## **Panasonic**®

# AC Servo Motor and Driver MINAS A4 Series



- •Thank you for buying and using Panasonic AC Servo Motor and Driver, MINAS A4 Series.
- •Read through this Instruction Manual for proper use, especially read "Precautions for Safety" ( P.8 to 11) without fail for safety purpose.
- •Keep this Manual at an easily accessible place so as to be referred anytime as necessary.

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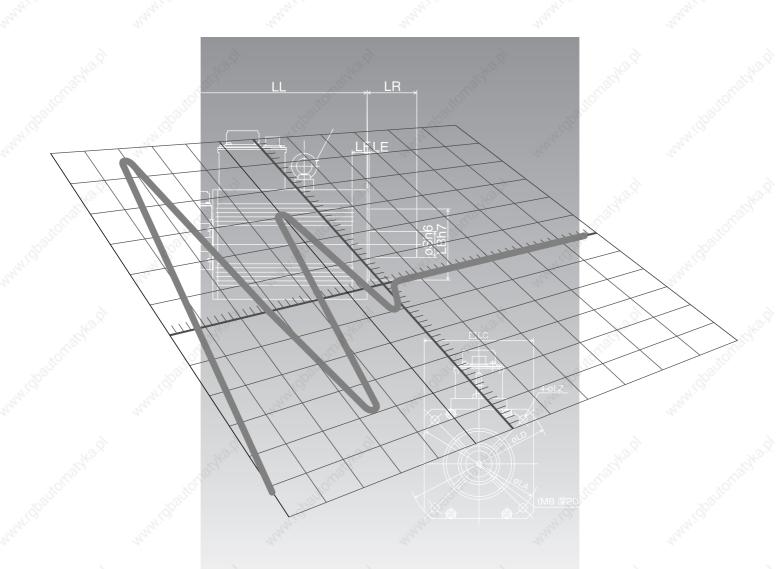
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## [Before Using the Products]

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## Safety Precautions Observe the Following Instructions Without Fail

Observe the following precautions in order to avoid damages on the machinery and injuries to the operators and other personnel during the operation.

• In this document, the following symbols are used to indicate the level of damages or injuries which might be incurred by the misoperation ignoring the precautions.



## **DANGER**

Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.



## **CAUTION**

Indicates a potentially hazardous situation which, if not avoided, will result in minor injury or property damage.

• The following symbols represent "MUST NOT" or "MUST" operations which you have to observe. (Note that there are other symbols as well.)



Represents "MUST NOT" operation which is inhibited.



Represents "MUST" operation which has to be executed.



Do not subject the Product to water, corrosive or flammable gases, and combustibles.



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.

Do not put your hands in the servo driver.



Failure to observe this instruction could result in burn and electrical shocks.

Do not touch the rotating portion of the motor while it is running.



Rotating portion

Failure to observe this instruction could result in injuries.

Do not drive the motor with external power.



Failure to observe this instruction could result in fire.

Do not touch the motor, servo driver and external regenerative resistor of the driver, since they become very hot.



Failure to observe this instruction could result in burns.

## **A DANGER**

Do not place combustibles near by the motor, driver and regenerative resistor.



Failure to observe this instruction could result in fire.

Ground the earth terminal of the motor and driver without fail.



Failure to observe this instruction could result in electrical shocks.

Install an emergency stop circuit externally so that you can stop the operation and shut off the power immediately.



Failure to observe this instruction could result in injuries, electrical shocks, fire, breakdowns and damages.

Install and mount the Product and machinery securely to prevent any possible fire or accidents incurred by earthquake.



Failure to observe this instruction could result in electrical shocks, injuries and fire.

Check and confirm the safety of the operation after the earthquake.



Failure to observe this instruction could result in electrical shocks, injuries and fire.

Mount the motor, driver and regenerative resistor on incombustible material such as metal.



Failure to observe this instruction could result in fire. Do not place the console close to a heating unit such as a heater or a large wire wound resistor.



Failure to observe this instruction could result in fire and breakdowns.

Install an over-current protection, earth leakage breaker, over-temperature protection and emergency stop apparatus without fail.



Failure to observe this instruction could result in electrical shocks, injuries and fire.

Turn off the power and wait for a longer time than the specified time, before transporting, wiring and inspecting the driver.



Failure to observe this instruction could result in electrical shocks.

Turn off the power and make it sure that there is no risk of electrical shocks before transporting, wiring and inspecting the motor.



Failure to observe this instruction could result in electrical shocks.

Wiring has to be carried out by the qualified and authorized specialist.



Failure to observe this instruction could result in electrical shocks.

Make the correct phase sequence of the motor and correct wiring of the encoder.



Failure to observe this instruction could result in injuries breakdowns and damages.

## **!** CAUTION

Do not hold the motor cable or motor shaft during the transportation.



Failure to observe this instruction could result in injuries.

Never run or stop the motor with the electro-magnetic contactor installed in the main power side.



Failure to observe this instruction could result in breakdowns.

Do not give strong impact shock to the motor shaft.





Failure to observe this instruction could result in 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.

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 modify, disassemble nor repair the Product.



Failure to observe this instruction could result in fire. electrical shocks and injuries.

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 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.

Do not turn on and off the main power of the driver repeatedly.



Failure to observe this instruction 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 give strong impact shock to the Product.



Failure to observe this instruction could result in breakdowns.

Do not pull the cables with excessive force.



Failure to observe this instruction could result in breakdowns.

## **A**CAUTION

Use the motor and the driver in the specified combination.



Failure to observe this instruction could result in fire.

Use the eye bolt of the motor for transportation of the motor only, and never use this for transportation of the machine.



Failure to observe this instruction could result in injuries and breakdowns.

Make an appropriate mounting of the Product matching to its weight and output rating.



Failure to observe this instruction could result in injuries and breakdowns.

Keep the ambient temperature below the permissible temperature for the motor and driver.



Failure to observe this instruction could result in breakdowns.

Connect the brake control relay to the relay which is to shut off at emergency stop in series.



Failure to observe this instruction could result in injuries and breakdowns.

When you dispose the batteries, observe any applicable regulations or laws after insulating them with tape.

Make a wiring correctly and securely.



Failure to observe this instruction could result in fire and electrical shocks.

Observe the specified mounting method and direction.



Failure to observe this instruction could result in breakdowns.

Observe the specified voltage.



Failure to observe this instruction could result in electrical shocks, injuries and fire.

Execute the trial run without connecting the motor to the machine system and fix the motor. After checking the operation, connect to the machine system again.



Failure to observe this instruction could result in injuries.

When any error occurs, remove the cause and release the error after securing the safety, then restart.



Failure to observe this instruction could result in injuries.

This Product shall be treated as Industrial Waste when you dispose.

## **Maintenance and Inspection**

• 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.
- 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.

#### **Inspection Items and Cycles**

General and normal running condition

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

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

Туре	Cycles	Items to be inspected		
Daily inspection Daily		<ul> <li>Ambient temperature, humidity, speck, dust or foreign object</li> <li>Abnormal vibration and noise</li> <li>Main circuit voltage</li> <li>Odor</li> <li>Lint or other particles at air holes</li> <li>Cleanness at front portion of the driver and connecter</li> <li>Damage of the cables</li> <li>Loose connection or misalignment between the motor and machine or equipment</li> <li>Pinching of foreign object at the load</li> </ul>		
Periodical inspection	Annual	<ul> <li>Loose tightening</li> <li>Trace of overheat</li> <li>Damage of the terminals</li> </ul>		

<sup>&</sup>lt;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.

The same of the sa			
Product	Component	Standard replacement cycles (hour)	Note
	Smoothing capacitor	Approx. 5 years	
.42.A	Cooling fan	2 to 3 years (10,000 to 30,000 hours)	Mary.
Driver	Aluminum electrolytic capacitor (on PCB)	Approx. 5 years	'i i porite
Dilvei	Rush current preventive relay	Approx. 100,000 times (depending on working condition)	Man. Man.
McLighto.,	Rush current preventive resistor	Approx. 20,000 times (depending on working condition)	These hours or cycles are reference.  When you experience any
	Bearing	3 to 5 years (20,000 to 30,000 hours)	error, replacement is required even before this standard
	Oil seal	5000 hours	replacement cycle.
240g	Encoder	3 to 5 years (20,000 to 30,000 hours)	19 <sub>1</sub> 10 13
Motor	Self-Chillian Self	Life time varies depending on working conditions.	15gHzchior .
	Battery for absolute encoder	Refer to the instruction manual attached to the battery for absolute	ALALAH ION HAVAHION
180	3	encoder.	3
Motor with gear reducer	Gear reducer	10,000 hours	10 (Lights )

### Introduction

#### **Outline**

MINAS-A4 Series with wide output range from 50W to 5kW, are the high speed, high functionality AC servo drivers and motors. Thanks to the adoption of a new powerful CPU, A4 Series now realize velocity response frequency of 1kHz, and contribute to the development of a high-speed machine and drastic shortening of tact-time.

Standard line-up includes full-closed control and auto-gain tuning function and the motors with 2500P/r incremental encoder and 17-bit absolute/incremental encoder.

A4 Series have also improved the user-friendliness by offering a console (option) which enables you to monitor the rotational speed display, set up parameters, trial run (JOG running) and copy parameters.

A4 Series can support various applications and their requirement by featuring automated gain tuning function, damping control which achieves a stable "Stop Performance" even in low-stiffness machine and high speed motor.

This document is designed for the customer to exploit the versatile functions of A4 Series to full extent.

#### **Cautions**

- 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.

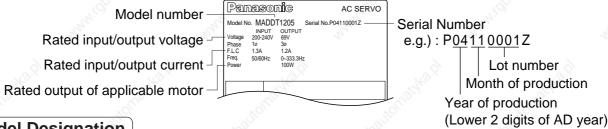
#### On Opening the Product Package

- Make sure that the model is what you have ordered.
- Check if the product is damaged or not during transportation.
- Check if the instruction manual is attached or not.
- Check if the power connector and motor connecters (CN X1 and CN X2 connectors) are attached or not (A to D-frame).

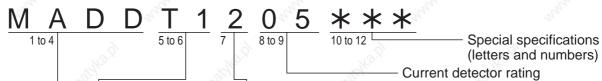
#### Contact to a dealer if you find any failures.

#### **Check of the Driver Model**

#### **Contents of Name Plate**



#### **Model Designation**



Frame-size symbol -

Symbol	Frame
MADD	A4-series, A-frame
MBDD	A4-series, B-frame
MCDD	A4-series, C-frame
MDDD	A4-series, D-frame
MEDD	A4-series, E-frame
MFDD	A4-series, F-frame
000	000

power device Symbol Current rating T1 10A T2 15A **T3** 30A T5 50A T7 70A TA 100A TB 150A

Max. current rating of

Power supply

Symbol Specifications

1 Single phase, 100V

2 Single phase, 200V

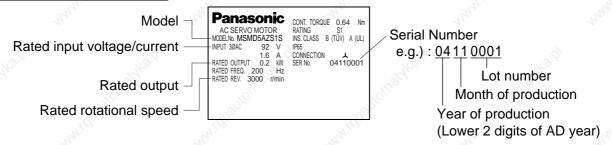
3 3-phase, 200V

5 Single/3-phase, 200V

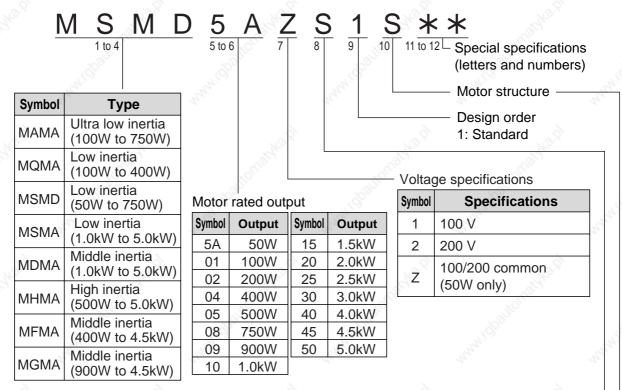
Symbol Current rating 05 5A 07 7.5A 10 10A 15 15A 20 20A 30 30A 40 40A 64 64A 90 90A A2 120A

#### **Check of the Motor Model**

#### **Contents of Name Plate**



#### **Model Designation**



Rotary encoder specifications

Symbol	<sup>1</sup> 19,	Specification	cifications		
Syllibol	Format	Pulse count	Resolution	Wire count	
P	Incremental	2500P/r	10,000	5-wire	
S	Absolute/Incremental common	17bit	131,072	7-wire	

Motor structure MSMD, MQMA

Cumbal	Shaft		Holding brake		Oil seal	
Symbol	Round	Key way	Without	With	Without	With*1
Α	•	200				
В		95,			80.0	
S	44	<b>*</b> 2		44.		
Т	24	*2		•		

<sup>\*1</sup> The product with oil seal is a special order product.

Products are standard stock items or build to order items. For details, inquire of the dealer.

#### MAMA

Cumbal	Shaft		Holding brak		Oil s	seal
Зуший	Round	Key way	Without	With	Without	With
Α	.5°			20.		
В			.90			.60
.≤È`						This.
F			77.			27

#### MSMA, MDMA, MFMA, MGMA, MHMA

Cumbal	Sh	aft	Holding	g brake	Oil seal		
Symbol	Round	Key way	Without	With	Without	With	
С	.50			20.			
D			.90			<b>0</b> %	
G							
H			27			27,	

<sup>\*2</sup> Key way with center tap.

## Introduction

#### **Check of the Combination of the Driver and the Motor**

This drive 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.

#### Incremental Specifications, 2500P/r

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

Power		Applica	ble motor	all all a	Applicable d	lriver			
supply	Motor series	Rated rotational speed	Model	Rated output	Model	Frame			
Single phase,	NAANAA	74/2	MAMA012P1*	100W	MADDT1207	A-frame			
200V	MAMA	5000v/min	MAMA022P1*	200W	MBDDT2210	B-frame			
3-phase,	Ultra low	5000r/min	MAMA042P1*	400W	MCDDT3520	C-frame			
200V	inertia	9	MAMA082P1*	750W	MDDDT5540	D-frame			
Cingle phase		16.	MQMA011P1*	100W	MADDT1107	A-frame			
Single phase, 100V	MAMA Low inertia	50	MQMA021P1*	200W	MBDDT2110	B-frame			
1000	× (-)	3000r/min	MQMA041P1*	400W	MCDDT3120	C-fram			
Cingle phase	U-0.0	30001/111111	MQMA012P1*	100W	MADDT1205	A-fram			
Single phase, 200V	mertia	7,0,	MQMA022P1*	200W	MADDT1207	A-fram			
200 V	The state of the s	742	MQMA042P1*	400W	MBDDT2210	B-fram			
	-		MSMD5AZP1*	50W	MADDT1207 A-fi MBDDT2210 B-fi MADDT1105 A-fi MADDT1107 B-fi MCDDT3120 C-fi MADDT1205 A-fi MADDT1207 MBDDT2210 B-fi MCDDT3520 C-f MDDDT5540 D-f MEDDT7364 E-fi MFDDTA390	A-fram			
Single phase,	MSMD Low		MSMD011P1*	100W	MADDT1107	A-mame			
100V		195.	MSMD021P1*	200W	MBDDT2110	B-fram			
	MSMD	38	MSMD041P1*	400W	MCDDT3120	C-fram			
- off	×0	3000r/min	MSMD5AZP1*	50W	MADDT4005				
Single phase,	inertia	35	MSMD012P1*	100W	MADD 1 1205	A-fram			
200V	190	(90)	MSMD022P1*	200W	MADDT1207	(6)			
	44.	" Type	MSMD042P1*	400W	MBDDT2210	B-fram			
Cinalo/2 phone	27.	27,	MSMD082P1*	750W	MCDDT3520	C-fram			
Single/3-phase,			MSMA102P1*	1.0kW	MDDDTCC40	D (110.110			
200V	MSMA	9	MSMA152P1*	1.5kW	MUUUU 1 5540	D-fram			
The.	Inema	Low inertia	-nhase Low	3000r/min	MSMA202P1*	2.0kW	MEDDT7364	E-fram	
3-phase,				A.U.	30001/111111	MSMA302P1*	3.0kW	MFDDTA390	
200V					inertia	inertia	inertia	merua	16
	7000	700	MSMA502P1*	5.0kW	MFDDTB3A2	X			
Single/3-phase,	747.00	71.10	MDMA102P1*	1.0kW	MDDDT3530	D-fram			
200V	MDMA	The same	MDMA152P1*	1.5kW	MDDDT5540	D-Iram			
		2000r/min	MDMA202P1*	2.0kW	MEDDT7364	E-fram			
3-phase,	Middle inertia	K-nhase	20001/111111	MDMA302P1*	3.0kW	MFDDTA390			
200V			13.7	MDMA402P1*	4.0kW	MEDDEDAAA	F-fram		
	-3	<i>S</i> ),	MDMA502P1*	5.0kW	MFDDTB3A2				
Cingle/2 phase	,01	×C	MHMA052P1*	500W	MCDDT3520	C-fram			
Single/3-phase, 200V	~377	~3) <sub>2</sub>	MHMA102P1*	1.0kW	MDDDT3530	D-fram			
200V	MHMA	(0)	MHMA152P1*	1.5kW	MDDDT5540	D-IIaili			
	High	2000r/min	MHMA202P1*	2.0kW	MEDDT7364	E-fram			
3-phase,	inertia	77	MHMA302P1*	3.0kW	MFDDTA390	20			
200V			MHMA402P1*	4.0kW	MFDDTB3A2	F-fram			
~8,		25	MHMA502P1*	5.0kW	IVIFUUIDSAZ				
Single/3-phase,	MFMA _	dt -	MFMA042P1*	400W	MCDDT3520	C-fram			
200V		2000r/min	MFMA152P1*	1.5kW	MDDDT5540	D-fram			
3-phase,	Middle	20001/111111	MFMA252P1*	2.5kW	MEDDT7364	E-fram			
200V	inertia	700	MFMA452P1*	4.5kW	MFDDTB3A2	F-fram			
Single/3-phase, 200V	NACNAN	27/2	MGMA092P1*	900W	MDDDT5540	D-fram			
-	MGMA	1000r/min	MGMA202P1*	2.0kW	MFDDTA390	212			
3-phase, 200V	Middle	1000r/min	MGMA302P1*	3.0kW	MEDDIDAAA	F-frame			
	inertia		MGMA452P1*	4.5kW	MFDDTB3A2				

#### <Note>

Suffix of " \* " in the applicable motor model represents the motor structure.

#### Absolute/Incremental Specifications, 17-bit

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

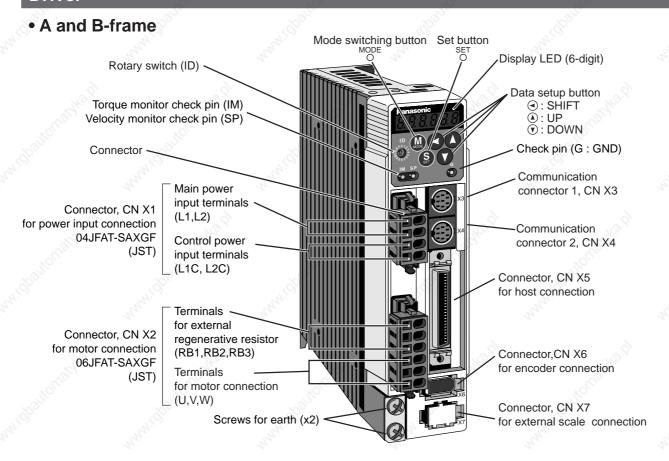
Power	Egs.	Applica	ble motor		Applicable of	driver	
supply	Motor series	Rated rotational speed	Model	Rated output	Model	Frame	
Single phase,	NAANAA	3.0,	MAMA012S1*	100W	MADDT1207	A-frame	
200V	MAMA Ultra low	5000r/min	MAMA022S1*	200W	MBDDT2210	B-frame	
3-phase,	inertia	50001/111111	MAMA042S1*	400W	MCDDT3520	C-frame	
200V	mertia	~3 <sup>1</sup> 0	MAMA082S1*	750W	MDDDT5540	D-fram	
Single phase,	_%°	'90°	MQMA011S1*	100W	MADDT1107	A-frame	
100V	MAMA	147	MQMA021S1*	200W	MBDDT2110	B-fram	
1004	Low	3000r/min	MQMA041S1*	400W	MCDDT3120	C-fram	
Single phase,		30001/111111	MQMA012S1*	100W	MADDT1205	A-fram	
200V	merua	9	MQMA022S1*	200W	MADDT1207	A-frame	
2007	MSMD Low inertia MSMA Low inertia	3.2	MQMA042S1*	400W	MBDDT2210	B-frame	
79 <sub>0</sub>	190		MSMD5AZS1*	50W	MADDT1105	A from	
Single phase,	XO <sup>C</sup> .	×0.	MSMD011S1*	100W	MADDT1107	A-fram	
100V	1000	1000	MSMD021S1*	200W	MBDDT2110	B-fram	
	MSMD	77,00	MSMD041S1*	400W	MCDDT3120	C-fram	
.6.	Low	3000r/min	MSMD5AZS1*	50W	MADDT1205	120	
Single phase,	e, inertia	2,	MSMD012S1*	100W	MADD 1 1205	A-fram	
200V			MSMD022S1*	200W	MADDT1207		
		, 5,	MSMD042S1*	400W	MBDDT2210	B-fram	
Cinala/O abasa	16°		MSMD082S1*	750W	MCDDT3520	C-fram	
Single/3-phase,	100	20	MSMA102S1*	1.0kW	MDDDTFF40	D (	
200V		MSMA	770	MSMA152S1*	1.5kW	MDDD15540	D-fram
	A 100	2000=/==:=	MSMA202S1*	2.0kW	MEDDT7364		
3-phase,	se, inertia	120	3000r/min	MSMA302S1*	3.0kW	MFDDTA390	Thy.
200V			inertia	The same	MSMA402S1*	4.0kW	MEDDEDAAA
			MSMA502S1*	5.0kW	WFDD1B3A2		
Single/3-phase,		9	MDMA102S1*	1.0kW	MDDDT3530	D (	
200V	MDM	3.,	MDMA152S1*	1.5kW	MDDDT5540	D-fram	
7300	MDMA	0000=/==:=	MDMA202S1*	2.0kW	MEDDT7364	E-fram	
3-phase,	Middle	2000r/min	MDMA302S1*	3.0kW	MFDDTA390		
200V	inertia	inertia	2020	MDMA402S1*	4.0kW	MEDDEDOAG	F-fram
	740.	770	MDMA502S1*	5.0kW	MADDT1207           MBDDT2210         B-fra           MCDDT3520         C-fra           MDDDT5540         D-fra           MEDDT7364         E-fra           MFDDTA390         F-fra           MDDT3530         D-fra           MDDT5540         MEDDT364           MFDDTA390         F-fra           MFDDTB3A2         F-fra           MFDDT3520         C-fra           MDDT3530         D-fra           MDDT3530         D-fra           MDDT3530         D-fra	77.0	
Cinalo/2 aboos	7	72/2	MHMA052S1*	500W	MCDDT3520	C-fram	
Single/3-phase,		-	MHMA102S1*	1.0kW		D f=====	
200V	MHMA	2	MHMA152S1*	1.5kW	MDDDT5540	-iram	
10.2	High	2000r/min	MHMA202S1*	2.0kW	MEDDT7364	E-frame	
3-phase,	inertia		MHMA302S1*	3.0kW	MFDDTA390		
200V	- office	200	MHMA402S1*	4.0kW	MEDDEDOAG	F-frame	
	- 31/10	-3170	MHMA502S1*	5.0kW	MFDDTB3A2		
Single/3-phase,	NACRAA	(0)	MFMA042S1*	400W	MCDDT3520	C-fram	
200V	MFMA	2000/22:2	MFMA152S1*	1.5kW	MDDDT5540	D-fram	
3-phase,	Middle	2000r/min	MFMA252S1*	2.5kW	MEDDT7364	E-frame	
200V	inertia		MFMA452S1*	4.5kW	MFDDTB3A2	F-frame	
ingle/3-phase, 200V	NACNAN	Q'	MGMA092S1*	900W	MDDDT5540	D-fram	
The	MGMA	4000#/==:=	MGMA202S1*	2.0kW	MFDDTA390		
3-phase, 200V	Middle	1000r/min	MGMA302S1*	3.0kW	- S.,	F-frame	
(O),	inertia	30	MGMA452S1*	4.5kW	MFDDTB3A2	20	

#### <Notes>

- 1) Suffix of " \* " in the applicable motor model represents the motor structure.
- 2) Default of the driver is set for the incremental encoder specifications.
  - When you use in absolute, make the following operations.
  - a) Install a battery for absolute encoder. (refer to P.314, "Options" of Supplement.)
  - b) Switch the parameter Pr0B (Absolute encoder setup) from "1 (default)" to "0".
- 3) No wiring for back up battery is required when you use the absolute 17-bit encoder in incremental.

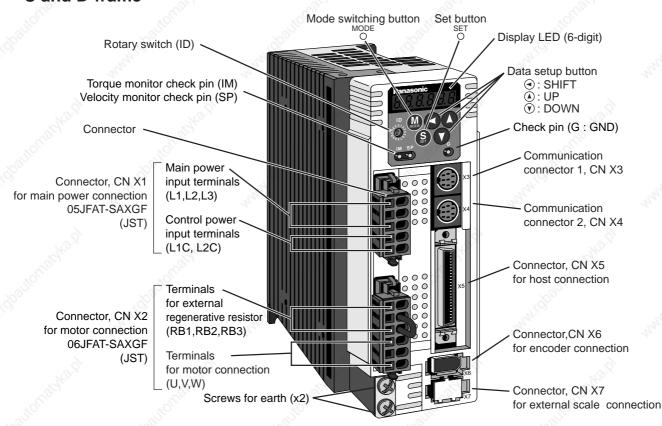
## **Parts Description**

#### **Driver**



e.g.): MADDT1207 (Single phase, 200V, 200W: A-frame)

#### C and D-frame

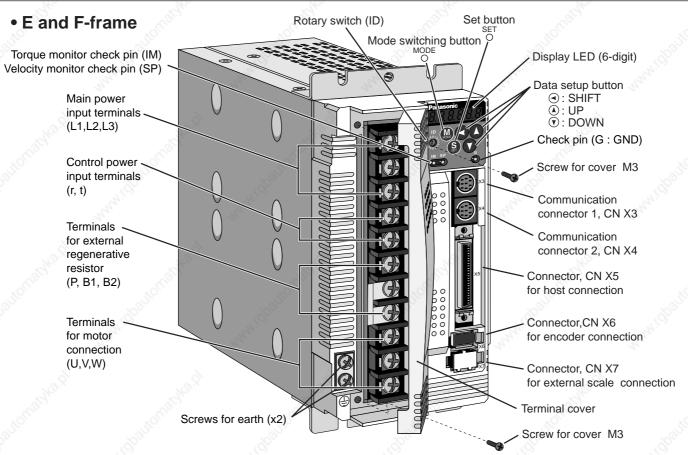


e.g.): MCDDT1207 (Single/3-phase, 200V, 750W: C-frame)

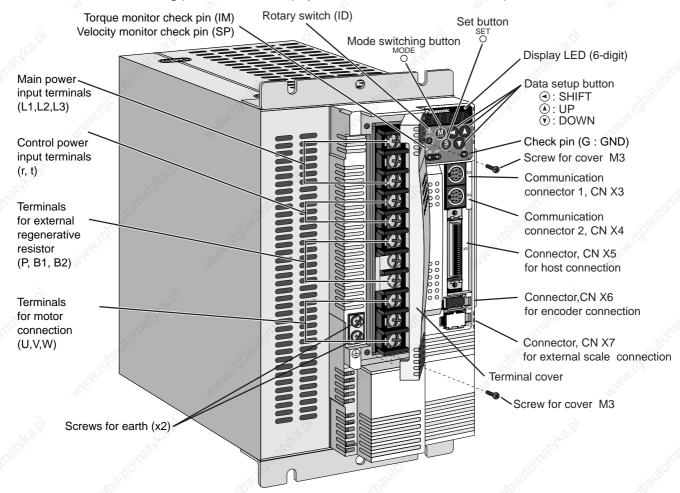
<Note>

X1 and X2 are attached in A to D-frame driver.

#### [Before Using the Products]



e.g.): MEDDT7364 (3-phase, 200V, 2.0kW: E-frame)



e.g.): MFDDTB3A2 (3-phase, 200V, 5.0kW: F-frame)

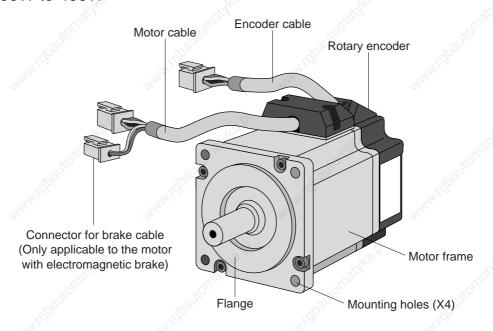
For details of each model, refer to "Dimensions" (P.324 to 326) of Supplement.

<Note>

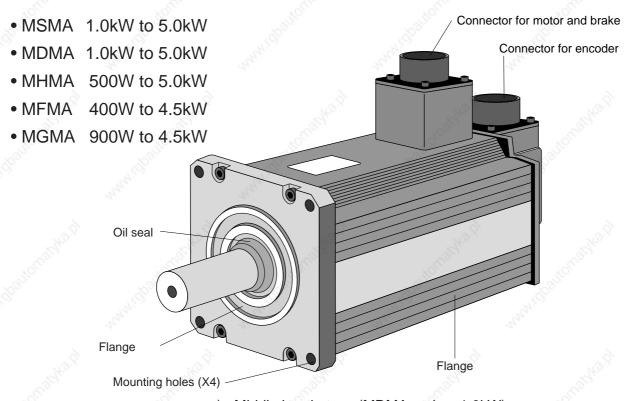
## **Parts Description**

#### Motor

- MSMD 50W to 750W
- MAMA 100W to 750W
- MQMA 100W to 400W



e.g.): Low inertia type (MSMD series, 50W)



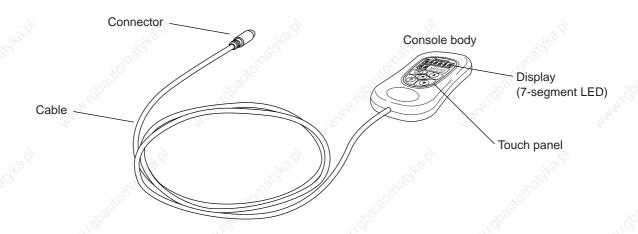
e.g.): Middle inertia type (MDMA series, 1.0kW)

#### <Note>

For details of each model, refer to "Dimensions" (P.327 to P.341) of Supplement.

#### Console

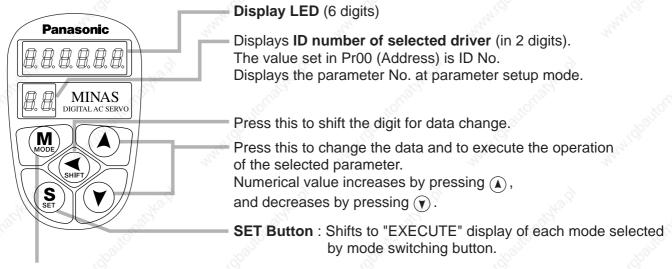
#### **Main Body**



#### <Note>

Console is an option (Part No.: DV0P4420).

#### Display/Touch panel



**Mode switching button**: Switches the mode among the following 6 modes.

- (1) Monitor mode
- (2) Parameter setup mode
- (3) EEPROM write mode
- (4) Normal auto-gain tuning mode
- (5) AUX function mode
  - Trial run (JOG mode)
  - Alarm clear
- (6) Copy mode
  - Parameter copy from the servo driver to the console
  - Parameter copy from the console to the servo driver

## How to Install

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

#### **Driver**

#### **Installation Place**

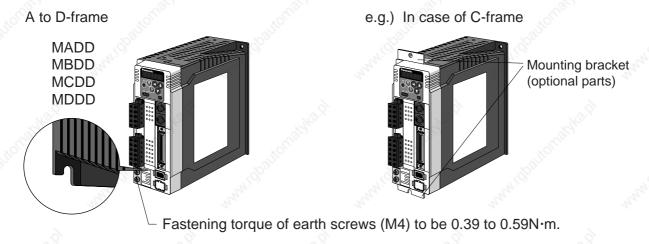
- 1) Indoors, where the products are not subjected to rain or direct sun beams. The products are not water-proof.
- 2) Where the products are not subjected to corrosive atmospheres such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, chloric gas, sulfuric gas, acid, alkaline and salt and so on, and are free from splash of inflammable gas, grinding oil, oil mist, iron powder or chips and etc.
- 3) Well-ventilated and low humidity and dust-free place.
- 4) Vibration-free place

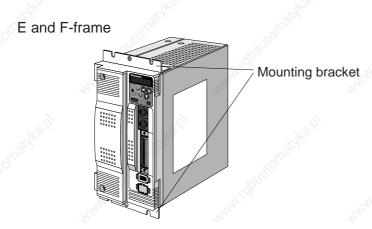
#### **Environmental Conditions**

Item	Condition	
Ambient temperature	0°C to 55°C (free from freezing)	2000
Ambient humidity	Less than 90% RH (free from condensation)	11/0
Storage temperature	-20°C to 80°C (free from freezing)	2/1/2
Storage humidity	Less than 90% RH (free from condensation)	
Vibration	Lower than 5.9m/S <sup>2</sup> (0.6G), 10 to 60Hz	
Altitude	Lower than 1000m	

#### How to Install

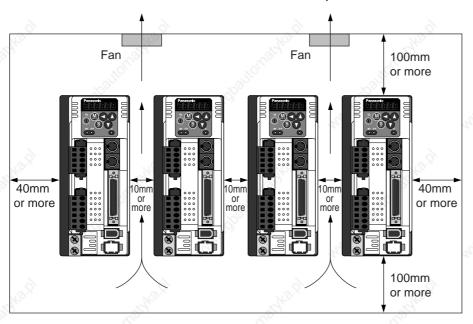
- 1) Rack-mount type. Install in vertical position, and reserve enough space around the servo driver for ventilation. Base mount type (rear mount) is standard (A to D-frame)
- Use the optional mounting bracket when you want to change the mounting face.





#### **Mounting Direction and Spacing**

- Reserve enough surrounding space for effective cooling.
- Install fans to provide uniform distribution of temperature in the control panel.
- Observe the environmental conditions of the control panel described in the next page.



#### <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**

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.

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.

### How to Install

#### Motor

#### **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 water-proof.
- 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) 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**

	. (3)					
Item	ì	Condition				
Ambient temperature		0°C to 40°C (free from freezing) *1				
Ambient humidity Less than 85% RH (free from condensation)		Less than 85% RH (free from condensation)				
Storage temperature		-20°C to 80°C (free from freezing) *2				
Storage hu	umidity	Less than 85% RH (free from condensation)				
Vibration	Motor only	Lower than 49m/s <sup>2</sup> (5G) at running, 24.5m/s <sup>2</sup> (2.5G) at stall				
Impact	Motor only	Lower than 98m/s² (10G)				
Enclosure rating	Motor only	<ul> <li>IP65 (except rotating portion of output shaft and lead wire end)</li> <li>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.</li> </ul>				

<sup>\*1</sup> Ambient temperature to be measured at 5cm away from the motor.

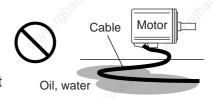
#### How to Install

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 (non-standard) when mounting the motor with gear reducer to prevent the reducer oil/grease from entering to the motor.
- 3) For mounting dimensions, refer to P.326 to 340 "Dimensions"

#### 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 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.



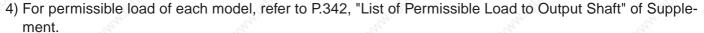
<sup>\*2</sup> Permissible temperature for short duration such as transportation.

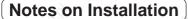
#### **Stress to Cables**

- 1) Avoid a stress application to the cable outlet and connecting portion by bending or self-weight.
- 2) Especially in an application where the motor itself travels, fix the attached cable and contain the extension junction cable into the bearer so that the stress by bending can be minimized.
- 3) Take the cable bending radius as large as possible. (Minimum R20mm)

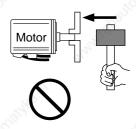
#### **Permissible Load to Output Shaft**

- 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.





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



## How to Install

#### Console

#### **Installation Place**

- 1) Indoors, where the products are not subjected to rain or direct sun beam. The products are not water-proof.
- 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 low humidity and dust-free place.
- 4) Easy-to-access place for inspection and cleaning

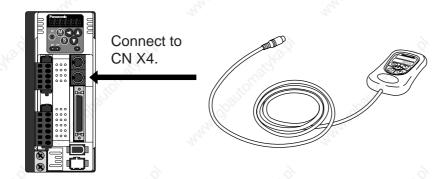
#### **Environmental Conditions**

Item	Condition				
Ambient temperature	0°C to 55°C (free from freezing)				
Ambient humidity	Less than 90% RH (free from condensation)				
Storage temperature	-20°C to 80°C (free from freezing)				
Storage humidity	Less than 90% RH (free from condensation)				
Vibration	Lower than 5.9m/s <sup>2</sup> (0.6G), 10 to 60Hz				
Impact	Conform to JISC0044 (Free fall test, 1m for 2 directions, 2 cycles)				
Altitude	Lower than 1000m				

#### <Cautions>

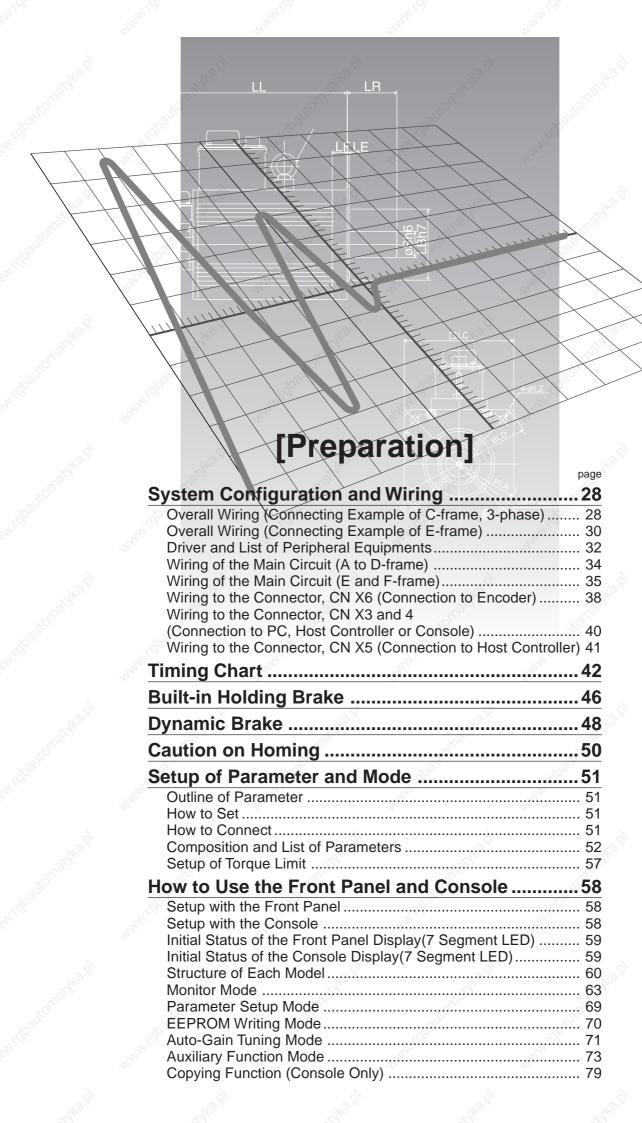
- Do not give strong impact to the products.
- Do not drop the products.
- Do not pull the cables with excess force.
- Avoid the place near to the heat source such as a heater or a large winding resistor.

#### **How to Connect**



#### <Remarks>

- Connect the console connector securely to CN X4 connector of the driver
- Never pull the cable to plug in or plug out.



#### Overall Wiring (Connecting Example of C-frame, 3-phase)

### Wiring of the Main Circuit

Circuit Breaker (NFB) (see P.32, 33 and 309.)

Use the circuit breaker matching capacity of the power source to protect the power lines.

## Noise Filter (NF) (see P.309)

Prevents external noise from the power lines. And reduces an effect of the noise generated by the servo driver.

## Magnetic Contactor (MC) (see P.32 and 33.)

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

Use a surge absorber together with this.

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

## Reactor (L) (see P.321)

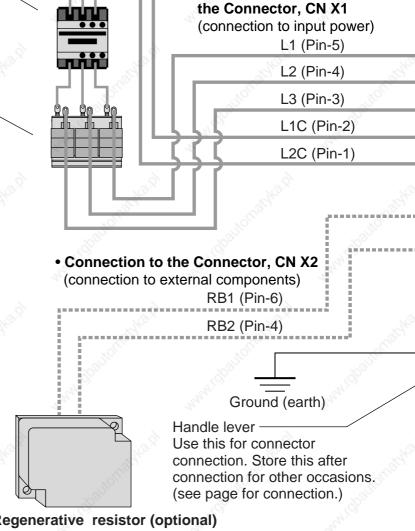
Reduces harmonic current of the main power.

#### Pin RB1 (6-pin), RB2 (4-pin), and **RB3 (5-pin)**

- RB2 and RB3 to be kept shorted for normal operation.
- When the capacity shortage of the regenerative resister is found, disconnect a shorting between RB2 and RB3, then connect the external regenerative resister between RB1 and RB2.

(Note that no regenerative resister is equipped in Frame A and B type. Install an external regenerative resister on incombustible material, such as metal. Follow the same wiring connection as the above.)

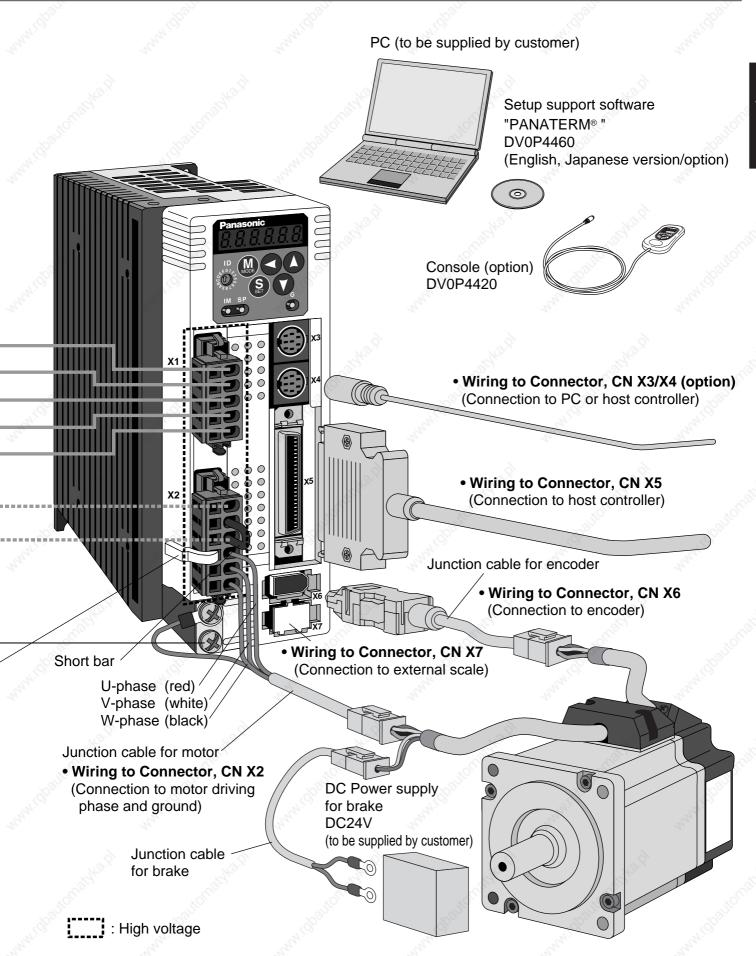
 When you connect an external regenerative resister, set up Parameter No. 6C to 1 or 2.



Connection to

#### Regenerative resistor (optional) <Remarks>

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



### Overall Wiring (Connecting Example of E-frame)

#### Wiring of the Main Circuit

Circuit Breaker (NFB) (see P.32, 33 and 309.)

Use the circuit breaker matching capacity of the power source to protect the power lines.

## Noise Filter (NF) (see P.309)

Prevents external noise from the power lines. And reduces an effect of the noise generated by the servo driver.

## Magnetic Contactor (MC) (see P.32 and 33.)

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

Use a surge absorber together with this.

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

## Reactor (L) (see P.321)

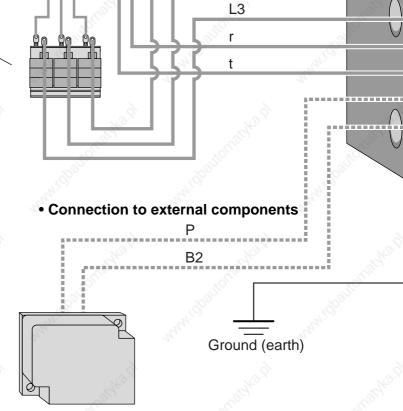
Reduces harmonic current of the main power.

#### Pin P, B1 and B2...

- B1 and B2 to be kept shorted for normal operation.
- When the capacity shortage of the regenerative resister is found, disconnect a short bar between B1 and B2, then connect the external regenerative resister between P and B2.

Install an external regenerative resister on incombustible material, such as metal. Follow the same wiring connection as the above.

 When you connect an external regenerative resister, set up Parameter No. 6C to 1 or 2.



Connection with input

L1

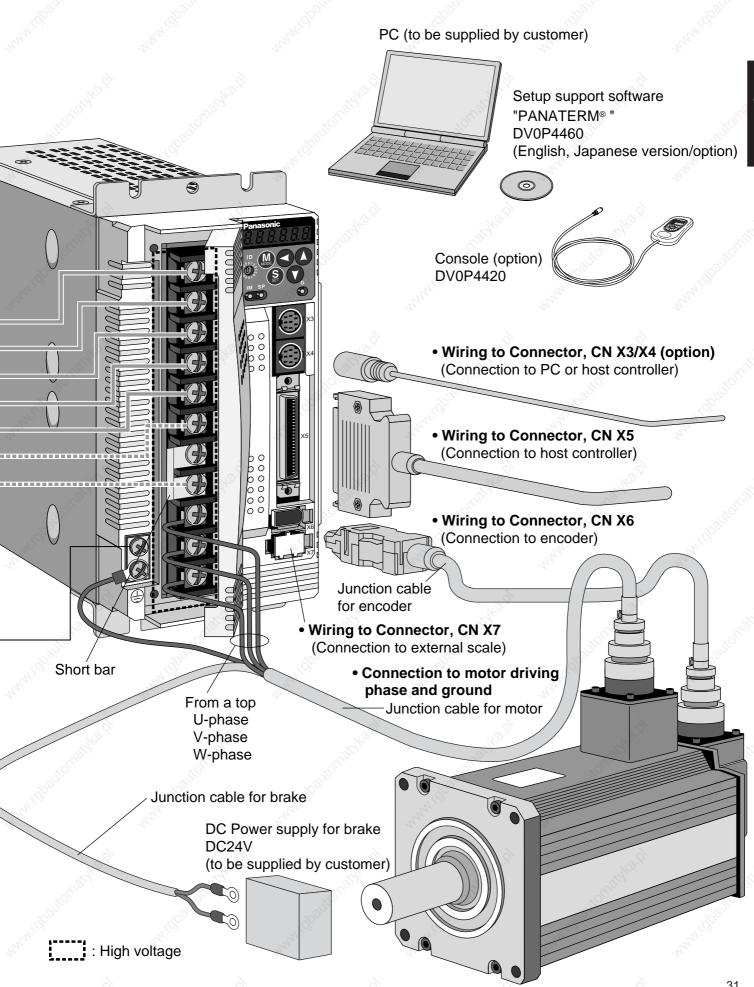
L2

power supply

#### Regenerative resistor (optional)

#### <Remarks>

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



## **Driver and List of Applicable Peripheral Equipments**

Driver	Applicable motor	Voltage	Rated output	Required Power (at the rated load)	Circuit breaker (rated current)	Noise filter	Surge absorber	Noise filter for signal	Magnetic contactor	Cable diameter (main circuit)	Cable diameter (control circuit)	Connection
	MSMD	Single	50W -100W	approx. 0.4kVA	72		13,		BMFT61041N	,	72	
	MQMA	phase, 100V	100W	approx. 0.4kVA	-	2			(3P+1a)		, jì	
	MSMD		50W -200W	approx.	-	Wildy.		Tale Mr.		100		
MADD		Single	100W	0.5kVA approx.	-	T <sub>C</sub>		CHILD)	DMETO4540NI	"BITOL		
8	MQMA	phase, 200V	200W	0.3kVA approx.	41.00		145	\$	BMFT61542N (3P+1a)	G.		41:00
	MAMA	777	100W	0.5kVA approx.	n.	DV0P4170	DV0P4190		Tru,		272	
	MSMD	Single	10077	0.3kVA	10A	2			Š.		, jì	
, Š	MQMA	phase,	200W	approx. 0.5kVA		" Pho		V919/F.	BMFT61041N (3P+1a)	0.75 to	0	
Mana		1007	"Itol.			Mor.		altor.		2.0mm <sup>2</sup> AWG		N.
MBDD	MSMD	Single	400W	approx. 0.9kVA	11/20	ĺ	14.	300	BMFT61542N	14 to 18		14.10°
	MQMA	phase, 200V		approx.	2727		20,		(3P+1a)		257	Conn
	MAMA		200W	0.5kVA	-	- 0		-	5		9	ectio
Š	MQMA	Single phase,	400W	approx. 0.9kVA		20/12.		" Sight	BMFT61541N (3P+1a)	E.	(D.)	n to
"IIOUL	MSMD	100V	TOU.			Tion.		a Horri	(3P+ 1a)	NICOTON .		exclu
MCDD		4.50	750W	approx. 1.3kVA	7190	DV0P4180	200	D) (0D4 400		igo,	0.75mm <sup>2</sup>	usive
	MAMA	Single/ 3- phase,	400W	approx.	n		The	DV0P1460	BMFT61542N		AWG18	Connection to exclusive connector
	MFMA	200V		0.9kVA		6			(3P+1a)		9	necto
X	МНМА		500W	approx. 1.1kVA	15A	2 Ho.		" THE		ĺz.	3×	Ť
JiON C	MAMA		750W	approx. 1.6kVA		JiO TO		TOU		"Ifolice		3
Post	MDMA	350	8,0	approx.	199	5	32.2	000		Burn		11/1/200
	МНМА	Aga,	1.0kW	1.8kVA	nn		21212		True.		47	2.
	MGMA	-	900W	approx. 1.8kVA		3	DV0P1450		BMFT61842N	2.0mm <sup>2</sup>	2	
MDDD	MSMA	Single/ 3- phase,	1.0kW	approx. 1.8kVA	-	"SANO"		The sales	(3P+1a)	AWG14	©.X	
10000	МНМА	200V	10000	1.000	-	HOLLIG		TOUGO		" Include		3
Bar	MDMA		800	annray	20A	DV0P4220	35.	3000		gpar.		(qpar
	MSMA	They	1.5kW	approx. 2.3kVA	way.		They		4444		42	12.
	MFMA	_		9		2						
×	MDMA			16.5		"AFO."		"The	8.	62	3.2	Terminal
, torno	MSMA	_	2.0kW	approx.		KOLLIGHT.		" TOURS"		2.0mm <sup>2</sup>		block M5
MEDD		3- phase,	Z.UKVV	3.3kVA	30A	8		2000	BMF6352N (3P+2a2b)	AWG14		11.0 or smaller
	MHMA MFMA	200V	2.5kW	approx.	Talay.		Truy.		4444	3.5mm <sup>2</sup>	, si	
	IVIFIVIA		∠.5KVV	3.8kVA						AWG12		/ø5.3

Driver	Applicable motor	Voltage	Rated output	Required Power (at the rated load)	Circuit breaker (rated current)	Noise filter	Surge absorber	Noise filter for signal	Magnetic contactor	Cable diameter (main circuit)	Cable diameter (control circuit)	Connection
	MGMA	74 igo.	2.0kW	approx. 3.8kVA	741;GD		'41''.		741.C	0~	in.	95,
	MDMA	12		7/	2		Ma		No.		W.	
	МНМА		0.0134/	approx.		2		2	BMF6352N (3P+2a2b)		3	
	MSMA		3.0kW	4.5kVA		Carly Mr.		C. Harris	,	3.5mm <sup>2</sup>		
	MGMA		310		wall.	0,	~	Tion.		AWG12		Terminal block
	MDMA	01/4/QP			14/07		7410		"74'C	ľ	in.	M5
MFDD	мнма	3- phase, 200V	4.0kW	approx. 6kVA	50A	DV0P3410	DV0P1450	DV0P1460	12,		0.75mm <sup>2</sup> AWG18	11.0 or smaller
	MSMA			3		200		130			2	
	MFMA		"Caid	approx. 6.8kVA		Caldle.		Cath.	BMF6652N	Click.		ø5.3
	MGMA	300	4.5kW	approx. 7.5kVA	10011	D,	.00	gic.	(3P+2a2b)	Saltic.		709/40.
	MDMA	And in			Try (c)		"ALA 'CO		"ALAJ!C	5.3mm <sup>2</sup> AWG10	and '	(5)
	МНМА		5.0kW	approx. 7.5kVA			20		2,		24	
	MSMA			, <u>()</u>		13.0		12.0		10	2	

- Select a single and 3-phase common specifications according to the power source.
- Manufacturer of circuit breaker and magnetic contactor: Matsushita Electric Works.
   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 ® marked).
   5000Arms, 240V is the maximum capacity to be delivered to the circuit of 750W or larger model when the maximum current value of the circuit breaker is limited to 20A.
- For details of noise filters, refer to P.309, "Noise Filter" and P.311, "Driver and List of Applicable Peripheral Equipments (EC Directives)" of Supplement.

#### <Remarks>

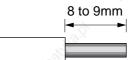
- Select and use the circuit breaker and noise filter with matching capacity to those of the power source, considering the load conditions as well.
- Terminal block and protective earth terminal
  - Use a copper conductor cable with temperature rating of 60°C or higher.
  - Protective earth terminal is M4 for A to D-frame, and M5 for E and F-frame.
  - Larger tightening torque of the screw than the max. value (M4 : 1.2 N·m, M5 : 2.0 N·m) may damage the terminal block.
- Earth cable diameter should be 2.0mm<sup>2</sup> (AWG14) or larger for 50W to 2.0kW model, and 3.5mm<sup>2</sup> (AWG12) or larger for 2.5kW to 4.0kW, and 5.3mm<sup>2</sup> (AWG10) or larger for 4.5kW to 5kW model.
- Use the attached exclusive connectors for A to D-frame, and maintain the peeled off length of 8 to 9mm.
- Tightening torque of the screws for connector (CN X5) for the connection to the host to be 0.3 to 0.35 N⋅m.
   Larger tightening torque than these may damage the connector at the driver side.

#### Wiring of the Main Circuit (A to D-frame)

- Wiring should be performed by a specialist or an authorized personnel.
- Do not turn on the power until the wiring is completed.

#### **Tips on Wiring**

1) Peel off the insulation cover of the cable. (Observe the dimension as the right fig. shows.)



2) Insert the cable to the connector detached from the driver. (See P.37 for details.)



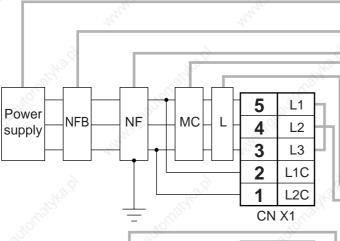








3) Connect the wired connector to the driver.



Check the name plate of the driver for power specifications.

OProvide a circuit breaker, or a leakage breaker. The leakage breaker to be the one designed for "Inverter" and is equipped with countermeasures for harmonics.

Provide a noise filter without fail.

Provide a surge absorber to a coil of the Magnetic Contactor. Never start/stop the motor with this **Magnetic Contactor.** 

Connect a fuse in series with the surge absorber. Ask the manufacturer of the Magnetic Contactor for the fuse rating.

Provide an AC Reactor.

○Connect L1 and L1C, and L3 and L2C at single phase use (100V and 200V), and don't use L2.

• Match the colors of the motor lead wires to those of the corresponding motor output terminals (U,V,W).

Don't disconnect the shorting cable between RB2 and RB3 (C and D frame type). Disconnect this only when the external regenerative register is used.

○Avoid shorting and ground fault. Don' t connect the main power.

Connect pin 3 of the connector on the amplifier side with pin 1 of the connector on the motor side.

Earth-ground this.

○Connect the protective earth terminal (♠) of the driver and the protective earth (earth plate) of the control panel without fail to prevent electrical shock.

ODon't co-clamp the earth wires to the protective earth terminal (4) . Two terminals are provided.

ODon't connect the earth cable to other inserting

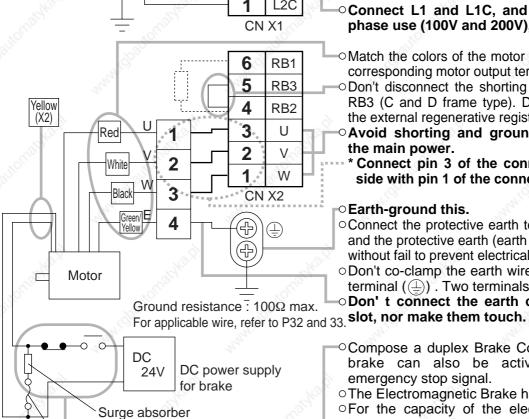
 Compose a duplex Brake Control Circuit so that the brake can also be activated by an external emergency stop signal.

• The Electromagnetic Brake has no polarity.

oFor the capacity of the electromagnetic brake and how to use it, refer to P.47, "Specifications of Built-in Holding Brake".

OProvide a surge absorber.

OConnect a 5A fuse in series with the surge absorber.



Fuse (5A)

#### Wiring of the Main Circuit (E and F-frame)

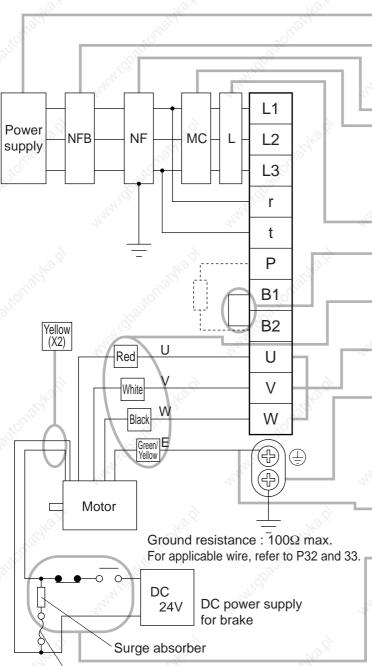
- Wiring should be performed by a specialist or an authorized personnel.
- Do not turn on the power until the wiring is completed.

#### 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, rater to "Driver and List of Applicable Peripheral Equipments" (P.32 and 33).

Attach the terminal cover, and fix with screws.
 Fastening torque of cover fixed screw in less than 0.2 N⋅m.



Fuse (5A)

- Check the name plate of the driver for power specifications.
- Provide a circuit breaker, or a leakage breaker. The leakage breaker to be the one designed for "Inverter" and is equipped with countermeasures for harmonics.
- Provide a noise filter without fail.
- Provide a surge absorber to a coil of the Magnetic Contactor. Never start/stop the motor with this Magnetic Contactor.

Connect a fuse in series with the surge absorber. Ask the manufacturer of the Magnetic Contactor for the fuse rating.

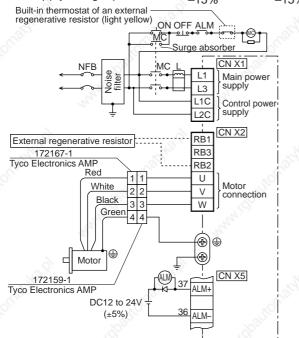
- OProvide an AC Reactor.
- Don't disconnect the short bar between B1 and B2. Disconnect this only when an external regenerative register is used.
- Match the colors of the motor lead wires to those of the corresponding motor output terminals (U,V,W).
- Avoid shorting and ground fault.Don' t connect the main power.
- Earth-ground this.
- Connect the protective earth terminal (⊕) of the driver and the protective earth (earth plate) of the control panel without fail to prevent electrical shock.
- Don't co-clamp the earth wires to the protective earth terminal (♣) . Two terminals are provided.
- ODon't connect the earth cable to other inserting slot, nor make them touch.
- For applicable wire, refer to P32 and 33. Compose a duplex Brake Control Circuit so that the brake can also be activated by an external emergency stop signal.
  - The Electromagnetic Brake has no polarity.
  - For the capacity of the electromagnetic brake and how to use it, refer to P.47, "Specifications of Built-in Holding Brake".
  - Provide a surge absorber.
  - Connect a 5A fuse in series with the surge absorber.

#### Wiring Diagram

Compose the circuit so that the main circuit power will be shut off when an error occurs.

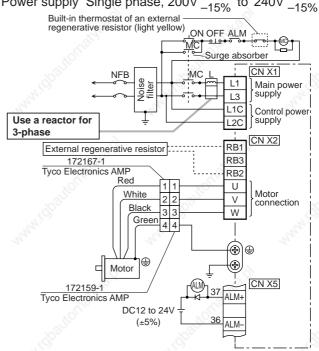
#### In Case of Single Phase, 100V (A and B-frame)

Power supply Single phase, 100V  $^{+10\%}_{-15\%}$  to 115V  $^{+10\%}_{-15\%}$ Built-in thermostat of an external regenerative resistor (light yellow) ON OFF ALM



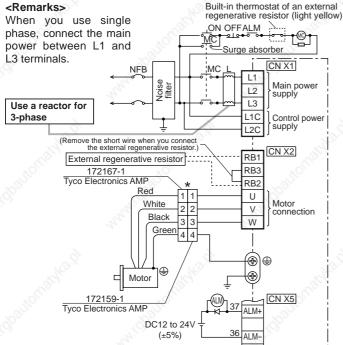
#### In Case of Single Phase, 200V (A and B-frame)

Power supply Single phase, 200V  $^{+10\%}_{-15\%}$  to 240V  $^{+10\%}_{-15\%}$ 



#### In Case of Single Phase, 200V (C and D-frame)

Power supply Single phase, 200V  $^{+10\%}_{-15\%}$  to 240V  $^{+10\%}_{-15\%}$ 



#### In Case of 3-Phase, 200V (C and D-frame)

Power supply 3-phase, 200V  $^{+10\%}_{-15\%}$  to 240V  $^{+10\%}_{-15\%}$ 

Built-in thermostat of an external <Remarks> regenerative resistor (light yellow) When you use single phase, connect the main power between L1 and Surge absorber L3 terminals. CN X1 Main power supply L2 L3 I 1C Control powe supply (Remove the short wire when you connect the external regenerative resistor.) RB1 External regenerative resistor RB3 172167-1 Tyco Electronics AMF RB2 Red U White Motor connection ٧ Black Green 4 4 W (<del>(</del> Motor 37 ALM+ 172159-1 Tyco Electronics AMF DC12 to 24V

\* When you use motor model of MSMA, MDMA, MFMA, MHMA and MGMA, use the connections as the right table shows...

[ Motor portion]

Connector: by Japan Aviation Electronics Ind.

Do not connect anything to NC.

JL04V-2E20-4PE-B-F JL04HV-2E22-22PE-B	
PIN No. Application	
A U-phase	
B V-phase	]

W-phase

Ground

3	GO	QHO O	A O OB
	OE	00	
JL0	4V-2E	20-1	8PE-B-I

PIN NO.	Application		
G	Brake		
Н "	Brake		
A_O	NC		
., Б\	U-phase		
92J	V-phase		
βВ	W-phase		
E	Ground		
D	Ground	Ŀ	
С	NC		

DINI No Application

	A O	ΔBO	00	Pic	
DO	)	OE		OF)	
	00/	O H	0-		
L04V	-2E	24-	11F	E-B	-

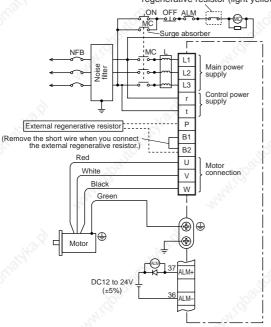
	PIN No.	Application
	(S) A	Brake
	В	Brake
	С	NC
	D	U-phase
	Е	V-phase
	F	W-phase
	G	Ground
	Η	Ground
		NC

36 ALM-

#### In Case of 3-Phase, 200V (E and F-frame)

Power supply 3-phase, 200V  $^{+10\%}_{-15\%}$  to 230V  $^{+10\%}_{-15\%}$ 

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



[ Motor portion]

Connector: by Japan Aviation Electronics Ind.



JL04V-2E20-4PE-B-R JL04HV-2E22-22PE-B-R

PIN No.	Application						
Α	U-phase						
В	V-phase						
С	W-phase						
D	Ground						





JL04V-2E20-18PE-B-R

PIN No. Application						
G	Brake					
Н	Brake					
Α δ	NC					
F.O.X	U-phase					
- 39)	V-phase					
В	W-phase					
E	Ground					
D	Ground					
С	NC					

١	JLU4V-2E24-11PE-D-P					
	PIN No.	Application				
	Α	Brake				
	В	Brake				
	C	NC				
	D 33	U-phase				
	E	V-phase				
	F	W-phase				
	G	Ground				
Ì	Н	Ground				
	ı	NC				

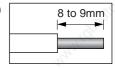
<Remark> Do not connect anything to NC.

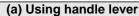
#### Wiring method to connector (A to D-frame)

• Follow the procedures below for the wiring connection to the Connector CN X1 and X2.

## How to connect

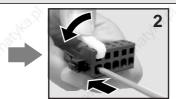
- 1. Peel off the insulation cover of the cable. (see the right fig for exact length for peeling.)
- 2. Insert the cable to the connecter in the following 2 methods.
  - (a) Using the attached Handle Lever
  - (b) Using a screw driver (blade width of 3.0 to 3.5 mm)







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



Insert the peeled cable while pressing down the lever, until it hits the insertion slot (round hole).



Release the lever.

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

#### (b) Using screw driver



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).

ert the peeled cable le pressing down the

#### <CAUTION>

3

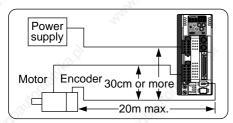
- Peel off the cable with exact length (8 to 9 mm).
- Take off the connector from the Servo Driver before making connection.
- Insert one cable into each one of cable insertion slot.
- Pay attention to injury by screw driver.



