peripheral Equipments" of Preparation. 4) Connect each phase of the power supply (L1, L2 and L3) correctly. For single phase, 100 V and 200 V driver, use L1 and L3. 5) Replace the driver with a new one.

Related page : P.2-12... "System Configuration and Wiring" • P.4-6 to P.4-85... "Details of parameter"

Protective function (Detail of error code)

Protective	Error c		Causes	Measures
function	Main	Sub	Caaboo	inoudui od
* Over-current protection	14	0	Current through the converter portion has exceeded the specified value. 1) Failure of servo driver (failure of the circuit, IGBT or other components) 2) Short of the motor wire (U, V and W)	1) Turn to Servo-ON, while disconnecting the motor. If error occurs immediately, replace with a new driver. 2) Check that the motor wire (U, V and W) is not shorted, and should the branched out.
* IPM error protection [IPM: Intelligent Power Module]		1	3) Earth fault of the motor wire4) Burnout of the motor	not shorted, and check the branched out wire out of the connector. Make a correct wiring connection. 3) Measure the insulation resistance between motor wires, U, V and W and earth wire. In case of poor insulation, replace the motor. 4) Check the balance of resister between each motor line, and if unbalance is found,
			 5) Poor contact of the motor wire. 6) Welding of contact of dynamic braking relay due to frequent servo ON/OFF operations. 7) Timing of pulse input is same as or earlier than Servo-ON. 8) Blowout of thermal fuse due to overheating dynamic brake circuit. (Only F and G frames) 9) Power Modulef overheat protection 	replace the motor. 5) Check the loose connectors. If they are, or pulled out, fix them securely. 6) Replace the servo driver. Do not use Servo-ON/Servo-OFF as a means of staring/stopping the operation. 7) Enter the pulses 100 ms or longer after Servo-ON. 8) Replace the driver. 9)Increase capacity of servo driver and motor. Set up longer acceleration/deceleration time.Reduce the load.
* Over-heat protection	15	0	Temperature of the heat sink or power device has been risen over the specified temperature. 1) Ambient temperature has risen over the specified temperature. 2) Over-load	1) Improve the ambient temperature and cooling condition. 2) Increase the capacity of the driver and motor. Set up longer acceleration/deceleration time. Lower the load.
* Encoders abnormal Over-heat protection		1	When encoder overheating prtection detection is valid by the setting value of bit 11 Pr6.10,(Invaild initial set value) The temperature of encoder has exceeded an encoder overheat abnormal level. 1) The ambient temperature of servomotor is high. 2) Overload	1) Improve the ambient temperature of servomotor and the cooling condition. 2) Increase capacity of servo driver and motor.Set up longer acceleration/deceleration time.Reduce the load



• When protective function marked with * in the protective function table is activated, it cannot be disabled by the alarm clear input (A-CLR). To return to the normal operation, turn off power, remove the cause, and then turn on power again.

Protective	Error co	ode No.	Causes	Magguros
function	Main	Sub	Causes	Measures
Over-load protection	16	0	Torque command value has exceeded the over-load level set with Pr5.12 (Setup of over-load level) and resulted in overload protection according to the time characteristics (described later) 1) Load was heavy and actual torque has exceeded the rated torque and kept running for a long time. 2) Oscillation and hunching action due to poor adjustment. Motor vibration, abnormal noise. Inertia ratio (Pr0.04) setup error. 3) Miswiring, disconnection of the motor. 4) Machine has collided or the load has gotten heavy. Machine has been distorted. 5) Electromagnetic brake has been kept engaged. 6) While wiring multiple axes, miswiring has occurred by connecting the motor cable to other axis. • The over-load protection time chara	Check that the torque (current) does not oscillates nor fluctuate up an down very much on the analog outoput and via communication. Check the over-load alarm display and load factor with the analog outoput and via communication 1) Increase the capacity of the driver and motor. Set up longer acceleration/ deceleration time. Lower the load. 2) Make a re-adjustment. 3) Make a wiring as per the wiring diagram. Replace the cables. 4) Remove the cause of distortion. Lower the load. 5) Measure the voltage between brake terminals. Release the brake 6) Make a correct wiring by matching the correct motor and encoder wires.
Torque saturation anomaly protection		1	Torque saturation has continued for the time set in Pr6.57 Torque saturation error protection detect time.	Check operation of the driver. Refer to Measures described for Err16.0.
* Over- regeneration load protection	18	0	you set up Pr0.16 to 2. C	Check the load factor of the regenerative resistor from the front panel or via communication. Do not use in the continuous regenerative brake application. 1) Check the running pattern (velocity monitor). Check the load factor of the regenerative resistor and over-regeneration warning display. Increase the capacity of the driver and the motor, and loosen the deceleration time. Use the external regenerative resistor. 2) Check the running pattern (speed monitor). Check the load factor of the regenerative resistor. Increase the capacity of the driver and the motor, and loosen the deceleration time. Lower the motor rotational speed. Use an external regenerative resistor. 3) Set up Pr0.16 to 2.

Note

• When protective function marked with * in the protective function table is activated, it cannot be disabled by the alarm clear input (A-CLR). To return to the normal operation, turn off power, remove the cause, and then turn on power again.

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

Protective function (Detail of error code)

Protective function	Error co		Causes	Measures
* Regenerative transistor error protection	18	1	Regenerative driver transistor on the servo driver is defective.	Replace the driver.
* Encoder communication disconnection error protection	21	0	Communication between the encoder and the driver has been interrupted in certain times, and disconnection detecting function has been triggered.	Make a wiring connection of the encoder as per the wiring diagram. Correct the miswiring of the connector pins.
* Encoder communication error protection		1	Communication error has occurred in data from the encoder. Mainly data error due to noise. Encoder cables are connected, but communication data has some errors.	Secure the power supply for the encoder of DC4.90 V to 5.25 V)pay an attention especially when the encoder cables are long. Separate the encoder cable and the motor
* Encoder communication data error protection	23	0	Data communication between the encoder is normal, but contents of data are not correct. Mainly data error due to noise. Encoder cables are connected, but communication data has some errors.	cable if they are bound together. • Connect the shield to FG.
Position deviation excess protection	24	0	Deviation pulses have exceeded the setup of Pr0.14. 1) The motor movement has not followed the command. 2) Setup value of Pr0.14 (Position deviation excess setup) is small.	1) Check that the motor follows to the position command pulses. Check that the output toque has not saturated in torque monitor. Make a gain adjustment. Set up maximum value to Pr0.13 and Pr5.22. Make a encoder wiring as per the wiring diagram. Set up the longer acceleration/deceleration time. Lower the load and speed. 2) Set up a larger value to Pr0.14.
Speed deviation excess protection		1	The difference between the internal positional command speed and actual speed (speed deviation) exceeds the setup vale of Pr6.02. Note) If the internal positional command speed is forcibly set to 0 due to instantaneous stop caused by the command pulse inhibit input (INH) or CW/CCW over-travel inhibit input, the speed deviation rapidly increases at this moment. Pr6.02 setup value should have sufficient margin because the speed deviation also largely increases on the rising edge of the internal positional command speed.	 Increase the setup value of Pr6.02. Lengthen the acceleration/deceleration time of internal positional command speed, or improve the follow-up characteristic by adjusting the gain. Disable the excess speed deviation detection (Pr6.02 = 0).

Protective	Error c	ode No.	Causes	Measures
function	Main	Sub	Causes	IVICASUICS
* Hybrid deviation excess error protection	25	0	 Position of load by the external scale and position of the motor by the encoder slips larger than the setup pulses with Pr3.28 (Setup of hybrid deviation excess) at full-closed control. During full closed control, numerator of command division/multiplication is changed or switched over. 	 Check the connection between the motor and the load. Check the connection between the external scale and the driver. Check that the variation of the motor position (encoder feedback value) and the load position (external scale feedback value) is the same sign when you move the load. Check that the numerator and denominator of the external scale division (Pr3.24 and 3.25) and reversal of external scale direction (Pr3.26) are correctly set. Do not change command division/multiplication during full closed control.
Over-speed protection	26	0	The motor rotational speed has exceeded the setup value of Pr5.13.	Do not give an excessive speed command. Check the command pulse input frequency
2nd Over- speed protection		1	The motor rotational speed has exceeded the setup value of Pr6.15.	 and division/multiplication ratio. Make a gain adjustment when an overshoot has occurred due to a poor gain adjustment. Make a wiring connection of the encoder as per the wiring diagram.
Command pulse input frequency error protection	27	0	The frequency of command pulse input is more than 1.2 times the setting in Pr5.32.	Check the command pulse input for frequency.
Absolute clear abnormal protection		1	Absolute encode multi-rotation clear has been executed when a block operation was enabled (Pr 6.28 is non 0).	Confirm whether absolute encode multi- rotation clear has when a block operation was enabled.(Note) This is a safety measure and is not an abnormality.
Command pulse multiplier error protection		2	Division and multiplication ratio which are set up with the command pulse counts per single turn and the1st and the 4th numerator/denominator of the electronic gear are not appropriate. The command pulses per 0.167 ms multiplied by the command division and multiplication ratio exceeds 3000 Mpps. The command pulse input fluctuates. Noises mixed with the command pulse input cause counting error.	 Set the command division and multiplication ratio to a value as small as possible e.g. between 1/1000 and 1000. Check the setup value of electronic gear. If possible, use the line driver I/F. Set Pr5.32 (setting of max. command pulse input) to a value less than 1000 and enable digital filter.
Limit of pulse replay protection	28	0	The output frequency of pulse regeneration has exceeded the limit.	 Check the setup values of Pr0.11 and 5.03. To disable the detection, set Pr5.33 to 0.

Protective function (Detail of error code)

Protective function	Error co		Causes	Measures
Deviation counter overflow protection	29	0	Position deviation value of the encoder pulse standard has exceeded 2 ³⁰ -1 (1073741823).	 Check that the motor follows the position command. Check that the output toque has not saturated on torque monitor. Make a gain adjustment. Maximize Pr0.13 "The 1st torque limit setup" and Pr5.22 "The 2nd torque limit setup". Make a connection of the encoder as described in the wiring diagram.
Counter overflow error protection 1		1	The value of absolute encoder (absolute external scale) position [pulse units] / electronic gear ratio has exceeded ±2 ³¹ (2147483648), in position information initialization process after closing control power supply under absolute mode when block operations is valid	Confirm the operating range of absolute encoder (absolute external scale) position and review the electronic gear ratio.
Counter overflow error protection 2		2	Value of positioning deviation has exceeded±2 ³⁰ -1(1073741823) in pulse units. Or the value ofpositioning deviation has exceeded ±2 ³⁰ (1073741824) in command units.	 Confirm that motor rotates in accordance with the positioning command. Confirm that output torque has not saturated by the torque monitor. Adjust gain. Set Pr.0.13 "1st torque limit setting" and Pr5.22 "2ndtorque limit setting" to maximum. Connect encoder connection wiring as per the wiring diagram.
* Safety function error protection	31	2	Safety function has detected an error.	In case of the repeated occurrence, because failure is possible, replace the servo driver. Return to a dealer for investigation (repair).
* I/F overlap allocation error 1 protection	33	0	Input signals (SI1, SI2, SI3, SI4, SI5) are assigned with two functions.	Allocate correct function to each connector pin.
* I/F overlap allocation error 2 protection		1	Input signals (SI6, SI7, SI8, SI9, SI10) are assigned with two functions.	
* I/F input function number error 1		2	Input signals (SI1, SI2, SI3, SI4, SI5) are assigned with undefined number.	

Note

• When protective function marked with * in the protective function table is activated, it cannot be disabled by the alarm clear input (A-CLR). To return to the normal operation, turn off power, remove the cause, and then turn on power again.

Protective function		ode No.	Causes	Measures
* I/F input function number error 2	33	3	Input signals (SI6, SI7, SI8, SI9, SI10) are assigned with undefined number.	Allocate correct function to each connector pin.
* I/F output function number error 1		4	Output signals (SO1, SO2, SO3) are assigned with undefined number.	
* I/F output function number error 2		5	Output signals (SO4, SO5, SO6) are assigned with undefined number.	
* Counter clear allocation error		6	Counter clear function is assigned to a signal number other than SI7.	
* Command pulse inhibition input allocation error		7	Command pulse inhibit input function is assigned to a signal number other than SI10.	
Motor working range setup error protection	34	0	The motor has exceeded the motor working range set to Pr5.14 "Allowable motor operating range setting" against the position command input range. 1) Gain is not appropriate. 2) Pr5.14 setup value is low.	 Check the gain (balance between position loop gain and speed loop gain) and inertia ratio. Increase the setup value of Pr5.14. Or, Set Pr5.14 to 0 to disable the protective function.
* EEPROM parameter error protection	36	1	Data in parameter storage area has been damaged when reading the data from EEPROM at power-on.	 Set up all parameters again. If the error persists, replace the driver (it may be a failure.) Return the product to the dealer or manufacturer.
* EEPROM check code error	37	0 1 2	Data for writing confirmation to EEPROM has been damaged when reading the data from EEPROM at power-on.	Replace the driver. (it may be a failure). Return the product to a dealer or manufacturer.
* Drive prohibition input protection	38	0	Both positive and negative direction drive prohibition inputs (POT and NOT) have been turned ON at Pr5.04 "Over-travel inhibition input setting" =0. Either positive direction drive prohibition input or negative direction drive prohibition input has been turned ON at Pr5.04=2.	Check that there is no error in the switches, wires and power supply connected to the positive direction/negative direction drive prohibition input. Check particularly that start-up of the power supply for the control signal (DC12 to 24 V) is not slow.

Protective function (Detail of error code)

Protective function	Error co		Causes	Measures
Analog input 1 (Al1) excess protection	39	0	The voltage more than the value set in Pr4.24 "Analog input 1 (Al1) excess setup" has been applied to analog input 1.	Correctly set Pr4.24 "Analog input 1 (Al1) excess setup." Check the connection of I/F connector. Set Pr4.24 to 0 and disable the protective function.
Analog input 2 (Al2) excess protection		1	The voltage more than the value set in Pr4.27 "Analog input 2 (Al2) excess setup" has been applied to analog input 2.	 Correctly set Pr4.24 "Analog input 1 (Al1) excess setup." Check the connection of I/F connector. Set Pr4.24 to 0 and disable the protective function.
Analog input 3 (AI3) excess protection		2	The voltage more than the value set in Pr4.30 "Analog input 3 (Al3) excess setup" has been applied to analog input 3.	 Correctly set Pr4.24 "Analog input 1 (Al1) excess setup." Clear the absolute encoder first to excute the alarm clear. Check the connection of I/F connector. Set Pr4.24 to 0 and disable the protective function.
Absolute system down error protection	40	0	The power supplies and battery powers to absolute encoder were shut down, and the built-in capacitor voltage dropped below specified value.	After connecting the power supply for the battery, clear the absolute encoder. • If you use the incremental system Pr 0.15 "sets the absolute encoder " is set to 1.
			Caution Once this error occurs, the encoder is reset.	ne alarm cannot be cleared until the absolute
* Absolute counter over error protection	41	0	Multi-turn counter of the absolute encoder has exceeded the specified value.	 Set Pr0.15 to 2 to ignore the multi-turn counter over. Limit the travel from the machine origin within 32767 revolutions.
Absolute over-speed error protection	42	0	When using absolute encoder 1) During a power failure, when only battery power is supplied, the motor rotational speed has exceeded the specified value. 2) During normal operation, for some reason, the power of encoder has been shut down, and the rotational speed has exceeded the specified value.	 Check the driving from outside in a power outage and the rotational speed at the time, and operate to make it below specified value. Because the mode was switched to a power failure mode during normal activity Check the encoder-side power supply voltage (5 V±5 %). Check the connection of connector CN2. The alarm cannot be cleared until the absolute encoder is reset. If you use the incremental system Pr 0.15 "sets the absolute encoder " is set to 1.
			Caution Once this error occurs, the encoder is reset.	ne alarm cannot be cleared until the absolute

Protective	Error co	ode No.	Causes	Magguros
function	Main	Sub	Causes	Measures
* Encoder initialization error protection *1	43	0	An error has been detected at initialization time of serial incremental encoder.	Replace the motor.
* Absolute single turn counter error protection/ incremental single turn counter error protection *1	44	0	Absolute encoder has detected a single turn counter error. Serial incremental encoder has detected an error in the incremental counter value of single turn counter. (between z-phase signals)	Replace the motor.
* Absolute multi-turn counter error protection/ incremental counter error protection *1	45	0	Absolute encoder has detected a multi- turn counter error. Serial incremental encoder has detected an error in the incremental counter values between CS signals.	Replace the motor. • If you use the incremental system Pr 0.15 "sets the absolute encoder " is set to 1.
* Absolute status error protection *1	47	0	When power is turned on, absolute encoder has been rotated at the specified value or above.	Arrange so as the motor does not run at power-on.
Incremental encoder Z phase error protection	48	0	Missing pulse of Z-phase of serial incremental encoder has been detected. Failure of encoder.	Replace the motor.
Incremental Encoder CS signal error protection	49	0	CS signal logic error of serial incremental encoder has been detected. Failure of encoder.	Replace the motor.
* External scale wiring error protection	50	0	Communication between the external scale and the driver has been interrupted in certain times, and disconnection detecting function has been triggered.	 Make a wiring connection of the external scale as per the wiring diagram. Correct the miswiring of the connector pins.
* External communication data error protection		1	Communication error has occurred in data from the external scale. Mainly data error due to noise. External scale cables are connected, but communication date has some error.	 Secure the power supply for the external scale of DC5±5 % (4.75 V to 5.25 V)pay attention especially when the external scale cables are long. Separate the external scale cable and the motor cable if they are bound together. Connect the shield to FGrefer to wiring diagram.

Note

• When protective function marked with * in the protective function table is activated, it cannot be disabled by the alarm clear input (A-CLR). To return to the normal operation, turn off power, remove the cause, and then turn on power again.

6-12

Protective function (Detail of error code)

Protective function	Error co		Causes	Measures
* External scale status 0 error protection *1	51	0	Bit 0 of the external scale error code (ALMC) has been turned to 1. Check the specifications of the external scale.	Remove the causes of the error, then clear the external scale error from the front panel. And then, shut off the power to reset.
* External scale status 1 error protection *1		1	Bit 1 of the external scale error code (ALMC) has been turned to 1. Check the specifications of the external scale.	
* External scale status 2 error protection *1		2	Bit 2 of the external scale error code (ALMC) has been turned to 1. Check the specifications of the external scale.	
* External scale status 3 error protection *1		3	Bit 3 of the external scale error code (ALMC) has been turned to 1. Check the specifications of the external scale.	
* External scale status 4 error protection *1		4	Bit 4 of the external scale error code (ALMC) has been turned to 1. Check the specifications of the external scale.	
* External scale status 5 error protection *1		5	Bit 5 of the external scale error code (ALMC) has been turned to 1. Check the specifications of the external scale.	Remove the causes of the error, then clear the external scale error from the front panel. And then, shut off the power to reset.
* A-phase wiring error protection	55	0	A-phase wiring in the external scale is defective, e.g. discontinued.	Check the A-phase wiring connection.
* B-phase wiring error protection		1	B-phase wiring in the external scale is defective, e.g. discontinued.	Check the B-phase wiring connection.
* Z-phase wiring error protection		2	Z-phase wiring in the external scale is defective, e.g. discontinued.	Check the Z-phase wiring connection.
U-phase current detector error protection	70	0	U-phase current offset error is detected.	 Turn off the power once, then re-enter. If error repeats, this might be a failure. Stop using the products, and replace the
W-phase current detector error protection		1	W-phase current offset error is detected.	motor and the driver. Return the products to the dealer or manufacturer.
Thermal protector error	72	0	Thermal protector error is detected.	

Protective	Error c	ode No.	Causes	Measures
function	Main	Sub	Causes	Weasules
Modbus communication timeout protection	80	0	While ensuring Modbus execution right, Modbus communication against own axis has not been received for more than the set time.	 Set Pr5.40 "Modbus communication timeout period" to 0 to be disabled or to appropriate time. Check the connection of Modbus communication.
Forced alarm input protection	87	0	Forced alarm input (E-STOP) is applied.	Check the wiring of forced alarm input (E-STOP).
Encoder data recovery abnormal protection	92	0	Initialization process of internal position information has not conducted normally under absolute and semi-closed control mode.	 Secure encoder power supply voltage at DC5V±5% (4.75 to 5.25V). Care must be taken when the encoder lines are lengthy. If motor wires and encoder wires are bundled together, separate them. Connect shield to FG.
External scale data recovery error protection		1	Internal position information initialization error under full-closed control and absolute mode with block operation enabled.	Secure external scale power supply voltage of 5 VDC±5% (4.75 to 5.25 V). Please take extra care in case the cable connecting the external scale is long. In case the motor line and the external scale connecting cable are bundled together, separate them. Connect shield to FG. Refer to external scale connecting diagram
Multi-rotation upper limit value inconsistency error protection		3	At continuous rotating absolute encoder function, there was a disagreement between the upper-limit value of encoder multi-turn data and the upper-limit value of driver parameter multi-turn data.	Please confirm the set values of parameters. Reclose the control power supply when this occurs immediately after closing the control power supply. (This is not an abnormality.)
Parameter setup error 1	93	0	 Electronic gear ratio exceeds the allowable range. When a block operation was enabled(Pr 6.28 is non 0), Modbus connection was disabled (Pr 5.37 is 0). 	Check the setting value of the parameter. When a block operation was enabled (Pr 6.28 is non 0), Electronic gear ratio must be in the range 1/1000 to 8000. When a block operation was enabled (Pr 6.28 is non 0), Modbus connection was disabled (Pr 5.37 is 0).

Note

• When protective function marked with * in the protective function table is activated, it cannot be disabled by the alarm clear input (A-CLR). To return to the normal operation, turn off power, remove the cause, and then turn on power again.

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Protective function (Detail of error code)

Protective function	Error c Main		Causes	Measures
Block data setting error protection	93	1	 1) Velocity, acceleration and deceleration were set to 0, and a block operation was started. 2) A conditional branch command has not been supported for comparison purpose. 3) A designated block data command has been undefined. 4) Also, block data setup has some error. 	1)Set a value other than zero for velocity, acceleration and deceleration. 2)Check whether the conditional branch command or the comparison purpose does not have any problems. 3)Check whether the block data does not have any problems.Check whether the block number designated does not have any problems. 4)Check whether the block data setup does not have any problems.
Parameter setting error protection 2		2	External scale ratio has exceeded the allowable range (1/160000 to 160000 times)	 Please confirm the set values of parameters. Use external scale ratio in the range of 1/40 to 1280 times
External scale connection error protection		3	Set value for Pr3.23 "External scale type selection" and the connected serial communication type external scale type to not match.	Set Pr3.23 to match the type of the connected external scale
Parameter setting error protection 6		8	Block operation origin offset (Pr60.49) has been set outside the range in absolute mode origin offset valid setting (Pr60.48 bit 1 =1) under infinite rotation absolute mode when block operation is valid (Pr6.28 \neq 0).	Please confirm the set values of parameters.
Block operation error protection	94	0	1)During the execution of movement system command (During the execution of position command creation process), a new movement system command has been executed. 2)During block operation, a new block number was designated to start. 3)Although it was servo-off, a block operation was started.	1)Check whether the block operation sequence does not have any problems. 2)Check whether the host sequence does not have any problems. 3)Check whether the host sequence does not have any problems.
Return to origin error protection		2	Abnormal condition has occurred during block operation return to origin.	Check for abnormalities in various sensor installation status.
* Motor automatic recognition error protection	95	0 to 4	The motor and the driver has not been matched.	Replace the motor which matches to the driver.
* Control mode setting error prtection	97	0	Block operation is set to enabled, when other than Position control (Pr0.01 = 0) or full-closed control (Pr0.01 = 6)	Check the setting of Pr 0.01"control mode setting" and Pr 6.28 "Special function selection"

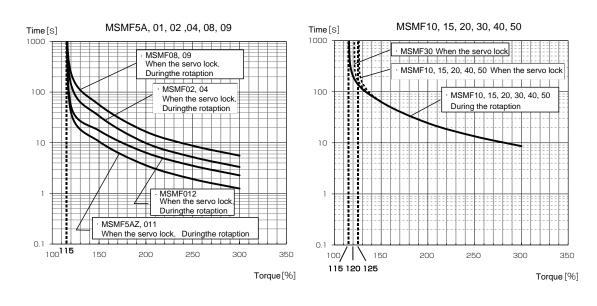
Protective function (Detail of error code)

Protective function	Error code No. Main Sub	Causes	Measures
* Other error	Other No.	Control circuit has malfunctioned due to excess noise or other causes. Some error has occurred inside of the driver while triggering self-diagnosis function of the driver.	 Turn off power once, and turn on again. Even so, if an error indication appears and an error occurs, failure is possible. Discontinue the use and replace the motor and servo driver. Return to a dealer for investigation (repair).

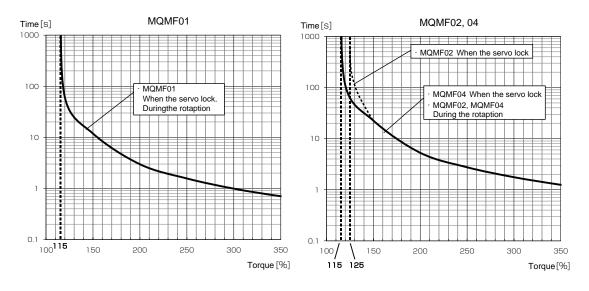
Protective function (Detail of error code)

Time characteristics of Err16.0 (Overload protection)

MSMF Overload protection time characteristics



MQMF Overload protection time characteristics

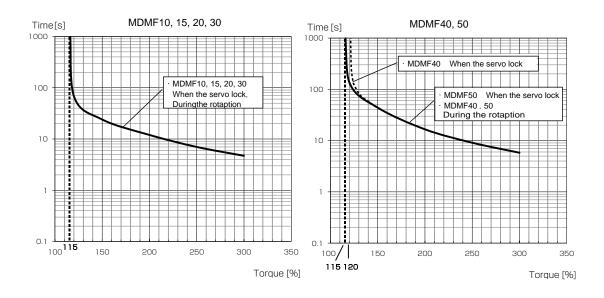


Caution ...

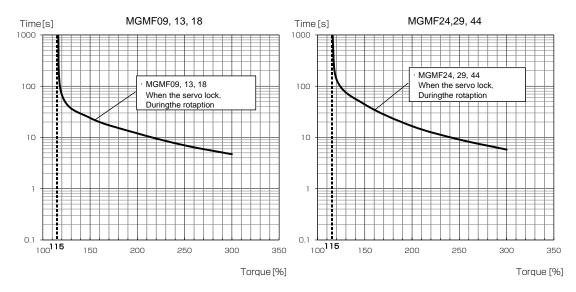
Use the motor so that actual torque stays in the continuous running range shown in "S-T characteristic" of the motor. For the S-T characteristics, see P.7-55 Motor characteristics (S-T characteristics).

Time characteristics of Err16.0 (Overload protection)

MDMF Overload protection time characteristics



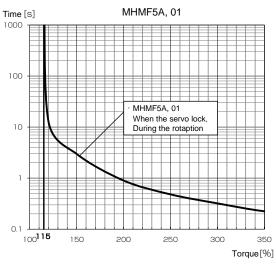
MGMF Overload protection time characteristics

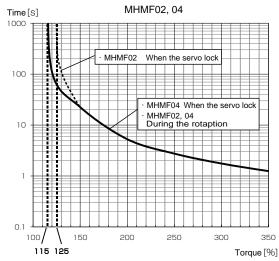


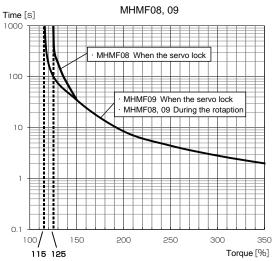
Protective function (Detail of error code)

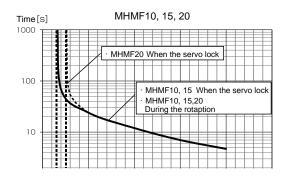
Time characteristics of Err16.0 (Overload protection)

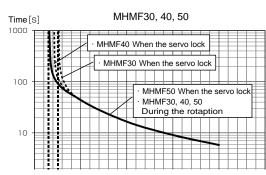
MHMF Overload protection time characteristics











Setting Pr5.13 Over-speed level setup and Pr6.15 2nd over-speed level setup

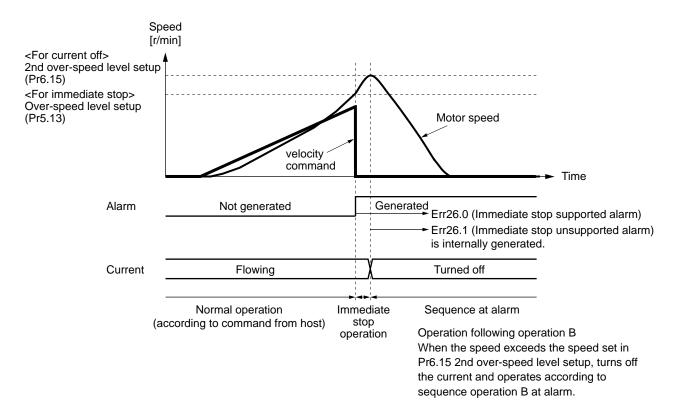
In a specific condition, the motor will not stop normally when the immediate stop function is activated.

For example, as shown below, when the motor speed exceeds Pr5.13 Over-speed level setup, and immediate stop function is activated, the motor speed cannot be controlled.

As a safety measure against over-speed, Err26.1 (2nd over-speed protection) is provided. Because Err26.1 is an immediate stop unsupported alarm, it shuts off motor current and stops the motor by following sequence operation B of alarm process. In Pr6.15 2nd over-speed level setup, set the allowable over-speed level.

Set Pr5.13 to the lower value compared with that of Pr6.15 to have sufficient margin. When both settings are the same or margin is small, Err26.0 and Err26.1 may be detected at the same time. In this case Err26.0 is displayed, but because Err26.1 is also generated internally, immediate stop unsupported alarm is given priority and immediate stop is not performed.

Furthermore, if the setup value of Pr6.15 is lower than that of Pr5.13, Err26.1 is generated before Err26.0, disabling immediate stop.



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

Adjustment

1. When in Trouble

Protective function (Detail of error code)

Allowable motor operating range setting function(Err34.0)

1) Outline

The motor is set for the range of the position command input by Pr5.14 "Allowable motor operating range."

When the motor exceeds the allowable operating range of motor, the motor is able to be stopped by issuing an alarm by the allowable motor operating range setting protection.

2) Applicable range

This function works under the following conditions.

	Conditions under which the software limit works
Control mode	Position control, Full-closed control
Others	 To be in the servo ON state. Elements other than control parameters, such as deviation counter clear command input prohibition, torque limit, etc. are properly set and the motor is free of obstacle to normal motor rotation.

3) Cautions

- Take care that this function is not the protection against the abnormal position command.
- When the allowable motor operating range setting protection is activated, the motor
 is decelerated and stopped in conformity to Pr5.10 "Sequence at alarm."
 Because depending on a load, the load may come in contact with the machine edge
 and break during deceleration, the range of setting of Pr5.14 shall be the setting
 with the deceleration action taken into account.
- Err34.0 "Allowable motor operating range abnormal protection" detection processing will be invalid when the allowable motor operating range ([Encoder pulse or [External pulse] units] exceeds ±2³¹. *1
- Position command input range and actual motor position for judgment managed inside the amplifier will be cleared and Err34.0 "Allowable motor operating range abnormal protection" detection processing will become invalid, in case any of the following conditions are satisfied:
 - Servo OFF state
 - Speed control state or torque control state
 - During motor test run conducted from front panel
 - During frequency response characteristics are being measured by Set-up support software (PANATERM)
 - Deviation clear state (When deviation counter clear (CL) is entered or when the deviation is cleared in various sequence actions)
 - During test run by Set-up support software (PANATERM) or start of Z-phase search operation
 - Pr5.14 = 0
 - When the value of Pr5.14, under full-close control, satisfies the following formula (in case the value of Pr5.14 converted into [External scale pulse] units exceed $\pm 2^{31}$) *1

Pr5.14 > ((231 -1) * Pr3.24 * 10) / (encoder resolution * Pr3.25)

*1 However in such cases, by enabling the following setting, Err34.0 will occur compulsory regardless of actual motor position for judgment.

Pr6.97 "Function expansion setting 3"

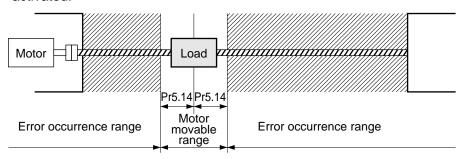
bit2 Expansion of Allowable motor operating range abnormal protection 0: Invalid, 1: Valid

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4) Example of movement

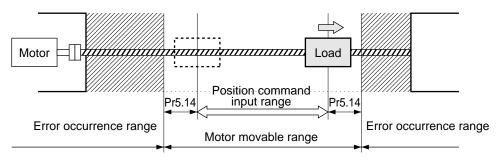
(1) When no position command is entered (Servo-ON status),

The motor movable range will be the travel range which is set at both sides of the motor with Pr5.14 since no position command is entered. When the load enters to the Err34.0 occurrence range (oblique line range), software limit protection will be activated.



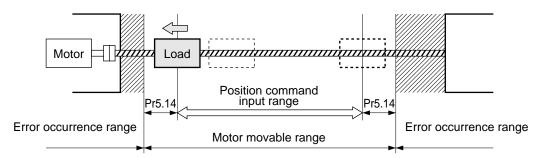
(2) When the load moves to the right (at Servo-ON),

When the position command to the right direction is entered, the motor movable range will be expanded by entered position command, and the movable range will be the position command input range + Pr5.14 setups in both sides.



(3) When the load moves to the left (at Servo-ON),

When the position command to the left direction, the motor movable range will be expanded further.



5) Condition under which the position command input range is cleared

The position command input range will be 0-cleared under the following conditions.

- when the power is turned on.
- while the position deviation is being cleared (Deviation counter clear is valid, Pr5.05 (Sequence at over-travel inhibition) is 2 and over-travel inhibition input is valid.)
- At the beginning and ending of trial run via communication.

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

Outline

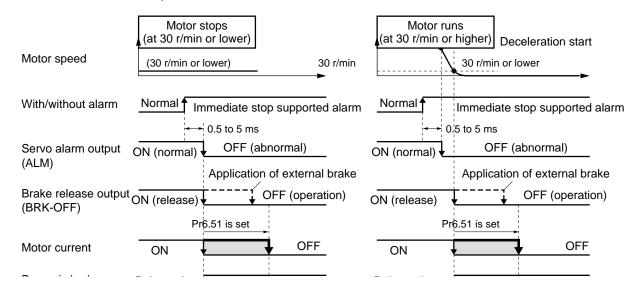
When the alarm that must respond to an immediate stop comes on, drop in the vertical axis, etc. is prevented by keeping the motor energized for the time from when the brake release output (BRK-OFF) is turned OFF to when the external brakes actually be gin to work.

Related parameters

Class	No.	Title	Function	
5	10	Sequence at alarm	To set the state during deceleration and after stopping when alarm is generated. Setting to 4 through 7 enables an immediate stop.	
6	10	Function expansion setting	To set the bit concerning drop prevention function. bit10: Drop prevention function at the time of alarm Positio deviation processing 0: Invalid (retention) 1: Valid (clear) When the drop prevention function is made enabled, usuall set to 1. Note: The lest significant bit is designated as bit0.	
6	51	Immediate stop completion wait time	When alarm that must respond to an immediate stop is generated, after turning OFF the brake release output (BRK-OFF), set the time to maintain the motor energization. In the case of zero setting, the drop prevention function is disabled.	

Content

Drop prevention function action when alarm that must respond to an immediate stop



Note

In the event that the drop prevention function is enabled when alarm is generated, set Pr5.10 "Sequence at alarm" to 4, Pr6.10 "Function expansion setting" bit 10 to "1," and a value longer than the time when brake release output (BRK-OFF) is turned OFF and external brake actually operates to Pr6.51 "Immediate stop end wait time."

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When in Trouble

1. Troubleshooting

Slow stop function

Outline

When the alarm that must respond to an immediate stop comes on, drop in the vertical axis, etc. is prevented by keeping the motor energized for the time from when the brake release output (BRK-OFF) is turned OFF to when the external brakes actually begin to work.

Scope of application

This function cannot be applied unless the following conditions are satisfied.

	Condition for activation of slow stop function			
Control mode	Position control (Pr0.01=0)			
Others	 Servo-ON state Elements other than control parameters, such as torque limit, etc. have been appropriately set, without any problems in normal operations. Block operation is set to "invalid." 			

Related parameters

Class No.	Parameter name	Set range	Units	Functions
Pr5.56	Slow stop deceleration time setting	0 to 10000	ms/ (1000r/min)	Sets the deceleration time under slow stop. This function will become effective when Pr6.10 "Function enhancement setting" bit 15 is set to 1.
Pr5.57	Slow stop S-shape acceleration and deceleration setting	0 to 1000	ms	Sets the S-shape time for deceleration under slow stop. This function will become effective when Pr6.10 "Function enhancement setting" bit 15 is set to 1.
Pr6.10	Function enhancement settings	-32768 to 32767	_	bit 10: Fall prevention function, position deviation processing under alarm 0:Invalid (maintain), 1: Valid (clear) Normally set to 1 to activate fall prevention function bit 15: Slow stop function 0:Invalid, 1: Valid *Only valid in case position control is set (Pr0.01 = 0) and block operation is invalid (Pr6.28 = 0)
Pr6.14	Immediate stop time under alarm	0 to 1000	ms	Sets the allowable time for stopping when alarm is triggered for immediate stop. Exceeding this set value will trigger a forced alarm condition. In case the set value is 0 (zero), no immediate stop will be made, but an alarm condition will immediately occur. In case the slow stop function is to be used, set it to a length sufficiently longer than the maximum deceleration time, as the motor velocity will have a delay from the deceleration and stop command. * Please refer to (3) of this item for maximum deceleration time.

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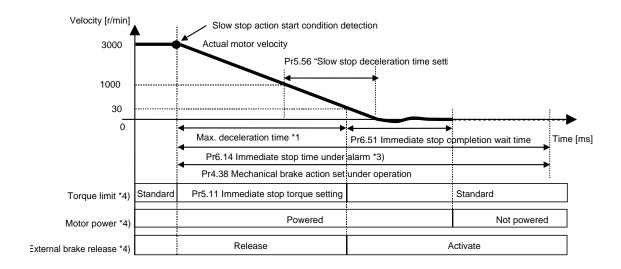
1. When in Trouble

Slow stop function

Contents

Slow stop operation

The figure below indicates the case of slow stop operation under alarm.



*1)The maximum deceleration time is approximately the value obtained by the following formula: Maximum deceleration time [ms]

Maximum velocity under normal operation pattern [r/min]) x Pr5.56 [ms/(1000 r/min)] + Pr5.57[ms]

- *2) To be the detection of following conditions:
 - Drive prohibited input with slow stop function valid setting.
 - Servo-OFF with slow stop function valid setting.
 - Main power OFF with slow stop function valid setting.
 - Immediate stop response alarm triggered with slow stop function valid setting. For immediate stop response alarm, refer to P.6-3.
- *3) Please set Pr6.14 "Immediate stop time under alarm" to a value that is sufficiently long in length than the completion of slow stop operation. The stop judgment under slow stop operation is based on actual velocity. Therefore, the time required for the actual deceleration may take longer than the maximum deceleration time.

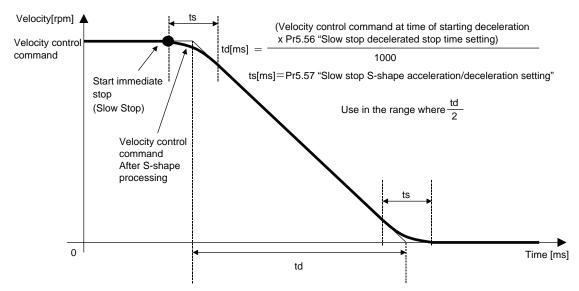
In the immediate stop operation from immediate stop response alarm, in case the immediate stop continuation duration exceeds Pr6.14 "Immediate stop time under alarm", an alarm state will be triggered regardless of the actual motor velocity.

Furthermore, immediate alarm condition will be triggered in case immediate stop non-response alarm is generated inside the driver during immediate stop.

- *4) There will be a maximum variance of about 5 [ms] in the switching timing.
- Note) Please maintain the main circuit power supply during the time of decelerated stop.

· S shape processing of slow stop operation

S shape process at the time of slow stop operation can be made by setting Pr5.57. Refer to the following figure to set Pr5.57.



- *) Velocity control command at the time of starting slow stop operation shall be calculated from the actual velocity.
- · Braking distance
 - *When Pr 5.56 and Pr5.57 has been set, the braking distance under immediate stop will increase by approximately the following formula. Please confirm its influence on the actual machine operations, when using.
- In case of linear deceleration (Pr5.57 =0)
 Linear deceleration brake distance [revolution] Linear decelerating time [s]

Linear deceleration brake distance [revolution]

 $\underline{\quad \quad \text{(Velocity control command at time of starting deceleration [r/min])} \times \text{Linear decelerating time [s]}}{60 \times 2}$

 $= \frac{\text{(Velocity control command at time of starting deceleration [r/min])}^2 \times \text{Pr5.56 [ms/(1000)[r/min]}}{60 \times 2 \times 1000 \times 1000}$

2) For Sshape deceleration (Pr5.57≠0)S-shape deceleration braking distance [revolution]

Note) The above formulae are braking distances for the velocity control command only and the actual motor control delay has to be taken into account. Furthermore, in case the torque command under deceleration is restricted by immediate stop torque stetting, the braking distance will not be as per the formulae indicated above.

When in Trouble

1. Troubleshooting

Warning functions

When an error condition e.g. overloading occurs, the warning code is issued to indicate that the corresponding protective function will be triggered if suitable corrective action is not taken. The warning will be cleared as the cause of the error is removed. However, certain warning will remain latched for predetermined period as shown in the table below. To forcibly clear the warning, take the normal alarm clear procedure.

If alarm clear input (A-CLR) is kept valid, all warnings are always cleared.

Warning No.	Warning name	Content	Pr6.27 *1	Pr4.40/ Pr4.41*2	Pr6.38/Pr6.39 corresponding bit *3
A0	Overload warning	Load factor is 85% or more the protection level.	0	1	Pr6.38 bit 7
A1	Over-regeneration warning	Regenerative load factor is 85% or more the level.	0	2	Pr6.38 bit 5
A2	Battery warning	Battery voltage is 3.2 V or lower.	Fixed at no time limit.	3	Pr6.38 bit 0
А3	Fan warning	Fan has stopped for 1 sec.	0	4	Pr6.38 bit 6
A4	Encoder communication warning	The number of successive encoder communication errors has exceeded the specified value.	0	5	Pr6.38 bit 4
A5	Encoder overheat warning *4	Encoder temperature has exceeded the specified value.	0	6	Pr6.38 bit 3
A6	Oscillation detection warning	Oscillation or vibration has been detected.	0	7	Pr6.38 bit 9
A7	Lifetime detection warning	The life expectancy of capacity or fan has dropped below specified value.	Fixed at no time limit.	8	Pr6.38 bit 2
A8	External scale error warning	The external scale has detected the warning.	0	9	Pr6.38 bit 8
A9	External scale communication warning	The number of successive external scale communication errors has exceeded the specified value.	0	10	Pr6.38 bit 10
AC	Deterioration diagnosis warning *6	Load characteristic estimates and torque command under constant speed has exceeded the set range.	0	22	Pr6.39 bit7
С3	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.	0	14	Pr6.38 bit 12

1. When in Trouble

Slow stop function

- *1 The part "I" indicates Pr6.27 "Latched time of warning" and can set the time interval 1 to 10s or no time limit. Note that the battery warning and the end of life warning have "no time limit."
- *2 Through Pr4.40 "Warning output select 1" and Pr4.41 "Warning output select 2," select the warning issued as the warning output signal 1 (WARN1) and signal 2 (WARN2). In case of setting value 0, OR output of all warnings will be obtained. In addition, do not use the setup values other than those listed in the above table.
- *3 Each warning detection can be disabled by Pr6.38 "Warning mask setup" and Pr6.37 "Warning mask setting 2." The corresponding bits are indicated in the table. The warning detection will be disabled by bit=1.
- *4 Encoder thermal warning is effective only when 23 bit absolute encoder, 20 bit absolute encoder and 20 bit incremental serial encoder are used. If other encoders are used, it will be disabled.
- *5 Warnings can be cleared by using the alarm clear. While the alarm clear input (A-CLR) is kept ON, the all existing warnings are always cleared.
- *6 Invalidated when Pr6.97 "Function expansion setting 3" bit 1 = 0.

When in Trouble

2. Setup of gain pre-adjustment protection

Before starting gain adjustment, set the following parameters based on the conditions of use, to assure safe operation.

1) Setup of over-travel inhibit input

By inputting the limit sensor signal to the driver, the bumping against mechanical end can be prevented. Refer to interface specification, positive/negative direction overtravel inhibit input (POT/NOT). Set the following parameters which are related to overtravel inhibit input.

Pr5.04 Setup of over-travel inhibit input

Pr5.05 Sequence at over-travel inhibit

Related page : P.3-40 (POT/NOT), P.4-52, P.4-53 (Pr5.04, Pr5.05)

2) Setup of torque limit

By limiting motor maximum torque, damage caused by failure or disturbance such as bite of the machine and collision will be minimized. To apply standardized limit through parameters, set Pr0.13 The 1st torque limit.

If the torque limit setup is lower than the value required during the actual application, the following two protective features will be triggered: over-speed protection when overshoot occurs, and excess positional deviation protection when response to the command delays.

By allocating the torque in-limit output (TLC) of interface specification to the output signal, torque limit condition can be detected externally.

Related page : P.3-48 (TLC), P.4-14 (Pr0.13), P.4-58 (Pr5.21)

3) Setup of over-speed protection

Generates Err26.0 Over-speed protection when the motor speed is excessively high. Default setting is the applicable motor maximum speed [r/min] × 1.2.

If your application operates below the motor maximum speed, set Pr5.13 Setup of over-speed level by using the formula below.

Pr5.13 Setup of over-speed level = $Vmax \times (1.2 \text{ to } 1.5)$

Vmax: motor maximum speed [r/min] in operating condition

Factor in () is margin to prevent frequent activation of over-speed protection.

When running the motor at a low speed during initial adjustment stage, setup the overspeed protection by multiplying the adjusting speed by a certain margin to protect the motor against possible oscillation.

Related page ·: P.4-56 (Pr5.13)

(Continued ...)

Before Using the Products

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2. Setup of gain pre-adjustment protection

4) Setup of the excess positional deviation protection

During the position control or full-closed control, this function detects potential excessive difference between the position command and motor position and issues Err24.0 "Position deviation excess protection".

Excess position deviation level can be set by Pr0.14 "Position deviation excess setting." The detection position can be selected from command position deviation [pulse (command unit)] and encoder position deviation [pulse (encoder unit)] or full-closed deviation [pulse (external scale unit)] in Pr5.20 "Position setting unit selection". (See the control block diagram) Default is set to 100000 [pulse (command unit)].

Because the position deviation during normal operation depends on the operating speed and gain setting, fill the values obtained from the equation below based on your operating condition and input the resulting value to Pr0.14.