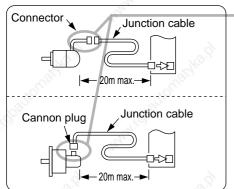
## **System Configuration and Wiring**

## Wiring to the Connector, CN X6 (Connection to Encoder)

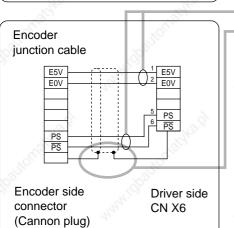
#### **Tips on Wiring**



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



- Encoder outlets are different by the motors, flyer leads + connecter and cannon plug type.
- OWhen you make your own encoder junction cable (for connectors, refer to P.319, "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 0.18mm<sup>2</sup> or larger (AWG24), and with higher bending resistance.



- -3) Use twisted pair cable for corresponding signal/power wiring.
- 4) Shielding treatment
  - Shield wall of the driver side : Connect to Pin-20 (FG) of CN X6.
  - Shield wall of the motor side :

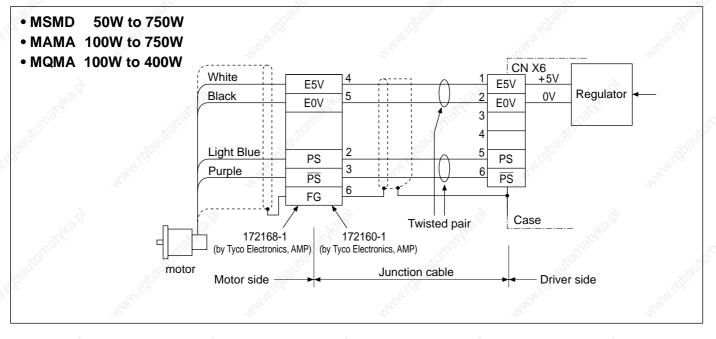
Tyco Electronics AMP

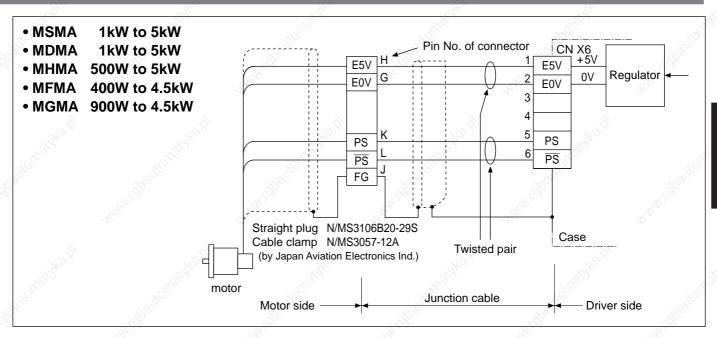
In case of 9-pin (17-bit absolute/incremental encoder): Connect to pin-3. In case of 6-pin (2500P/r incremental encoder): Connect to pin-6. In case of cannon plug, connect to Pin-J.

5) Connect nothing to the empty terminals of each connector and Cannon Plug.

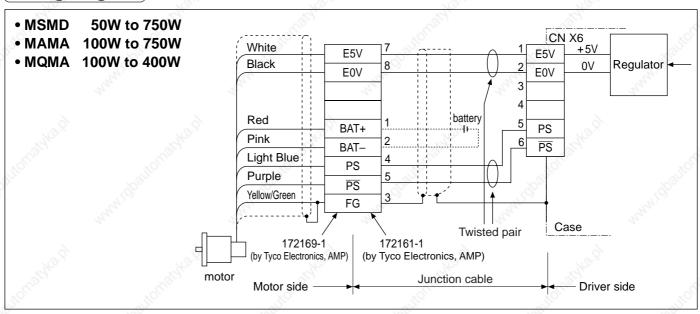
#### Wiring Diagram

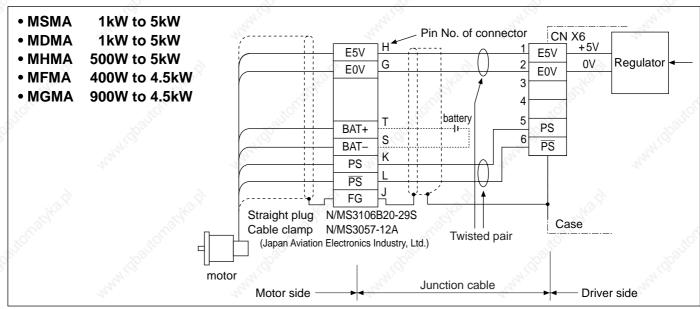
In case of 2500P/r incremental encoder





### Wiring Diagram In case of 17-bit absolute/incremental encoder





## **System Configuration and Wiring**

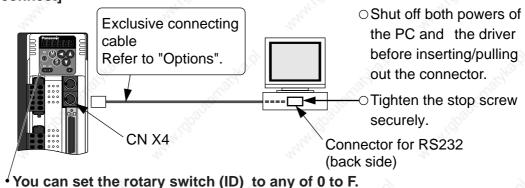
#### Wiring to the Connectors, CN X3 and X4 (Connection to PC, Host or Console)

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

#### In Case of Communication with One Driver Using RS232

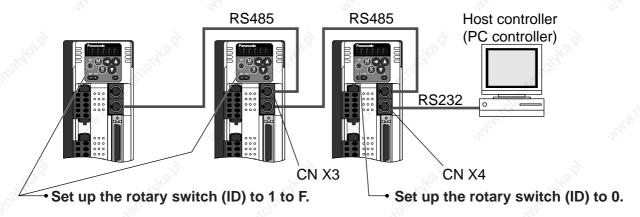
By connecting the PC and the driver via RS232, you can utilize the setup support software, "PANATERM®" (option). "PANATERM "offers useful functions such as monitoring of various status, setup/change of parameters and waveform graphic display and so on.

#### [How to connect]



#### In Case of Communication with Multiple Drivers Using 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..



## In Case of Communication with Multiple Drivers Using RS485 Only

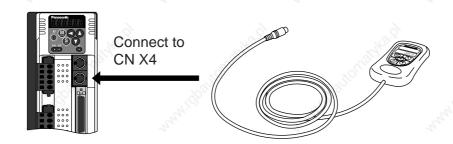
By connecting the host with all drivers via RS485 you can realize connection with multiple drivers.

• Set up the rotary switch (ID) to 1 to F.

#### <Notes>

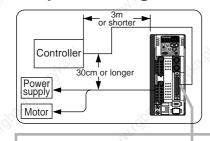
- You can connect up to 15 drivers with the host.
- For details, refer to P.278, "Communication" of Supplement.

#### **Connection with the Console**



## Wiring to the Connector, CN X5 (Connection to Host Controller)

#### Tips on wiring



СОМ+

COM-

FG

GND

- Peripheral apparatus such as host controller should be located within 3m
- Separate the main circuit at least 30cm away.
   Don't pass them in the same duct, nor bind them together.
- Power supply for control signals (Vcc) between COM+ and COM- (Vbc) 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 24V to the control signal output terminals, nor run 50mA 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) is connected to the earth terminal inside of the driver.
- For detailed information, refer to Wiring Diagram at each control mode, P.83 (Position control mode), P.127 (Velocity control mode), P.161 (Torque control mode) and P.192 (Full-closed control mode).

#### Specifications of the Connector, CN X5

Connector at driver side	Connecter to be pre	Manufacturer	
Connector at universide	Part name Part No.		
"14 <sup>1</sup> 6.01	Connector (coldering type)	54306-5011 or	20
	Connecter (soldering type)	54306-5019 (lead-free)	Molex Inc.
F2006 F074	Connector cover 54331-0501		
52986-5071	. 500	or	Page 190
	Connecter (soldering type) 10150-3000VE		Cumitomo 2M
	Connector cover	10350-52A0-008	Sumitomo 3M

#### <Note>

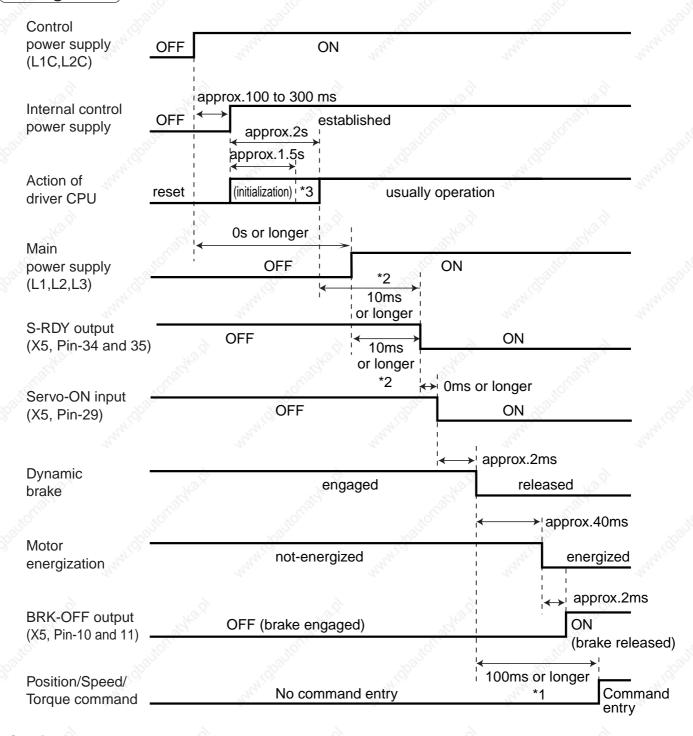
For details, refer to P.312, "Options" of Supplement.

#### <Remarks>

• Tightening torque of the screws for connector (CN X5) for the connection to the host to be 0.3 to 0.35N·m. Larger tightening torque than these may damage the connector at the driver side.

## **Timing Chart**

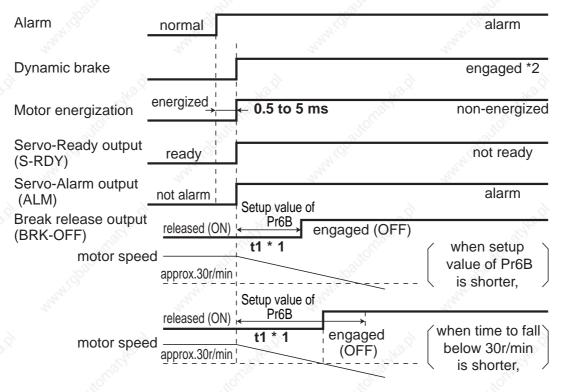
#### Timing Chart



#### <Cautions>

- The above chart shows the timing from AC power-ON to command input.
- Activate the external command input according to the above timing chart.
- \*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 overtravel inhibit input (CWL,CCWL) or external scale input, so as to decide their logic until this term.

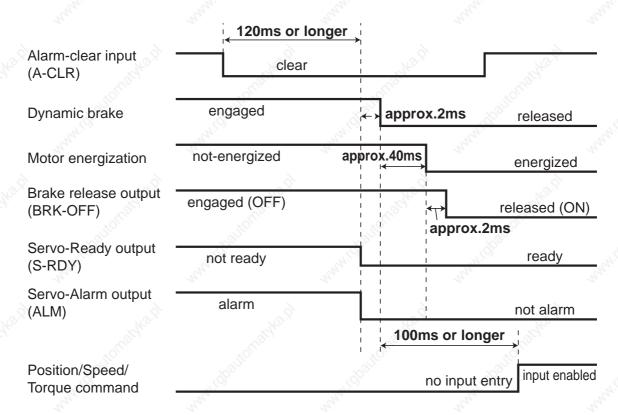
### When an Error (Alarm) Has Occurred (at Servo-ON Command)



#### <Cautions>

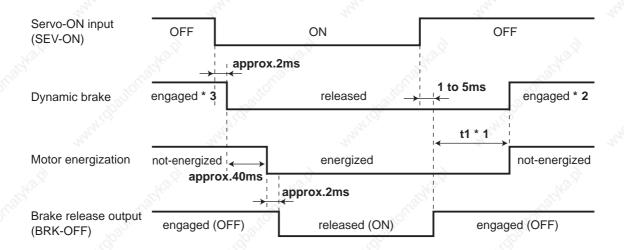
- \*1. t1 will be a shorter time of either the setup value of Pr6B or elapsing time for the motor speed to fall below 30r/min.
  - t1 will be 0 when the motor is in stall regardless of the setup pf Pr6A.
- \*2. For the action of dynamic brake at alarm occurrence, refer to an explanation of Pr68, "Sequence at alarm ("Parameter setup" at each control mode) as well.

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



## **Timing Chart**

#### Servo-ON/OFF Action While the Motor Is at Stall (Servo-Lock)

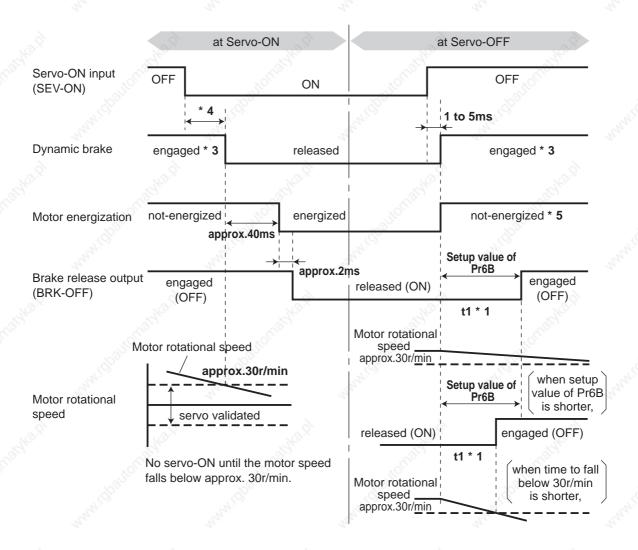


#### <Cautions>

- \*1. t1 will be determined by Pr6A setup value.
- \*2. For the dynamic brake action at Servo-OFF, refer to an explanation of Pr69, "Sequence at Servo-OFF ("Parameter setup" at each control mode) as well.
- \*3. Servo-ON will not be activated until the motor speed falls below approx. 30r/min.

#### Servo-ON/OFF Action While the Motor Is in Motion

(Timing at emergency stop or trip. Do not repeat this sequence. During the normal operation, stop the motor, then make Servo-ON/OFF action.)



#### <Cautions>

- \*1. t1 will be a shorter time of either the setup value of Pr6B or elapsing time for the motor speed to fall below 30r/min.
- \*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 Pt69, "Sequence at Servo-OFF ("Parameter setup" at each control mode) as well.
- \*4. Servo-ON will not be activated until the motor speed falls below approx. 30r/min.
- \*5. For the motor energization during deceleration at Servo-OFF, refer to an explanation of Pr69, "Sequence at Serve-OFF ("Parameter setup" at each control mode) as well.

## **Built-in Holding Brake**

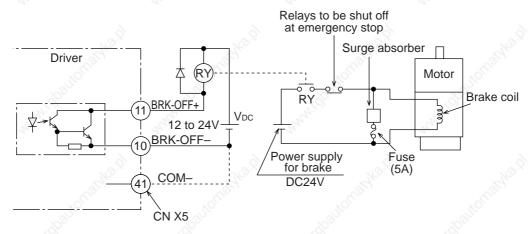
In the applications where the motor drives the vertical axis, this brake would be used to hold and prevent the work (moving load) from falling by gravity while the power to the servo is shut off.

#### <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.



#### <Notes, Cautions>

- 1. The brake coil has no polarity.
- 2. Power supply for the brake to be provided by customer. Do not co-use the power supply for the brake and for the control signals (VDC).
- 3. Install a surge absorber as the above Fig. shows to suppress surge voltage generated by ON/OFF action of the relay (RY). When you use a diode, note that the time from the brake release to brake engagement is slower than that of the case of using a surge absorber.
- 4. For a surge absorber, refer to P.323, "Recommended Components" of Supplement.
- 5. Recommended components are specified to measure the brake releasing time. Reactance of the cable varies depending on the cable length, and it might generate surge voltage. Select a surge absorber so that relay coil voltage (max. rating : 30V, 50mA) 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.42, "Timing Chart".
- With the parameter, Pr6B (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.

#### <Notes>

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

#### **Specifications of Built-in Holding Brake**

Motor series	Motor output	Static friction torque N·m	Rotor inertia X10 <sup>-4</sup> kg·m <sup>2</sup>	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 <sup>3</sup> J																					
MOMB	50W, 100W	0.29 or more	0.002	35 or less	40 1	0.25	D00)/	39.2	4.9																					
MSMD	200W, 400W	1.27 or more	0.018	50 or less	10 or less	≥ 0.30	DC2V	137	44.1																					
MAMA	750W	2.45 or more	0.075	70 or less	20 or less	0.35	or more	196	147																					
NAONAA	100W	0.29 or more	0.03	50 or less	45 -	0.29	DC1V	137	44.1																					
MQMA	200W, 400W	1.27 or more	0.09	60 or less	15 or less	0.41	or more	196	147																					
	1.0kW	4.9 or more	0.25	50 l ·	45	0.74	(G)		196																					
	1.5kW, 2.0kW	7.8 or more	0.00	50 or less	15 or less	0.04	L.	392	400																					
MSMA	3.0kW	11.8 or more	0.33	80 or less	(100)	0.81		3	490																					
ALO.	4.0kW, 5.0kW	16.1 or more	1.35	110 or less	50 or less (130)	0.90	S. Light Blicker	1470	2156																					
Tion or	1.0kW	4.9 or more	1.05	80 or less	70 or less (200)	0.59		"igparitotio	(lipalitotto	(1900 profession	(lg) <sub>elfeles</sub>	I GO BITCH S		~altona	~altono	- Siltorna					" SIIIO (10)		Micho	alicho	autoria	automa	autoria		588	780
	1.5kW, 2.0kW	13.7 or more	1.35	100 or less	50 or less	0.79							1176	1470																
MDMA	3.0kW	16.1 or more		110 or less	(130)	0.90		1470	2156																					
MIDIMA	4.0kW	21.5 or more	4.25	90 or less	35 or less (150)	1.10		1078	2450																					
Mapha.	5.0kW	24.5 or more	4.7		25 or less (200)	1.30			1372	2940																				
	500W, 1.0kW	4.9 or more	Popula	80 or less	70 or less (200)	0.59	DC2V	588	784																					
МНМА	1.5kW	13.7 or more	1.35	100 or less	50 or less (130)	0.79	or more	1176	1470																					
Aro. S	2.0kW to 5.0kW	24.5 or more	4.7	93	25 or less (200)	1.30		1372	2940																					
Tiplio.	400W	4.9 or more	1.35	80 or less	70 or less (200)	0.59	120 High	588	784																					
MFMA	1.5kW	7.8 or more	4.7		35 or less (150)	0.83	N <sub>io</sub> ,	1372	2940																					
	2.5kW	21.6 or more	0.75	450	100 or less	0.75		4.470	1470																					
20	4.5kW	31.4 or more	8.75	150 or less	(450)	0.75		1470	2156																					
"OLUGIA"	900W	13.7 or more	1.35	100 or less	50 or less (130)	0.79	, official	1176	1470																					
MGMA	2.0kW	24.5 or more	4.7	80 or less	25 or less (200)	1.3	(d)alite	4070	2040																					
	3.0kW, 4.5kW	58.8 or more	4.7	150 or less	50 or less (130)	1.4		1372	2940																					

- Excitation voltage is DC24±10%.
- \* Values represent the ones with DC-cutoff using a surge absorber for holding brake.

  Values in ( ) represent those measured by using a diode (V03C by Renesas Technology Corp.)
- 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.
- Permissible angular acceleration: 30000rad/s² for MAMA series

10000rad/s² for MSMD, MQMA, MSMA, MDMA, MHMA, MFMA and MGMA series

• 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.)

## **Dynamic Brake**

This driver is equipped with a dynamic brake for emergency stop.

Pay a special attention to the followings.

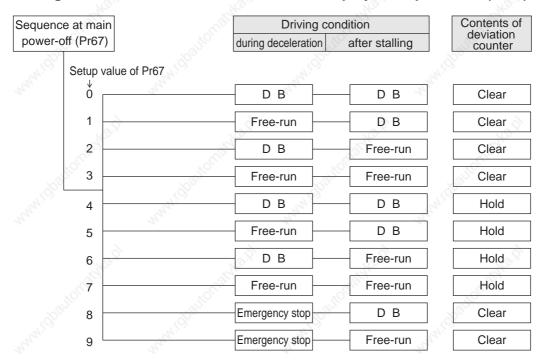
#### <Caution>

1. Dynamic brake is only for emergency stop.

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

The motor becomes a dynamo when driven externally, and shorting current runs while this dynamic brake is activated and might cause smoking or fire.

- 2. Dynamic brake is a short-duration rating, and designed for only emergency stop. Allow approx. 3 minutes pause when the dynamic brake is activated during high-speed running. (Over-current protection (error code No. 14) may be activated when the dynamic brake circuit inside the F-frame amplifier has overheated.)
- 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 (CWL, CCWL) of CN X5 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, the dynamic brake will be kept activated.
  - 1) Setup of driving condition from deceleration to after stop by main power-off (Pr67)



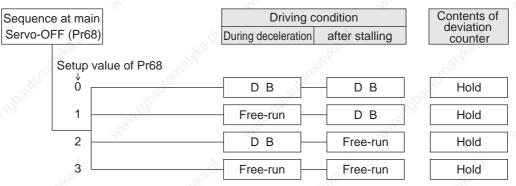
Torque limit value at emergency stop will be that of Pr6E (Setup of torque at emergency stop) when the setup value is 8 or 9.

#### 2) Setup of driving condition from deceleration to after stop by Servo-OFF (Pr69)

Sequence at main			Driving co	Driving condition			
Servo-OFF (Pr69)		During deceleration	after stalling	deviation counter			
	Setup val	lue of Pr69					
	o L		D B	D B	Clear		
	1 -		Free-run	D B	Clear		
	2 —	70,70,	D B	Free-run	Clear		
	3 —	- 1241 <sub>[0]</sub>	Free-run	Free-run	Clear		
	4	13,	D B	D B	Hold		
	5		Free-run	D B	Hold		
	6		D B	Free-run	Hold		
	7	<u> </u>	Free-run	Free-run	Hold		
	8	Allen .	Emergency stop	D B	Clear		
	9		Emergency stop	Free-run	Clear		

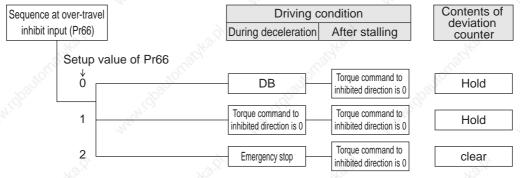
Torque limit value at emergency stop will be that of Pr6E (Setup of torque at emergency stop) when the setup value is 8 or 9.

## 3) Setup of driving condition from deceleration to after stop by activation of protective function (Pr68)



Deviation counter at activation of protective function will be cleared at alarm-clear.

## 4) Setup of driving condition from deceleration to after stop by validation of over-travel inhibit input (Pr66)



Torque limit value during deceleration will be that of Pr6E (Setup of torque at emergency stop) when the setup value is 2.

Changes will be validated after the control power is turned on.

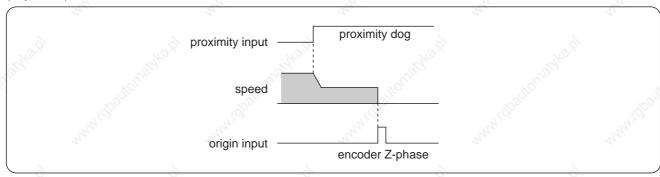
## **Caution on Homing Operation**

• 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.

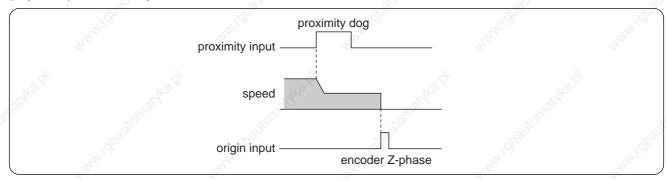
For the details of homing, observe the instruction manual of the host controller.

#### **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



## **Setup of Parameter and Mode**

### **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.

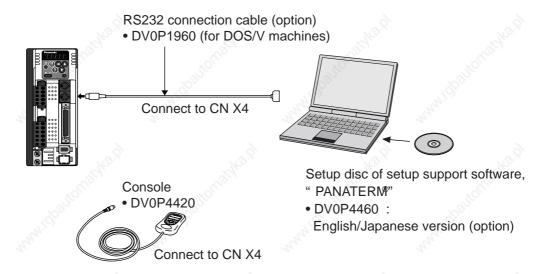
### **How to Set**

- 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®" (Option, DV0P4460: English/Japanese version) and PC.
  - 3) Console (DV0P4420, option)

#### <Note>

For setup of the parameters on PC screen, refer to the instruction manual of the "PANATERM®".

### **How to Connect**



#### <Remarks>

- Connect the console connector to the connector, CN X4 of the driver securely.
- Do not pull the cable to insert/unplug.

# **Setup of Parameter and Mode**

## **Composition and List of Parameters**

Group	Parameter No. (Pr□□)	Outline
Functional selection	00 to 0F	You can select a control mode, designate I/O signals and set up a baud rate.
Adjustment	10 to 1F, 27 to 2E	You can set up servo gains (1st and 2nd) of position, velocity, integration, etc, and time constants of various filters.
go <sup>nic</sup>	20 to 26, 2F	Parameters related to Real Time Auto-Gain Tuning. You can set up a mode and select a mechanical stiffness.
Try,	30 to 3F	You can set up parameters related to gain switching(1st ←→ 2nd)
Position (Step) Control	40 to 4F	You can set up an input form, directional selection of command pulses, dividing of encoder output pulse and set up a division multiplier ratio of command pulse.
Velocity Control, Torque Control	50 to 5A, 74 to 77	You can set up an input gain of command pulse, reverse polarity and adjust offset. You can also set up internal speeds (1 to 8th speed), acceleration/deceleration time.
9	5B to 5F	You can set an input gain, reverse polarity and set up a torque limit of torque command.
Sequence	60 to 6F	You can set up detecting conditions of output signals, such as positioning-complete and zero-speed.  You can also set up a deceleration/stop action at main power-off, at alarm output and at servo-off, and clear condition of the deviation counter.
	70 to 73	You can set up actions of protective functions.
Full-Closed Control	78 to 7F	You can set up dividing of external scale.

For details, refer to "Parameter Setup" of each control mode.

#### • In this document, following symbols represent each mode.

Symbol	Control mode	Setup value of Pr02
Р	Position control	0
S	Velocity control	1
Т	Torque control	2
F	Full-Closed control	6

Symbol	Control mode	Setup value of Pr02
P/S	Position (1st)/Velocity (2nd) control	3*
P/T	Position (1st)/Torque (2nd) control	4*
S/T	Velocity (1st)/Torque (2nd) control	5*

<sup>\*</sup> 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 open: 1st mode selection When C-Mode is closed: 2nd mode selection

Do not enter the command 10ms before/after the switching.

### **Parameters for Functional Selection**

Parameter No. (Pr □□)	Set up of parameter	Range	Default	Unit	Related Control Mode
00 *1	Address of axis	0 to 15	1	21/4	all
01 *1	Initial display of LED	0 to 17	1	_	all
02 *1	Setup of control mode	0 to 6	1.8	_	all
03	Selection of torque limit	0 to 3	_1 <sup>©</sup>	_	P, S, F
04 *1	Setup of over-travel inhibit input	0 to 2	_&®1	_	all
05	Switching of Internal/External speed setup	0 to 3	0	- "Š	S
06	Selection of ZEROSPD input	0 to 2	0	<del>-</del> 95,	S, T
07	Selection of speed monitor (SP)	0 to 9	3	- 41 44.	all
08	Selection of torque monitor (IM)	0 to 12	0	1.	all
09	Selection of TLO output	0 to 8	0	_	all
0A	Selection of ZSP output	0 to 8	10×	_	all
0B *1	Setup of absolute encoder	0 to 2	<u>√</u> 81	-	all
0C *1	Baud rate setup of RS232	0 to 5	2	- 3	all
0D *1	Baud rate setup of RS485	0 to 5	2	-'95,	all 📈
0E *1	Setup of front panel lock	0 to 1	0	"4 <sub>7</sub>	all
0F	(For manufacturer's use)	27,	_	24.	-4,

<sup>•</sup> For parameters with suffix of "\*1", change will be validated after the reset of the control power.

### Parameters for Adjustment of Time Constant for Gains and Filters

Parameter No. (Pr □□)	Set up of parameter	Range	Def		Unit	Related Control Mode	
10	1st gain of position loop	0 to 3000	<63>	<32>	1/s		
11	1st gain of velocity loop	1 to 3500	<35>	<18>	Hz	all	
12	1st time constant of velocity loop integration	1 to 1000	<16>	<31>	ms	all	
13	1st filter of velocity detection	0 to 5	<(	0>	_	all	
14	1st time constant of torque filter	0 to 2500	<65>	<126>	0.01ms	all	25
15	Velocity feed forward	-2000 to 2000	<30	>00	0.1%	P, F	7035
16	Time constant of feed forward filter	0 to 6400	<5	<0>	0.01ms	P, F	150
17	(For manufacturer's use)	77	-	-	122	-7,4	
18	2nd gain of position loop	0 to 3000	<73>	<38>	1/s	P, F	
19	2nd gain of velocity loop	1 to 3500	< 35>	< 18>	Hz	all	
1A	2nd Time constant of velocity loop integration	1 to 1000	<10	000>	ms	all	
. 1B	2nd filter of velocity detection	0 to 5	, o ( < (	0>		all	*0
1C	2nd torque filter time constant	0 to 2500	<65>	<126>	0.01ms	all	1000
1D	1st notch frequency	100 to 1500	15	00	Hz	all	150,
1E	Selection of 1st notch width	0 to 4	2	2	2777	all	
1F	(For manufacturer's use)	-	-	-	_	_	
27	Setup of instantaneous velocity observer	0 to 1	<(	0>0	_	P, S	
28	2nd notch frequency	100 to 1500	15	00	Hz	all	
29	Selection of 2nd notch width	0 to 4	1002	2	-	all	
2A	Selection of 2nd notch depth	0 to 99	S (	)	- 20	all	28/20
2B	1st damping frequency	0 to 2000	(	)	0.1Hz	P, F	(10)
2C	Setup of 1st damping filter	-200 to 2000	(	)	The.	P, F	
2D	2nd damping frequency	0 to 2000	(	)	0.1Hz	P, F	
2E 👌	Setup of 2nd damping filter	-200 to 2000	(	6 (	_	∂ P, F	

<sup>•</sup> For parameters which default values are parenthesized by "< >", default value varies automatically by the real-time auto-gain tuning function. Set up Pr21 (Setup of Real-time auto-gain tuning mode) to 0 (invalid) when you want to adjust manually.

## **Setup of Parameter and Mode**

#### **Parameters for Auto-Gain Tuning**

Parameter No. (Pr □□)	Set up of parameter	Range	Default A to C-frame D to F-frame	Unit	Related Control Mode
20	Inertia ratio	0 to 10000	<250>	%	All M
21	Setup of real-time auto-gain tuning mode	0 to 7	1	_	All
22	Mechanical stiffness at real-time auto-gain tuning	0 to 15	4 1	_	All
23	Setup of adaptive filter mode	0 to 2	101	_	P, S, F
24	Selection of damping filter switching	0 to 2	0	_	, of P, F
25	Setup of action at normal mode auto-gain tuning	0 to 7	0	- <sub>20</sub> 3	All
26	Setup of software limit	0 to 1000	10	0.1rev	P, F
2F *3	Adaptive filter frequency	0 to 64	0	1/2,	P, S, F

<sup>\*3</sup> this parameter will be automatically set up when the adaptive filter is validated (Pr23, "Setup of adaptive filter mode" is "1", and you cannot set this up at your discretion. Set up Pr23, "Setup of adaptive filter mode" to "0" (invalid) to clear this parameter.

### Parameters for Adjustment (2nd Gain Switching Function)

Parameter No.		_ 41 <sub>17</sub>	5.4.1	717	444	
(Pr □□)	Set up of parameter	Range	Default	Unit	Related Control Mode	
30	Setup of 2nd gain	0 to 1	<1>	_	All	
31	1st mode of control switching	0 to 10	<0>	-	All	
32	1st delay time of control switching	0 to 10000	<30>	166μS	All	
33	1st level of control switching	0 to 20000	< 50>	- %	All	
34	1st hysteresis of control switching	0 to 20000	<33>	-450	All	
35	Time for position gain switching	0 to 10000	<20>	(1+setup value) x 166µs	P, F	
36	2nd mode of control switching	0 to 5	<0>	_	S, T	
37	2nd delay time of control switching	0 to 10000	0 0	166μS	S, T	
38	2nd level of control switching	0 to 20000	0	_	S, T	
39	2nd hysteresis of control switching	0 to 20000	20110	-	S, T	
3A	(For manufacturer's use)	- 26	S -	- 200	- <sub>20</sub> 0	
3B	(For manufacturer's use)	- 45	_	-4.50	- 45	
3C	(For manufacturer's use)	-14	_	4 <sub>0</sub>	- 1/4	
3D	Setup of JOG speed	0 to 500	300	r/min	All	
3E	(For manufacturer's use)	S -	- 25	_	- (2 <sub>0</sub> 0	
3F	(For manufacturer's use)	_	39	_	367 -	

<sup>•</sup> For parameters which default values are parenthesized by "< >", default value varies automatically by the real-time auto-gain tuning function. Set up Pr21 (Setup of Real-time auto-gain tuning mode) to 0 (invalid) when you want to adjust manually.

<sup>\*</sup> In this documentation, each mode is represented by the following symbols

P: Position control, S: Velocity control, T: Torque control, F: Full-closed control, P/S: Position (1st),/Velocity (2nd) control, P/T: Position (1st)/Torque (2nd) control, S/T: Velocity (1st)/Torque (2nd) control

### **Parameters for Position Control**

Parameter No. (Pr □□)	Set up of parameter	Range	Default	Unit	Related Control Mode	
40*1	Selection of command pulse input	0 to 1	0	144	P, F	
41*1	setup of rotational direction of command pulse	0 to 1	0	_	P, F	
42*1	setup of command pulse input mode	0 to 3	1,0	_	P, F	
43	Canceling of command pulse prohibition input	0 to 1	. 1	_	P, F	
44*1	Numerator of pulse output division	1 to 32767	2500		all	
45*1	Denominator of pulse output division	0 to 32767	0	- 200	all	
46*1	Logic reversal of pulse output	0 to 3	0	'2'. C).	all	
47*1	Setup of Z-phase of external scale	0 to 32767	0	774,-	Full	
48	1st numerator of electronic gear	0 to 10000	0	_	P, F	
49	2nd numerator of electronic gear	0 to 10000	0 0	_	P, F	
4A	Multiplier for numerator of electronic gear	0 to 17	0	_	P, F	
4B	Denominator of electronic gear	1 to 10000	10000	- x	P, F	
4C	Setup of smoothing filter for primary delay	0 to 7	1	- 2002	P, F	
4D*1	Setup of FIR smoothing	0 to 31	0	P, F		
4E	Counter clear input mode	0 to 2	1	л <sup>и</sup> – Р, F		
4F	(For manufacturer's use)	_		_	_	

<sup>•</sup> For parameters with suffix of "\*1", change will be validated after the reset of the control power.

## Parameters for Velocity/Torque control

Parameter No. (Pr □□)	Set up of parameter	Range	Default	Unit	Related Control Mode
50	Input gain of speed command	10 to 2000	500	(r/min)/V	S, T
51	Input reversal of speed command	0 to 1	1,5	_	S
52	Offset of speed command	-2047 to 2047	0	0.3mV	S, T
53	1st speed of speed setup	-20000 to 20000	(O)	r/min	S s
54	2nd speed of speed setup	-20000 to 20000	0	r/min	S XO
55	3rd speed of speed setup	-20000 to 20000	0	r/min	S M
56	4th speed of speed setup	-20000 to 20000	0	r/min	S, T
74	5th speed of speed setup	-20000 to 20000	0	r/min	S
75	6th speed of speed setup	-20000 to 20000	0 %	r/min	S
76	7th speed of speed setup	-20000 to 20000	0	r/min	S
77	8th speed of speed setup	-20000 to 20000	(C) 0	r/min	S
57	Setup of speed command filter	0 to 6400	0	0.01ms	S, T
58	Setup of acceleration time	0 to 5000	0	2ms/(1000r/min)	S M
59	Setup of deceleration time	0 to 5000	0	2ms/(1000r/min)	S
5A	Setup of sigmoid acceleration/deceleration time	0 to 500	0	2ms	S
5B	Selection of torque command	0 to 1	0	_	√2 <sup>,2</sup> T
5C	Input gain of torque command	10 to 100	30	0.1V/rated torque	Jail T
5D	Input reversal of torque command	0 to 1	0	- 3	T NO
5E	Setup of 1st torque limit	0 to 500	<500>*2	%	all
5F	Setup of 2nd torque limit	0 to 500	<500>*2	%	P, S, F

<sup>\*2</sup> Defaults of Pr5E and Pr5F vary depending on the combination of the driver and the motor. Refer to P.57, "Setup of Torque Limit".

# **Setup of Parameter and Mode**

#### **Parameters for Sequence**

Parameter No. (Pr □□)	Set up of parameter	Range	Default	Unit	Related Control Mode	
60	In-position (positioning complete) range	0 to 32767	131	Pulse	P, F	
61	Zero speed	10 to 20000	50	r/min	all	
62	At-speed (arrived speed)	10 to 20000	1000	r/min	S, T	
63	Setup of in-position output	0 to 3	0	_	P, F	
64	(For manufacturer's use)	_	.of 2	_	.dr°	
65	Selection of LV-trip at main power off	0 to 1	(a <sup>V)</sup> 1	- %	all	
66*1	Sequence at run-prohibition	0 to 2	0	-4'CO.	all	
67	Sequence at main power off	0 to 9	0	7/2	all 🔊	
68	Sequence at alarm	0 to 3	0	_	all	
69	Sequence at servo-off	0 to 9	0 0	_	all	
6A	Setup of mechanical brake action at stall	0 to 100	0	2ms	all	
6B	Setup of mechanical brake action in motion	0 to 100	0	2ms	all	
6C*1	Selection of external regenerative resister	0 to 3	A, B-frame : 3, C,D,E-frame : 0	i <sub>0x</sub> –	all so	
<sup>∂</sup> 6D*1	Detection time of main power shut-off	35 to 1000	35	2ms	all	
6E	Setup to torque at emergency stop	0 to 500	0	%	all	
6F	(For manufacturer's use)	_	_	_	_	
70	Excess setup of positional deviation	0 to 32767	25000	256Pulse	P, F	
71	Excess setup of analog input	0 to 100	0	0.1V	S, T	
72	Setup of over-load level	0 to 500	.00	%	all	
73	Setup of over-speed level	0 to 20000	0	r/min 🧬	all	

### Parameters for Full-Closed Control

Parameter No. (Pr □□) Set up of parameter		Range	Default	Unit	Related Control Mode		
78*1	Numerator of external scale division	0 to 32767	, to 0	_	F s		
79*1	Numerator multiplier of external scale division	0 to 17	ூ் 0	- 70	F N		
7A*1 Denominator of external scale division		1 to 32767	10000	747	F whi		
7B*1	Excess setup of hybrid deviation	1 to 10000	100	16X external scale pulses			
7C*1	Reversal of direction of external scale	0 to 1	0	_	F		
7D 🔗	(For manufacturer's use)	°5. –	-70'5,	_	70·2		
7E	7E (For manufacturer's use)		7 <u>-</u> 70),	_	79 <sub>101</sub> -		
7F	(For manufacturer's use)	_	10°-	_	<u> </u>		

<sup>•</sup> For parameters with suffix of "\*1", change will be validated after the reset of the control power.

<sup>\*</sup> In this documentation, each mode is represented by the following symbols

P: Position control, S: Velocity control, T: Torque control, F: Full-closed control, P/S: Position (1st),/Velocity (2nd) control, P/T: Position (1st)/Torque (2nd) control, S/T: Velocity (1st)/Torque (2nd) control

### **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	Frame	Model No.	Applicable motor	Max. value of torque limit
Α-	MADDT4007	MAMA012P1*	500		103	MGMA092P1*	225
frame	MADDT1207	MAMA012S1*	500	]  D-	MDDDTEE	MGMA092S1*	225
B-	MDDDT0040	MAMA022P1*	500	frame	MDDDT5540	MAMA082P1*	500
frame	MBDDT2210	MAMA022S1*	500			MAMA082S1*	500
	77.00	MAMA042P1*	500	24.50	MEDDIAGO	MGMA202P1*	230
C-	MODDTOFOO	MAMA042S1*	500	272,	MFDDTA390	MGMA202S1*	230
frame	MCDDT3520	MHMA052P1*	255	F- frame		MGMA302P1*	235
ļ.,		MHMA052S1*	255		MEDDEDOAG	MGMA302S1*	235
- A		de	"The	]	MFDDTB3A2	MGMA452P1*	255
						MGMA452S1*	255

• The above limit applies to Pr5E, 1st torque limit setup, Pr5F, 2nd torque limit setup and Pr6E, Torque setup at emergency stop.

#### <Caution>

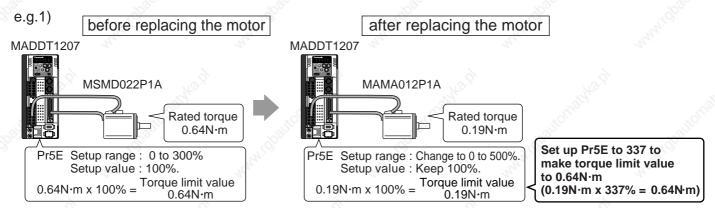
When you change the motor model, above max. value may change as well. Check and reset the setup values of Pr5E, Pr5F and Pr6E.

#### **Cautions on Replacing the Motor**

As stated above, torque limit setup range might change when you replace the combination of the motor and the driver. Pay attention to the followings.

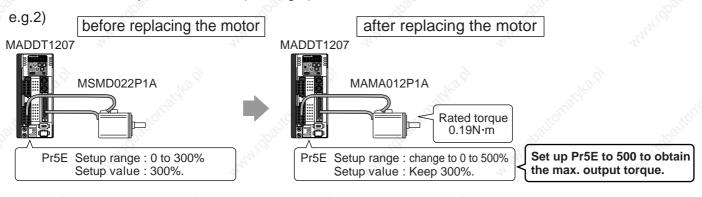
#### 1. When the motor torque is limited,

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)



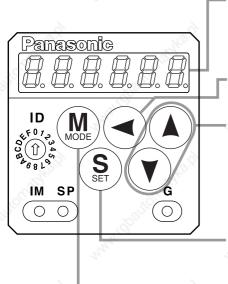
#### 2. When you want to obtain the max. motor torque,

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)



### **Setup with the Front Panel**

#### Composition of Touch Panel and Display



Display LED (6-digit)

All of LED will flash when error occurs, and switch to error display screen. All of LED will flash slowly when warning occurs.

Shifting of the digit for data changing to higher digit. (Valid to the digit whose decimal point flashes.)

Press these to change display and data, select parameters and execute actions.

(Change/Selection/Execution is valid to the digit which decimal point flashes.)

Numerical value increases by pressing, decreases by pressing (▼).

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

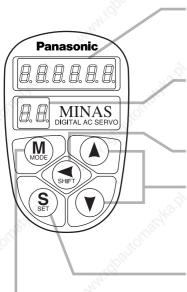
Mode switching button (valid at SELECTION display)

Press this to switch 5 kinds of mode.

- 1) Monitor Mode
- 2) Parameter Set up Mode 3) EEPROM Write Mode
- 4) Auto-Gain Tuning Mode
- 5) Auxiliary Function Mode

## **Setup with the Console**

## **Composition of Touch Panel and Display**



#### Display LED (6-digit)

All of LED will flash when error occurs, and switch to error display screen.

Displays ID No. (address) of selected driver (in 2 digits).

The value set in Pr00(address) is ID No. Parameter No. is displayed (2 digits) at parameter setup mode.

Press this to shift the digit for data change.

Press these to change data or execute selected action of parameter.

Numerical value increases by pressing, (A), decreases by pressing (▼).

**SET Button** 

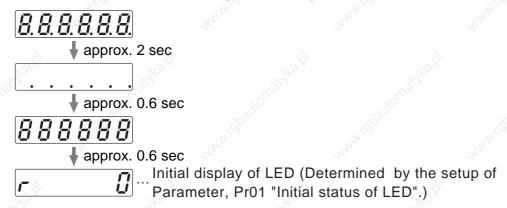
Press this to shift each mode which is selected by mode switching button to EXECUTION display.

Mode Switching Button Press this to switch 6 kinds of mode.

- 1) Monitor mode
- 2) Parameter setup mode
- 3) EEPROM write mode
- 4) Normal auto-gain tuning mode
- 5) Auxiliary function mode
- 6) Copy mode

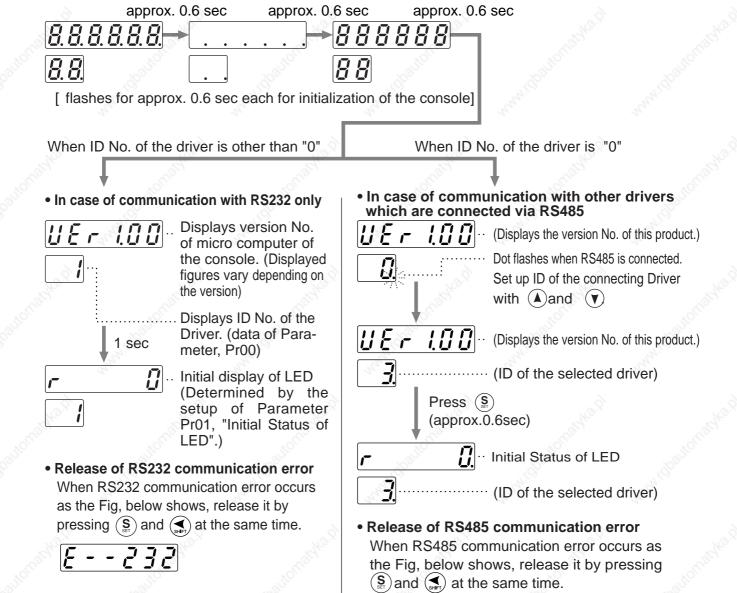
## **Initial Status of the Front Panel Display (7 Segment LED)**

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



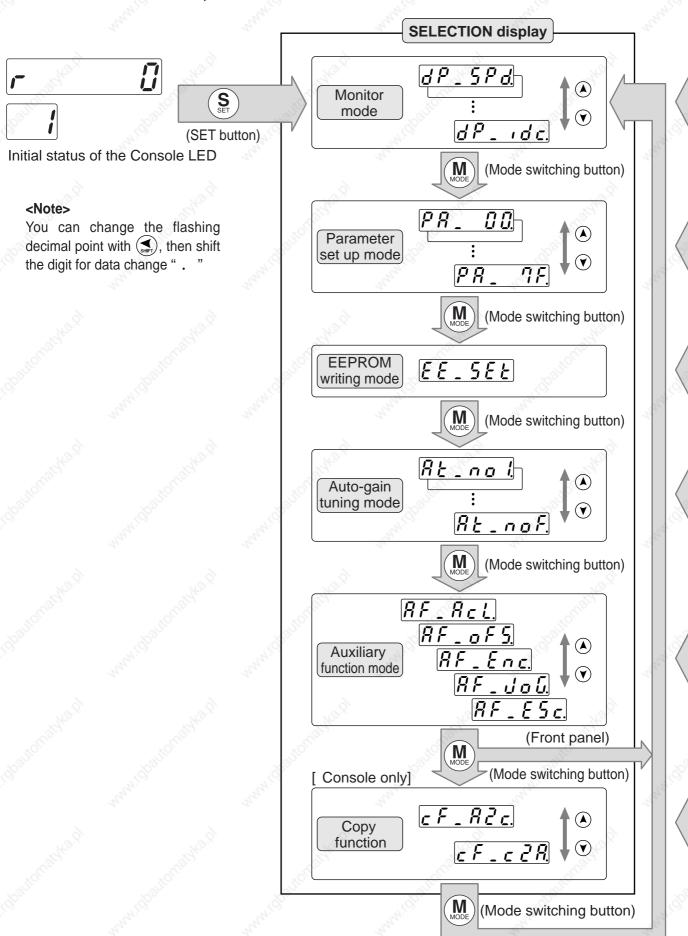
## **Initial Status of the Console Display (7 Segment LED)**

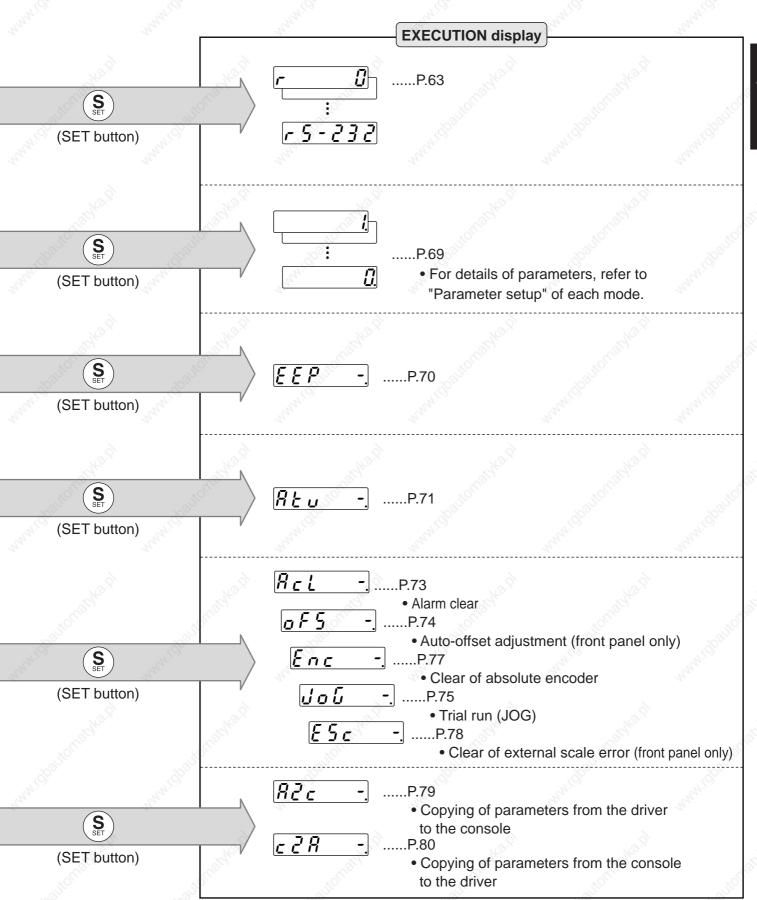
Turn on the power of the driver while inserting the console connector to the driver main body, or inserting the console connector to CN X4 connector.



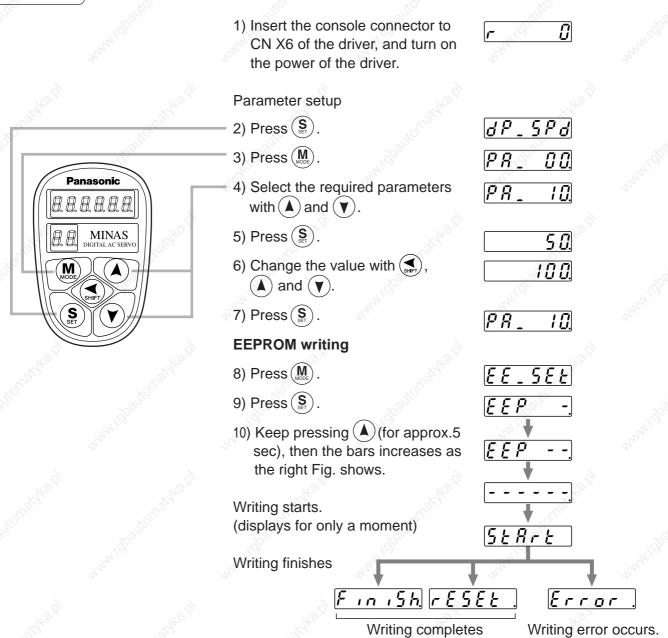
#### **Structure of Each Mode**

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





How to Set



After the writing completes, return to SELECTION display by referring to "Structure of each mode" (P.60 and 61).

#### <Remarks>

- FESEE will be displayed when you change the parameter setup which change will be validated only after the reset. Turn off the power of the driver, then reset it.
- When writing error occurs, repeat the writing. If the writing error persists, the console might be a failure.
- Do not shut down the power during EEPROM writing, otherwise wrong data might be written. In such case, set up all parameters again to write them again after full confirmation.
- Do not disconnect the console connector from the driver between <u>\$\frac{\fra</u>

## **Monitor Mode**

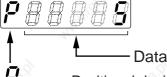
When you turn on the Product for the first time, display shows 🕝 🗓 . (at motor stall) To change this display, change the setup of Pr01 (Initial status of LED). (For details, refer to Parameter Setup of each control mode.)

	SELECTION display
- Mark	
Mar.	<b>B</b> Positional deviation
	<b>dP_5Pd</b> Motor rotational speed
. No. 13	Torque output
Cint.	Control mode
	/ I/O signal status
200	Error factor, history
Majery.	Software version
	<u>d</u> P _ r n Alarm
	Regenerative load factor
Cappyon,	Overload factor
	☐ P ☐ ☐ F ☐ Inertia ratio
	Feedback pulse sum
21/2.D	Command pulse sum
Rico.	dP_FEr External scale deviation
	External scale feedback pulse sum
(No.9)	Automatic motor recognizing function
8P_	Selection of communication [ Front panel]
[ Conso	value
	Factor for No-Motor Running
Display shift	ts toward the arrowed direction by

		EXECUTION display	
	Display example	Description	Pages to refer
P	or or	5 (5 deviation pulses)	P.64
<u></u>	100	[] (1000r/min)	P.64
<u> </u>	100.	[] (Torque output 100%)	P.64
Po	Scn	[Position control mode]	P.64
11	ı Ü.	[ (Input signal No.0 : Active)	P.64
Er	r	- (No error currently)	P.65
<b>A</b> -	0. 2	(Software version of 0.23)	P.66
<u> </u>	<u> </u>	- (No alarm)	P.66
<u>- [</u>	3	(30% of permissible regenerative power)	P.66
<u>o L</u>	2	[28% of overload factor)	P.66
<u>u</u>	10	[] (Inertia ratio 100%)	P.66
	5	(Feedback pulse sum is 50 pulses.)	P.66
	Ý.	(Command pulse sum is 10 pulses.)	P.66
FE	OLIGICA.	5 (External scale deviation is 5 pulses.)	P.66
1000	50	External scale feedback pulse sum is 500 pulses.	P.67
Ru	<u>d o</u>	(Automatic motor recognizin function is validated.)	<sup>19</sup> P.67
<u></u>	- 23	(RS232 communication)	P.67
R	10.0	(SPR input +10.00V)	P.67
c F		[No Servo-ON input)	P.68

(Mode switch button)

#### Display of Position Deviation, Motor Rotational Speed and Torque Output



P.....Positional deviation (cumulative pulse counts of deviation counter)

• – display : generates rotational torque of CW direction (viewed from shaft end) no display: generates rotational torque of CCW direction (viewed from shaft end)

pressing (1).

..........Rotational speed of the motor unit [r/min]

• - display: CW rotation, no display: CCW rotation

**/** ........Torque command unit [%] (100 for rated torque)

• - display : CW rotation, no display : CCW rotation

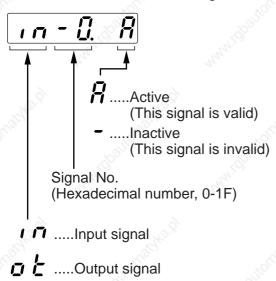
#### <Note>

"+" is not displayed on LED, but only "-" appears.

#### **Display of Control Mode**

### **Display of I/O Signal Status**

Displays the control input and output signal to be connected to CN X5 connector. Use this function to check if the wiring is correct or not.

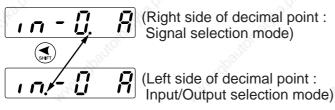


Select the signal No. to be monitored by pressing  $(\blacktriangle)(\blacktriangledown)$ 

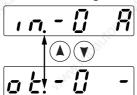
(Lowest place No. of input signal) (Highest place No. of input Transition when signal) (Lowest place No. of output signal) (Highest place No. of output signal)

<Note>

• Shift the flashing decimal point with (



• The other way to change signal No. at I/O selection mode Signal selection mode.



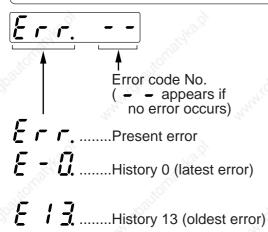


#### • Signal No. and its title

Input signal				
Signal No.	Title	Symbol	Pin No.	
0	Servo-ON	SRV-ON	29	
1	Alarm clear	A-CLR	31	
2	CW over-travel inhibit	CWL	8	
3	CCW over-travel inhibit	CCWL	9	
4	Control mode switching	C-MODE	32	
5	Speed-Zero clamp	ZEROSPD	26	
6	Switching of electronic gear	DIV	28	
8	Command pulse input inhibition	INH	33	
9	Gain switching	GAIN	27	
Α	Deviation counter clear	CL	30	
С	Selection 1 of Internal command speed	INTSPD1	33	
D	Selection 2 of Internal command speed	INTSPD2	30	
13	Damping control switching input	VS-SEL	26	
14	Selection 3 of internal command speed	INTSPD3	28	
15	Torque limit switching input	TL-SEL	27	

	Input signal				
Signal No.	Title	Symbol	Pin No.		
0	Servo-Ready	S-RDY	35/34		
1	1 Servo-Alarm ALM 37/3				
2	Positioning complete (In-position)	COIN	39/38		
3	Release of external brake	BRK-OFF	11/10		
4	Zero-speed detection	ZSP	12		
5	Torque in-limit	TLC	40		
6	In-speed(Speed coincidence)	V-COIN	12/40		
9	At-speed(Speed arrival)	COIN	39/38		
Α	Full-closed positioning complete	EX-COIN	39/38		

#### Reference of Error Factor and History



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

#### <Note>

• Following errors are not included in the history.

11:Under-voltage protection for control power
13:Under-voltage protection for main power
36:EEPROM parameter error protection
37:EEPROM check code error protection
38:Ocer-travel inhibition input protection

95:Automatic motor recognition error protection

- When one of the errors which are listed in error history occurs, this error and history o shows the same error No.
- When error occurs, the display flashes.

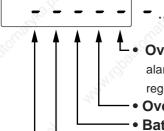
#### Error code No. and its content

Error code No.	Error content	Error code No.	Error content
11	Under-voltage protection for control power	39	Excess analog input error protection
12	Over-voltage protection	40	Absolute system-down error protection
13	Under-voltage protection for main power	41	Absolute counter-over error protection
14	Over-current protection	42	Absolute over-speed error protection
15	Overheat protection	44	Absolute single-turn error protection
16	Overload protection	45	Absolute multi-turn error protection
18	Over-regenerative load protection	47	Absolute status error protection
21	Encoder communication error protection	48	Encoder Z-phase error protection
23	Encoder communication data error protection	49	Encoder CS signal error protection
24	Excess positional deviation protection	50	External scale status 0 error protection
25	Excess hybrid deviation error protection	51	External scale status 1 error protection
26	Over-speed protection	52	External scale status 2 error protection
27	Command pulse multiplication error protection	53	External scale status 3 error protection
28	External scale communication data error protection	54	External scale status 4 error protection
29	Deviation counter overflow protection	55	External scale status 5 error protection
34	Software limit protection	65	Excess CCWTL input protection
35	External scale communication data error protection	ction 66 Excess CWTL input protection	
36	EEPROM parameter error protection	95	Automatic motor recognition error protection
37	EEPROM parameter error protection	others	Other error
38	Run-inhibition input protection	L	1, 1,

#### **Software Version**

Displays the software version of the driver.

#### **Alarm Display**

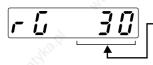


.....no alarm **7** ......Alarm occurrence

 Over-regeneration alarm: Turns on when regenerative load reaches more than 85% of alarm trigger level of regenerative load protection. Alarm trigger level is defined as 10% of regenerative resister working ratio, when Pr6C "Selection of external regenerative resister" is 1.

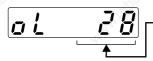
- Overload alarm: Turns on when the load reaches 85% or more of alarm trigger level of over-load protection.
- Battery alarm: Turns on when battery voltage for absolute encoder falls to alarm level (approx.3.2V) or lower.
- Cooling fan rotational speed error alarm : Shows cooling fan rotational speed error.
- External scale alarm: Turns on when external scale temperature rises to more than 85°C or scale rigidity is not enough (adjustment is needed on mounting).

#### **Display of Regenerative Load Factor**



- Display the ratio (%) against the alarm trigger level of regenerative protection. This is valid when Pr6C (Selection of external regenerative resistor) is 0 or 1.

### **Display of Over-load Factor**



 $\mathbf{Z}^{\mathbf{J}}\mathbf{B}|_{\Gamma}$  Displays the ratio (%) against the rated load.

Refer to P.258, "Overload Protection Time Characteristics" of When in Trouble.

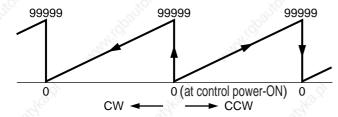
## **Display of Inertia Ratio**

Displays the inertia ratio (%).

Value of Pr20 (Inertia ratio) will be displayed as it is.

### Display of Feedback Pulse Sum, Command Pulse Sum and External Scale Feedback Pulse Sum

Total sum of pulses after control power-ON. Display overflows as the figures show.



By pressing (A) for approx. 3 sec. or longer on either one of screens of total sum of pulses display, you can clear feedback total sum, command pulse total sum or external scale feedback pulse total sum to "0".

## [0-clear EXECUTION display] 50. 5.0 Keep pressing ( to shift the " . the right fig. shows. 50

#### <Cautions>

- You can not clear the each date of [ PANATERM ] and console to "0" with this operation.
- Since accumulation process of command pulse cannot be executed when the command pulse input prohibition is validated, during normal auto-gain tuning and while measuring function to frequency characteristics of [ PANATERM ] is used, actual pulse input counts may differ from the displayed value of command pulse total sum.

#### **External Scale Deviation**

- FE 5
- Polarity (+): CCW, (-): CW
   Limited by ± 999999.

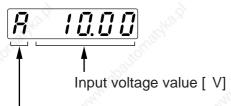
**Note)** You can 0-clear the external scale deviation during normal auto-gain tuning and motor trial run.

## **Automatic Motor Recognizing Function**

Rud on

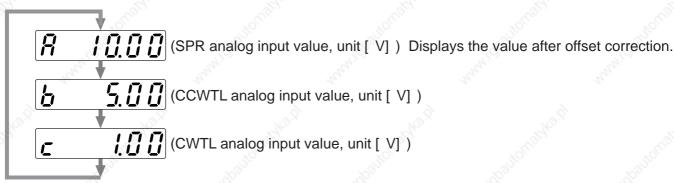
Automatic recognition is valid.

## **Display of Analog Input Value (Front Panel Only)**



Input signal

•Select the signal No. to be monitored by pressings ( ) .



Note) Voltage exceeding ± 10V can not be displayed correctly.

## **Switching of the Driver to be Communicated**

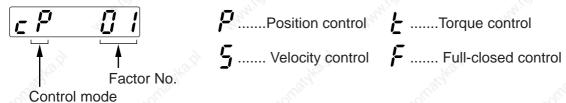
- RS232 communication
- ......Displays the ID of the connected driver. ID cannot be switched.
- F
   5
   4
   5
   5
   RS485 communication
- .......Select the ID of the driver to be operated by pressing ♠ ▼.

  Initial display of LED of the selected driver will appear by pressing ⑤.

  E - 485 will appear when you select the ID of not-selected driver.

#### Display of the Factor of No-Motor Running

Displays the factor of no-motor running in number.



#### • Explanation of factor No.

Factor No.	Factor	Control mode	Content			
flashing	Occurrence of error/alarm	all	An error is occurring, and an alarm is triggered.			
00	No particular factor	all	No factor is detected for No-motor run.  The motor runs in normal case.			
01	Main power shutoff	all	The main power of the driver is not turned on.			
02	No entry of SRV-ON input	all	The Servo-ON input (SRV-ON) is not connected to COM			
03	Over-travel inhibition input is valid	all	While Pr04 is 0 (Run-inhibition input is valid),  • CCW over-travel inhibition input (CCWL) is open and speed command is CCW direction.  • CW over-travel inhibition input (CWL) is open and speed command is CW direction.			
04	Torque limit setup is small	all	Either one of the valid torque limit setup value of Pr5E (1st) or Pr5F (2nd) is set to 5% or lower than the rating.			
05	Analog torque limit input is valid.	P,S,F	<ul> <li>While Pr03 is 0 (analog torque limit input accepted),</li> <li>CCW analog torque limit input (CCWTL) is negative voltage and speed command is CCW direction.</li> <li>CW analog torque limit input (CWTL) is positive voltage and speed command is CW direction.</li> </ul>			
06	INH input is valid.	P,F	Pr43 is 0 (Command pulse inhibition input is valid.), and INH is open.			
07	Command pulse input frequency is low.	P,F	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 Pr40.  • No matching to input status selected with Pr41 pr Pr42.			
08	CL input is valid.	P,F	While Pr4E is 0 (Deviation counter clear at level), the deviation counter clear input (CL) is connected to COM			
09	ZEROSPD input is valid.	S,T	While Pr06 is 1 (Speed zero clamp is valid.), the speed zero clamp input (ZEROSPD) is open.			
10	External speed command is small.	S	While the analog speed command is selected, the analog speed command is smaller than 0.06[V].			
11	Internal speed command is 0.	S	While the internal speed command is selected, the internal speed command is set to lower than 30 [ r/min]			
12	Torque command is small.	€ T	The analog torque command input (SPR or CCWTL) is smaller than 5 [ %] of the rating.			
13	Speed limit is small.	т	<ul> <li>While Pr5B is 0 (speed is limited by 4th speed of internal speed), Pr56, (4th speed of speed setup) is set to lower than 30 [ r/min] .</li> <li>While Pr5B is 1 (speed is limited by SPR input), the analog speed limit input (SPR) is smaller than 0.06 [ V] .</li> </ul>			
14	Other factor	all	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>

<sup>\*</sup> Motor might run even though the other number than 0 is displayed.

### **Parameter Setup Mode**

## Operation at | SELECTION display

Press (M) once after pressing (S) from initial status of LED to change the display to

Parameter setup mode,



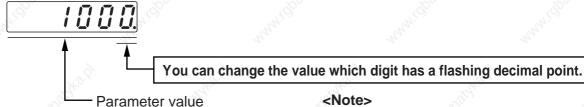
For parameters which place is displayed with " r ", the content changed and written to EEPROM becomes valid after turning off the power once.

Press (▲) or (▼) to select parameter No. to be referred/set.



## Operation at EXECUTION display

Press (S) to change to EXECUTION display of



Each parameter has a limit in number of places for upper-shifting.

- (1) You can change the decimal point with (♣), then shift the digit for data change.
- (2) Press (▲) or (▼) to set up the value of parameter.