4-1) In case two degree-of-freedom is set to valid (Pr6.47 bit 0 = 1)

• For Pr5.20 = 0 (Detection by command position deviation)

Pr0.14 "Excessive position deviation setting" = $(P1 + P2 + P3 + P4) \times (1.2 \text{ to } 2.0)$ Coefficients in parenthesis are allowances to prevent frequent triggering of excessive position deviation protection

Position command smoothing accumulator pulse count: P1 = $Vc \times$ (set value for Pr2.22 / 10000) x 2 Position command FIR filter accumulator pulse count: P2 = $Vc \times$ (set value for Pr2.23 / 10000) / 2 Adjustment filter accumulator pulse count: P3 = $Vc \times$ (Set value for Pr6.48 / 10000) Damping filter accumulator pulse count: P4 = $Vc / (\pi \times \text{damping frequency [Hz]})$

* Damping frequency is 1/10 of the set values for Pr2.14 (first), Pr2.16 (second), Pr2.18 (third) and Pr2.20 (fourth) and is calculated only when the set values are effective. In case multiple damping controls are valid, P4 shall be calculated for each damping filter and P4 shall be the total of the calculated values

.• For Pr5.20 = 1 (Detection by encoder position deviation or full-closed position deviation)

* In this case, the position deviation cannot be obtained through calculation formula. Set the value including allowance, by estimating the maximum value of encoder position deviation or full-closed position deviation (Pmax) from the actual operation waveform that could be used.

Pr0.14 "Excessive position deviation setting" = $Pmax \times (1.2 \text{ to } 2.0)$

Note 1) Measure with the smallest value when switching position loop gain Kp.

Note 2) Setting of command filter and damping control will not have any effect in case Pr 5.20 = 1.

2. Setup of gain pre-adjustment protection

4-2) In case two degree-of-freedom control is invalid (Pr6.47 bit 0 = 0)

• For Pr5.20 = 0 (detection through command position deviation),

Pr0.14 "Position deviation excess setting" = $Vc/Kp \times (1.2 \text{ to } 2.0)$

Vc: Maximum frequency of positional command pulse [pulse (command unit)/s]

Kp: Position loop gain [1/s]

Factor in () is margin to prevent frequent activation of position deviation excess protection.

Note 3) When switching position loop gain Kp, select the smallest value for calculation.

Note 4) When using the positional command filter and damping control, add the following values.

Positional command smoothing filter: $Vc \times Filter$ time constant [s]

Positional command FIR filter: Vc × Filter time constant [s]/2

Damping control: $Vc/(\pi \times Damping frequency [Hz])$

.• For Pr5.20 = 1 (Detection through encoder position deviation and full-closed position deviation)

Pr0.14 "Position deviation excess setting" = $Ve/Kp \times (1.2 \text{ to } 2.0)$

Ve: Maximum operation frequency [pulse/s] in encoder unit or full-closed unit

Kp: Position loop gain [1/s]

Note 5) NOTE 3) When switching position loop gain Kp, select the smallest value for calculation.

Note 6) When Pr5.20 = 1, setups of positional command filter and damping control have no effect.

Related page : P.4-14 (Pr0.14), P.4-58 (Pr5.20)

5) Motor working range setup

During the position control or full-closed control, this function detects the motor position which exceeds the revolutions set to Pr5.14 Allowable motor operating range setting, and issues Err34.0 Motor working range limit protection.

For details, see 6-3 Motor working range setup functions.

Related page :: P.4-56 (Pr5.14)

6) Hybrid deviation excess error protection setup

At the initial operation with full-closed control, operation failure may occur due to reverse connection of external scale or wrong external scale division ratio.

To indicate this type of defect, Err25.0 "Hybrid deviation excess error protection" is issued when the deviation of motor position (encoder unit) and load position (external scale unit) exceed Pr3.28 "Hybrid deviation excess setting."

For details, see 4-5-3 Setting of hybrid deviation excess.

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When in Trouble

3. Troubleshooting

Motor Does Not Run

When the motor does not run, refer to P.2-102, "Display of Factor of No-Motor Running" of Preparation as well.

Classification		Causes	Measures
Parameter	Setup of the control mode is not correct	Check that the present control mode is correct with monitor mode of the front panel.	1) Set up Pr0.01 again. 2) Check that the input to control mode switching (C-MODE) of the Cnnector X4 is correct, when Pr0.01 is set to 3 to 5.
	Selection of torque limit is not correct	Check that the external analog input (N-ATL/P-ATL) is not used for the torque limit.	1) Set up Pr05.21 to 0 and apply -9 [V] to N-ATL and +9 [V] to P-ATL when you use the external input. 2) Set up Pr05.21 to 1 and set up the max. value to Pr0.13 when you use the parameter value.
	Setup of electronic gear is not correct. (Position/Full- closed)	Check that the motor moves by expected revolution against the command pulses.	 Check the setups of Pr0.09, Pr0.10 and Pr5.00 to Pr5.02 again. Connect the electronic gear switching input (DIV) of Connector X4 to COM-, or invalidate the division/ multiplication switching by setting up the same value to Pr0.09 and Pr5.00.
Wiring	Servo-ON input of Connector X4 (SRV-ON) is open.	In the front panel monitor mode, is the Pin No. corresponding to SRV- ON in " - " state?	Check and make a wiring so as to connect the SRV-ON input to COM
	Positive/negative direction over-travel inhibit input of Connector X4 (NOT/POT) is open.	In the front panel monitor mode, is the Pin No. corresponding to NOT/ POT in " A " state?	1) Check and make a wiring so as to connect both NOT/POT inputs to COM 2) Set up Pr5.04 to 1 (invalid) and reset the power.
	Command pulse input setup is incorrect. (Position/Full-closed)	Check that the input pulse counts and variation of command pulse sum does not slips, with monitor mode of the front panel.	Check that the command pulses are entered correctly to the direction selected with Pr0.05. Check that the command pulses are entered correctly in the format selected with Pr0.07.
	Command pulse input inhibition (INH) of Connector X4 is open. (Position/ Full-closed)	In the front panel monitor mode, is the Pin No. corresponding to INH in "A" state?	1) Check and make a wiring so as to connect the INH input to COM 2) Set up Pr5.18 to 1 (invalid).
	Counter clear input (CL) of Connector X4 is connected to COM (Position/Full-closed)	In the front panel monitor mode, is the Pin No. corresponding to CL in " A " state?	1) Check and make wiring so as to open the CL input 2) Set up Pr5.17 to 0 (invalid).

Related page ·: ❖

[•] P.2-88... "How to Use the Front Panel" • P.3-32 "Inputs and outputs on connector X4"

[•] P.4-6 to P.4-85... "Details of parameter"

3. Troubleshooting

Motor Does Not Run

When the motor does not run, refer to P.2-102, "Display of Factor of No-Motor Running" of Preparation as well.

Classification		Causes	Measures
Wiring	Speed command is invalid (Velocity)	Check that the velocity command input method (external analog command/internal velocity command) is correct.	1) Check the setups of Pr3.02 to Pr3.03 again by setting up Pr3.00 to 0, when you use the external analog command. 2) Set up Pr3.04 to Pr3.07 and Pr3.08 to Pr3.11 by setting up Pr3.00 to either one of 1, 2 or 3, when you use the internal speed command.
	Speed zero clamp input (ZEROSPD) of Connecter X4 is open. (Velocity/Torque)	In the front panel monitor mode, is the Pin No. corresponding to ZEROSPD in "A" state?	1) Check and make wiring so as to connect speed zero clamp input to COM–. 2) Set up Pr3.15.
	Torque command is invalid (Torque)	Check that the torque command input method (SPR/TRQR input, P-ATL/TRQR input) is correct.	 Check that the input voltage is applied correctly by setting up Pr3.17 to 0, when you use SPR/TRQR input. Check that the input voltage is applied correctly by setting up Pr3.17 to 1, when you use the P-ATL/TRQR input.
	Velocity control is invalid (Torque)	Check that the velocity limit input method (parameter velocity, SPR/TRQR/SPL input) is correct.	1) Set up the desired value to Pr3.21 by setting up Pr3.17 to 0, when you use the parameter speed. 2) Check that the input voltage is applied correctly by setting up Pr3.17 to 1, when you use the SPR/TRQR/SPL input.
Installation	Main power is shut off.	In the front panel monitor mode, is the Pin No. corresponding to S-RDY in " - " state?	Check the wiring/voltage of main power of the driver (L1, L2 and L3).
	The motor shaft drags, the motor does not run.	1) Check that you can turn the motor shaft, after turning off the power and separate it from the machine. 2) Check that you can turn the motor shaft while applying DC24 V to the brake in case of the motor with electromagnetic brake.	If you cannot turn the motor shaft, consult with the dealer for repair.

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When in Trouble

3. Troubleshooting

Unstable Rotation (Not Smooth), Motor Runs Slowly Even with Speed Zero at Velocity Control Mode

Classification	Causes	Measures
Parameter	Setup of the control mode is not correct.	If you set up Pr0.01 to 1(Velocity control mode) by mistake at position control mode, the motor runs slowly at servo-ON due to speed command offset. Change the setup of Pr0.01 to 0.
Adjustment	Gain adjustment is not proper.	Increase the setup of Pr1.01, 1st velocity loop gain. Enter torque filter of Pr1.04 and increase the setup of Pr1.01 again.
	Velocity and position command are not stable.	Check the motor movement with connector X7 of the front panel or the waveform graphic function of the PANATERM. Review the wiring, connector contact failure and controller.
Wiring	Each input signal of Connector X4 is chattering. 1) Servo-ON signal	Check the wiring and connection between Pin29 and 41 of the Connector X4 using the display function of I/O signal status. Correct the wiring and connection so that the Servo-ON signal can be turned on normally. Review the controller.
	Positive/Negative direction torque limit input signal	2) Check the wiring and connection between Pin-18 and 17, 16 and 17 of the Connector X4 using tester or oscilloscope. Correct the wiring and connection so that Positive/Negative direction torque limit input can be entered normally.
	3) Deviation counter input signal	3) Check the wiring and connection between Pin-30 and 41 of the Connector X4 using display function of I/O signal status. Correct the wiring and connection so that the deviation counter input can be turned on normally. Review the controller.
	4) Speed zero clamp signal	4) Check the wiring and connection between Pin-26 and 41of the Connector X4 using Display function of I/O signal status. Correct the wiring and connection so that the speed zero clamp input can be entered normally. Review the controller.
	5) Command pulse inhibition input	5) Check the wiring and connection between Pin-33 and 41of the Connector X4 using display function of I/O signal status. Correct the wiring and connection so that the command pulse inhibition input can be entered normally. Review the controller.
	Noise is on the velocity command.	Use a shield cable for connecting cable to the Connector X4. Separate the power line and signal line (30 cm or longer) in the separate duct.
	Slip of offset	Check the voltage between Pin-14 and 15 (speed command input) using a tester or an oscilloscope.
	Noise is on the position command.	Use a shield cable for connecting cable to the Connector X4. Separate the power line and signal line (30 cm or longer) in the separate duct.

Related page .:

[•] P.4-6 to P.4-85... "Details of parameter" • P.3-32 "Inputs and outputs on connector X4"

[•] P.7-26 "Outline of Setup support software "PANATERM"

When in Trouble

3. Troubleshooting Positioning Accuracy Is Poor

Classification	Causes	Measures	
System	Position command is not correct. (Amount of command pulse)	Count the feedback pulses with a monitor function of the PANATERM or feedback pulse monitor mode of the console while repeating the movement of the same distance. If the value does not return to the same value, review the controller. Make a noise measure to command pulse.	
	Captures the positioning complete signal at the edge.	Monitoring with the waveform graphic function of the PANATERM. Make the controller capture the signal not at the edge but with some time allowance.	
	Shape or width of the command pulse is not per the specifications.	If the shape of the command pulse is broken or narrowed, review the pulse generating circuit. Make a noise measure.	
	Noise is superposed on deviation counter clear input CL (Connector X4, Pin-30).	Make a noise measure to external DC power supply and make no wiring of the unused signal lines.	
Adjustment	Position loop gain is small.	Check the position deviation with the monitor function of the PANATERM or at the monitor mode of the console. Increase the setup of Pr1.00 within the range where no oscillation occurs.	
Parameter	Setup of the positioning complete range is large.	Lower the setup of Pr4.31 within the range where no chattering of complete signal occurs.	
	Command pulse frequency have exceeded 500kpps or 4Mpps.	Lower the command pulse frequency. Change the division/ multiplication ratio of 1st and 2nd numerator of command division/ multiplication, Pr0.09 and Pr0.10. Use a pulse line interface exclusive to line driver when pulse line interface is used.	
	Setup of the division/ multiplication is not correct.	Check if the repetition accuracy is same or not. If it does not change, use a larger capacity motor and driver.	
	Velocity loop gain is proportion action at motor in stall.	 Set up Pr1.02 and Pr1.07 of time constant of velocity loop integration to 9999 or smaller. Review the wiring and connection so that the connection between Pin-27 and 41 of the gain switching input connector, Connector X4 becomes off while you set up Pr1.14 of 2nd gain setup, to 1. 	
Wiring	Each input signal of Connector X4 is chattering. 1) Servo-ON signal	Check the wiring and connection between Pin29 and 41 of the connector, Connector X4 using the display function of I/O signal status. Correct the wiring and connection so that the servo-On signal can be turned on normally. Review the controller.	
	Deviation counter clear input signal	2) Check the wiring and connection between Pin-30 and 41 of the connector, Connector X4 using display function of I/O signal status. Correct the wiring and connection so that the deviation counter clear input can be turned on normally. Review the controller.	
	Positive/Negative direction torque limit input signal	3 Check the wiring and connection between Pin-18 and 17, 16 and 17 of the connector, Connector X4 using tester or oscilloscope. Correct the wiring and connection so that Positive/Negative direction torque limit input can be entered normally.	
	Command pulse inhibition input	4) Check the wiring and connection between Pin-33 and 41of the connector, Connector X4 using display function of I/O signal status. Correct the wiring and connection so that the command pulse inhibition input can be entered normally. Review the controller.	
Installation	Load inertia is large.	Check the overshoot at stopping with graphic function of the PANATERM. If no improvement is obtained, increase the driver and motor capacity.	

Related page : P.4-6 to P.4-85... "Details of parameter" • P.3-32 "Inputs and outputs on connector X4"

[•] P.7-26 "Outline of Setup support software "PANATERM"

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When in Trouble

3. Troubleshooting

Origin Point Slips

Classification	Causes	Measures
System	Z-phase is not detected.	Check that the Z-phase matches to the center of proximity dog. Execute the homing matching to the controller correctly.
	Homing creep speed is fast.	Lower the homing speed at origin proximity. Or widen the origin sensor.
Wiring	Chattering of proximity sensor (proximity dog sensor) output .	Check the dog sensor input signal of the controller with oscilloscope. Review the wiring near to proximity dog and make a noise measure or reduce noise.
	Noise is on the encoder line.	Reduce noise (installation of noise filter or ferrite core), shield treatment of I/F cables, use of a twisted pair or separation of power and signal lines.
	No Z-phase signal output.	Check the Z-phase signal with oscilloscope. Check that the Pin- 13 of the connector, connector X4 is connected to the earth of the controller. Connect the earth of the controller because the open collector interface is not insulated. Replace the motor and driver. Request for repair.
	Miswiring of Z-phase output.	Check the wiring to see only one side of the line driver is connected or not. Use a CZ output (open collector if the controller is not differential input.

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When in Trouble

3. Troubleshooting

Abnormal Motor Noise or Vibration

Classification	Causes	Measures
Wiring	Noise is on the speed command.	Measure the speed command inputs of Pin-14 and 15 of the connector, Connector X4 with an oscilloscope. Reduce noise (installation of noise filter or ferrite core), shield treatment of I/F cables, use of a twisted pair, separation of power and signal lines.
Adjustment	Gain setup is large.	Lower the gain by setting up lower values to Pr1.01 and 1.06, of velocity loop gain and Pr1.00 and Pr1.05 of position loop gain.
Installation	Resonance of the machine and the motor.	Re-adjust Pr1.04 and 1.09. Check if the machine resonance exists or not with frequency characteristics analyzing function of the PANATERM. Set up the notch frequency to Pr2.01, Pr2.04, Pr2.07, Pr2.10 or Pr2.24 if resonance exists.
	Motor bearing	Check the noise and vibration near the bearing of the motor while running the motor with no load. Replace the motor to check. Request for repair.
	Electro-magnetic sound, gear noise, rubbing noise at brake engagement, hub noise or rubbing noise of encoder.	Check the noise of the motor while running the motor with no load. Replace the motor to check. Request for repair.

When in Trouble

3. Troubleshooting

Overshoot/Undershoot,
Overheating of the Motor (Motor Burn-Out)

Classification	Causes	Measures
Adjustment	Gain adjustment is not proper.	Check with graphic function of PANATERM or monitor (connector X7). Make a correct gain adjustment. Refer to "Adjustment".
Installation	Load inertia is large.	Check with graphic function of PANATERM or monitor (Connector X7). Make an appropriate adjustment. Increase the motor and driver capacity and lower the inertia ratio. Use a gear reducer.
	Looseness or slip of the machine.	Review the mounting to the machine.
	Ambient temperature, environment.	Lower the temperature with cooling fan if the ambient temperature exceeds the predications.
	Stall of cooling fan, dirt of fan ventilation duct.	Check the cooling fans of the driver and the machine. Replace the driver fan or request for repair. (The upper fan on the H-frame driver stops during servo OFF to save energy. This is normal.)
	Mismatching of the driver and the motor.	Check the name plates of the driver and the motor. Select a correct combination of them referring to the instruction manual or catalogue.
	Failure of motor bearing.	Check that the motor does not generate rumbling noise while turning it by hand after shutting off the power. Replace the motor and request for repair if the noise is heard.
	Electromagnetic brake is kept engaged (left un-released).	Check the voltage at brake terminals. Apply the power (DC24 V) to release the brake.
	Motor failure (oil, water or others)	Avoid the installation place where the motor is subject to high temperature, humidity, oil, dust or iron particles.
	Motor has been turned by external force while dynamic brake has been engaged.	Check the running pattern, working condition and operating status, and inhibit the operation under the condition of the left.

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3. Troubleshooting

When in Trouble

Motor Speed Does Not Reach to the Setup, Motor Revolutions (Travel) Is Too Large or Small

Classification	Causes	Measures
Parameter	Velocity command input gain is not correct.	Check that the setup of Pr3.02, speed command input gain, is made so as to make the setup of 500 makes 3000 r/min/6 V.
Adjustment	Position loop gain is low.	Set up Pr1.00and Pr1.05, position loop gain to approx. 1000.
	Division/Multiplication is not proper.	Set up correct values to Pr0.09, 1st numerator of electronic gear, Pr0.11, numerator multiplier of electronic gear and Pr0.10, denominator of electronic gear. Refer to parameter setup at each mode.

Related page : P.4-6 to P.4-85... "Details of parameter" • P.7-26 "Outline of Setup support software "PANATERM"

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When in Trouble

3. Troubleshooting

Parameter Returns to Previous Setup

Classification	Causes	Measures
Parameter	No writing to EEPROM has been carried out before turning off the power.	Refer to P.2-109, "EEPROM Writing Mode" of Preparation.

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3. Outline of Setup Support Software, "PANATERM"

1. Safety function

2. Absolute system

4. Communication

7

Supplement

1. Safety function

Outline

SE	SG	SF
		0

Outline description of safe torque off (STO)

The safe torque off (STO) function is a safety function that shuts the motor current and turns off motor output torque by turning off the driving signal of the servo driver's internal power transistor, when safety input signal is detected.

When STO function operates, the servo driver turns off the servo ready output signal (S-RDY) and enters safety state, "St" is displayed on the front panel. Also when STO input is off and servo on input is off, it enters servo off status automatically.



STO function differs from MINAS A5 series.
 Unlike A5 series, when STO function is on. Alarm will not be activated.
 When safety function detects an error, it will trigger an alarm (Err31.0, Err31.2).

Safety precautions

- When using the STO function, be sure to perform equipment risk assessment to ensure that the system conforms to the safety requirements.
- Even while the STO function is working, the following potential safety hazards exist. Check safety in risk assessment.
 - The motor may move when external force (e.g. gravity force on vertical axis) is exerted on it. Provide an external brake, etc., as necessary to secure the motor. Note that the purpose of motor with brake is holding and it cannot be used for braking application.
 - When parameter Pr5.10 Sequence at alarm is set to free run (disable dynamic brake), the motor is free run state and requires longer stop distance even if no external force is applied. Make sure that this does not cause any problem.
 - When power transistor, etc., becomes defective, the motor will move to the extent equivalent of 180 electrical angle (max.). Make sure that this does not cause any problem.
 - The STO turns off the current to the motor but does not turn off power to the servo driver and does not isolate it. When starting maintenance service on the servo driver, turn off the driver by using a different disconnecting device.
- External device monitor (hereafter EDM) output signal is not a safety signal. Do not use it for an application other than failure monitoring.
- Dynamic brake and external brake release signal output are not related to safety function. When designing the system, make sure that the failure of external brake release during STO condition does not result in danger condition.
- When using STO function, connect equipment conforming to the safety standards.

P.3-33 "Inputs and outputs on connector X4"

Input & output signals

Safety input signal

For list of connector pin numbers, refer to P.2-34,

Signal	Symbol	Pin No.	Contents	Control mode
Safety	SF1+	4	 Input 1 that triggers STO function. This input turns off the upper arm drive signal of power transistor. When using the function, connect this pin in a way 	
input 1 SF1-		3	so that the photocoupler of this input circuit turns off to activate STO function.	Compatible all control
Safety	SF2+	6	 Input 2 that triggers STO function. This input turns off the lower arm drive signal of power transistor. When using the function, connect this pin in a way 	mode
input 2	SF2-	5	so that the photocoupler of this input circuit turns off to activate STO function.	

<Response time>

Safety input 1 or 2 enables STO to operate: within 5 ms of response time, the motor output torque will be turned off.

Caution

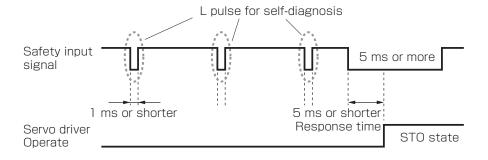
Safety equipment self-diagnosis L pulse

Safety output signal from the safety controller and safety sensor may include L pulse for self-diagnosis.

To prevent the L pulse from mis-triggering STO function, the safety input circuit has built-in filter that removes the self-diagnosis L pulse.

Therefore, if the off period of safety input signal less than 1 ms, the safety input circuit does not detect this "off" event.

To validate this "off" period, turn off the input signal for more than 5 ms.



Related page …

P.2-2 "Conformance to international standards"
 P.2-74 "How to Use the Front Panel"

P.3-33 "Inputs and outputs on connector X4"

External device monitor (EDM) output signal

The monitor output signal is used by the external device to monitor the state of the safety input signal. Connect the monitor output to the external device monitor terminal of the safety devices such as safety controller and safety sensor.

Signal	Symbol	Pin No.	Contents	Control mode
EDM	EDM+	8	Outputs monitor signal that is used to check the safety function.	Compatible all control
output	EDM-	7	Caution ∵ This output signal is not a safety output.	mode

Logical relationship between safety input signal and EDM output signal

When both safety input 1 and 2 are off, i.e. when STO function of 2 safety input channels are active, the photocoupler in EDM output circuit turns on.

Signal	Symbol	photocoupler logic				
Safety input	SF1	ON	ON	OFF	OFF	
	SF2	ON	OFF	ON	OFF	
EDM output	EDM	OFF	OFF	OFF	ON	

By monitoring the logics (all 4 states) of photocoupler shown in the table above, the external device can determine the status (normal or abnormal) of safety input circuit and EDM output circuit. That is to say, in the case of an anomaly, although both safety input 1 and 2 are off, the photocoupler in EDM output circuit does not turn on. Or, although either safety input 1 or 2 or both safety input 1 and 2 turned on, the state in which the photocoupler in EDM output circuit turned on has been detected.



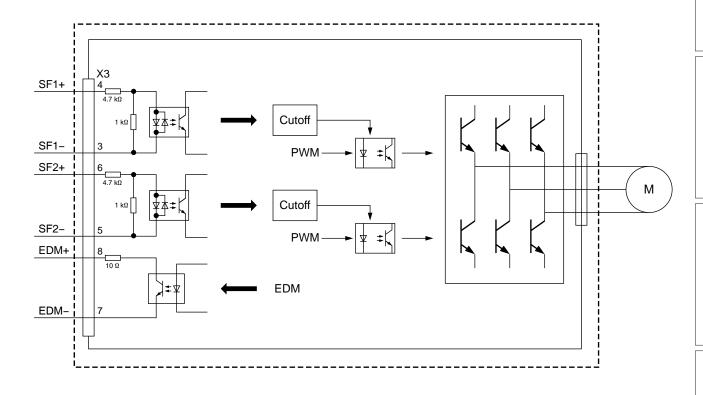
Maximum delay time from input of safety 1 and 2 signals to output of EDM signal is 6 ms.

Related page …

[•] P.2-2 "Conformance to international standards" • P.2-74 "How to Use the Front Panel"

[•] P.3-33 "Inputs and outputs on connector X4"

Supplement Safety Circuit Block Diagram



Related page · ∵:•

[•] P.2-2 "Conformance to international standards" • P.2-74 "How to Use the Front Panel"

[•] P.3-33 "Inputs and outputs on connector X4"

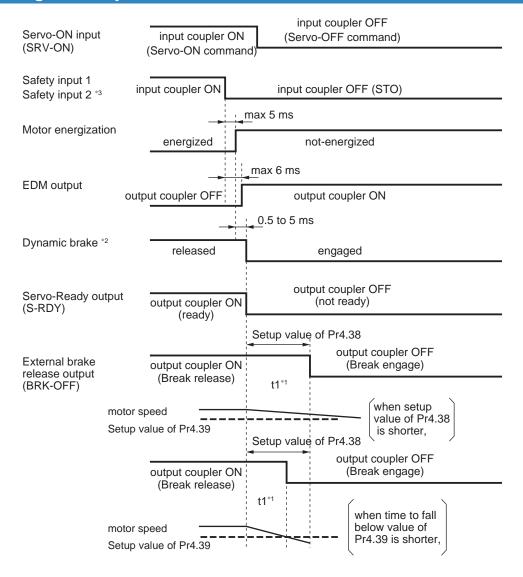
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Supplement

1. Safety function

Timing Chart

Operating timing for safety status



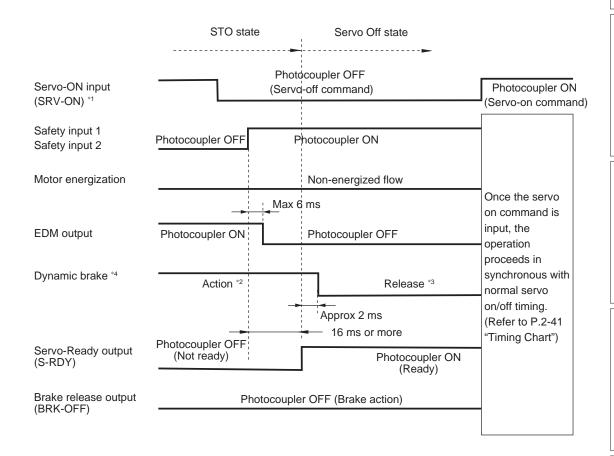
- *1 t1 is the value set to Pr4.38 Setup of mechanical brake action at running or the time at which the motor revolution speed drops below the time set to Pr4.39 Brake release speed setup, whichever comes first.
- *2 Dynamic brake operates to the setting of Pr5.10 Sequence at alarm.
- *3 When safety input 1 or 2 turns off, the state changes to STO condition.
- *4. The driver will not enter an alarm state.

[•] P.2-2 "Conformance to international standards" • P.2-74 "How to Use the Front Panel"

[•] P.3-33 "Inputs and outputs on connector X4"

Timing Chart

Return timing from safety state



- *1. Photocouplers for safety input 1 and 2 should be turned on again with servo-on input turned off.
 - Returning photocouplers for safety inputs 1 and 2 to ON will automatically reset it to Servo Off mode. There is no need to conduct alarm-clear.
- *2. This is an STO state and the dynamic brake operates according to Pr5.10 "Sequence at alarm."
- *3. This is normal servo-off condition and the dynamic brake operates according to Pr5.06 "Sequence at servo-off."

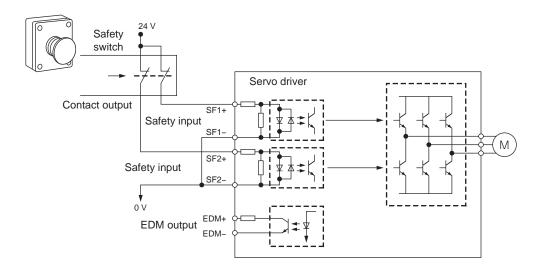
Related page …

[•] P.2-2 "Conformance to international standards" • P.2-74 "How to Use the Front Panel"

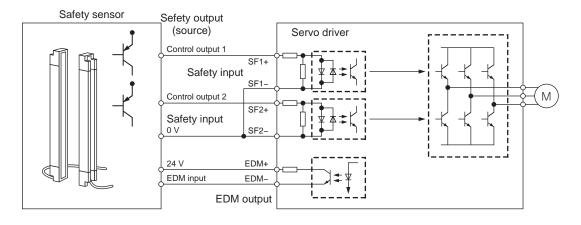
[•] P.3-33 "Inputs and outputs on connector X4"

Example of connection

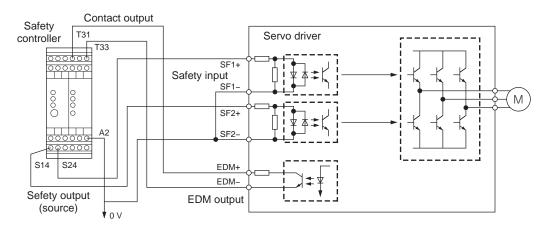
Example of connection to safety switch



Example of connection to safety sensor



Example of connection to safety controller



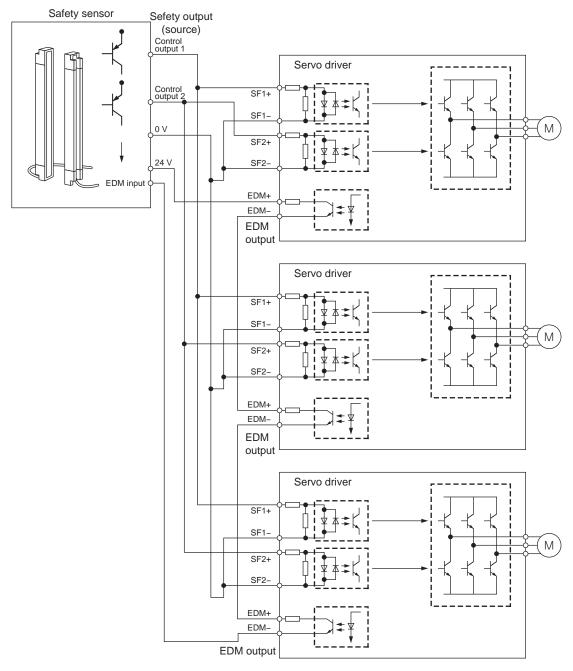
Related page …

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

[•] P.2-2 "Conformance to international standards" • P.2-74 "How to Use the Front Panel"

Example of connection

Example of connection when using multiple axes



- Capacity requirement per safety output (source) channel: 5 x No. of connected axes (mA)
- 24 VDC supply allowable voltage: 24 V±15 %
- Maximum No. of connectable axes: 8
- * The number of connectable axes shown in the figure is for reference only.

 EDM output depends on external circuit because saturated voltage Vce (sat) of approx.

 1.0 V in the built-in photocoupler varies with collector current.

 Amount of current flowing to SF input is 5 mA per circuit.

When increasing the number of axes to be connected, make sure that required amount of current does not exceed the maximum output current of the safety controller.



- P.2-2 "Conformance to international standards" P.2-74 "How to Use the Front Panel"
- P.3-33 "Inputs and outputs on connector X4"

7Supplement

2. Absolute system	
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Outline

SE	SG	SF
	\circ	\circ

Outline of Absolute System

When you compose an absolute system using an absolute encoder, you are not required to carry out homing operation at the power-on, and this function suits very well to such an application as a robot.

The host controller with motors of absolute encoder specification, by connecting an absolute encoder battery, and by setting Pr0.15 "Absolute encoder setting" to value other than "1" (factory setting), can be setup that will not require an absolute system where return to origin is not required after reclosing of power supply.

Shift the system to origin once after installing the battery and clear the multi-turn data by clearing the absolute encoder, then you can detect the absolute position without carrying out homing operation.

Via RS232 or RS485 communication, the host controller can connect up to 32 MINAS-A6 and capture the present position information as serial data to obtain the absolute position of each axis by processing. each data.

Absolute Specifications

There are 2 connecting methods of the host controller and MINAS-A6 driver as described below, and select a method depending on the interface of the host controller specs or number of axis to be connected. Designate a module ID to Pr5.31 of each MINAS-A6 driver when you connect multiple MINAS-A6 in communication to one host controller as shown below.

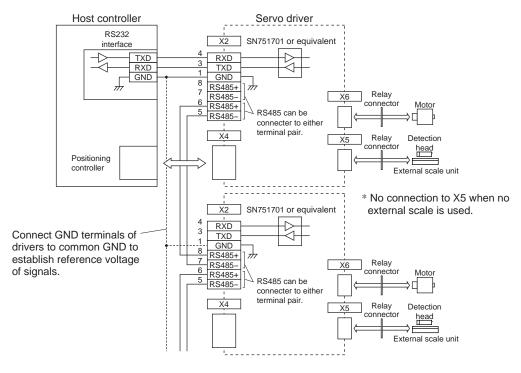
[Parameter Pr5.31]

- When you connect each MINAS-A6 to the host separately with RS232 and switch the communication individually, designate 0 to 31 to each MINAS-A6.
- When you connect one MINAS-A6 to the host with RS232 and connect each MINAS-A6 with RS485, designate 0 to the MINAS-A6 connected with the host, and designate 1 to 31 to other MINAS-A6. (Max 32 axis are connectable.)
- When you connect MINAS-A6 to the host with RS485, the host is given module ID of 0, and designate 1 to 31 to MINAS-A6. (Max 31 axis are connectable.)

2. Absolute system

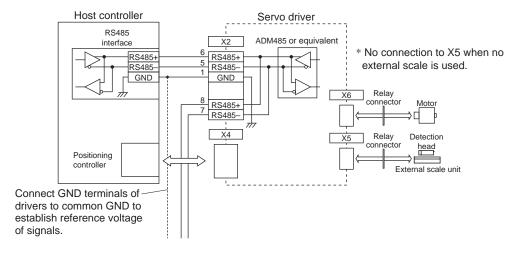
Configuration

Configuration of absolute system of scale using RS232 interface



Related page : P.7-28 "Connection of Communication Line"

Configuration of absolute system of scale using RS485 interface



[Related page :: P.7-28 "Connection of Communication Line"

Note ·

7-11

Before Using the Produ

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Preparation

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Setup

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When in Trouble

Supplemen

^{*} Battery for absolute encoder is required to store the multi-turn data into the encoder. Connect the battery between BAT+ and BAT- of the motor.

Supplement

2. Absolute system

Battery (for Backup) Installation

First Installation of the Battery

After installing and connecting the back-up battery to the motor, execute an absolute encoder setup. Refer to P.7-16, "Setup (initialization) of Absolute Encoder ".

It is recommended to perform ON/OFF action once a day after installing the battery for refreshing the battery.

A battery error might occur due to voltage delay of the battery if you fail to carry out the battery refreshment.

Caution **∵**

Use the following battery for absolute encoder.

BatteryPart No.: DV0P2990 (3.6 V 2000 mAh)

Battery boxPart No.: DV0P4430

Replacement of the Battery

It is necessary to replace the battery for absolute encoder when battery alarm occurs.

Replace while turning on the control power. Data stored in the encoder might be lost when you replace the battery while the control power of the driver is off.

After replacing the battery, clear the battery alarm. Refer to P.7-25, "How to Clear the Battery Alarm".

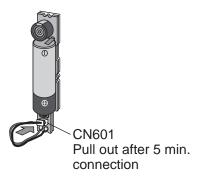
Caution ...

When you execute the absolute encoder with the front panel (refer to P.2-102 of Preparation), or via communication (refer to P.7-56), all of error and multi-turn data will be cleared together with alarm, and you are required to execute "Setup (Initialization) of absolute encoder" (refer to P.7-16).

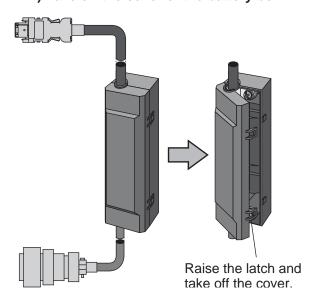
How to Replace the Battery

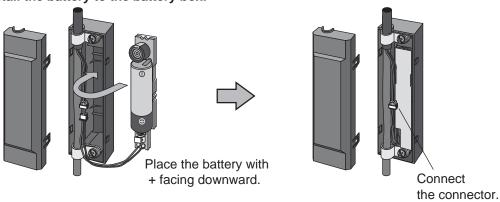
1) Refresh the new battery.

Connector with lead wire of the battery to CN601 and leave of 5 min. Pull out the connector from CN601 5 min after.



2) Take off the cover of the battery box.





4) Close the cover of the battery box.



Close the cover not to pinch the connector cable.





Caution 🔅

- Be absolutely sure to follow the precautions below since improper use of the battery can cause electrolyte to leak from the battery, giving rise to trouble where the product may become corroded, and/or the battery itself may rupture.
 - 1) Insert the battery with its "+" and "-" electrodes oriented correctly.
 - 2) Leaving a battery which has been used for a long period of time or a battery which is no longer usable sitting inside the product can cause electrolyte leakage and other trouble. For this reason, ensure that such a battery is replaced at an early date. (As a general guideline, it is recommended that the battery be replaced every two years.)
 - The electrolyte inside the battery is highly corrosive, and if it should leak out, it will not only corrode the surrounding parts but also give rise to the danger of short-circuiting since it is electrically conductive. For this reason, ensure that the battery is replaced periodically.
 - 3) Do not disassemble the battery or throw it into a fire.
 - Do not disassemble the battery since fragments of the interior parts may fly into your eyes, which is extremely dangerous. It is also dangerous to throw a battery into a fire or apply heat to it as doing to may cause it to rupture.
 - 4) Do not cause the battery to be short-circuited. Under no circumstances must the battery tube be peeled off.
 - It is dangerous for metal items to make contact with the "+" and "-" electrodes of the battery since such objects may cause a high current to flow all at once, which will not only reduce the battery performance but also generate considerable heat, possibly leading to the rupture of the battery.
 - 5) This battery is not rechargeable. Under no circumstances must any attempt be made to recharge it.

Caution ·*

The disposal of used batteries after they have been replaced may be subject to restri imposed by local governing authorities. In such cases, ensure that their disposal is in ac cordance with these restrictions.

Before Using the Produ

Adjustment

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When in Trouble

Life of the battery

Following example shows the life calculation of the back-up battery used in assumed robot operation.

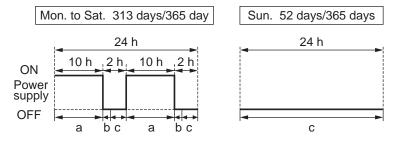
2000[mAh] of battery capacity is used for calculation.

Note that the following value is not a guaranteed value, but only represents a calculated value

Caution 🔆

The values below were calculated with only the current consumption factored in. The calculations do not factor in electrolyte leakage and other forms of battery deterioration. Life time may be shortened depending on ambient condition.

1) 2 cycles/day



a: Current consumption in normal mode 0 [µA]

b: Current consumption at power failure timer mode 90 [µA]

c: Current consumption at power failure mode 30 [µA]

Annual consumption capacity = $(10 \text{ h} \times \text{a} + 0.0014 \text{ h} \times \text{b} + 2 \text{ h} \times \text{c}) \times 2 \times 313 \text{ days} + 24 \text{ h} \times \text{c} \times 52 \text{ days} = \\ 75.1 \text{ [mAh]})$ Battery life = 2000 [mAh]/75.1 [mAh/year] = 26.6 [year]

2) 1 cycle/day

(2nd cycle of the above 1) is for rest.

Annual consumption capacity = $(10 \text{ h} \times \text{a} + 0.0014 \text{ h} \times \text{b} + 14 \text{ h} \times \text{c}) \times 313 \text{ days} + 24 \text{ h} \times \text{c} \times 52 \text{ days} = 168.9 \text{ [mAh]})$ Battery life = 2000 [mAh]/168.9 [mAh/year] = 11.8 (11.841) [year]

in Trouble

2. Absolute system

Battery (for Backup) Installation

When you make your own cable for absolute encoder

When you make your own cable for absolute encoder, connect the optional battery for absolute encoder, DV0P2990 as per the wiring diagram below. Connector of the battery for absolute encoder shall be provided by customer as well.

Caution ...

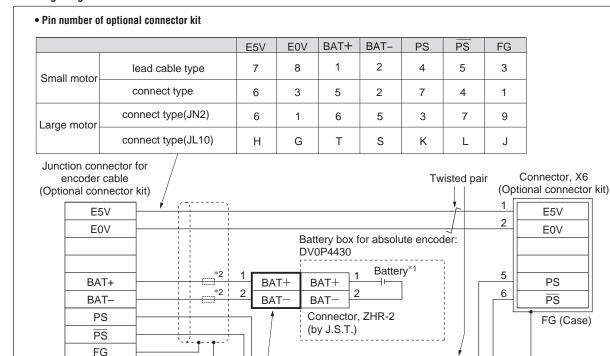
Install and fix the battery securely. If the installation and fixing of the battery is not appropriate, it may cause the wire breakdown or damage of the battery.

Refer to the instruction manual of the battery for handling the battery.

Installation Place

- 1) Indoors, where the products are not subjected to rain or direct sun beam.
- 2) Where the products are not subjected to corrosive atmospheres such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, chloric gas, sulfuric gas, acid, alkaline and salt and so on, and are free from splash of inflammable gas, grinding oil, oil mist, iron powder or chips and etc.
- 3) Well-ventilated and humid and dust-free place.
- 4) Vibration-free place

Wiring Diagram



Title	Part No.	Manufacturer
Connector	ZMR-2	J.S.T.
Connector pin	SMM-003T-P0.5	J.S.T.
Clamping Jig	YRS-800	J.S.T.

- *1 Battery for absolute encoder (Option): DV0P2990
- *2 Since applicable wire diameters of the battery connector and connector at encoder side are different, please connect wires by soldering.

Connector for absolute encoder connection (To be provided by customer)

Related page : P.7-140 "Battery For Absolute Encoder"

Supplement

2. Absolute system

Setup (Initialization) of Absolute Encoder

Absolute multi-turn data will be maintained by the absolute encoder battery.

When operating the machine for the first time after installing the battery to the absolute encoder, clear the encoder data (multi-turn data) to 0 at the origin by following the procedure described below.

Clear the absolute encoder from the front panel (see P.2-98) or PANATERM. Turn off power and then on again.

Supplement

2. Absolute system

Transferring absolute data

Transfer the absolute data (absolute data of external scale) from the servo driver to the host controller: turn on power and wait until the servo ready output (S-RDY) is turned on, and then start transfer.

Setup of serial communication interface on host controller

• RS232

Baud rate	2400, 4800, 9600, 19200, 38400, 57600, 115200 bps
Data	8 bit
Parity	none
Start bit	1 bit
Stop bit	1 bit

The baud rate is set according to Pr5.29 Baud rate setup of RS232 communication.

RS485

Baud rate	2400, 4800, 9600, 19200, 38400, 57600, 115200 bps
Data	8 bit
Parity	none
Start bit	1 bit
Stop bit	1 bit

The baud rate is set according to Pr5.30 Baud rate setup of RS485 communication.

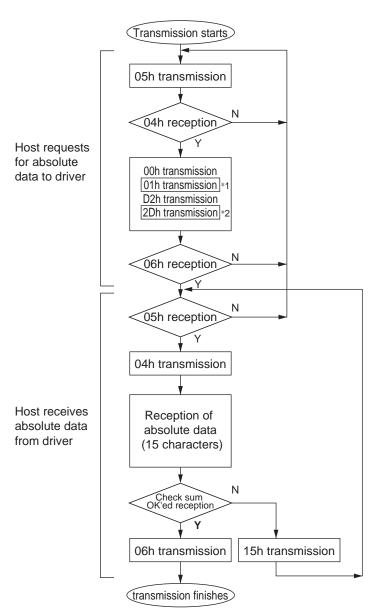
Related page 💀 • P.3-33 "Inputs and outputs on connector X4" • P.4-6 to P.4-85 "Details of parameter"

2. Absolute system

Transferring absolute data

RS232 Communication Protocol

Refer to the instruction manual of the host for the transmission/reception method of command.



Data of *1 and *2 are determined by the setup of Pr5.31 "Axis address".

Axis address (example)	Data of 1	Data of 2
0	00h	2Eh
1	01h	2Dh
2	02h	2Ch
3	03h	2Bh
4	04h	2Ah
5	05h	29h
6	06h	28h
7	07h	27h
8	08h	26h
9	09h	25h
10	0Ah	24h
11	0Bh	23h
12	0Ch	22h
13	0Dh	21h
14	0Eh	20h
15	0Fh	1Fh
16	10h	1Eh
17	11h	1Dh
18	12h	1Ch
19	13h	1Bh
20	14h	1Ah
21	15h	19h
22	16h	18h
23	17h	17h
24	18h	16h
25	19h	15h
26	1Ah	14h
27	1Bh	13h
28	1Ch	12h
29	1Dh	11h
30	1Eh	10h
31	1Fh	0Fh

Check sum becomes OK'ed when the lower 8-bit of the sum of the received absolute data (15 characters) is 0.

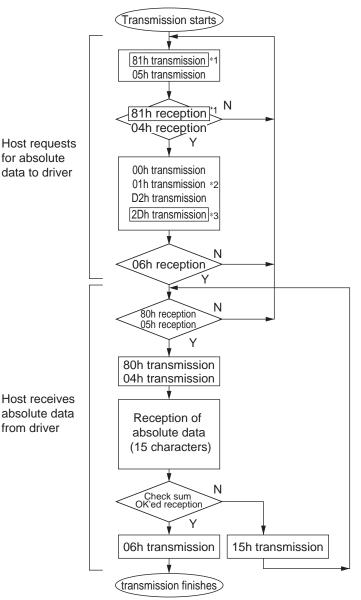
Enter the Pr5.31 value of the driver to which you want to communicate from the host to axis (*1 data) of the command block, and transmit the command according to the RS232 communication protocol. For details of communication, refer to P.7-27, "Communication".

Caution 🔅

- Allow 50 ms or longer interval for axis switching when you want to capture multiple axes data.
- It is recommended for you to repeat the above communication more than 2 times to confirm the absolute data coincide, in order to avoid mis-operation due to unexpected noise.

RS485 Communication Protocol

Refer to the instruction manual of the host for the transmission/reception method of command. Following shows the communication example of the driver to Pr5.31 "Axis address = 1".