Value increases with (▲) decreases with (▼).

After setting up parameters, return to SELECT mode, referring to structure of each mode (P.60 and 61).

#### <Remarks>

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

## **EEPROM Writing Mode**

## **EEPROM Writing**

## Operation at | SELECTION display

Starting from the initial LED status, press (M) two time after pressing (S),

then brings the display of

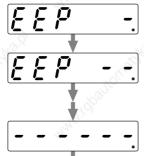
**EEPROM Writing Mode,** 

## Operation at **EXECUTION** display

Press (S) to make 

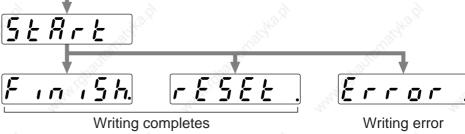
Keep pressing (A) until the display changes to 5 t R r t when you execute writing.

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



Starts writing.

Finishes writing



- When you change the parameters which contents become valid after resetting, | £ 5 £ £ displayed after finishing wiring. Turn off the control power once to reset.
- Note 1) When writing error occurs, make writing again. If the writing error repeats many times, this might be a failure.
- Note 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.

### **Auto-Gain Tuning Mode**

#### Normal Mode Auto-Gain Tuning Screen

#### <Remarks>

- For details of normal auto-gain tuning, refer to P.236, "Normal Auto-Gain Tuning" of Adjustment. Pay a special attention to applicable range and cautions.
- The motor will be driven in a preset pattern by the driver in normal auto-gain tuning mode. You can change this pattern with Pr25 (Setup of action at normal auto-gain tuning), however, shift the load to where the operation in this pattern may not cause any trouble, then execute this tuning.
- Depending on the load, oscillation may occur after the tuning. In order to secure the safety, use the protective functions of Pr26 (Setup of software limit), Pr70 (Setup of excess position deviation) or Pr73 (Setup of over-speed level).

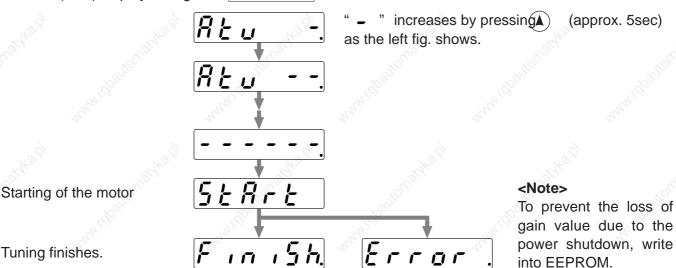


Starting from the initial LED status, press (M) three time after pressing (S) then brings the display of normal auto-gain tuning, <Note> then press  $(\blacktriangle)(\blacktriangledown)$  to select the machine For machine stiffness No. stiffness No., refer to P.238. machine stiffness No. Operation at | EXECUTION display (1 to 9, A (10) to F (15))

Press (S) to make **EXECUTION DISPLAY to** 



After inhibiting command input, and during Servo-On status, keep pressing (A) until Console (LED) display changes to 5 t 8 r t



Tuning finishes.

After setting up tuning, return to SELECT DISPLAY, referring to structure of each mode (P.60 and 61). <Remarks>

Don't disconnect the console from the driver between  $\begin{bmatrix} 5 & 1 & 1 \\ 5 & 1 & 1 \end{bmatrix}$  and  $\begin{bmatrix} 5 & 1 \\ 5 & 1 \end{bmatrix}$ 

Should the connector is pulled out, insert it again and repeat the procedures from the beginning.

<Note> If the following status occurs during the tuning action, the tuning error occurs.

Tuning completes

(1) During the tuning action, 1) when an error occurs, 2) when turned to Servo-OFF, 3) even the deviation counter is cleared, 4) when the tuning is actuated close to the limit switch and 5) when the main power is shut off.

Tuning error

- (2) When the output torque is saturated because the inertia or load is too large.
- (3) When the tuning can not be executed well causing oscillation.

If the tuning error occurs, value of each gain returns to the previous value before the tuning. The driver does not trip except error occurrence. Depending on the load, the driver might oscillate without becoming tuning error. (not showing [f, r, q, r]) Extra attention should be paid to secure the safety.

into EEPROM.

Fit-Gain Screen		
Operation at SELI	ECTION display	
86_F .8	- white	
Operation at EXE	CUTION display	
Press (\$) to call for E	EXECUTION DISPLAY.	
(6) (5) (4) (3) (2) (7)	filter or start the	e/store the setup of real time auto-gain tuning/adaptive fit-gain function by using (A) (V) key, after matching the (1), (2), (4), (6) by pressing (A).
30.5	(1) Stiffness setup of	f real time auto-gain tuning / Start of fit-gain
	Display	Contents/Expansion function
2010	You can Stiffness 15	with each press of (A), stiffness changes in
,	change with Stiffness 1	numerical/alphabetical order (0 to 9,A(10) to F(15).
7 2	Stiffness 0	Fit gain function starts by pressing vat stiffness 0.
70°S     L	(2) Action setup of re	eal time auto-gain tuning/Start of fit-gain
. of the second	Display	Contents/Expansion function
20,000	<b>▲</b> ? Valid	No gain switching : Load inertia does not change.
	<b>5</b> Valid	Vertical axis mode : Load inertia changes rapidly.
77	Yay aan 5. Valid	Vertical axis mode : Load inertia changes slowly.
8	You can change You Valid	Vertical axis mode : Load inertia does not change.
20 P	with Valid	Normal mode : Load inertia changes rapidly.
40m² 40	Valid	Normal mode : Load inertia changes slowly.
	Valid	Normal mode : Load inertia does not change.
The state of the s	<b>▼</b> [] Invalid	Executes automatic gain setup by pressing v for approx.3sec. in this status.
	(3) Status of real time	e auto-gain tuning action (display only)
70×	May -	: Invalid
, office	<b>-</b>	: Valid
Dann Houne	or	: Estimating load inertia
	(4) Switch of adaptive f	ilter action and copy to 1st notch filter pf adaptive filter setup
	Display	Contents/Expansion function
, 13 (2.12)	You can change with Hold Valid	Save the present adaptive filter setup to Pr1D,Pr1E by pressing (A) for approx. 3 sec. in this status.
Daliton Dalit	<b>♠ ♦ 1</b> Invalid	Clears 1st notch filter (Pr1D, Pr1E) by pressing v for approx. 3 sec. in this status.
Contract of the contract of th	(5) Status of real time	e auto-gain tuning action (display only)
79.		: Invalid
, di	-	: Valid
98g) 10°	or	: Adaptive action working
NIOPE L	(6) EEPROM writing	
	Display	Contents/Expansion function

## **Auxiliary Function Mode**

#### Alarm Clear Screen

Protective function will be activated and release the motor stall status (error status).

## Operation at SELECTION display

Starting from the initial LED status,

Press (M) four time after pressing (S),

then press (A) (V) to make a display to

RF\_RcL

## Operation at **EXECUTION** display

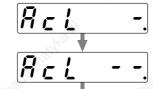
Press  $(\mathbf{S})$  to call for

**EXECUTION** display of

8 c L -

Keep pressing (LED)

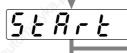
changes to 5 + A - +



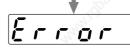
" - " increases by pressing (A) (approx. 5sec) as the right fig. shows.

Alarm clear starts.

Clearing finishes.



F, n, 5h.
Alarm clear completes



Clear is not finished.

Release the error by resetting the power.

After alarm cleaning, return to SELECTION display, referring to structure of each mode (P.60 and 61).

#### <Remarks>

Don't disconnect the console from the driver between 5 + 8 + 1 = 10 and 7 + 10 = 10.

Should the connector is pulled out, insert it again and repeat the procedures from the beginning.

# How to Use the Front Panel and Console

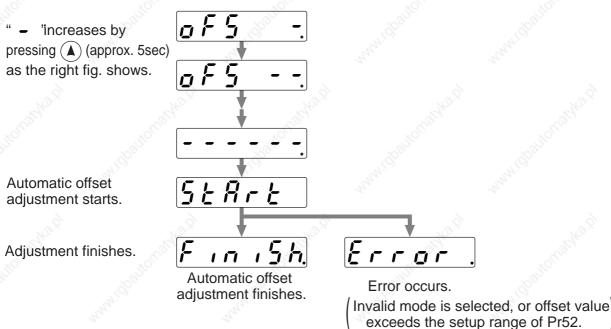
#### Automatic Offset Adjustment (Front Panel Only)

Automatically adjust the offset value of Pr52 (Velocity command offset) of analog velocity command input (SPR/TRQR).

# Operation at SELECTION display

## Operation at **EXECUTION** display

• Press (§) to call for EXECUTION display of p F 5 - When you execute automatic offset adjustment, make command input to 0V, then keep pressing (A) until the display changes to 5 + R r + .



#### <Notes>

This function is invalid at position control mode.

You cannot write the data only by executing automatic offset adjustment.

Execute a writing to EEPROM when you need to reflect the result afterward.

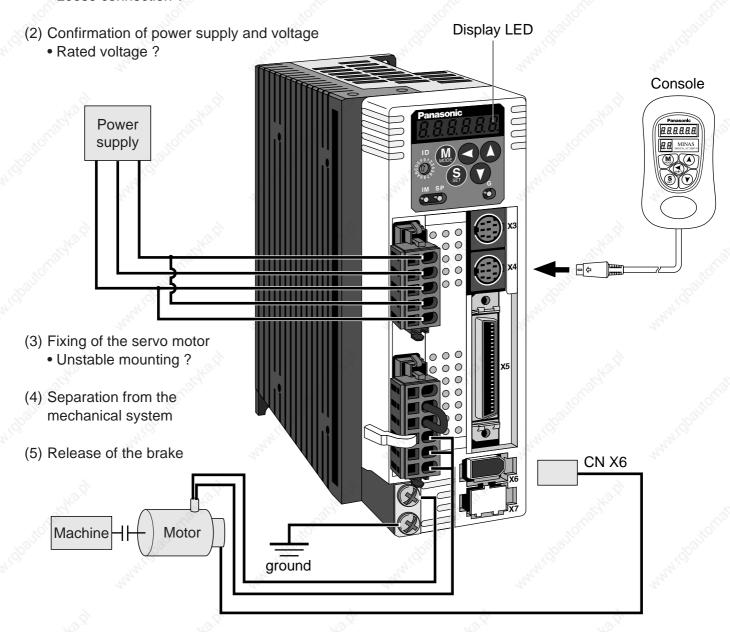
#### Trial Run (JOG Run)

You can make a trial run (JOG run) without connecting the Connector, CN X5 to the host controller such as PLC. <Remarks>

- Separate the motor from the load, detach the Connector, CN X5 before the trial run.
- Bring the user parameter setups (especially Pr11-14 and 20) to defaults, to avoid oscillation or other failure.

#### **Inspection Before Trial Run**

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

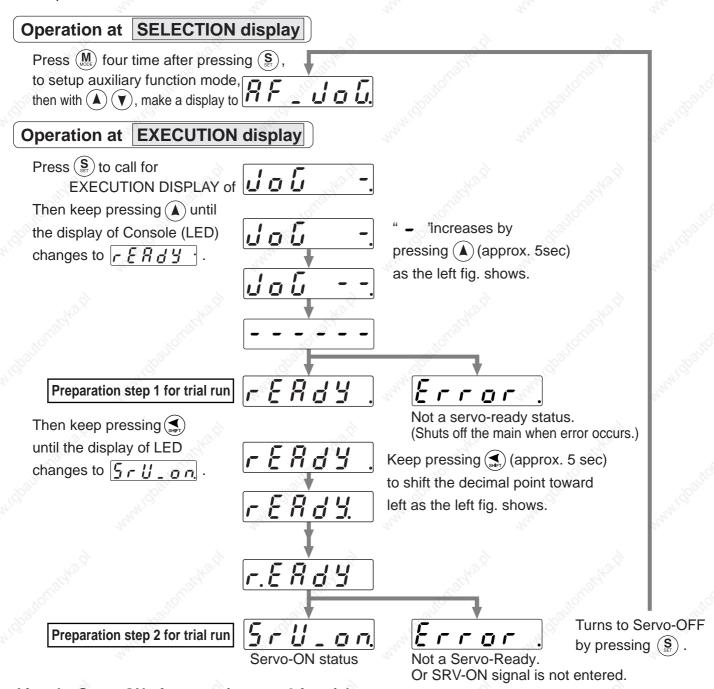


(6) Turn to Servo-OFF after finishing the trial run by pressing (§)

# How to Use the Front Panel and Console

#### **Procedure for Trial Run**

When you use the console, insert the console connector to CN X4 of the driver securely and turn on the driver power.



#### After the Servo-ON of preparation step 2 for trial run,

the motor runs at the preset speed with Pr3D (JPG speed) to CCW direction by pressing  $\bigcirc$  CW by pressing  $\bigcirc$ .

The motor stops by pressing  $(\blacktriangle)$   $(\blacktriangledown)$ .

After finished trial running, return to SELECTION display, referring to structure of each mode (P.60 and 61).

#### <Notes>

- Set up torque limit input invalidation (Pr03) to 1, run-inhibit input invalidation (Pr04) to 1 and ZEROSPD input (Pr06) to 0.
- If SRV-ON becomes valid during trial run, the display changes to Frrgr which is normal run through external command.

#### <Caution>

If such trouble as disconnection of cable or connector occurs during trial run, the motor makes over-run for maximum 1 sec. Pay an extra attention for securing safety.

#### **Clearing of Absolute Encoder**

Only applicable to the system which uses absolute encoder. You can clear the alarm and multi-turn data of the absolute encoder.

## Operation at | SELECTION display

Press (M) four time after pressing (S), to setup auxiliary function mode,

then with (▲) (▼), make a display to

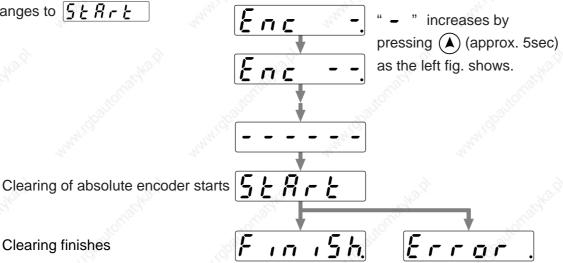
RF\_Enc

## Operation at EXECUTION display

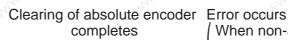
Press (S) to call for EXECUTION DISPLAY of

Then keep pressing (A) until the display of Console (LED)

changes to 5 + A - +



Clearing finishes



When non-applicable encoder is connected

After clearing of absolute encoder finishes, return to SELECTION display, referring to structure of each mode (P.60 and 61).

#### <Remarks>

Don't disconnect the console from the driver between  $5 \nmid R \mid L$  to  $F \mid R \mid L$ .

Should the connector is pulled out, insert it again and repeat the procedures from the beginning.

# How to Use the Front Panel and Console

## Clearing of External Scale Error (Front panel only)

You can clear an error of the external scale.

## Operation at SELECTION display

Press (M) four time after pressing (S), to setup auxiliary function mode,

then with (A) (V), make a display to

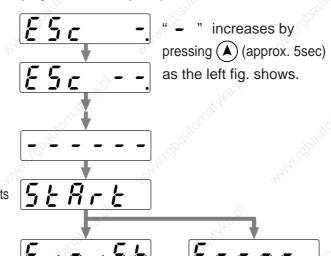
RF\_ESc

# Operation at **EXECUTION** display

Press sto call for EXECUTION DISPLAY of \$5.5.

Then keep pressing (A) until the display of Console (LED)

changes to 5 £ R r £



Clearing of absolute encoder starts

Clearing finishes.

Clearing of absolute encoder Error occurs completes (At other con

(At other control mode than full-closed control, and when no external scale error has occurred)

After cleaning of External scale Error, return to SELECTION display, referring to the structure of each mode (P.60 and 61).

## **Copying Function (Console Only)**

#### Copying of Parameters from the Driver to the Console

## Operation at | SELECTION display

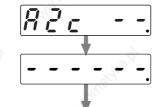
Starting from initial LED status, Press (M) five time after pressing (S), then press  $(\blacktriangle)$   $(\blacktriangledown)$ , to make a display to



# Operation at **EXECUTION** display

Press (S) to call for EXECUTION DISPLAY of

Keep pressing (A) until the console display (LED) changes to PHRSE!



increases by

pressing (A) (approx. 3sec) as the left fig. shows.

Initialization of EEPROM of the console starts.

PHASE I \*\* Universal decreases as time passes.

Copying of parameters

from the driver to the console starts.

into the console EEPROM starts.

PHR5E2

Copying completes normally.

Error Error display

#### <Remarks>

If error is displayed, repeat the procedures from the beginning.

Press (S) for releasing error.

After copying finishes, return to SELECTION display, referring to structure of each mode (P.60 and 61)

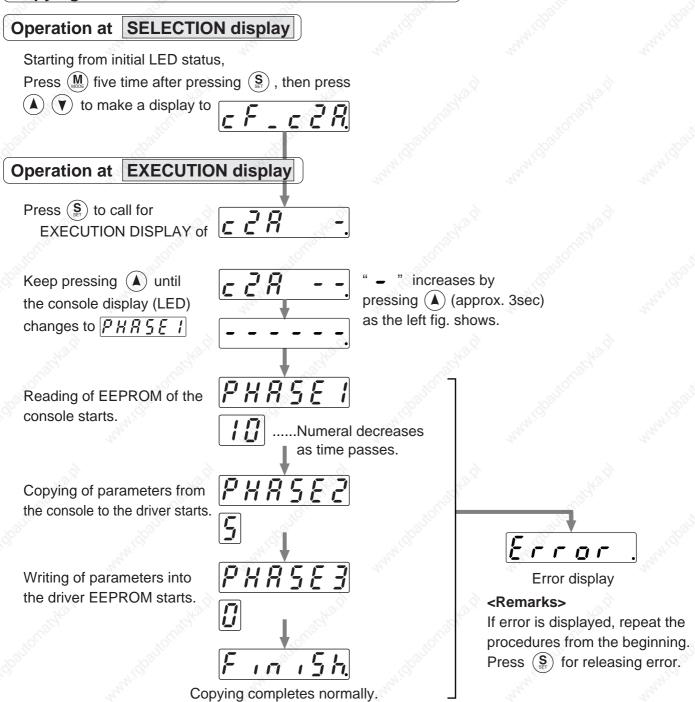
Don't disconnect the console from the driver between PHRSEI to PHRSE3

Should the connector is pulled out, insert it again and repeat the procedures from the beginning.

If the error display repeats frequently, check the broken cable, disconnection of the connector, misoperation due to noise or failure of console.

# How to Use the Front Panel and Console

#### **Copying of Parameters from the Console to the Driver**



After copying finishes, return to SELECTION display, referring to structure of each mode (P.60 and 61).

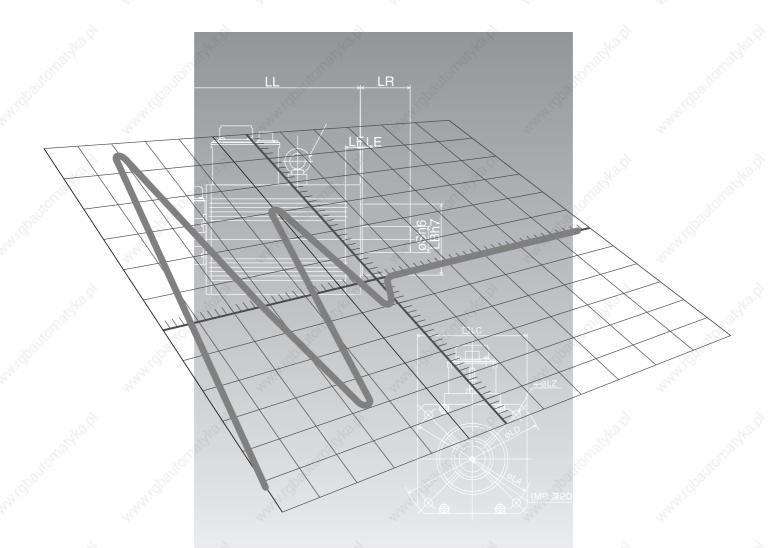
#### <Remarks>

Don't disconnect the console from the driver between PHRSEI to PHRSE3

Should the connector is pulled out, insert it again and repeat the procedures from the beginning.

#### <Note>

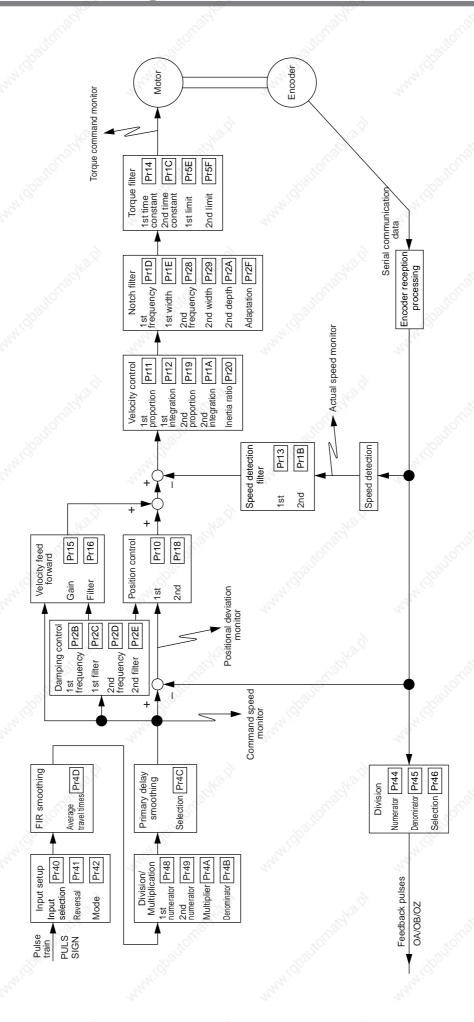
If the error display repeats frequently, check the broken cable, disconnection of the connector, misoperation due to noise or failure of console.



# [Connection and Setup of Position Control Mode]

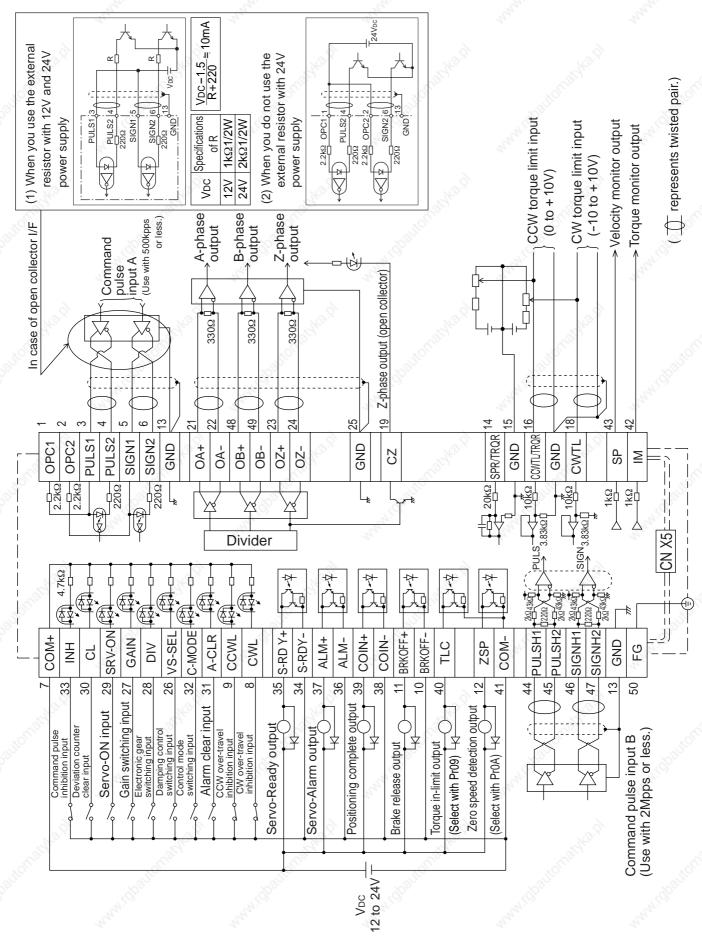
	page
Control Block Diagram of Position Control N	/lode 82
Wiring to the Connector, CN X5	83
Wiring Example to the Connector, CN X5	84
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raiameters for Sequence	120

# **Control Block Diagram of Position Control Mode**



## Wiring Example to the Connector, CN X5

#### **Wiring Example of Position Control Mode**

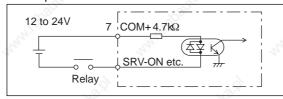


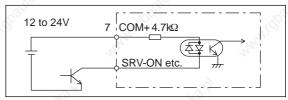
#### **Interface Circuit**

#### **Input Circuit**

#### SI Connection to sequence input signals

- 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 to 24V) as 11.4V or more in order to secure the primary current for photo-couplers.





#### PI1 Connection to sequence input signals (Pulse train interface)

- (1) Line driver I/F (Input pulse frequency: max. 500kpps)
- This signal transmission method has better noise immunity. We recommend this to secure the signal transmission.

(2)Open collector I/F (Input pulse frequency: max. 200kpps)

- The method which uses an external control signal power supply (VDC)
- Current regulating resistor R corresponding to VDC is required in this case.
- · Connect the specified resister as below.

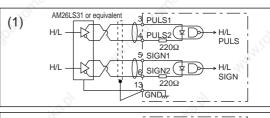
	10.1
VDC	Specifications
12V	1kΩ1/2W
24V	2kΩ1/2W

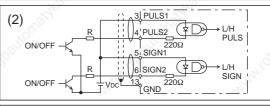
$$\frac{\mathsf{VDC} - 1.5}{\mathsf{R} + 220} = 10\mathsf{mA}$$

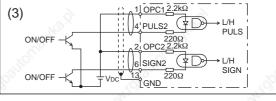
- (3)Open collector I/F (Input pulse frequency: max. 200kpps)
- Connecting diagram when a current regulating resistor is not used with 24V power supply.



Max.input voltage : DC24V, Rated current : 10mA





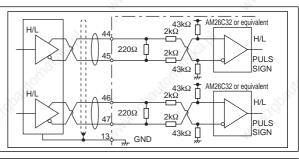


# PI2 Connection to sequence input signals (Pulse train interface exclusive to line driver)

Line driver I/F (Input pulse frequency: max. 2Mpps)

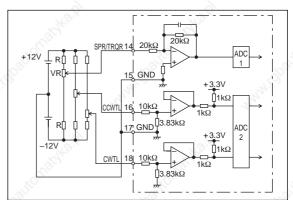
This signal transmission method has better noise immunity.
 We recommend this to secure the signal transmission when line driver I/F is used.

# represents twisted pair.



## Al Analog command input

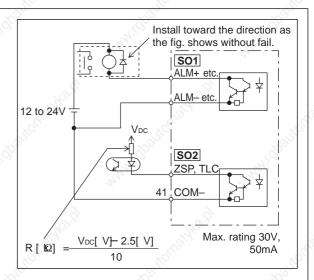
- The analog command input goes through 3 routes, SPR/TRQR(Pin-14), CCWTL (Pin-16) and CWTL (Pin-18).
- Max. permissible input voltage to each input is ±10V.
   For input impedance of each input, refer to the right Fig.
- When you compose a simple command circuit using variable resistor(VR) and register R, connect as the right Fig. shows. When the variable range of each input is made as -10V to +10V, use VR with  $2k\Omega$ , B-characteristics, 1/2W or larger, R with  $200\Omega$ , 1/2W or larger.
- A/D converter resolution of each command input is as follows.
   (1)ADC1: 16 bit (SPR/TRQR), (including 1bit for sign), ±10V
   (2)ADC2: 10 bit (CCWTL, CWTL), 0 to 3.3V



#### **Output Circuit**

#### SO1 SO2 Sequence output circuit

- The output circuit is composed of open collector transistor outputs in the Darlington connection, and connect to relays or photo-couplers.
- 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 which emitter side of the output transistor is independent and is connectable individually, and the one which is common to – side of the control power supply (COM–).
- If a recommended primary current value of the photo-coupler is 10mA, decide the resistor value using the formula of the right Fig.

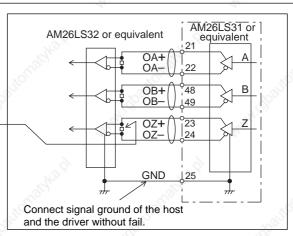


For the recommended primary current value, refer to the data sheet of apparatus or photo-coupler to be used.

#### PO1 Line driver (Differential output) output

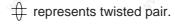
- Feeds out the divided encoder outputs (A, B and Z-phase) in differential through each line driver.
- At the host side, receive these in line receiver. Install a terminal resistor (approx.  $330\Omega$ ) between line receiver inputs without fail
- These outputs are not insulated.

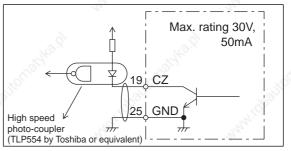




#### PO2 Open collector output

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



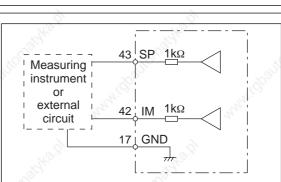


#### **AO** Analog monitor output

- There are two outputs, the speed monitor signal output (SP) and the torque monitor signal output (IM)
- Output signal width is ±10V.
- The output impedance is  $1k\Omega$ . 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 6V/3000r/min (Pr07=3), the resolution converted to speed is 8r/min/16mV.
- (2) Torque monitor output (IM) With a relation of 3V/rated torque (100%), the resolution converted to torque is 0.4%/12mV.



# Input Signal and Pin No. of the Connector, CN X5

# Input Signals (common) and Their Functions

Title of signal	Pin No.	Symbol	274,				Func	tion	I/F circui	
Power supply for control signal (+)	7	COM+		<ul> <li>Connect + of the external DC power supply (12 to 24V).</li> <li>Use the power supply voltage of 12V ± 5% – 24V ± 5%</li> </ul>						
Power supply for control signal (-)	41	COM-	• The p	• Connect – of the external DC power supply (12 to 24V). • The power capacity varies depending on a composition of I/O circuit. 0.5A or more is recommended.						
CW over-travel inhibit input	8	CWL	<ul><li>Conn movin</li><li>CWL inhibit</li><li>You c of up</li></ul>	<ul> <li>Use this input to inhibit a CW over-travel (CWL).</li> <li>Connect this so as to make the connection to COM— open when the moving portion of the machine over-travels the movable range toward CW.</li> <li>CWL input will be invalidated when you set up Pr04 (Setup of over-travel inhibit input) to 1.Default is "Invalid (1)".</li> <li>You can select the action when the CWL input is validated with the setup of up Pr66 (Sequence at over-travel inhibit). Default is "Emergency stop with dynamic brake".(Pr66=0)</li> </ul>						
CCW over-travel inhibit input	9	CCWL	<ul><li>Conne portion</li><li>CWL inhibit</li><li>You can of Pr6</li></ul>	ect this n of the input w input) an sele 6 (Sec	so as to remarkable machine will be invalid to 1.Defa	make th over-tra alidated ult is "Ir ion whe over-tra	e connectavels the when your walid (1) and the Co	avel (CCWL).  ction to COM- open when the moving movable range toward CCW.  ou set up Pr04 (Setup of over-travel ".  CWL input is validated with the setup bit). Default is "Emergency stop with	SI P.84	
damping control	26	VS-SEL	• Functi	on var	ies depen	ding on	the con	trol mode.	SI	
switching input	24/10		12	S	• Become	es to a	speed-ze	ero clamp input (ZEROSPD).	P.84	
7,7	1/2,		2720		Pr06 (	Connectio	n to COM-	Content	27.2.	
					0	-	-	ZEROSPD input is invalid.		
		"Akorily	Velocity/		28	ор	en	Speed command is 0		
				Tord	lue	10	clo	+	Normal action	
			con	trol	082,			Speed command is to CCW		
					2	op				
	- 25					clo	3.3	Speed command is to CW.  que control, ZERPSPD is invalid.	90,	
Madhala	and	analyka.pl	Posi Full-c con	losed	Become     While I     1st dan     open th	es to an Pr24 (D nping fil nis inpu	input of co camping ter (Pr2E t, and th	lamping control switching (VS-SEL). filter switching selection) is 1, the 3, Pr2C) will be validated when you see 2nd damping filter (Pr2D, Pr2E) you connect this input to COM	ann.	
Gain switching input	27	GAIN			ries depe ion of torc			etups of Pr30 (2nd gain setup) and	SI P.84	
or	The state of the s		Pr03	Pr30	Connection	to COM-		Content	The same	
Torque limit		TL-SEL		0	оре	en	Velocity	loop : PI (Proportion/Integration) action		
witching input				0	clos	se		loop : P (Proportion) action		
7/F9.4					Thou	wh		etups of Pr31 and Pr36 are 2		
			0-2		оре		1	n selection (Pr10,11,12,13 and 14)		
				.150	clos			n selection (Pr18,19,1A,1B and 1C)		
	.89		Ш.,	960	whe	n the se		Pr31 and Pr36 are other than 2	.95,	
	747		122			2	17.	invalid	24.	
			3	-	• Pr5E (open t	Setup c his inpu	of 1st torout, and F	ritching (TL-SEL) que limit) will be validated when you Pr5F (Setup of 2nd torque limit) will connect this input to COM	200	
Bittelfar,		altornor,			of 2nd gai Adjustme		hing fund	ction, refer to P.243 "Gain Switching		

# Connection and Setup of Position Control Mode

# [Connection and Setup of Position Control Mode]

Title of signal	Pin No.	Symbol		Function		I/F circui				
Electronic gear	28	DIV	<ul> <li>Function var</li> </ul>	ries depending on the control mode.	1020	SI				
(division/ multiplication) switching input		OK BINE D	Position/ Full-closed control	<ul> <li>You can switch the numerator of electronic gear.</li> <li>By connecting to COM-, you can switch the numerator of electronic gear from Pr48 (1st numerator of electronic gear) to Pr49 (2nd numerator of electronic gear)</li> <li>For the selection of command division/multiplication, refer to the table of next page, "Numerator selection of command scaling"</li> </ul>						
	AN I GOOD		Velocity control	<ul> <li>Input of internal speed selection 3 (INTSPD3).</li> <li>You can make up to 8-speed setups combining INH/INTSPD1 and CL/INTSPD2 inputs. For details of setup, refer to the table of P.131, "Selection of Internal Speed".</li> </ul>						
			Torque control	This input is invalid.						
ation apport		• Numerato	or selection	the command pulse 10ms before/after sw n of electronic gear	No. Comment	20 Jic				
	184 J.C.	DIV	71/0.	Setup of electronic gea	V.	41,00				
	£.		1st numera	ator of electronic gear (Pr48) x 2 Multiplier o	f command scaling (Pr4A)	20				
	Оро	Open	or	Denominator of electronic gear (Pr4B)						
		9	2nd numerator of electronic gear (Pr49) x 2 Multiplier of command scaling (Pr4A)							
	The state of the s	Short	or	Denominator of electronic gear ( Encoder resolution*		Red Con				
8			Comn	nand pulse counts per single turn (Pr4B)	* Automatic setup by setting up Pr49 to 0					
Servo-ON input	29			vo-ON status by connecting this input to rvo-OFF status by opening connection to		SI P.84				
	S. T. L.	183	<ul> <li>You can so clearing acti</li> <li>Caution&gt;</li> <li>1.Servo-ON ir (see P.42, '2.Never run/s)</li> </ul>	will be shut off. elect the dynamic brake action and the on at Servo-OFF with Pr69 (Sequence at a specific property of Preparation.) top the motor with Servo-ON/OFF. g to Servo-ON, allow 100ms or longer property of the servo-ON, allow 100ms or longer property or lo	Servo-OFF).	RM-IBBITE				
all'o		all'o	the pulse co	ommand.						

Title of signal	Pin No.	Symbol	6	Co.,	Function		OLE .	I/F circu					
Deviation	30	CL	Function variable	ies depending or	the control mo	de.	9	SI					
counter clear input	Art Co		Maries	<ul><li>and full-close</li><li>You can clear full-closed dev</li></ul>	d deviation cour the counter of p iation by conne	positional deviater. ositional deviational deviational this to CONode with Pr4E (C	on and /	P.84					
			Position/ Full-closed control			Position/	Pr4E	.0175	Content	OFFICE STATES			
	ART OF ARTHUR			Full-closed control	0	tion and full-o		while CL is	MAN GO				
				1 [ Default]	and full-clos	ounter of position ed deviation on to COM- from o	ly once by						
	R. R		Velocity control	Input of select     You can ma     INTSPD1 and	on 2 of internal ke up to 8-spo CL/INTSPD3 ble in P.131, "S	command speed eed setups con inputs. For deta election of Intern	nbining INH/ ails of setup,	Thru igh					
			Torque control	This input is in		3	9						
Alarm clear input	31	A-CLR	You can rele	ease the alarm	status by conne	ecting this to CO	DM- for more	SI					
Billouin			than 120ms. • The deviation • There are so	n counter will be me alarms whicl	cleared at alarn cannot be rele	-	put.	P.84					
Control mode switching input	32	C-MODE	You can switch the control mode as below by setting up Pr02 (Control mode setup) to 3-5.					SI					
			Pr02 setu	Ope				P.84					
	20ths						10.01			en (1st)	Connection to	COM- (2nd)	P.84
			3	Positi	on control	Velocity	control	P.84					
			3 4	Positi Positi	on control	Velocity Torque	control	P.84					
	and the		3 4 5 <caution> Depending or</caution>	Positi Positi Veloc how the common rapidly when sw	on control on control ity control and is given at e	Velocity	control control	P.84					
nhibition input	33	INH S	3 4 5 <caution> Depending or might change an extra atten</caution>	Positi Positi Veloc how the common rapidly when sw	on control on control ity control and is given at e itching the cont	Velocity Torque Torque each control moderol mode with C-	control control	P.84					
of command	33	INH A	3 4 5 <caution> Depending or might change an extra atten</caution>	Positi Positi Veloc  how the common rapidly when swittion.  ries depending of Inhibition inpute Ignores the connection to You can invalid	on control on control ity control and is given at exitching the control on the control more of command position common co	Velocity Torque Torque each control mode rol mode with C- ode. ulse input (INH) hand pulse by ut with Pr43 (In	control control le, the action MODE. Pay opening the	They are					
of command	33	INH IN	3 4 5 <caution> Depending or might change an extra atten • Function var</caution>	Positi Positi Veloc  how the common rapidly when swittion.  ries depending of Inhibition inpute Ignores the connection to You can invalid	on control on control ity control and is given at exitching the control on the control more of command prosition common c	Velocity Torque Torque each control mode rol mode with C- ode. ulse input (INH) hand pulse by ut with Pr43 (In	control control le, the action MODE. Pay opening the	SI					
of command	33	INH A	3 4 5 <caution> Depending or might change an extra atten • Function var  Position/ Full closed</caution>	Positi Positi Veloc  how the comma rapidly when sw tion.  ies depending o  Inhibition input Ignores the connection to You can inva command puls	on control on control ity control and is given at exitching the control on the control more of command prosition common c	Velocity Torque Torque each control mode rol mode with Code. ulse input (INH) nand pulse by ut with Pr43 (In	control control control le, the action MODE. Pay opening the avalidation of	SI					
nhibition input of command oulse	33 34 34 34	INHA P	3 4 5 <caution> Depending or might change an extra atten • Function var  Position/ Full closed</caution>	Positi Positi Veloc  how the comma rapidly when swition.  lies depending o  Inhibition input Ignores the connection to You can inva command puls  Pr43  0  1(Default You can ma INH/INTSPD2 setup, refer to	on control on control ity control and is given at exitching the control of command p position comm COM— didate this inpute inhibition input out of internal coake up to 8 and CL/INTSP the table of P.1	Velocity Torque Torque each control mode rol mode with Code.  ulse input (INH) hand pulse by  ut with Pr43 (Inut)  Content INH is valid. INH is valid. ommand speed ( -speed setups D3 inputs. For	control control control control de, the action MODE. Pay  opening the evalidation of  INTSPD1) combining details of the	SI					

## 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

Title of signal	Pin No.	Symbol	Function	I/F circuit
Command pulse	44	PULSH1	• Input terminal for position command pulse. You can select by setting up	PI2
input 1			Pr40 (Selection of command pulse input) to 1.	P.84
nichter,	45	PULSH2	<ul> <li>This input becomes invalid at such control mode as velocity control or torque control, where no position command is required.</li> <li>Permissible max. input frequency is 2Mpps.</li> </ul>	allor
Command pulse sign input 1	46	SIGNH1	You can select up to 6 command pulse input formats with Pr41 (Setup of command pulse rotational direction) and Pr42 (Setup of command pulse input mode).	NA GO
	47	SIGNH2	For details, refer to the table below, "Command pulse input format".	

#### • Pulse train interface

Title of signal	Pin No.	Symbol	Function	I/F circuit
Command pulse	100	OPC1	• Input terminal for the position command. You can select by setting up Pr40 (Selection of command pulse input) to 0.	PI1
input 2	3	PULS1	• This input becomes invalid at such control mode as the velocity control or	P.84
	4	PULS2	torque control, where no position command is required.  • Permissible max. input frequency is 500kpps at line driver input and	
Command pulse	2	OPC2	200kpps at open collector input.  • You can select up to 6 command pulse input formats with Pr41 (Setup of	
sign input 2	5	SIGN1	command pulse rotational direction) and Pr42 (Setup of command pulse	
	6	SIGN2	input mode). For details, refer to the table below, "Command pulse input format".	1021JE

#### Command pulse input format

Pr41 Setup value (Setup of command pulse rotational direction)	Pr42 Setup value (Setup of command pulse input mode)	Command pulse format	Signal title	CCW command	CW command
	0 or 2	2-phase pulse with 90° difference (A+B-phase)	PULS SIGN	A-phase t1 t1  B-phase t1 t1  B-phase advances to A by 90°.	t1 t
0	1	CW pulse train + CCW pulse train	PULS SIGN	t3 t2 t2	12 12
Traight.	3	Pulse train + Sign	PULS SIGN	14 t5 16 "H" t6	t4 t5 "L" t6
	0 or 2	2-phase pulse with 90° difference (A+B-phase)	PULS SIGN	A-phase in the phase in the phase delays from A by 90°.	t1 t
Mary 1	1 1000	CW pulse train + CCW pulse train	PULS SIGN	12 12	t2 t2
	3	Pulse train + Sign	PULS SIGN	t4 t5 "L" t6 t6	14 t5 H" H6

- PULS and SIGN represents the outputs of pulse train in put circuit. Refer to the fig. of P.84, "Input Circuit".
- In case of CW pulse train
   + CCW 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 of command pulse input signal and min. necessary time width

Input I/E	of PULS/SIGN signal	Permissible max.	Minimum necessary time width					
input i/r	input frequency	€ t1	t2	t3	t4	t5	t6	
Pulse train interface e	Pulse train interface exclusive for line driver				250ns	250ns	250ns	250ns
Pulse train interface	500kpps	2μs	1μs	1μs	1μs	1μs	1μs	
"4' <sub>C</sub> C.	Open collector interface	200kpps	5μs	2.5µs	2.5µs	2.5µs	2.5µs	2.5µs

Set up the rising/falling time of command pulse input signal to  $0.1 \mu s$  or shorter.

## Input Signals (Analog Command) and Their Functions

Title of signal	Pin No.	Symbol				Function		I/F circuit	
Speed command	14	SPR	Function varies depending on control mode.						
input			Pr02	Control mode		Function	1	P.84	
or Torque command input		TRQR	3	Position/ Velocity	veloci • Set u Speed Pr50 Pr51 Pr52	of external speed comity control is selected. up the gain, polarity, of command with; (Speed command input) (Speed command offset) (Speed command offset) (Speed command filter)	offset and filter of the t gain) t reversal)	www.idlo	
		12.0		10°		cion varies depending (e) command)	on Pr5B (Selection of		
		Sig)		Vaga,	Pr5B	Cont	ent		
	r <sup>an</sup> ice.		4	Position/ Torque	0	Torque command (TF  Set up the torque (Toffset and filter with; Pr5C (Torque commer5D (Torque commer52 (Speed commer57) (Speed commer57)  Torque commer50 (Speed commer50)  Torque commer51 (Speed commer51)	rRQR) gain, polarity, nand input gain) nand input reversal) and offset)	WANT GE	
		alternatives	man	25 Titoli sides	1	Speed limit (SPL) wil     Set up the speed lin and filter with;     Pr50 (Speed comman Pr52 (Speed comman Pr57 (Speed comman	nit (SPL) gain, offset d input gain) d offset)	WHY! GO	
		in the state of	Others	Other control mode	• This ir	nput is invalid.	16. j		
Partougly	Š	NICHOTO I	(includ	ling 1 bit for si	gn).	nverter used in this inpu 1[ LSBD.3[ mV]	t is 16 bit		

<sup>\*</sup>Function becomes valid when the control mode with underline ( \_\_\_\_\_ / \_\_\_\_\_

#### <Remark>

Do not apply voltage exceeding ±10V to analog command input of SPR/TRQR.

# [Connection and Setup of Position Control Mode]

Title of signal	Pin No.	Symbol			Function	I/F circui
CCW-Torque	16	CCWTL	• Functi	ion varies dep	ending on Pr02 (Control mode setup).	Al
limit input	97.00.		Pr02	Control mode	Function	P.84
			En		Function varies depending on Pr5B (Selection of torque command)	
				20	Pr5B Content	
				27/10	0 This input becomes invalid.	
	A. idos		4	Torque Control Position/Torque	Torque command input (TRQR) will be selected.  Set up the gain and polarity of the command with;  Pr5C (Torque command input gain)  Pr5D (Torque command input reversal)  Offset and filter cannot be set up.	N.W.I.G. S.
		onadko.	5	Velocity/ Torque	Becomes to the torque command input (TRQR).  Set up the gain and polarity of the command with; Pr5C (Torque command input gain) Pr5D (Torque command input reversal)  Offset and filter cannot be set up.	RW GROUNG
		onathe d	4 5 Other	Position/Torque Velocity/Torque Other control mode	<ul> <li>Becomes to the analog torque limit input to CCW (CCWTL).</li> <li>Limit the CCW-torque by applying positive voltage (0 to +10V) (Approx.+3V/rated toque)</li> <li>Invalidate this input by setting up Pr03 (Torque limit selection) to other than 0.</li> </ul>	
	istille.		(includ	ding 1 bit for si	onverter used in this input is 16 bit ign). [V], 1 [ LS₽]23[ mV]	May Go
CW-Torque limit	18	CWTL	• Functi	ion varies dep	ending on Pr02 (Control mode setup).	AI
input			Pr02	Control mode	Function	P.84
		Cition	2 4 5	Torque control Position/Torque Velocity/Torque	This input becomes invalid when the torque control is selected.	dbalte
	G.	enadks.pl	4 5 Other	Position/Torque Velocity/Torque Other control mode	<ul> <li>Becomes to the analog torque limit input to CW (CWTL).</li> <li>Limit the CW-torque by applying negative voltage (0 to -10V) (Approx.+3V/rated toque). Invalidate this input by setting up Pr03 (Torque limit selection) to other than 0.</li> </ul>	K. R.
S. National States			(includ	ding 1 bit for si	onverter used in this input is 16 bit ign).  [V], 1 [LSB]23[mV]	May Idogur

<sup>\*</sup>Function becomes valid when the control mode with underline ( \_\_\_\_\_ / \_\_\_\_ ) is selected while the switching mode is used in the control mode in table.

#### <Remark>

Do not apply voltage exceeding ±10V to analog command input of CWTL and CCWTL

# Output signal and Pin No. of the Connector, CN X5

## Output Signals (Common) and Their Functions

Title of signal	Pin No	Symbol	N.	Function	I/F circuit				
External brake release signal	11 10	BRKOFF+ BRKOFF-	Turns the magnetic bra     You can se mechanical	Feeds out the timing signal which activates the electromagnetic brake of the motor. Turns the output transistor ON at the release timing of the electromagnetic brake.  You can set up the output timing of this signal with Pr6A (Setup of mechanical brake action at stall) and Pr6B (Setup of mechanical brake action at motion). For details, refer to P42, "Timing Chart" of Preparation.)					
Servo-Ready output	35 34	S-RDY+ S-RDY-		shows that the driver is ready to be activated. sistor turns ON when both control and main power are ON but status.	SO1 P.85				
Servo-Alarm output	37 36	ALM+ ALM-	Output trans	his signal shows that the driver is in alarm status Dutput transistor turns ON when the driver is at normal status, and turns OFF at alarm status.					
Positioning	39	AT-SPEED+	• Function var	ries depending on the control mode.	SO1				
complete (In-position)	38	AT-SPEED-	Position control	Output of positioning complete (COIN)     The output transistor will turn ON when the absolute value of the position deviation pulse becomes smaller than the setup value of Pr60 (Positioning complete range).     You can select the feeding out method with Pr63 (Setup of positioning complete output).	P.85				
	r <sup>ara</sup> ldî	STOWST,	Full-closed control	<ul> <li>Output of full-closed positioning complete (EX-COIN)</li> <li>The output transistor will turn ON when the absolute value of full-closed-position deviation pulse becomes smaller than the setup value of Pr60 (Positioning complete range).</li> <li>You can select the feeding out method with Pr63 (Setup of positioning complete output).</li> </ul>	What i godi				
		Elighborg)	Velocity/ Torque control	Output at-speed (speed arrival) (AT-SPEED)     The output transistor will turn ON when the actual motor speed exceeds the setup value of Pr62 (In-speed).					
Zero-speed detection output signal	12 (41)	ZSP (COM-)	• Default is 1,	e output signal varies depending on Pr0A (Selection of ZSP output). and feeds out the zero speed detection signal. see the table below, "Selection of TLC,ZSP output".	SO2 P.85				
Torque in-limit signal output	40 (41)	TLC (COM-)	• Default is 1,	e output signal varies depending on Pr09 (Selection of TLC output). and feeds out the torque in-limit signal. see the table below, "Selection of TLC,ZSP output".	SO2 P.85				

#### Selection of TCL and ZSP outputs

Value of Pr09 or Pr0A	X5 TLC : Output of Pin-40	X5 ZSP : Output of Pin-12				
0	Torque in-limit output (Default of X5 TLC Pr09)     The output transistor turns ON when the torque comm	and is limited by the torque limit during Servo-ON.				
1	• Zero-speed detection output (Default of X5 ZSP Pr The output transistor turns ON when the motor speed	,				
2	Alarm signal output     The output transistor turns ON when either one of the battery alarm, fan-lock alarm or external scale alarm.	alarms is triggered, over-regeneration alarm, overload alarm				
3	Over-regeneration alarm  The output transistor turns ON when the regeneration exceeds 85% of the alarm trigger level of the regenerative load protection.					
4	• Over-load alarm The output transistor turns ON when the load exceeds 85% of the alarm trigger level of the overload alarm.					
5	• Battery alarm  The output transistor turns ON when the battery voltage for absolute encoder falls lower than approx. 3.2V.					
6	• Fan-lock alarm The output transistor turns ON when the fan stalls for I	onger than 1s.				
51 <sup>10</sup> 7	External scale alarm     The output transistor turns ON when the external sca (adjustment on mounting is required). Valid only at the	le temperature exceeds 65°, or signal intensity is not enoug full-closed control.				
8	-79	ween the actual motor speed and the speed command beforge with Pr61. Valid only at the velocity and torque control.				

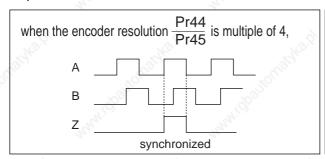
# [Connection and Setup of Position Control Mode]

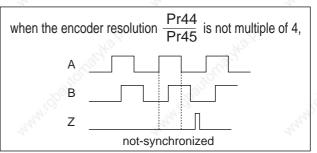
#### **Output Signals (Pulse Train) and Their Functions**

Title of signal	Pin No	Symbol	Function	I/F circuit
A-phase output	21	OA +	• Feeds out the divided encoder signal or external scale signal (A, B, Z-phase) in differential. (equivalent to RS422)	PO1 P.85
	22	OA -	<ul> <li>You can set up the division ratio with Pr44 (Numerator of pulse output division) and Pr45 (Denominator of pulse output division)</li> <li>You can select the logic relation between A-phase and B-phase, and the</li> </ul>	
B-phase output	48	OB +	<ul> <li>output source with Pr46 (Reversal of pulse output logic).</li> <li>When the external scale is made as an output source, you can set up the interval of Z-phase pulse output with Pr47 (Setup of external scale Z-phase).</li> </ul>	~ajjo
n'i	49	OB –	Ground for line driver of output circuit is connected to signal ground (GND) and is not insulated.	Varion,
Z-phase output	23	OZ +	Max. output frequency is 4Mpps (after quadrupled)	
	24	OZ –	The state of the s	-6
Z-phase output	19	CZ	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.	PO2 P.85

#### <Note>

- When the output source is the encoder
  - If the encoder resolution  $X = \frac{Pr44}{Pr45}$  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.





• In case of the 5-wire, 2500P/r incremental encoder, the signal sequence might not follow the above fig. until the first Z-phase is fed out. When you use the pulse output as the control signal, rotate the motor one revolution or more to make sure that the Z-phase is fed out at least once before using.

# Output Signals (Analog) and Their Functions

Title of signal	Pin No	Symbol		920	Function	I/F circui
Torque monitor signal output	42	IM	(IM) s	<ul> <li>The content of output signal varies depending on Pr08 (Torque monitor (IM) selection).</li> <li>You can set up the scaling with Pr08 value.</li> </ul>		AO P.85
			Pr08	Content of signal	Function	
	199		0, 11,12	Torque command	Feeds out the voltage in proportion to the motor torque command with polarity.     + : generates CCW torque     - : generates CW torque	1900
	in and a second		1 – 5	Positional deviation	Feeds out the voltage in proportion to the positional deviation pulse counts with polarity.     + : positional command to CCW of motor position     - : positional command to CW of motor position	n <sub>n</sub>
	e de la		6 –10	Full-closed deviation	Feeds out the voltage in proportion to the full- closed deviation pulse counts with polarity.     + : positional command to CCW of external scale position     - : positional command to CW of external scale position	anan idibaj
Speed monitor signal output	43	SP	(IM) s	election).	output signal varies depending on Pr07 (Speed monitor scaling with Pr07 value.	AO P.85
			Pr07	Control mode	Function	
	and the		0 – 4	Motor speed	Feeds out the voltage in proportion to the motor speed with polarity. + : rotates to CCW     - : rotates to CW	WHY I GO
			5 – 9	Command speed	Feeds out the voltage in proportion to the command speed with polarity.     + : rotates to CCW     - : rotates to CW	

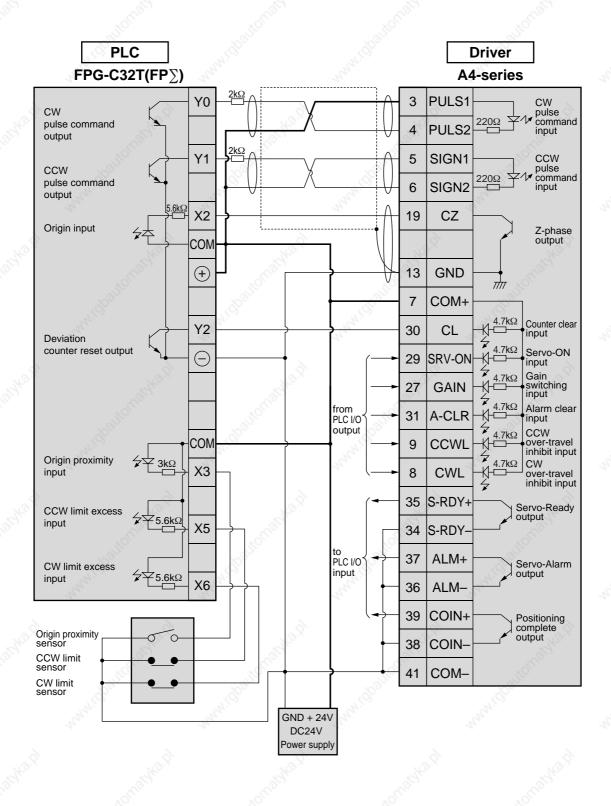
# [Connection and Setup of Position Control Mode]

# Output Signals (Others) and Their Functions

Title of signal	Pin No	Symbol	Function	I/F circuit
Signal ground	13,15, GND 17,25	Signal ground     This output is insulated from the control signal power (COM–) inside of the driver.	E	
Frame ground	50	FG	This output is connected to the earth terminal inside of the driver.	_

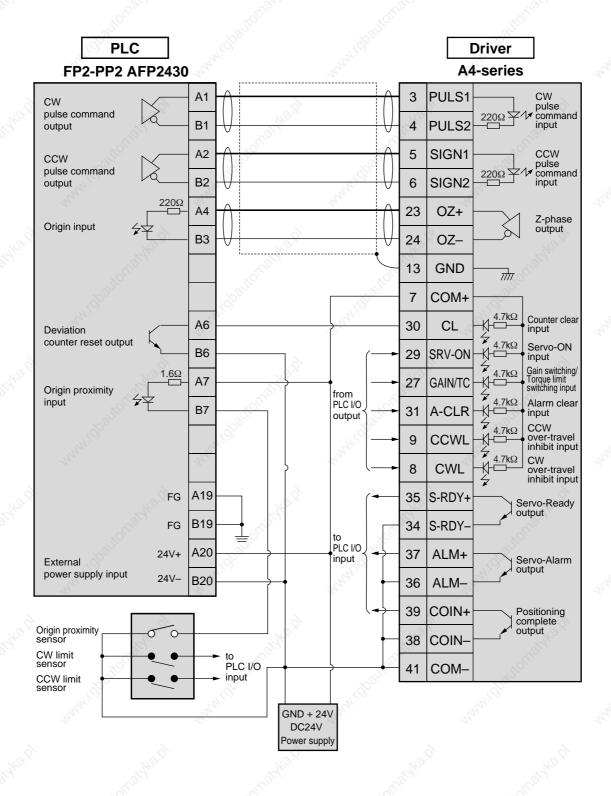
## **Connecting Example to Host Controller**

## Matsushita Electric Works, FPG-C32T



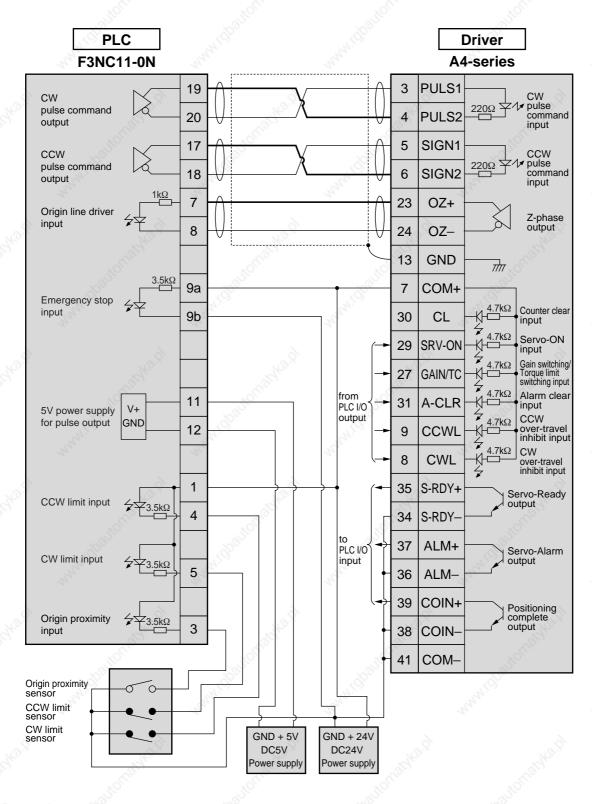
#### <Remark>

## Matsushita Electric Works, FP2-PP2 AFP2430



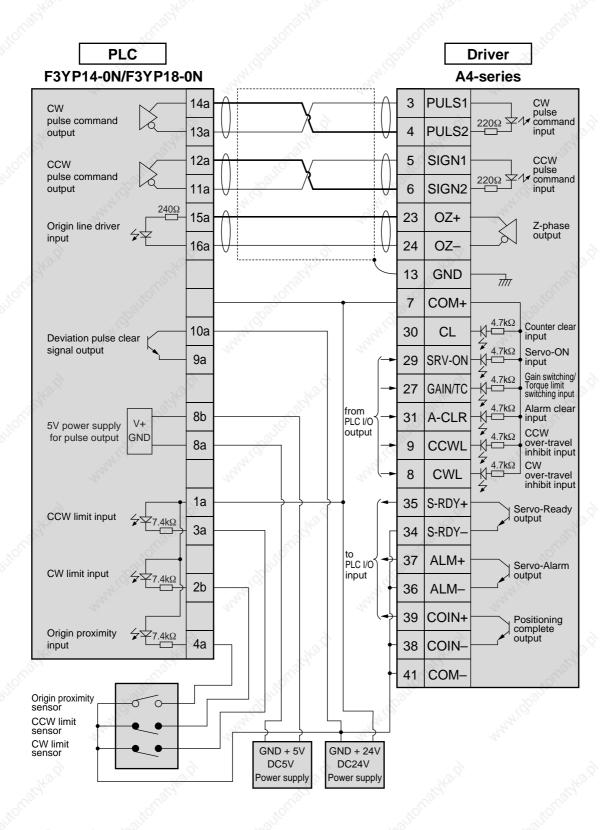
#### <Remark>

## Yokogawa Electric, F3NC11-ON



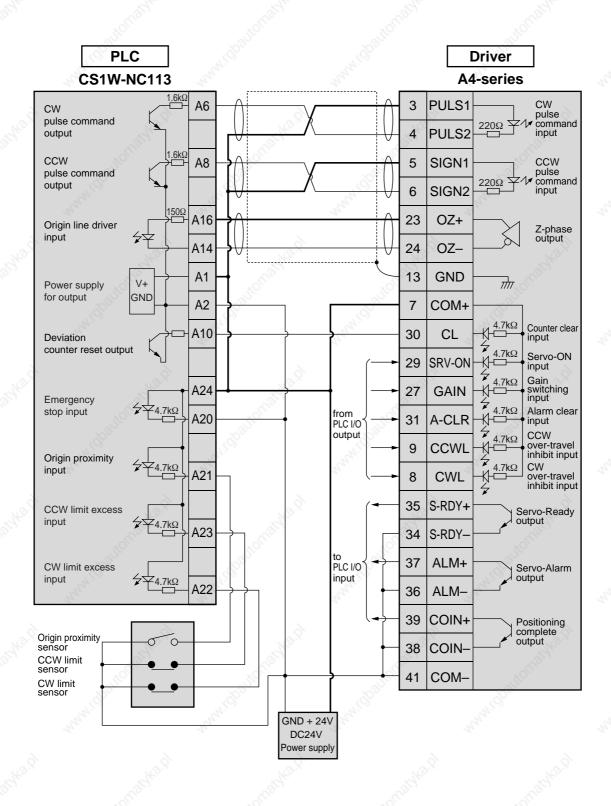
#### <Remark>

## Yokogawa Electric, F3YP14-0N/F3YP18-0N



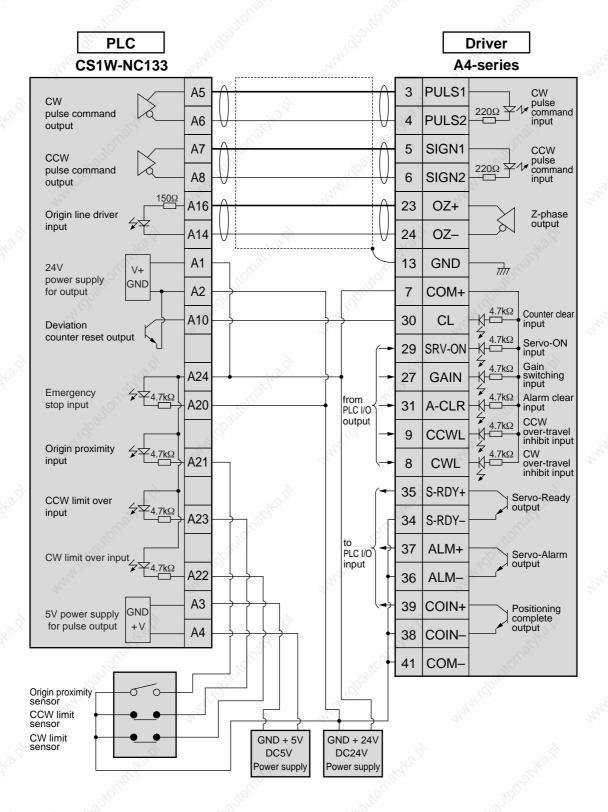
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## Omron, CS1W-NC113



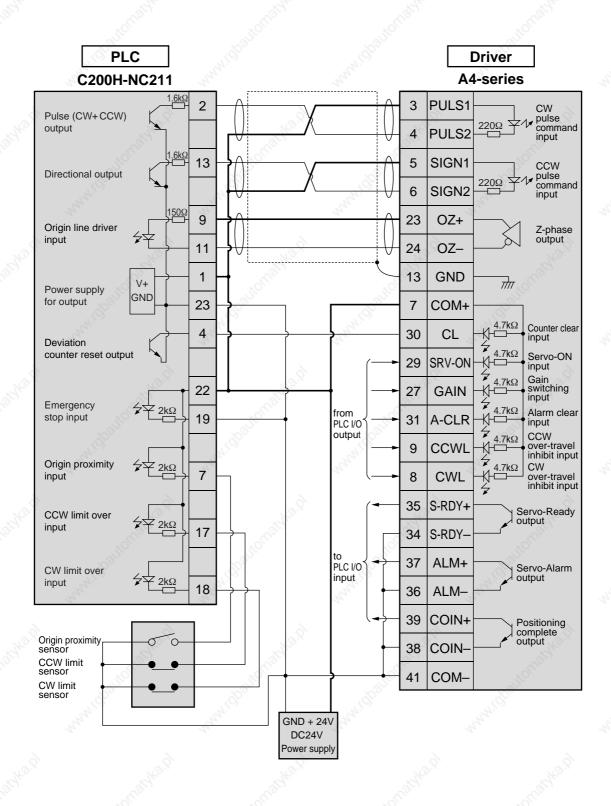
#### <Remark>

# Omron, CS1W-NC133



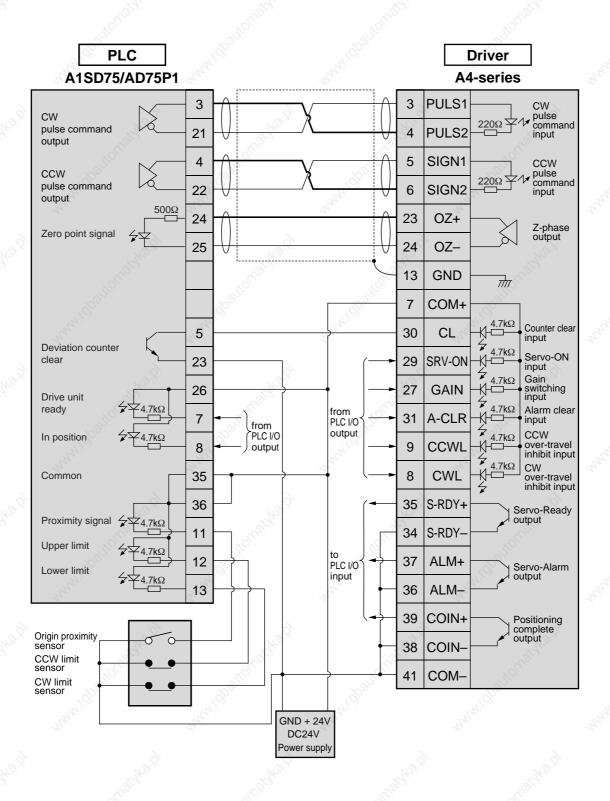
#### <Remark>

#### Omron, C200H-NC211



#### <Remark>

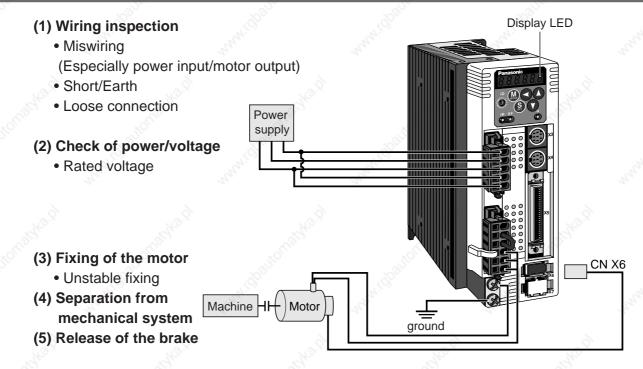
#### Mitsubishi, A1SD75/AD75P1



#### <Remark>

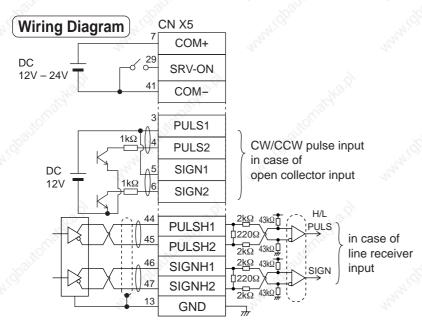
# Trial Run (JOG run) at Position Control Mode

## **Inspection Before Trial Run**



## **Trial Run by Connecting the Connector, CN X5**

- (1) Connect the CN X5.
- (2) Enter the power (DC12 to 24V) 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 Pr42 (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, CN X5, Pin-29) and COM- (CN X5, 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.68, "Display of Factor for No-Motor Running" of Preparation.