Data of *1, *2 and *3 are determined by the setup of Pr5.31 "Axis address".

Axis address (example)	Data of 1	Data of 2	Data of 3		
0	not usable with RS485 communication				
1	81h	01h	2Dh		
2	82h				
3	83h	03h	2Bh		
4	84h	04h	2Ah		
5	85h	05h	29h		
6	86h	06h	28h		
7	87h	07h	27h		
8	88h	08h	26h		
9	89h	09h	25h		
10	8Ah	0Ah	24h		
11	8Bh	0Bh	23h		
12	8Ch	0Ch	22h		
13	8Dh	0Dh	21h		
14	8Eh	0Eh	20h		
15	8Fh	0Fh	1Fh		
16	90h	10h	1Eh		
17	91h	11h	1Dh		
18	92h	12h	1Ch		
19	93h	13h	1Bh		
20	94h	14h	1Ah		
21	95h	15h	19h		
22	96h	16h	18h		
23	97h	17h	17h		
24	98h	18h	16h		
25	99h	19h	15h		
26	9Ah	1Ah	14h		
27	9Bh	1Bh	13h		
28	9Ch	1Ch	12h		
29	9Dh	1Dh	11h		
30	9Eh	1Eh	10h		
31	9Fh	1Fh	0Fh		

Check sum becomes OK'ed when the lower 8-bit of the sum of the received absolute data (15 characters) is 0.

Command from the host will be transmitted to the desired driver based on RS485 transmission protocol. For details of communication, refer to P.7-27, "Communication".

Caution -∻

- Allow 50 ms or longer interval for axis switching when you want to capture multiple axes data.
- It is recommended for you to repeat the above communication more than 2 times to confirm the absolute data coincide, in order to avoid mis-operation due to unexpected noise.

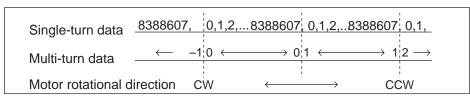
When in Trouble

2. Absolute system

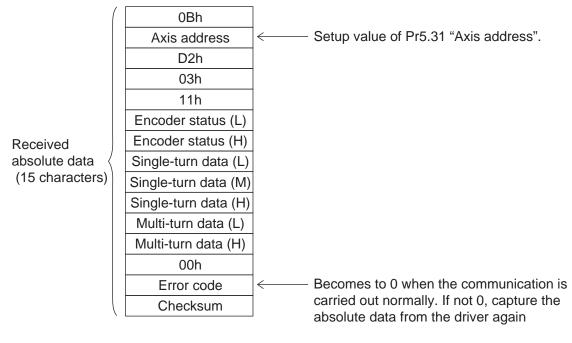
Transferring absolute data

Composition of Absolute Data

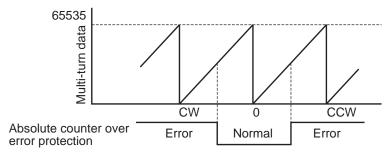
Absolute data consists of singe-turn data which shows the absolute position per one revolution and multi-turn data which counts the number of revolution of the motor after clearing the encoder.



Single-turn data and multi-turn data are composed by using 15-character data (hexadecimal binary code) which are received via RS232 or RS485.



• Details of multi-turn data



Single-turn data ← Single-turn data (H)×10000 h+Single-turn data (M)×100 h+Single-turn data (L)

multi-turn data ← multi-turn data (H) ×100 h+multi-turn data (L)

Remarks 🔆

If the multi-turn data of the above fig. is between 32768 to 65535, convert it to signed date after deducting 65536.

• Encoder status (L)----1 represents error occurrence.

	Encoder status (L)								
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0		
			0						
-		ı				ı			
(1)	(2)	(3)		(4)	(5)	(6)	(7)		

(1) Over-speed

→ Err42.0 (Absolute over-speed error protection)

(2) Full absolute status → Err47.0 (Absolute status error protection)

(3) Counter error

→ Err44.0 (Absolute single-turn counter error protection)

(4) Counter overflow

→ Err41.0 (Absolute counter over error protection)

(5) Multi-turn error

→ Err45.0 (Absolute multi-turn counter error protection) → Err40.0 (Absolute system down error protection)

(6) Battery error (7) Battery alarm

→ Alarm No.A2 "Battery alarm"

• Encoder status (H)----1 represents error occurrence.

Encoder status (H)								
bit7 bit6 bit5 bit4 bit3 bit2 bit1 bit0							bit0	
0	0			0	0	0	0	

Battery error

One of the following has occurred. Battery alarm, multi-turn error, counter overflow, counter error, full absolute status, Counter overflow

Remarks : For detail of the Encoder status, refer to the Encoder specification.

Remarks ...

• Transmit the absolute data while fixing the motor with brake by turning to Servo-Off.

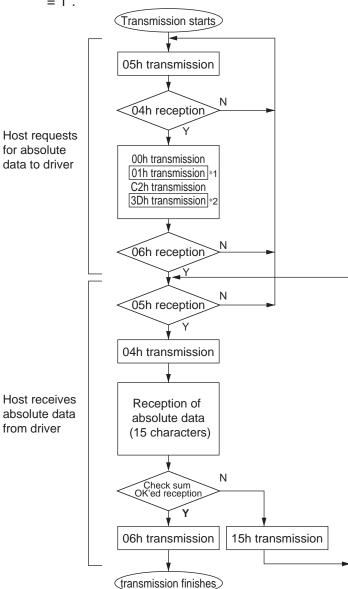
2. Absolute system

Transferring external scale absolute data

External scale RS232 communication procedure

Refer to the instruction manual of the host for the transmission/reception method of command. Following shows the communication example of the driver to Pr5.31 "Axis address

= 1".



Data of *1 and *2 are determined by the setup of Pr5.31 "Axis address".

Axis address (example)	Data of 1	Data of 2
0	00h	3Eh
1	01h	3Dh
2	02h	3Ch
3	03h	3Bh
4	04h	3Ah
5	05h	39h
6	06h	38h
7	07h	37h
8	08h	36h
9	09h	35h
10	0Ah	34h
11	OBh	33h
12	0Ch	32h
13	ODh	31h
14	0Eh	30h
15	0Fh	2Fh
16	10h	2Eh
17	11h	2Dh
18	12h	2Ch
19	13h	2Bh
20	14h	2Ah
21	15h	29h
22	16h	28h
23	17h	27h
24	18h	26h
25	19h	25h
26	1Ah	24h
27	1Bh	23h
28	1Ch	22h
29	1Dh	21h
30	1Eh	20h
31	1Fh	1Fh

Check sum becomes OK'ed when the lower 8-bit of the sum of the received absolute data (15 characters) is 0.

Enter the Pr5.31 value of the driver to which you want to communicate from the host to axis (*1 data) of the command block, and transmit the command according to the RS232 communication protocol. For details of communication, refer to P.7-27, "Communica-

Caution ·

- Allow 50 ms or longer interval for axis switching when you want to capture multiple axes data.
- It is recommended for you to repeat the above communication more than 2 times to confirm the absolute data coincide, in order to avoid mis-operation due to unexpected noise.

External scale RS485 communication procedure

Refer to the instruction manual of the host for the transmission/reception method of command. Following shows the communication example of the driver to Pr5.31 "Axis address = 1".

Transmission starts 81h transmission *1 05h transmission 81h reception 1 04h reception Host requests for absolute 00h transmission data to driver 01h transmission *2 C2h transmission 3Dh transmission *3 06h reception N 80h reception 05h reception 80h transmission 04h transmission Host receives absolute data Reception of from driver absolute data (15 characters) Check sum OK'ed reception 06h transmission 15h transmission (transmission finishes)

Data of *1, *2 and *3 are determined by the setup of Pr5.31 "Axis address".

Axis address	Data of *1	Data of *2	Data of *3
(example)	Data Of 1	Data Of 2	Data Of 3
0	Not usable with RS485 communication		
1	81h	01h	3Dh
2	82h	02h	3Ch
3	83h	03h	3Bh
4	84h	04h	3Ah
5	85h	05h	39h
6	86h	06h	38h
7	87h	07h	37h
8	88h	08h	36h
9	89h	09h	35h
10	8Ah	0Ah	34h
11	8Bh	0Bh	33h
12	8Ch	0Ch	32h
13	8Dh	0Dh	31h
14	8Eh	0Eh	30h
15	8Fh	0Fh	2Fh
16	90h	10h	2Eh
17	91h	11h	2Dh
18	92h	12h	2Ch
19	93h	13h	2Bh
20	94h	14h	2Ah
21	95h	15h	29h
22	96h	16h	28h
23	97h	17h	27h
24	98h	18h	26h
25	99h	19h	25h
26	9Ah	1Ah	24h
27	9Bh	1Bh	23h
28	9Ch	1Ch	22h
29	9Dh	1Dh	21h
30	9Eh	1Eh	20h
31	9Fh	1Fh	1Fh

Check sum becomes OK'ed when the lower 8-bit of the sum of the received absolute data (15 characters) is 0.

Command from the host will be transmitted to the desired driver based on RS485 transmission protocol. For details of communication, refer to P.7-27, "Communication".



- Allow 50 ms or longer interval for axis switching when you want to capture multiple axes data.
- It is recommended for you to repeat the above communication more than 2 times to confirm the absolute data coincide, in order to avoid mis-operation due to unexpected noise.

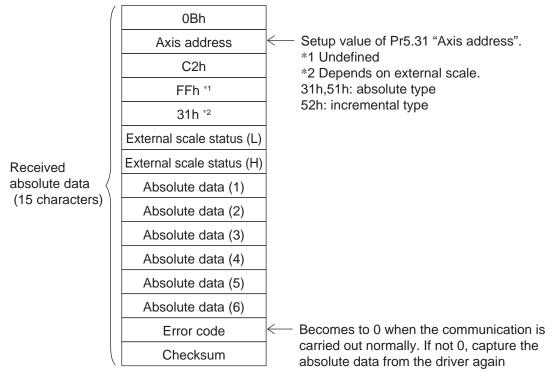
6

2. Absolute system

Transferring external scale absolute data

Composition of external scale absolute data

Using 15-character data received through RS232/RS485, organize 1-turn data and multi-turn data.



External scale absolute data

- ← Absolute data (6)×10000000000h
 - +Absolute data (5)×100000000h
 - +Absolute data (4)×1000000h
 - +Absolute data (3)×10000h
 - +Absolute data (2)×100h
 - +Absolute data (1)

Absolute data of external scale is represented as 48 bit number (negative value is represented as two's complement).

Remarks ::

If the multi-turn data of the above fig. is between 32768 to 65535, convert it to signed date after deducting 65536.

• External scale status (L)----1 represents error occurrence.

	External scale status (L)						
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	0						
1	ı	1	1	1			I
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

- (1) Alarm No. A8 "External scale error alarm"
- (2) Alarm No. A8 "External scale error alarm"
- (3) Err51.5 "External scale status 5 error protection"
- (4) Err51.4 "External scale status 4 error protection"
- (5) Err51.3 "External scale status 3 error protection"
- (6) Err51.2 "External scale status 2 error protection"
- (7) Err51.1 "External scale status 1 error protection"
- (8) Err51.0 "External scale status 0 error protection"
- External scale status (H)----1 represents error occurrence.

	External scale status (H)							
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	
0	0 0 0 0 0							
	Logical sum of bit6 and bit 7 of external scale status (L)							

Logical sum of bit0 to bit 5 of external scale status (L)

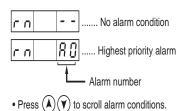
Remarks : For detail of the external scale status, refer to the external scale specification.

Remarks → Transmit the External scale absolute data while fixing the motor with brake by turning to Servo-Off.

2. Absolute system

Display of Battery Alarm

Following alarm will be displayed when making the front panel to alarm execution mode of monitor mode.





Kinds of alarm

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	The life expectancy of capacity or fan becomes shorter than the specified time.	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 ∞

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-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 ∞.

How to Clear the Battery Alarm

Replace the battery for absolute encoder when battery alarm occurs according to P.7-12, "How to Replace the Battery". After replacement, clear the battery alarm in the following 3 methods.

- (a) "Connector X4" Connecting Alarm clear input (A-CLR) to COM- for more than 120 ms.
- (b) Executing the alarm clear function in auxiliary function mode by using the front panel.
- (c) Click the "Battery warning" Clear button, after select the "Absolute encoder" tab in the monitor display window by using the PANATERM (option).

Related page ···

- P.2-98"Alarm Clear Screen" P.3-33 "Inputs and outputs on connector X4"
- P.7-26 "Outline of Setup Support Software, "PANATERM""

6

Supplement

3.Outline of Setup Support Software, "PANATERM"

Setup on the PC

SE	SG	SF
0	0	0

Connector X1 of MINAS A6 can be connected to your PC through USB cable for computer. Once you download the setup support software PANATERM from our web site and install it to your PC, the following tasks can be easily performed.

Outline of PANATERM

With the PANATERM, you can execute the followings.

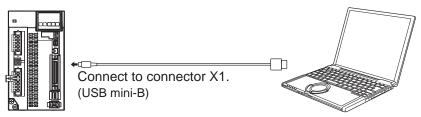
- (1) Setup and storage of parameters, and writing to the memory (EEPROM).
- (2) Monitoring of I/O and pulse input and load factor.
- (3) Display of the present alarm and reference of the error history.
- (4) Data measurement of the wave-form graphic and bringing of the stored data.
- (5) Normal auto-gain tuning
- (6) Frequency characteristic measurement of the machine system.

Note

Distribution media such as CD-ROM for this software are not prepared.

Download the software from our web site and install it to your PC.

How to Connect



Download setup support software PANATERM from our web site and install it to your PC.

USB cable

The connection cable should be provided with USB mini-B connector at the driver side and the PC compatible connector on the other end.

If the cable has no noise filter, install a signal noise filter (DV0P1460) to both ends of the cable.

System required for PANATERM

To use PANATERM, the following system components are required.

• PC

os	Windows® XP SP3 (32-bit Ver.) Windows® VISTA SP1 (32-bit Ver.) Windows® 7,8 (32-bit Ver., 64-bit Ver.) (Japanese, English, Chinese or Korean version)		
CPU	Pentium III 512 MHz or better		
Memory	256 MB or more (512 MB recommended)		
Hard disk	512 MB or more free space		
Serial communication	USB port		

Display

Resolution	1024 x 768 pixel or more
No. of colors	24-bit color (True Color) or better

^{*} Please confirm the latest system requirements on the homepage.

You can connect up to 32 MINAS-A6 series with your computer or NC via serial communication based on RS232 and RS484, and can execute the following functions.

- (1) Change over of the parameters
- (2) Referring and clearing of alarm data status and history
- (3) Monitoring of control conditions such as status and I/O.
- (4) Referring of the absolute data
- (5) Saving and loading of the parameter data

Merits

- You can write parameters from the host to the driver in batch when you start up the machine.
- You can display the running condition of machine to improve serviceability.
- You can compose multi-axis absolute system with simple wiring.

■ To the use of Modbus communications client

RS485 serial communications corresponding to our compant unique commands and Modbus.

Using the modbus customers please refer to the Technical Reference.

(Modbus communication)

Technical Reference is published on our website.

Before Using the Product

[•] P.7-26 "Outline of Setup Support Software, "PANATERM"

7

Supplement

4. Communication

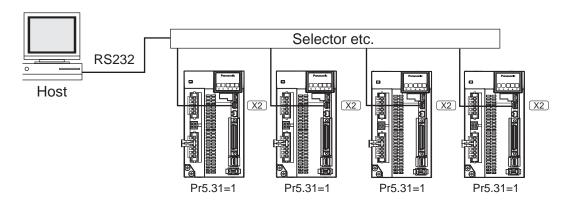
Specifications

Connection of Communication Line

MINAS-A6 series provide 2 types of communications ports of RS232 and RS485, and support the following 3 types of connection with the host.

RS232 communication

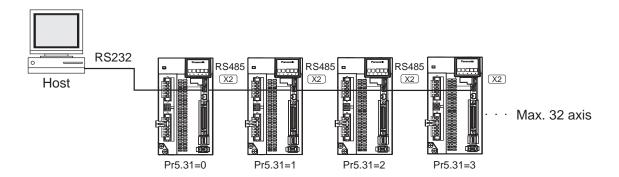
Connect the host and the driver in one to one with RS232, and communicate according to RS232 transmission protocol.



• Set up the module ID of MINAS-A6. In the above case, you can set any value of 0 to 31. You can set the same module ID as long as the host has no difficulty in control.

RS232 and RS485 communication

When you connect one host to multiple MINAS-A6, connect the host to connector X2 of one driver with RS232 communication, and connect each MINAS-A6 with RS485 communication. Set up the Pr5.31 of the driver to 0 which is connected to the host, and set up 1 to 31 to other drivers each.



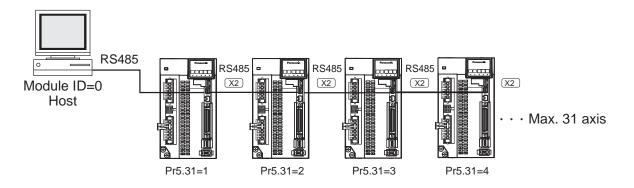
When in Trouble

4. Communication

Specifications

RS485 communication

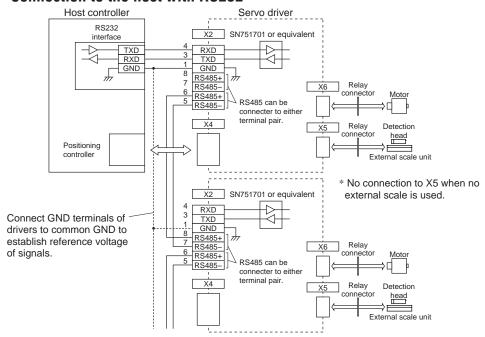
Connect the host to multiple MINAS-A6 with RS485 communication, set up the Pr5.31 of each front panel of MINAS-A6 to 1 to 31.



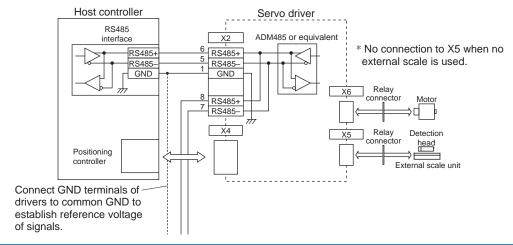
Allow 50 ms or longer interval for switching the axes while capturing data of multiple axes.

Interface of Communication Connector

Connection to the host with RS232



Connection to the host with RS485



Communication Method

	RS232	RS485
	Full duplex, asynchronous	Half duplex, asynchronous
Communication baud rate	2400, 4800, 9600, 19200, 38400, 57600, 115200 bps	2400, 4800, 9600, 19200, 38400, 57600, 115200 bps
Data	8 bit	8 bit
Parity	none	none
Start bit	1 bit	1 bit
Stop bit	1 bit	1 bit

• Set up the RS232 communication baud rate with Pr5.29, and RS485 communication baud rate with Pr5.30. The change of these parameters will be validated after the control power entry. For details, refer to the following list of parameters related to communication.

List of User Parameters for Communication

Class	No.	Title	Setup value	
5	31	Axis address	0 to 127	Set the axis number for serial communication to 0 to 31. This parameter setup value has no effect on servo operation.
5	29	Baud rate setup of RS232 communication	0 to 6	Set up the communication speed of RS232 communication. 0:2400[bpps], 1:4800[bps], 2:9600[bps], 3:19200[bps], 4:38400[bps], 5:57600[bps], 6:115200[bps] Updated setup of is validated upon turning on of control power.
5	30	Baud rate setup of RS485 communication	0 to 6	Set up the communication speed of RS485 communication. 0:2400[bpps], 1:4800[bps], 2:9600[bps], 3:19200[bps], 4:38400[bps], 5:57600[bps], 6:115200[bps] Updated setup of is validated upon turning on of control power.

 Required time for data transmission per 1 byte is calculated in the following formula in case of 9600[bps].

Note that the time for processing the received command and time for switching the line and transmission/reception control will added to the actual communication time.

Handshake code

Following codes are used for line control.

Title	Code	Function
ENQ	05h (Module recognition byte of the transmitted)	Enquire for transmission
EOT	04h (Module recognition byte of the transmitted)	Ready for receiving
ACK	06h	Acknowledgement
NAK	15h	Negative acknowledgement

ENQ..... The module (host or driver) sends out ENQ when it has a block to send.

EOT The module (host or driver) sends out EOT when it is ready to receive a block. The line enters to a transmission mode when ENQ is transmitted and EOT is received.

ACK When the received block is judged normal, the module (host or driver) will send out ACK.

NAK When the received block is judged abnormal, NAK will be sent. A judgment is based on checksum and timeout.

Caution 🔆

1 byte of module recognition is added to ENQ and EOT at RS485 communication. Module recognition byte... Make the Pr5.31 value of the front panel as a module ID, and data which makes its bit7 as 1, becomes a module recognition byte.

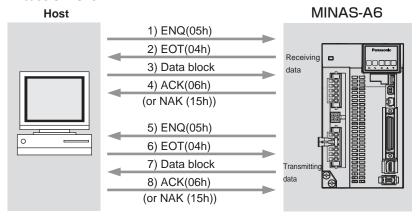
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
1	0	0	0		Modu	ıle ID	

Module ID : The module ID of the host side will be 0 in case of RS485 communication, therefore set up Pr5.31 of MINAS-A6 to 1 to 31.

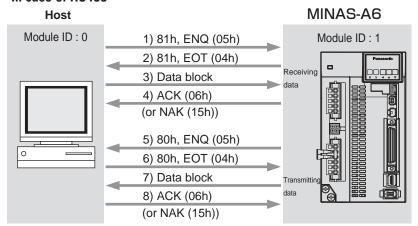
Transmission Sequence

Transmission protocol

• In case of RS232



• In case of RS485



Line control

Decides the direction of transmission and solves the contention.

Reception mode... From when the module (host or driver) returns EOT after receiving ENQ. Transmission mode... From when the module (host or driver) receives EOT after transmitting ENQ.

At contention of transmission and reception... Slave side will enter to reception mode when it receives ENQ while waiting for EOT after transmitting ENQ, by giving priority to ENQ (of master side).

• Transmission control

On entering to transmission mode, the module transmits the command block continuously and then waits for ACK reception. Transmission completes at reception of ACK.. ACK may not be returned at transmission failure of command byte counts. If no ACK is received within T2 period, or other code than NAK or ACK is received, sequence will be retried. Retry will start from ENQ.

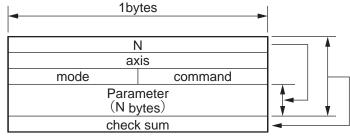
Reception control

On entering to reception mode, the module receives the transmitted block continuously. It will receive the command byte counts from the first byte, and continuously receive extra 3 bytes. It will return ACK when the received data sum becomes 0, by taking this status as normal. In case of a check sum error or a timeout between characters, it will return NAK.

Before Using the Produ

• Data Block Composition

Below shows the composition of data block which is transmitted in physical phase.



N : Command byte counts (0 to 240)

Shows the number of parameters which are required by command.

axis : Sets up the value of Pr5.31.(0 to 127)

command: Control command (0 to 15)

mode : Command execution mode (0 to 15)

Contents vary depending on the mode.

check sum : 2's complement of the total number of bytes, ranging from the top to the

end of the block

Protocol Parameter

Following parameters are used to control the block transmission. You can set any value with the INIT command (described later).

Title	Function		Initial value	Setup range	Unit
T1	Time out between characters	RS232	5 (0.5 sec)	1 to 255	0.1 sec
- 11	Time out between characters	RS485	1 (0.1 sec)	1 10 255	0.1 Sec
T2	Protocol time out	RS232	5 (0.5 sec)	1 to 255	1 sec
12	Flotocol time out	RS485	1 (0.1 sec)	1 10 255	1 260
Т6	Driver response time	RS232	0 (0 ms)	0 to 255	1 ms
10	Driver response time	RS485	6 (6 ms)	2 to 255	1 1115
RTY	Retry limit		1 (once)	1–8	Once
M/S	Master/Slave		0 (Slave)	0, 1 (Master)	

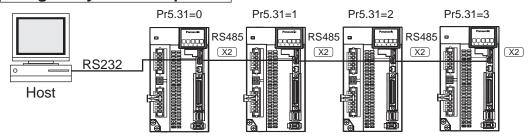
- T1: Permissible time interval for this driver to receive the consecutive character cods which exists between the module recognition bytes and ENQ/EOT, or in the transmission/reception data block. Time out error occurs and the driver returns NAK to the transmitter when the actual reception time has exceed ed this setup time.
- T2: •Permissible time interval for the driver to transmit ENQ and to receive EOT. If the actual reception time exceeds this setup, this represents that the receiver is not ready to receive, or it has failed to receive ENQ code in some reason, and the driver will re-transmit ENQ code to the receiver. (retry times)
 - Permissible time interval for the driver to transmit EOT and to receive the reception of the 1st character code. The driver will return NAK and finishes the reception mode if the actual reception has exceeded this setup time.
 - Permissible time interval for the module to transmit the check sum bytes and to receive ACK.
 The module will re-transmit ENQ code to the receiver in the same way as the NAK reception, if the actual reception time exceeds this setup time.
- T6: Permissible time interval for the driver to receive ENQ and to transmit EOT; Permissible time interval for the driver to receive the check sum bytes and to transmit ACK; and Permissible time interval for the driver to receive EOT and to transmit the 1st character.
- RTY: Maximum value of retry times. Transmission error occurs if the actual retry has exceeds this setup value.
- M/S: Switching of master and slave. When contention of ENQ has occurred, the module decides which is to be given priority.
 - Priority is given to the transmitter which is set up as a master. (0: Slave mode, 1: Master mode)

Example of Data Communication

• e.g. Reference of Absolute Data

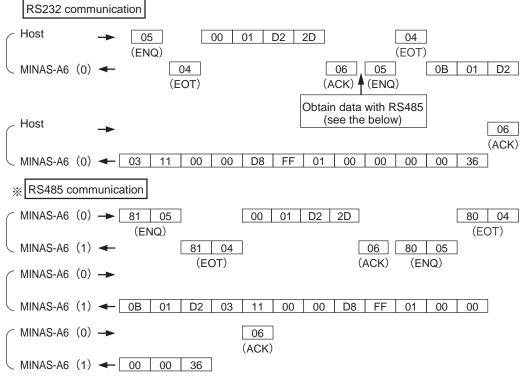
When you connect the host to one driver with RS232 communication, and connect multiple MINAS-A6 with RS485 communication. Following flow chart describes the actual flow of the communication data when you want to capture the absolute data of the module ID=1.

e.g. of system composition



e.g. of capturing the absolute data

Following shows the communication data in time series when you want to capture the absolute data. Data is presented in hexadecimals.



Caution **∵**

See the below for the captured data. Refer to P.7-50, "Read out of Absolute Encoder" of details of communication command, for the data composition.

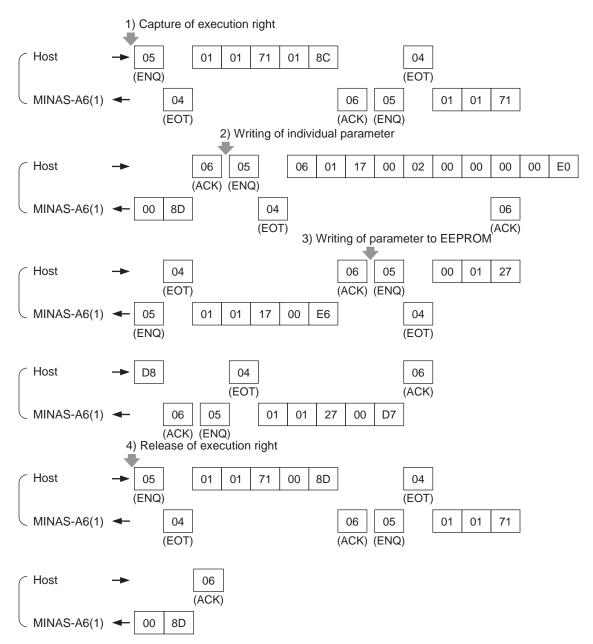
Multi-turn data : 0000h = 0

Single turn data: 01FFD8h = 131032

Allow 50ms or longer interval for switching the axis while capturing data of multiple axes.

• Example of Parameter Change

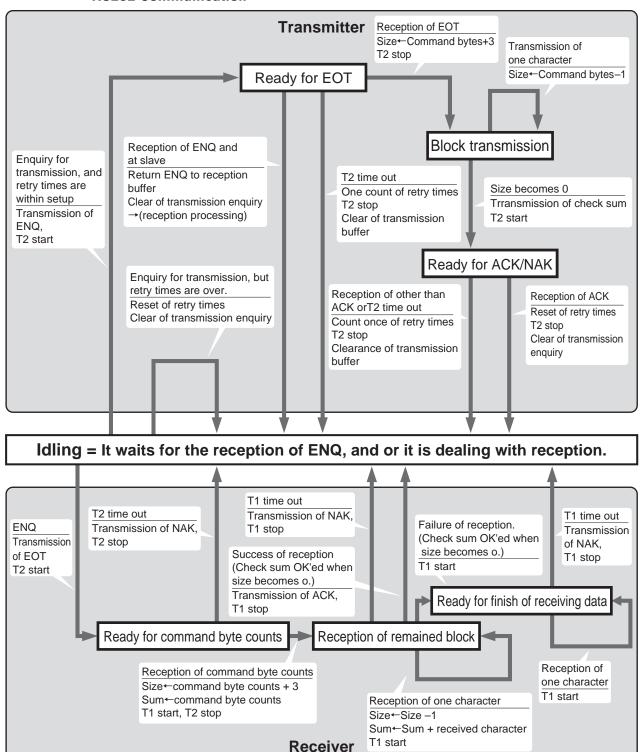
Following shows the communication data in time series when you change parameters. Communication in general will be carried out in sequence of (1) Request for capturing of execution right, (2) Writing of individual parameter, and (3) Writing to EEPROM when saving of data is required, and (4) Release of execution right. Here the hardware connection shows the case that the driver (user ID=1) is directly connected to the host with RS232. Date is presented in hexadecimals.



Caution → For details of command, refer to P.7-40, "Details of Communication Command".

Status Transition Chart

RS232 Communication

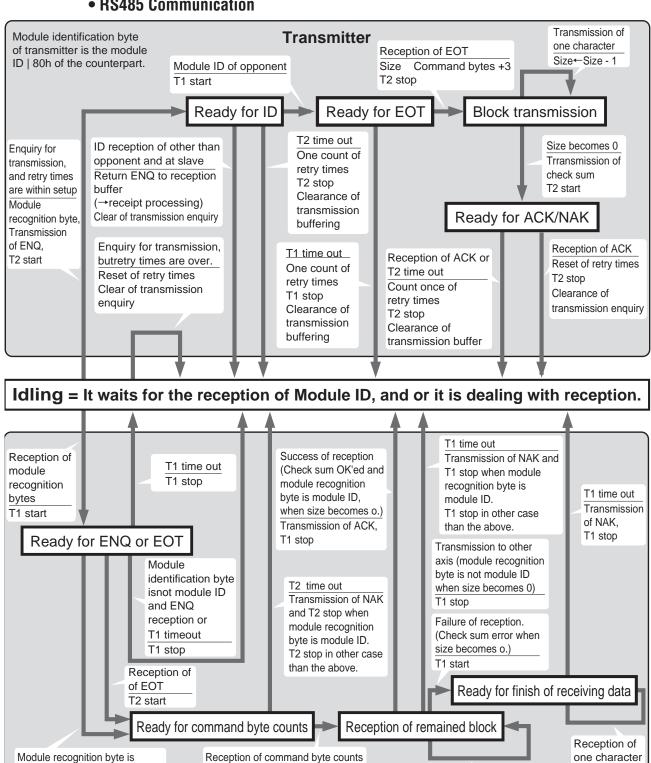


module ID and reception of ENQ

Transmission of EOT, T2 start

Module recognition byte,

RS485 Communication



Size←command byte counts + 3

Receiver

Sum←command byte counts

T1 start, T2 stop

T1 start

Reception of one character

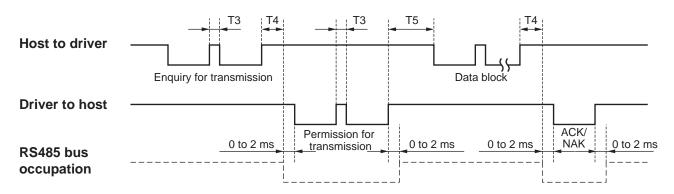
Sum←Sum + received character

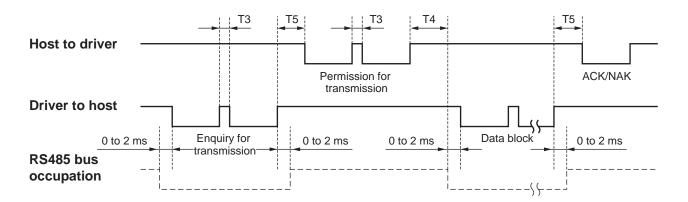
Size←Size - 1

T1 start

Timing of Data Communication

• In case of RS485 (RS232 to follow)





Symbol	Title Minimum		Maximum
Т3	Continuous inter-character time	Stop bit length	Protocol parameter T1
T4	Response time of driver	Protocol parameter T6	Protocol parameter T2
T5	Response time of host	2 ms	Protocol parameter T2

Caution → Above time represents a period from the rising edge of the stop bit.

List of Communication Command

command	mode	Content					
		NOP					
	1	Read software version information					
0	5	Read driver model					
	6	Read motor model					
	А	Read driver serial number					
	В	Read motor serial number					
		INIT					
_	7	Obtain, release execution right					
1	8	Set RS232 protocol parameter					
	9	Set RS485 protocol parameter					
		POS, STATUS, I/O					
	0	Read status					
	1	Read command pulse counter					
	2	Read feedback pulse counter					
	4	Read current velocity					
	5	Read current torque output					
2	6	Read current deviation counter					
2	7	Read input signal					
	8	Read output signal					
	9	Read current velocity, torque and deviation counter					
	Α	Read status, input signal, and output signal					
	В	Read overload load ratio					
	С	Read external scale					
	D	Read absolute encoder					
	Е	Read external scale deviation and aggregate pulse					
		PARAMETER					
	0	Read individual user parameters					
7	1	Write individual user parameters					
	2	Write user parameters into EEPROM					
	6	Read individual user parameter attributes					
	7	Read multiple user parameter attributes					
	8	Write multiple user parameters					
		ALARM					
9	0	Read current alarm data					
	2	Read batched alarm history					
	3	Clear alarm history					
	4	Alarm clear					
	В	Absolute clear					

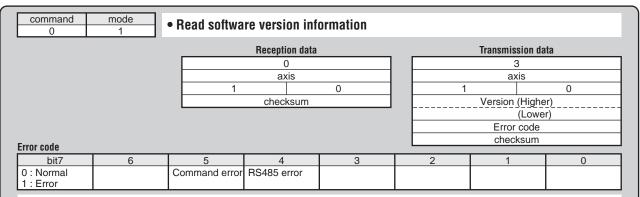
- Use only the abovementioned commands.
- Action of the driver cannot be guaranteed in case commands other than those listed above have been transmitted.
- In the event the number of received data with the abovementioned command is in error, regardless of the communication command, a single byte transmission communication data (error code only) will be transmitted.

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Supplement

4. Communication

Details of Communication Command



- Version information will be returned with V.0.00 being separated into higher data and lower data. (Decimal point will be returned, expressed by 0 for the lower four (4) bits of the higher data.)
- Version shall be indicated by numbers ranging from 0 to 9.(Example: Ver 3.13 will be expressed as upper data: 13h and lower data: 06h.)

		Re	eception data			Transmission d	ata		
			0			0Dh			
			axis			axis			
		5)		5	0		
			checksum		D	Driver model name (higher)			
rror code						Error code checksum			
bit7 D : Normal	6	5	4	3	2	1 1	0		
J Mormai		Command error	HS485 error						
1 : Error						-	<u> </u>		

		R	eception data			Transmission d	ata
			0			0Dh	
			axis	_		axis	
		6		0		6	0
			checksum		N	lotor model name	(Higher)
or code						Error code checksum	
bit7	6	5	4	3	2	1	0
: Normal : Error		Command error	RS485 error				
	of motor in tr	ansmitted in 12 A	SCII code char	acters.			

Details of Communication Command

Reception data Transmission data										
		ne					ııa			
	_		0			5				
			axis			axis				
		A	C)	A		0			
			checksum			Production year	ır			
						Production mon	th			
					S	erial in the month(I	_ower)			
					Se	erial in the month(F	Higher)			
						Error code				
						checksum				
or code							<u> </u>			

- Read the driver production serial number.
- Serial in the month (Lower/Higher) is binary data.
- Range of serial number in the month (Higher/Lower) is 0-255.
 Serial number in the month is calculated by the following formula.
 Serial number in the month = Serial number in the month (Higher) × 100 + Serial number in the month (Lower)

command 0	mode B	•Read motor ser	ial number					
			Received data				Transmitted da	nta
			0				5	
			axis				axis	
		В	()		В		0
			checksum				Production ye	ar
			Production month					
			Serial in the month(Lower)					
						Se	rial in the month	(Higher)
							Error code	
							checksum	
rror code								
bit7	6	5	4	3		2	1	0
0 : Normal 1 : Error		Command error	RS485 error					

- •Read the motor production serial number.
- •Serial in the month (Lower/Higher) is binary data.
- •Range of serial number in the month (Higher/Lower) is 0-255.

Serial number in the month is calculated by the following formula.

 $Serial\ number\ in\ the\ month\ (Higher)\times 256\ +\ Serial\ number\ in\ the\ month\ (Lower)$

command 1	• Capture and release of execution right										
		Re	ception data			Transmission	n data				
			1			1					
		•	axis			axis					
		7 1			7		1				
			mode			Error cod	е				
			checksum			checksum					
Error code											
bit7	6	5	4	3	2	1	0				
0 : Normal 1 : Error		Command error	RS485 error	mode error			in use				

- Capture the execution right to prevent the conflict of the operation via communication and that with the front panel.
- Enquires for the capture of the execution right at parameter writing and EEPROM writing, and release the execution right after the action finishes.
- mode = 1 : Enquires for the capture of the execution right mode = 0 : Enquires for the release of the execution right
- You cannot operate with the front panel at other than monitor mode while the execution right is captured via communication.
- When the module fails to capture the execution right, it will transmit the error code of in use.

command 1	mode 8	• Setup of R	S232 protoc	ol param	eter			
		Re	ception data				Transmission d	ata
			4				1	
			axis			axis		
		8		1		8		1
		T1					Error code	
		T2					checksum	
			T6					
		0	R'	ΓY				
			checksum					
Error code								
bit7	6	5	4	3		2	1	0
0 : Normal 1 : Error		T6error	RS485 error	RTYerror	T2	error	T1error	

- Until this command completes, previous set up protocol parameter will be processed.

 After this command has been executed, this parameter setup will be valid from the next command.
- RTY is 4-bit.
- Unit... T1 : 0.1 s, T2 : 0.1 s, T6 : 1 ms

1	9	 Setup of R 	3400 proto	coi parame	eter		
		Re	eception data			Transmission (data
			4			1	
			axis			axis	
		9		1		9	1
			T1			Error code	
			T2		checksum		
			T6				
		0	R	TY			
			checksum				
rror code							
bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error		T6error	RS485 error	RTYerror	T2error	T1error	

- Until this command completes, previously set up protocol parameter will be processed.
 After this command has been executed, this parameter setup will be valid from the next command.
- RTY is 4-bit.
- Unit... T1 : 0.1 s, T2 : 0.1 s, T6 : 1 ms

Details of Communication Command

command mode 2 0	• Read out of sta	atus						
	Reception	on data		Transmis	sion data			
	0	0			3			
	ax	axis			axis			
	0	0 2			2			
	check	sum		control mode				
				sta	itus			
				error	code			
				chec	ksum			
etatue								

status											
bit7	6	5	4	3	2	1	0				
				Positive direction	Negative direction	Slower than DB	Torque in-limit				
				running	running	permission					
Error code	Error code										
bit7	6	5	4	3	2	1	0				
0 : Normal		Command error	RS485 error								
1 : Error											

• Control modes are defined as follows.

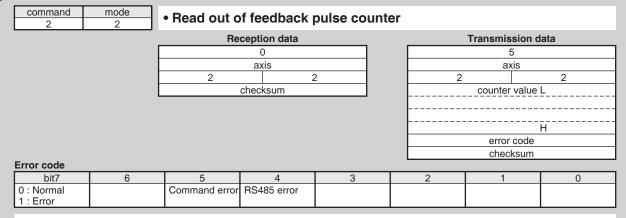
	0	Position control mode
	1	Velocity control mode
	2	Torque control mode
Г	3	Full-closed control mode

- positive direction/negative direction running : This becomes 1 when motor speed (after converted to r/min) is positive (positive direction) or negative (negative direction).
- Slower than DB permission: This becomes 1 when motor speed (after converted to r/min) is below 30 r/min.
- Torque in-limit: This becomes 1 when torque command is limited by analog input or parameter.

command mode 2 1	• Read out o	of command	pulse coun	ter				
	Re	ception data			Transmission o	lata		
		0			5			
		axis			axis			
	1		2	1		2		
		checksum			counter value L			
					error code			
					checksum			
Error code								
bit7 6	5	4	3	2	1	0		
0 : Normal 1 : Error	Command error	RS485 error						

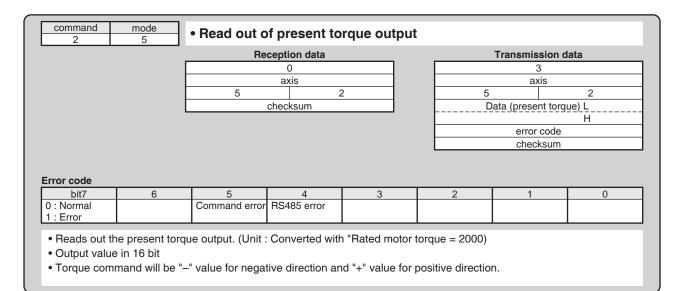
- Module returns the present position in absolute coordinates from the starting point. (Total sum of accumulated command pulses)
- Counter value in 32 bit.
- Counter value will be "-" for negative direction and "+" for positive direction.

Details of Communication Command



- Module returns the present position of feedback pulse counter in absolute coordinates from the staring point.
- Counter value will be "-" for negative direction and "+" for positive direction.
- Feedback pulse counter is the total pulse counts of the encoder and represents the actual motor position traveled

		Rec	ception data			Transmission	data
			0			3	
			axis			axis	
		4		2		1	2
		C	checksum			Data (present sp	eed) L
							Н
						error code	
						checksum	
ror code						checksum	
bit7	6	5	4	3	2	checksum	0
	6	5 Command error	·	3	2	checksum	



Details of Communication Command

2	6	Tioud out of	procent poort	ional commar	ia aoviation		
		Re	eception data			Transmission	data
			0			5	
			axis			axis	
		6		2		6	2
			checksum			data (deviati	on) L
							н
						Error cod	
						checksu	m
ror code						T .	
bit7	6	5	4	3	2	1 1	0
: Normal : Error		Command error	RS485 error				

- Reads out the present positional command deviation. (Unit : [command unit]
- Output value in 32bit
- Becomes "+" when the encoder is located at negative direction against position command, and "-" when it is located at positive direction.

command 2	mode 7	 Read out of 	input signal				
•		Re	eception data			Transmission da	ta
			0			5	
			axis			axis	
		7		2	7		2
	L		checksum			data_L	
						data_H_	
						Error code	
						checksum	
error code							
bit7	6	5	4	3	2	1	0
0 : Normal	0	Command error	RS485 error				0
1 : Error		00					
Data							
bit7	6	5	4	3	2	1	0
For	Switching of	Speed zero	Control mode	CCW over-travel	CW over-travel	Alarm clear	Servo-ON
manufacturer's use	electronic gear 1	clamp	switching	inhibit	inhibit		
bit15	14	13	12	11	10	9	8
For	For	Internal speed command	Internal speed command	For	Counter clear	Gain switching	Command pulse
manufacturer's use	manufacturer's use	selection 2	selection 1	manufacturer's use			input inhibition
bit23	22	21	20	19	18	17	16
Switching of	Damping control	Torque limit	Internal speed command	Damping control	For	For	For
electronic gear 2	switching 2	switching	selection 3	switching 1	manufacturer's use	manufacturer's use	manufacturer's us
bit31	31	29	28	27	26	25	24
For	For	For	Safety input 2	Safety input 1	For	Torque	Speed
		manufacturer's use			manufacturer's use	command sign	command sign

- Logic of input signal is based on assignment set in the parameter.
- Because of the internal logical data after conversion of input, it does not directly correspond to the input signal from the connector X5.
- CW over-travel inhibit input and CCW over-travel inhibit input will change according to the input logic, even if they have been disabled by the parameter,

Control inrush suppression relay

Dynamic brake engagement

Control power latch

Excite motor

command 2	mode 8	• Read out o	of output signal					
			Reception data				Transmission da	ita
	Γ		0				7	
			axis				axis	
		8	2	2		8		2
			checksum				data L	
					L.			
					L.			
							data H	
							alarm data L	
							F	
							error code	
					L		checksum	
error code								
bit7	6	5	4	3		2	1	0
0 : Normal		Command err	or RS485 error					
1 : Error								
Data								
bit7	6	5	4	3		2	1	0
For	In-speed	Torque in-limi		Mechanical	Positi	ioning blete	Servo-Alarm	Servo-Ready
manufacturer's use	<u> </u>		detection	brake released	(In-po	osition)		
hi+1E	14	12	12	11		10	9	8
bit15 Excite motor	Control power	13 Dynamic brak		11 Control		10	At-speed	For
Excite motor	latch	engagement	suppression relay	Control regeneration brake			At-speed	manufacturer's use
bit23	22	21	20	19		18	17	16
Safety EDM	Speed	Alarm attribute	e Speed in-limit	2nd positioning complete	Positi	ional	Alarm output 2	Alarm output 1
	command ON/OFF	output	output	(In-position)	comn ON/C)FF	•	·
bit31	31	29	28	27		26	25	24
For manufacturer's use	For manufacturer's use	For manufacturer's us	For manufacturer's use	For manufacturer's use	For manufa	acturer's use	For manufacturer's use	For manufacturer's use
alarm data								
bit7	6	5	4	3		2	1	0
Overload	Fan	Over-regeneration	on Encoder	Encoder overheat	Lifetir	me	For	Battery
protection	alarm	alarm	communication alarm	alarm	detec	tion alarm	manufacturer's use	alarm
bit15	14	13	12	11	Forter	10	9	8
For	For	For			comn	nal scale nunication	Oscillation detection	External scale error alarm
manufacturer's use		manufacturer's us			alarm	1	alarm	error alarm
The table bel		elation of the	signals and action	is.				
	Signal title			0			1	
	Servo-Ready		Servo-N	lot Ready			At Servo-Read	dy
	Servo-Alarm		No	rmal			At Servo-Alarr	n
Pos	sitioning comple	tod		not completed	-+	Po	sitioning in-com	
					-+			
	anical brake rel			rake engaged			nanical brake re	
Ze	ro speed detect	ion	· · · · · · · · · · · · · · · · · · ·	not detected		Z	ero speed dete	cted
	Torque in-limit		Torque r	not in-limit			Torque in-limi	t T
At-si	peed (Speed ar	rival)	Not at-speed(S		(b		Speed arriving	
	ed (Speed coinc		Not in-speed(Spe			ln on	•	
		-			5 u)		eed (Speed coi	
Contr	ol regeneration	ргаке	i urn off reg	generation Tr	\rightarrow	l ur	n on regenerat	ion I r
			D 1 1		- 1			

• Because of the internal logical data before output conversion, it does not directly correspond to the output signal to the connector X5.