#### Parameter

PrNo.	Title	
02	Setup of control mode	0
04	Invalidation of over-travel inhibit input	1
40	Selection of command pulse input	0/1
42	Mode setup of command pulse input	10
43	Inhibition setup of command pulse input	<u></u> 1
4E	Counter clear mode	2

• Enter command pulses from the host controller.

#### Input signal status

No.	Title of signal	Monitor display
0	Servo-ON	+ A

# Connection and Setup of Position Control Mode

#### **Setup of Motor Rotational Speed and Input Pulse Frequency**

Input pulse frequency	Motor rotational	Pr48 x 2 Pr4A Pr4B		
(pps)	speed (r/min)	17-bit	2500P/r	
2M	3000	1 x 2 <sup>15</sup>	2500 x 2 <sup>0</sup>	
500K	3000	1 x 2 <sup>17</sup>	10000 x 2 <sup>0</sup>	
250K	3000	1 x 2 <sup>17</sup> 5000	10000 x 2 0 5000	
100K	3000	1 x 2 <sup>17</sup>	10000 x 2 <sup>0</sup>	
500K	1500	1 x 2 <sup>16</sup>	50000 x 2 <sup>0</sup>	

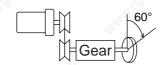
#### <Note>

Defaults of Pr48 and Pr49 are both 0, and encoder resolution is automatically set up as numerators. Defaults of Pr48 and Pr49 are both 0, and encoder resolution is automatically set up as numerators.

#### <Remarks>

- Max. input pulse frequency varies depending on input terminals.
- You can set up any values to numerator and denominator, however, setup of an extreme division ratio or multiplication ratio may result in dangerous action. Recommended ratio is 1/50-20.

Relation between the motor rotational speed and input pulse counts



Pulley ratio:  $\frac{18}{60}$ Gear ratio:  $\frac{12}{73}$ 

Total reduction ratio :  $\frac{18}{365}$ 

e.g.) When you want to rotate the motor by 60° with the load of total reduction ratio of 18/365.

	Encoder			
	17-bit	2500P/r		
Pr48 x 2 Pr4A Pr4B	365 x 2 <sup>10</sup> 6912	365 x 2 <sup>0</sup> 108		
Command pulse	To rotate the output shaft by 60°, enter the command of 8192 (2 <sup>13</sup> ) pulses from the host controller.	To rotate the output shaft by 60°, enter the command of 10000 pulses from the host controller.		
How to determine parameter	$\frac{365}{18} \times \frac{1 \times 2^{17}}{2^{13}} \times \frac{60^{\circ}}{360^{\circ}}$ $= \frac{365 \times 2^{17}}{884736}$	$\frac{365}{18} \times \frac{10000}{10000} \times \frac{60^{\circ}}{360^{\circ}}$ $= \frac{365 \times 2^{0}}{108}$		
	Hence the obtained numerator becomes 47841280>2621440 and denominator exceeds the max value of 10000, you have to reduce to the common denominator to obtain.	unithana kati		
	$\frac{365}{18} \times \frac{1 \times 2^{10}}{2^6} \times \frac{60^\circ}{360^\circ}$ $= \frac{365 \times 2^{10}}{6912}$	7/63 th		

<b>2</b> <sup>n</sup>	Decimal
2	figures
20	A 35 PM
2 <sup>1</sup>	2
2 <sup>2</sup>	4
2 <sup>3</sup>	8
2 <sup>4</sup>	16
2 <sup>5</sup>	32
2 <sup>6</sup>	64
27	128
2 <sup>8</sup>	256
2 <sup>9</sup>	512
2 <sup>10</sup>	1024
2 <sup>11</sup>	2048
2 <sup>12</sup>	4096
2 <sup>13</sup>	8192
2 <sup>14</sup>	16384
2 <sup>15</sup>	32768
2 <sup>16</sup>	65536
2 <sup>17</sup>	131072
28.	•

<sup>\*</sup>Refer to P.306 "Division Ratio for Parameters" of Supplement.

# **Real-Time Auto-Gain Tuning**

#### **Outline**

The driver estimates the load inertia of the machine in real time, and automatically sets up the optimum gain responding to the result. Also the driver automatically suppress the vibration caused by the resonance with an adaptive filter.

# Position/Velocity command Auto-filter adjustment | Torque command | Auto-filter adjustment | Adaptive | Fosition/Velocity | Adaptive | Fosition/Velocity | Adaptive | Current | Filter | Current | Current | Current | Control | Motor | Current | Current | Current | Current | Control | Current | Cu

#### **Applicable Range**

 Real-time auto-gain tuning is applicable to all control modes.

#### Caution

Real-time auto-gain tuning may not be executed properly under the conditions described in the right table. In these cases, use the normal mode auto-gain tuning (refer to P.236 of Adjustment), or execute a manual gain tuning. (refer to P.240, of Adjustment)

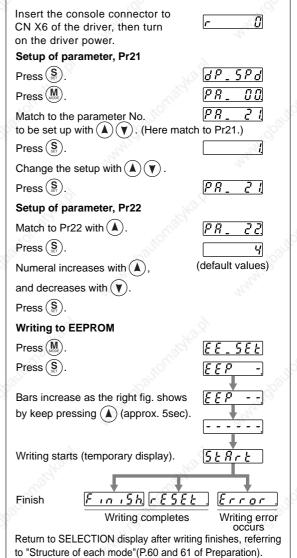
	Conditions which obstruct real-time auto-gain tuning
	Load is too small or large compared to rotor inertia.
Load	(less than 3 times or more than 20 times)
inertia	Load inertia change too quickly. (10 [ s] or less)
9	Machine stiffness is extremely low.
Load	Chattering such as backlash exists.
	Motor is running continuously at low speed of 100 [ r/min] or lower.
	Acceleration/deceleration is slow (2000[ r/min] per 1[ s] or low
Action	Acceleration/deceleration torque is smaller than
pattern	unbalanced weighted/viscous friction torque.
•	When speed condition of 100[ r/min] or more and
	acceleration/deceleration condition of 2000[ r/min] per
	1[ s] are not maintained for 50[ ms] .

#### **How to Operate**

- (1) Bring the motor to stall (Servo-OFF).
- (2) Set up Pr21 (Real-time auto-gain tuning mode setup) to 1-7. Default is 1.

Setup value	Real-time auto-gain tuning	Varying degree of load inertia in motion
0	(not in use)	-197
<1>	. of C	no change
2	normal mode	slow change
3		rapid change
4	The state of the s	no change
5	vertical axis mode	slow change
6	8	rapid change
7	no-gain switching mode	no change

- When the varying degree of load inertia is large, set up 3 or 6.
- When the motor is used for vertical axis, set up 4-6.
- When vibration occurs during gain switching, set up 7.
- When resonance might give some effect, validate the setup of Pr23 (Setup of adaptive filter mode).
- (3) Set up Pr22 (Machine stiffness at real-time auto-gain tuning) to 0 or smaller value.
- (4) Turn to Servo-ON to run the machine normally.
- (5) Gradually increase Pr22 (Machine stiffness at real-time auto-gain tuning) when you want to obtain better response. Lower the value (0 to 3) when you experience abnormal noise or oscillation.
- (6) Write to EEPROM when you want to save the result.



## [Connection and Setup of Position Control Mode]

## **Adaptive Filters**

The adaptive filter is validated by setting up Pr23 (Setup of adaptive filter mode) to other than 0.

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

The adaptive filter may not operate property under the following conditions. In these cases, use 1st notch filter (Pr1D and 1E) and 2nd notch filter (Pr28-2A) to make measures against resonance according to the manual adjusting procedures. For details of notch filters, refer to P.246, "Suppression of Machine Resonance" of Adjustment.

	Conditions which obstruct adaptive filter action
Resonance point	<ul> <li>When resonance frequency is lower than 300[ Hz] .</li> <li>While resonance peak is low or control gain is small and when no affect from these condition is given to the motor speed.</li> <li>When multiple resonance points exist.</li> </ul>
<ul> <li>When the motor speed variation with high frequency factor is generated due to non-linear factor s</li> </ul>	
Command pattern • When acceleration/deceleration is very extreme such as more than 30000 [ r/min] pe	

#### <Note>

Even though Pr23 is set up to other than 0, there are other cases when adaptive filter is automatically invalidated. Refer to P.235, "Invalidation of adaptive filter" of Adjustment.

#### Parameters Which Are Automatically Set Up.

Following parameters are automatically adjusted.

Also following parameters are automatically set up.

PrNo.	Title	
10	1st gain of position loop	
11	1st gain of velocity loop	
12	1st time constant of velocity loop integration	
13	1st filter of velocity detection	
14	1st time constant of torque filter	
18	2nd gain of position loop	
19	2nd gain of velocity loop	
1A	2nd time constant of velocity loop integration	
1B	2nd filter of speed detection	
1C	2nd time constant of torque filter	
20	Inertia ratio	
2F	Adaptive filter frequency	

PrNo.	Title	Setup value
15	Velocity feed forward	300
16	Time constant of feed forward filter	50
27	Setup of instantaneous speed observer	0
30	2nd gain setup	ŢĬŢ.
31	1st mode of control switching	10
<b>32</b>	1st delay time of control switching	30
33	1st level of control switching	50
34	1st hysteresis of control switching	33
35	Position gain switching time	20
36	2nd mode of control switching	0 80
		- (50)

#### <Notes>

- When the real-time auto-gain tuning is valid, you cannot change parameters which are automatically adjusted.
- Pr31 becomes 10 at position or full closed control and when Pr21 (Setup of Real-Time Auto-Gain Tuning Mode) is 1 to 6, and becomes 0 in other cases.

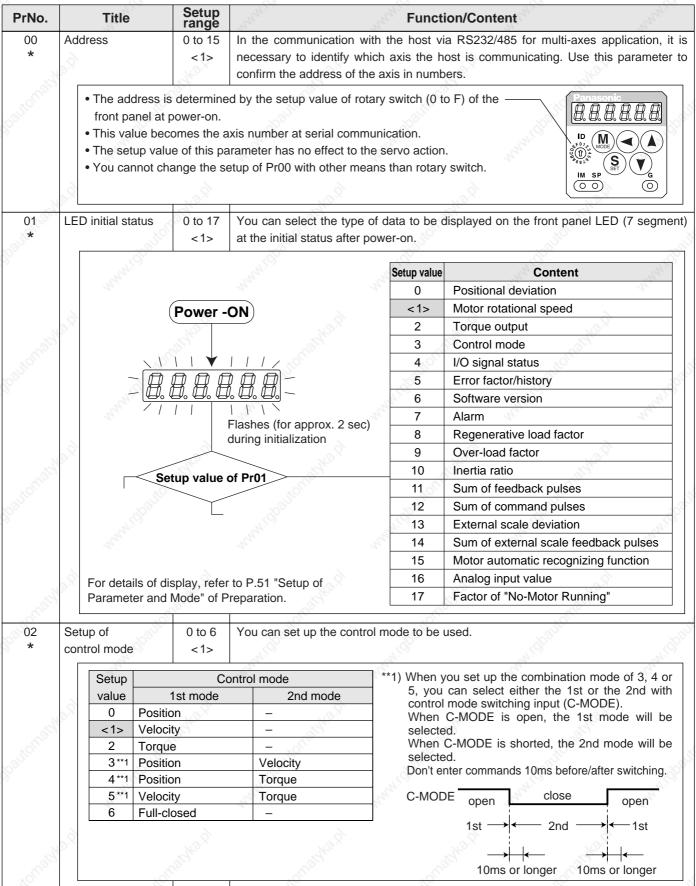
#### Cautions

- (1) After the start-up, you may experience abnormal noise and oscillation right after the first Servo-ON, or when you increase the setup of Pr22 (Selection of machine stiffness at real-time auto-gain tuning), until load inertia is identified (estimated) or adaptive filter is stabilized, however, these are not failures as long as they disappear immediately. If they persist over 3 reciprocating operations, take the following measures in possible order.
  - 1) Write the parameters which have given the normal operation into EEPROM.
  - 2) Lower the setup of Pr22 (Selection of machine stiffness at real-time auto-gain tuning).
  - 3) Set up both Pr21 (Setup of real-time auto-gain tuning) and Pr23 (Setup of adaptive filter mode) to 0, then set up other value than 0. (Reset of inertia estimation and adaptive action)
  - 4) Invalidate the adaptive filter by setting up Pr23 (Setup of adaptive filter mode setup) to 0, and set up notch filter manually.
- (2) When abnormal noise and oscillation occur, Pr20 (Inertia ratio) or Pr2F (Adaptive filter frequency) 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, Pr20 (Inertia ratio) and Pr2F (Adaptive filter frequency) will be written to EEPROM every 30 minutes. When you turn on the power again, auto-gain tuning will be executed using the latest data as initial values.
- (4) When you validate the real-time auto-gain tuning, Pr27 (Setup of instantaneous speed observer) will be invalidated automatically.
- (5) The adaptive filter is normally invalidated at torque control, however, when you select torque control while you set up Pr02 (Control mode setup) to 4 and 5, the adaptive filter frequency before mode switching will be held.
- (6) During the trial run and frequency characteristics measurement of "PANATERM®", the load inertia estimation will be invalidated.

# **Parameter Setup**

## **Parameters for Functional Selection**

Standard default : < >



#### <Notes>

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

PrNo.	Title	Setup range	10 July 1	×	Function/Cor	ntent	102 III			
03	Selection of	0 to 3	You can set u	p the torque limit	ing method for Co	CW/CW direction	n. <sub>M</sub> iO			
	torque limit	<1>	Setup value	₹ C(	CW	Tr.	CW			
			0	X5 CCW7	L : Pin-16	X5 C	WTL : Pin-18			
,	3	20	<1>	Pr5E is	a limit value for b	oth CCW and C	CW direction			
29/co		- AP	2	Set wit	th Pr5E	Set	t with Pr5F			
allio		OLLIO.	When GAIN/TL-SEL input is open, set with Pr5E							
710	~alice		When GAIN/TL-SEL input is shorted, set with Pr5F							
	HALM TOP		limit setup). A	At the torque co	ntrol, Pr5E becor up of this paramet	mes the limiting er.	d by Pr5E (1st torque g value for CCW/CW			
04 *	Setup of over-travel inhibit input	0 to 2 <1>	motor to run to	the direction spot that you can pre	ecified by limit swi event the work loa	itches which are ad from damagir	function to inhibit the installed at both ends ing the machine due to			
1101		1011	the over-trave	I. With this input,	you can set up the	e action of over-t	ravel inhibit input.			
5	700	×	7000	CW direction	Work CCW dire	ection				
,	14/6		14 C			Driver				
	Re.		E.	Servo motor ↑	Limit Limit	71,2				
					switch switch CC	CWL -				
The	×	163.7	_3	K3.X	CV	<u> </u>	Marx			
"Ollier,	Setup	CCWL/CWL	In most	Commention to COM	1 -000000	Action				
BILL .	value	input	Input	Connection to COM-	Name al atatua vuls	ila CCM aida limit	auditab ia wat aatiwata d			
	7/02		CCWL (CNLVE Din 0)	CCWL Close Normal status while CCW-side limit switch is not activated (CN X5,Pin-9) Open Inhibits CCW direction, permits CW direction.						
	0	Valid	CWL Close Normal status while CW-side limit switch is not activated.							
	4									
			(CN X5,Pin-9)	Open			ection permitted.			
160	<1>	Invalid		na CWL inputs w	ili be ignored, and	a over-traver inin	nibit function will be			
Mag.		30,	invalidated.	aval inhihit innut	protoction) is tria	garad whan aith	or one			
BILLOI.	2	Valid	3,00	(Over-travel inhibit input protection) is triggered when either one connection of CW or CCW inhibit input to COM– become open.						
, orally a	Ann Marie		ates and s travel inhibited. When both trips with Eeg. 3. When you to	tops according to tion). For details of CCWL and C' rr38 (Overtravel i ourn off the limit s	o the preset sequence to the explain the explainment of the explainmen	uence with Pr6 anation of Pr66. ened while Pr04 judging that this de of the work a	is set to 0, the driver s is an error. t vertical axis applica-			
Julie .	.200	200					the loosing of upward ontroller instead of us-			
			torque. In this case, set up Pr66 to 2, or limit with the host controller instead of using this function.							
07	Selection of sp	eed 0 to 9	You can set	up the content of	of analog speed	monitor signal	output (SP: CN X5,			
	monitor (SP)	<3>	Pin43) and the	e relation betwee	n the output volta	age level and the	e speed.			
120	5,	12.5	Setup value	Signal of SP	Relation between	the output voltage	ge level and the speed			
Vaga,		A S	0	5	730	6V / 47 r/min	S)			
HOL.		10F	1,0	NA-4-	10	6V / 188 r/mi				
367	200	-	2	Motor actual	500	6V / 750 r/mi	A97			
)	"H' <sub>(O)</sub>		<3> speed		6V / 3000 r/min					
	The state of		4	44		1.5V / 3000 r/m	- 19			
			5	-		6V / 47 r/min				
4	5	6	6	. 6	. 6	6V / 188 r/mi	_			
The		Mr.	7	Command	"Tho.,	6V / 750 r/mi				
Mar,		Willey,	8	speed	The ,	6V / 3000 r/m				
110.	~	20.	9		12 <sub>C</sub>	1.5V / 3000 r/m				
Y			200	6,	5"		- 50'0			

Dill.	T:41.	Setup	Standard default : <					
PrNo.	Title	Setup range	2025		70,	7000	305	
08	Selection of torque monitor (IM)	0 to 12 <0>	646		analog torque monitor of output voltage level and to	-	(-1)	
			Setup value	Signal of IM	Relation between the output voltage	ge level and torq	ue or deviation pulse counts	
	, g)	29	<0>	Torque command	3V/rate	d (100%) to	orque	
	₽	ig/co	1	200	3V / 31	Pulse	3/2	
	, sé	(a)	2	Position	3V / 12	5Pulse		
	- Silve		3	deviation	3V / 50	0Pulse	9	
	(a)		4	ueviation	3V / 20	00Pulse		
	Tay.		5	Tay.	3V / 80	00Pulse	The state of the s	
	7		6		3V / 31	9.		
	6	9	7	Full-closed	3V / 12			
	\$ x	753.	8	deviation	3V / 500Pulse			
	8	100°	9	ALL GOVERNMENT	437	00Pulse	9	
	11/0		10	_	3V / 80			
	(9)		11	Torque .	3V / 20			
and the second			12	command	3V / 40	0% torque	44,	
09	Selection of	0 to 8	You can assi	gn the function o	f the torque in-limit outpu	ut (TLC : CI	N X5 Pin-40).	
	TLC output	<0>	Setup value	2	Function		Note	
	.S.	15.5.	<0>	Torque in-limit	output		10.8	
		(g)	1	Zero speed dete	ection output	5.	For details of	
	105		2	Alarm output of	either one of Over-reg	generation	function of each	
	Wildpan I		2 00	/Over-load/Abso	lute battery/Fan lock/Exte	ernal scale	output of the left, refer to the table of P.92, "Selection of	
			3	Over-regenerati	on alarm trigger output	4.0		
May.			4	Overload alarm				
			5	Absolute battery				
	, <u>(</u> )		6	Fan lock alarm output  External scale alarm output			TCL and ZSP	
		ight.	7				outputs".	
	*05	100	8	In-speed (Speed	d coincidence) output	'77 <sub>0x</sub>		
0A	Selection of	0 to 8	You can assi	ou can assign the function of the zero speed detection output (Z			SP: CN X5 Pin-12).	
	ZSP output	<1>	Setup value	12.	Function	47	Note	
	12		0	Torque in-limit		For details of		
			<1>	Zero speed dete				
	<sup>9</sup> .6,	13.5	2		either one of Over-reg		function of each	
		J. C.		77.7	lute battery/Fan lock/Exte	ernal scale	output of the	
	10%		3		on alarm trigger output	10/1/	left, refer to the	
	1090		4	Overload alarm	- VNV	1237	table of P.92, "Selection of	
	"41 <sub>10</sub>		5	Absolute battery Fan lock alarm	· · · · · · · · · · · · · · · · · · ·	400	TCL and ZSP	
	Tr.		7	External scale a			outputs".	
			8		d coincidence) output		outputs.	
	(Q)	100		26.	~ ~ ~		20	
0B *	Setup of	0 to 2	You can set	up the using meth	nod of 17-bit absolute er	coder.	3/2	
, of 100	absolute encoder	<1>	Setup value	×	Content	-,50°		
	2 Sallie		0	Use as an abso	lute encoder.	Zajir.	~	
	"4'CA.		<1>		mental encoder.	70,	77(0)	
	May.		2	Use as an abso	lute encoder, but ignore	the multi-tu	ırn counter over.	
			<caution></caution>					
	9	6	This paramet	er will be invalida	ted when 5-wire, 2500P	/r incremen	tal encoder is used.	
0C *	Baud rate setup of	0 to 5	You can set	up the communic	ation speed of RS232.	• Error of	baud rate is ±0.5%	
300	RS232 communication	<2>	Setup value	Baud ra	Setup valu	ie . de	Baud rate	
	L COMMUNICATION		0.00	2400bp	os 3	- 35	19200bps	
	Communication		0	24000	55	7000	102000p0	
	Communication		1	4800bp	30.	7/00,	38400bps	

Standard default : < >

PrNo.	Title	Setup range	Marito.	Function/Content							
0D *	Baud rate setup of	0 to 5 <2>	You can set up tl	ne communication speed	d of RS485.	• Error of	baud rate is ±0.5%				
^	RS485		Setup value Baud rate Setup		Setup val	lue	Baud rate				
	communication		0	2400bps	3		19200bps				
	\$		1 4800bps 4			38400bps					
29 A.C.	ð		<2>	9600bps	5	Pion	57600bps				
0E	Setup of front	0 to 1	- C/-	operation of the front pa	anel to the	Setup value	Content				
*	panel lock	<0>	monitor mode on	.00		<0>	Valid to all				
	Mary.		You can prevent such a misoperation as unexpected parameter change.			1	Monitor mode only				
			<note></note>								
	, P	16.61	You can still change parameters via communication even though this setup is 1. To return this parameter to 0, use the console or the "PANATERM®".								

### Parameters for Adjustment of Time Constants of Gains and Filters

Standard default: < >

PrNo.	Title	Setup range	Unit	Function/Content
10	1st gain of position loop	O to 3000 A to C-frame:<63>* D to F-frame:<32>*	1/s	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.
11	1st gain of velocity loop	1 to 3500 A to C-frame:<35>* D to F-frame:<18>*	Hz	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 Pr20 is set correctly, the setup unit of Pr11 becomes (Hz).</caution>
12	1st time constant of velocity loop integration	1 to 1000 A to C-frame:<16>* D to F-frame:<31>*	ms	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 "999".  The integration effect will be lost by setting to "1000".
13	1st filter of speed detection	0 to 5 <0>*	_	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.
14	1st time constant of torque filter	O - 2500 A to C-frame:<65>* D to F-frame:<126>*	0.01ms	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.
15	Velocity feed forward	-2000 to 2000 <300>*	0.1%	You can set up the velocity feed forward volume at position control.  Higher the setup, smaller positional deviation and better response you can obtain, however this might cause an overshoot.
16	Time constant of feed forward filter	0 to 6400 <50>*	0.01ms	You can set up the time constant of 1st delay filter inserted in velocity feed forward portion.  You might expect to improve the overshoot or noise caused by larger setup of above velocity feed forward.

### <Notes>

- For parameters which No. have a suffix of "\*", changed contents will be validated when you turn on the control power.
- Parameters which default values have a suffix of "\*" will be automatically set up during real time auto-gain tuning. When you change manually, invalidate the real-time auto-gain tuning first then set, referring to P.239, "Release of Automatic Gain Adjusting Function" of Adjustment.

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content
18	2nd gain of	0 to 3000	1/s	Position loop, velocity loop, speed detection filter and torque command
	position loop	A to C-frame:<73>		filter have their 2 pairs of gain or time constant (1st and 2nd).
19	2nd gain of velocity	D to F-frame:<38>* 1 to 3500	Hz	For details of switching the 1st and the 2nd gain or the time constant, refer
19	loop	A to C-frame:<35>* D to F-frame:<18>*	П	to P.226, "Adjustment".  The function and the content of each parameter is as same as that of the 1st gain and time constant.
1A	2nd time constant of velocity loop integration	1 to 1000 <1000>*	ms	jedi. 9
1B	2nd filter of velocity detection	0 to 5 <0>*	Marin .	Hange Bang, Manying Hanger
1C	2nd time constant of torque filter	O to 2500 A to C-frame:<65>* D to F-frame:<126>*	0.01ms	The is
1D	1st notch	100 to 1500	Hz	You can set up the frequency of the 1st resonance suppressing notch filter.
	frequency	<1500>		The notch filter function will be invalidated by setting up this parameter to "1500".
1E	1st notch width	0 to 4	- Lale	You can set up the notch filter width of the 1st resonance suppressing filter in 5 steps.
	selection	<2>		Higher the setup, larger the notch width you can obtain.
	8	- 2		Use with default setup in normal operation.

# Parameters for Auto-Gain Tuning

PrNo.	Title	Setup range	Unit	in.	Function/Cont	ent				
20	Inertia ratio	0 to 10000	%	You can set up the ratio of the load inertia against the rotor (of the motor) inertia.						
	9	<250>*		Pr20= (load inertia/rotor inertia) X 100 [ %]						
	o., hungigane	Page 4	V()							
21	Setup of real-time auto-gain tuning	0 to 7 <1>	- -	You can set up the action mode of the real-time auto-gain tuning. With higher setup such as 3 or 6, the driver respond quickly to the change of the inertia during operation, however it might cause an unstable operation. Use 1 or 4 for normal operation. For the vertical axis application, use with the setup of 4 to 6. When vibration occurs at gain switching, set up this to "7".						
	Hay.			use with the setup	or 4 for normal operation. For 4 to 6.	For the vertical axis application				
	od nan	15/40.D		use with the setup	or 4 for normal operation.F of 4 to 6. curs at gain switching, se Real-time	For the vertical axis application to the vertical axis application to the total to the vertical axis application.  Varying degree of				
	10 de 1 de	edistha ti		use with the setup When vibration oc	or 4 for normal operation.F of 4 to 6. curs at gain switching, se Real-time auto-gain tuning	For the vertical axis application tup this to "7".				
	10 Hay.	eadhad		When vibration oc	or 4 for normal operation.F of 4 to 6. curs at gain switching, se Real-time	t up this to "7".  Varying degree of load inertia in motion				
	o di man	gathad)		wise with the setup When vibration oo Setup value	or 4 for normal operation.F of 4 to 6. curs at gain switching, se Real-time auto-gain tuning	Tor the vertical axis application, tup this to "7".  Varying degree of load inertia in motion  —  Little change				
	aci www.clialite	(STANC)		Setup value  0 <1>	or 4 for normal operation. F of 4 to 6. curs at gain switching, se Real-time auto-gain tuning Invalid	t up this to "7".  Varying degree of load inertia in motion				
	add why ill all of	REPART!		Setup value  0 <1> 2	or 4 for normal operation. F of 4 to 6. curs at gain switching, se Real-time auto-gain tuning Invalid	t up this to "7".  Varying degree of load inertia in motion  Little change  Gradual change				
	od why illustra			Setup value  0 <1> 2 3	or 4 for normal operation. F of 4 to 6. curs at gain switching, se Real-time auto-gain tuning Invalid	t up this to "7".  Varying degree of load inertia in motion  Little change Gradual change Rapid change				
	od hundigalio	ARCO D		Setup value  0 <1> 2  3  4	or 4 for normal operation. F of 4 to 6. curs at gain switching, se Real-time auto-gain tuning Invalid  Normal mode	varying degree of load inertia in motion  Little change  Rapid change  Little change  Little change				

Standard default : < >

r	Selection of machine stiffness at real-time auto-gain tuning	O to 15 A to C-frame:	"4'O.		up the machine stiffn	ess in 16 steps while the real-time auto
á	at real-time	-	7.0	gain tuning is	valid.	
Hollidako (*	auto-gain tuning	<4>			low←ma	chine stiffness→ high
icugalko).	aato gani taning	D to F-frame:				servo gain → high
Hollingth.		<1>		NO. Y		14, 15
Prou.		3		99	low ←	response → high
2,			×0		10W —	response — mgn
			1030	<caution></caution>		
			11/0			ue rapidly, the gain changes rapidly a to the machine. Increase the setu
I .			The same		tching the movement	
- 00	Catura of a damting	0.45.0			up the action of the a	
	Setup of adaptive	0 to 2	_	0 : Invalid	up the action of the a	daptive iliter.
FO KI	filter mode	<1>		1 : Valid		
Vales.		33			ulde the adaptive filter fo	requency when this setup is changed to 2.)
400			89	<caution></caution>	ilus tile adaptive liitei li	requericy when this setup is changed to 2.)
3			7027		at up the adaptive filte	er to invalid, the adaptive filter frequenc
			"1'(O.	•		adaptive filter is always invalid at the
			The same	torque contro		adaptive litter is always invalid at the
-04	0-1	0.4- 0				
	Selection of	0 to 2	_		- A	nod when you use the damping filter.
	damping filter	<0>			ching (both of 1st and	· New York
A STATE OF S	switching	5			2nd with damping control switching inpu	
10,			30	(VS-SEL		
			900			st damping filter selection (Pr2B, 2C)
	"H'{Q,		410			I damping filter selection (Pr2D, 2E)
			120	2 : You car	switch with the posit	tion command direction.
				CCW	: 1st damping filter se	election (Pr2B, 2C).
- 6	<b>N</b>	9			: 2nd damping filter s	
100	Setup of an action	0 to 7	_			at the normal mode auto-gain tuning.
	at normal mode	<0>	* C	-	Number of revolution	Rotational direction
3	auto-gain tuning		100 m	<0>	7. S. J.	CCW → CW
			(0)	1	2 [ revolution]	CW → CCW
			The same	2	Zinovolationi	CCM → CCM
		*	E.	3	1,	CM → CM
				4		CCM → CM
138		13.5.		5	1. Franchitian	CW → CCW
30/2		3		6	1 [ revolution]	CCW → CCW
.0 <sup>(1)</sup>			×C	7	,0171	CW → CW
200			~30°	e.g.) When t	he setup is 0, the m	notor turns 2 revolutions to CCW and
	77,07		77,07	revolutions to		
26	Setup of software	0 to 1000	0.1			inge of the motor against the position
1	limit	<10>	revolution	command in	put range. When the	e motor movement exceeds the setu Pr34 will be triggered. This parameter i
				invalid with s	etup value of 0.	rio4 wiii be triggered. This parameter i
27	Setup of	0 to 1	_			ou can achieve both high response an
2,-4	instantaneous	<0>*		7,147	16,44	sing this instantaneous speed observer
	speed observer		.89	Setup value		eous speed observer setup
	70%		7035	<0>*	motantan	Invalid
			410		- 14 CO	
	44,	<u> </u>	24,	1	M.	Valid

### <Notes>

• Parameters which default values have a suffix of "\*" will be automatically set up during real time auto-gain tuning. When you change manually, invalidate the real-time auto-gain tuning first then set, referring to P.239, "Release of Automatic Gain Adjusting Function" of Adjustment.

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content
28	2nd notch frequency	100 to 1500 <1500>	Hz	You can set up the 2nd notch width of the resonance suppressing filter in 5 steps. The notch filter function is invalidated by setting up this parameter to "1500".
29	Selection of 2nd notch width	0 to 4 <2>	_	You can set up the notch width of 2nd resonance suppressing filter in 5 steps. Higher the setup, larger the notch width you can obtain.  Use with default setup in normal operation.
2A	Selection of 2nd notch depth	0 to 99 <0>	- 100	You can set up the 2nd notch depth of the resonance suppressing filter. Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.
2B	1st damping frequency	0 to 2000 <0>	0.1Hz	You can set up the 1st 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 10.0 to 200.0[ Hz] . Setup of 0 to 99 becomes invalid Refer to P.250, "Damping control" as well before using this parameter.
2C	Setup of 1st damping filter	-200 to 2000 < 0>	0.1Hz	While you set up Pr2B (1st damping frequency), set this up to smaller value when torque saturation occurs, and to larger value when you need faster action. Use with the setup of 0 in normal operation. Refer to P.250, "Damping control" of Adjustment. <caution> Setup is also limited by 10.0[ Hz] -Pr2₽Pr2C≦Pr2B</caution>
2D	2nd damping frequency	0 to 2000 <0>	0.1Hz	You can set up the 2nd damping frequency of the damping control which suppress vibration at the load edge.  The driver measures vibration at the load edge. Setup unit is 0.1 [ Hz] .  Setup frequency is 10.0 to 200.0 [ Hz] . Setup of 0-99 becomes invalid.  Refer to P.250, "Damping control" of Adjustment as well before using this parameter.
2E	Setup of 2nd damping filter	-200 to 2000 < 0>	0.1Hz	While you set up Pr2D (2nd damping frequency), set this up to smaller value when torque saturation occurs, and to larger value when you need faster action.  Use with the setup of 0 in normal operation. Refer to P.250, "Damping control" of Adjustment. <caution></caution>
2F	Adaptive filter frequency	0 to 64 <0>	nen la	Setup is also limited by 10.0[ Hz] –Pr2€Pr2E≦Pr2D  Displays the table No. corresponding to the adaptive filter frequency. (Refer to P.234 of Adjustment.) This parameter will be automatically set and cannot be changed while the adaptive filter is valid. (when Pr23 (Setup of adaptive filter mode) is other than 0.)  0 to 4 Filter is invalid.  5 to 48 Filter is valid.  49 to 64 Filter validity changes according to Pr22.  This parameter will be saved to EEPROM every 30 minutes while the adaptive filter is valid, and when the adaptive filter is valid at the next power-on, the adaptive action starts taking the saved data in EEPROM as an initial value. <caution></caution>
Postino,	White The State of			When you need to clear this parameter to reset the adaptive action while the action is not normal, invalidate the adaptive filter (Pr23, "Setup of adaptive filter mode" to 0) once, then validate again.  Refer to P.239, "Release of Automatic Gain Adjusting Function" of Adjustment as well.

#### <Notes>

- For parameters which No. have a suffix of "\*", changed contents will be validated when you turn on the control power.
- Parameters which default values have a suffix of "\*" will be automatically set up during real time auto-gain tuning. When you change manually, invalidate the real-time auto-gain tuning first then set, referring to P.239, "Release of Automatic Gain Adjusting Function" of Adjustment.

# Parameters for Adjustment (2nd Gain Switching Function)

PrNo.	Title	Setup range	Unit	Content	"Hyllo					
30	Setup of 2nd gain	0 to 1	_	You can select the	PI/P action switching of the	velocity control of	or 1st/2nd gain switching.			
	h	<1>*		Setup value	Gain selec	ction/switchir	ıg 👌			
		150.		0	1st gain (PI/P	switching ena	bled) *1			
	Z.	30		<1>*	1st/2nd gain s	witching enab	led *2			
	" (Applito)		(qp <sub>Blife</sub>	*1 Switch the PI/P action with the gain switchi 27). PI is fixed when Pr03 (Torque limit sele			5-50			
	"Ange.		Taga.	GA	IN input	Action of	velocity loop			
				Open	with COM-	Pl	action			
	5	6		Conne	ect to COM-	P	action			
-offishko	- Cres	Mar.		02/1	g condition of the 1st and condition of Adjustment.	and the 2nd,	refer to P.243, "Gair			
31	1st mode of control switching	0 to 10 <0>*	'90 <sub>0</sub> 0	You can select to 1.	he switching condition	of 1st gain and	d 2nd gain while Pr30			
	Setup value		The same of the sa	Gain	switching condition	124	The same of the sa			
	<0>*	Fixed to the	e 1st gain.		g		th,			
	1	Fixed to th			À		À			
	2 *1	2nd gain selection when the gain switching input is turned on. (Pr30 setup must be 1.)								
	2 2nd gain selection when the toque command variation is larger than the setups of Pr33 (1st level of control switching) and Pr34 (1st hysteresis of control switching).									
	4 *2	Fixed to the			11 104 (15t Hysteresis C	or control switch	illig).			
	5 *2				speed is larger than th	e setups of	"H'O"			
	HIN Z	Pr33 (1st le	evel of con	trol switching) and	d Pr34 (1st hysteresis a	at control switch	ning).			
	6 *2	/-		\	deviation is larger than r34 (1st hysteresis of c	=	g).			
	7 *2				e command pulse exist		7.0			
	8 *2	-		nen the positional npleter range).	deviation counter value	e exceeds the	setup of			
	9 *2	2nd gain selection when the motor actual speed exceeds the setup of Pr33 (1st level of control switching) and Pr34 (1at hysteresis of control switching).								
	*2	Switches to	the 2nd g	gain while the pos	tion command exists.		4,			
	10		_	gain when no-position command status lasts for the setup of $Pr32 [ x 16 f as]$ slower than the setups of $Pr33-34[ r/min]$ .						
	1000	23,	35	1, 7	1st gain regardless of		hen Pr31 is set to 2			
	(Apa)		'Gpgn'	and Pr03 (Torque limit selection) is set to 3.  *2 For the switching level and the timing, refer to P.243, "Gain Switching level and the timing, refer to P.243,"						
	TAY.		My.	Function" of	Adjustment.		Tay.			
32	1st delay time of control switching	0 to 10000 <30>*	x 166μs	You can set up while Pr31 is se	the delay time when ret t to 3 or 5 to 10.	turning from th	e 2nd to the 1st gain			
33	1st level of	0 to 20000	_	You can set up	the switching (judging)	level of the 1:	st and the 2nd gains			
	control switching	<50>*	250		t to 3, 5, 6. 9 and 10.	2x24 (4 at ye a da	of control conitables			
34	1st hysteresis	0 to 20000	- 350		ending on the setup of F hysteresis width to be	-131 (1St 11100E	or control switching			
NOT REAL PROPERTY.	of control switching	<33>*	in a second	implemented judging level v Pr33. Unit varie setup of Pr31 mode). Definition	above/below the which is set up with es depending on the (1st control switching ons of Pr32 (Delay), and Pr34 (Hysteresis)	Pr33  0	2nd gain 1st gai			
<u> </u>	North Illian		Kright Gogs	<caution></caution>	r33 (Level) and Pr34	(Hysteresis) a	re valid as absolute			

#### Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content				
35	Switching time of position gain	0 – 10000 <20>*	(setup value +1) x 166μs	You can setup the step-by-step switching time to the position loop gain only at gain switching while the 1st and the 2nd gain switching is valid. <b>Caution&gt;</b> Reg.)  166 166 166 166 166 166 166 166 166 1				
3D	JOG speed setup	0 – 500 <300>	r/min	You can setup the JOG speed.  Refer to P.75, "Trial Run"of Preparation.				

## **Parameters for Position Control**

Standard default : < >

PrNo.	Title		Setup range	The,		Fu	nction/	Content	All de la company
40 *	Selection of co		0 to 1 <0>	You can se		•	upler inp	ut or the exclusive in	nput for line driver as
- 314	Setup value		a de la companya della companya della companya de la companya della companya dell		-92J	Conte	nt d	_	<sup>2</sup> G/L
10 SHILD THE	<0>							Pin-5, SIGN2:Pin-6) Pin-45, SIGNH1:Pin-4	46, SIGNH2:Pin-47)
41 *	Command pul	I	0 to 1 <0>	You can set up the rotational direction against the command pulse input, and command pulse input format.					
42	Setup Setup of command pulse input mode		0 to 3	Pr41 setup value (Command pulse rotational direction setup)	Pr42 setup value (Command pulse input mode setup)	Command pulse format	Signal title	CCW command	CW command
g allows		Palicr		"Had i Opening	0 or 2	90° phase difference 2-phase pulse (A + B-phase)		A-phase H1 H1  B-phase H1 H1  B-phase advances to A by 90°	t1 t
	eg n			<0>	<1>	CW pulse train + CCW pulse train	PULS SIGN	t3 t2 t2	12 12
adjornate)		alitor .		Zalicia.	3	pulse train + Signal	PULS SIGN	t4 t5 t6 "H" t6	t4 t5 t6
3	MANIE	8		Many ich.	0 or 2	90° phase difference 2-phase pulse (A + B-phase)		A-phase H 1 1 1 B-phase delays from A by 90°.	t1 t1 t1 t1 B-phase advances to A by 90°.
*Official	10.2°	, oš		1	Catch 1	CW pulse train + CCW pulse train	PULS SIGN	12 12	6.77
Dan.	nanti	Bank		annighair	3	pulse train + Signal	PULS SIGN	t4 t5 "L" t6 t6	14 t5 16

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

Input I/E	of PULS/SIGN signal	Permissible max.		Min. necessary time width						
input i/F	DI POLS/SIGN SIGNAI	input frequency	t1	t <sub>2</sub>	tз	t <sub>4</sub>	t <sub>5</sub>	t <sub>6</sub>		
Pulse train interface ex	clusive to line driver	2Mpps	500ns	250ns	250ns	250ns	250ns	250ns		
D	Line driver interface	500kpps	2μs	1μs	1μs	1μs	1μs	1μs		
Pulse train interface	Open collector interface	200kpps	5μs	2.5μs	2.5µs	2.5μs	2.5μs	2.5µs		

Make the rising/falling time of the command pulse input signal to  $0.1\mu s$  or smaller.

Standard default : < >

PrNo.	Title	Setup range	Function/Content	~81 <u>10</u>
43	Invalidation of	0 to 1	You can select either the validation or the invalidation of the comman	nd pulse inhibit
	command pulse inhibit input	<1>	input (INH : CN X5 Pin-33).	
	in indic in pac	2	Setup value INH input  0 Valid	
	X	42×	<1> Invalid	
HIOTO	WHI LIP SHOW		Command pulse input will be inhibited by opening the connection of COM When you do not use INH input, set up Pr43 to 1 so that need to connect INH (CN I/F Pin-33) and COM- (Pin-41) outside of the connect INH (CN I/F Pin-33).	you may not
44	Numerator of pulse	1 to 32767		(X5 0A+ : Pin-
*	output division	<2500>	21, 0A- : Pin-22, 0B+ : Pin-48, 0B- : Pin-49).  • Pr45= <0> (Default)	
alitor lately.	, altoma	36	You can set up the output pulse counts per one motor revolution and OB with the Pr44 setup. Therefore the pulse output res quadruple can be obtained from the formula below.	
	"I'MM' COL		The pulse output resolution per one revolution = Pr44 (Numerator of pulse output division) X4	TANICE,
Nou Sign	is and the state of the state o	H <sup>O</sup> LD .	Pr45 (Denominator of pulse output division) < Cautions> <ul> <li>The encoder resolution is 131072 [ P/r] for the 17-bit absolution</li> <li>10000 [ P/r] for the 5-wire 2500P/r incremental encoder.</li> </ul>	Encoder resolution ute encoder, an
45 *	Denominator of pulse output division	0 to 32767 <0>	<ul> <li>The pulse output resolution per one revolution cannot be grencoder resolution.</li> <li>(In the above setup, the pulse output resolution equals to the enco</li> <li>Z-phase is fed out once per one revolution of the motor.</li> <li>When the pulse output resolution obtained from the above formula Z-phase synchronizes with A-phase. In other case, the Z-phase voutput with the encoder resolution, and becomes narrower than A does not synchronize with A-phase.</li> </ul>	oder resolution.) is multiple of 4, width equals to
Nous State Control of the Control of	Mary Hillianich o	Hall .	when encoder resolution x $\frac{Pr44}{Pr45}$ is multiple of 4  A  B  Z  Synchronized  When encoder resolution x $\frac{Pr44}{Pr45}$ A  B  Z  Not-synchron	

### <Notes>

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

PrNo.	Title	Setup range			Function	/Content			
46 *	Reversal of pulse output logic	0 to 3 <0>	You can set up the B-phase logic and the output source of the pulse output (X5 OB+: Pin-48, OB-: Pin-49). 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.						
	9	9	0.1	. 6	at motor CCV	V rotation	at motor CW rotation		
	D^	Sigha.	Setup value	A-phase (OA)					
	(qp <sub>3</sub> ) <sub>1tQ</sub>		<0>, 2	B-phase(OB) non-reversal					
	May.		1, 3	B-phase(OB) reversal	May.	Thu a			
	9	9	Pr46	<b>В-р</b>	hase logic	9	Output source		
	9.2	743.x	<0>	12077	n-reversal	0.	Encoder position		
		(gr)	1 3	F F	Reversal		Encoder position		
	1/0		2 *1	No	n-reversal	E	xternal scale position		
	1200		3 *1	F	Reversal	É	xternal scale position		
	"Ay		*1 The outpu		46=2, 3 is valid	M.			
40	257		11.	17		17.	ised control.		
48	40.	0			n-related (Pr48	·			
	1st numerator of electronic gear	0 to 10000 <0>	• Purpose of	of this function	pulse division/r	9.5	runction r input command unit.		
49	2nd numerator of	0 to 10000	(2) You ca	an increase the	nominal comn	nand pulse free	quency when you cannot		
49	electronic gear	<0>		the required spagnam of electro		mit of pulse ge	nerator of the host controller.		
4A	Multiplier of electronic gear	0 to 17 <0>	Commar pulse	*1 1st nume *1 2nd num	erator (Pr48) erator (Pr49) x 2	Multiplier (Pr4A)	Internal command + Deviation counter		
N.I.	numerator	18.5		10.0	Denominator (Pr	4B)	Feed back		
4B	Denominator of	0 to 10000		92 <u>1</u>	201		pulse 10000P/rev		
	electronic gear	<10000>					(Resolution) 2 <sup>17</sup> P/rev		
	MA I GO GO		*1 : Select				ronic gear input switching		
	27,		27.	DIV input ope	en .	Selection of	1st numerator (Pr48)		
					nect to COM-		2nd numerator (Pr49)		
	98,	12.P	The electroni	~ 6.	set with the for	7.6,	10 Namorada (* * 10)		
	,.0	C. S. C. L.		721		:Numerator (F	Pr48,49)X2Pr4A) is automat-		
	Midpan.		"Highgin				ual to encoder resolution, a set command pulse per th Pr4B.		
	AL A.		27.			Encoder res			
			Electron	ic gear ratio =	Command nu		one revolution (Pr48)		
	3. <sup>(2)</sup>	12.0	• when num	nerator ≠ 0 :	- N	3.S			
		Sign.		ic gear ratio =	Numerator of command electronic gear (Pr48,49) x 2 div/multiple of command div/multiple numerator (Pr4A)		Multiplier of command 2 div/multiple numerator (Pr4A)		
	"Page"			-	Denominator	ot command	electronic gear (Pr4B)		
	MANIC			culation of nur the max. valu		Pr49) X2 <sup>Pr4A</sup> ,	4194304 (Pr4D setup value		
	)	2				· d	o be continued to next page)		

Standard default : < >

PrNo.	Title	Setup range	Walto.	Function/Content	ing.
	"7' <sub>CO</sub> "	_	gear function-related (Pr48-4B)	1,17	ıs page)
48	1st numerator of electronic gear	8	<ul> <li>Setup example when numer</li> <li>When division/multiplication the motor turns one revo</li> </ul>	ratio=1, it is essential to ke	
49	2nd numerator of electronic gear	Nro.	resolution. Therefore, when the encode of f=5000Pulses in case of order to turn the motor by or	duplicate, f=40000Pulse i	
4A	Multiplier of electronic gear numerator		Set up Pr48, 4A and 4B multiplication may equal to t	he encoder resolution (1000	
4B	Denominator of electronic gear	Hadi	F = f x Pr48 x 2 <sup>Pr4A</sup> = 1000 F: Internal command pulse f: Command pulse counts	counts per motor one revol	lution
	alich.		Encoder resolution	217 (131072)	10000 (2500P/r x 4)
	WHI I I I		Example 1 when making the command input (f) as 5000 per one	Pr4A 17 2 17	Pr4A Pr48 10000 x 2
			motor revolution	Pr4B 5000	Pr4B 5000
	<b>\$</b>	N. j	Example 2 when making the command input (f) as 40000 per one		Pr4A Pr48 2500 x 2 0
	HOLL.		motor revolution	Pr4B 10000	Pr4B 10000
	delay smoothing	<1>	Actual examples which ca	of the motor while the commause rough command pulse the multiplier ratio (10 times of the frequency is low.	are;
	" igh		You can set the time constant	of the smoothing filter in 8	steps with Pr4C.
	The state of the s		1	constant	n
				r function	
	2	13.2	<1> Time cor	stant small	
	, de	SAT.	7 Time 200	otant lana	
OL.				nstant large	,3 <sup>0</sup> C
4D *	Setup of FIR smoothing	0 to 31 <0>	You can set up the moving a pulse. (Setup value + 1) become	(A)	ilter covering the comman
4E	Counter clear input mode	0 to 2 <1>	You can set up the clearing of the deviation counter.		ear input signal which clear
	<u> </u>	13.2	Setup value	Clearing condition	on Jack
ition at the same and the same at the same		317		ation counter at level (shorti on counter at falling edge (open-s	7.0
	New York		*1 : Min. time width of CL sign	al white	Mahille
	6	9	OL(FIII-30)	100μs or longer	
70	1	13.	J&^	79.	79.,

### <Notes>

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

# Parameters for Velocity and Torque Control

Standard default: < >

PrNo.	Title	Setup range	Unit	Function/Content
5E	1st torque limit setup	0 to 500 <500> *2	%	You can set up the limit value of the motor output torque (Pr5E : 1st torque, Pr5F : 2nd torque). For the torque limit selection, refer to Pr03 (Torque limit selection).
430	6	30		This torque limit function limits the max. motor torque inside of the
5F	2nd torque limit setup	0 to 500 <500> *2	%	driver with parameter setup.  In normal operation, this driver permits approx. 3 times larger torque than the rated torque instantaneously. If this 3 times bigger torque causes any trouble to the load (machine) strength, you can use this function to limit the max. torque.  • Setup value is to be given in % against the rated torque.  • Right fig. shows example of
Bourse,	Whitelpalicit			150% setup with Pr03=1.  • Pr5E limits the max. torque for both CCW and CW directions.  (Rated)  (Rated)  (Rating) (Max.)
gearionate)	<sup>al</sup> idogiot		Mildo	<b>Caution&gt;</b> You cannot set up a larger value to this parameter than the default setup value of "Max. output torque setup" of System parameter (which you cannot change through operation with PANATERM® or panel). Default value varies depending on the combination of the motor and the driver. For details, refer to P.57, "Setup of Torque Limit" of Preparation.

#### <Note>

• For parameters which default. has a suffix of "\*2", value varies depending on the combination of the driver and the motor.

### **Parameters for Sequence**

				Standard default . < 5
PrNo.	Title	Setup range	Unit	Function/Content
60	Positioning complete(In-position) range	0 to 32767 <131>	Pulse	You can set up the timing to feed out the positioning complete signal (COIN: CN X5, Pin-39).  The positioning complete signal (COIN) will be fed out when the deviation counter pulse counts fall within ± (the setup value), after the command pulse entry is completed.  The setup unit should be the encoder pulse counts at the position control and the external scale pulse counts at the full-closed control.
Pallomate	aci w	EL PER DE	71/183	Basic unit of deviation pulse is encoder "resolution", and varies per the encoder as below.  (1) 17-bit encoder: 2 <sup>17</sup> = 131072  (2) 2500P/r encoder: 4 X 2500 = 10000  Cautions>  1. If you set up too small value to Pr60, the time until the COIN signal is fold might.  Pr60
alito Ministri	gg) Here	STAC O	m' .	COIN signal is fed might become longer, or cause chattering at output.  2. The setup of "Positioning complete range" does not give any effect to the final positioning accuracy.

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content
61	Zero-speed	10 to 20000 <50>	r/min	You can set up the timing to feed out the zero-speed detection output signal (ZSP: CN X5, Pin-12 or TCL: CN X5, Pin-40) 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, Pr61.
	, while distributed	A. S.	un digitalis	The setup of P61 is valid for both CCW and CW direction regardless of the motor rotating direction.  There is hysteresis of 10 [ r/min] .  (Pr61+10)r/min (Pr61-10)r/min
	2, 24, 24, 24, 24, 24, 24, 24, 24, 24, 2	3	P	ZSP ON
63	Setup of positioning	0 to 3	-	You can set up the action of the positioning complete signal (COIN : Pin-39 of CN X5) in combination with Pr60 (Positioning complete range).
	complete		~9/10	Setup value Action of positioning complete signal
	(In-position) output		" 14 1/Q"	The signal will turn on when the positional deviation is smaller than Pr60 (Positioning complete range)
	. 4		100	The signal will turn on when there is no position command and the positional deviation is smaller than Pr60 (Positioning complete range).
	<u> </u>	163.G		The signal will turn on when there is no position command, the zero-speed detection signal is ON and the positional deviation is
	, dps. items	7	, d <sup>O0110</sup>	smaller than Pr60 (Positioning complete range).  The signal will turn on when there is no position command and the positional deviation is smaller than Pr60 (Positioning complete range).  Then holds "ON" status until the next position command is entered.
65	LV trip selection at main power OFF	0 to 1 <1>	May -	You can select whether or not to activate Err13 (Main power undervoltage protection) function while the main power shutoff continues for the setup of Pr6D (Main power-OFF detection time).
	5,	M3.5,		Setup value Action of main power low voltage protection
	, di	3		When the main power is shut off during Servo-ON, Err13 will
	"ILOI"		100	0 not be triggered and the driver turns to Servo-OFF. The driver
	<sup>12</sup> 141 <sup>1</sup> 120°		"Halippo	returns to Servo-ON again after the main power resumption.  When the main power is shut off during Servo-ON, the driver
	20	,	12	will trip due to Err13 (Main power low voltage protection).
	in in indication of	Ke.A	, Hidbalic	<b>Caution&gt;</b> This parameter is invalid when Pr6D (Detection time of main power OFF)=1000. Err13 (Main power under-voltage protection) is triggered when setup of P66D is long and P-N voltage of the main converter falls below the specified value before detecting the main power shutoff, regardless of the Pr65 setup. Refer to P.42, "Timing Chart-At Power-ON" of Preparation as well.
66 *	Sequence at over-travel inhibit	0 to 2 <0>	kg. –	You can set up the running condition during deceleration or after stalling, while over-travel inhibit input (CCWL: Connector CN X5, Pin-9 or CWL: Connector CN X5, Pin-8) is valid
	Κ	163.X		Setup value   During deceleration   After stalling   Deviation counter content
	ttelfred	. 1	315	<0> Dynamic brake Torque command=0 towards inhibited direction Hold
	"MMI (A); o.		"Herifoldon	1 Torque command=0 towards inhibited direction towards inhibited direction Hold
	14		12	2 Emergency stop Torque command=0 Clears before/ towards inhibited direction after deceleration

### <Notes>

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

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content						
67	Sequence at main power OFF	0 to 9 <0>	Nulsi,	1) the act 2) the clea	(LV trip selection at maion during deceleration aring of deviation coun ain power is shut off.	0, you can set up,				
	3.X	12.7		Setup	Acti	on	<b>Deviation counter</b>			
		ig,		value	During deceleration	After stalling	content			
	10/2			<0>	DB	DB 🚫	Clear			
	1000		703	1	Free-run	DB	Clear			
	74.C		71/0	2	DB	Free-run	Clear			
	They		777,	3	Free-run	Free-run	Clear			
				4	DB	DB	Hold			
	9	9		5	Free-run	DB	Hold			
	D.,	"Tho.,		6	DB	Free-run	Hold			
	.5	(g.,		7	Free-run	Free-run	Hold			
	170.		à	8	Emergency stop	DB J	Clear			
	'92, <sub>0</sub>		.000	9	Emergency stop	Free-run	Clear			
68	Sequence at alarm	0 to 3		<caution> In case of the limited by the limited by</caution>	nic Brake action)  he setup value of 8 or the setup value of Pr6E the transfer of the action during th	(Torque setup at e	emergency stop).			
Salitoffian	Dequence at alaim	<0>	305		occurs while either one of the protective functions of the diered.					
	"4' <sub>1</sub> 'O.		410	Setup	Acti		Deviation counter			
	My.		2724	value	During deceleration	After stalling	content			
				<0>	DB	DB	Hold			
	9	9		1	Free-run	DB	Hold			
	9.,	Mo.		2	DB 🔎	Free-run	Hold			
	8	(gr.)		3	Free-run	Free-run	Hold			
	AMM I GOOTO		MAHIGE	<caution> The content alarm. Reference   Content   Conte</caution>	nic Brake action)  It of the deviation cou er to P.43, "Timing Ch command status)" of Pr	nart (When an err				
69	Sequence at	0 to 9	_	You can se	·		À			
pautomatel	Servo-Off	<0>	. <sub>rH</sub> Idb <sup>2</sup>	1) the action 2) the clear The relation counter clear Refer to P.	orn during deceleration a r treatment of deviation n between the setup arance is same as that 44, "Timing Chart"-Ser paration as well.	counter is set up. value of Pr69 and of Pr67 (Sequence	d the action/deviation at Main Power Off)			

### <Notes>

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

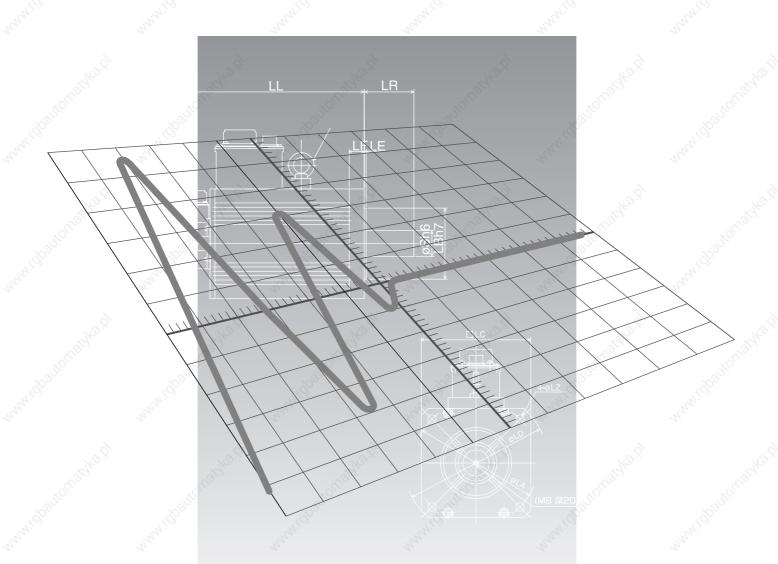
PrNo.	Title	Setup range	Unit	Function/Content
6A	Setup of mechanical brake action at stalling	0 to 100 <0>	2ms	You can set up the time from when the brake release signal (BRK-OFF: CN X5, Pin-10 and 11) turns off to when the motor is de-energized (Servo-free), when the motor turns to Servo-OFF while the motor is at stall.
Butonatika	anny illianion a	\$ 1.00 miles		• 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 Pr6a ≥ tb, then compose the sequence so as the driver turns to Servo-OFF after the brake is actually activated.  • SRV-ON  ON  OFF  release  tb  hold  release  release
affaithe		Y.		Refer to P.44, "Timing Chart"-Servo-ON/OFF Action While the Motor Is at Stall" of Preparation as well.
6B	Setup of mechanical brake action at running	0 to 100 <0>	2ms	You can set up time from when detecting the off of Servo-ON input signal (SRV-ON: CN X5, Pin-29) is to when external brake release signal (BRK-OFF: CN X5, Pin-10 and 11) turns off, while the motor turns to servo off during the motor in motion.
Butonalyko	od why the steel to be	rod.		Set up to prevent the brake deterioration due to the motor running.     At Servo-OFF during the motor is running, tb of the right fig. will be a shorter one of either Pr6B setup time, or time lapse till the motor speed falls below 30r/min.  SRV-ON  ON  OFF  release hold  actual brake  energized  non-energized  30 r/min  energization
alle a	Š.	40.G		Refer to P.45, "Timing Chart"-Servo-ON/OFF action while the motor is in motion" of Preparation as well.
6C *	Selection of external regenerative resistor	0 to 3 for A, B-frame <3>	<sup>1</sup> 1111 <sub>1</sub> 1	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 RB1 and RB2 of Connector CN X2 in case of A to D-frame, between P and B2 of terminal block in case of E, F-frame).
		for C to F-frame		Setup value Regenerative resistor Regenerative processing and regenerative resistor overload
· ottocko	s.	<0>		(C, D, E and 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).
File	Waka idhang			1 External resistor The driver trips due to regenerative overload protection (Err18), when regenerative processing circuit is activated and its active ratio exceeds 10%,
4	5	9		Regenerative processing circuit is activated, but no regenerative over-load protection is triggered.
Litomatyko	, altotos	Ho.		(A, B-frame)  No resistor    Both regenerative processing circuit and regenerative protection are not activated, and built-in capacitor handles all regenerative power.
	Market I II Co.			<remarks> Install an external protection such as thermal fuse when you use the external regenerative resistor. Otherwise, the regenerative resistor might be heated up abnormally and result in burnout, regardless of validation or invalidation of regenerative</remarks>
Bitcheigho	. Hilipairema	3 <sup>60</sup> .	, wildbalte	over-load protection. <b>Caution&gt;</b> 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.

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content
6D	Detection time of	35 to 1000	2ms	You can set up the time to detect the shutoff while the main power is kept
*	main power off	<35>	N.	shut off continuously.  The main power off detection is invalid when you set up this to 1000.
6E	Torque setup at emergency stop	0 to 500 <0>	%	<ul> <li>You can set up the torque limit in case of emergency stop as below.</li> <li>During deceleration of over-travel inhibit with the setup 2 of Pr66 (Sequence at over-travel inhibit input)</li> <li>During deceleration with the setup of 8 or 9 of Pr67 (Sequence at main power off)</li> <li>During deceleration with the setup of 8 or 9 of Pr69 (Sequence at Servo-OFF)</li> <li>Normal torque limit is used by setting this to 0.</li> </ul>
70	Setup of position deviation excess	0 to 32767 <25000>	256 x resolution	<ul> <li>You can set up the excess range of position deviation.</li> <li>Set up with the encoder pulse counts at the position control and with the external scale pulse counts at the full-closed control.</li> <li>Err24 (Error detection of position deviation excess) becomes invalid when you set up this to 0.</li> </ul>
72	Setup of over-load level	0 to 500 <0>	%	<ul> <li>You can set up the over-load level. The overload level becomes 115 [ %] by setting up this to 0.</li> <li>Use this with 0 setup in normal operation. Set up other value only when you need to lower the over-load level.</li> <li>The setup value of this parameter is limited by 115[ %] of the motor rating.</li> </ul>
73	Setup of over-speed level	0 to 20000 <0>	r/min	<ul> <li>You can set up the over-speed level. The over-speed level becomes 1.2 times of the motor max. speed by setting up this to 0.</li> <li>Use this with 0 setup in normal operation. Set up other value only when you need to lower the over-speed level.</li> <li>The setup value of this parameter is limited by 1.2 times of the motor max. speed.</li> <li>Caution&gt;</li> <li>The detection error against the setup value is ±3 [ r/min] in case of the 7-wire absolute encoder, and ±36 [ r/min] in case of the 5-wire incremental encoder.</li> </ul>

### <Notes>

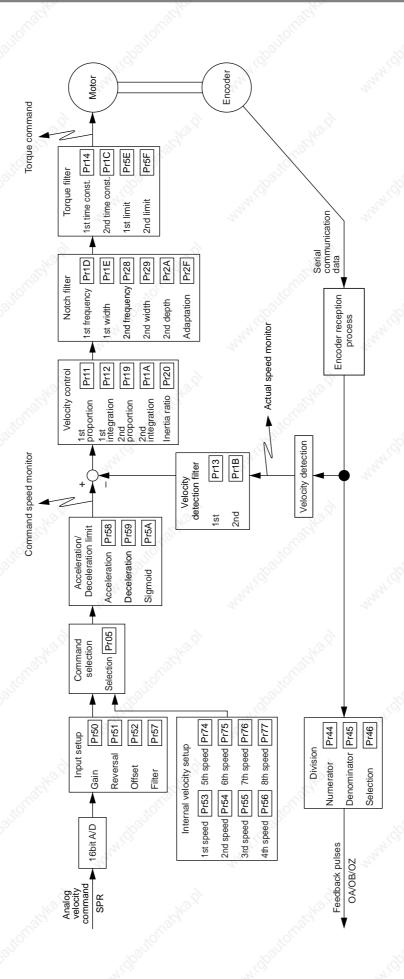
• For parameters which No. have a suffix of "\*", changed contents will be validated when you turn on the control power.



# [Connection and Setup of Velocity Control Mode]

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Parameters for Functional Selection Parameters for Adjustment of Time Constant of Gains and Filters Parameters for Auto-Gain Tuning Parameters for Adjustment (2nd Gain Switching Function) Parameters for Position Control Parameters for Velocity/Torque Control Parameters for Sequence	142 146 147 149 151

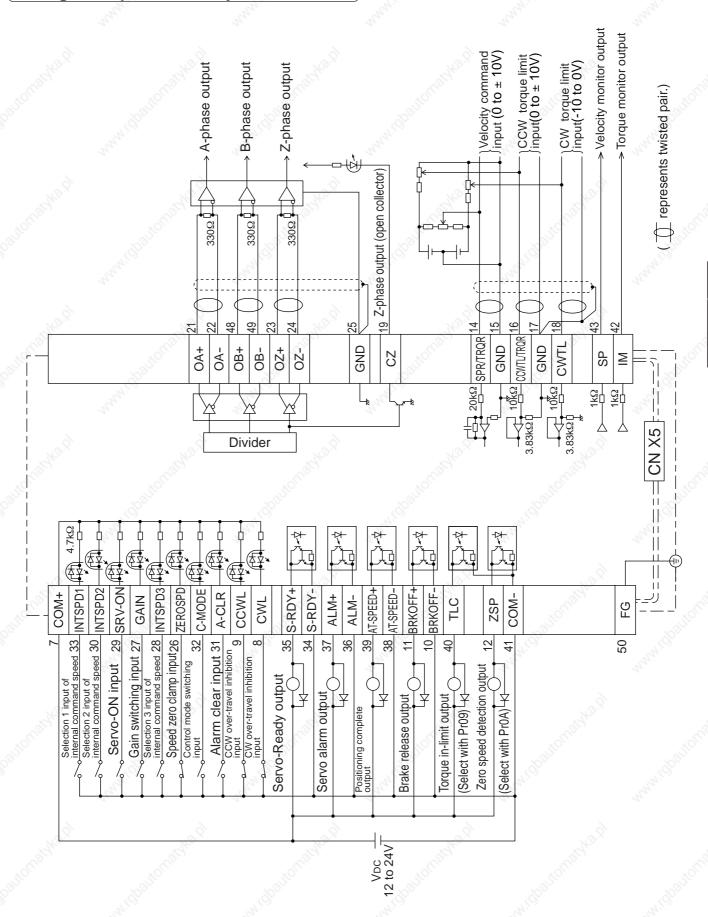
# Control block diagram of velocity control mode



### Wiring Example to the Connector CN X5

Wiring to the connector, CN X5

### Wiring Example of Velocity Control Mode



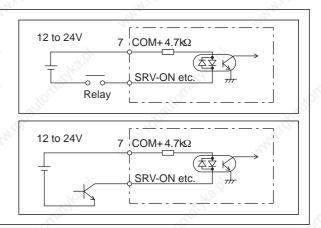
# Wiring to the connector, CN X5

### **Interface Circuit**

### **Input Circuit**

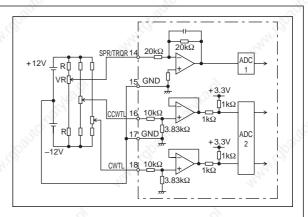
#### SI Connection to sequence input signals

- 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 to 24V) as 11.4V or more in order to secure the primary current for photo-couplers.



### Al Analog command input

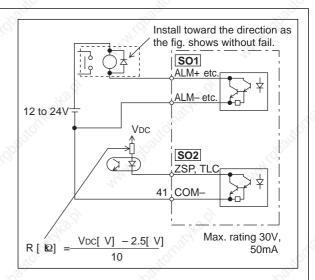
- The analog command input goes through 3 routes, SPR/TRQR(Pin-14), CCWTL (Pin-16) and CWTL (Pin-18).
- Max. permissible input voltage to each input is ±10V.
   For input impedance of each input, refer to the right Fig.
- When you compose a simple command circuit using variable resistor(VR) and register R, connect as the right Fig. shows. When the variable range of each input is made as -10V to +10V, use VR with  $2k\Omega$ , B-characteristics, 1/2W or larger, R with  $200\Omega$ , 1/2W or larger.
- A/D converter resolution of each command input is as follows.
   (1)ADC1: 16 bit (SPR/TRQR), (including 1bit for sign), ±10V
   (2)ADC2: 10 bit (CCWTL, CWTL), 0 to 3.3V



### **Output Circuit**

### SO1 SO2 Sequence output circuit

- The output circuit is composed of open collector transistor outputs in the Darlington connection, and connect to relays or photo-couplers.
- 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 which emitter side of the output transistor is independent and is connectable individually, and the one which is common to – side of the control power supply (COM–).
- If a recommended primary current value of the photo-coupler is 10mA, decide the resistor value using the formula of the right Fig.

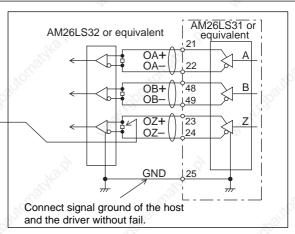


For the recommended primary current value, refer to the data sheet of apparatus or photo-coupler to be used.

### 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.  $330\Omega$ ) between line receiver inputs without fail.
- · These outputs are not insulated.

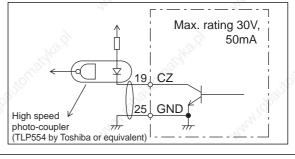




#### PO2 Open collector output

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



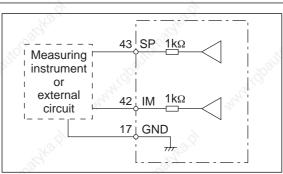


### AO Analog monitor output

- There are two outputs, the speed monitor signal output (SP) and the torque monitor signal output (IM)
- Output signal width is ±10V.
- The output impedance is  $1k\Omega$ . 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 6V/3000r/min (Pr07=3), the resolution converted to speed is 8r/min/16mV.
- (2) Torque monitor output (IM) With a relation of 3V/rated torque (100%), the resolution converted to torque is 0.4%/12mV.



# Wiring to the connector, CN X5

# Input Signal and Pin No. of the Connector, CN X5

## Input Signals (common) and Their Functions

Title of signal	Pin No.	Symbol	2021				Funct	tion		I/F circuit	
Power supply for control signal (+)	7	COM+						upply (12 to 2 5% – 24V ±		-	
Power supply for control signal (-)	41	COM-	• The p	Connect – of the external DC power supply (12 to 24V).  The power capacity varies depending on a composition of I/O circuit. 0.5A or more is recommended.							
CW over-travel inhibit input	8	CWL	<ul><li>Conn movin</li><li>CWL inhibit</li><li>You c of up</li></ul>	Use this input to inhibit a CW over-travel (CWL). Connect this so as to make the connection to COM— open when the moving portion of the machine over-travels the movable range toward CW. CWL input will be invalidated when you set up Pr04 (Setup of over-travel inhibit input) to 1.Default is "Invalid (1)". You can select the action when the CWL input is validated with the setup of up Pr66 (Sequence at over-travel inhibit). Default is "Emergency stop with dynamic brake".(Pr66=0)							
CCW over-travel inhibit input	9	CCWL	<ul><li>Conne portion</li><li>CWL inhibit</li><li>You ca of Pr6</li></ul>	ect this n of the input v input) an sele 66 (Sec	input to inhibit a CCW over-travel (CCWL).  this so as to make the connection to COM- open when the moving f the machine over-travels the movable range toward CCW.  ut will be invalidated when you set up Pr04 (Setup of over-travel out) to 1.Default is "Invalid (1)".  select the action when the CCWL input is validated with the setup (Sequence at over-travel inhibit). Default is "Emergency stop with brake".(Pr66=0)						
Speed zero clamp	26	ZEROSPD	• Functi	ion var	ies depe	nding or	the conti	rol mode.	7000	SI	
input	46		- 27	1	Becomes to a speed-zero clamp input (ZEROSPD).				P.128		
	1/2,		True,		Pr06   Connection to COM-   Content					77.00	
				Velocity/	0	-	-		PD input is invalid.		
		2	Velo		28	op	en		command is 0		
		"The	Tord	que	10		se	N-V	rmal action		
		Maria	con	trol	0,000		en .	Ç0	mmand is to CCW		
		Nic.			2				ommand is to CW.	1	
	363		<	close Speed command is to CW.  In case Pr06 is 2 at torque control, ZERPSPD is invalid.							
engalka d		Walter Li	Posi Full-c con	losed trol	<ul> <li>Becomes to an input of damping control switching (VS-SEL).</li> <li>While Pr24 (Damping filter switching selection) is 1, the 1st damping filter (Pr2B, Pr2C) will be validated when you open this input, and the 2nd damping filter (Pr2D, Pr2E) will be validated when you connect this input to COM</li> </ul>						
Gain switching input	27	GAIN			ries depe			tups of Pr30	) (2nd gain setup) and	DI SI P.128	
or	The same		Pr03	Pr30	Connectio	n to COM-		Co	ntent	The state	
Torque limit		TL-SEL		_		en	+	oop : PI (Prop	ortion/Integration) action	1	
switching input		9		0		se	<del>-</del>	oop : P (Propo		11	
7/20.V		May.			No	wh			and Pr36 are 2	1	
		The same	0-2		on	en	1	200	r10,11,12,13 and 14)	11	
		710,		150		se	-		Pr18,19,1A,1B and 1C)	1 3	
	.89	0		900.					36 are other than 2	1 790	
	741		142			2	M. T.	invalid	741.	24/2	
		Marin Comment	3	-	• Pr5E open	(Setup of this inp	of 1st torq ut, and P	tching (TL-S lue limit) will r5F (Setup o	EL) be validated when you of 2nd torque limit) will input to COM–.		
altomor,		Tiplust,			of 2nd ga Adjustme		hing func	tion, refer to	P.243 "Gain Switching	9	

# Connection and Setup of Velocity Control Mode

# [Connection and setup of velocity control mode]

Title of signal	Pin No.	Symbol	, of 10°	Function	I/F circuit			
Internal	28	INTSPD3	Function vari	ies depending on the control mode.	SI			
command speed selection 3 input				<ul> <li>You can switch the numerator of electronic gear.</li> <li>By connecting to COM-, you can switch the numerator of electronic gear from Pr48 (1st numerator of electronic gear) to Pr49 (2nd numerator of electronic gear)</li> <li>For the selection of command division/multiplication, refer to the table of next page, "Numerator selection of command scaling"</li> </ul>	P.128			
and and	NATION STATES			<ul> <li>Input of internal speed selection 3 (INTSPD3).</li> <li>You can make up to 8-speed setups combining INH/INTSPD1 and CL/INTSPD2 inputs. For details of setup, refer to the table of P.131, "Selection of Internal Speed".</li> </ul>	M.M. illipanie			
6			Torque control	This input is invalid.				
Servo-ON input	29	SRV-ON	<ul> <li>Turns to Ser to the motor</li> <li>You can se clearing actio</li> <li>Caution&gt;</li> <li>1.Servo-ON in</li> </ul>	<ul> <li>Turns to Servo-ON status by connecting this input to COM—.</li> <li>Turns to Servo-OFF status by opening connection to COM—, and currer to the motor will be shut off.</li> <li>You can select the dynamic brake action and the deviation counter clearing action at Servo-OFF with Pr69 (Sequence at Servo-OFF).</li> </ul>				
*OUSPAGE,	CHAINE D		2.Never run/stop the motor with Servo-ON/OFF.  3.After shifting to Servo-ON, allow 100ms or longer pause before entering the pulse command.					

# • Selection of Internal Speed

Г	Co	nnector Pin No. of	X5	Pr05,	Pr05, Internal/external switching of speed setup			
	Pin-33 INTSPD1(INH)	Pin-30 INTSPD2(CL)	Pin-28 INTSPD3(DIV)	0	1	2	3	
	open	open	open	Analog speed command (CN X5, Pin-14)	1st speed of speed setup (Pr53)	1st speed of speed setup (Pr53)	1st speed of speed setup (Pr53)	
S	short	open	open	Analog speed command (CN X5, Pin-14)	2nd speed of speed setup (Pr54)	2nd speed of speed setup (Pr54)	2nd speed of speed setup (Pr54)	
	open	short	open	Analog speed command (CN X5, Pin-14)	3rd speed of speed setup (Pr55)	3rd speed of speed setup (Pr55)	3rd speed of speed setup (Pr55)	
	short	short	open	Analog speed command (CN X5, Pin-14)	4th speed of speed setup (Pr56)	Analog speed command (CN X5, Pin-14)	4th speed of speed setup (Pr56)	
	open	open	short	Analog speed command (CN X5, Pin-14)	1st speed of speed setup (Pr53)	1st speed of speed setup (Pr53)	5th speed of speed setup (Pr74)	
	short	open	short	Analog speed command (CN X5, Pin-14)	2nd speed of speed setup (Pr54)	2nd speed of speed setup (Pr54)	6th speed of speed setup (P75)	
Sol	open	short	short	Analog speed command (CN X5, Pin-14)	3rd speed of speed setup (Pr55)	3rd speed of speed setup (Pr55)	7th speed of speed setup (Pr76)	
	short	short	short	Analog speed command (CN X5, Pin-14)	4th speed of speed setup (Pr56)	Analog speed command (CN X5, Pin-14)	8th speed of speed setup (Pr77)	

# Wiring to the connector, CN X5

Title of signal	Pin No.	Symbol	-6	Car.	Function		" Chillips	I/F circu
Selection 2 input	30	INTSPD2	Function var	ies depending on	the control m	node.	<i>(</i>	SI
of internal command speed			"hunder	<ul> <li>Input (CL) wh and full-closed</li> <li>You can clear the full-closed devia</li> <li>You can select input mode).</li> </ul>	deviation con he counter of ation by conn	unter. positional devia	ition and DM–.	P.128
			Position/	Pr4E	70,	Content	TOL.	
	i sanidi		Full-closed control	0	100	counter of pos I-closed deviation to COM–.	1.1	annight.
				1 [ Default]	and full-clo	counter of positions  Sed deviation of  CL to COM- from	only once by	
			್ದರ	2	CL is invalid	d		
			Velocity control		e up to 8-s CL/INTSPD3 le in P.131, "		ombining INH/ etails of setup,	WANTIGO S
			Torque control	• This input is inv	/alid.	98	10.9	
Alarm clear input	31	A-CLR	• Vou con role	ease the alarm s	tatus by son	nooting this to	COM for more	
Alarılı ciear iliput	31	A-CLK	than 120ms.	ease the alaint s	tatus by com	necting this to	COM- IOI MOTE	SI P.128
	r regis		• There are so	n counter will be ome alarms which refer to P.252, "P	cannot be re	leased with this		HANNIE OF
Control mode switching input	32	C-MODE	You can switch the control mode as below by setting up Pr02 (Control mode setup) to 3-5.					SI P.128
			Pr02 setu		n (1st)		to COM- (2nd)	
			3		n control		ty control	
	.89		4		n control		e control	30%
			Caution> Depending on how the command is given at each control mode, the action might change rapidly when switching the control mode with C-MODE. Pay an extra attention.					any.
Selection 1 input	33	INTSPD1	Function val	ries depending on	the control n	node.	N. S.	SI
of internal command speed	100		Position/ Full closed	<ul> <li>Inhibition input</li> <li>Ignores the properties to Connection to Connection to Connection to Command pulse</li> </ul>	oosition com COM- idate this in	mand pulse b	y opening the	P.128
			control	Pr43 0 1(Default)	i ellogit	Content INH is val INH is val	id.	
			-25	Selection 1 inper	ut of internal	command speed	(INTCDD1)	~3
			Velocity control	<ul> <li>You can male</li> <li>INH/INTSPD2 setup, refer to the</li> </ul>	ke up to and CL/INTS he table of P. ternal Speed'	8-speed setu PD3 inputs. Fo	ps combining or details of the	May G.

# Connection and Setup of Velocity Control Mode

# [Connection and setup of velocity control mode]

### Input Signals (Analog Command) and Their Functions

Title of signal	Pin No.	Symbol	(9)	30"		Function		I/F circuit
Speed command	14	SPR	• Functi	on varies dep	ending o	on control mode.	74	AI
input			Pr02	Control mode		Function	n	P.128
Hough by	A. Idbas		1 3 5	Velocity control  Position/ Velocity  Velocity/ Torque	veloci • Set u Speed Pr50 Pr51 Pr52	ty control is selected.	t reversal) et)	SWIGE INC.
				100	torque	e command)	on Pr5B (Selection of	
				"Capa	Pr5B	Cont	20	
	A.I.B.		5	Velocity/ Torque	1	This input becomes i Speed limit (SPL) wi Set up the speed lir and filter with; Pr50 (Speed comm Pr52 (Speed comm Pr57 (Speed comm	Il be selected. nit (SPL) gain, offset and input gain) and offset)	A THILLIPS LIC
	33		Others	Other control mode	• This in	nput is invalid.	"Paricilla	1001110
	THE STATE OF		(includ	ing 1 bit for sig	gn).	nverter used in this inpu	t is 16 bit	Nanio,

<sup>\*</sup>Function becomes valid when the control mode with underline ( \_\_\_\_\_ / \_\_\_\_ ) is selected while the switching mode is used in the control mode in table.

### <Remark>

Do not apply voltage exceeding ±10V to analog command input of SPR

# Wiring to the connector, CN X5

Title of signal	Pin No.	Symbol		XOTO COL	Function	I/F circui
CCW-Torque limit	16	CCWTL	• Funct	ion varies dep	ending on Pr02 (Control mode setup).	Al
input	77:0.		Pr02	Control mode	Function	P.128
	7,7		R.		<ul> <li>Function varies depending on Pr5B (Selection of torque command)</li> </ul>	Zu,
					Pr5B Content	
				27/20	This input becomes invalid.	
			2 4	Torque Control Position/ <u>Torque</u>	Torque command input (TRQR) will be selected.  Set up the gain and polarity of the command with;  Pr5C (Torque command input gain)  Pr5D (Torque command input reversal)  Offset and filter cannot be set up.	HANNIGO O
	MH I OC		5	Velocity/ Torque	<ul> <li>Becomes to the torque command input (TRQR).</li> <li>Set up the gain and polarity of the command with;</li> <li>Pr5C (Torque command input gain)</li> <li>Pr5D (Torque command input reversal)</li> <li>Offset and filter cannot be set up.</li> </ul>	und iobo
			4 5 Other	Position/Torque Velocity/Torque Other control mode	<ul> <li>Becomes to the analog torque limit input to CCW (CCWTL).</li> <li>Limit the CCW-torque by applying positive voltage (0 to +10V) (Approx.+3V/rated toque)</li> <li>Invalidate this input by setting up Pr03 (Torque limit selection) to other than 0.</li> </ul>	2,
			(includ	ding 1 bit for s	nverter used in this input is 16 bit gn). [V],1[LS鲟23[ mV]	HALA I GO
<b>CW-Torque limit</b>	18	CWTL	• Funct	ion varies dep	ending on Pr02 (Control mode setup).	AI
input			Pr02	Control mode	Function	P.128
	.85		2 4 5	Torque control Position/Torque Velocity/Torque	<ul> <li>This input becomes invalid when the torque control is selected.</li> </ul>	(900)
	and the second		4 5 Other	Position/Torque Velocity/Torque Other control mode	<ul> <li>Becomes to the analog torque limit input to CW (CWTL).</li> <li>Limit the CW-torque by applying negative voltage (0 to -10V) (Approx.+3V/rated toque). Invalidate this input by setting up Pr03 (Torque limit selection) to other than 0.</li> </ul>	
	i nai S		(includ	ding 1 bit for s	nverter used in this input is 16 bit gn). [V] , 1 [ LSB]23[ mV]	HANNIGOS)

<sup>\*</sup>Function becomes valid when the control mode with underline ( \_\_\_\_\_ / \_\_\_\_ is selected while the switching mode is used in the control mode in table.

#### <Remark>

Do not apply voltage exceeding ±10V to analog command input of CWTL and CCWTL

## Output signal and Pin No. of the Connector, CN X5

## Output Signals (Common) and Their Functions

Title of signal	Pin No	Symbol	Na.	Function	I/F circuit
External brake release signal	11 10	BRKOFF+ BRKOFF-	Turns the or magnetic bra     You can see mechanical	<ul> <li>Feeds out the timing signal which activates the electromagnetic brake of the motor.</li> <li>Turns the output transistor ON at the release timing of the electromagnetic brake.</li> <li>You can set up the output timing of this signal with Pr6A (Setup of mechanical brake action at stall) and Pr6B (Setup of mechanical brake action at motion). For details, refer to P42, "Timing Chart" of Preparation.)</li> </ul>	
Servo-Ready output	35 34	S-RDY+ S-RDY-		hows that the driver is ready to be activated. istor turns ON when both control and main power are ON but status.	SO1 P.129
Servo-Alarm output	37 36	ALM+ ALM-		hows that the driver is in alarm status sistor turns ON when the driver is at normal status, and turns in status.	SO1 P.129
Positioning	39	AT-SPEED+	Function var	ies depending on the control mode.	SO1
complete (In-position)	38	AT-SPEED-	Position control	Output of positioning complete (COIN) The output transistor will turn ON when the absolute value of the position deviation pulse becomes smaller than the setup value of Pr60 (Positioning complete range). You can select the feeding out method with Pr63 (Setup of positioning complete output).	P.129
	A. Bara		Full-closed control	Output of full-closed positioning complete (EX-COIN) The output transistor will turn ON when the absolute value of full-closed-position deviation pulse becomes smaller than the setup value of Pr60 (Positioning complete range). You can select the feeding out method with Pr63 (Setup of positioning complete output).	, w.idbalitof
		"Watako bi	Velocity/ Torque control	Output at-speed (speed arrival) (AT-SPEED)     The output transistor will turn ON when the actual motor speed exceeds the setup value of Pr62 (In-speed).	3
Zero-speed detection output signal	12 (41)	ZSP (COM-)	• Default is 1,	e output signal varies depending on Pr0A (Selection of ZSP output). and feeds out the zero speed detection signal. see the table below, "Selection of TLC,ZSP output".	SO2 P.129
Torque in-limit signal output	40 (41)	TLC (COM-)	• Default is 1,	Content of the output signal varies depending on Pr09 (Selection of TLC output). Default is 1, and feeds out the torque in-limit signal. For details, see the table below, "Selection of TLC,ZSP output".	

#### Selection of TCL and ZSP outputs

Value of Pr09 or Pr0A	X5 TLC : Output of Pin-40	X5 ZSP : Output of Pin-12
0	• Torque in-limit output (Default of X5 TLC Pr09)  The output transistor turns ON when the torque comma	nd is limited by the torque limit during Servo-ON.
1	Zero-speed detection output (Default of X5 ZSP Pro The output transistor turns ON when the motor speed fa	,
2	Alarm signal output     The output transistor turns ON when either one of the a battery alarm, fan-lock alarm or external scale alarm.	larms is triggered, over-regeneration alarm, overload alarm
3	Over-regeneration alarm     The output transistor turns ON when the regeneration exceed	s 85% of the alarm trigger level of the regenerative load protection
4	Over-load alarm     The output transistor turns ON when the load exceeds 8	55% of the alarm trigger level of the overload alarm.
5	Battery alarm     The output transistor turns ON when the battery voltage	for absolute encoder falls lower than approx. 3.2V.
6	• Fan-lock alarm The output transistor turns ON when the fan stalls for lo	nger than 1s.
7	External scale alarm     The output transistor turns ON when the external scale (adjustment on mounting is required). Valid only at the features.	temperature exceeds 65°, or signal intensity is not enough
8	In-speed (Speed coincidence) output     The output transistor turns ON when the difference between acceleration/deceleration reaches within the preset range.	reen the actual motor speed and the speed command before with Pr61. Valid only at the velocity and torque control.

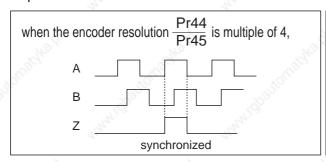
# Wiring to the connector, CN X5

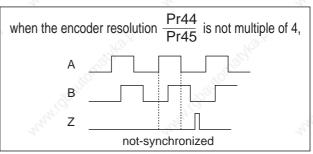
### Output Signals (Pulse Train) and Their Functions

Title of signal	Pin No	Symbol	Function	I/F circuit
A-phase output	21	OA +	Feeds out the divided encoder signal or external scale signal (A, B, Z-phase) in differential. (equivalent to RS422)	PO1 P.129
240 tj	22	OA –	<ul> <li>You can set up the division ratio with Pr44 (Numerator of pulse output division) and Pr45 (Denominator of pulse output division)</li> <li>You can select the logic relation between A-phase and B-phase, and the</li> </ul>	
B-phase output	48	OB +	<ul> <li>output source with Pr46 (Reversal of pulse output logic).</li> <li>When the external scale is made as an output source, you can set up the interval of Z-phase pulse output with Pr47 (Setup of external scale Z-phase).</li> </ul>	
	49	OB –	Ground for line driver of output circuit is connected to signal ground (GND) and is not insulated.	and Co
Z-phase output	23	OZ +	Max. output frequency is 4Mpps (after quadrupled)	
	24	OZ –	Chiadko.	
Z-phase output	19	CZ	<ul> <li>Open collector output of Z-phase signal</li> <li>The emitter side of the transistor of the output circuit is connected to the signal ground (GND) and is not insulated.</li> </ul>	PO2 P.129

#### <Note>

- When the output source is the encoder
  - If the encoder resolution  $X = \frac{Pr44}{Pr45}$  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.





• In case of the 5-wire, 2500P/r incremental encoder, the signal sequence might not follow the above fig. until the first Z-phase is fed out. When you use the pulse output as the control signal, rotate the motor one revolution or more to make sure that the Z-phase is fed out at least once before using.

# [Connection and setup of velocity control mode]

## Output Signals (Analog) and Their Functions

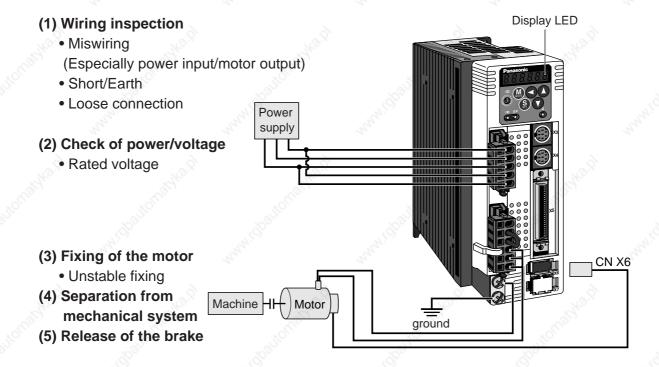
Title of signal	Pin No	Symbol	(6)		Function	I/F circui	
Torque monitor signal output	42	IM	<ul> <li>The content of output signal varies depending on Pr08 (Torque monit (IM) selection).</li> <li>You can set up the scaling with Pr08 value.</li> </ul>				
			Pr08	Content of signal	Function		
	(g)		0, 11,12	Torque command	<ul> <li>Feeds out the voltage in proportion to the motor torque command with polarity.</li> <li>+ : generates CCW torque</li> <li>- : generates CW torque</li> </ul>	. (dbalte	
			1 – 5	Positional deviation	Feeds out the voltage in proportion to the positional deviation pulse counts with polarity.     + : positional command to CCW of motor position     - : positional command to CW of motor position	Y.	
	R.I. IJOS		6 –10	Full-closed deviation	Feeds out the voltage in proportion to the full- closed deviation pulse counts with polarity.     + : positional command to CCW of external scale position     - : positional command to CW of external scale position	N.W.I.G. B. I.E.	
Speed monitor signal output	43	SP	(IM) s	election).	output signal varies depending on Pr07 (Speed monitor scaling with Pr07 value.	AO P.129	
	_3		Pr07	Control mode	Function	310	
	<sup>rag</sup> ri <sub>Gg.</sub>		<sup>17</sup> Gg,	0 – 4	Motor speed	Feeds out the voltage in proportion to the motor speed with polarity. + : rotates to CCW     - : rotates to CW	WHI GO.
			5-9	Command speed	Feeds out the voltage in proportion to the command speed with polarity.     + : rotates to CCW     - : rotates to CW		
				*O*	,0,	4	

## Output Signals (Others) and Their Functions

Title of signal	Pin No	Symbol	Function	I/F circuit
Signal ground	13,15, 17,25	GND	Signal ground     This output is insulated from the control signal power (COM–) inside of the driver.	- ,,0°
Frame ground	50	FG	This output is connected to the earth terminal inside of the driver.	Will San

# Trial Run (JOG run) at Velocity Control Mode

## **Inspection Before Trial Run**



### **Trial Run by Connecting the Connector, CN X5**

- 1) Connect the CN X5.
- 2) Enter the power (DC12-24V) 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, CN X5, Pin-29) and COM- (CN X5, 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 (CN X5, Pin-14) and GND (CN X5, Pin-15), and gradually increase from 0V 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, correct the command voltage referring to P.74, "Automatic offset adjustment" of Preparation.
- 9) When you want to change the rotational speed and direction, set up the following parameters again.

Pr50 : Speed command input gain

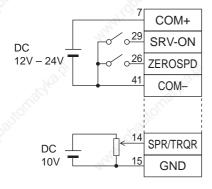
Refer to P.152, "Parameter Setup"

Pr51 : Speed command input reversal

(Parameters for Velocity/Torque Control)

10) If the motor does not run correctly, refer to P.68, "Display of Factor for No-Motor Running" of Preparation.

### Wiring Diagram



Run with ZEROSPD switch close, and Stop with open

In case of one-directional operation

In case of bi-directional operation (CW/CCW), provide a bipolar power supply, or use with Pr06 = 3.

### Parameter

PrNo.	Title	Setup value
02	Setup of control mode	1
04	Invalidation of over-travel inhibit input	1
06	Selection of ZEROSPD input	1
50	Velocity command gain	0.1
51	Velocity command reversal	Set up
52	Velocity command offset	required
57	Setup of velocity command filter	

#### Input signal status

No.	Title of signal	Monitor display
0	Servo-ON	+ A
5.0	Speed zero clamp	

# **Real-Time Auto-Gain Tuning**

### **Outline**

The driver estimates the load inertia of the machine in real time, and automatically sets up the optimum gain responding to the result. Also the driver automatically suppress the vibration caused by the resonance with an adaptive filter.

### actual condition Resonance frequency calculation Load inertia calculation Real-time auto-gain tuning Encode Servo driver

Position/Velocity

### **Applicable Range**

• Real-time auto-gain tuning is applicable to all control modes.

### Caution

Real-time auto-gain tuning may not be executed properly under the conditions described in the right table. In these cases, use the normal mode auto-gain tuning (refer to P.236 of Adjustment), or execute a manual gain tuning. (refer to P.240, of Adjustment)

	Conditions which obstruct real-time auto-gain tuning
Load	Load is too small or large compared to rotor inertia.
	(less than 3 times or more than 20 times)
inertia	Load inertia change too quickly. (10 [ s] or less)
Dood	Machine stiffness is extremely low.
Load	Chattering such as backlash exists.
	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)
Action	Acceleration/deceleration torque is smaller than
pattern	unbalanced weighted/viscous friction torque.
•	When 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] .

Auto-filter

Position/Veloc

Motor curren

Motor

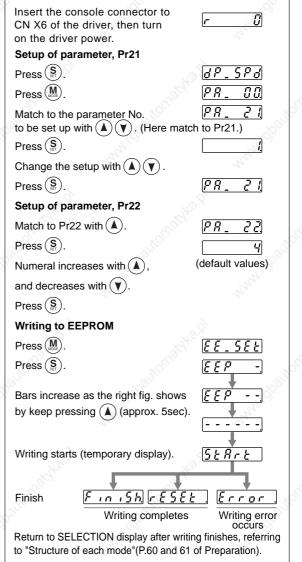
Current

### **How to Operate**

- (1) Bring the motor to stall (Servo-OFF).
- (2) Set up Pr21 (Real-time auto-gain tuning mode setup) to 1-7. Default is 1.

Setup value	Real-time auto-gain tuning	Varying degree of load inertia in motion
0	(not in use)	· ~ ~
<1>,4,7	£,,	no change
2,5	normal mode	slow change
3,6	, kp <sup>2</sup> -	rapid change

- When the varying degree of load inertia is large, set up 3 or 6.
- When resonance might give some effect, validate the setup of Pr23 (Setup of adaptive filter mode).
- (3) Set up Pr22 (Machine stiffness at real-time auto-gain tuning) to 0 or smaller value.
- (4) Turn to Servo-ON to run the machine normally.
- (5) Gradually increase Pr22 (Machine stiffness at real-time auto-gain tuning) when you want to obtain better response. Lower the value (0 to 3) when you experience abnormal noise or oscillation.
- (6) Write to EEPROM when you want to save the result.



### [Connection and setup of velocity control mode]

### **Adaptive Filters**

The adaptive filter is validated by setting up Pr23 (Setup of adaptive filter mode) to other than 0.

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

The adaptive filter may not operate property under the following conditions. In these cases, use 1st notch filter (Pr1D and 1E) and 2nd notch filter (Pr28-2A) to make measures against resonance according to the manual adjusting procedures. For details of notch filters, refer to P.246, "Suppression of Machine Resonance" of Adjustment.

.80	Conditions which obstruct adaptive filter action
Resonance point	<ul> <li>When resonance frequency is lower than 300[ Hz] .</li> <li>While resonance peak is low or control gain is small and when no affect from these condition is given to the motor speed.</li> <li>When multiple resonance points exist.</li> </ul>
Load	<ul> <li>When the motor speed variation with high frequency factor is generated due to non-linear factor such as backlash.</li> </ul>
Command pattern	When acceleration/deceleration is very extreme such as more than 30000 [ r/min] per 1 [ s] .

#### <Note>

Even though Pr23 is set up to other than 0, there are other cases when adaptive filter is automatically invalidated. Refer to P.235, "Invalidation of adaptive filter" of Adjustment.

### Parameters Which Are Automatically Set Up.

Following parameters are automatically adjusted. Also following parameters are automatically set up.

PrNo.	Title						
11	1st gain of velocity loop						
12	1st time constant of velocity loop integration						
13	1st filter of velocity detection						
14	1st time constant of torque filter						
19	2nd gain of velocity loop						
1A	2nd time constant of velocity loop integration						
€1B	2nd filter of speed detection						
1C	2nd time constant of torque filter						
20	Inertia ratio						
2F	2F Adaptive filter frequency						

PrNo.	Title	Setup value
27	Setup of instantaneous speed observer	0
30	2nd gain setup	1,40
31	1st mode of control switching	0
32	1st delay time of control switching	30
33	1st level of control switching	50
34	1st hysteresis of control switching	33
36	2nd mode of control switching	0

#### <Notes>

- When the real-time auto-gain tuning is valid, you cannot change parameters which are automatically adjusted.
- Pr31 becomes 10 at position or full closed control and when Pr21 (Setup of Real-Time Auto-Gain Tuning Mode) is 1 to 6, and becomes 0 in other cases.

### Cautions

- (1) After the start-up, you may experience abnormal noise and oscillation right after the first Servo-ON, or when you increase the setup of Pr22 (Selection of machine stiffness at real-time auto-gain tuning), until load inertia is identified (estimated) or adaptive filter is stabilized, however, these are not failures as long as they disappear immediately. If they persist over 3 reciprocating operations, take the following measures in possible order.
  - 1) Write the parameters which have given the normal operation into EEPROM.
  - 2) Lower the setup of Pr22 (Selection of machine stiffness at real-time auto-gain tuning).
  - 3) Set up both Pr21 (Setup of real-time auto-gain tuning) and Pr23 (Setup of adaptive filter mode) to 0, then set up other value than 0. (Reset of inertia estimation and adaptive action)
  - 4) Invalidate the adaptive filter by setting up Pr23 (Setup of adaptive filter mode setup) to 0, and set up notch filter manually.
- (2) When abnormal noise and oscillation occur, Pr20 (Inertia ratio) or Pr2F (Adaptive filter frequency) 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, Pr20 (Inertia ratio) and Pr2F (Adaptive filter frequency) will be written to EEPROM every 30 minutes. When you turn on the power again, auto-gain tuning will be executed using the latest data as initial values.
- (4) When you validate the real-time auto-gain tuning, Pr27 (Setup of instantaneous speed observer) will be invalidated automatically.
- (5) The adaptive filter is normally invalidated at torque control, however, when you select torque control while you set up Pr02 (Control mode setup) to 4 and 5, the adaptive filter frequency before mode switching will be held.
- (6) During the trial run and frequency characteristics measurement of "PANATERM®", the load inertia estimation will be invalidated.

# Parameters for Functional Selection

PrNo.		Title	0	Setup range	Halaite,	Func	tion/Content	Standard default : <	
00 *	Addre	ess		0 to 15					
	•	front pa This val The set	nel at p ue bec up valu	oower-on. omes the a e of this pa	d by the setup value of a xis number at serial com- rameter has no effect to etup of Pr00 with other m	nmunication. the servo action	n.	ID M A SET V G	
01	LED	nitial sta	atus	0 to 17 <1>	You can select the typ at the initial status afte		displayed on the front	panel LED (7 segment	
						Setup value	Conte	ent	
						0	Positional deviation	7/1/2	
			(	Dawar 4	21)	<1>	Motor rotational spee	-d	
	20		(	Power -	ON)	2	Torque output	,u	
	10			34°		3	Control mode	19/10	
			1.15			4	I/O signal status	100	
		_	- 1	<u>`</u>		5	Error factor/history		
		<u> </u>				6	Software version		
			1	11		177		The same	
					Flashes (for approx. 2 se	ec) 7	Alarm		
	2				during initialization	8	Regenerative load fa	ctor	
	10.×				NO NO N	9	Over-load factor	10.7	
			≪Se	tup value o	of Pr01	10	Inertia ratio	200	
		'	110		7101	11	Sum of feedback pul		
						12	Sum of command pu		
						13	External scale deviat	50	
						14	Sum of external scale	e feedback pulses	
						15	Motor automatic reco	ognizing function	
	68) F	or detai	ls of dis	splay, refer	to P.51 "Setup of	16	Analog input value	2	
				Mode" of P		17	Factor of "No-Motor I	Running"	
170,			10,	_	, of 1	· 70,		A	
02	Setup			0 to 6	You can set up the cor	itrol mode to be	used.		
*	contr	control mode <1>							
		Setup		Cc	entrol mode	atrol mode **1) When you set up the		ation mode of 3, 4 or	
		value		1st mode	2nd mode	5, you	can select either the	1st or the 2nd with	
	2	0	Positio				I mode switching input		
	10	<1>	Veloci	1400	- 33/2	When C-MODE is open, the 1st mod selected.		e 1st mode will be	
		2	Torque	-	- 2/1/2		C-MODE is shorted, the	ne 2nd mode will be	
		3**1	Positio	n	Velocity	select		-form /ofton ovvitabinos	
	4**1 Position Torque					Don't e	Don't enter commands 10ms before/after switching.		
		5 **1	Veloci		Torque	C-MOI	DE open clos	se open	
		6	Full-cl	osed	_	1	орон		
	19			9	7	<u>-</u>	1st → ← 2nd	d <del>→ </del> 1st	
	D.X						Wax	18 July 19 19 19 19 19 19 19 19 19 19 19 19 19	
							→ I ← 10ms or longer	10ms or longer	
						- Jo.	Toms or longer	Toma or longer	

# [Connection and setup of velocity control mode]

Standard default : < >

PrNo.	Title	Setup range	Function/Content				
03	Selection of	0 to 3	You can set u	You can set up the torque limiting method for CCW/CW direction.			
	torque limit	<1>	Setup value	CO	CW	CM	
			0	X5 CCWT	L : Pin-16	X5 CWTL : Pin-18	
	\$	20	<1>	Pr5E is	a limit value for both CC	CW and CW direction	
34°0		X N.O.	2	Set wit	h Pr5E	Set with Pr5F	
Morrior		HOLLS.	3		N/TL-SEL input is open N/TL-SEL input is short	20.	
	MAN HILLI		limit setup). A	t the torque con		be limited by Pr5E (1st torque limiting value for CCW/CW	
04	Setup of over-travel inhibit input	0 to 2 <1>	In linear drive application, you can use this over-travel inhibiting function to inhibit the motor to run to the direction specified by limit switches which are installed at both ends of the axis, so that you can prevent the work load from damaging the machine due to the over-travel. With this input, you can set up the action of over-travel inhibit input.  CW direction  Work  CCW direction  Driver  Servo motor				
, Chilippe	Setup value	CCWL/CWL input	Input Connection to COM-				
80.	value	input	CCWL	Close	N. Committee of the com	/-side limit switch is not activated.	
	.450		(CN X5,Pin-9)	Open		n, permits CW direction.	
	0	Valid	CWL	Close		side limit switch is not activated.	
			(CN X5,Pin-9)	Open		CCW direction permitted.	
27/E	<1>	Invalid	Both CCWL and CWL inputs will be ignored, and over-travel inhibit function will be invalidated.				
alitorne.	2	Valid	Err38 (Over-travel inhibit input protection) is triggered when either one of the connection of CW or CCW inhibit input to COM– become open.				
sutomatika	od www.iopa	jjo <sup>noš</sup> ijoci	ates and st travel inhibi 2. When both trips with Er 3. When you t tion, the wo	ops according to tion). For details, of CCWL and CV r38 (Overtravel i urn off the limit sork may repeat unis case, set up F	o the preset sequence refer to the explanation WL inputs are opened w nhibit input error) judgin witch on upper side of the up/down movement bec	hile Pr04 is set to 0, the driver	

### <Notes>

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

Standard default : < >

PrNo.	Title	Setup range	Function/Content				
05	Speed setup, Internal/External	0 to 3 <0>	This driver is equipped with internal speed setup function so that you can control the speed with contact inputs only.				
	switching		Setup value Speed setup method				
	્છે	3	<0>	External speed command (SPR:CN X5, Pin-14)			
Dr.	0	"This	1	Internal speed command 1st to 4th speed (Pr53 to Pr56)			
Mar.	<u> </u>	(O., )	2	Internal speed command 1st to 3rd speed (Pr53-Pr55), External speed command (SPR)			
-3/10	-31/10		3 Internal speed command 1st to 8th speed (Pr53 to Pr56, I				
	700	1	30,00				

- You can select a speed command at velocity control.
- When the setup value is 1 or 2, switch 4 kinds of internal speed command with 2 kinds of contact input.
   (1) INH (CN X5, Pin-33) :
  - Selection 1 input of internal command speed (2) INH (CN X5, Pin-30):
- Selection 2 input of internal command speed DIV input is ignored.
- When the setup value is 3, switch 8 kinds of internal speed command with 3 kinds of contact input.
  - (1) INH (CN X5, Pin-33):
    - Selection 1 input of internal command speed
  - (2) INH (CN X5, Pin-30):
    - Selection 2 input of internal command speed
  - (3) INH (CN X5, Pin-28):
    - Selection 3 input of internal command speed

#### Selection of internal speed

Co	nnector Pin No. of	X5	Pr05, Internal/external switching of speed setup			
Pin-33 INTSPD1(INH)	Pin-30 INTSPD2(CL)	Pin-28 INTSPD3(DIV)	0	15)	2	3
open	open	open	Analog speed command (CN X5, Pin-14)	1st speed of speed setup (Pr53)	1st speed of speed setup (Pr53)	1st speed of speed setup (Pr53)
short	open	open	Analog speed command (CN X5, Pin-14)	2nd speed of speed setup (Pr54)	2nd speed of speed setup (Pr54)	2nd speed of speed setup (Pr54)
open	short	open	Analog speed command (CN X5, Pin-14)	3rd speed of speed setup (Pr55)	3rd speed of speed setup (Pr55)	3rd speed of speed setup (Pr55)
short	short	open	Analog speed command (CN X5, Pin-14)	4th speed of speed setup (Pr56)	Analog speed command (CN X5, Pin-14)	4th speed of speed setup (Pr56)
open	open	short	Analog speed command (CN X5, Pin-14)	1st speed of speed setup (Pr53)	1st speed of speed setup (Pr53)	5th speed of speed setup (Pr74)
short	open	short	Analog speed command (CN X5, Pin-14)	2nd speed of speed setup (Pr54)	2nd speed of speed setup (Pr54)	6th speed of speed setup (P75)
open	short	short	Analog speed command (CN X5, Pin-14)	3rd speed of speed setup (Pr55)	3rd speed of speed setup (Pr55)	7th speed of speed setup (Pr76)
short	short	short	Analog speed command (CN X5, Pin-14)	4th speed of speed setup (Pr56)	Analog speed command (CN X5, Pin-14)	8th speed of speed setup (Pr77)

• Example of 4-speed run with internal speed command.

In addition to CL/INH inputs, use the speed zero clamp input (ZEROSPD) and Servo-ON input (SRV-ON) to control the motor stop and start.

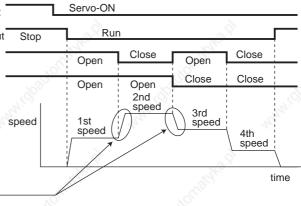
SRV-ON input

ZROSPD input

INH input

CL input

eration time, cceleration/



#### <Caution>

You can individually set up acceleration time, deceleration time, and sigmoid acceleration/deceleration time with parameter. Refer to

Pr58 : Acceleration time setup Pr59 : Deceleration time setup Pr5A : Sigmoid acceleration/

deceleration time setup in this Chapter.

06	Selection of	0 to 2	You can set up the function of the speed zero clamp input (ZEROSPD : CN X5, Pin-26)				
	ZEROSPD input <0>		Setup value	Function of ZEROSPD (Pin-26)			
31	<sup>9</sup> Ç		<0>	ZEROSPD input is ignored and the driver judge that it Is not in speed zero clamp status.			
TIOU GO	, itof	(E)	1 1	ZEROSPD input becomes valid. Speed command is taken as 0 by opening the connection to COM–.			
\$ <sup>5</sup>	"HAT I I DO		2	Becomes speed command sign. You can set command direction to CCW by opening the connection to COM–, and CW by closing.			

# [Connection and setup of velocity control mode]

PrNo.	Title	Setup range	Majiro.		Function/Content	
07	Selection of speed monitor (SP)	0 to 9 <3>	( - C)	You can set up the content of analog speed monitor signal Pin43) and the relation between the output voltage level and the		(-)
			Setup value	Signal of SP	Relation between the output voltage	e level and the speed
	<b>\</b>	9	0	0	6V / 47 r/min	0
	×	Mrs.	1	160.	6V / 188 r/min	Ę.,
	The state of the s	7	2	Motor actual	6V / 750 r/min	
	aldio.		<3>	speed	6V / 3000 r/mi	n 🔊
			4	5,	1.5V / 3000 r/mi	n 🖑
	The state of the s		5	" And	6V / 47 r/min	'Aga,
	1,		6	Command	6V / 188 r/min	40
		7	speed	6V / 750 r/min		
	X	13.7	8	speed	6V / 3000 r/mi	n
	Į, Š	3.	9	3.	1.5V / 3000 r/mi	n
08	Selection of torque monitor (IM)	0 to 12 <0>	. 055		analog torque monitor of the signal o output voltage level and torque or dev	100
	"WAY.		Setup value	Signal of IM	Relation between the output voltage level and tord	que or deviation pulse counts
	27.	-	<0>	Torque command		
			1	Δ.	3V / 31Pulse	
	<u>P</u>	13.9°	2	12 P	3V / 125Pulse	.0. <sup>2</sup>
	న	3	3	Position	3V / 500Pulse	}
	40 <sup>f</sup> f*		4	deviation	3V / 2000Pulse	8
	1000		5	2	3V / 8000Pulse	7020
	14 C		6	Full-closed	3V / 31Pulse	41,50
	11/2		7		3V / 125Pulse	
		8	deviation	3V / 500Pulse		
	H2.21	9	deviation	3V / 2000Pulse	<u>_</u>	
		10	760	3V / 8000Pulse	F.	
	-Ollio		11	Torque	3V / 200% torque	
	California de la companya della companya della companya de la companya della comp		12	command	3V / 400% torque	
09	Selection of	0 to 8	You can assi	gn the function o	f the torque in-limit output (TLC : C	N X5 Pin-40).
	TLC output	<0>	Setup value	774	Function	Note
			<0>	Torque in-limit	output	
	<u> </u>	20	1	Zero speed dete		For details of
	X	A.	2	w 2	f either one of Over-regeneration	function of each
	,0Kg		- 20/1		lute battery/Fan lock/External scale	output of the
	Mallin Contract of the Contrac		3		ion alarm trigger output	left, refer to the
	"4' CD.		4	Overload alarm		table of P135,
	Hay.		5	Absolute battery		"Selection of
			6	Fan lock alarm	-	TCL and ZSP
		9	7	External scale a	· ~	outputs".
- The	×	Mr. S.	8	2	d coincidence) output	0
0A	Selection of	0 to 8	You can assi	gn the function of	the zero speed detection output (Z	SP: CN X5 Pin-12).
	ZSP output	<1>	Setup value		Function	Note
	77/01/2		0	Torque in-limit	output	770
	The state		<1>	Zero speed dete		For details of
Sight of			2	Alarm output of /Over-load/Abso	function of each output of the	
	K	13.X	3	Over-regenerati	ion alarm trigger output	left, refer to the
	Š.	3	4 👌	Overload alarm	output	table of P.135,
	100		5	Absolute battery	y alarm output	"Selection of
	1000		6	Fan lock alarm	V	TCL and ZSP
	"4 <sub>1ES</sub>		M. 7	External scale a		outputs".
	The state of the s		8	In-speed (Spee	d coincidence) output	Ma.

Standard default : < >

PrNo.	Title	Setup range	103/20	Function/Content					
0B	Setup of	0 to 2	You can set	You can set up the using method of 17-bit absolute encoder.					
*	absolute encoder	<1>	Setup value	Thy.	Content		274		
			0	Use as an absolute enco	der.				
	S.	20	<1>	<1> Use as an incremental encoder.					
6.	100	"The	2	Use as an absolute enco	der, but ignore	e the multi-tu	rn counter over.		
Wallfolding.	, allor	0.	<caution> This paramet</caution>	er will be invalidated when	5-wire, 2500P	r incrementa	al encoder is used.		
0C	Baud rate setup of	0 to 5	You can set	up the communication spe	ed of RS232.	• Error of	baud rate is ±0.5%.		
*	RS232	<2>	Setup value	Baud rate	Setup val	ue I	Baud rate		
	communication		0	2400bps	3		19200bps		
		20	1	4800bps 4		38400bps			
100		iche	<2> 9600bps 5 57600bp				57600bps		
0D *	Baud rate setup of	0 to 5	You can set	up the communication spe	ed of RS485.	• Error of	baud rate is ±0.5%.		
So. •	RS485	<2>	Setup value	Baud rate	Setup val	ue S	Baud rate		
	communication		0	2400bps	3	Tr.	19200bps		
	20		1	4800bps	4	;	38400bps		
	3	8	<2>	9600bps	5		57600bps		
0E	Setup of front	0 to 1		the operation of the front	panel to the	Setup value	Content		
*	panel lock	<0>	monitor mode		2	<0>	Valid to all		
~3JIL	alie Laile		ted paramete	vent such a misoperation a	as unexpec-	~150	Monitor mode only		
89	W. W. W. C.		<note> You can still</note>	change parameters via co		•	•		

# Parameters for Adjustment of Time Constants of Gains and Filters

PrNo.	Title	Setup range	Unit	Function/Content
11	1st gain of velocity loop	1 to 3500 A to C-frame:<35>* D to F-frame:<18>*	.√Hz	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 Pr20 is set correctly, the setup unit of Pr11 becomes (Hz).</caution>
12	1st time constant of velocity loop integration	1 to 1000 A to C-frame:<16>' D to F-frame:<31>'	ms	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 "999".  The integration effect will be lost by setting to "1000".
13	1st filter of speed detection	0 to 5 <0>*		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.
14	1st time constant of torque filter	O to 2500 A to C-frame:<65>* D to F-frame:<126>*	0.01ms	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.

## [Connection and setup of velocity control mode]

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content
19	2nd gain of velocity loop	1 to 3500 A to C-frame:<35>* D to F-frame:<18>*	Hz	Position loop, velocity loop, speed detection filter and torque command filter have their 2 pairs of gain or time constant (1st and 2nd).  For details of switching the 1st and the 2nd gain or the time constant, refer
1A	2nd time constant of velocity loop integration	1 to 1000 <1000>*	ms	to P.226, "Adjustment".  The function and the content of each parameter is as same as that of the
1B	2nd filter of velocity detection	0 to 5 <0>*	- 35	1st gain and time constant.
1C	2nd time constant of torque filter	O to 2500 A to C-frame:<65>* D to F-frame:<126>*	0.01ms	WHY TOO.
1D	1st notch frequency	100 to 1500 <1500>	Hz	You can set up the frequency of the 1st resonance suppressing notch filter. The notch filter function will be invalidated by setting up this parameter to "1500".
1E	1st notch width selection	0 to 4 <2>		You can set up the notch filter width of the 1st resonance suppressing filter in 5 steps.  Higher the setup, larger the notch width you can obtain.  Use with default setup in normal operation.

## **Parameters for Auto-Gain Tuning**

Standard default : < >

PrNo.	Title	Setup range	Unit	Mag.	Function/Cont	ent	
20	Inertia ratio	0 to 10000	%	You can set up the	ratio of the load inertia again	st the rotor (of the motor) inertia.	
	141 C	<250>*		Pr20= (load ir	nertia/rotor inertia) X 100 [	%]	
	or who will be the constitution of the constit	Maria I		When you execute the normal auto-gain tuning, the load inertial will be automatically estimated after the preset action, and this result will be reflected in this parameter.  The inertia ratio will be estimated at all time while the real-time auto-gain tuning is valid, and its result will be saved to EEPROM every 30 min. <b>Caution&gt;</b> If the inertia ratio is correctly set, the setup unit of Pr11 and Pr19 becomes (Hz). When the inertia ratio of Pr20 is larger than the actual, the setup unit of the velocity loop gain becomes larger, and when the inertia ratio of Pr20 is smaller than the actual, the setup unit of the velocity loop gain becomes smaller.			
21	Setup of real-time auto-gain tuning	0 to 7 <1>	-	With higher setup	operation, however it migh	time auto-gain tuning. spond quickly to the change of nt cause an unstable operation	
	M. Idhania			Setup value	Real-time auto-gain tuning	Varying degree of load inertia in motion	
The state of the s	The.	La Tara		0	Invalid	- 44	
				<1>, 4, 7		Little change	
	6	9		2, 5	Normal mode	Gradual change	
	Î	13.		3, 6		Rapid change	

#### <Notes>

- For parameters which No. have a suffix of "\*", changed contents will be validated when you turn on the control power.
- Parameters which default values have a suffix of "\*" will be automatically set up during real time auto-gain tuning. When you change manually, invalidate the real-time auto-gain tuning first then set, referring to P.239, "Release of Automatic Gain Adjusting Function" of Adjustment.

Standard default: < >

PrNo.	Title	Setup range	Unit	20. Zang	Function/Content				
22	Selection of machine stiffness	0 to 15 A to C-frame:	Thus is,	You can set up the machi gain tuning is valid.	ne stiffness in 16 steps while the real-time auto-				
	at real-time auto-gain tuning	<4> D to F-frame: <1>		Pr22	w ← machine stiffness → high w ← servo gain → high 0, 114, 15 w ← response → high				
	N/C			<caution></caution>	<u> </u>				
	WHIH IGO			When you change the se	etup value rapidly, the gain changes rapidly a impact to the machine. Increase the setu exement of the machine.				
23	Setup of adaptive filter mode	0 to 2 <1>	-	<caution></caution>	ve filter frequency when this setup is changed to 2.)				
	WHUTCH.		MANION		otive filter to invalid, the adaptive filter frequence.  O. The adaptive filter is always invalid at the				
25	Setup of an action	0 to 7	_	You can set up the action	pattern at the normal mode auto-gain tuning.				
	at normal mode	<0>		Setup value Number of revol	ution Rotational direction				
	auto-gain tuning		<0>	CCW → CW					
				2 [ revolution	onl CW → CCW				
	'92,0		WHAT I GO,	2	GGW → GGW				
	My.			3	CW → CW				
	2,			5	CCW → CW				
	2			1 [ revolution	on] CCW → CCW				
	0.2	10%		7	CW → CW				
	) 	E STAN							43
27	Setup of	0 to 1	70	0.7	chine, you can achieve both high response an				
	instantaneous	<0>*		reduction of vibration at st	all, by using this instantaneous speed observer				
	speed observer			Setup value In:	stantaneous speed observer setup				
	_			<0>*	Invalid				
	D.S.	12.5.		1.2	Valid				
		(*		20 correctly to use this func uning mode setup, to other	tion. than 0 (valid), Pr27 becomes 0 (invalid)				
28	2nd notch	100 to 1500	Hz	You can set up the 2nd no	otch width of the resonance suppressing filter i				
-	frequency	<1500>	My.	- 1950 Table 1	unction is invalidated by setting up this parame				
29	Selection of	0 to 4	_		width of 2nd resonance suppressing filter in				
	2nd notch width	<2>			rger the notch width you can obtain.				
		Else.		Use with default setup in r	7001				
2A	Selection of	0 to 99		You can set up the 2nd not	ch depth of the resonance suppressing filter. Higher				
	2nd notch depth	<0>		the setup, shallower the note	h depth and smaller the phase delay you can obtain.				

#### <Notes>

• Parameters which default values have a suffix of "\*" will be automatically set up during real time auto-gain tuning. When you change manually, invalidate the real-time auto-gain tuning first then set, referring to P.239, "Release of Automatic Gain Adjusting Function" of Adjustment.

# [Connection and setup of velocity control mode]

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content
2F	Adaptive filter frequency	0 to 64 <0>	HWI GOOD	Displays the table No. corresponding to the adaptive filter frequency. (Refer to P.234 of Adjustment.) This parameter will be automatically set and cannot be changed while the adaptive filter is valid. (when Pr23 (Setup of adaptive filter mode) is other than 0.)  0 to 4 Filter is invalid.  5 to 48 Filter is valid.  49 to 64 Filter validity changes according to Pr22.  This parameter will be saved to EEPROM every 30 minutes while the adaptive filter is valid, and when the adaptive filter is valid at the next power-on, the adaptive action starts taking the saved data in EEPROM as an initial value. <caution></caution>
		14.G		When you need to clear this parameter to reset the adaptive action while the action is not normal, invalidate the adaptive filter (Pr23, "Setup of adaptive filter mode" to 0) once, then validate again.  Refer to P.239, "Release of Automatic Gain Adjusting Function" of Adjustment as well.

# Parameters for Adjustment (2nd Gain Switching Function)

PrNo.	Title	Setup range	Unit	20	Function/Conte	nt
30	Setup of 2nd gain	0 to 1	_	You can select the PI/P action	switching of the velocity	y control or 1st/2nd gain switching.
"Ollico	Offic	<1>*	, (	Setup value	Gain selection/s	switching
SILL.	Palle		1000	0 1	st gain (PI/P switch	ning enabled) *1
	710		110	<1>*	st/2nd gain switchii	ng enabled *2
	nu.		The same		•	ning input (GAIN CN X5, Pin-
	3	2		27). PI is fixed when Pi		ction of velocity loop
		y.		Open with COM	N.V	PI action
				Connect to COM	1_	P action
			. 44 ! (S) (S) (S)	*2 For switching condition Switching Function" of		e 2nd, refer to P.243, "Gain
31	1st mode of	0 to 10	1 <sub>2</sub> -	You can select the switchi	ing condition of 1st	gain and 2nd gain while Pr30
	control switching	<0>*		is set to 1.		
	Setup value			Gain switching	condition	a.S)
	<0>*, 6to 10	Fixed to the	e 1st gain.		10 <sup>1</sup>	19/2
	1 3	Fixed to the	•	1		-01°
	2 *1	•		en the gain switching input	•	
	3 *2	•		nen the toque command var trol switching) and Pr34 (1s		
	4 *2	Fixed to the	e 1st gain.	1/2	1/2	2,
	5 *2			nen the command speed is I trol switching) and Pr34 (1s	•	
Michigan	'spanieus,	B.	19914	and Pr03 (Torque limit	selection) is set to 3 and the timing, refe	input, when Pr31 is set to 2 3. er to P.243, "Gain Switching

Standard default: < >

PrNo.	Title	Setup range	Unit	Function/Content		
32	1st delay time of control switching	0 to 10000 <30>*	x 166μs	You can set up the delay time when returning from the 2nd to the 1st gain, while Pr31 is set to 3 or 5 to 10.		
33	1st level of control switching	0 to 20000 <50>*	-	You can set up the switching (judging) level of the 1st and the 2nd gains while Pr31 is set to 3, 5, 6. 9 and 10. Unit varies depending on the setup of Pr31 (1st mode of control switching)		
34	1st hysteresis of control switching	0 to 20000 <33>*	WANTER STATE	You can set up hysteresis width to be implemented above/below the judging level which is set up with Pr33. Unit varies depending on the setup of Pr31 (1st control switching mode). Definitions of Pr32 (Delay), Pr33 (Level) and Pr34 (Hysteresis) are explained in the fig. below. <a href="#">Caution&gt;</a> The setup of Pr33 (Level) and Pr34 (Hysteresis) are valid as absolut values (positive/negative).		
36	2nd mode of control switching	0 to 5 <0>*	141	You can select the switching condition of the 1st and 2nd gain while Pr30 is set to 1 and when the 2nd control mode is velocity control.		
	6	9		Setup value Gain switching condition		
	D.X	JE3.7		<0>* Fixed to the 1st gain		
		(g)		1 Fixed to the 2nd gain		
	Hilpanc,			2 *1 2nd gain selection when gain switching input is turned on (GAIN: CN X5, Pin-27) (Pr30 setup must be 1.) 3 *2 2nd gain selection when the torque command variation is larger.		
	My,			4 *2 2nd gain selection when the speed command variation (acceleration) is larger.		
	<sup>1</sup> 92511 <sub>02</sub>	asko.o.		5 *2 2nd gain selection when the command speed is larger.  *1 Fixed to the 1st gain regardless of the GAIN input, when Pr31 is set to 2 and Pr03 (Torque limit selection) is set to 3.  *2 For the switching level and timing, refer to P.244, "Setup of Gair Switching Condition" of Adjustment.		
37	2nd delay time of control switching	0 to 10000 <0>	x 166μs	You can set up the delay time when returning from 2nd to 1st gain, while Pr36 is set to 3 to 5.		
38	2nd level of control switching	0 to 20000 <0>	-	You can set up the switching (judging) level of the 1st and the 2nd gains, while Pr36 is set to 3 to 5 Unit varies depending on the setup of Pr36 (2nd mode of control switching).		
39	2nd hysteresis of control switching	0 to 20000 <0>	HANNING THE STATE OF THE STATE	You can set up the hysteresis width to be implemented above/below the judging level which is set up with Pr38.  Unit varies depending on the setup of Pr36 (2nd mode of control switching). Definition of Pr37 (Delay), Pr38 (Level) and Pr39 (Hysteresis) are explained in the fig. below.  Caution>  Setup of Pr38 (Level) and Pr39 (Hysteresis) are valid as absolute value		
	May May		Tayle.	(positive/negative).		
3D	JOG speed setup	0 to 500 <300>	r/min	You can setup the JOG speed.  Refer to P.75, "Trial Run"of Preparation.		

#### <Notes>

• Parameters which default values have a suffix of "\*" will be automatically set up during real time auto-gain tuning. When you change manually, invalidate the real-time auto-gain tuning first then set, referring to P.239, "Release of Automatic Gain Adjusting Function" of Adjustment.

# [Connection and setup of velocity control mode]

# Parameters for Position Control

Standard default : < >

PrNo.	Title	Setup range	Function/Content
44 *	Numerator of pulse output division	1 to 32767 <2500>	You can set up the pulse counts to be fed out from the pulse output (X5 0A+ : Pin-21, 0A- : Pin-22, 0B+ : Pin-48, 0B- : Pin-49).
Mollogike	output division	<2500>	Pr45=<0> (Default)     You can set up the output pulse counts per one motor revolution for each OA and OB with the Pr44 setup. Therefore the pulse output resolution after quadruple can be obtained from the formula below.  The pulse output resolution per one revolution
	un,	3	= Pr44 (Numerator of pulse output division) X4  • Pr45≠0:
M2		160.57	The pulse output resolution per one revolution can be divided by any ration according to the formula below.
Michigan	unnidbaltofra		Pulse output resolution per one revolution Pr44 (Numerator of pulse output division)  Cautions>  The encoder resolution is 131072 [ P/r] for the 17-bit absolute encoder, an 10000 [ P/r] for the 5-wire 2500P/r incremental encoder.
45 *	Denominator of pulse output division	0 to 32767 <0>	<ul> <li>The pulse output resolution per one revolution cannot be greater than the encoder resolution. (In the above setup, the pulse output resolution equals to the encoder resolution.)</li> <li>Z-phase is fed out once per one revolution of the motor.</li> <li>When the pulse output resolution obtained from the above formula is multiple of 4,</li> <li>Z-phase synchronizes with A-phase. In other case, the Z-phase width equals to output with the encoder resolution, and becomes narrower than A-phase, hence does not synchronize with A-phase.</li> </ul>
13/E		Mag.	when encoder resolution x $\frac{Pr44}{Pr45}$ is multiple of 4
Hickey	unnidbilitotti		B B Z Synchronized Not-synchronized

## <Notes>

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

Standard default : < >

PrNo.	Title	Setup range	2021/10	Function/Content				
46	Reversal of pulse	0 to 3	You can set	t up the B-pha	se logic and the output	source of the pulse output (X5 OB+		
*	output logic	<0>	: Pin-48, O	B– : Pin-49).	With this parameter, y	ou can reverse the phase relation		
			between the	A-phase puls	se and the B-phase pulse	e by reversing the B-phase logic.		
	.g.	20	Cotup	A phase	at motor CCW rotati	on at motor CW rotation		
- Caid	o	ich,	Setup value	A-phase (OA)				
Beario,	' (q)pgqqo		<0>, 2	B-phase(OB) non-reversal				
	May.		1, 3	B-phase(OB) reversal				
	ò	9	Pr46	В-	phase logic	Output source		
1/2	8.	Tho.	<0>	Me N	on-reversal	Encoder position		
Migh	25	S.,	1	8	Reversal	Encoder position		
NIO.	"Ito.		2 *1	N	on-reversal	External scale position		
800	1900		3 *1		Reversal	External scale position		
	MAN		*1 The outp	out source of F	Pr46=2, 3 is valid only at	full-closed control.		