Release inrush suppression relay

Dynamic brake released

Release power latch

Energize motor

Operate inrush suppression relay

Dynamic brake engaged

Power abnormal latching

Servo free

• Names and functions shown above are for MINAS-A6 . Some of input signals will have different meaning for different series.

When in Trouble

4. Communication

Details of Communication Command

command 2	mode 9	• Read out of	present speed	, torque and p	ositional com	mand deviatio	n
		Ro	eception data			Transmission da	ıta
			0			9	
			axis			axis	
		9		2	9		2
			checksum			data_L	
						(speed) H	
					L	data L	
						(torque) H	
					L	data L	
						(deviation) H	 I
						error code	
						checksum	
Error cod							
bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error		Command error	RS485 error				

- Output value of speed and torque are in 16 bit and deviation in 32bit.
- Unit and sign of the output data is as same as that of command No. 24 (command = 2, mode = 4), 25 (mode = 5) and 26 (mode = 6).

		Re	eception data			Transmission	data
			0			13 (0Dh)	
			axis			axis	
		A	2	2	A		2
			checksum			control mod	de
						status	
						input signal	L
						input signal	Н
						output signa	
						output signa	 I H
						alarm data	
						alarm data	Н
						error code	e
						checksum	1
or cod							
bit7	6	5	4	3	2	1	0
: Normal	·	Command error	RS485 error				

• Meaning of each bit of control mode, status, input signal, output signal and alarm data is as same as that of command No. 20 (command = 2, mode = 0), 27 (mode = 7) and 28 (mode = 8).

	_		Received data			Transmitted	data
			0			9	
	_		axis			axis	
		В		2	E		2
	L		checksum			Manufacturer u	
							Н
						Manufacturer u	
							Н
						Overload load va	
							_H
						Manufacturer us	
							_H
						Manufacturer us	
							Н
						Error code	
						checksum	
rror code							
bit7	6	5	4	3	2	T 1	T 0
0 : Normal			RS485 error				
1 : Error							
			io=0.2 % unit(500	400.0()			

checksum

4. Communication

Details of Communication Command

command mode 2 C	• Read external sca	le		
	Reception	data	Transm	ission data
	0		11	(0Bh)
	axis			axis
	С	2	С	2
	checks	um	External	scale ID (L)
				(H)
			Sta	tus (L)
				(H)
				(L)
			L	
			Absolute pos	ition data (48bit)
				J
				(H)
			Erro	or code

External scale ID

• Please refer to external scale specifications for details of external scale ID.

Status (L)

• Please refer to the external scale specifications for details of external scale status.

Error code

- [bit7	6	5	4	3	2	1	0
	0 : Normal 1 : Error		Command error	RS485 error				

- Command error will occur, when external scale position information monitor function under semi-closed control is invalid, in control mode other than full closed control.
- Absolute position data = 48bits (80000000000h to 7FFFFFFFFFh)

Details of Communication Command

command 2	mode D	• Read absolu	te encoder				
		R	eception data			Transmission da	ata
	Γ		0			11 (0Bh)	
			axis			axis	
		D	2	2	D		2
	L		checksum			Encoder ID (L)
							H)
						Status (L	
						(F	
						(L	,
						1 revolution da	
						(H Multi rev data	
							(<u>L)</u> (H)
						0	(11)
						Error code	
						checksum	
					_		
		Encode		Encode			
23bit	absolute	0	Bh	A.	7h		
Status (L)							
bit7	6	5	4	3	2	1	0
Battery alarm	System down	Multi-turn error	0	Counter	Count error	Full absolute	Over speed
				overflow		status	
• bit4 : Syster • bit5 : Batter		rn error, counte	r overflow, cour	nt error, full abso	olute status and	logical sum of	over speed
Error code							
bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error		Command error	RS485 error				
• 1 revolution	data = 23bit (00	for encoder othe 00000h to 7FFFI : (0000h to FFFF	FFh)				

mode E command • Read external scale deviation and aggregate pulse Reception data Transmission data 0 axis axis Е checksum (L) External scale FB aggregate pulse (H) (L) external scale deviation (H) Error code checksum **Error code** 5 3 0 0 : Normal Command error RS485 error

- External scale FB pulse sum will return the present position of the external scale counter in absolute coordinates from the starting point.
- External scale FB pulse sum will be "-" for negative direction and "+" for positive direction.
- External scale deviation becomes "+" when the external scale is positioned at negative direction against position command, and "-" when it is positioned at positive direction.

Details of Communication Command

command 7	mode 0	• Read individ	lual paramete	ers			
		R	eception data			Transmission	ı data
			2			5	
			axis			axis	
		0		7	0		7
		Param	eter classification	า			(L)
		Pa	arameter No.			Parameter v	/alue
			checksum				
							(H)
						error cod	le
						checksu	m
rror code							
bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error		Command error	RS485 error	No.Error			

command mode 7 1	• Write individua	l parameters				
	Recep	tion data		Transmiss	ion data	
		6	[1		
	a	ixis		axi	S	
	1	7		1	7	
	Parameter	classification		Error code		
	Param	neter No.		check	sum	
		(L)				
	Parame	eter value				
		(H)				
	che	cksum				

• Returns number error in case parameter classification and parameter number are out of range.

Command error RS485 error

• This command is to temporarily change the parameter. In case of writing onto EEPROM, please execute the EEPROM write parameter (mode =2).

No.Error

- Please make sure to set all unused parameters to 0 (zero). Failure to do this may result in data error. Data error will also occur when parameter values outside the set range is transmitted.
- Please transmit parameters code extended into 32bits.

6

Data Error

bit7

0 : Normal

• Parameter value will be returned in value code extended to 32bits.

command 7	mode 2	Write param	eters into EEI	PROM				
		R	eception data			Transmission (lata	
		0				1		
		axis				axis		
		2	2 7			2	7	
			checksum			Error code		
						checksum		
Error code bit7	6	5	4	3	2	1	0	
	Data Error	Command error	RS485 error			Control LV		

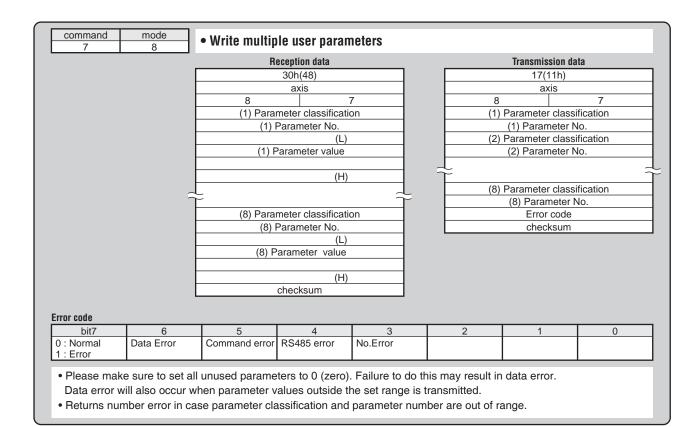
- Write set parameters into EEPROM.
- Transmission data will be replied after completion of writing into EEPROM.

 It may take about 5 seconds maximum, to write onto the EEPROM. (when all parameters are changed)
- Data error will occur when writing fails.
- In case of control power supply LV, control LV error code will be returned and write will not be take place.

		Re	eception data				Transmission	data
			2				17 (11h)	
			axis				axis	
		6		7		6		7
			eter classification	n		P	arameter class	
			arameter No.				Parameter	
			checksum				Parameter v	<u>(L)</u> alue
								(H)
								(L)
							MIN valu	
								(H)
							MAX valu	(L) e
								(H)
							Attribute	
								Н
							Error cod	
							checksur	n
Property								
bit7	6	5	4	3		2	1	0
Unused parameter	Display prohibited		Change at initialization		\perp			
bit15	14	13	12	11	\top	10	9	8
								Read only
Error code		_						
bit7 0 : Normal	6	5 Command error	4	No.Error		2	1	0
1 : Error		Command error	RS485 error	No.Error				

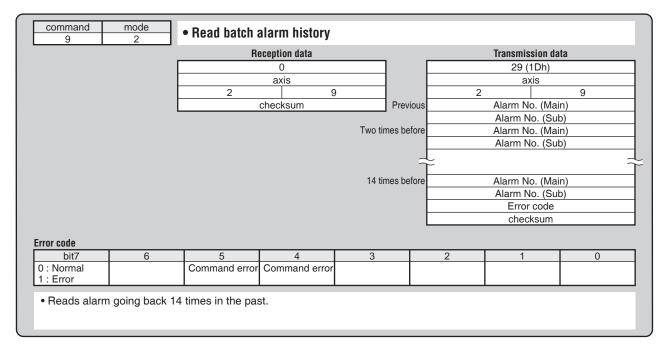
Details of Communication Command

		R	eception data			Transmission	ı data
			10h (16)			129 (81)	
			axis			axis	'/
		7		7	7	- CARO	7
		·	meter classificati			Parameter cla	
			Parameter No.	···	(.)	(1) Paramete	
			meter classificati	on		(1)1 010111010	(L)
			Parameter No.	<u></u>		(1) Paramete	
	_	()		_			
	_	Ĕ		$\widetilde{\gamma}$			(H)
		(8)Parar	meter classification	on			(L)
		(8)	Parameter No.			(1) MIN va	
			checksum				
							(H)
							(L)
						(1) MAX va	alue
							(H)
						(1) Attrib	ute (L)
							(H)
					لے ا		
					(8)	Parameter cla	
						(8) Paramete	er No.
						:	
						(O) Attaile	
						(8) Attrib	(H)
						Error cod	
						checksu	m
Property							
bit7	6	5	4	3	2	1	0
Unused	Display		Change at				
parameter	prohibited		initialize				
bit15	14	13	12	11	10	9	8
						-	Read only
Error code	6	5	4	3	2	1	0
Error code bit7		1 -	DO 405	No.Error			
		Command error	RS485 error	NO.⊑HOI			1



		0				3		
			axis			axis		
		0 9				0 9		
			checksum			Alarm No. (Ma		
						alarm No. (Si		
						Error code	!	
						checksum		
rror code bit7	6	5	4	3	2	1	0	
0 : Normal 1 : Error		Command error	RS485 error					

Details of Communication Command



command 9	mode 3	• Clear alarm	history					
		Ro	eception data				Transmission da	ıta
			0				1	
		axis					axis	
		3	3 9			3		9
			checksum				Error code	
							checksum	
ror code bit7	T 6	5	4	3		2	T 1	0

• In case of control power supply LV, error code Control LV will be returned and write will not take place.

command 9	mode 4	• Alarm clear						
		Re	eception data			Transmission da	ıta	
		0				1		
		axis				axis		
		4		9	4		9	
			checksum			Error code		
						checksum		
rror code								
irror code bit7	6	5	4	3	2	1 1	0	

- Clears currently activated alarm (only in case of alarms that can be cleared).
- Also clears absolute battery alarm.

• Data error in case of clear failure.

Details of Communication Command

		nece	eption data O			Transmission o	iaia	
			axis			axis		
		В	В 9			В 9		
		checksum				Error code		
						checksum		
or code	6	5	4	3	2	1 1	0	
	6	5 Command error R:		3	2	1	0	

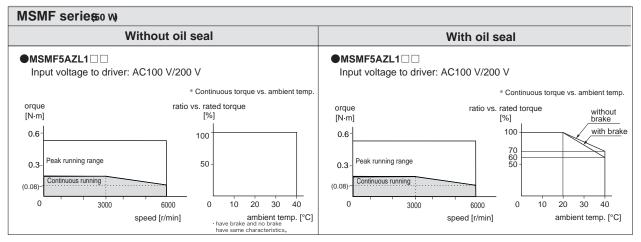
Supplement

5. Motor Characteristics

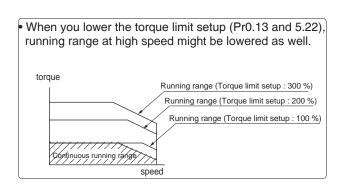
MSMF series w)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

Motor model	Unit	MSMF5A	ZL1 🗆 🗆	
Brake		without	with	
Oil seal		withou	ut/with	
Output rating	W	5	0	
Matabaal duiva		MADL 01		
Matched drive		MADL □ 05 □□		
Power supply of drive	V(AC)	100/200		
Rated torque	N⋅m	0.16		
Continuous stall torque	N⋅m	0.16		
Max.instantaneous speed	N⋅m	0.	48	
Rated curren	A (rms)	1.1		
Max.instantaneous current	A (o-p)	4.7		
Rated rotational speed	r/min	30	00	
Max.rotational speed	r/min	60	00	
Rotor inertia	×10 ⁻⁴ kg⋅m ²	0.026	0.029	



^{*} These are subject to change. Contact us when you use these values for your machine design.



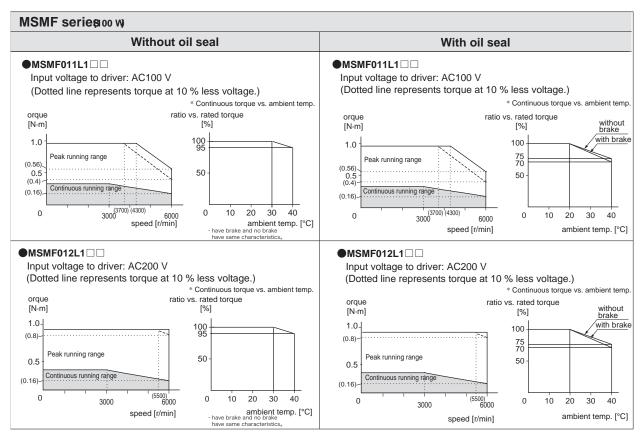
Supplement

5. Motor Characteristics

MSMF serie \$00 W)

•Note that the motor characteristics may vary due to the existence of oil seal or brake.

Motor model	Unit	MSMF01	1L1 🗆 🗆	MSMF01	2L1 🗆 🗆
Brake		without	with	without	with
Oil seal		withou	ut/with	withou	ut/with
Output rating	W	10	00	100	
Matched drive		MADL 🗌 11 🔲		MADL □ 05 □□	
Power supply of drive	V(AC)	100		200	
Rated torque	N⋅m	0.3	0.32		32
Continuous stall torque	N⋅m	0.3	32	0.32	
Max.instantaneous speed	N∙m	0.9	95	0.95	
Rated curren	A (rms)	1.	.6	1.	.1
Max.instantaneous current	A (o-p)	6	.9	4	.7
Rated rotational speed	r/min	30	00	30	00
Max.rotational speed	r/min	60	00	60	00
Rotor inertia	×10 ⁻⁴ kg⋅m ²	0.048	0.051	0.048	0.051

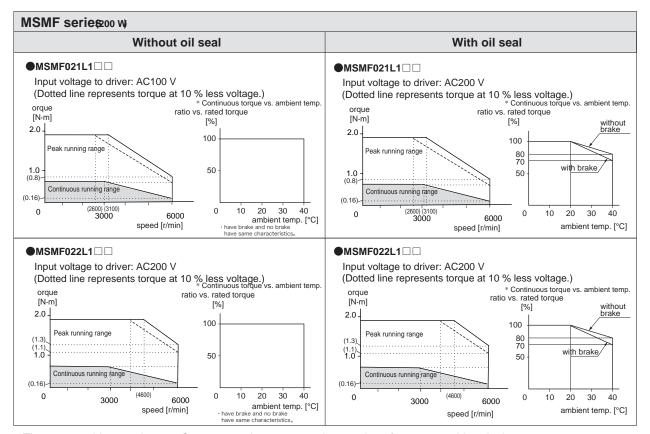


^{*} These are subject to change. Contact us when you use these values for your machine design.

5. Motor Characteristics

MSMF serieæ00 w)

Motor model	Unit	MSMF021L1 □□		MSMF022L1 □□	
Brake		without	with	without	with
Oil seal		withou	ut/with	withou	ut/with
Output rating	W	20	00	20	00
Matched drive		MBDL [21 🔲	MADL [] 15 🔲 🗌
Power supply of drive	V(AC)	10	00	20	00
Rated torque	N⋅m	0.64		0.64	
Continuous stall torque	N⋅m	0.0	0.64 0.64		64
Max.instantaneous speed	N⋅m	1.9	1.91 1.91		91
Rated curren	A (rms)	2.	.5	1.	.5
Max.instantaneous current	A (o-p)	10).6	6	.5
Rated rotational speed	r/min	30	00	30	00
Max.rotational speed	r/min	60	6000 6000		00
Rotor inertia	×10 ⁻⁴ kg⋅m ²	0.14	0.17	0.14	0.17

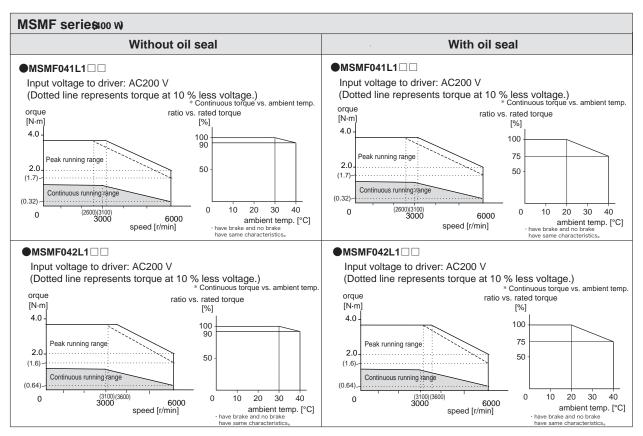


^{*} These are subject to change. Contact us when you use these values for your machine design.

5. Motor Characteristics

MSMF serie \$100 W)

Motor model	Unit	MSMF041L1 🗆		MSMF04	2L1 🔲
Brake		without	with	without	with
Oil seal		withou	ut/with	withou	ut/with
Output rating	W	40	00	40	00
Matched drive		MCDL [31 🔲	MBDL [25 🗆 🗆
Power supply of drive	V(AC)	10	00	200	
Rated torque	N⋅m	1.27		1.27	
Continuous stall torque	N⋅m	1.27		1.27	
Max.instantaneous speed	N⋅m	3.	3.82 3.82		82
Rated curren	A (rms)	4	.6	2.	.4
Max.instantaneous current	A (o-p)	19	9.5	10).2
Rated rotational speed	r/min	30	00	30	00
Max.rotational speed	r/min	60	6000		00
Rotor inertia	×10 ⁻⁴ kg⋅m ²	0.27	0.30	0.27	0.30



^{*} These are subject to change. Contact us when you use these values for your machine design.

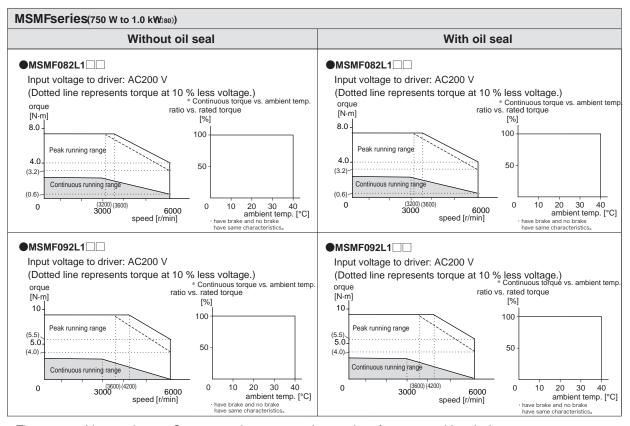
When in Trouble

7 Supplement

5. Motor Characteristics)

MSMF serie\$750 W to 1.0 kW(□ 80))

Motor model	Unit	MSMF082L1 □□		MSMF09	2L1 🔲 🗌
Brake		without	with	without	with
Oil seal		withou	ut/with	withou	ut/with
Output rating	W	75	50	10	00
Matched drive		MCDL [35 🗆 🗆	MDDL [45 🗆 🗆
Power supply of drive	V(AC)	20	00	20	00
Rated torque	N⋅m	2.39		3.18	
Continuous stall torque	N⋅m	2.39		3.18	
Max.instantaneous speed	N∙m	7.	16	9.55	
Rated curren	A (rms)	4	.1	5	.7
Max.instantaneous current	A (o-p)	17	7.4	24	1.2
Rated rotational speed	r/min	30	00	30	00
Max.rotational speed	r/min	6000		6000	
Rotor inertia	×10 ⁻⁴ kg⋅m ²	0.96	1.06	1.26	1.36

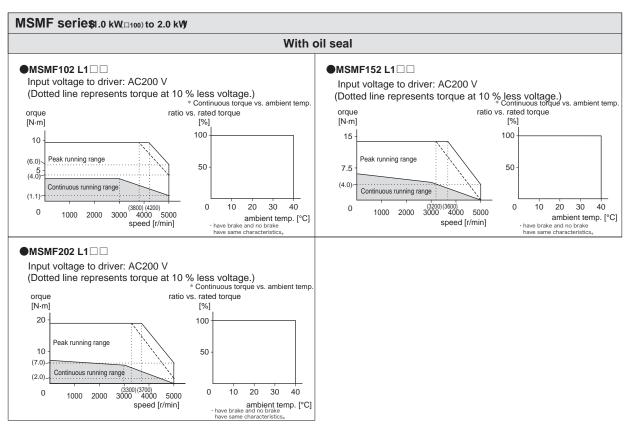


^{*} These are subject to change. Contact us when you use these values for your machine design.

5. Motor Characteristics

MSMF serie\$.0 kW (\$\sup\$100) to 2.0 kW)

Motor model	Unit	MSMF10	2 L1 🔲	MSMF15	2 L1 🗆 🗆	MSMF20	2 L1 □□
Brake		without	with	without	with	without	with
Oil seal		wi	ith	w	with		th
Output rating	kW	1	.0	1.5		2.	0
Matched drive		MDDL [55 🗆 🗆	MDDL □ 55 □□		MEDL [83 🗆
Power supply of drive	V(AC)	20	00	200		200	
Rated torque	N⋅m	3.18		4.77		6.37	
Continuous stall torque	N⋅m	3.	18	4.77		6.37	
Max.instantaneous speed	N⋅m	9.	55	14.3		19.1	
Rated curren	A (rms)	6	.6	8	8.2		.3
Max.instantaneous current	A (o-p)	2	8	3	5	4	8
Rated rotational speed	r/min	30	00	30	00	30	00
Max.rotational speed	r/min	5000		5000		5000	
Rotor inertia	×10 ⁻⁴ kg⋅m ²	2.15	2.47	3.10	3.45	4.06	4.41

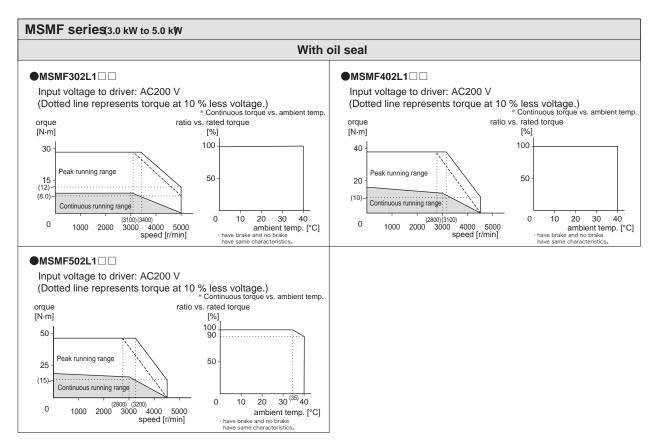


^{*} These are subject to change. Contact us when you use these values for your machine design.