# **Parameters for Velocity and Torque Control**

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content
50	Input gain of speed command	10 to 2000 <500>	(r/min)/V	You can set up the relation between the voltage applied to the speed command input (SPR : CN X5, Pin-14) and the motor speed.
Spilishid	adi www.dbaulo			<ul> <li>You can set up a "slope" of the relation between the command input voltage and the motor speed, with Pr50.</li> <li>Default is set to Pr50=500 [ r/min] , hence input of 6V becomes 3000r/min.</li> <li>Cautions&gt; <ol> <li>Do not apply more than ±10V to the speed command input (SPR).</li> <li>When you compose a position loop outside of the driver while you use the driver in velocity control mode, the setup of Pr50 gives larger variance to the overall servo system.</li> <li>Pay an extra attention to oscillation caused by larger setup of Pr50.</li> </ol> </li> </ul>

#### -Notes

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

# [Connection and setup of velocity control mode]

PrNo.	Title	Setup range	Unit	Function/Content	
51	Reversal of speed command input	0 to 1 <1>	And Services	You can reverse the polarity of the speed command inp X5, Pin-14). Use this function when you want to crotational direction without changing the polarity of the from the host.	hange the motor
	5,	3.5		Setup value Motor rotating direction	3,
	3	ye.		0 CCW direction with (+) command (viewed from the	
	, of C			<1> CW direction with (+) command (viewed from the	
	MAN I GOOT			<notes> • Default of this parameter is 1, and the motor turns to 0 this has compatibility to existing MINAS series driver. • When Pr06 (ZEROSPD) is set to 2, this parameter bed</notes>	CW with (+) signal,
	).	Marile .		<a href="#"> <caution></caution></a> When you compose the servo drive system with the velocity control mode and external positioning unit, perform an abnormal action if the polarity of the speed from the unit and the polarity of this parameter setup does not be a server of the system.	the motor might command signal
52	Speed command offset	-2047 to 2047 <0>	0.3mV	<ul> <li>You can make an offset adjustment of analog speed CN X5, Pin-14) with this parameter.</li> <li>The offset volume is 0.3mV per setup value of "1".</li> <li>There are 2 offset methods, (1) Manual adjustment adjustment.</li> </ul>	
	White I post of the second	3"		1) Manual adjustment  • When you make an offset adjustment with the driv Enter 0 V exactly to the speed command input ( connect to the signal ground), then set this paran the motor may not turn.  • when you compose a position loop with the host,	SPR/TRQR), (or neter up so that
	)	K.		<ul> <li>Set this parameter up so that the deviation pulse method at the Servo-Lock status.</li> <li>2) Automatic adjustment</li> <li>For the details of operation method at automatic of mode, refer to P.73, "Auxiliary Function Mode" of Result after the execution of the automatic offset reflected in this parameter, Pr52.</li> </ul>	offset adjustment Preparation.
53	1st speed of speed setup	-20000 to	r/min	When the internal speed setup is validated with parameter of internal or external speed setup", you can set up 1st	
54	2nd speed of speed setup	<0>		Pr53 to 56, 5th to 8th speed into Pr74 to 77 in direct unit <b><caution></caution></b> • The polarity of the setup value represents that of the	-
55	3rd speed of			speed.	internal command
	speed setup	]			tor shaft and)
56	4th speed of			Command to CCW (viewed from the motor     Command to CW (viewed from the motor	
	speed setup		V-		
74	5th speed of speed setup	-20000 to 20000	r/min	<ul> <li>The absolute value of the parameter setup is limited w over-speed level)</li> </ul>	vith Pr73 (Setup of
75	6th speed of speed setup	<0>			
76	7th speed of speed setup				
77	8th speed of speed setup	1			
57	Setup of speed	0 to 6400	0.01ms	You can set up the time constant of the primary delay	filter to the analog
JI A	command filter	<0>	0.011115	speed command/analog torque command/analog veloc CN X5, Pin-14)	

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content
58	Acceleration time setup	0 to 5000 <0>	(1000r/min)	You can make the velocity control while adding acceleration and deceleration command to the speed command inside of the driver. With this function, you can make a soft-start when you enter the step-speed command and when you use with the internal speed setup.
59	Deceleration time setup	0 to 5000 <0>	2ms/ (1000r/min)	Speed command         ta         Pr58 x 2ms/(1000r/min)           Speed         td         Pr59 x 2ms/(1000r/min)
(·)	Many Co.		MAN	<caution> Do not use these acceleration/deceleration time setup when you use the external position loop. (Set up both Pr58 and Pr59 to 0.)</caution>
5A	Sigmoid acceleration/ deceleration time setup	0 to 500 <0>	2ms	In order to obtain a smooth operation, you can set up the quasi sigmoid acceleration/deceleration in such application as linear acceleration/deceleration where acceleration variation is large at starting/stopping to cause a strong shock.
1.010)	adi Munido	<sup>914</sup> 16 ij	Hubbligg,	1. Set up acceleration/deceleration for basic linear portion with Pr58 and Pr59 2. Set up sigmoid time with time width centering the inflection point of linear acceleration/deceleration with Pr5A. (unit: 2ms)
Spariton,	"HHHIII)palice		WWW GA	ta: Pr58 Use with the setup of td: Pr59 $\frac{ta}{ts}$ : Pr5A $\frac{ta}{2}$ > ts, ts, and $\frac{td}{2}$ > ts
5E	1st torque limit setup	0 to 500 <500> *2	%	You can set up the limit value of the motor output torque (Pr5E : 1st torque, Pr5F : 2nd torque). For the torque limit selection, refer to Pr03 (Torque limit selection).
5F	2nd torque limit setup	0 to 500 <500> *2	%	This torque limit function limits the max. motor torque inside of the driver with parameter setup.  In normal operation, this driver permits approx. 3 times larger torque than the rated torque instantaneously. If this 3 times bigger torque causes any trouble to the load (machine) strength, you can use this function to limit the max. torque.  • Setup value is to be given in % against the rated torque.  • Right fig. shows example of 150% setup with Pr03-1 (Rated)
g <sub>allon</sub> .	WWW.Idpartor		War Ing	Pr5E limits the max. torque for both CCW and CW directions.        100
grantomats)	ag.	P. P. C. L.		<b><caution></caution></b> You cannot set up a larger value to this parameter than the default setup value of "Max. output torque setup" of System parameter (which you cannot change through operation with PANATERM® or panel). Default value varies depending on the combination of the motor and the driver. For details, refer to P.57, "Setup of Torque Limit " of Preparation.

#### <Notes>

- For parameters which No. have a suffix of "\*", changed contents will be validated when you turn on the control power.
- For parameters which default. has a suffix of "\*2", value varies depending on the combination of the driver and the motor.

# [Connection and setup of velocity control mode]

# Parameters for Sequence

	-450	Satur	- 40°	Standard default . < >
PrNo.	Title	Setup range	Unit	Function/Content
61	Zero-speed	10 to 20000 <50>	r/min	You can set up the timing to feed out the zero-speed detection output signal (ZSP: CN X5, Pin-12 or TCL: CN X5, Pin-40) 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, Pr61.  In-speed (Speed coincidence) signal (V-COIN) will be fed out when the difference between the speed command and the motor speed falls below the setup of this parameter, Pr61.
Jionatyko	\$	Mo St.	.3"	The setup of P61 is valid for both CCW and CW direction regardless of the motor rotating direction.      There is hysteresis of 10 [ r/min] . ZSP ON (Pr61–10)r/min
62	At-speed (Speed arrival)	10 to 20000 <50>	r/min	You can set up the timing to feed out the At-speed signal (COIN+ : CN X5, Pin-39, COIN- : CN X5, Pin-38) At-speed (Speed arrival) (COIN) will be fed out when the motor speed exceeds the setup speed of this parameter, Pr62
alion sight	Mary idibalicitis	R. J.	and ideal	The setup of P62 is valid for both CCW and CW direction regardless of the motor rotational direction. There is hysteresis of 10 [ r/min] .  CCW  CCW  CCW  CCW  CCW  CCW  CCW  C
"CLUGAYS	<sup>10</sup> Clus	<sub>1</sub> 40.91	25	AT-SPEED OFF ON
65	LV trip selection at main power OFF	0 to 1 <1>	"H441 <u>"</u> DOST	You can select whether or not to activate Err13 (Main power undervoltage protection) function while the main power shutoff continues for the setup of Pr6D (Main power-OFF detection time).
				Setup value
Wigh.	, company	H. S.		When the main power is shut off during Servo-ON, Err13 will not be triggered and the driver turns to Servo-OFF. The driver returns to Servo-ON again after the main power resumption.
NJIC.	"Idpanie.		. John Jan	When the main power is shut off during Servo-ON, the driver will trip due to Err13 (Main power low voltage protection).
JiChi Bilike	S Walley	Horizon .	and a second	<b>Caution&gt;</b> This parameter is invalid when Pr6D (Detection time of main power OFF)=1000. Err13 (Main power under-voltage protection) is triggered when setup of P66D is long and P-N voltage of the main converter falls below the specified value before detecting the main power shutoff, regardless of the Pr65 setup. Refer to P.42, "Timing Chart-At Power-ON" of Preparation as well.

Standard default : < >

PrNo.	Title	Setup range	Unit	Z <sub>C</sub> .	Funct	tion/Content	
66 *	Sequence at over-travel inhibit	0 to 2 <0>	Rulai.	while over-tr			ation or after stalling, I X5, Pin-9 or CWL:
	_			Setup value	During deceleration	After stalling	Deviation counter content
. BC	135.	ald Farry		<0>	Dynamic brake action	Torque command=0 towards inhibited direction	Hold
Mariton.	1031400		300	1	Torque command= 0 towards inhibited direction	Torque command=0 towards inhibited direction	Hold
(5)	MAN		Mayin	2	Emergency stop	Torque command=0 towards inhibited direction	Clears before/ after deceleration
-3	0.00	~16.ij			he setup value of 2, e setup value of Pr6E		deceleration will be mergency stop).
67	Sequence at main power OFF	0 to 9 <0>	- HIGO	1) the action 2) the clean	LV trip selection at mon during deceleration ring of deviation cour n power is shut off.	n and after stalling	, you can set up,
	7/4,		The same	Setup	Act	ion	Deviation counter
				value	During deceleration	After stalling	content
	3	2		<0>	DB	DB	Clear
	100	"The			Free-run	DB	Clear
		Ø.,		2	DB	Free-run	Clear
	ald to		.0	3	Free-run	Free-run	Clear
200	(g)°		1900	4	DB	DB	Hold
	The state of the s		1241	5	Free-run	DB	Hold
	17		24	6	DB	Free-run	Hold
				7	Free-run	Free-run	Hold
	3.5)			8	Emergency stop	DB	Clear
100		TON THE		9	Emergency stop	Free-run	Clear
68	Sequence at alarm	0 to 3	en u i i i po	<caution> In case of the limited by the</caution>	e setup value of Pr6E	(Torque setup at e	g deceleration will be mergency stop). r stalling when some
00	Sequence at alaim	<0>					tions of the driver is
Nage.	1	G.C.		Setup	Act	ion	Deviation counter
2,0	10			value	During deceleration	After stalling	content
	" Programme		'90,	<0>	DB	DB	Hold
	74.		"Tay ju	1	Free-run	DB	Hold
	Me		200	2	DB	Free-run	Hold
				3	Free-run	Free-run	Hold
,onatri	,of	eigheig,		<caution> The content</caution>			d when clearing the or (alarm) occurs (at
	· · · · · · · · · · · · · · · · · · ·	1			,	,	. , , (at

#### <Notes>

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

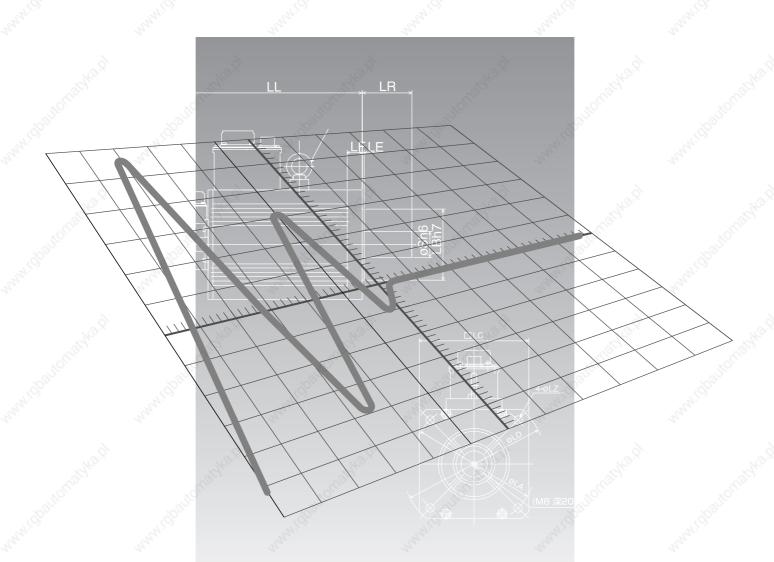
# [Connection and setup of velocity control mode]

PrNo.	Title	Setup range	Unit	Function/Content
69	Sequence at Servo-Off	0 to 9 <0>	And S	You can set up, 1) the action during deceleration and after stalling 2) the clear treatment of deviation counter is set up. The relation between the setup value of Pr69 and the action/deviation counter clearance is same as that of Pr67 (Sequence at Main Power Off) Refer to P.44, "Timing Chart"-Servo-ON/OFF action while the motor is at stall" of Preparation as well.
6A	Setup of mechanical brake action at stalling	0 to 100 <0>	2ms	You can set up the time from when the brake release signal (BRK-OFF: CN X5, Pin-10 and 11) turns off to when the motor is de-energized (Servo-free), when the motor turns to Servo-OFF while the motor is at stall.
	anna illantolog	Hardi Hardi	and the second	• 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 Pr6a ≥ tb, then compose the sequence so as the driver turns to Servo-OFF after the brake is actually activated.  SRV-ON  ON  OFF  release  tb  hold  release  relea
	()	10.01		Refer to P.44, "Timing Chart"-Servo-ON/OFF Action While the Motor Is at Stall" of Preparation as well.
6B	Setup of mechanical brake action at running	0 to 100 <0>	2ms	You can set up time from when detecting the off of Servo-ON input signal (SRV-ON: CN X5, Pin-29) is to when external brake release signal (BRK-OFF: CN X5, Pin-10 and 11) turns off, while the motor turns to servo off during the motor in motion.
	el was still be the first	**************************************	ithu ilogali	Set up to prevent the brake deterioration due to the motor running.     At Servo-OFF during the motor is running, tb of the right fig. will be a shorter one of either Pr6B setup time, or time lapse till the motor speed falls below 30r/min.  Refer to P.45, "Timing Chart"-Servo-ON/OFF action while the motor is in  SRV-ON ON OFF  release hold  actual brake energized motor energization  30 r/min energization

PrNo.	Title	Setup range	Unit	Function/Content						
6C *	Selection of external regenerative resistor	0 to 3 for A, B-frame <3>	Andries -	resistor of the externally ins	e driver, or to sep stall the regener	select either to use the built-in regenerative parate this built-in regenerative resistor and ative resistor (between RB1 and RB2 of a to D-frame, between P and B2 of terminal				
Sparke matel	s and a second	for C to F-frame <0>	7/92 <sub>9</sub>	<0>	Regenerative resistor to be used Built-in resistor	Regenerative processing and regenerative resistor overload  Regenerative processing circuit will be activated and regenerative resistor overload protection will be triggered according to the built-in resistor (approx. 1% duty).				
	S. May	, ĝ	White I	1 1	External resistor	The driver trips due to regenerative overload protection (Err18), when regenerative processing circuit is activated and its active ratio exceeds 10%,  Regenerative processing circuit is activated,				
	, d	Sighe.		2	External resistor	but no regenerative over-load protection is triggered.  Both regenerative processing circuit and				
	ill. H. H. H. Balle			<3> (A, B-frame)	No resistor	regenerative protection are not activated, and built-in capacitor handles all regenerative power.				
Spirituring of	ad www.idbattof	adika di	Water 100 g	external reger Otherwise, the result in burn over-load prot <b><caution></caution></b> When you us value than 0.	nerative resistor. e regenerative resout, regardless of tection. se the built-in re	such as thermal fuse when you use the esistor might be heated up abnormally and of validation or invalidation of regenerative generative resistor, never to set up other xternal regenerative resistor.				
6D *	Detection time of main power off	35 to 1000 <35>	2ms	You can set u	up the time to det	gets very hot, and might cause burning.  ect the shutoff while the main power is kept s invalid when you set up this to 1000.				
6E	Torque setup at emergency stop	0 to 500 <0>	%	You can set u  During dece Sequence a  During dece power off)  During decele	p the torque limit beleration of ove at over-travel inhi eleration with the	in case of emergency stop as below. er-travel inhibit with the setup 2 of Pr66 bit input) setup of 8 or 9 of Pr67 (Sequence at main up of 8 or 9 of Pr69 (Sequence at Servo-OFF)				
70	Setup of position deviation excess	0 to 32767 <25000>	256 x resolution	<ul><li>Set up with the external sca</li><li>Err24 (Erro</li></ul>	the encoder pulse le pulse counts a	nge of position deviation. e counts at the position control and with the t the full-closed control. osition deviation excess) becomes invalid				
72	Setup of over-load level	0 to 500 <0>	%	<ul><li>by setting up</li><li>Use this with you need to</li></ul>	o this to 0. h 0 setup in norm lower the over-lo	level. The overload level becomes 115 [ % nal operation. Set up other value only when ad level. eter is limited by 115[ %] of the motor rating.				
73	Setup of over-speed level	0 to 20000 <0>	r/min	times of the  Use this with you need to The setup wax. speed.  Caution> The detection	motor max. spee h 0 setup in norm lower the over-sp value of this para error against the	ed level. The over-speed level becomes 1.2 d by setting up this to 0. nal operation. Set up other value only when beed level.  ameter is limited by 1.2 times of the motor setup value is ±3 [ r/min] in case of the 7-wir in] in case of the 5-wire incremental encoder.				

## <Notes>

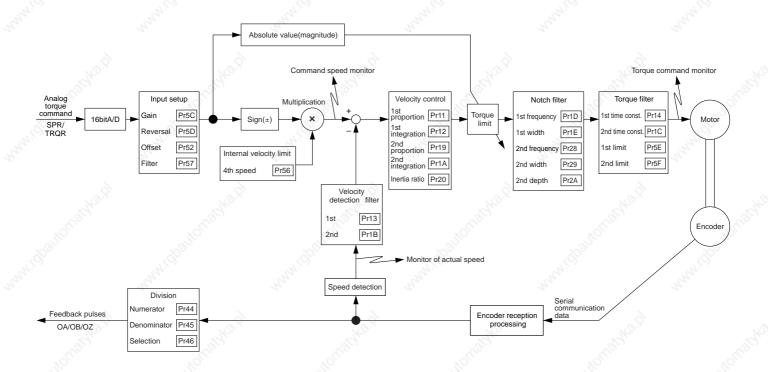
• For parameters which No. have a suffix of "\*", changed contents will be validated when you turn on the control power.



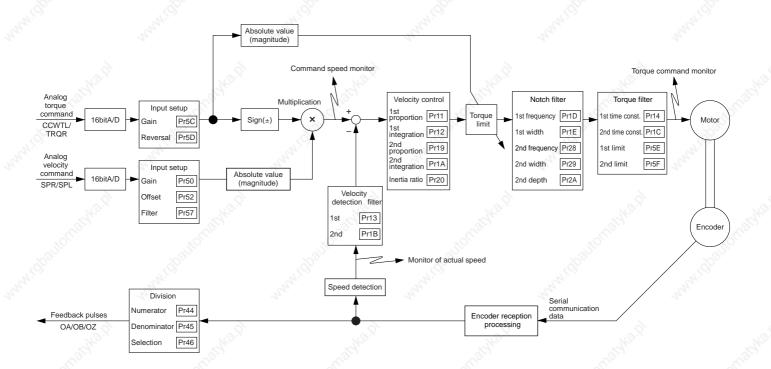
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# **Control Block Diagram of Torque Control Mode**

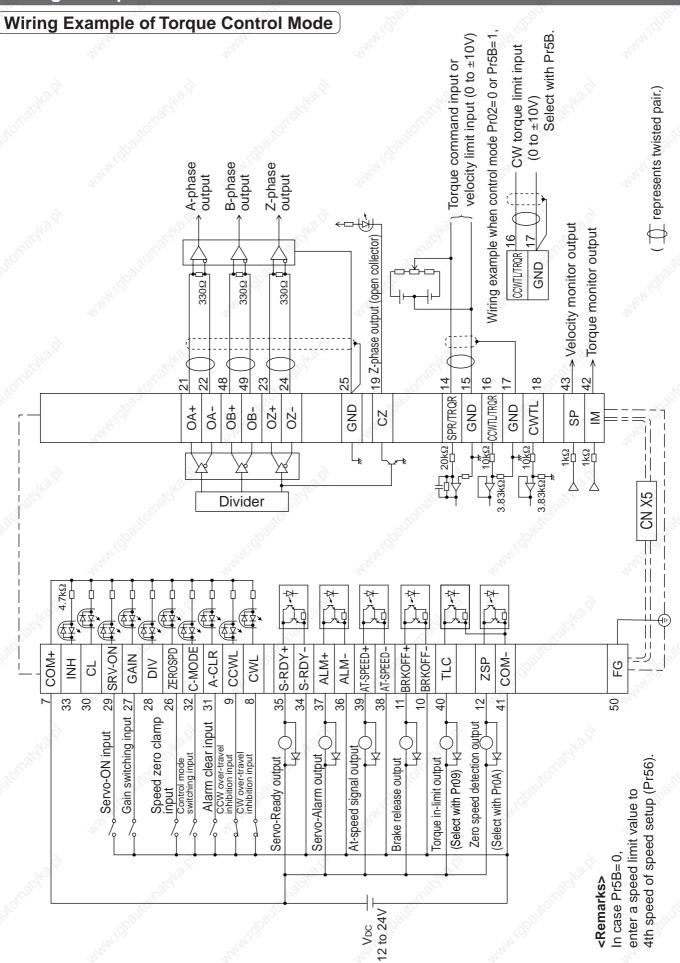
• when Pr5B (Torque command selection) is 0



• when Pr5B (Torque command selection) is 1



## Wiring Example to the Connector CN X5



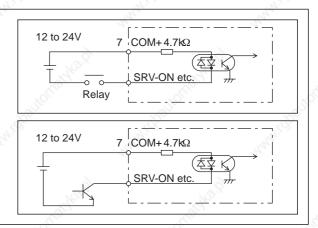
# Wiring to the connector, CN X5

## **Interface Circuit**

## **Input Circuit**

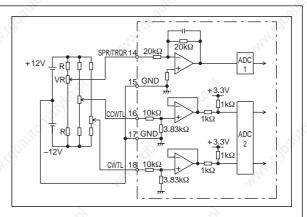
#### SI Connection to sequence input signals

- 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 to 24V) as 11.4V or more in order to secure the primary current for photo-couplers.



## Al Analog command input

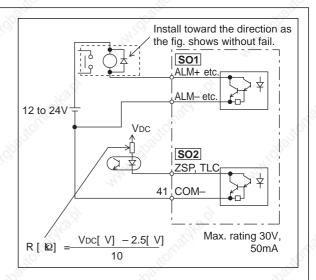
- The analog command input goes through 3 routes, SPR/TRQR(Pin-14), CCWTL (Pin-16) and CWTL (Pin-18).
- Max. permissible input voltage to each input is ±10V.
   For input impedance of each input, refer to the right Fig.
- When you compose a simple command circuit using variable resistor(VR) and register R, connect as the right Fig. shows. When the variable range of each input is made as -10V to +10V, use VR with  $2k\Omega$ , B-characteristics, 1/2W or larger, R with  $200\Omega$ , 1/2W or larger.
- A/D converter resolution of each command input is as follows.
   (1)ADC1: 16 bit (SPR/TRQR), (including 1bit for sign), ±10V
   (2)ADC2: 10 bit (CCWTL, CWTL), 0 to 3.3V



## **Output Circuit**

## SO1 SO2 Sequence output circuit

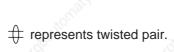
- The output circuit is composed of open collector transistor outputs in the Darlington connection, and connect to relays or photo-couplers.
- There exists collector to emitter voltage, VcE (SAT) of approx.
   1V at transistor-ON, due to the Darlington connection of the output or. Note that normal TTL IC cannot be directly connected since it does not meet VIL.
- There are two types of output, one which emitter side of the output transistor is independent and is connectable individually, and the one which is common to – side of the control power supply (COM–).
- If a recommended primary current value of the photo-coupler is 10mA, decide the resistor value using the formula of the right Fig.

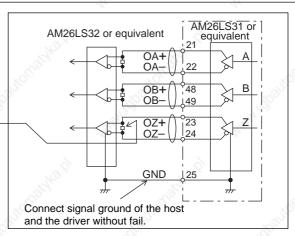


For the recommended primary current value, refer to the data sheet of apparatus or photo-coupler to be used.

## 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.  $330\Omega$ ) between line receiver inputs without fail.
- · These outputs are not insulated.

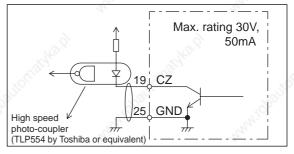




## PO2 Open collector output

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



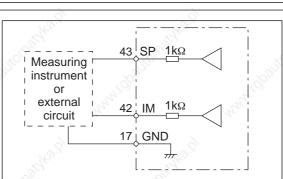


## AO Analog monitor output

- There are two outputs, the speed monitor signal output (SP) and the torque monitor signal output (IM)
- Output signal width is ±10V.
- The output impedance is  $1k\Omega$ . 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 6V/3000r/min (Pr07=3), the resolution converted to speed is 8r/min/16mV.
- (2) Torque monitor output (IM) With a relation of 3V/rated torque (100%), the resolution converted to torque is 0.4%/12mV.



# Wiring to the connector, CN X5

# Input Signal and Pin No. of the Connector, CN X5

## Input Signals (common) and Their Functions

Title of signal	Pin No.	Symbol	26,				Funct	ion		I/F circu
Power supply for control signal (+)	7	COM+		<ul> <li>Connect + of the external DC power supply (12 to 24V).</li> <li>Use the power supply voltage of 12V ± 5% – 24V ± 5%</li> </ul>						
Power supply for control signal (-)	41	COM-	• The p	<ul> <li>Connect – of the external DC power supply (12 to 24V).</li> <li>The power capacity varies depending on a composition of I/O circuit. 0.5A or more is recommended.</li> </ul>						
CW over-travel inhibit input	8	CWL	<ul><li>Conn movin</li><li>CWL inhibit</li><li>You c of up</li></ul>	<ul> <li>Use this input to inhibit a CW over-travel (CWL).</li> <li>Connect this so as to make the connection to COM- open when the moving portion of the machine over-travels the movable range toward CW.</li> <li>CWL input will be invalidated when you set up Pr04 (Setup of over-travel inhibit input) to 1.Default is "Invalid (1)".</li> <li>You can select the action when the CWL input is validated with the setup of up Pr66 (Sequence at over-travel inhibit). Default is "Emergency stop with dynamic brake".(Pr66=0)</li> </ul>						
CCW over-travel inhibit input	9	CCWL	Use the Conner portion     CWL inhibit     You confort Pro	nis inpuect this of the input vinput) an sele	at to inhib so as to machine will be inv to 1.Defa	it a CCV make the cover-transition ralidated ault is "In tion wheat tover-transition	V over-transe connectates the investment of the investment of the contract of	movable rar u set up P WL input is	).  1- open when the moving toward CCW.  1- open when the moving toward CCW.  1- open was compared to the setup of the setup of the setup of the setup with	
Speed zero clamp	26	ZEROSPD	• Functi	on var	ies deper	nding on	the contr	ol mode.		SI
input	THIS		124		• Becom	es to a	speed-zei	ro clamp in	out (ZEROSPD).	P.162
	1		272		Pr06	Connection	n to COM-		Content	Tr.
					0	_	-	ZEROS	PD input is invalid.	
		2	Velo	city/	26,	ор	en		d command is 0	
		"The	Tord	que	1	clo		14.	ormal action	
		all are	con	trol	0			70	ommand is to CCW	
		170,			2	op clo				
	265		4	1900					command is to CW. ZERPSPD is invalid.	'90,
. orladiya.gi	are a	-chathail	Posi Full-c con	losed	<ul> <li>Becomes to an input of damping control switching (VS-SEL).</li> <li>While Pr24 (Damping filter switching selection) is 1, the 1st damping filter (Pr2B, Pr2C) will be validated when you open this input, and the 2nd damping filter (Pr2D, Pr2E) will be validated when you connect this input to COM</li> </ul>				Walley.	
Gain switching input	27	GAIN			ries depe ion of tor			tups of Pra	30 (2nd gain setup) and	P.162
or	12/2		Pr03	Pr30	Connectio	n to COM-		C	ontent	True.
Torque limit		TL-SEL		_	ор	en	Velocity lo	oop : PI (Pro	portion/Integration) action	
switching input		9		0	clo	se	Velocity lo	oop : P (Prop	portion) action	
Marie Comment		740.			Thou	wh	en the se	tups of Pr3	31 and Pr36 are 2	]
		Mar,	0-2		ор				Pr10,11,12,13 and 14)	11
		120,		100	clc	se	2nd gain	selection (	Pr18,19,1A,1B and 1C)	
	- 269	0		200	whe	en the se	etups of I	Pr31 and P	r36 are other than 2	1900
	My.		Page 1		invalid				2027	
		13 <sup>40</sup> .9	3	_	• Pr5E open	Setup o	of 1st torq ut, and Pi	5F (Setup	SEL) I be validated when you of 2nd torque limit) will s input to COM	
Will Char.		"Itolion.			of 2nd ga Adjustme		hing func	tion, refer t	o P.243 "Gain Switching	9

Title of signal	Pin No.	Symbol	*040,000	Function	*QL(gr.	I/F circuit			
Servo-ON input	29	SRV-ON			input to COM nection to COM-, and current	SI P.162			
HIOLOGIAN W.	A. Idbaid	oluşiye il	<ul> <li>You can select the dynamic brake action and the deviation counter clearing action at Servo-OFF with Pr69 (Sequence at Servo-OFF).</li> <li>Caution&gt;</li> <li>1.Servo-ON input becomes valid approx. 2 sec after power-on. (see P.42, "Timing Chart" of Preparation.)</li> <li>2.Never run/stop the motor with Servo-ON/OFF.</li> <li>3.After shifting to Servo-ON, allow 100ms or longer pause before entering the pulse command.</li> </ul>						
Alarm clear input	31	A-CLR		the alarm status by conne	ecting this to COM- for more	SI			
			• There are some al	nter will be cleared at alarr arms which cannot be rele o P.252, "Protective Func	eased with this input.	P.162			
Control mode switching input	32	C-MODE	You can switch the mode setup) to 3-5		v by setting up Pr02 (Control	SI P.162			
	45		Pr02 setup	Open (1st)	Connection to COM- (2nd)	W.C.			
			3	Position control	Velocity control	200			
			4	Position control	Torque control				
			5	Velocity control	Torque control				
NI Chia Like		omatyko			each control mode, the action trol mode with C-MODE. Pay	, (d)Oalde			

# Wiring to the connector, CN X5

## Input Signals (Analog Command) and Their Functions

Title of signal	Pin No.	Symbol	,	900		Function	, (d)0°	I/F circui
Torque command	14	TRQR	• Funct	ion varies dep	ending o	on control mode.	Colonia.	AI
input,			Pr02	Control mode		Function	1	P.162
or Speed limit input		SPL		16		tion varies depending of command)	on Pr5B (Selection of	
				aller,	Pr5B	Cont	ent	
	H. C.		2 4	Torque control	0 📣	Torque command (TF selected.  Set up the torque (TF polarity offset and filte Pr5C (Torque comm Pr5D (Torque comm	RQR) gain, er with; land input gain)	MANIEL STEEL
			_	Position/ Torque	€	Pr52 (Speed comma Pr57 (Speed comma		
	HH.IOS		mai	Postor,	1	Speed limit (SPL) wil     Set up the speed limit offset and filter with;     Pr50 (Speed common Pr52 (Speed common Pr57 (S	t (SPL) gain, and input gain) and offset)	WANTER STATE
				Maidke		tion varies depending of command)	on Pr5B (Selection of	
				walto.	Pr5B	Cont	ent	
	77.00		3,5	20.	0	This input becomes in		11/0/0
	W.		5	Velocity/ Torque	1	<ul> <li>Speed limit (SPL) wil</li> <li>Set up the speed lin and filter with;</li> <li>Pr50 (Speed commander</li> <li>Pr52 (Speed commander</li> <li>Pr57 (Speed commander</li> </ul>	nit (SPL) gain, offset and input gain) and offset)	and a
	41.00		Others	Other control mode	• This in	nput is invalid.	"I'I'P <sub>00</sub>	41.000
<u> </u>	74	, ĝ	(includ	ing 1 bit for si	gn).	nverter used in this inpu	t is 16 bit	n,

<sup>\*</sup>Function becomes valid when the control mode with underline ( \_\_\_\_\_ / \_\_\_\_ ) is selected while the switching mode is used in the control mode in table.

Title of signal	Pin No.	. Symbol		"Ollige"		Function	"OUSE,	I/F circuit
Torque command	16	TRQR	• Funct	ion varies dep	ending	on Pr02 (Control mode setup)	).	AI
input	450		Pr02	Control mode	_ 3	Function		P.162
	2		E.			tion varies depending on Pr e command)	5B (Selection of	Z.
18. P		12.00		19.0	Pr5B	5.1762	1.35	
		"The		201	0	This input becomes invalid.	THE STATE OF THE S	
storie se			2 4	Torque Control Position/Torque	11	Torque command input (selected.  Set up the gain and polar mand with; Pr5C (Torque command in Pr5D (T	input gain) input reversal)	and displaying
alionable.	Walighan	OUSTIN	5	Velocity/ Torque	• Set up Pr5C Pr5D	mes to the torque command in p the gain and polarity of the command input gain (Torque command input revolution) (Torque command input revolution) (Torque command input revolution)	command with; in)	entiglisation
utonatiyka.d		Ornatyka pl	4 5 Other	Position/Torque Velocity/Torque Other	(CCW • Limit (0 to +	mes to the analog torque lin /TL). the CCW-torque by applying +10V) (Approx.+3V/rated tor date this input by setting up F tion) to other than 0.	g positive voltage rque)	
No.	RAILED"		(includ	ding 1 bit for si	ign).	used in this input is 16 bit [ LSB]23[ mV]	3	and tops

<sup>\*</sup>Function becomes valid when the control mode with underline ( \_\_\_\_\_ / \_\_\_\_ is selected while the switching mode is used in the control mode in table.

#### <Remark>

Do not apply more than  $\pm 10V$  to analog command inputs of SPR/TRQR/SPL Do not apply more than  $\pm 10V$  to analog command input of TRQR.

# Wiring to the connector, CN X5

# Output signal and Pin No. of the Connector, CN X5

## Output Signals (Common) and Their Functions

Title of signal	Pin No	Symbol	Tru,	Function	I/F circuit				
External brake release signal	11 10	BRKOFF+ BRKOFF-	Turns the magnetic bra     You can se mechanical	<ul> <li>Feeds out the timing signal which activates the electromagnetic brake of the motor.</li> <li>Turns the output transistor ON at the release timing of the electromagnetic brake.</li> <li>You can set up the output timing of this signal with Pr6A (Setup of mechanical brake action at stall) and Pr6B (Setup of mechanical brake action at motion). For details, refer to P42, "Timing Chart" of Preparation.)</li> </ul>					
Servo-Ready output	35 34	S-RDY+ S-RDY-	Output trans	<ul> <li>This signal shows that the driver is ready to be activated.</li> <li>Output transistor turns ON when both control and main power are ON but not at alarm status.</li> </ul>					
Servo-Alarm output	37 36	ALM+ ALM-	Output trans	<ul> <li>This signal shows that the driver is in alarm status</li> <li>Output transistor turns ON when the driver is at normal status, and turns OFF at alarm status.</li> </ul>					
Speed arrival	39	AT-SPEED+	Function var	ries depending on the control mode.	SO1				
output	38	AT-SPEED-	Position control	Output of positioning complete (COIN)     The output transistor will turn ON when the absolute value of the position deviation pulse becomes smaller than the setup value of Pr60 (Positioning complete range).     You can select the feeding out method with Pr63 (Setup of positioning complete output).	P.163				
	v www.tdf	EIT <sub>OLIC</sub>	Full-closed control	Output of full-closed positioning complete (EX-COIN) The output transistor will turn ON when the absolute value of full-closed-position deviation pulse becomes smaller than the setup value of Pr60 (Positioning complete range). You can select the feeding out method with Pr63 (Setup of positioning complete output).	WHY I GOLD				
		Matha b	Velocity/ Torque control	Output at-speed (speed arrival) (AT-SPEED)    The output transistor will turn ON when the actual motor speed exceeds the setup value of Pr62 (In-speed).					
Zero-speed detection output signal	12 (41)	ZSP (COM-)	• Default is 1,	<ul> <li>Content of the output signal varies depending on Pr0A (Selection of ZSP output).</li> <li>Default is 1, and feeds out the zero speed detection signal.</li> <li>For details, see the table below, "Selection of TLC,ZSP output".</li> </ul>					
Torque in-limit signal output	40 (41)	TLC (COM-)	• Default is 1,	• Content of the output signal varies depending on Pr09 (Selection of TLC output). • Default is 1, and feeds out the torque in-limit signal. • For details, see the table below, "Selection of TLC,ZSP output".					

## Selection of TCL and ZSP outputs

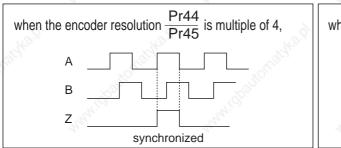
Value of Pr09 or Pr0A	X5 TLC : Output of Pin-40	X5 ZSP : Output of Pin-12
0	<ul> <li>Torque in-limit output (Default of X5 TLC Pr09)</li> <li>The output transistor turns ON when the torque common of the common</li></ul>	nand is limited by the torque limit during Servo-ON.
1	<ul> <li>Zero-speed detection output (Default of X5 ZSP F The output transistor turns ON when the motor speed</li> </ul>	
2	<ul> <li>Alarm signal output         The output transistor turns ON when either one of the battery alarm, fan-lock alarm or external scale alarm.     </li> </ul>	e alarms is triggered, over-regeneration alarm, overload alarm,
3	Over-regeneration alarm     The output transistor turns ON when the regeneration exce	eds 85% of the alarm trigger level of the regenerative load protection.
4	Over-load alarm     The output transistor turns ON when the load exceed	s 85% of the alarm trigger level of the overload alarm.
5	Battery alarm     The output transistor turns ON when the battery volta	ge for absolute encoder falls lower than approx. 3.2V.
6	• Fan-lock alarm The output transistor turns ON when the fan stalls for	" S
7	• External scale alarm  The output transistor turns ON when the external sc (adjustment on mounting is required). Valid only at th	ale temperature exceeds 65°, or signal intensity is not enough e full-closed control.
8	. [4]	etween the actual motor speed and the speed command before age with Pr61. Valid only at the velocity and torque control.

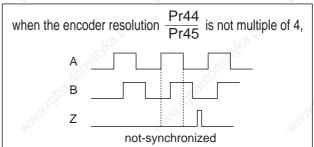
## **Output Signals (Pulse Train) and Their Functions**

Title of signal	Pin No	Symbol	Function	I/F circuit
A-phase output	21	OA +	• Feeds out the divided encoder signal or external scale signal (A, B, Z-phase) in differential. (equivalent to RS422)	PO1 P.163
	22	OA -	<ul> <li>You can set up the division ratio with Pr44 (Numerator of pulse output division) and Pr45 (Denominator of pulse output division)</li> <li>You can select the logic relation between A-phase and B-phase, and the</li> </ul>	
B-phase output	48	OB +	output source with Pr46 (Reversal of pulse output logic).  • When the external scale is made as an output source, you can set up the interval of 7 phase pulse output with Pr47 (Setup of external scale 7 phase).	~ajjo
n'i	49	OB –	<ul> <li>interval of Z-phase pulse output with Pr47 (Setup of external scale Z-phase).</li> <li>Ground for line driver of output circuit is connected to signal ground (GND) and is not insulated.</li> </ul>	KIN!(D)
Z-phase output	23	OZ +	Max. output frequency is 4Mpps (after quadrupled)	
	24	OZ –	THE SHE	. 6
Z-phase output	19	CZ	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.	PO2 P.163

#### <Note>

- When the output source is the encoder
  - If the encoder resolution  $X = \frac{Pr44}{Pr45}$  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.





• In case of the 5-wire, 2500P/r incremental encoder, the signal sequence might not follow the above fig. until the first Z-phase is fed out. When you use the pulse output as the control signal, rotate the motor one revolution or more to make sure that the Z-phase is fed out at least once before using.

# Wiring to the connector, CN X5

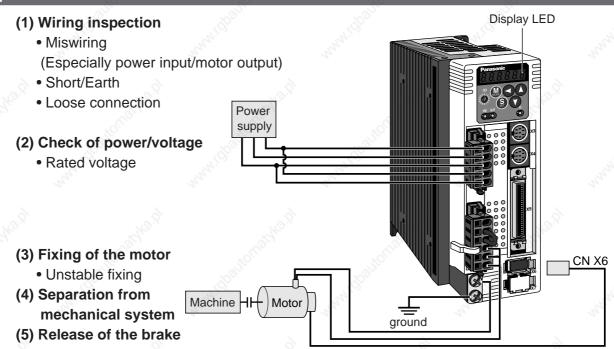
## Output Signals (Analog) and Their Functions

Title of signal	Pin No	Symbol			Function	I/F circui
Torque monitor signal output	42	IM	<ul> <li>The content of output signal varies depending on Pr08 (Torque monitor (IM) selection).</li> <li>You can set up the scaling with Pr08 value.</li> </ul>			
			Pr08	Content of signal	Function	
	.8		0, 11,12	Torque command	Feeds out the voltage in proportion to the motor torque command with polarity.     + : generates CCW torque     - : generates CW torque	(1900)
	T. T.		1 – 5	Positional deviation	Feeds out the voltage in proportion to the positional deviation pulse counts with polarity.     + : positional command to CCW of motor position     - : positional command to CW of motor position	an,
	and de		6 –10	Full-closed deviation	Feeds out the voltage in proportion to the full-closed deviation pulse counts with polarity.     + : positional command to CCW of external scale position     - : positional command to CW of external scale position	arran idiba
Speed monitor signal output	43	SP	(IM) s	election).	output signal varies depending on Pr07 (Speed monitor scaling with Pr07 value.	AO P.163
			Pr07	Control mode	Function	
	and left		0 – 4	Motor speed	Feeds out the voltage in proportion to the motor speed with polarity. + : rotates to CCW     - : rotates to CW	HAH! GO
			5 – 9	Command speed	Feeds out the voltage in proportion to the command speed with polarity.     + : rotates to CCW     - : rotates to CW	

## Output Signals (Others) and Their Functions

Title of signal	Pin No	Symbol	Function	I/F circuit
Signal ground	13,15, 17,25	GND	<ul> <li>Signal ground</li> <li>This output is insulated from the control signal power (COM–) inside of the driver.</li> </ul>	-
Frame ground	50	FG	This output is connected to the earth terminal inside of the driver.	"HHIODO

## **Inspection Before Trial Run**



## **Trial Run by Connecting the Connector, CN X5**

- 1) Connect the CN X5.
- 2) Enter the power (DC12-24V) 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 Pr56 (4th speed of speed setup).
- 6) Energize the motor by connecting the Servo-ON input (SRV-ON, CN X5, Pin-29) and COM- (Pin-41 of CN X5) to turn to Servo-ON status.
- 7) Confirm that the motor runs as per the setup of Pr56 by applying DC voltage (positive/negative) between the torque command input (Pin-14 of CN X5) and GND (Pin-41 of CN X5).
- 8) If you want to change the torque magnitude, direction and velocity limit value against the command voltage, set up the following parameters.

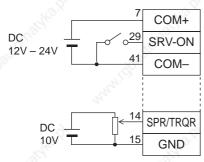
Pr56: 4th speed of speed setup Pr5C: Torque command input gain

Pr5D : Torque command input reversal

Refer to P.183, "Parameter Setup-Parameters for Velocity and Torque Control".

9) If the motor does not run correctly, refer to P.68, "Display of factor for No-motor running" of Preparation.

## Wiring Diagram



In case of one way running

For bi-directional running (CW/CCW), provide a bipolar power supply.

## **Parameter**

PrNo.	Title	Setup value
02	Setup of control mode	2
04	Invalidation of over-travel inhibit input	1 🔊
06	Selection of ZEROSPD	0
56	4th speed of speed setup	lower value
5B	Selection of torque command	0
5C	Torque command input gain	Set up
5D	Torque command input reversal	required

## Input signal status

No.	Title of signal	Monitor display
0	Servo-ON	+ A
5	Speed zero clamp	2/_

# **Real-Time Auto-Gain Tuning**

## **Outline**

The driver estimates the load inertia of the machine in real time, and automatically sets up the optimum gain responding to the result. Also the driver automatically suppress the vibration caused by the resonance with an adaptive filter.

# Position/Velocity command Position/Velocity adjustment actual condition Action command under actual condition Resonance frequency calculation Real-time auto-gain tuning Motor current current Current Filter Motor current Current control Motor current Motor current Motor current Motor current Current control Motor speed Encoder

Auto-filter

## **Applicable Range**

 Real-time auto-gain tuning is applicable to all control modes.

## Caution

Real-time auto-gain tuning may not be executed properly under the conditions described in the right table. In these cases, use the normal mode auto-gain tuning (refer to P.236 of Adjustment), or execute a manual gain tuning. (refer to P.240, of Adjustment)

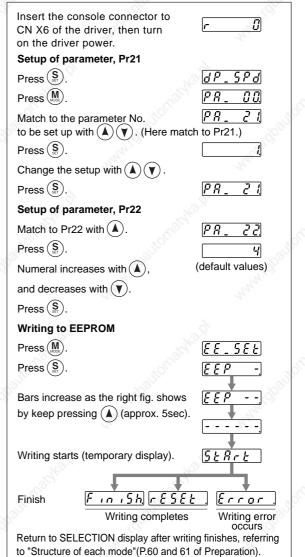
	Conditions which obstruct real-time auto-gain tuning
Laad	Load is too small or large compared to rotor inertia.
Load	(less than 3 times or more than 20 times)
inertia	Load inertia change too quickly. (10 [ s] or less)
- Ø	Machine stiffness is extremely low.
Load	Chattering such as backlash exists.
	Motor is running continuously at low speed of 100 [ r/min] or lower
	Acceleration/deceleration is slow (2000[ r/min] per 1[ s] or low
Action	Acceleration/deceleration torque is smaller than
pattern	unbalanced weighted/viscous friction torque.
-	When speed condition of 100[ r/min] or more and
	acceleration/deceleration condition of 2000[ r/min] per
	1[s] are not maintained for 50[ms].

## **How to Operate**

- (1) Bring the motor to stall (Servo-OFF).
- (2) Set up Pr21 (Real-time auto-gain tuning mode setup) to 1-7. Default is 1.

Setup value	Real-time auto-gain tuning	Varying degree of load inertia in motion
0	(not in use)	-,07
<1>,4,7		no change
2, 5	normal mode	slow change
3, 6		rapid change

- When the varying degree of load inertia is large, set up 3.
- (3) Set up Pr22 (Machine stiffness at real-time auto-gain tuning) to 0 or smaller value.
- (4) Turn to Servo-ON to run the machine normally.
- (5) Gradually increase Pr22 (Machine stiffness at real-time auto-gain tuning) when you want to obtain better response. Lower the value (0 to 3) when you experience abnormal noise or oscillation.
- (6) Write to EEPROM when you want to save the result.



## Parameters Which Are Automatically Set Up.

Following parameters are automatically adjusted. Also following parameters are automatically set up.

PrNo.	Title
11	1st gain of velocity loop
12	1st time constant of velocity loop integration
13	1st filter of velocity detection
14	1st time constant of torque filter
19	2nd gain of velocity loop
1A	2nd time constant of velocity loop integration
1B	2nd filter of speed detection
1C	2nd time constant of torque filter
20	Inertia ratio

PrNo.	Title Title	Setup value
30	2nd gain setup	1
31	1st mode of control switching	0
32	1st delay time of control switching	30
33	1st level of control switching	50
34	1st hysteresis of control switching	33
36	2nd mode of control switching	0 🔊

#### <Notes>

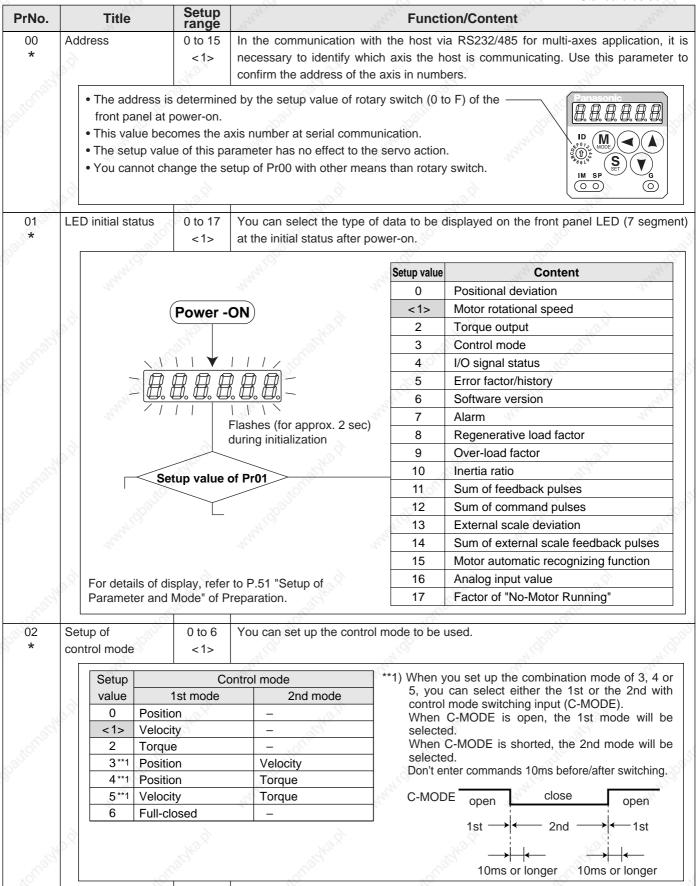
- When the real-time auto-gain tuning is valid, you cannot change parameters which are automatically adjusted.
- Pr31 becomes 10 at position or full closed control and when Pr21 (Setup of Real-Time Auto-Gain Tuning Mode) is 1 to 6, and becomes 0 in other cases.

## **Cautions**

- (1) After the start-up, you may experience abnormal noise and oscillation right after the first Servo-ON, or when you increase the setup of Pr22 (Selection of machine stiffness at real-time auto-gain tuning), until load inertia is identified (estimated) or adaptive filter is stabilized, however, these are not failures as long as they disappear immediately. If they persist over 3 reciprocating operations, take the following measures in possible order.
  - 1) Write the parameters which have given the normal operation into EEPROM.
  - 2) Lower the setup of Pr22 (Selection of machine stiffness at real-time auto-gain tuning).
  - 3) Set up both Pr21 (Setup of real-time auto-gain tuning) and Pr23 (Setup of adaptive filter mode) to 0, then set up other value than 0. (Reset of inertia estimation and adaptive action)
  - 4) Invalidate the adaptive filter by setting up Pr23 (Setup of adaptive filter mode setup) to 0, and set up notch filter manually.
- (2) When abnormal noise and oscillation occur, Pr20 (Inertia ratio) or Pr2F (Adaptive filter frequency) 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, Pr20 (Inertia ratio) and Pr2F (Adaptive filter frequency) will be written to EEPROM every 30 minutes. When you turn on the power again, auto-gain tuning will be executed using the latest data as initial values.
- (4) When you validate the real-time auto-gain tuning, Pr27 (Setup of instantaneous speed observer) will be invalidated automatically.
- (5) The adaptive filter is normally invalidated at torque control, however, when you select torque control while you set up Pr02 (Control mode setup) to 4 and 5, the adaptive filter frequency before mode switching will be held.
- (6) During the trial run and frequency characteristics measurement of "PANATERM®", the load inertia estimation will be invalidated.

## **Parameters for Functional Selection**

Standard default : < >



#### <Notes>

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

PrNo.	Title	Setu	p e	V	Function/Content	
04 *	Setup of over-travel inhibit input	0 to <1:	In linear drive motor to run to of the axis, so	o the direction sp that you can pr	can use this over-travel inhibiting function to inhibit the pecified by limit switches which are installed at both ends event the work load from damaging the machine due to you can set up the action of over-travel inhibit input.	
	S.	itolusiyka b.	un dialional	CW direction	Work CCW direction  Driver  Limit Limit switch switch CCWL  CWL	
	Setup	CCWL/CW	'L	- 20	Action	
	value	input	Input	Connection to COM-	- Action	
	., «	Tho.,	CCWL	Close	Normal status while CCW-side limit switch is not activated.	
		Valid	(CN X5,Pin-9)	Open	Inhibits CCW direction, permits CW direction.	
	0	Valid	CWL	Close	Normal status while CW-side limit switch is not activated.	
			(CN X5,Pin-9)	Open	Inhibits CW direction, CCW direction permitted.	
	<1>	Invalid			vill be ignored, and over-travel inhibit function will be	
	2	Valid	· ·	Err38 (Over-travel inhibit input protection) is triggered when either one of the connection of CW or CCW inhibit input to COM– become open.		
, madko	3 Walterligge		travel inhib 2. When both trips with E 3. When you tion, the w	ition). For details of CCWL and C rr38 (Overtravel turn off the limit sork may repeat this case, set up	to the preset sequence with Pr66 (Sequence at overs, refer to the explanation of Pr66. CWL inputs are opened while Pr04 is set to 0, the driver inhibit input error) judging that this is an error. Switch on upper side of the work at vertical axis applicately/down movement because of the loosing of upward Pr66 to 2, or limit with the host controller instead of us-	
06	Selection of	0 to	2 You can set u	p the function of t	he speed zero clamp input (ZEROSPD : CN X5, Pin-26)	
	ZEROSPD inp	ut <0>	Setup value	(4)	Function of ZEROSPD (Pin-26)	
	nen		<0>, 2	ZEROSPD inpu	ut is ignored and the driver judge that it Is not in mp status.	
	9	Karly	1		ut becomes valid. Speed command is taken as 0 by nnection to COM	
07	Selection of sp	peed 0 to	9 You can set	up the content	of analog speed monitor signal output (SP: CN X5,	
	monitor (SP)	<3>	Pin43) and th	e relation betwee	en the output voltage level and the speed.	
	(1)		Setup value	Signal of SP	Relation between the output voltage level and the speed	
	They.		0	The state of the s	6V / 47 r/min	
	13		1	24	6V / 188 r/min	
			2	Motor actual	6V / 750 r/min	
	8.	13.9	<3>	speed	6V / 3000 r/min	
		200	4	3	1.5V / 3000 r/min	
		.x0f0"	5		6V / 47 r/min	
	~3	2.	6	V	6V / 188 r/min	
	770		7	Command	6V / 750 r/min	
	222		8	speed	6V / 3000 r/min	
	-		9	1	1.5V / 3000 r/min	
			L 3		1.37 / 3000 1/111111	

PrNo.	Title	Setup range	2010		Function/Content	73/10/	
08	Selection of torque	0 to 12	You can set up	p the content of the	analog torque monitor of the	e signal ou	tput (IM : CN X5, Pin-
	monitor (IM)	<0>	42), and the re	elation between the	output voltage level and torq	ue or devi	ation pulse counts.
			Setup value	Signal of IM	Relation between the output voltage	level and torg	ue or deviation pulse counts
	9	6.	<0>	Torque command		(100%) to	· ·
	(p.,	743.	1	"Ag	3V / 31Pc	-	160
		(gr.)	2 (	(g.,	3V / 125F		
	alto.		3	Position	3V / 500F		63
	Sign of the second		4	deviation	3V / 2000	400	190
	The same		5	arth.	3V / 8000	Pulse	The same
	2,		6	24	3V / 31Pi	ulse	10
	2		7	T:://\alaaad	3V / 125F	Pulse	2
	19.5.	12.5.	8	Full-closed	3V / 500F	Pulse	10.3
		ig,	9	deviation	3V / 2000	)Pulse _	3,
	10%	,	10		3V / 8000	Pulse	
	1000		11	Torque	3V / 2009	% torque	2000
	"41'CO		12	command	3V / 4009	% torque	410
09	Selection of	0 to 8	You can assi	ian the function o	f the torque in-limit output	(TLC · CN	V X5 Pin-40)
00	TLC output	<0>				(120.01	
	120 odtpat		Setup value	Table in Cast	Function		Note
	10	"The	<0>	Torque in-limit			For details of
		0	1	Zero speed dete	f either one of Over-rege	norotion	For details of
	- Siller		2		lute battery/Fan lock/Exterr	-/ )	function of each output of the
	(Q)		3		on alarm trigger output	iai scale	left, refer to the
	"ALA".		3 4	Overload alarm			table of P168,
	1,		5	Absolute battery	•		"Selection of
	À		6	Fan lock alarm			TCL and ZSP
	₽×	16.1	7	External scale a			outputs".
	4	Sig.	8		d coincidence) output	~~~	outputs.
30)	30		70,		- 20	30),	
				an the tunetion of	the zero eneed detection (		
0A	Selection of	0 to 8	407		.07	output (28	SP: CN X5 Pin-12).
0A	Selection of ZSP output	<1>	Setup value	1/2	Function	output (28	SP: CN X5 Pin-12).  Note
0A	. 677		Setup value	Torque in-limit	Function output	output (28	Note
0A	. 677		Setup value	Torque in-limit	Function output ection output		Note For details of
0A	. 677		Setup value	Torque in-limit Zero speed dete Alarm output of	Function output ection output f either one of Over-rege	neration	Note For details of function of each
0A	. 677		0 < 1>	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso	Function output ection output f either one of Over-rege lute battery/Fan lock/Extern	neration	Note  For details of function of each output of the
OA	. 677		0 <1> 2	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati	Function output ection output f either one of Over-rege lute battery/Fan lock/Extern on alarm trigger output	neration	For details of function of each output of the left, refer to the
0A	. 677		0 <1> 2 3 4	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati Overload alarm	Function output ection output f either one of Over-rege lute battery/Fan lock/Exterr on alarm trigger output output	neration	For details of function of each output of the left, refer to the table of P.168,
OA	. 677		0 <1> 2 3 4 5	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati Overload alarm Absolute battery	Function output ection output f either one of Over-rege lute battery/Fan lock/Exterr on alarm trigger output output y alarm output	neration	For details of function of each output of the left, refer to the table of P.168, "Selection of
OA	. 677		Setup value  0 <1> 2  3 4 5 6	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati Overload alarm Absolute battery Fan lock alarm	Function output ection output f either one of Over-rege lute battery/Fan lock/Extern on alarm trigger output output / alarm output output	neration	For details of function of each output of the left, refer to the table of P.168, "Selection of TCL and ZSP
OA	. 677		3 4 5 6 7	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati Overload alarm Absolute battery Fan lock alarm External scale a	Function output ection output f either one of Over-rege lute battery/Fan lock/Exterr on alarm trigger output output / alarm output alarm output	neration	For details of function of each output of the left, refer to the table of P.168, "Selection of
pattornate)	ZSP output	<1>	Setup value  0 <1> 2  3 4 5 6 7 8	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati Overload alarm Absolute battery Fan lock alarm External scale a	Function output ection output f either one of Over-rege lute battery/Fan lock/Extern on alarm trigger output output y alarm output output alarm output d coincidence) output	neration nal scale	For details of function of each output of the left, refer to the table of P.168, "Selection of TCL and ZSP
OB N	ZSP output	<1>	Setup value  0 <1> 2  3 4 5 6 7 8	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati Overload alarm Absolute battery Fan lock alarm External scale a	Function output ection output f either one of Over-rege lute battery/Fan lock/Exterr on alarm trigger output output / alarm output alarm output	neration nal scale	For details of function of each output of the left, refer to the table of P.168, "Selection of TCL and ZSP
pattornate)	ZSP output	<1>	Setup value  0 <1> 2  3 4 5 6 7 8	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati Overload alarm Absolute battery Fan lock alarm of External scale at In-speed (Speed	Function output ection output f either one of Over-rege lute battery/Fan lock/Extern on alarm trigger output output y alarm output output alarm output d coincidence) output	neration nal scale	For details of function of each output of the left, refer to the table of P.168, "Selection of TCL and ZSP
OB N	ZSP output	<1>	Setup value  0 <1> 2  3 4 5 6 7 8  You can set	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati Overload alarm Absolute battery Fan lock alarm of External scale at In-speed (Speed	Function output ection output f either one of Over-rege lute battery/Fan lock/Extern on alarm trigger output output y alarm output output alarm output d coincidence) output nod of 17-bit absolute ence	neration nal scale	For details of function of each output of the left, refer to the table of P.168, "Selection of TCL and ZSP
OB N	ZSP output	<1>	Setup value	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati Overload alarm Absolute battery Fan lock alarm External scale a In-speed (Speed	Function output ection output f either one of Over-rege lute battery/Fan lock/Extern on alarm trigger output output y alarm output output alarm output d coincidence) output nod of 17-bit absolute ence	neration nal scale	For details of function of each output of the left, refer to the table of P.168, "Selection of TCL and ZSP
OB N	ZSP output	<1>	Setup value	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati Overload alarm Absolute battery Fan lock alarm External scale a In-speed (Speed up the using meth Use as an abso Use as an incre	Function output ection output f either one of Over-rege lute battery/Fan lock/Exterr on alarm trigger output output y alarm output alarm output d coincidence) output nod of 17-bit absolute ence Content lute encoder.	neration nal scale oder.	For details of function of each output of the left, refer to the table of P.168, "Selection of TCL and ZSP outputs".
OB N	ZSP output	<1>	Setup value	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati Overload alarm Absolute battery Fan lock alarm External scale a In-speed (Speed up the using meth Use as an abso Use as an incre	Function output ection output f either one of Over-rege lute battery/Fan lock/Extern on alarm trigger output output / alarm output d coincidence) output nod of 17-bit absolute ence Content lute encoder. mental encoder.	neration nal scale oder.	For details of function of each output of the left, refer to the table of P.168, "Selection of TCL and ZSP outputs".
OB N	ZSP output	<1>	Setup value	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati Overload alarm Absolute battery Fan lock alarm External scale a In-speed (Speed up the using meth Use as an abso Use as an incre Use as an abso	Function output ection output f either one of Over-rege lute battery/Fan lock/Extern on alarm trigger output output / alarm output d coincidence) output nod of 17-bit absolute ence Content lute encoder. mental encoder.	neration nal scale oder.	For details of function of each output of the left, refer to the table of P.168, "Selection of TCL and ZSP outputs".
OB N	ZSP output	<1>	Setup value	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati Overload alarm Absolute battery Fan lock alarm External scale a In-speed (Speed up the using meth Use as an abso Use as an incre Use as an abso der will be invalida	Function output ection output f either one of Over-rege lute battery/Fan lock/Extern on alarm trigger output output / alarm output d coincidence) output nod of 17-bit absolute enco Content lute encoder. mental encoder. lute encoder, but ignore the	neration nal scale oder. ne multi-tu	For details of function of each output of the left, refer to the table of P.168, "Selection of TCL and ZSP outputs".
OB *	Setup of absolute encoder	0 to 2 <1>	Setup value  0 <1> 2  3 4 5 6 7 8  You can set  Setup value 0 <1> 2 <caution> This paramet You can set</caution>	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati Overload alarm Absolute battery Fan lock alarm External scale a In-speed (Speed up the using meth Use as an abso Use as an incre Use as an abso er will be invalida up the communic	Function output ection output f either one of Over-rege lute battery/Fan lock/Exterr on alarm trigger output output / alarm output d coincidence) output hod of 17-bit absolute ence Content lute encoder. mental encoder. lute encoder, but ignore the ted when 5-wire, 2500P/r is ation speed of RS232.	neration nal scale  oder.  ne multi-tu ncrementa	For details of function of each output of the left, refer to the table of P.168, "Selection of TCL and ZSP outputs".
0B *	Setup of absolute encoder	0 to 2 <1>	Setup value  0 <1> 2  3 4 5 6 7 8  You can set  Setup value  0 <1> 2 <caution> This paramet You can set  Setup value  You can set</caution>	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati Overload alarm Absolute battery Fan lock alarm External scale a In-speed (Speed up the using meth Use as an abso Use as an incre Use as an abso er will be invalida up the communic	Function output ection output f either one of Over-rege lute battery/Fan lock/Extern on alarm trigger output output / alarm output d coincidence) output hod of 17-bit absolute enco Content lute encoder. mental encoder. lute encoder, but ignore the ted when 5-wire, 2500P/r i ation speed of RS232.	neration nal scale oder. ne multi-tu ncrementa	For details of function of each output of the left, refer to the table of P.168, "Selection of TCL and ZSP outputs".
0B *	Setup of absolute encoder  Baud rate setup of RS232	0 to 2 <1>	Setup value  0 <1> 2  3 4 5 6 7 8  You can set  Setup value 0 <1> 2 <caution> This paramet You can set</caution>	Torque in-limit Zero speed dete Alarm output of /Over-load/Abso Over-regenerati Overload alarm Absolute battery Fan lock alarm External scale a In-speed (Speed up the using meth Use as an abso Use as an incre Use as an abso er will be invalida up the communic	Function output ection output f either one of Over-rege lute battery/Fan lock/Exterr on alarm trigger output output y alarm output d coincidence) output hod of 17-bit absolute enco Content lute encoder. mental encoder. lute encoder, but ignore the ted when 5-wire, 2500P/r is ation speed of RS232.  Setup value as Setup value 3	neration nal scale oder. ne multi-tu ncrementa • Error of	For details of function of each output of the left, refer to the table of P.168, "Selection of TCL and ZSP outputs".

Standard default : < >

PrNo.	Title	Setup range	Function/Content						
0D *	Baud rate setup of	0 to 5	You can set up the communication speed of RS485. • Error of baud rate is $\pm 0.5\%$ .						
^	RS485	<2>	Setup value Baud rate Setu		Setup valu	value Baud rate			
	communication	140.j	0	0 2400bps			19200bps		
			1 4800bps		4		38400bps		
19/10			<2>	9600bps	5	57600bps			
0E *	Setup of front panel lock	0 to 1 <0>	You can limit the monitor mode on	operation of the front pa	inel to the	Setup value	Content Valid to all		
,	The State of the S		You can prevent such a misoperation as unexpected parameter change. <note> You can still change parameters via communication even though this setup is 1.  To return this parameter to 0, use the console or the "PANATERM®".</note>						
160	<u>}</u>	16. j							

## Parameters for Adjustment of Time Constants of Gains and Filters

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content
11	1st gain of velocity loop	1 to 3500 A to C-frame:<35>* D to F-frame:<18>*	Hz	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 Pr20 is set correctly, the setup unit of Pr11 becomes (Hz).</caution>
12	1st time constant of velocity loop integration	1 to 1000 A to C-frame:<16>* D to F-frame:<31>*	ms	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 "999".  The integration effect will be lost by setting to "1000".
13	1st filter of speed detection	0 to 5 <0>*	unuighaus	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.
14	1st time constant of torque filter	O to 2500 A to C-frame:<65>* D to F-frame:<126>*	0.01ms	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.
19	2nd gain of velocity loop	1 to 3500 A to C-frame:<35>* D to F-frame:<18>*	Hz	Position loop, velocity loop, speed detection filter and torque command filter have their 2 pairs of gain or time constant (1st and 2nd).  For details of switching the 1st and the 2nd gain or the time constant, refer
1A	2nd time constant of velocity loop integration	1 to 1000 <1000>*	ms	to P.226, "Adjustment".  The function and the content of each parameter is as same as that of the
1B	2nd filter of velocity detection	0 to 5 <0>*	-	1st gain and time constant.
1C	2nd time constant of torque filter	O to 2500 A to C-frame:<65>* D to F-frame:<126>*	0.01ms	Related Parisonal Parison Parisonal
1D	1st notch frequency	100 to 1500 <1500>	Hz	You can set up the frequency of the 1st resonance suppressing notch filter. The notch filter function will be invalidated by setting up this parameter to "1500".

#### <Notes>

- For parameters which No. have a suffix of "\*", changed contents will be validated when you turn on the control power.
- Parameters which default values have a suffix of "\*" will be automatically set up during real time auto-gain tuning. When you change manually, invalidate the real-time auto-gain tuning first then set, referring to P.239, "Release of Automatic Gain Adjusting Function" of Adjustment.

#### Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content
1E	1st notch width	0 to 4	-2'(O).	You can set up the notch filter width of the 1st resonance suppressing filter in 5 steps.
	selection	<2>	The state of	Higher the setup, larger the notch width you can obtain.
				Use with default setup in normal operation.

# Parameters for Auto-Gain Tuning

PrNo.	Title	Setup range	Unit	Function/Content				
20	Inertia ratio	0 to 10000	-7.	You can set up the ratio of the load inertia against the rotor (of the motor) inertia.				
		<250>*		Pr20= (load inertia/rotor inertia) X 100 [ %]				
	tough of municipalitor as he is			When you execute the normal auto-gain tuning, the load inertial will be automatically estimated after the preset action, and this result will be reflected in this parameter.  The inertia ratio will be estimated at all time while the real-time auto-gain tuning is valid, and its result will be saved to EEPROM every 30 min. <b>Caution&gt;</b> If the inertia ratio is correctly set, the setup unit of Pr11 and Pr19 becomes (Hz). When the inertia ratio of Pr20 is larger than the actual, the setup unit of the velocity loop gain becomes larger, and when the inertia ratio of Pr20 is smaller than the actual, the setup unit of the velocity loop gain becomes smaller.				
21 Setup of real-time auto-gain tuning		0 to 7 <1>		With higher setup	operation, however it mig	time auto-gain tuning. spond quickly to the change on the cause an unstable operation		
	Way.		ne ne	Setup value	Real-time auto-gain tuning	Varying degree of load inertia in motion		
	2	2		0	Invalid	28		
		Sight.		<1>, 4, 7	20/20	Little change		
	- 5				2, 5	Normal mode	Gradual change	
	~BIJE			3, 6		Rapid change		
22	Selection of machine stiffness	0 to 15 A to C-frame:	Mr. C.	You can set up the gain tuning is vali		steps while the real-time auto		
	at real-time auto-gain tuning	<4> D to F-frame:			low ← machine stiffi low ← servo gai	in → high		
		<1>		197	000	14, 15		
	-05	O.		1000 m	low ← response	e → high		
Sign.	www.idpanie			well, and this m		, the gain changes rapidly a machine. Increase the setu		

Standard default: < >

PrNo.	Title	Setup range	Unit	3.	Function/Content		
25	Setup of an action	0 to 7	"7'D.	You can set up the action pattern at the normal mode auto-gain tuning.			
	at normal mode	<0>		Setup value	Number of revolution	Rotational direction	
	auto-gain tuning			<0>		CCW → CW	
		9		1	2 [ royolution]	CW → CCW	
	,	Aro.		2	2 [ revolution]	CCW → CCW	
	AL.			3	West,	CM → CM	
	allie.		270	4	1 [ revolution]	CCW → CW	
	WHINI GO			5		CW → CCW	
				6		CCW → CCW	
				7		CW → CW	
	§)			e.g.) When the setup is 0, the motor turns 2 revolutions to CCW and 2 revolutions to CW.			
28	2nd notch frequency	100 to 1500 <1500>	Hz	You can set up the 2nd notch width of the resonance suppressing filter i 5 steps. The notch filter function is invalidated by setting up this parameter to "1500".			
29	Selection of 2nd notch width	0 to 4 <2>	The state of the s	You can set up the notch width of 2nd resonance suppressing filter in 5 steps. Higher the setup, larger the notch width you can obtain.  Use with default setup in normal operation.			
2A	Selection of 2nd notch depth	0 to 99 <0>	_	You can set up the 2nd notch depth of the resonance suppressing filter. Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.			

## Parameters for Adjustment (2nd Gain Switching Function)

Standard default : < >

PrNo.	Title	Setup range	Unit	May,	Function/Content			
30	Setup of 2nd gain	0 to 1	_	You can select the PI/P action switching of the		f the velocity control or 1st/2nd gain switching.		
No	×	<1>*		Setup value Gain selection/switching				
Nago.	8	90		0	0 1st gain (PI/P switching enabled) *1			
Tio,	"IIIO"		.31	<1>* 1st/2nd gain switching enabled *2				
50	.ww.Hidp.o		Thuy igho	*1 Switch the PI/P action with the gain switching input (GAIN CN X5, Pin 27). PI is fixed when Pr03 (Torque limit selection) is 3.				
	1,	,	1.	GAI	N input	Action of velocity loop		
				Open v	vith COM-	PI action		
No	X	Ka.x		Connec	t to COM-	P action		
Witchigh,	- Millor	9.,	-217		condition of the 1 ction" of Adjustment	st and the 2nd, refer to P.243, "Gain nt.		
31	1st mode of control switching	0 to 10 <0>*	Harris (S)	You can select the is set to 1.	e switching conditi	ion of 1st gain and 2nd gain while Pr30		
	Setup value	Gain switching condition						
	<0>*, 4to 10	Fixed to the 1st gain.						
120	1	Fixed to the 2nd gain.						
VIII.	2 *1	2nd gain selection when the gain switching input is turned on. (Pr30 setup must be 1.)						
Salton .	3 *2	2nd gain selection when the toque command variation is larger than the setups of Pr33 (1st level of control switching) and Pr34 (1st hysteresis of control switching).						
	Wallet I		True Co	and Pr03 (Tor	que limit selection) ing level and the t	of GAIN input, when Pr31 is set to 2 is set to 3. iming, refer to P.243, "Gain Switching		

#### <Notes>

• Parameters which default values have a suffix of "\*" will be automatically set up during real time auto-gain tuning. When you change manually, invalidate the real-time auto-gain tuning first then set, referring to P.239, "Release of Automatic Gain Adjusting Function" of Adjustment.

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content
32	1st delay time of control switching	0 to 10000 <30>*	x 166μs	You can set up the delay time when returning from the 2nd to the 1st gain, while Pr31 is set to 3.
33	1st level of control switching	0 to 20000 <50>*	_	You can set up the switching (judging) level of the 1st and the 2nd gains, while Pr31 is set to 3.  Unit varies depending on the setup of Pr31 (1st mode of control switching)
34	1st hysteresis of control switching	0 to 20000 <33>*	HANHIII DO	You can set up hysteresis width to be implemented above/below the judging level which is set up with Pr33. Unit varies depending on the setup of Pr31 (1st control switching mode). Definitions of Pr32 (Delay), Pr33 (Level) and Pr34 (Hysteresis) are explained in the fig. below.
Paritotic	""(d)aitof		7/900	<a href="https://www.negative/negative"></a> (Aution> The setup of Pr33 (Level) and Pr34 (Hysteresis) are valid as absolute values (positive/negative).
35	Switching time of position gain	0 to 10000 <20>*	(setup value +1) x 166μs	You can setup the step-by-step switching time to the position loop gain only at gain switching while the 1st and the 2nd gain $Kp2(Pr18)$ $E.g.$ $F.g.$ $F.$
	White I floor	8	MAHIGO	switching is valid.  1st gain 2nd gain 1st gain  Caution> The switching time is only valid when switching from small position gain to large position gain.
37	2nd delay time of control switching	0 to 10000 <0>	x 166μs	You can set up the delay time when returning from 2nd to 1st gain, while Pr36 is set to 3 to 5.
38	2nd level of control switching	0 to 20000 <0>	MAN I GO	You can set up the switching (judging) level of the 1st and the 2nd gains, while Pr36 is set to 3 to 5 Unit varies depending on the setup of Pr36 (2nd mode of control switching).
39	2nd hysteresis of control switching	0 to 20000 <0>	Mary 1920	You can set up the hysteresis width to be implemented above/below the judging level which is set up with Pr38.  Unit varies depending on the setup of Pr36 (2nd mode of control switching). Definition of Pr37 (Delay), Pr38 (Level) and Pr39 (Hysteresis) are explained in the fig. below. <a href="#">Caution&gt;</a> Setup of Pr38 (Level) and Pr39 (Hysteresis) are valid as absolute value (positive/negative).
3D	JOG speed setup	0 to 500	r/min	You can setup the JOG speed.  Refer to P.75. "Trial Run" of Preparation.

### [Connection and Setup of Torque Control Mode]

### **Parameters for Position Control**

Standard default : < >

PrNo.	Title	Setup range	Function/Content	4.
44 *	Numerator of pulse output division	1 to 32767 <2500>	You can set up the pulse counts to be fed out from the pulse output (X5 0A 21, 0A-: Pin-22, 0B+: Pin-48, 0B-: Pin-49).	\+ : Pin-
	ouput umoion	12000	Pr45=<0> (Default)     You can set up the output pulse counts per one motor revolution for each and OB with the Pr44 setup. Therefore the pulse output resolution quadruple can be obtained from the formula below.	
	Nath Co.		The pulse output resolution per one revolution = Pr44 (Numerator of pulse output division) X4	410
			<ul> <li>• Pr45≠0 :         The pulse output resolution per one revolution can be divided by an according to the formula below.     </li> </ul>	y ration
	, www.idbaltomai		Pulse output resolution per one revolution  Pr44 (Numerator of pulse output division)  Pr45 (Denominator of pulse output division)  Cautions>  The encoder resolution is 131072 [ P/r] for the 17-bit absolute enc 10000 [ P/r] for the 5-wire 2500P/r incremental encoder.	oder, ar
45 *	Denominator of pulse output division	0 to 32767 <0>	<ul> <li>The pulse output resolution per one revolution cannot be greater the encoder resolution.</li> <li>(In the above setup, the pulse output resolution equals to the encoder resequence)</li> <li>Z-phase is fed out once per one revolution of the motor.</li> <li>When the pulse output resolution obtained from the above formula is multiput.</li> </ul>	olution.)
	HHHIIII		Z-phase synchronizes with A-phase. In other case, the Z-phase width electron output with the encoder resolution, and becomes narrower than A-phase does not synchronize with A-phase.	
	, idhalloma	*O.O.	when encoder resolution x $\frac{Pr44}{Pr45}$ is multiple of 4 when encoder resolution x $\frac{Pr44}{Pr45}$ is not multiple of 4 B B Z	Itiple of 4
	Way.	,	Z Z Synchronized Z Not-synchronized	<i>I</i> <sub>4</sub> .

### <Notes>

- For parameters which No. have a suffix of "\*", changed contents will be validated when you turn on the control power.
- Parameters which default values have a suffix of "\*" will be automatically set up during real time auto-gain tuning. When you change manually, invalidate the real-time auto-gain tuning first then set, referring to P.239, "Release of Automatic Gain Adjusting Function" of Adjustment.

Standard default : < >

PrNo.	Title	Setup range	10 10 10 10 10 10 10 10 10 10 10 10 10 1	Function/Content							
46	Reversal of pulse	0 to 3	You can set	up the B-pha	se logic and the output s	source of the pulse output (X5 OB+					
*	output logic	<0>	: Pin-48, O	B–:Pin-49).	With this parameter, ye	ou can reverse the phase relation					
			between the	A-phase puls	se and the B-phase pulse	e by reversing the B-phase logic.					
	Ŝ	9	Sotup	A-phase	at motor CCW rotation	on at motor CW rotation					
Total .	· .	ich,	Setup value	A-phase (OA)							
Postic.	' (q)qqqq		<0>, 2	B-phase(OB) non-reversal							
	My.		1, 3	B-phase(OB) reversal							
	9	6	Pr46	→ B-	phase logic	Output source					
1/2	D	Tho.	<0>	N N	on-reversal	Encoder position					
all st.	25	S.,	1		Reversal	Encoder position					
Wille.	Mic.		2 *1	N	on-reversal	External scale position					
800	. B		3 *1		Reversal	External scale position					
	Thing.		*1 The outp	out source of F	Pr46=2, 3 is valid only at	full-closed control.					

### <Notes>

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

# [Connection and Setup of Torque Control Mode]

# Parameters for Velocity and Torque Control

Standard default : < >

PrNo.	Title	Setup range	Unit	il in the second	Function/Cont	tent
50	Input gain of speed command	10 to 2000 <500>	(r/min)/V	· ·	the relation between the (SPR : CN X5, Pin-14) and	voltage applied to the speed the motor speed.
NTO LIGHT	ann an	<i>y</i> .		between the and the moto • Default is set hence input of <b>Cautions&gt;</b> 1. Do not app speed comm	up a "slope" of the relation command input voltage or speed, with Pr50. to Pr50=500 [ r/min] , of 6V becomes 3000r/min.  Ily more than ±10V to the mand input (SPR). compose a position loop	Speed (r/min) 3000 Slope at ex-factory -10 Command input voltage (V)
<u> Litoftable</u>	.ww.idbaltcfr.a			outside of the driver in versetup of Pr5 the overall s	the driver while you use the elocity control mode, the so gives larger variance to ervo system.	cw sed by larger setup of Pr50.
52	Speed command offset	-2047 to 2047 <0>	0.3mV	CN X5, Pin-14 • The offset volu	) with this parameter. Ime is 0.3mV per setup valu	nalog speed command (SPR le of "1". adjustment and (2) Automati
2014 S	s whiteliggs	H. C.		Enter 0 V connect to the motor • when you	n make an offset adjustment exactly to the speed common the signal ground), then so may not turn. compose a position loop wit	mand input (SPR/TRQR), (or et this parameter up so that
	Wald if the life of the life o			2) Automatic a • For the de mode, refe • Result aft	etails of operation method after to P.73, "Auxiliary Function	t automatic offset adjustment on Mode" of Preparation. omatic offset function will be
56	4th speed of speed setup	-20000 to 20000 <0>	r/min	<caution></caution>		of [r/min].
57	Setup of speed command filter	0 to 6400 <0>	10μs			imary delay filter to the analog analog velocity control (SPR
5B	Selection of	0 to 1	_	You can select	the input of the torque comm	nand and the speed limit.
The	torque command	<0>		Pr5B	Torque command	Velocity limit
Marie	-Co	, D		<0>	SPR/TRQR/SPL	Pr56
770.	"Zio,			1 1	CCWTL/TRQR	SPR/TRQR/SPL

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content
5C	Input gain of torque command	10 to 100 <30>	0.1V/ 100%	You can set the relation between the voltage applied to the torque command input (SPR/TRQR : CN X5, Pin-14 or CCWTL/TRQR : CN X5, Pin-16) and the motor output torque.
go <sub>lit</sub> omati <sup>i</sup>	a di www.ldtailoí	Salke ()		Unit of the setup value is [ 0.1V/100%] and set up input voltage necessary to produce the rated torque.      Default setup of 30 represents 3V/100%.  Default Rated 200 torque 1000 torque 1000 torque 200 t
5D	Input reversal of torque command	0 to 1 <0>	_	You can reverse the polarity of the torque command input (SPR/TRQR : CN X5, Pin-14 or CCWTL/TRQR : CN X5, Pin-16)
Positio.	Hundi (q)Silto			Setup value   Direction of motor output torque
5E	1st torque limit setup	0 to 500 < 500>	%	You can limit the max torque for both CCW and CW direction with Pr5E. Pr03 setup and Pr5F are ignored.
gaillathath	And High of the state of the st	*2		This torque limit function limits the max. motor torque with the parameter setup.  In normal operation, this driver permits approx. 3 times larger torque than the rated torque instantaneously. If this 3 times bigger torque causes any trouble to the load (machine) strength, you can use this function to limit the max. torque.  • Setup value is to be given in
Pallomari	o di wanilipaito	adko li		% against the rated torque. • Right fig. shows example of 150% setup with Pr03=1. • Pr5E limits the max. torque for both CCW and CW directions.  when Pr5E=150 200 (Rated)  (Rating) (Max.)
Ballonari	o di dipaliof	all cit		<b>Caution&gt;</b> You cannot set up a larger value to this parameter than the default setup value of "Max. output torque setup" of System parameter (which you cannot change through operation with PANATERM® or panel). Default value varies depending on the combination of the motor and the driver. For details, refer to P.57, "Setup of Torque Limit " of Preparation.

### -Notes>

• For parameters which default. has a suffix of "\*2", value varies depending on the combination of the driver and the motor.

# [Connection and Setup of Torque Control Mode]

# Parameters for Sequence

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content
61	Zero-speed	10 to 20000 <50>	r/min	You can set up the timing to feed out the zero-speed detection output signal (ZSP: CN X5, Pin-12 or TCL: CN X5, Pin-40) 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, Pr61.  In-speed (Speed coincidence) signal (V-COIN) will be fed out when the difference between the speed command and the motor speed falls below the setup of this parameter, Pr61.
Tion grays	, R	140.D		The setup of P61 is valid for both CCW and CW direction regardless of the motor rotating direction.     There is hysteresis of 10 [ r/min] . ZSP ON (Pr61-10)r/min
62	At-speed (Speed arrival)	10 to 20000 <50>	r/min	You can set up the timing to feed out the At-speed signal (COIN+ : CN X5, Pin-39, COIN- : CN X5, Pin-38) At-speed (Speed arrival) (COIN) will be fed out when the motor speed exceeds the setup speed of this parameter, Pr62
automatyke	WALTER STOLLING	Kenga.	awat dbaite	The setup of P62 is valid for both CCW and CW direction regardless of the motor rotational direction. There is hysteresis of 10 [ r/min] .  CCW  (Pr62+10)r/min  (Pr62-10)r/min
*Ousight		<sub>1</sub> 40.01	200	AT-SPEED OFF ON
65	LV trip selection at main power OFF	0 to 1 <1>	"Hay i Cour	You can select whether or not to activate Err13 (Main power undervoltage protection) function while the main power shutoff continues for the setup of Pr6D (Main power-OFF detection time).
				Setup value
Maight		At a Cal		When the main power is shut off during Servo-ON, Err13 will not be triggered and the driver turns to Servo-OFF. The driver returns to Servo-ON again after the main power resumption.
ALIE CONTRACTOR	AD BUILD		Abadii	When the main power is shut off during Servo-ON, the driver will trip due to Err13 (Main power low voltage protection).
NOW RIVE	NATURAL DE STEELE SE	**.d	<sup>Int</sup> ults	<b>Caution&gt;</b> This parameter is invalid when Pr6D (Detection time of main power OFF)=1000. Err13 (Main power under-voltage protection) is triggered when setup of P66D is long and P-N voltage of the main converter falls below the specified value before detecting the main power shutoff, regardless of the Pr65 setup. Refer to P.42, "Timing Chart-At Power-ON" of Preparation as well.

Standard default : < >

PrNo.	Title	Setup range	Unit	20,	Funct	tion/Content	78.
66 *	Sequence at over-travel inhibit	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1					
	2			Setup value	During deceleration	After stalling	Deviation counter content
.30	(b.2.	agkari.		<0>	Dynamic brake action	Torque command=0 towards inhibited direction	Hold
10g/Hour	Daliton		30%	) 1	Torque command=0 towards inhibited direction	Torque command=0 towards inhibited direction	Hold
05	Allen IC.		May Co.	2	Emergency stop	Torque command=0 towards inhibited direction	Clears before/ after deceleration
3	90				he setup value of 2 e setup value of Pr6E		deceleration will be mergency stop ).
67	Sequence at main power OFF	0 to 9 <0>	- INTOSE	1) the action 2) the clea	LV trip selection at mon during deceleration ring of deviation cour power is shut off.	n and after stalling	), you can set up,
	Tr.		272,	Setup	Act	ion	Deviation counter
				value	During deceleration	After stalling	content
	S)	2		<0>	DB	DB	Clear
E.	0	"The		31	Free-run	DB	Clear
		(D.,		2	DB	Free-run	Clear
	autio.		ó	3	Free-run	Free-run	Clear
	(9)		(90,	4	DB	DB	Hold
	The state of the s		They want	5	Free-run	DB	Hold
	17		24	6	DB	Free-run	Hold
				7	Free-run	Free-run	Hold
	0,0			8	Emergency stop	DB	Clear
100		de		9	Emergency stop	Free-run	Clear
Palipun	HHHIQDIATOR		"Maj log	<caution> In case of the limited by the</caution>	e setup value of Pr6E	(Torque setup at e	
68	Sequence at alarm	0 to 3 <0>	_				r stalling when some tions of the driver is
18 Jan	2	Sec.		Setup	Act	ion	Deviation counter
TON	100			value	During deceleration	After stalling	content
	"Par		30%	<0>	DB	DB	Hold
	"4'ES		" Wills	1	Free-run	DB	Hold
	Tr.		W.	2	₩ DB	Free-run	Hold
				3	Free-run	Free-run	Hold
Note in	<sup>9</sup> ģ	aidhaid		<caution></caution>	ic Brake action) of the deviation co	unter will be cleare	d when clearing the
Paliton,	"Ipung,		.202	alarm. Refe		hart (When an erro	or (alarm) occurs (at

### <Notes>

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

# [Connection and Setup of Torque Control Mode]

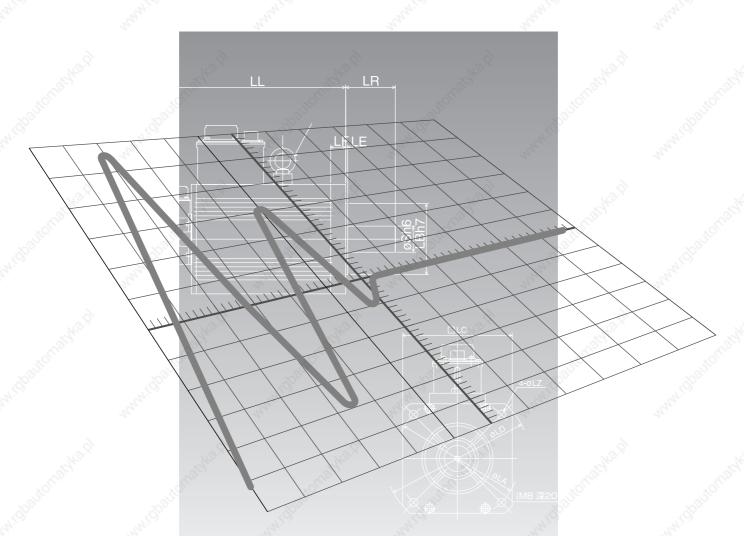
Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content
69	Sequence at Servo-Off	0 to 9 <0>	Regular Control	You can set up, 1) the action during deceleration and after stalling 2) the clearing of deviation counter content, after turning to Servo-OFF (SRV-ON signal: CN X5, Pin-29 is turned from ON to OFF) The relation between the setup value of Pr69 and the action/deviation counter clearance is same as that of Pr67 (Sequence at Main Power Off) Refer to P.44, "Timing Chart"-Servo-ON/OFF action while the motor is at stall" of Preparation as well.
6A	Setup of mechanical brake action at stalling	0 to 100 <0>	2ms	You can set up the time from when the brake release signal (BRK-OFF: CN X5, Pin-10 and 11) 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 Pr6a ≥ tb, then compose the sequence so as the driver turns to Servo-OFF after the brake is actually activated.  BRK-OFF release tb hold actual brake release tb hold release release to hold release rele
"Olligies	<sub>KO</sub> CO	50	28	Refer to P.44, "Timing Chart"-Servo-ON/OFF Action While the Motor Is at Stall" of Preparation as well.
6B	Setup of mechanical brake action at running	0 to 100 <0>	2ms	You can set up time from when detecting the off of Servo-ON input signal (SRV-ON: CN X5, Pin-29) is to when external brake release signal (BRK-OFF: CN X5, Pin-10 and 11) turns off, while the motor turns to servo off during the motor in motion.
SHOWSPA	and the state of t	Kali	RAIN I GOTHE	Set up to prevent the brake deterioration due to the motor running.      At Servo-OFF during the motor is running, the of the right fig. will be a shorter one of either Pr6B setup time, or time lapse till the motor speed falls below 30r/min.  Refer to P.45, "Timing Chart"-Servo-ON/OFF action while the motor is in motion" of Preparation as well.  SRV-ON ON OFF  release hold  actual brake energized non-energized 30 r/min energization  Refer to P.45, "Timing Chart"-Servo-ON/OFF action while the motor is in motion" of Preparation as well.

PrNo.	Title	Setup range	Unit	kg.,	Fur	Standard default : < >
6C *	Selection of external regenerative resistor	0 to 3 for A, B-frame <3>	select either to use the built-in regenerative parate this built-in regenerative resistor and ative resistor (between RB1 and RB2 of a to D-frame, between P and B2 of terminal			
bs.		for		Setup value	Regenerative resistor to be used	Regenerative processing and regenerative resistor overload
Palifoliar	"lighaling	C to F-frame <0>		<0>	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).
	of why.	>		1	External resistor	The driver trips due to regenerative overload protection (Err18), when regenerative processing circuit is activated and its active ratio exceeds 10%,
ALIGNA A	). 	Sighon,		2	External resistor	Regenerative processing circuit is activated, but no regenerative over-load protection is triggered.
Parise.	unwidtaute			<3> (A, B-frame)	No resistor	Both regenerative processing circuit and regenerative protection are not activated, and built-in capacitor handles all regenerative power.
goziterniti <sup>s</sup>	ad whilipping	Carly Co.		external rege Otherwise, the result in burnover-load pro <b>Caution&gt;</b> When you use value than 0.	enerative resistor. The regenerative response regenerative response regenerative response regenerative regenerative regenerative response regenerative response regenerative response regenerative response regenerative response regenerative	such as thermal fuse when you use the esistor might be heated up abnormally and of validation or invalidation of regenerative generative resistor, never to set up other xternal regenerative resistor. gets very hot, and might cause burning.
6D *	Detection time of main power off	35 to 1000 <35>	2ms	shut off conti	nuously.	ect the shutoff while the main power is kept s invalid when you set up this to 1000.
6E	Torque setup at emergency stop	0 to 500 <0>	%	During de (Sequence     During dec power off)     During deco OFF)	celeration of ove at over-travel inhi eleration with the	setup of 8 or 9 of Pr67 (Sequence at main setup of 8 or 9 of Pr69 (Sequence at Servo-
71	Setup of analog input excess	0 to 100 <0>	0.1V	command (	SPR: CN X5, Pin log input excess	detection judgment level of analog velocity -14) with voltage after offset correction. protective function) becomes invalid when
72	Setup of over-load level	0 to 500 <0>	%	<ul><li>by setting u</li><li>Use this wi</li><li>you need to</li></ul>	ip this to 0. th 0 setup in norm o lower the over-lo	level. The overload level becomes 115 [ % nal operation. Set up other value only when ad level. eter is limited by 115[ %] of the motor rating.
73	Setup of over-speed level	0 to 20000 <0>	r/min	times of the  Use this wiyou need to The setup max. speed Caution> The detection	e motor max. spee th 0 setup in norm o lower the over-sp value of this para d.	ed level. The over-speed level becomes 1.2 d by setting up this to 0. hal operation. Set up other value only when beed level.  ameter is limited by 1.2 times of the motor setup value is ±3 [ r/min] in case of the 7-wir in] in case of the 5-wire incremental encoder.

### <Notes>

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



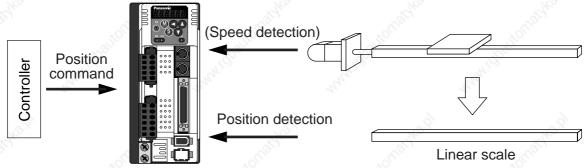
# [Full-Closed Control Mode]

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# **Outline of Full-Closed Control**

### What Is Full-Closed Control?

In this full-closed control, you can make a position control by using a linear scale mounted externally which detects the machine 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 linear scale division ratio of  $\frac{1}{20} \le \text{Linear scale division ratio } \le 20$ 

### **Cautions on Full-Closed Control**

- (1) Enter the command pulses making the external scale as a reference.

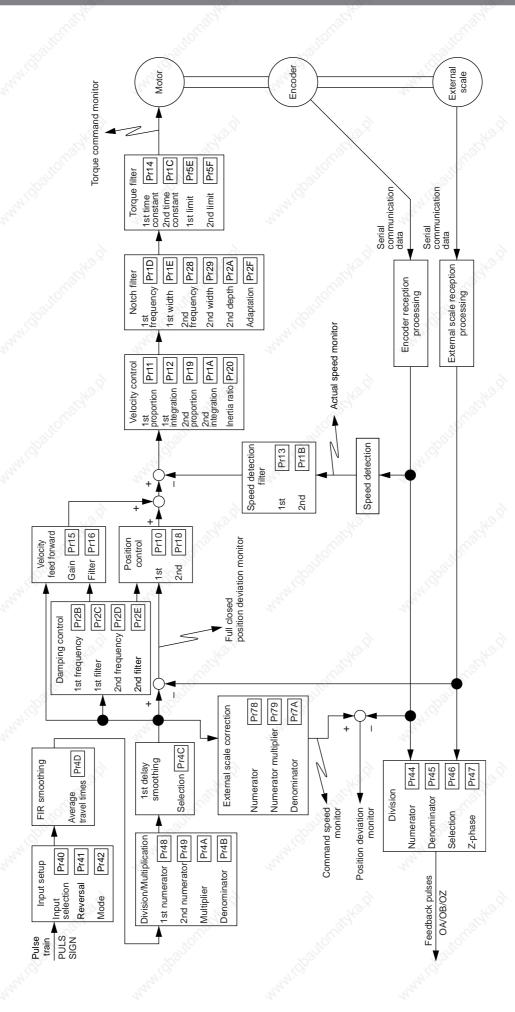
  If the command pulses do not match to the external scale pulses, use the command division/multiplication function (Pr48-4B) and setup so that the command pulses after division/multiplication is based on the external scale reference.
- (2) A4-series supports the linear scale of a communication type. Execute the initial setup of parameters per the following procedures, then write into EEPROM and turn on the power again before using this function.

### <How to make an initial setup of parameters related to linear 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 or with the setup support software, PANATERM .
- 3) Move the work and check the travel from the initial values of the above 2).
- 4) If the travel of the feedback sum and the external scale feedback pulse sum are reversed in positive and negative, set up the reversal of external scale direction (Pr7C) to 1.
- 5) Set up the external scale division ratio (Pr78-7A) using the formula below,

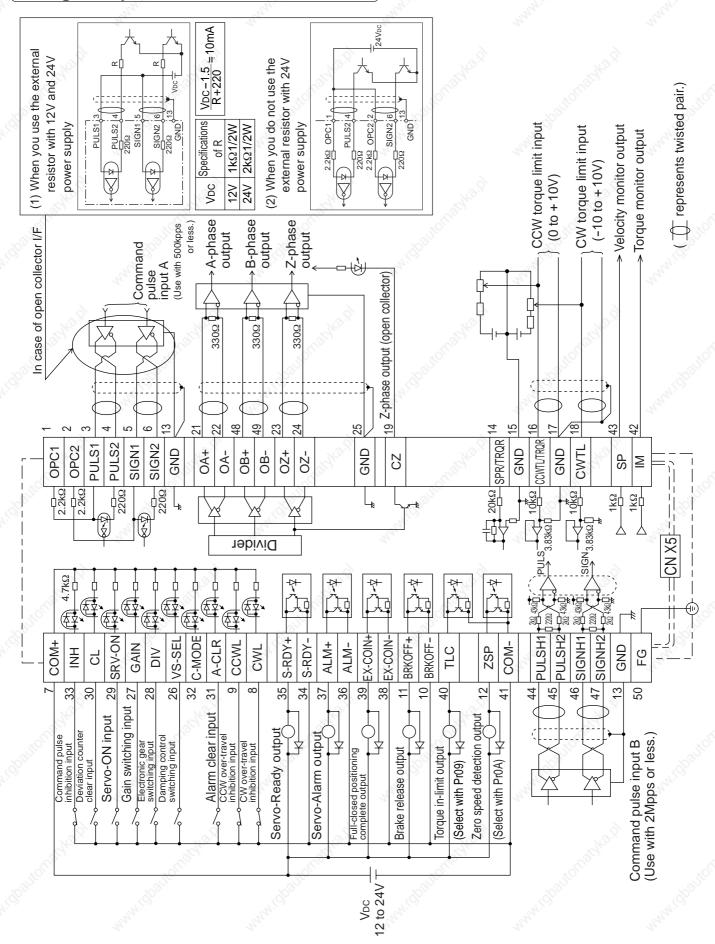
External scale division ratio = 
$$\frac{\text{Total variation of external scale feedback pulse sum}}{\text{Total variation of feedback pulse sum}}$$
$$= \frac{\text{Pr78 x 2}^{\text{Pr79}}}{\text{Pr7A}}$$

- \* If the design value of the external scale division ratio is obtained, set up this value.
- 6) Set up appropriate value of hybrid deviation excess (Pr7B) in 16 pulse unit of the external scale resolution, in order to avoid the damage to the machine.
  - \* A4-series driver calculates the difference between the encoder position and the linear scale position as hybrid deviation, and is used to prevent the machine runaway or damage in case of the linear 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) may occur especially when the work travels long distance, even though the linear 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.



### Wiring Example to the Connector, CN X5

### Wiring example of full-closed control mode



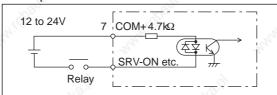
# ontrol Mode

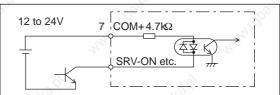
### **Interface Circuit**

### Input Circuit

### SI Connection to sequence input signals

- 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 to 24V) as 11.4V or more in order to secure the primary current for photo-couplers.





### PI1 Connection to sequence input signals (Pulse train interface)

- (1) Line driver I/F (Input pulse frequency: max. 500kpps)
- This signal transmission method has better noise immunity. We recommend this to secure the signal transmission.
- (2)Open collector I/F (Input pulse frequency: max. 200kpps)
- The method which uses an external control signal power supply (VDC)
- Current regulating resistor R corresponding to VDC is required in this case.
- · Connect the specified resister as below.

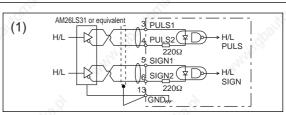
VDC	Specifications
12V	1kΩ1/2W
24V	2kΩ1/2W

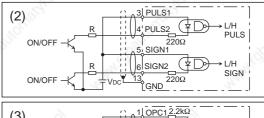
$$\frac{\text{VDC}-1.5}{\text{R}+220} = 10\text{mA}$$

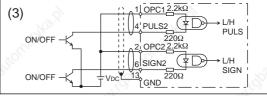
- (3)Open collector I/F (Input pulse frequency: max. 200kpps)
- Connecting diagram when a current regulating resistor is not used with 24V power supply.



Max.input voltage : DC24V, Rated current : 10mA





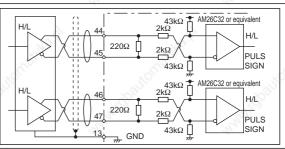


# PI2 Connection to sequence input signals (Pulse train interface exclusive to line driver)

Line driver I/F (Input pulse frequency: max. 2Mpps)

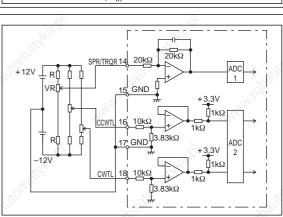
This signal transmission method has better noise immunity.
 We recommend this to secure the signal transmission when line driver I/F is used.

# represents twisted pair.



### Al Analog command input

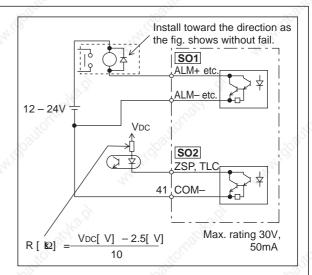
- The analog command input goes through 3 routes, SPR/TRQR(Pin-14), CCWTL (Pin-16) and CWTL (Pin-18).
- Max. permissible input voltage to each input is ±10V.
   For input impedance of each input, refer to the right Fig.
- When you compose a simple command circuit using variable resistor(VR) and register R, connect as the right Fig. shows. When the variable range of each input is made as -10V to +10V, use VR with  $2k\Omega$ , B-characteristics, 1/2W or larger, R with  $200\Omega$ , 1/2W or larger.
- A/D converter resolution of each command input is as follows.
   (1)ADC1: 16 bit (SPR/TRQR), (including 1bit for sign), ±10V
   (2)ADC2: 10 bit (CCWTL, CWTL), 0 3.3V



### **Output Circuit**

### SO1 SO2 Sequence output circuit

- The output circuit is composed of open collector transistor outputs in the Darlington connection, and connect to relays or photo-couplers.
- 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 which emitter side of the output transistor is independent and is connectable individually, and the one which is common to side of the control power supply (COM–).
- If a recommended primary current value of the photo-coupler is 10mA, decide the resistor value using the formula of the right Fig.

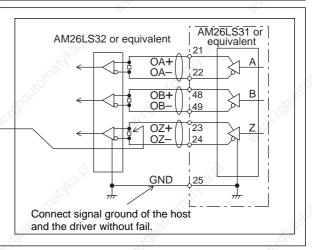


For the recommended primary current value, refer to the data sheet of apparatus or photo-coupler to be used.

### 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.  $330\Omega$ ) between line receiver inputs without fail.
- These outputs are not insulated.

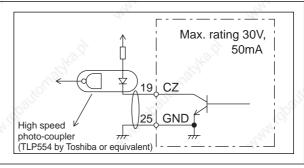
 $\oplus$  represents twisted pair.



### PO2 Open collector output

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

# represents twisted pair.



### **AO** Analog monitor output

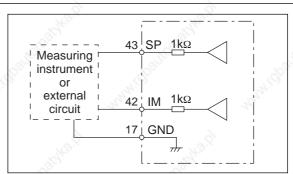
- There are two outputs, the speed monitor signal output (SP) and the torque monitor signal output (IM)
- Output signal width is ±10V.
- The output impedance is  $1k\Omega$ . Pay an attention to the input impedance of the measuring instrument or the external circuit to be connected.

### <Resolution>

(1) Speed monitor output (SP)

With a setup of 6V/3000r/min (Pr07=3), the resolution converted to speed is 8r/min/16mV.

(2) Torque monitor output (IM)
With a relation of 3V/rated torque (100%), the resolution converted to torque is 0.4%/12mV.



# Input Signal and Pin No. of the Connector, CN X5

### Input Signals (common) and Their Functions

Title of signal	Pin No.	Symbol	Tru.				Func	etion	I/F circui			
Power supply for control signal (+)	7	COM+		<ul> <li>Connect + of the external DC power supply (12 to 24V).</li> <li>Use the power supply voltage of 12V ± 5% – 24V ± 5%</li> </ul>								
Power supply for control signal (-)	41	COM-	• The p	<ul> <li>Connect – of the external DC power supply (12 to 24V).</li> <li>The power capacity varies depending on a composition of I/O circuit. 0.5A or more is recommended.</li> </ul>								
CW over-travel inhibit input	8	CWL	<ul><li>Conn movin</li><li>CWL inhibit</li><li>You c of up</li></ul>	<ul> <li>Use this input to inhibit a CW over-travel (CWL).</li> <li>Connect this so as to make the connection to COM— open when the moving portion of the machine over-travels the movable range toward CW.</li> <li>CWL input will be invalidated when you set up Pr04 (Setup of over-travel inhibit input) to 1.Default is "Invalid (1)".</li> <li>You can select the action when the CWL input is validated with the setup of up Pr66 (Sequence at over-travel inhibit). Default is "Emergency stop with dynamic brake".(Pr66=0)</li> </ul>								
CCW over-travel inhibit input	9	CCWL	<ul><li>Conne portion</li><li>CWL inhibit</li><li>You conform</li><li>You conform</li></ul>	<ul> <li>Use this input to inhibit a CCW over-travel (CCWL).</li> <li>Connect this so as to make the connection to COM— open when the moving portion of the machine over-travels the movable range toward CCW.</li> <li>CWL input will be invalidated when you set up Pr04 (Setup of over-travel inhibit input) to 1.Default is "Invalid (1)".</li> <li>You can select the action when the CCWL input is validated with the setup of Pr66 (Sequence at over-travel inhibit). Default is "Emergency stop with dynamic brake".(Pr66=0)</li> </ul>								
damping control	26	VS-SEL	• Functi	on var	ies deper	nding on	the cont	trol mode.	SI			
switching input	71,0		410		• Becom	es to a	speed-ze	ero clamp input (ZEROSPD).	P.193			
	7		122	120		-27	n to COM-	Content	182			
					<b>Pr06</b>	_	-	ZEROSPD input is invalid.	111			
		(2)	Velo	city/	-8	on	en	Speed command is 0	111			
		Thomas	Torque		₩1 +		se	Normal action	111			
		-Clar.	con	trol			en .	Speed command is to CCW	111			
	1 3	60,			2	clo	. 0.7	Speed command is to CCW.	100			
	1900		(8)	1900	• In case Pr06 is 2 at torque control, ZERPSPD is invalid.							
allaghad		elleit to di	Posi Full-c con	losed	<ul> <li>Becomes to an input of damping control switching (VS-SEL).</li> <li>While Pr24 (Damping filter switching selection) is 1, the 1st damping filter (Pr2B, Pr2C) will be validated when you open this input, and the 2nd damping filter (Pr2D, Pr2E) will be validated when you connect this input to COM</li> </ul>							
Gain switching input	27	GAIN			ries depe ion of tor			etups of Pr30 (2nd gain setup) a	nd SI P.193			
or 📈	7.		Pr03	Pr30	Connectio	n to COM-		Content	2 E 12.			
Torque limit		TL-SEL		0	ор	en	Velocity	loop : PI (Proportion/Integration) action	<u>1</u>			
switching input		6			े clo	se	Velocity	loop : P (Proportion) action	_]			
		"Tron			74.o.	wh	en the se	etups of Pr31 and Pr36 are 2				
		Mar.	0-2	700	ор	en	1st gain	selection (Pr10,11,12,13 and 14)				
	100	0		JY	clo	se	2nd gai	n selection (Pr18,19,1A,1B and 1C	(3)			
	"igh.		730		whe	en the s	etups of	Pr31 and Pr36 are other than 2	7/90			
	50	,11 <sup>4</sup> 2.0 <sup>1</sup>	3	_	• Pr5E open	Setup o	of 1st torout, and F	invalid vitching (TL-SEL) que limit) will be validated when you verse (Setup of 2nd torque limit) we connect this input to COM				
HOWST.		Ollige,		For details of 2nd gain switching function, refer to P.243 "Gain Switching Function" of Adjustment.								

Title of signal	Pin No.	Symbol	*Q	6000	Function	"OLE",	I/F circui		
Electronic gear	28	DIV	Function var	ies depending on	the control mode.		SI		
(division/ multiplication) switching input	Mark Co.	rowgithg by	Position/ Full-closed control	Full-closed gear) to Pr49 (2nd numerator of electronic gear)					
	Service Contraction of the Contr	Same	Velocity control	<ul> <li>You can male INTSPD1 and refer to the tab</li> </ul>	Input of internal speed selection 3 (INTSPD3). You can make up to 8-speed setups combining IN INTSPD1 and CL/INTSPD2 inputs. For details of seture fer to the table of P.131, "Selection of Internal Speed".				
			Torque control	This input is inv	valid.				
			<caution> Do not enter</caution>	the command pul	se 10ms before/after s	witching.			
Servo-ON input	29	SRV-ON			connecting this input to		SI		
800-	Salari Og		to the motor • You can se	will be shut off. elect the dynam	10	to COM-, and current the deviation counter at Servo-OFF).	P.193		
pattornat Wash	.8	HOM BY POOR	(see P.42, " 2.Never run/s 3.After shifting	<ul> <li>*Caution*</li> <li>1.Servo-ON input becomes valid approx. 2 sec after power-on. (see P.42, "Timing Chart" of Preparation.)</li> <li>2.Never run/stop the motor with Servo-ON/OFF.</li> <li>3.After shifting to Servo-ON, allow 100ms or longer pause before entering the pulse command.</li> </ul>					
Deviation	30	CL	Function var	ies depending on	the control mode.		SI		
counter clear input			<ul> <li>Input (CL) which clears the positional deviation counter and full-closed deviation counter.</li> <li>You can clear the counter of positional deviation and full-closed deviation by connecting this to COM</li> <li>You can select the clearing mode with Pr4E (Counter clear input mode).</li> </ul>						
	.89		D	Pr4E	Con	tent	900		
	nay!		Position/ Full-closed control	0 444	Clears the counter tion and full-closed connected to COM-	of positional devia- deviation while CL is	my		
		*OWBINE DI	official to the	1 [ Default]	Clears the counter of and full-closed devi connecting CL to COM	ation only once by			
	.89		1997	2	CL is invalid	79097	1900		
	MAN.		Velocity control	<ul> <li>You can make INTSPD1 and refer to the tab Velocity Control</li> </ul>	- 20	rups combining INH/ For details of setup,	way.		
			Torque control	This input is in	valid.	*2000.			
Alarm clear input	31	A-CLR	than 120ms. • The deviatio • There are so	n counter will be o	status by connecting the cleared at alarm clear. In cannot be released with the content of the c		SI P.193		

Title of signal	Pin No.	Symbol	, of C	Fun	ction	I/F circui
Inhibition input	33	INH	• Function va	ries depending on the co	ntrol mode.	SI
of command pulse input	200		Position/ Full closed	connection to COM-  You can invalidate t	n command pulse by o	
			control	Pr43	Content	200
	- 3		1601	0 🚫	INH is valid.	160
	1900		1900	1(Default)	INH is valid.	
	7		Velocity control	You can make up INH/INTSPD2 and CL setup, refer to the tabl	ternal command speed (IN to 8-speed setups /INTSPD3 inputs. For do e of P.131, Speed" of Velocity Contro	combining etails of the
			Torque control	This input is invalid.	S.	

### • Numerator selection of electronic gear

CN X5 Pin-28 DIV		Setup of electronic gear	No.
15°E	16.5	1st numerator of electronic gear (Pr48) x 2 Multiplier of command so	caling (Pr4A)
Open	or	Denominator of electronic gear (Pr4B)	-Killy
Open	11/10. OI	Encoder resolution*	
	3	Command pulse counts per single turn (Pr4B)	* Automatic setup by setting up Pr48 to 0
My.		2nd numerator of electronic gear (Pr49) x 2 Multiplier of command s	scaling (Pr4A)
Short	or	Denominator of electronic gear (Pr4B)	
Short	Ve S	Encoder resolution*	
Clife,	"Clair,	Command pulse counts per single turn (Pr4B)	* Automatic setup by setting up Pr49 to 0

### 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

Title of signal	Pin No.	Symbol	Function	I/F circuit
Command pulse	44	PULSH1	• Input terminal for position command pulse. You can select by setting up	PI2
input 1			Pr40 (Selection of command pulse input) to 1.	P.193
Latter at	45	PULSH2	<ul> <li>This input becomes invalid at such control mode as velocity control or torque control, where no position command is required.</li> <li>Permissible max. input frequency is 2Mpps.</li> </ul>	
Command pulse sign input 1	46	SIGNH1	You can select up to 6 command pulse input formats with Pr41 (Setup of command pulse rotational direction) and Pr42 (Setup of command pulse input mode).	ethylich
	47	SIGNH2	For details, refer to the table below, "Command pulse input format".	

### Pulse train interface

Title of signal	Pin No.	Symbol	Function	I/F circuit				
Command pulse input 2  Command pulse sign input 2	1,8	OPC1	• Input terminal for the position command. You can select by setting up Pr40 (Selection of command pulse input) to 0.	307				
	3	PULS1	• This input becomes invalid at such control mode as the velocity control or	P.193				
	4	PULS2	<ul> <li>torque control, where no position command is required.</li> <li>Permissible max. input frequency is 500kpps at line driver input and 200kpps at open collector input.</li> <li>You can select up to 6 command pulse input formats with Pr41 (Setup of</li> </ul>					
	2	OPC2						
	5	SIGN1	command pulse rotational direction) and Pr42 (Setup of command pulse					
	6	SIGN2	input mode). For details, refer to the table below, "Command pulse input format".	10210				

### Command pulse input format

Pr41 Setup value (Setup of command pulse rotational direction)	Pr42 Setup value (Setup of command pulse input mode)	Command pulse format	Signal title	CCW command	CW command
Security .	0 or 2	2-phase pulse with 90° difference (A+B-phase)	PULS SIGN	A-phase t1 t1  B-phase t1 t1  B-phase advances to A by 90°.	t1 t
0	1	CW pulse train + CCW pulse train	PULS SIGN	t3 t2 t2	t2 t2
Telugah.	3	Pulse train + Sign	PULS SIGN	14 t5 16 "H" t6	t4 t5 t6 t6
	0 or 2	2-phase pulse with 90° difference (A+B-phase)	PULS SIGN	A-phase Handle H	B-phase advances to A by 90°.
Comach A	1	CW pulse train + CCW pulse train	PULS SIGN	t2 t2	t2 t2
5"	3	Pulse train + Sign	PULS SIGN	14 t5 16 t6	t4 t5

- PULS and SIGN represents the outputs of pulse train in put circuit. Refer to the fig. of P.193, "Input Circuit".
- In case of CW pulse train
   + CCW pulse train and pulse train + sign, pulse train will be captured at the rising edge.
- In case of 2-phase pulse, pulse train will be captured at each edge.

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

Input I/E o	f PULS/SIGN signal	Permissible max.	Minimum necessary time width					
input i/F o	input frequency	ti	t2	t3	t4	t5	t6	
Pulse train interface exc	Pulse train interface exclusive for line driver			250ns	250ns	250ns	250ns	250ns
Pulse train interface	Line driver interface	500kpps	2μs	1μs	1μs	1μs	1μs	1μs
"H'_C)	Open collector interface	200kpps	5μs	2.5µs	2.5µs	2.5µs	2.5µs	2.5µs

Set up the rising/falling time of command pulse input signal to  $0.1 \mu s$  or shorter.

### Input Signals (Analog Command) and Their Functions

Title of signal	Pin No.	Symbol	.00			Function		I/F circuit	
Speed command	14	SPR	• Functi	on varies dep	ending o	on control mode.	4	AI	
input or Torque command input, or Speed limit input	, A. L. D'O'S	TRQR SPL	1 3 5	Control mode  Velocity control  Position/ Velocity  Velocity/ Torque	veloci • Set u speed Pr50 Pr51 Pr52	Function  nal velocity command in ty control is selected. up the gain, polarity, of command with; (Speed command input of (Speed command offset) (Speed command offset) (Speed command filter s	fset and filter of the gain) reversal)	P.193	
				16.0	• Funct	ion varies depending of command)	n Pr5B (Selection of		
Nigotian,	* igg <sub>ag</sub>		2 4	Torque control	<b>Pr5B</b>	• Torque command (TRO • Set up the torque (Troffset and filter with; Pr5C (Torque command (Torque command) Pr52 (Speed command) Pr57 (Speed command)	QR) will be selected. RQR) gain, polarity, and input gain) and input reversal) and offset)	S. W. Chaire	
utorratako.**		Post Clugates	iling Charles	, and idi	Torque	1	<ul> <li>Speed limit (SPL) will</li> <li>Set up the speed limit offset and filter with;</li> <li>Pr50 (Speed commar Pr52 (Speed commar Pr57 (Speed commar</li> </ul>	(SPL) gain, and input gain) and offset)	unit i do de la composition della composition de
<sub>10</sub> .9				20,0		ion varies depending o	n Pr5B (Selection of		
				Majey.	Pr5B	Conte	nt		
	_3			710,	0	• This input becomes in	valid.	200	
1940. Q) WAR	<sup>M</sup> idge,		5	Velocity/ Torque	1	<ul> <li>Speed limit (SPL) will</li> <li>Set up the speed lim and filter with;</li> <li>Pr50 (Speed commar Pr52 (Speed commar Pr57 (Speed commar</li> </ul>	it (SPL) gain, offset and input gain) and offset)		
HIGH	.6003		Others	Other control mode	• This in	nput is invalid.	(Shaliton)	(Apalito	
The state of the s	4.		(includ	ing 1 bit for sig	gn).	nverter used in this input 1[ LSBp.3[ mV]	is 16 bit	news.	

<sup>\*</sup>Function becomes valid when the control mode with underline ( \_\_\_\_\_ / \_\_\_\_ ) is selected while the switching mode is used in the control mode in table.

### <Remark>

Do not apply voltage exceeding ±10V to analog command inputs of SPR/TRQR/SPL.

Title of signal	Pin No.	Symbol		XOTO BY	Function	I/F circui
CCW-Torque	16	CCWTL	• Funct	ion varies dep	ending on Pr02 (Control mode setup).	Al
limit input	"4'¿Q,		Pr02	Control mode	Function	P.193
	27		W		<ul> <li>Function varies depending on Pr5B (Selection of torque command)</li> </ul>	Ny.
		9		_<	Pr5B Content	
		A.		"The	0 This input becomes invalid.	
Egiffilizer,		allomar,	2 4	Torque Control Position/Torque	Torque command input (TRQR) will be selected.  Set up the gain and polarity of the command with;  Pr5C (Torque command input gain)  Pr5D (Torque command input reversal)  Offset and filter cannot be set up.	Mary logic
Dalloftallya r		alfolitalyko.F	5	Velocity/ Torque	<ul> <li>Becomes to the torque command input (TRQR).</li> <li>Set up the gain and polarity of the command with; Pr5C (Torque command input gain) Pr5D (Torque command input reversal)</li> <li>Offset and filter cannot be set up.</li> </ul>	"Hillpa
"Oughto's	to a	NOTTRETHE D	4 5 Other	Position/Torque Velocity/Torque Other control mode	<ul> <li>Becomes to the analog torque limit input to CCW (CCWTL).</li> <li>Limit the CCW-torque by applying positive voltage (0 to +10V) (Approx.+3V/rated toque)</li> <li>Invalidate this input by setting up Pr03 (Torque limit selection) to other than 0.</li> </ul>	Pro-
	nanië.	ř	(includ	ding 1 bit for s	nverter used in this input is 16 bit gn). [ V] , 1 [ LSB]23[ mV]	NAM! (JO)
<b>CW-Torque limit</b>	18	CWTL	• Funct	ion varies dep	ending on Pr02 (Control mode setup).	AI
input		10.0	Pr02	Control mode	Function	P.193
baltomately	86	Nitchillippe .	2 4 5	Torque control Position/Torque Velocity/Torque	<ul> <li>This input becomes invalid when the torque control is selected.</li> </ul>	
2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		Sald Forty	4 5 Other	Position/Torque Velocity/Torque Other control mode	<ul> <li>Becomes to the analog torque limit input to CW (CWTL).</li> <li>Limit the CW-torque by applying negative voltage (0 – -10V) (Approx.+3V/rated toque).</li> <li>Invalidate this input by setting up Pr03 (Torque limit selection) to other than 0.</li> </ul>	HALAH KOL
palion	74;Q	allon.	(includ	ding 1 bit for s	nverter used in this input is 16 bit gn). [V] , 1 [ LSB]23[ mV]	"Millipa

<sup>\*</sup>Function becomes valid when the control mode with underline ( \_\_\_\_\_ / \_\_\_\_ is selected while the switching mode is used in the control mode in table.

### <Remark>

Do not apply voltage exceeding ±10V to analog command input of CWTL and CCWTL

### Output signal and Pin No. of the Connector, CN X5

### Output Signals (Common) and Their Functions

Title of signal	Pin No	Symbol	Tru,	Function	I/F circuit			
External brake release signal	11 10	BRKOFF+ BRKOFF-	<ul> <li>Turns the ormagnetic bra</li> <li>You can see mechanical</li> </ul>	Preeds out the timing signal which activates the electromagnetic brake of the motor.  Turns the output transistor ON at the release timing of the electromagnetic brake.  You can set up the output timing of this signal with Pr6A (Setup of mechanical brake action at stall) and Pr6B (Setup of mechanical brake action at motion). For details, refer to P42, "Timing Chart" of Preparation.)				
Servo-Ready output	35 34	S-RDY+ S-RDY-	Output trans	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.				
Servo-Alarm output	37 36	ALM+ ALM-	Output trans	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.				
Positioning	39	EX-COIN+	• Function var	ries depending on the control mode.	SO1			
complete (In-position)	38	EX-COIN-	Position control	Output of positioning complete (COIN) The output transistor will turn ON when the absolute value of the position deviation pulse becomes smaller than the setup value of Pr60 (Positioning complete range). You can select the feeding out method with Pr63 (Setup of positioning complete output).	P.194			
	R. A. I. C.	S <sub>ULIO</sub>	Full-closed control	<ul> <li>Output of full-closed positioning complete (EX-COIN)</li> <li>The output transistor will turn ON when the absolute value of full-closed-position deviation pulse becomes smaller than the setup value of Pr60 (Positioning complete range).</li> <li>You can select the feeding out method with Pr63 (Setup of positioning complete output).</li> </ul>	an idoano			
		-ttottko:bj	Velocity/ Torque control	<ul> <li>Output at-speed (speed arrival) (AT-SPEED)</li> <li>The output transistor will turn ON when the actual motor speed exceeds the setup value of Pr62 (In-speed).</li> </ul>	3			
Zero-speed detection output signal	12 (41)	ZSP (COM-)	• Default is 1,	e output signal varies depending on Pr0A (Selection of ZSP output). and feeds out the zero speed detection signal. see the table below, "Selection of TLC,ZSP output".	SO2 P.194			
Torque in-limit signal output	40 (41)	TLC (COM-)	• Default is 1,	e output signal varies depending on Pr09 (Selection of TLC output). and feeds out the torque in-limit signal. see the table below, "Selection of TLC,ZSP output".	SO2 P.194			

### Selection of TCL and ZSP outputs

Value of Pr09 or Pr0A	X5 TLC : Output of Pin-40	X5 ZSP : Output of Pin-12
0	Torque in-limit output (Default of X5 TLC Pr09)     The output transistor turns ON when the torque comman	d is limited by the torque limit during Servo-ON.
1	<ul> <li>Zero-speed detection output (Default of X5 ZSP ProA The output transistor turns ON when the motor speed fall</li> </ul>	,
2	<ul> <li>Alarm signal output         The output transistor turns ON when either one of the alabattery alarm, fan-lock alarm or external scale alarm.     </li> </ul>	arms is triggered, over-regeneration alarm, overload alarm
3	Over-regeneration alarm     The output transistor turns ON when the regeneration exceeds	85% of the alarm trigger level of the regenerative load protection
4	Over-load alarm     The output transistor turns ON when the load exceeds 85	5% of the alarm trigger level of the overload alarm.
5	Battery alarm     The output transistor turns ON when the battery voltage f	or absolute encoder falls lower than approx. 3.2V.
6	• Fan-lock alarm The output transistor turns ON when the fan stalls for lon	ger than 1s.
7	<ul> <li>External scale alarm         The output transistor turns ON when the external scale (adjustment on mounting is required). Valid only at the full     </li> </ul>	temperature exceeds 65°, or signal intensity is not enoug
8	In-speed (Speed coincidence) output	en the actual motor speed and the speed command before

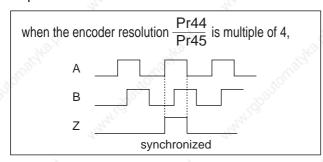
### Output Signals (Pulse Train) and Their Functions

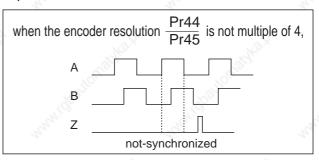
Title of signal	Pin No	Symbol	Function	I/F circuit					
A-phase output	21	OA +	Feeds out the divided encoder signal or external scale signal (A, B, Z-phase) in differential. (equivalent to RS422)	PO1 P.194					
: No. 19	22	OA –	<ul> <li>You can set up the division ratio with Pr44 (Numerator of pulse output division) and Pr45 (Denominator of pulse output division)</li> <li>You can select the logic relation between A-phase and B-phase, and the</li> </ul>						
B-phase output	48	OB +	output source with Pr46 (Reversal of pulse output logic).  • When the external scale is made as an output source, you can set up the						
8	49	OB –	<ul> <li>interval of Z-phase pulse output with Pr47 (Setup of external scale Z-phase).</li> <li>Ground for line driver of output circuit is connected to signal ground (GND) and is not insulated.</li> </ul>						
Z-phase output	23	OZ +	Max. output frequency is 4Mpps (after quadrupled)						
"OLUGICIACO"	24	OZ –	This is the state of the state						
Z-phase output	19	CZ	<ul> <li>Open collector output of Z-phase signal</li> <li>The emitter side of the transistor of the output circuit is connected to the signal ground (GND) and is not insulated.</li> </ul>	PO2 P.194					

### <Note>

### • When the output source is the encoder

• If the encoder resolution  $X = \frac{Pr44}{Pr45}$  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.





• In case of the 5-wire, 2500P/r incremental encoder, the signal sequence might not follow the above fig. until the first Z-phase is fed out. When you use the pulse output as the control signal, rotate the motor one revolution or more to make sure that the Z-phase is fed out at least once before using.

### When output source is the external scale,

- When the external scale is the output source, Z-phase pulse will not be fed out until the absolute position crosses 0 (00000000000h).
- Z-phase pulse after its crossing of the absolute position 0, will be fed out synchronizing with A-phase in every A-phase pulses which are set with Pr47 (External scale Z-phase setup)

### Output Signals (Analog) and Their Functions

Title of signal	Pin No	Symbol	(8)	50"	Function	I/F circui		
Torque monitor signal output	42	IM	(IM) s	election).	eput signal varies depending on Pr08 (Torque monitor scaling with Pr08 value.	AO P.194		
			Pr08	Content of signal	Function			
		Ph. State	-	Torque command	•			
			1 – 5	Positional deviation	Feeds out the voltage in proportion to the positional deviation pulse counts with polarity.     + : positional command to CCW of motor position     - : positional command to CW of motor position	T.		
	A.I.B.	on in the second	6 –10	Full-closed deviation	Feeds out the voltage in proportion to the full-closed deviation pulse counts with polarity.     + : positional command to CCW of external scale position     - : positional command to CW of external scale position	anidhain		
Speed monitor signal output	43	SP	(IM) s	election).	output signal varies depending on Pr07 (Speed monitor scaling with Pr07 value.	AO P.194		
	3	OLL	Pr07	Control mode	Function	30		
71 <sub>22</sub>	Mary I Chic	<i>\$</i> <sub>6,2</sub>	<sup>12</sup> Gg,	200	0 – 4	Motor speed	Feeds out the voltage in proportion to the motor speed with polarity.    + : rotates to CCW     - : rotates to CW	Arth I Good
			5 – 9	Command speed	Feeds out the voltage in proportion to the command speed with polarity.     + : rotates to CCW     - : rotates to CW			

# **Output Signals (Others) and Their Functions**

Title of signal	Pin No	Symbol	Function	I/F circuit
Signal ground	13,15, 17,25	GND	Signal ground     This output is insulated from the control signal power (COM–) inside of the driver.	-
Frame ground	50	FG	This output is connected to the earth terminal inside of the driver.	<sup>124</sup> 10 <del>70</del> 0

### Connector, CN X7

Power supply for the external scale shall be prepared by customer, or use the following power supply output for the external scale (250mA or less).

Application	Connector PinNo.	Content
Power supply output	1	EX5V
for external scale	2 30	EX0V
I/F of external scale signals	5	EXPS
(serial signal)	6	EXPS
Frame ground	Case	FG

### <Note>

EXOV of the external scale power supply output is connected to the control circuit ground which is connected to the Connecter, CN X5.

### <Remark>

Do not connect anything to other Pin numbers descried in the above table (Pin-3 and 4).

### Cautions

- (1) Following external scale can be used for full-closed control.
  - AT500 series by Mitutoyo (Resolution 0.05[μm], max. speed 2[ m/s] )
  - ST771 by Mitutoyo (Resolution 0.5[μm], max. speed 2[ m/s] )

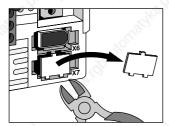
### (2) Recommended external scale ratio is 1/20<External scale ratio<20

If you set up the external scale ratio to smaller value than 50/position loop gain (Pr10 and 18), you may not be able to control per 1 pulse unit. Setup of larger scale ratio may result in larger noise.

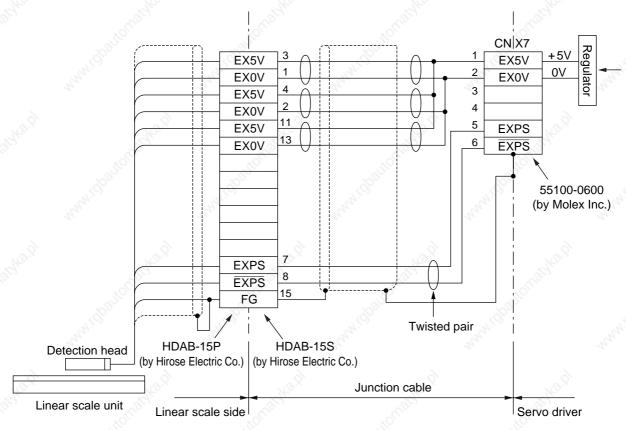
### Wiring to the External Scale, Connector, CN X7

Wire the signals from the external scale to the external scale connector, CN X7.

- 1) Cable for the external scale to be the twisted pair with bundle shielding and to having the twisted core wire with diameter of 0.18mm2.
- 2) Cable length to be max. 20m. Double wiring for 5V 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 CN X7 of the driver without fail.
- 4) Separate the wiring to CN X7 from the power line (L1, L2, L3, L1C \_ , L2C (t), U, V. W,⊕ ) as much as possible (30cm or more). Do not pass these wires in the same duct, nor bundle together.
- 5) Do not connect anything to the vacant pins of CN X7.
- 6) Cut away the amplifier's CN X7 cover.



Please cut it out with nippers etc.



# **Real-Time Auto-Gain Tuning**

### **Outline**

The driver estimates the load inertia of the machine in real time, and automatically sets up the optimum gain responding to the result. Also the driver automatically suppress the vibration caused by the resonance with an adaptive filter.