5. Motor Characteristics

MSMF serie\$3.0 kW to 5.0 kW)

Motor model	Unit	MSMF30	2L1 🔲	MSMF40	2L1 🔲	MSMF502L1 □□	
Brake		without	with	without	with	without	with
Oil seal		wi	th	wi	th	with	
Output rating	kW	3.	.0	4.	.0	5.	0
Matched drive		MFDL 🗆	A3 🗆	MFDL [MFDL 🗆 B3 🔲 🗆		B3 □□
Power supply of drive	V(AC)	20	00	200		200	
Rated torque	N⋅m	9.5	55	12.7		15.9	
Continuous stall torque	N⋅m	9.5	55	12.7		15.9	
Max.instantaneous speed	N⋅m	28	3.6	38.2		47.7	
Rated curren	A (rms)	18	3.1	19.6		2	4
Max.instantaneous current	A (o-p)	7	7	8	3	10)2
Rated rotational speed	r/min	30	00	30	00	30	00
Max.rotational speed	r/min	5000		4500		4500	
Rotor inertia	×10 ⁻⁴ kg⋅m ²	7.04	7.38	14.4	15.6	19.0	20.2

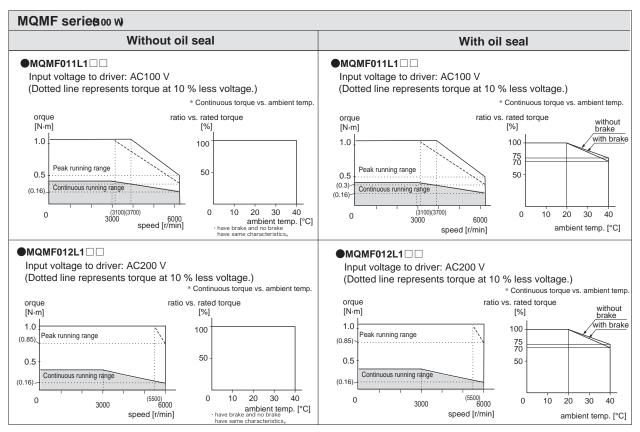


^{*} These are subject to change. Contact us when you use these values for your machine design.

5. Motor Characteristics)

MQMF series00 w)

Motor model	Unit	MQMF01	1L1 🔲	MQMF01	2L1 🔲
Brake		without	with	without	with
Oil seal		withou	ut/with	withou	ut/with
Output rating	W	10	00	10	00
Matched drive		MADL [] 11 🔲 🗌	MADL [05 🗆 🗆
Power supply of drive	V(AC)	10	00	200	
Rated torque	N⋅m	0.32		0.32	
Continuous stall torque	N⋅m	0.	32	0.32	
Max.instantaneous speed	N⋅m	1.	1.11 1.11		11
Rated curren	A (rms)	1	.6	1	.1
Max.instantaneous current	A (o-p)	7	.9	5	.5
Rated rotational speed	r/min	30	00	30	00
Max.rotational speed	r/min	65	6500 6500		00
Rotor inertia	×10 ⁻⁴ kg⋅m ²	0.15	0.18	0.15	0.18

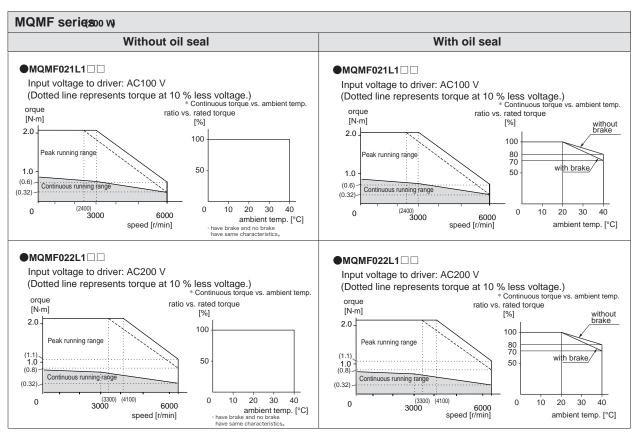


^{*} These are subject to change. Contact us when you use these values for your machine design.

5. Motor Characteristics)

MQMF serieg200 W)

Motor model	Unit	MQMF021L1 □□		MQMF02	2L1 □□	
Brake		without	with	without	with	
Oil seal		withou	ut/with	withou	ut/with	
Output rating	W	20	00	20	00	
Matched drive		MBDL [21 🗆	MADL [15 🗆 🗆	
Power supply of drive	V(AC)	10	00	20	00	
Rated torque	N⋅m	0.64		0.64		
Continuous stall torque	N⋅m	0.0	64	0.64		
Max.instantaneous speed	N⋅m	2.2	23	2.:	23	
Rated curren	A (rms)	2	.1	1.	.4	
Max.instantaneous current	A (o-p)	10).4	6	.9	
Rated rotational speed	r/min	30	00	30	00	
Max.rotational speed	r/min	6500		6500 6500		00
Rotor inertia	×10 ⁻⁴ kg⋅m ²	0.50	0.59	0.50	0.59	

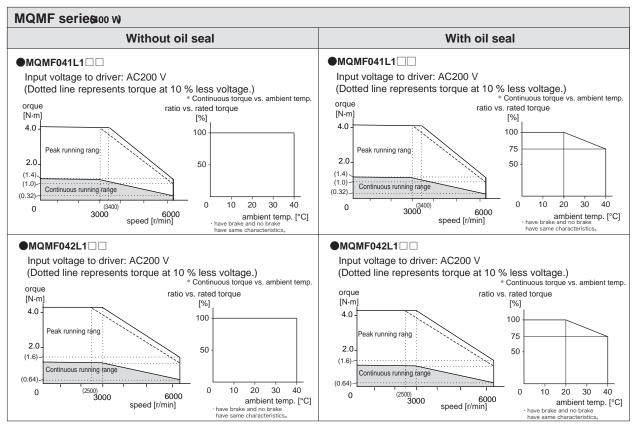


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5. Motor Characteristics)

MQMF series00 W)

Motor model	Unit	MQMF041L1 □□		MQMF04	l2L1 □□
Brake		without	with	without	with
Oil seal		withou	ut/with	withou	ut/with
Output rating	W	40	00	4(00
Matched drive		MCDL [] 31 □□	MBDL [25 □□
Power supply of drive	V(AC)	10	00	20	00
Rated torque	N⋅m	1.27		1.27	
Continuous stall torque	N⋅m	1.27 1.2		27	
Max.instantaneous speed	N⋅m	4.	46	4.46	
Rated curren	A (rms)	4	.1	2	.1
Max.instantaneous current	A (o-p)	20).3	10).4
Rated rotational speed	r/min	30	00	30	00
Max.rotational speed	r/min	65	6500 6500		00
Rotor inertia	×10 ⁻⁴ kg⋅m ²	0.98	1.06	0.98	1.06

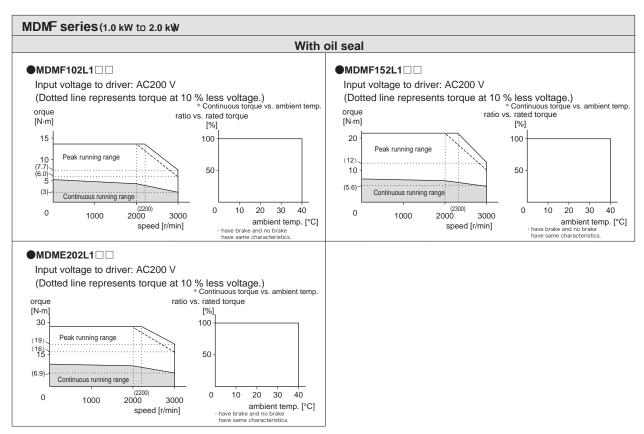


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5. Motor Characteristics

MDMF serie\$1.0 kW to 2.0 kW)

Motor model	Unit	MDMF10	2L1 🔲	MDMF152L1 🗆		MDMF202L1 🗆		
Brake		without	with	without	with	without	with	
Oil seal		with		wi	with		with	
Output rating	kW	1.	0	1.	1.5		0	
Matched drive		MDDL [45 🗆	MDDL □ 55 □□		MEDL 🗆	83 🗆 🗆	
Power supply of drive	V(AC)	20	00	200		200		
Rated torque	N⋅m	4.7	77	7.16		9.55		
Continuous stall torque	N⋅m	4.7	77	7.16		9.55		
Max.instantaneous speed	N⋅m	14	.3	21.5		28.6		
Rated curren	A (rms)	5.	2	8.	8.0		9	
Max.instantaneous current	A (o-p)	2	2	3	4	4:	2	
Rated rotational speed	r/min	20	00	20	00	20	00	
Max.rotational speed	r/min	3000		3000		3000		
Rotor inertia	×10 ⁻⁴ kg⋅m ²	6.18	7.40	9.16	10.4	12.1	13.3	

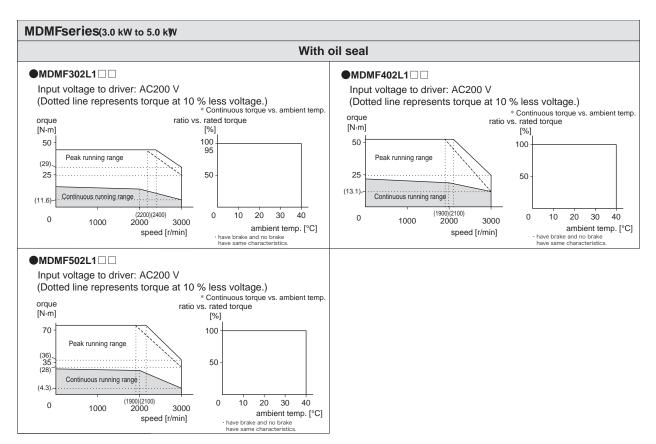


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5. Motor Characteristics)

MDMF serie\$3.0 kW to 5.0 kW)

Motor model	Unit	MDMF30)2L1 🔲 🗌	MDMF40)2L1 🔲	MDMF502L1 □□	
Brake		without	with	without	with	without	with
Oil seal		W	ith	W	with		th
Output rating	kW	3	.0	4	4.0		0
Matched drive		MFDL [A3 🗌 🗌	MFDL 🗌 B3 🔲 🗌		MFDL [В3 🗆
Power supply of drive	V(AC)	20	00	200		200	
Rated torque	N∙m	14	1.3	19.1		23.9	
Continuous stall torque	N∙m	14	1.3	19.1		23.9	
Max.instantaneous speed	N∙m	43	3.0	57.3		71.6	
Rated curren	A (rms)	16	6.4	20).0	23	.3
Max.instantaneous current	A (o-p)	7	0	8	5	9	9
Rated rotational speed	r/min	2000		20	00	20	00
Max.rotational speed	r/min	3000		3000		3000	
Rotor inertia	×10 ⁻⁴ kg⋅m ²	18.6	19.6	46.9	52.3	58.2	63.0

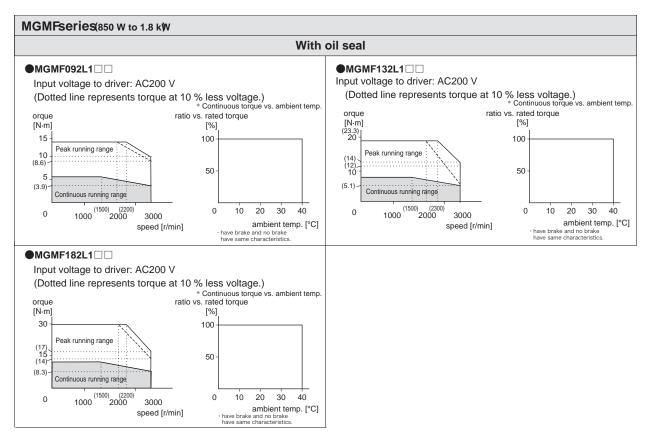


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5. Motor Characteristics

MGMF serie(9.85 kW to 1.8 kW)

Motor model	Unit	MGMF09)2L1 🔲	MGMF132L1 🗆		MGMF182L1 □□	
Brake		without	with	without	with	without	with
Oil seal		W	ith	wi	th	with	
Output rating	kW	0.	85	1.	.3	1.	8
Matched drive		MDDL [45 🗆	MDDL ☐ 55 ☐☐		MEDL [83 🗆 🗆
Power supply of drive	V(AC)	20	00	200		200	
Rated torque	N⋅m	5.	41	8.28		11.5	
Continuous stall torque	N⋅m	5.	41	8.28		11.5	
Max.instantaneous speed	N⋅m	14	l.3	23.3		28.7	
Rated curren	A (rms)	5	.9	9.	9.3		.8
Max.instantaneous current	A (o-p)	2	2	3	7	4:	2
Rated rotational speed	r/min	15	00	15	00	15	00
Max.rotational speed	r/min	30	00	3000		3000	
Rotor inertia	×10 ⁻⁴ kg⋅m ²	6.18	7.40	9.16	10.4	12.1	13.3

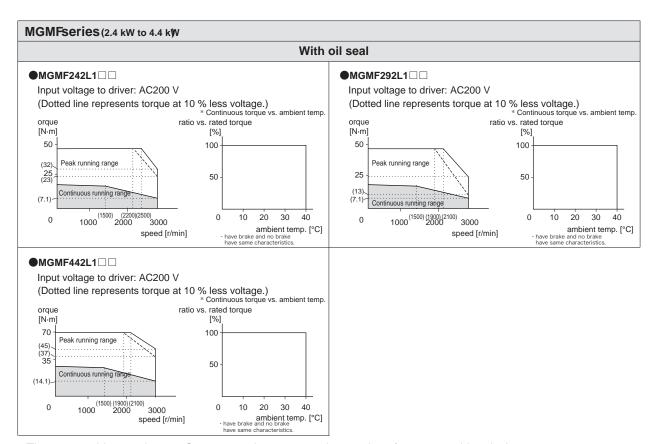


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5. Motor Characteristics

MGMF serie@.4 kW to 4.4 kW)

Motor model	Unit	MGMF24	2L1 🔲	MGMF29	2L1 🗌	MGMF44	2L1 🗌 🗌
Brake		without	with	without	with	without	with
Oil seal		wi	th	wi	th	with	
Output rating	kW	2.	4	2.9		4.	4
Matched drive		MEDL 🗆	93 🗆 🗆	MFDL 🗆 B3 🗆 🗆		MFDL 🗆 B3 🗆 🗆	
Power supply of drive	V(AC)	20	00	200		200	
Rated torque	N⋅m	15.3		18.5		28.0	
Continuous stall torque	N⋅m	15	.3	18.5		28.0	
Max.instantaneous speed	N⋅m	45	.3	45.2		70.0	
Rated curren	A (rms)	16	5.0	19	.3	27	.2
Max.instantaneous current	A (o-p)	66	5.5	6	7	9	6
Rated rotational speed	r/min	15	00	15	00	15	00
Max.rotational speed	r/min	3000		3000		3000	
Rotor inertia	×10 ⁻⁴ kg⋅m ²	46.9	52.3	46.9	52.3	58.2	63.0



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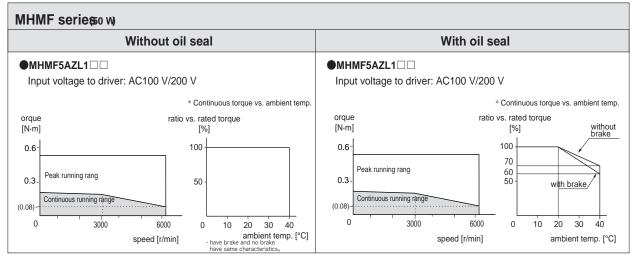
When in Trouble

Supplement

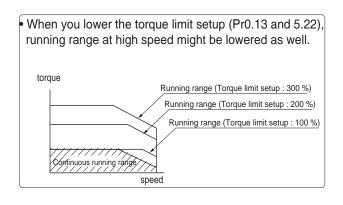
5. Motor Characteristics

MHMF series w)

Motor model	Unit	MHMF5AZL1 🗆		
Brake		without with		
Oil seal		without/with		
Output rating	W	50		
Matched drive		MADL [MADL 01	
iviatched drive		MADL ☐ 05 ☐☐		
Power supply of drive	V(AC)	100/200		
Rated torque	N⋅m	0.16		
Continuous stall torque	N⋅m	0.16		
Max.instantaneous speed	N⋅m	0.56		
Rated curren	A (rms)	1.1		
Max.instantaneous current	A (o-p)	5.5		
Rated rotational speed	r/min	3000		
Max.rotational speed	r/min	6500		
Rotor inertia	×10 ⁻⁴ kg⋅m ²	0.038 0.042		



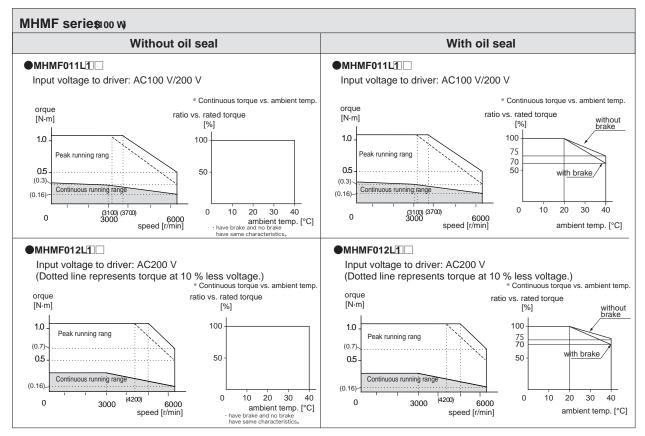
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5. Motor Characteristics

MHMF series00 w)

Motor model	Unit	MHMF011L1 🗆 🗆		MHMF012L1 □□	
Brake		without	with	without	with
Oil seal		without/with		without/with	
Output rating	W	100		100	
Matched drive		MADL 🗌 11 🔲		MADL 🗌 05 🔲 🗌	
Power supply of drive	V(AC)	100		200	
Rated torque	N⋅m	0.32		0.32	
Continuous stall torque	N⋅m	0.32		0.32	
Max.instantaneous speed	N⋅m	1.11		1.11	
Rated curren	A (rms)	1.6		1.1	
Max.instantaneous current	A (o-p)	7.9		5.5	
Rated rotational speed	r/min	3000		3000	
Max.rotational speed	r/min	6500		6500	
Rotor inertia	×10⁻⁴ kg⋅m²	0.071	0.074	0.071	0.074

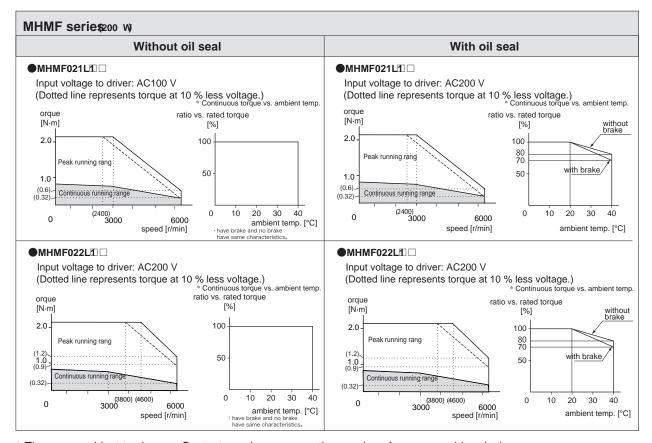


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5. Motor Characteristics

MHMF serie 200 w)

Motor model	Unit	MHMF021L1 □□		MHMF022L1 🗆	
Brake		without	with	without	with
Oil seal		without/with		without/with	
Output rating	W	200		200	
Matched drive		MBDL □ 21 □□		MADL 🗌 15 🔲 🗌	
Power supply of drive	V(AC)	100		200	
Rated torque	N⋅m	0.64		0.64	
Continuous stall torque	N⋅m	0.64		0.64	
Max.instantaneous speed	N⋅m	2.23		2.23	
Rated curren	A (rms)	2.1		1.4	
Max.instantaneous current	A (o-p)	10.4		6.9	
Rated rotational speed	r/min	3000		3000	
Max.rotational speed	r/min	6500		6500	
Rotor inertia	×10 ⁻⁴ kg⋅m ²	0.29	0.31	0.29	0.31

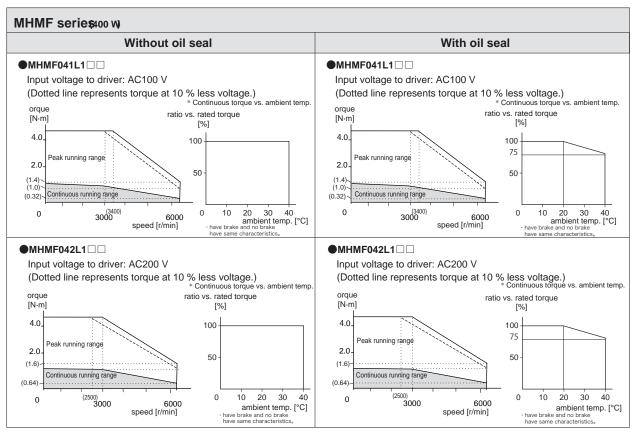


st These are subject to change. Contact us when you use these values for your machine design.

5. Motor Characteristics

MHMF serie \$100 W)

Motor model	Unit	MHMF041L1 □□		MHMF042L1 □□	
Brake		without	with	without	with
Oil seal		without/with		without/with	
Output rating	W	400		400	
Matched drive		MCDL ☐ 31 ☐☐		MBDL □ 25 □□	
Power supply of drive	V(AC)	100		200	
Rated torque	N⋅m	1.27		1.27	
Continuous stall torque	N⋅m	1.27		1.27	
Max.instantaneous speed	N⋅m	4.46		4.46	
Rated curren	A (rms)	4.1		2.1	
Max.instantaneous current	A (o-p)	20.3		10.4	
Rated rotational speed	r/min	3000		3000	
Max.rotational speed	r/min	6500		6500	
Rotor inertia	×10⁻⁴ kg⋅m²	0.56	0.58	0.56	0.58

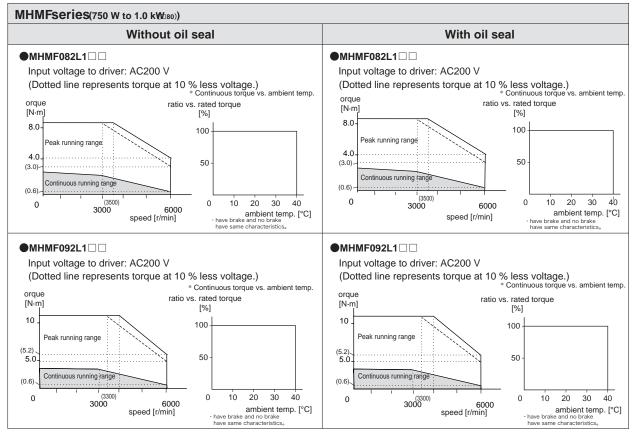


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5. Motor Characteristics

MHMF serie\$750 W to 1.0 kW(\square 80))

Motor model	Unit	MHMF082L1 □□		MHMF092L1 □□	
Brake		without	with	without	with
Oil seal		without/with		without/with	
Output rating	W	750		1000	
Matched drive		MCDL □ 35 □□		MDDL □ 45 □□	
Power supply of drive	V(AC)	200		200	
Rated torque	N⋅m	2.39		3.18	
Continuous stall torque	N⋅m	2.39		3.18	
Max.instantaneous speed	N∙m	8.36		11.1	
Rated curren	A (rms)	3.8		5.7	
Max.instantaneous current	A (o-p)	18.8		28.2	
Rated rotational speed	r/min	3000		3000	
Max.rotational speed	r/min	6000		6000	
Rotor inertia	×10 ⁻⁴ kg⋅m ²	1.56	1.66	2.03	2.13



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