# Position/Velocity command Auto-gain Auto-filter adjustment Position/Velocity command Position/Velocity adjustment Action command under actual condition Action command under actual condition Real-time auto-gain tuning Motor current command Motor speed Encoder

### **Applicable Range**

 Real-time auto-gain tuning is applicable to all control modes.

### Caution

Real-time auto-gain tuning may not be executed properly under the conditions described in the right table. In these cases, use the normal mode auto-gain tuning (refer to P.236 of Adjustment), or execute a manual gain tuning. (refer to P.240, of Adjustment)

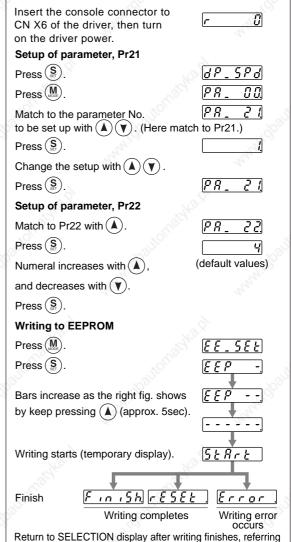
	Conditions which obstruct real-time auto-gain tuning						
Laad	Load is too small or large compared to rotor inertia.						
Load	(less than 3 times or more than 20 times)						
inertia	Load inertia change too quickly. (10 [ s] or less)						
9	Machine stiffness is extremely low.						
Load	Chattering such as backlash exists.						
	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						
Action	Acceleration/deceleration torque is smaller than						
pattern	unbalanced weighted/viscous friction torque.						
•	When speed condition of 100[ r/min] or more and						
	acceleration/deceleration condition of 2000[ r/min] per						
	1[ s] are not maintained for 50[ ms] .						

### **How to Operate**

- (1) Bring the motor to stall (Servo-OFF).
- (2) Set up Pr21 (Real-time auto-gain tuning mode setup) to 1-7. Default is 1.

Setup value	Real-time auto-gain tuning	Varying degree of load inertia in motion
0	(not in use)	-19,
<1>	, of C	no change
2	normal mode	slow change
3		rapid change
4	"The	no change
5	vertical axis mode	slow change
6		rapid change
7	no-gain switching mode	no change

- When the varying degree of load inertia is large, set up 3 or 6.
- When the motor is used for vertical axis, set up 4-6.
- When vibration occurs during gain switching, set up 7.
- When resonance might give some effect, validate the setup of Pr23 (Setup of adaptive filter mode).
- (3) Set up Pr22 (Machine stiffness at real-time auto-gain tuning) to 0 or smaller value.
- (4) Turn to Servo-ON to run the machine normally.
- (5) Gradually increase Pr22 (Machine stiffness at real-time auto-gain tuning) when you want to obtain better response. Lower the value (0 to 3) when you experience abnormal noise or oscillation.
- (6) Write to EEPROM when you want to save the result.



to "Structure of each mode" (P.60 and 61 of Preparation).

### **Adaptive Filters**

The adaptive filter is validated by setting up Pr23 (Setup of adaptive filter mode) to other than 0.

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

The adaptive filter may not operate property under the following conditions. In these cases, use 1st notch filter (Pr1D and 1E) and 2nd notch filter (Pr28-2A) to make measures against resonance according to the manual adjusting procedures. For details of notch filters, refer to P.246, "Suppression of Machine Resonance" of Adjustment.

and a	Conditions which obstruct adaptive filter action
Resonance point	<ul> <li>When resonance frequency is lower than 300[ Hz] .</li> <li>While resonance peak is low or control gain is small and when no affect from these condition is given to the motor speed.</li> <li>When multiple resonance points exist.</li> </ul>
Load	• When the motor speed variation with high frequency factor is generated due to non-linear factor such as backlash
Command pattern	• When acceleration/deceleration is very extreme such as more than 30000 [ r/min] per 1 [ s] .

### <Note>

Even though Pr23 is set up to other than 0, there are other cases when adaptive filter is automatically invalidated. Refer to P.235, "Invalidation of adaptive filter" of Adjustment.

### Parameters Which Are Automatically Set Up.

Following parameters are automatically adjusted. Also fo

Also following parameters are automatically set up.

PrNo.	Title						
10	1st gain of position loop						
11	1st gain of velocity loop						
12	12 1st time constant of velocity loop integrati						
13	1st filter of velocity detection						
14	1st time constant of torque filter						
18 👌	2nd gain of position loop						
19	2nd gain of velocity loop						
1A	2nd time constant of velocity loop integration						
1B	2nd filter of speed detection						
1C	2nd time constant of torque filter						
20	Inertia ratio						
2F	Adaptive filter frequency						

PrNo.	Title	Setup value					
15	Velocity feed forward	300					
16	Time constant of feed forward filter	50					
27	Setup of instantaneous speed observer 0						
30	2nd gain setup	1					
31	1st mode of control switching	10					
32	1st delay time of control switching	30					
33	1st level of control switching	50					
34							
35							
36	2nd mode of control switching	0 80					

### <Notes>

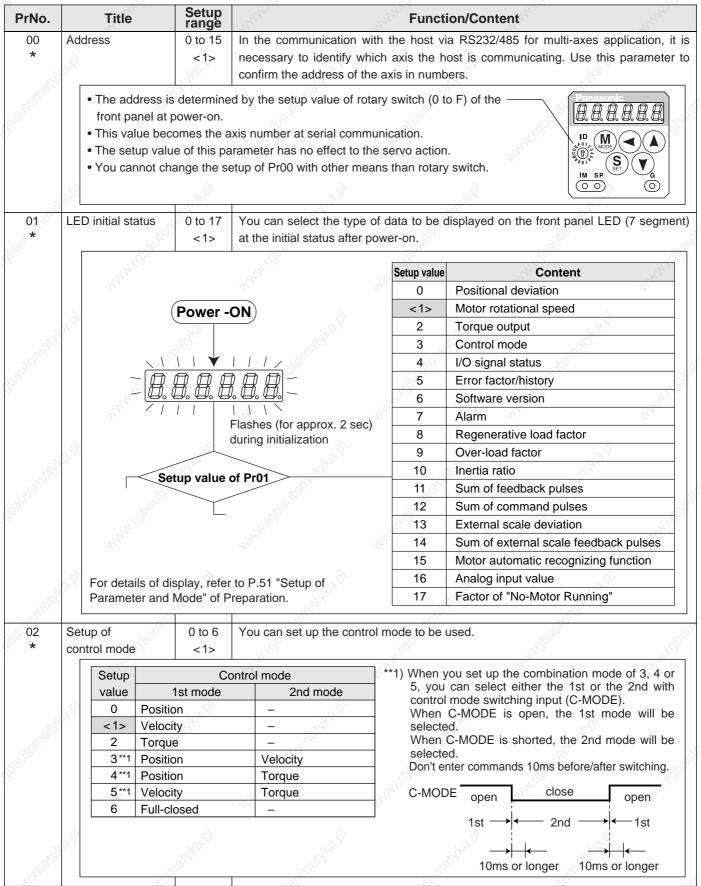
- When the real-time auto-gain tuning is valid, you cannot change parameters which are automatically adjusted.
- Pr31 becomes 10 at position or full closed control and when Pr21 (Setup of Real-Time Auto-Gain Tuning Mode) is 1 to 6, and becomes 0 in other cases.

### Cautions

- (1) After the start-up, you may experience abnormal noise and oscillation right after the first Servo-ON, or when you increase the setup of Pr22 (Selection of machine stiffness at real-time auto-gain tuning), until load inertia is identified (estimated) or adaptive filter is stabilized, however, these are not failures as long as they disappear immediately. If they persist over 3 reciprocating operations, take the following measures in possible order.
  - 1) Write the parameters which have given the normal operation into EEPROM.
  - 2) Lower the setup of Pr22 (Selection of machine stiffness at real-time auto-gain tuning).
  - 3) Set up both Pr21 (Setup of real-time auto-gain tuning) and Pr23 (Setup of adaptive filter mode) to 0, then set up other value than 0. (Reset of inertia estimation and adaptive action)
  - 4) Invalidate the adaptive filter by setting up Pr23 (Setup of adaptive filter mode setup) to 0, and set up notch filter manually.
- (2) When abnormal noise and oscillation occur, Pr20 (Inertia ratio) or Pr2F (Adaptive filter frequency) 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, Pr20 (Inertia ratio) and Pr2F (Adaptive filter frequency) will be written to EEPROM every 30 minutes. When you turn on the power again, auto-gain tuning will be executed using the latest data as initial values.
- (4) When you validate the real-time auto-gain tuning, Pr27 (Setup of instantaneous speed observer) will be invalidated automatically.
- (5) The adaptive filter is normally invalidated at torque control, however, when you select torque control while you set up Pr02 (Control mode setup) to 4 and 5, the adaptive filter frequency before mode switching will be held.
- (6) During the trial run and frequency characteristics measurement of "PANATERM®", the load inertia estimation will be invalidated.

### **Parameters for Functional Selection**

Standard default : < >



### <Notes>

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

Standard default : < >

PrNo.	Title	Setup range	10 alifo.	Function/Content				
03	Selection of	0 to 3	You can set up the torque limiting method for CCW/CW direction.					
	torque limit	<1>	Setup value	All C	CW	CW		
			0	X5 CCW	TL : Pin-16	X5 CWTL : Pin-18		
	2	20	<1>	Pr5E is	a limit value for both	th CCW and CW direction		
		is the	2	Set wi	th Pr5E	Set with Pr5F		
		China Contraction of the Contrac	When GAIN/TL-SEL input is open, set with Pr5E					
		200	3/10	When GA	IN/TL-SEL input is	shorted, set with Pr5F		
	WHIN'GD.		limit setup). A	When the setup value is 0, CCWTL and CWTL will be limited by Pr5E (1st torque limit setup). At the torque control, Pr5E becomes the limiting value for CCW/CW direction regardless of the setup of this parameter.				
04	Setup of	0 to 2	In linear drive	application, you	can use this over-t	ravel inhibiting function to inhibit the		
* 10	over-travel	<1>				ches which are installed at both ends		
	inhibit input	The same				I from damaging the machine due to action of over-travel inhibit input.		
		200	the over-trave					
			. 300	CW direction	Work CCW directi	ion		
	They.		They.			Driver		
	20		E.	Servo motor	Limit Limit	12,		
				_	switch switch CCM	/L		
	5,	73.5.		18.	CWL			
	Setup	CCWL/CWL	~30	)	- 100 m			
	value	input	Input	Connection to COM-	] x0 <sup>ff</sup>	Action		
	Value	mpat	CCWL	Close	50.0	CCW-side limit switch is not activated.		
	" " " " " " " " " " " " " " " " " " "		(CN X5,Pin-9)	Open	)-	ection, permits CW direction.		
	0	Valid	CWL	Close		e CW-side limit switch is not activated.		
			(CN X5,Pin-9)	Open		etion, CCW direction permitted.		
		6	,					
	<1>	Invalid	Both CCWL and CWL inputs will be ignored, and over-travel inhibit function invalidated.					
		(g)	Err38 (Over-travel inhibit input protection) is triggered when either one					
	2	Valid	of the connection of CW or CCW inhibit input to COM– become open.					
	1000		<cautions></cautions>					
	North State of the	ionei Madi	<ol> <li>When Pr04 ates and s travel inhib</li> <li>When both trips with E</li> <li>When your</li> </ol>	tops according tition). For details of CCWL and Crr38 (Overtravel turn off the limit s	o the preset seque , refer to the explan WL inputs are oper inhibit input error) ju switch on upper side	ned while Pr04 is set to 0, the drive udging that this is an error. e of the work at vertical axis applicate.		
	500	200				t because of the loosing of upward		
	"7'(0),		1 1 1 1	1.5	Pr66 to 2, or limit w	ith the host controller instead of us		
07	Selection of sp monitor (SP)	peed 0 to 9 <3>		up the content		nonitor signal output (SP: CN X5 e level and the speed.		
	5,	13·2°	Setup value	Signal of SP	Relation between th	ne output voltage level and the speed		
		28.3	0	7	797)	6V / 47 r/min		
		10th	1:0		100	6V / 188 r/min		
	30%	2	2	Motor actual	200°	6V / 750 r/min		
	"71 <sub>1O.</sub>	"iQ,		speed	7	6V / 3000 r/min		
	11/2/2		<3>		-1	.5V / 3000 r/min		
			5		'	6V / 47 r/min		
	5	9	6		9	6V / 188 r/min		
		15. x	7	Command	7/5.2	6V / 750 r/min		
		18 July 19 Jul	-03	speed	- 200	72		
			8	· ·	4.	6V / 3000 r/min		

Standard default : < >

	Title	Setup range	Partie.		Function/Content	
08	Selection of torque monitor (IM)	0 to 12 <0>	6.47		analog torque monitor of the signal output voltage level and torque or de	
			Setup value	Signal of IM	Relation between the output voltage level and to	orque or deviation pulse counts
	9	- 9	<0>	Torque command	3V/rated (100%)	
	19.,	Sighta.	1	3V / 31Pulse	- A	
	,		2	(A)	3V / 125Pulse	(g)
	1/10		3	Position	3V / 500Pulse	
	100		4	deviation	3V / 2000Pulse	
Jalitofratilia di		5	24	3V / 8000Pulse	74/	
		6	1/10.	3V / 31Pulse	42,	
		7	1 _ %	3V / 125Pulse		
	, <u>(</u> )	20	8	Full-closed	3V / 500Pulse	
		ig/e	9	deviation	3V / 2000Pulse	79/2
		0	10	10	3V / 8000Pulse	Ço.
	all the same of th		11	Torque	3V / 200% torqu	
	. 432		12	command	-07	100
	21/41.		72,	-27	3V / 400% torqu	720
09	Selection of	0 to 8	You can assi	gn the function of	the torque in-limit output (TLC:	CN X5 Pin-40).
	TLC output	<0>	Setup value		Function	Note
	195.	13.5.	<0>	Torque in-limit	output	10.X
		gich.	1	Zero speed dete		For details of
	20%		70,		either one of Over-regeneration	L 5/2
0700	10977		2	-	ute battery/Fan lock/External scale	
	77.02		3		on alarm trigger output	left, refer to the
	"THE		4	Overload alarm		table of P.201,
			5	Absolute battery	•	"Selection of
10.01	8	Parker by	6	Fan lock alarm		TCL and ZSP
	13×		7	.0.13		outputs".
	3		8			outputs .
40,	30)		70)		- 10°	
OA	Selection of	0 to 8	You can assi	gn the function of	the zero speed detection output (	
-		output <1>		tr <sub>ie</sub>	Function	Note
	ZSP output		6-0.7			
	2SP output		0	Torque in-limit		77,
	2SP output		0 <1>	Zero speed dete	ection output	For details of
	ZSP output	18.8	<1>	Zero speed dete Alarm output of	ection output either one of Over-regeneration	n function of each
	2SP output	aleka id	<1>	Zero speed dete Alarm output of /Over-load/Absol	ection output either one of Over-regeneration ute battery/Fan lock/External scale	function of each output of the
	2SP output	ell ke ji	<1>	Zero speed dete Alarm output of /Over-load/Absol Over-regeneration	ection output either one of Over-regeneration ute battery/Fan lock/External scale on alarm trigger output	function of each output of the left, refer to the
	ZSP output	er Arcid	2 3 4	Zero speed dete Alarm output of /Over-load/Absol Over-regenerati Overload alarm	ection output either one of Over-regeneration lute battery/Fan lock/External scale on alarm trigger output output	function of each output of the left, refer to the table of P.201,
	ZSP output		<1> 2  3 4 5	Zero speed dete Alarm output of /Over-load/Absol Over-regenerati Overload alarm Absolute battery	ection output either one of Over-regeneration ute battery/Fan lock/External scale on alarm trigger output output valarm output	function of each output of the left, refer to the table of P.201, "Selection of
	2SP output	ed <sup>te di</sup>	<1> 2  3 4 5 6	Zero speed dete Alarm output of /Over-load/Absol Over-regenerati Overload alarm Absolute battery Fan lock alarm of	ection output either one of Over-regeneration ute battery/Fan lock/External scale on alarm trigger output output v alarm output output	function of each output of the left, refer to the table of P.201, "Selection of TCL and ZSP
	ZSP output	ente ji	<1> 2  3 4 5 6 7	Zero speed dete Alarm output of /Over-load/Absol Over-regenerati Overload alarm Absolute battery Fan lock alarm of External scale a	ection output either one of Over-regeneration lute battery/Fan lock/External scale on alarm trigger output output v alarm output output output larm output	function of each output of the left, refer to the table of P.201, "Selection of
	ZSP output	el <sup>k</sup> Ct.	<1> 2  3 4 5 6	Zero speed dete Alarm output of /Over-load/Absol Over-regenerati Overload alarm Absolute battery Fan lock alarm of External scale a	ection output either one of Over-regeneration ute battery/Fan lock/External scale on alarm trigger output output v alarm output output	function of each output of the left, refer to the table of P.201, "Selection of TCL and ZSP
OB	ood what doubt	0 to 2	<1> 2  3 4 5 6 7 8	Zero speed dete Alarm output of /Over-load/Absol Over-regenerati Overload alarm Absolute battery Fan lock alarm of External scale a In-speed (Speed	ection output either one of Over-regeneration ute battery/Fan lock/External scale on alarm trigger output output valarm output output larm output d coincidence) output	function of each output of the left, refer to the table of P.201, "Selection of TCL and ZSP
0B *	Setup of	0 to 2 <1>	<1> 2  3 4 5 6 7 8  You can set	Zero speed dete Alarm output of /Over-load/Absol Over-regenerati Overload alarm Absolute battery Fan lock alarm of External scale a In-speed (Speed	ection output either one of Over-regeneration ute battery/Fan lock/External scale on alarm trigger output output valarm output butput larm output d coincidence) output	function of each output of the left, refer to the table of P.201, "Selection of TCL and ZSP
	ood what doubt	0 to 2 <1>	<1> 2  3 4 5 6 7 8  You can set of Setup value	Zero speed dete Alarm output of /Over-load/Absol Over-regenerati Overload alarm Absolute battery Fan lock alarm of External scale a In-speed (Speed	ection output either one of Over-regeneration ute battery/Fan lock/External scale on alarm trigger output output valarm output butput larm output d coincidence) output nod of 17-bit absolute encoder.  Content	function of each output of the left, refer to the table of P.201, "Selection of TCL and ZSP
	Setup of	200	<1> 2  3 4 5 6 7 8  You can set  Setup value 0	Zero speed dete Alarm output of /Over-load/Absol Over-regenerati Overload alarm Absolute battery Fan lock alarm of External scale a In-speed (Speed up the using meth	ection output either one of Over-regeneration tute battery/Fan lock/External scale on alarm trigger output output valarm output larm output d coincidence) output nod of 17-bit absolute encoder.  Content tute encoder.	function of each output of the left, refer to the table of P.201, "Selection of TCL and ZSP
	Setup of	200	<1> 2  3 4 5 6 7 8  You can set  Setup value 0 <1>	Zero speed dete Alarm output of /Over-load/Absol Over-regenerati Overload alarm Absolute battery Fan lock alarm of External scale at In-speed (Speed up the using methods Use as an absol Use as an incre	ection output either one of Over-regeneration oute battery/Fan lock/External scale on alarm trigger output output valarm output larm output d coincidence) output nod of 17-bit absolute encoder.  Content output encoder. mental encoder.	function of each output of the left, refer to the table of P.201, "Selection of TCL and ZSP outputs".
	Setup of	200	<1> 2  3 4 5 6 7 8  You can set of the set o	Zero speed dete Alarm output of /Over-load/Absol Over-regenerati Overload alarm Absolute battery Fan lock alarm of External scale at In-speed (Speed up the using methods Use as an absol Use as an incre	ection output either one of Over-regeneration tute battery/Fan lock/External scale on alarm trigger output output valarm output larm output d coincidence) output nod of 17-bit absolute encoder.  Content tute encoder.	function of each output of the left, refer to the table of P.201, "Selection of TCL and ZSP outputs".
	Setup of	200	<1> 2  3 4 5 6 7 8  You can set  Setup value 0 <1> 2 <caution></caution>	Zero speed determined Alarm output of Alarm output of Over-load/Absol Over-regeneration Overload alarm Absolute battery Fan lock alarm of External scale at In-speed (Speed up the using method Use as an absolute as an	ection output either one of Over-regeneration lute battery/Fan lock/External scale on alarm trigger output output valarm output larm output d coincidence) output nod of 17-bit absolute encoder.  Content lute encoder. mental encoder. lute encoder, but ignore the multi	function of each output of the left, refer to the table of P.201, "Selection of TCL and ZSP outputs".
* not the	Setup of absolute encoder	<1>	<1> 2 3 4 5 6 7 8 You can set Setup value 0 <1> 2 <caution> This parameter</caution>	Zero speed determined Alarm output of Alarm output of Over-load/Absol Over-regeneration Overload alarm Absolute battery Fan lock alarm of External scale at In-speed (Speed up the using method Use as an absolute as an absolute as an absolute will be invalidated.	ection output either one of Over-regeneration lute battery/Fan lock/External scale on alarm trigger output output valarm output decoincidence) output larm output decoincidence) output lute encoder. Content lute encoder. lute encoder, but ignore the multi ted when 5-wire, 2500P/r increme	function of each output of the left, refer to the table of P.201, "Selection of TCL and ZSP outputs".
* 0C	Setup of absolute encoder	<1>	<1> 2 3 4 5 6 7 8 You can set Setup value 0 <1> 2 <caution> This parameter</caution>	Zero speed determined Alarm output of Alarm output of Over-load/Absol Over-regeneration Overload alarm Absolute battery Fan lock alarm of External scale at In-speed (Speed up the using method Use as an absolute as an absolute as an absolute will be invalidated.	ection output either one of Over-regeneration ute battery/Fan lock/External scale on alarm trigger output output valarm output larm output d coincidence) output nod of 17-bit absolute encoder.  Content lute encoder. mental encoder. lute encoder, but ignore the multi ted when 5-wire, 2500P/r incremental encoder.	function of each output of the left, refer to the table of P.201, "Selection of TCL and ZSP outputs".
philiotron.	Setup of absolute encoder  Baud rate setup of RS232	<1>	<1> 2  3 4 5 6 7 8  You can set  Setup value 0 <1> 2 <caution> This paramet You can set</caution>	Zero speed determined and a speed determined	ection output either one of Over-regeneration interpretation output output valarm output dicoincidence) output and of 17-bit absolute encoder. Content interpretation inter	function of each output of the left, refer to the table of P.201, "Selection of TCL and ZSP outputs".  -turn counter over.  ental encoder is used. of baud rate is ±0.5%.
* 0C	Setup of absolute encoder	<1>	<1>  2   3   4   5   6   7   8	Zero speed determined Alarm output of Alarm output of Over-load/Absol Over-regeneration Overload alarm Absolute battery Fan lock alarm of External scale at In-speed (Speed up the using method Use as an absolute as an absolute as an absolute will be invalidated up the communication Baud ra	ection output either one of Over-regeneration lute battery/Fan lock/External scale on alarm trigger output output valarm output decoincidence) output larm output decoincidence) output lute encoder. Content lute encoder. lute encoder, but ignore the multi ted when 5-wire, 2500P/r increme ation speed of RS232.  Error  Setup value	function of each output of the left, refer to the table of P.201, "Selection of TCL and ZSP outputs".  -turn counter over.  ental encoder is used.  of baud rate is ±0.5%.  Baud rate
* 0C	Setup of absolute encoder  Baud rate setup of RS232	<1>	<1> 2  3 4 5 6 7 8  You can set  Setup value 0 <1> 2 <caution> This paramet You can set</caution>	Zero speed determined and a speed determined	ection output either one of Over-regeneration ute battery/Fan lock/External scale on alarm trigger output output valarm output decoincidence) output and of 17-bit absolute encoder.  Content lute encoder. Indee encoder, but ignore the multi ted when 5-wire, 2500P/r increme ation speed of RS232.  Error  Setup value S	function of each output of the left, refer to the table of P.201, "Selection of TCL and ZSP outputs".  -turn counter over.  ental encoder is used. of baud rate is ±0.5%.

Standard default : < >

PrNo.	Title	Setup range	Function/Content					
0D *	Baud rate setup of	0 to 5	You can set up the communication speed of RS485. • Error of baud rate is $\pm 0.5\%$ .					
	RS485	<2>	Setup value	Baud rate	Setup va	lue	Baud rate	
	communication		0	2400bps	3		19200bps	
	\$	20	1	4800bps	4		38400bps	
297	્રે	28 Jr.	<2>	9600bps	5	25/3/	57600bps	
0E *	Setup of front	0 to 1	W).	operation of the front	panel to the	Setup value	Content	
*	panel lock	<0>	monitor mode on	100		<0>	Valid to all	
	They.		ted parameter ch	such a misoperation ange.	as unexpec-	1	Monitor mode only	
			<note></note>					
W.	<b>\</b>	16.01	A 2	nge parameters via co		•	4 X	

### Parameters for Adjustment of Time Constants of Gains and Filters

Standard default: < >

PrNo.	Title	Setup range	Unit	Function/Content
10	1st gain of position loop	O to 3000 A to C-frame:<63>* D to F-frame:<32>*	1/s	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.
11	1st gain of velocity loop	1 to 3500 A to C-frame:<35.5* D to F-frame:<18.5*	Hz	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 Pr20 is set correctly, the setup unit of Pr11 becomes (Hz).</caution>
12	1st time constant of velocity loop integration	1 to 1000 A to C-frame:<16>* D to F-frame:<31>*	ms	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 "999".  The integration effect will be lost by setting to "1000".
13	1st filter of speed detection	0 to 5 <0>*	_	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.
14	1st time constant of torque filter	O to 2500 A to C-frame:<65>* D to F-frame:<126>*	0.01ms	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.
15	Velocity feed forward	-2000 to 2000 <300>*	0.1%	You can set up the velocity feed forward volume at position control.  Higher the setup, smaller positional deviation and better response you can obtain, however this might cause an overshoot.
16	Time constant of feed forward filter	0 to 6400 <50>*	0.01ms	You can set up the time constant of 1st delay filter inserted in velocity feed forward portion.  You might expect to improve the overshoot or noise caused by larger setup of above velocity feed forward.

### <Notes>

- For parameters which No. have a suffix of "\*", changed contents will be validated when you turn on the control power.
- Parameters which default values have a suffix of "\*" will be automatically set up during real time auto-gain tuning. When you change manually, invalidate the real-time auto-gain tuning first then set, referring to P.239, "Release of Automatic Gain Adjusting Function" of Adjustment.

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content
18	2nd gain of position loop	O to 3000 A to C-frame:<73>* D to F-frame:<38>*	1/s	Position loop, velocity loop, speed detection filter and torque command filter have their 2 pairs of gain or time constant (1st and 2nd).  For details of switching the 1st and the 2nd gain or the time constant, refer
19	2nd gain of velocity loop	1 to 3500 A to C-frame:<35>* D to F-frame:<18>*	Hz	to P.226, "Adjustment".  The function and the content of each parameter is as same as that of the 1st gain and time constant.
1A	2nd time constant of velocity loop integration	1 to 1000 <1000>*	ms	ignatio, "Aparico, "Aparic
1B	2nd filter of velocity detection	0 to 5 <0>*	21/12	Mary, Mary, Mary,
1C	2nd time constant of torque filter	O to 2500 A to C-frame:<65>* D to F-frame:<126>*	0.01ms	11 140 th 11 11 11 11 11 11 11 11 11 11 11 11 11
1D	1st notch frequency	100 to 1500 <1500>	Hz	You can set up the frequency of the 1st resonance suppressing notch filter. The notch filter function will be invalidated by setting up this parameter to "1500".
1E	1st notch width selection	0 to 4 <2>	Mr.	You can set up the notch filter width of the 1st resonance suppressing filter in 5 steps. Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.

# **Parameters for Auto-Gain Tuning**

Standard default : <

PrNo.	PrNo. Title Setup range Unit Function/Content									
20	Inertia ratio	0 to 10000	%	You can set up the ratio of the load inertia against the rotor (of the motor) inertia.						
	8	<250>*		Pr20= (load in	nertia/rotor inertia) X 100 [	%]				
	When you execute the normal auto-gain tun automatically estimated after the preset act reflected in this parameter.  The inertia ratio will be estimated at all time valuation tuning is valid, and its result will be saved to E <caution>  If the inertia ratio is correctly set, the set becomes (Hz). When the inertia ratio of Pr20 setup unit of the velocity loop gain becomes ratio of Pr20 is smaller than the actual, the set gain becomes smaller.</caution>				ction, and this result will be while the real-time auto-gair EEPROM every 30 min.  etup unit of Pr11 and Pr15 0 is larger than the actual, the s larger, and when the inertial					
21	Setup of real-time auto-gain tuning	0 to 7 <1>	naniigo	With higher setup of the inertia du operation. Use 1 use with the setup	ring operation, however or 4 for normal operation.	respond quickly to the change it might cause an unstable for the vertical axis application				
	».d	ic/Ko.O		Setup value	Real-time auto-gain tuning	Varying degree of load inertia in motion				
	200	0.		0	Invalid	,or -				
	2377			<1>	:0 <sup>1</sup> / <sub>2</sub>	Little change				
	17.00			2	Normal mode	Gradual change				
	227			3		Rapid change				
	**************************************									
				4		Little change				
	9	6		5	Vertical axis mode	Little change Gradual change				
	10 cg	. 142.D			Vertical axis mode					

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content	Na <sub>IIO</sub>					
22	Selection of machine stiffness	0 to 15 A to C-frame:	THY.	You can set up the machine stiffness in 16 steps while the real- gain tuning is valid.	time auto-					
Taldka.	at real-time auto-gain tuning	<4> D to F-frame: <1>		low←machine stiffness→ high low← servo gain → high  Pr22 0, 114, 15  low← response → high						
B. It.C.	Many Ignito,		ingillonic	<a href="#"><caution></caution></a> When you change the setup value rapidly, the gain changes well, and this may give impact to the machine. Increase gradually watching the movement of the machine.						
23	Setup of adaptive filter mode	0 to 2 <1>	- Control of the cont	You can set up the action of the adaptive filter.  0: Invalid  1: Valid  2: Hold (holds the adaptive filter frequency when this setup is changed to <b>Caution&gt;</b> When you set up the adaptive filter to invalid, the adaptive filter frequency of Pr2F will be reset to 0. The adaptive filter is always invalid a torque control mode.						
24	Selection of damping filter switching	0 to 2 <0>		You can select the switching method when you use the damping filter 0: No switching (both of 1st and 2nd are valid.)  1: You can select either 1st or 2nd with damping control switching (VS-SEL).  when VS-SEL is opened, 1st damping filter selection (Pr2B, 20 when VS-SEL is close, 2nd damping filter selection (Pr2D, 2E)  2: You can switch with the position command direction.  CCW: 1st damping filter selection (Pr2B, 2C).  CW: 2nd damping filter selection (Pr2D, 2E).						
25	Setup of an action	0 to 7	_	You can set up the action pattern at the normal mode auto-gain	tuning.					
West,	at normal mode	<0>		Setup value Number of revolution Rotational direction						
BUIL	auto-gain tuning		End i Gorge	$ \begin{array}{ c c c c }\hline <0> \\\hline 1\\\hline 2\\\hline 3\\\hline \end{array} \hspace{0.5cm} 2 \hspace{0.1cm} [ \hspace{0.1cm} \text{revolution} ] \hspace{0.1cm} \begin{array}{ c c c c c c c c c c c c c c c c c c c$	MA SOLITO					
Wagho.	)	Acij		$ \begin{array}{c c} 4 & & & CCW \rightarrow CW \\ \hline 5 & & CW \rightarrow CCW \\ \hline 6 & & CCW \rightarrow CCW \\ \end{array} $						
Salito.	"Tapanic,		1929,40	e.g.) When the setup is 0, the motor turns 2 revolutions to CCW and revolutions to CW.						
26	Setup of software limit	0 to 1000 <10>	0.1 revolution	You can set up the movable range of the motor against the position						
28	2nd notch frequency	100 to 1500 <1500>	Hz	You can set up the 2nd notch width of the resonance suppressing filter in 5 steps. The notch filter function is invalidated by setting up this parameter to "1500".						
29	Selection of 2nd notch width	0 to 4 <2>	huniggs.	You can set up the notch width of 2nd resonance suppressing steps. Higher the setup, larger the notch width you can obtain.  Use with default setup in normal operation.	filter in 5					
2A	Selection of 2nd notch depth	0 to 99 <0>	_	You can set up the 2nd notch depth of the resonance suppressing fi the setup, shallower the notch depth and smaller the phase delay you compared to the setup.	•					

### <Notes>

• Parameters which default values have a suffix of "\*" will be automatically set up during real time auto-gain tuning. When you change manually, invalidate the real-time auto-gain tuning first then set, referring to P.239, "Release of Automatic Gain Adjusting Function" of Adjustment.

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content						
2B	1st damping frequency	0 to 2000 <0>	0.1Hz	You can set up the 1st 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 10.0 to 200.0[ Hz] . Setup of 0 to 99 becomes inval Refer to P.250, "Damping control" as well before using this parameter.						
2C	Setup of 1st damping filter	-200 to 2000 < 0>	0.1Hz	While you set up Pr2B (1st damping frequency), set this up to smaller value when torque saturation occurs, and to larger value when you need faster action. Use with the setup of 0 in normal operation. Refer to P.250, "Damping control" of Adjustment. <caution> Setup is also limited by 10.0[ Hz] —Pr2BPr2C≦Pr2B</caution>						
2D	2nd damping frequency	0 to 2000 <0>	0.1Hz	You can set up the 2nd damping frequency of the damping control which suppress vibration at the load edge.  The driver measures vibration at the load edge. Setup unit is 0.1 [ Hz] .  Setup frequency is 10.0 to 200.0 [ Hz] . Setup of 0 to 99 becomes invalid. Refer to P.250, "Damping control" of Adjustment as well before using this parameter.						
2E	Setup of 2nd damping filter	-200 to 2000 < 0>	0.1Hz	While you set up Pr2D (2nd damping frequency), set this up to smaller value when torque saturation occurs, and to larger value when you need faster action.  Use with the setup of 0 in normal operation. Refer to P.250, "Damping control" of Adjustment. <caution> Setup is also limited by 10.0[ Hz] -Pr2Pr2E=Pr2D</caution>						
2F	Adaptive filter frequency	0 to 64 <0>	NAVA GRE	Displays the table No. corresponding to the adaptive filter frequency. (Refer to P.234 of Adjustment.) This parameter will be automatically set and cannot be changed while the adaptive filter is valid. (when Pr23 (Setup of adaptive filter mode) is other than 0.)  0 to 4 Filter is invalid.  5 to 48 Filter is valid.  49 to 64 Filter validity changes according to Pr22.  This parameter will be saved to EEPROM every 30 minutes while the adaptive filter is valid, and when the adaptive filter is valid at the next power-on, the adaptive action starts taking the saved data in EEPROM as an initial value. <caution>  When you need to clear this parameter to reset the adaptive action while the action is not normal, invalidate the adaptive filter (Pr23, "Setup of adaptive filter mode" to 0) once, then validate again.  Refer to P.239, "Release of Automatic Gain Adjusting Function" of Adjustment as well.</caution>						

# Parameters for Adjustment (2nd Gain Switching Function)

Standard default : < >

PrNo.	Title	Setup range	Unit		Function	/Content				
30	Setup of 2nd gain	0 to 1	_	You can select the F	PI/P action switching of the	ne velocity control or 1st/2nd gain switching.				
"IIO"	"Iţo,	<1>*	o o	Setup value	Setup value Gain selection/switchin				Gain selection/switching	ection/switching
30,0	'Sp'		1900	0	1st gain (PI/I	P switching enabled) *1				
	Alay.		my	<1>* 1st/2nd gain switching enabled *2						
	6	6		*1 Switch the PI/P action with the gain switching input (GAIN CN X5, Pin-27). PI is fixed when Pr03 (Torque limit selection) is 3.						
1	3.x	N3.7		GAI	N input	Action of velocity loop				
Elge,	.5	Or.	1	Open v	vith COM-	PI action				
MO.	"Ito.		o o	Connec	t to COM-	P action				
300	12.44.1GC		"Lunigo,	*2 For switching condition of the 1st and the 2nd, refer to P.243, 'Switching Function" of Adjustment.						

Standard default: < >

PrNo.	Title	Setup range	Unit	Function/Content							
31	1st mode of	0 to 10	4.0	You can select the switching condition of 1st gain and 2nd gain while Pr30							
	control switching	<0>*	E24.	is set to 1.							
	Setup value	Gain switching condition									
	<0>*	Fixed to the 1st gain.									
	1	Fixed to the 2nd gain.									
	2 *1	· ·		en the gain switching input is turned on. (Pr30 setup must be 1.)							
	*2			en the toque command variation is larger than the setups of							
	3 2	-		rol switching) and Pr34 (1st hysteresis of control switching).							
	4 *2	Fixed to the		an an							
	5 *2		A.	en the command speed is larger than the setups of							
		-		rol switching) and Pr34 (1st hysteresis at control switching).							
	2 *2	7.55		en the positional deviation is larger than the setups of							
	6 2	Pr33 (1st control switching level) and Pr34 (1st hysteresis of control switching).									
	7 *2	2nd gain selection when more than one command pulse exist between 166µs.									
	*2	2nd gain selection when the positional deviation counter value exceeds the setup of									
	8 2	Pr60 (Positioning completer range).									
	2 *2	2nd gain selection when the motor actual speed exceeds the setup of									
	9 2	-		rol switching) and Pr34 (1at hysteresis of control switching).							
	*2			ain while the position command exists.							
	10		-	in when no-position command status lasts for the setup of Pr32 [ x 166s]							
	, i		-	ower than the setups of Pr33-34[ r/min] .							
	10,		16	*1 Fixed to the 1st gain regardless of GAIN input, when Pr31 is set to 2							
	7200		7000	and Pr03 (Torque limit selection) is set to 3.							
	415		410								
	Tr.		120	*2 For the switching level and the timing, refer to P.243, "Gain Switching							
20	4 at alalayy time a af	0.45.40000	v 400 a	Function" of Adjustment.							
32	1st delay time of	0 to 10000	χ τοομς	You can set up the delay time when returning from the 2nd to the 1st gain							
	control switching	<30>*		while Pr31 is set to 3 or 5 to 10.							
33	1st level of	0 to 20000		You can set up the switching (judging) level of the 1st and the 2nd gains							
33	70.	<50>*		while Pr31 is set to 3, 5, 6. 9 and 10.							
	control switching	< 50>	10,0	70, 1							
34	1 at by atorogia	0 to 20000	age.	Unit varies depending on the setup of Pr31 (1st mode of control switching) You can set up hysteresis width to be							
34	1st hysteresis			implemented above/below the							
	of control switching	<33>		judging level which is set up with Pr33							
	8	10.7		Pr33. Unit varies depending on the							
	Ś	39.		setup of Pr31 (1st control switching 0							
	105		. 89	mode). Definitions of Pr32 (Delay),							
	2000		7037	Pr33 (Level) and Pr34 (Hysteresis)							
	410		410	are explained in the fig. below.							
	Ily,	4	124	<caution></caution>							
				The setup of Pr33 (Level) and Pr34 (Hysteresis) are valid as absolute							
0.5	Outtable of	0.45 40000	1	values (positive/negative).							
35	Switching time of	0 to 10000		You can setup the step- by-step switching time to Kp1(Pr10) = 166 166 166 Kp1(Pr10) = Kp2(Pr18							
	position gain	<20>*	value +1)	the position loop gain (PT(FTO)							
	770		x 166μs	only at gain switching							
	'92,0		1900	while the 1st and the 2nd							
	74/		" My	gain switching is valid. $Kp2(Pr18) \rightarrow$							
	The.	-	17.0	<caution> 1st gain 2nd gain 1st gain</caution>							
				The switching time is							
	2	200		only valid when switching from small position gain to large position gain.							
3D	JOG speed setup	0 to 500	r/min	You can setup the JOG speed.							
		<300>		Refer to P.75, "Trial Run" of Preparation.							

### <Notes>

• Parameters which default values have a suffix of "\*" will be automatically set up during real time auto-gain tuning. When you change manually, invalidate the real-time auto-gain tuning first then set, referring to P.239, "Release of Automatic Gain Adjusting Function" of Adjustment.

# **Parameters for Position Control**

Standard default : < >

PrNo.	Title		Setup range	Function/Content									
40	Selection of c		0 to 1	You can select either the photo-coupler input or the exclusive input for line dr								driver	
*	mand pulse in	nput	<0>	the comman	nd pulse inp	out.		9			9		
	Setup value		Thom		"Tho.	Conter	nt 📈			1/2	9		
	<0>	Photo	o-coupler in	put (X5 PULS1:Pin-3, PULS2:Pin-4, SIGN1:Pin-5, SIGN2:Pin-6)									
	1	Exclu	isive input f	out for line driver (X5 PULSH1:Pin-44, PULSH2:Pin-45, SIGNH1:Pin-46, SIGNH2:Pin-46, SIGNH2:Pin-4									
41 *	Command purotational dire		0 to 1	You can set up the rotational direction against the command pulse input, and the command pulse input format.									
	setup	00	101	Pr41 setup value	Pr42 setup value	Command	- 25				77		
42 *	Setup of compulse input me		0 to 3	(Command pulse rotational direction setup)	(Command pulse input mode setup)	pulse	Signal title	CCW	comma	and	CW cor	nmand	
	paise inpacin	palicí	gel.	Wight of the	0 or 2	90° phase difference 2-phase pulse (A + B-phase)	PULS SIGN	A-phase  B-phase	t1 t1 t1 t1 vances to A	by 90°. B-pl		from A by §	
			à	<0>	<1>	CW pulse train + CCW pulse train	PULS SIGN		2 t2	t3	12 t2	4	
			Sigho.	350	101 3	pulse train + Signal	PULS SIGN	to to	4 t5 " H"	t6 t6	t4 t5 " L"	t6	
				WHAN GOOD	0 or 2	90° phase difference 2-phase pulse (A + B-phase)	PULS SIGN	A-phase H		by 90°. B-pl	t1 t1 t1 t1 nase advance	ees to A by 9	
	181 <sup>3</sup> 201		(Sichorb)	1	naty 4.0	CW pulse train + CCW pulse train	PULS SIGN	- t	2 t2	t3	2 t2		
				""HIQDING	3	pulse train + Signal	PULS SIGN	†6	4 t5 " L"	t6 t6	t4 t5 " H"	t6	
• Perr	nissible max. ir	nput fre	equency, ar	nd min. neces	sary time w	idth of comn	nand pul	se input	signal.			12	
	_	-			-	ermissible max		•		ary time	width		
NI NI	Input I	/F of F	PULS/SIGN	I signal	0.	nput frequency		t <sub>2</sub>	t <sub>3</sub>	t <sub>4</sub>	t <sub>5</sub>	t <sub>6</sub>	
Pulse	train interface	exclus	sive to line	driver	200	2Mpps	500ns			250ns			
X000		×0.	Line driver		2.	500kpps	2μs	1μs	1μs	1µs	1μs	1μs	
Pulse	train interface	1097		ctor interface		200kpps	5μs	2.5µs			2.5µs	2.5µs	
Make	the rising/fallin	g time	•	(4)	nput signal	- (~)			14/10			- C416	
	70/2			727,		70,		n (al: d = 1	ion of th		nond =:	ulaa iaki	
43	Invalidation of command pul		0 to 1 <1>	You can select either the validation or the invalidation of the command pulse input (INH : CN X5 Pin-33).							iise inni		
	inhibit input		3 Ho.	Setup value	- 3				"Ao.,				
			Con.	0	10°	Valid Valid							
				<1>		Invalid	9.						
				COM W	hen you do	nt will be inhil o not use INI (CN I/F Pin-3	H input,	set up	Pr43 to	1 so th	at you	may no	

### <Notes>

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

## [Connection and Setup of Full-closed Control]

Standard default : < >

PrNo.	Title	Setup range	Zalio.	Function/Con	tent	~31 <sub>20</sub> ,
44	Numerator of pulse output division	1 to 32767 <2500>	You can set up the pul 21, OA-: Pin-22, OB+:	se counts to be fed out fr Pin-48, OB-: Pin-49).	om the pulse outputs	(X5 OA+: Pin-
Mitoling Age		ke d	logic) is 2 or 3.) Pr45 = 0 : No division When Pr45 is other according to the form Travel per one	ode is full-closed control will be executed. than 0, travel per one pul	lse will be divided with	
Nitorial Ho	igh and a state of the state of	Hardy .	<ul> <li>[ É m] for ST771 s</li> <li>Setup of Pr44 &gt; Pr</li> <li>Z-phase will be fed absolute position at</li> </ul>	e of the external scale is eries. 45 becomes invalid. (In thout synchronizing with A-pfirst time after the control pintervals set with Pr47 (Z-	is case, no division wi hase when the work co power is turned on. Afte	Il be executed) rosses the zero er this, Z-phase
45 *	Denominator of pulse output division	0 to 32767 <0>	(Reversal of pulse ou You can set up the p	mode is position, veloc	4.	2,
atternative	, while the little litt	<i>X</i> ************************************	and OB with the quadruple can be of the pulse output	e output pulse counts per Pr44 setup. Therefore obtained from the formula t resolution per one revolumerator of pulse output of	the pulse output res below. ution	
alionally.	, Receipted to the second seco	Hod)	• Pr45≠0: The pulse output according to the fo Pulse output resolution p <cautions></cautions>	resolution per one revolution	ution can be divided or of pulse output division) x E	incoder resolution
alicholyk	, planter.	ho'd	10000 [ P/r] for the first output encoder resolution (In the above setulent output encoder resolution)     The pulse is fed out the first output encoder resolution (In the above setulent encoder)      The pulse output encoder output encoder resolution (In the pulse output encoder)      The pulse output encoder resolution (In the pulse output encoder)      The pulse output encoder resolution (In the pulse output encoder)      The pulse output encoder resolution (In the above setulent encoder)      The pulse output encoder resolution (In the above setulent encoder)      The pulse output encoder resolution (In the above setulent encoder)      The pulse output encoder resolution (In the above setulent encoder)      The pulse output encoder resolution (In the above setulent encoder)      The pulse output encoder encode	ne 5-wire 2500P/r increment resolution per one revolution, the pulse output resolution court resolution obtained from the with A-phase. In other der resolution, and becomes with A-phase, and becomes with A-phase.	ental encoder. colution cannot be gra- ion equals to the enco of the motor. m the above formula in case, the Z-phase was	eater than the der resolution.) s multiple of 4, vidth equals to
Alichard Me	, dballond	Hadi .	A	Pr44 is multiple of 4 when A B Z		is not multiple of 4

# Parameter Setup

Standard default : < >

The state of the s		0-1	- 6	(O.,	The state of the s		Standard default : <
PrNo.	Title	Setup range	Variety.		Function	/Content	
46 *	Reversal of pulse output logic	0 to 3 <0>	: Pin-48, OB	– : Pin-49).	With this param	eter, you can	of the pulse output (X5 OB+ reverse the phase relation rersing the B-phase logic.
	9	6	Cotum	A phase	at motor CCW	/ rotation	at motor CW rotation
	(b).	affa.	Setup value	A-phase (OA)	162		ST
	autor	C.		B-phase(OB) non-reversal			
	'MAI'GD'			B-phase(OB) reversal			
	17,		Pr46	В-р	hase logic	10	Output source
	A		<0>	No	n-reversal		Encoder position
	873	10.7	1	13.7	Reversal	25.	Encoder position
		ich.	2 *1	No.	on-reversal		xternal scale position
	10		3 *1	1	Reversal	E	xternal scale position
	1000		*1 The outpu	it source of Pi	46=2, 3 is valid	only at full-clo	sed control.
47 *	Z-phase setup of external scale	0 to 32767 <0>	external scal source for th pulse output	e (before qua e pulse outpu logic) is 2 or 3	adruple), when t. (Pr02, (Contro t.)	you use the e	phase output pulses of the external scale as an output is 6 and Pr46 (Reversal of
		Gid!		47 = < 0 > (details)	erauit), of the external s	cale.	all light
	"MMI GDO JEO		Z-phase absolute	position of 0	ut synchronizing	r the control p	when the work crosses the ower on. After this, Z-phase
48	-				n-related (Pr48	· · · · · · · · · · · · · · · · · · ·	
49	electronic gear  2nd numerator of electronic gear	0 to 10000 <0>	(1) You ca (2) You ca obtain t	an increase th	motor revolution e nominal comm eed due to the li	and pulse free	input command unit. Juency when you cannot Juerator of the host controller.
4A	Multiplier of	0 to 17	Commai pulse		erator (Pr48) nerator (Pr49) x 2	Multiplier (Pr4A)	Internal command + Deviation counter
N	electronic gear numerator	<0>	f	10:5	Denominator (Pr	4B)	F counter  External scale Feed back
4B	Denominator of	0 to 10000	25	Sec.	William.		pulse
	electronic gear	<10000>	*1 : Selec				(Resolution)  ronic gear input switching
	7,		2,	DIV input op	en	Selection of	st numerator (Pr48)
	A			DIV input co	nnect to COM-	Selection of 2	2nd numerator (Pr49)
	97	13/12.X	The electroni	c gear ratio is	set with the form	nula below.	
	doaltof		• when the numerator is <0> (Default) :Numerator (Pr48,49)X2 <sup>Pr4A</sup> ) is at ically set equal to encoder resolution				
	"47'LO		Flectron	ic gear ratio =	W.C.	Encoder res	olution
	124		Liection	o geal fallo =	Command pu	lse counts per	one revolution (Pr48)
	94	etilka.di		nerator ≠ 0 : ic gear ratio =	Numerator of electronic ge	f command ar (Pr48,49) X	2 Multiplier of command 2 div/multiple numerator (Pr4A)
	108 <sup>1</sup> 10 <sup>1</sup>		<caution></caution>				OBJEC.
	"" Hylo,			culation of nu the max. valu		Pr49) X2 <sup>Pr4A</sup> , <sup>4</sup>	1194304 (Pr4D setup value
	1	1			-	247	

## [Connection and Setup of Full-closed Control]

Standard default : < >

PrNo.	Title	Setup range	Function/Content
4C	Setup of primary	0 to 7	Smoothing filter is the filter for primary delay which is inserted after the electronic
	delay smoothing	<1>	gear.
nic Major ka (	, thallomai	<sup>ko</sup> g	Purpose of smoothing filter  • Reduce the step motion of the motor while the command pulse is rough.  • Actual examples which cause rough command pulse are;  (1) when you set up a high multiplier ratio (10 times or more).  (2) when the command pulse frequency is low.
	"Ay'.		You can set the time constant of the smoothing filter in 8 steps with Pr4C.
	The state of the s	-	Setup value Time constant
			0 No filter function
	5.	13.S.	<1> Time constant small
	Š	3	1 3 1 1 3 1
10 C	1000		7 Time constant large
4D *	Setup of FIR smoothing	0 to 31 <0>	You can set up the moving average times of the FIR filter covering the command pulse. (Setup value + 1) become average travel times.
4E	Counter clear	0 to 2	You can set up the clearing conditions of the counter clear input signal which clears
	input mode	<1>	the deviation counter.
	2	13.9	Setup value Clearing condition
" Sight	Á	3	0 Clears the deviation counter at level (shorting for longer than 100μs)*1
	100		<1> Clears the deviation counter at falling edge (open-shorting for longer than 100μs)*1
87	4000		2 Invalid
	MANNE		*1 : Min. time width of CL signal
13	>	12.01	CL(Pin-30) 100μs or longer

## <Notes>

# **Parameter Setup**

## Parameters for Velocity and Torque Control

Standard default : < >

PrNo.	Title	Setup range	Unit	Function/Content
5E	1st torque limit setup	0 to 500 <500> *2	%	You can set up the limit value of the motor output torque (Pr5E : 1st torque, Pr5F : 2nd torque). For the torque limit selection, refer to Pr03 (Torque limit selection).
Wile.	.6	(g)		This torque limit function limits the max. motor torque inside of the
5F	2nd torque limit setup	0 to 500 <500> *2	%	driver with parameter setup.  In normal operation, this driver permits approx. 3 times larger torque than the rated torque instantaneously. If this 3 times bigger torque causes any trouble to the load (machine) strength, you can use this function to limit the max. torque.
gallonats)	a.Q. www.ldballof			<ul> <li>Setup value is to be given in % against the rated torque.</li> <li>Right fig. shows example of 150% setup with Pr03=1.</li> <li>Pr5E limits the max. torque for both CCW and CW directions.</li> </ul>
Baltonati	a.di	14. d.	**!Qgg	<b><caution></caution></b> You cannot set up a larger value to this parameter than the default setup value of "Max. output torque setup" of System parameter (which you cannot change through operation with PANATERM® or panel). Default value varies depending on the combination of the motor and the driver. For details, refer to P.57, "Setup of Torque Limit " of Preparation.

## <Note>

• For parameters which default, has a suffix of "\*2", value varies depending on the combination of the driver and the motor.

## **Parameters for Sequence**

Standard default : < >

				Standard default.
PrNo.	Title	Setup range	Unit	Function/Content
60	Positioning complete(In-position) range	0 to 32767 <131>	Pulse	You can set up the timing to feed out the positioning complete signal (COIN: CN X5, Pin-39).  The positioning complete signal (COIN) will be fed out when the deviation counter pulse counts fall within ± (the setup value), after the command pulse entry is completed.  The setup unit should be the encoder pulse counts at the position control and the external scale pulse counts at the full-closed control.
Ballemard	'a'd'	(Educid	19 <sub>0</sub>	Basic unit of deviation pulse is encoder "resolution", and varies per the encoder as below.  (1) 17-bit encoder: 2 <sup>17</sup> = 131072  (2) 2500P/r encoder: 4 X 2500 = 10000  Cautions>  If you set up too small value to Pr60, the time until the pulses  deviation pulses  A Caution pulses
o.HEMBEN	od why.	(Maril	May.	COIN signal is fed might become longer, or cause chattering at output.  2. The setup of "Positioning complete range" does not give any effect to the final positioning accuracy.  Pr60  ON  Pr60

## [Connection and Setup of Full-closed Control]

Standard default: < >

61	Zero-speed	range		
	Zeio-speed	10 to 20000 <50>	r/min	You can set up the timing to feed out the zero-speed detection output signal (ZSP: CN X5, Pin-12 or TCL: CN X5, Pin-40) 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, Pr61.
into Lighter,		A. S.	(May idlo) the	The setup of P61 is valid for both CCW and CW direction regardless of the motor rotating direction. There is hysteresis of 10 [ r/min] .  (Pr61-10)r/min  CW  ON
		,2 <sup>(2)</sup>		
63	Setup of positioning	0 to 3 <0>	-	You can set up the action of the positioning complete signal (COIN: Pin-39 of CN X5) in combination with Pr60 (Positioning complete range).
	complete		201/10	Setup value Action of positioning complete signal
	(In-position)		410	The signal will turn on when the positional deviation is smaller than Pr60 (Positioning complete range)
	output	-	U.	The signal will turn on when there is no position command and the
,				positional deviation is smaller than Pr60 (Positioning complete range).  The signal will turn on when there is no position command, the
Tho.		"OUTS HODE.		zero-speed detection signal is ON and the positional deviation is
"Ollier,				smaller than Pr60 (Positioning complete range).  The signal will turn on when there is no position command and the
775			Spann.	positional deviation is smaller than Pr60 (Positioning complete range). Then holds "ON" status until the next position command is entered.
65	LV trip selection at	0 to 1	74.	You can select whether or not to activate Err13 (Main power under-
	main power OFF	<1>		voltage protection) function while the main power shutoff continues for the
	5	· la		setup of Pr6D (Main power-OFF detection time).
30/ho		ye.		Setup value Action of main power low voltage protection  When the main power is shut off during Servo-ON, Err13 will
HOTTE .			. 15	0 not be triggered and the driver turns to Servo-OFF. The driver
7			19035	returns to Servo-ON again after the main power resumption.
			The state of the s	When the main power is shut off during Servo-ON, the driver
		,	100	will trip due to Err13 (Main power low voltage protection).
litous the		Hog.	Michalite	<b><caution></caution></b> This parameter is invalid when Pr6D (Detection time of main power OFF)=1000. Err13 (Main power under-voltage protection) is triggered when setup of P66D is long and P-N voltage of the main converter falls below the specified value before detecting the main power shutoff, regardless of the Pr65 setup. Refer to P.42, "Timing Chart-At Power-ON" of Preparation as well.
66	Sequence at	0 to 2	124 -	You can set up the running condition during deceleration or after stalling,
*	over-travel inhibit	<0>		while over-travel inhibit input (CCWL : Connector CN X5, Pin-9 or CWL : Connector CN X5, Pin-8) is valid
1/2		12.S.		Setup value   During deceleration   After stalling   Deviation counter content
Milita				O> Dynamic brake Torque command=0 Hold
The same			12 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	action towards inhibited direction
			74/02	1 Torque command=0 Torque command=0 Hold towards inhibited direction
		-	E	2 Emergency stop Torque command=0 Clears before/
_ <		20		towards inhibited direction   after deceleration
Valyto.		Ho.		In case of the setup value of 2, torque limit during deceleration will be limited by the setup value of Pr6E (Torque setup at emergency stop).

#### <Notes>

PrNo.	Title	Setup range	Unit	80,	Functi	on/Content	
67	Sequence at main power OFF	0 to 9 <0>	nu die	When Pr65 1) the acti 2) the clea	0, you can set up,		
	0'6,	13.9		Setup	Acti	on	Deviation counter
		igh.		value	During deceleration	After stalling	content
				<0>	DB DB	DB	Clear
	~91JL		~2	1	Free-run	DB	Clear
	77/07		7/07	2	DB	Free-run	Clear
	22/20		Me	3	Free-run	Free-run	Clear
	12.		3	4	DB	DB	Hold
	2			5		DB	Hold
	10.X	12.7		6	Free-run DB		0-2
	1	ig,		(3)-1		Free-run	Hold
	205			7	Free-run	Free-run	Hold
	10977		202	8	Emergency stop	DB	Clear
	7/07		77,07	9	Emergency stop	Free-run	Clear
	'G	, jì	nn,	<caution> In case of the</caution>	nic Brake action) he setup value of 8 or ne setup value of Pr6E		
68	Sequence at alarm	0 to 3 <0>	- 3	1/0	t up the action during as while either one of		(/),
	77/07		7/07	Setup	Acti	on	Deviation counter
	Thu.		Me	value	During deceleration	After stalling	content
	1.		3	<0>	DB	DB	Hold
	2			1 🔊	Free-run	DB	A Hold
	0.5.	13.5.		2	DB 🔎	Free-run	Hold
		90		3	Free-run	Free-run	Hold
	Whiteldpart		NAN 1882	<caution> The conten alarm. Refe</caution>	nic Brake action)  It of the deviation couer to P.43, "Timing Chemand status)" of President in the command status in the command sta	nart (When an err	ed when clearing the ror (alarm) occurs (at
69	Sequence at Servo-Off	0 to 9 <0>	- Handelle	2) the clear after turning ON to OFF) The relation counter clear Refer to P.4	on during deceleration a ring of deviation counte g to Servo-OFF (SRV-0	er content, DN signal : CN X5, value of Pr69 and of Pr67 (Sequence	d the action/deviation e at Main Power Off)
6A	Setup of mechanical brake action at stalling	0 to 100 <0>	2ms	CN X5, Pir	t up the time from who n-10 and 11) turns o ), when the motor tur	off to when the m	
	dd www.idb.	este j	Manifely.	drop of t action de • After sei then con the drive	to prevent a micro-tr the motor (work) due to elay time (tb) of the bra tting up Pr6a ≧ tb , mpose the sequence s er turns to Servo-OFF e is actually activated.	o the lke BRK-OFF so as actual brake	ON OFF  release to hold  release hold  non-energized energized
	Mary Ch.		ARRICE .		44, "Timing Chart"-Ser	vo-ON/OFF Action	While the Motor Is at

## [Connection and Setup of Full-closed Control]

Standard default : < :

10.0		Setup	25	Standard default : < >		
PrNo.	Title	range	Unit	Function/Content		
6B	Setup of mechanical brake action at running	0 to 100 <0>	2ms	You can set up time from when detecting the off of Servo-ON input signal (SRV-ON: CN X5, Pin-29) is to when external brake release signal (BRK-OFF: CN X5, Pin-10 and 11) turns off, while the motor turns to servo off during the motor in motion.		
Callemanka	white in the state of the state		(MAH) (JOH) (S	Set up to prevent the brake deterioration due to the motor running.      At Servo-OFF during the motor is running, tb of the right fig. will be a shorter one of either Pr6B setup time, or time lapse till the motor speed falls below 30r/min.  SRV-ON ON OFF  BRK-OFF release hold  actual brake energized energized  motor energization  30 r/min energization		
30/20	Ď.	H2.2		Refer to P.45, "Timing Chart"-Servo-ON/OFF action while the motor is in motion" of Preparation as well.		
6C *	Selection of external regenerative resistor	0 to 3 for A, B-frame <3>	innui idositic	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 RB1 and RB2 of Connector CN X2 in case of A to D-frame, between P and B2 of terminal block in case of E, F-frame).		
- orozajko	)	for C to F-frame <0>	-0	Setup value   Regenerative resistor to be used   Regenerative processing and regenerative resistor overload		
S. J. L.	WANT THE STATE OF		in the state of th	The driver trips due to regenerative overload protection (Err18), when regenerative processing circuit is activated and its active ratio exceeds 10%,  Regenerative processing circuit is activated,		
<b>₩</b>	\$	10 P		2 External resistor but no regenerative over-load protection is triggered.  Both regenerative processing circuit and		
Blitchigter.	~attom?	33.	~81 <sup>1</sup> 10	(A, B-frame) No resistor regenerative protection are not activated, and built-in capacitor handles all regenerative power.		
14 A	J. HALAHICH	Kali .	Then in	<remarks> Install an external protection such as thermal fuse when you use the external regenerative resistor. Otherwise, the regenerative resistor might be heated up abnormally and result in burnout, regardless of validation or invalidation of regenerative over-load protection. <caution></caution></remarks>		
Palitorn.	With the Land		"I'QDUIL	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.		
6D *	Detection time of main power off	35 to 1000 <35>	2ms	You can set up the time to detect the shutoff while the main power is kept shut off continuously.  The main power off detection is invalid when you set up this to 1000.		
6E	Torque setup at emergency stop	0 to 500 <0>	%	You can set up the torque limit in case of emergency stop as below.  • During deceleration of over-travel inhibit with the setup 2 of Pr66 (Sequence at over-travel inhibit input)  • During deceleration with the setup of 8 or 9 of Pr67 (Sequence at main power off)  • During deceleration with the setup of 8 or 9 of Pr69 (Sequence at Servo-OFF) Normal torque limit is used by setting this to 0.		
70	Setup of position deviation excess	0 to 32767 <25000>	256 x resolution	<ul> <li>You can set up the excess range of position deviation.</li> <li>Set up with the encoder pulse counts at the position control and with the external scale pulse counts at the full-closed control.</li> <li>Err24 (Error detection of position deviation excess) becomes invalid when you set up this to 0.</li> </ul>		

## <Notes>

# **Parameter Setup**

Standard default : < >

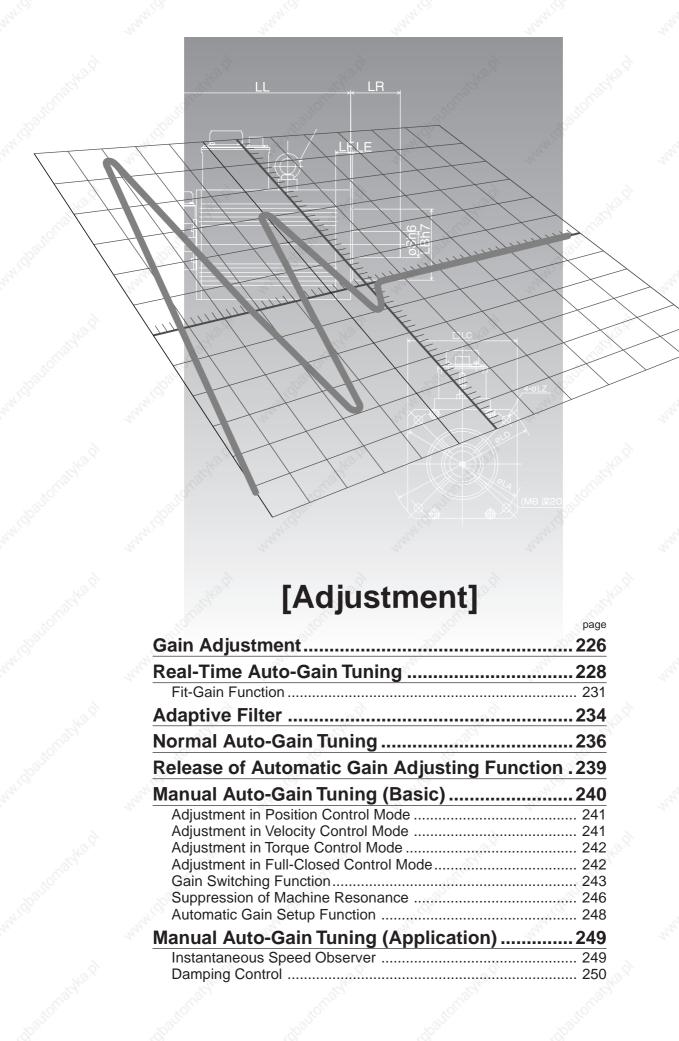
PrNo.	Title	Setup range	Unit	Function/Content
72	Setup of over-load level	0 to 500 <0>	%	<ul> <li>You can set up the over-load level. The overload level becomes 115 [%] by setting up this to 0.</li> <li>Use this with 0 setup in normal operation. Set up other value only when you need to lower the over-load level.</li> <li>The setup value of this parameter is limited by 115[%] of the motor rating.</li> </ul>
73	Setup of over-speed level	0 to 20000 <0>	r/min	<ul> <li>You can set up the over-speed level. The over-speed level becomes 1.2 times of the motor max. speed by setting up this to 0.</li> <li>Use this with 0 setup in normal operation. Set up other value only when you need to lower the over-speed level.</li> <li>The setup value of this parameter is limited by 1.2 times of the motor max. speed.</li> <li>Caution&gt;</li> <li>The detection error against the setup value is ±3 [ r/min] in case of the 7-wire absolute encoder, and ±36 [ r/min] in case of the 5-wire incremental encoder.</li> </ul>

## **Parameters for Full-Closed Control**

Standard default : < >

PrNo.	Title	Setup range	Unit		Function/Content									
78 *	Numerator of external scale division	0 to 32767 <0>	- -	scale resoluti Encode External so	up the ratio between the encoder resolution at full-closed control.  r resolution per one motor revolution cale resolution per one motor revolution	on and the external  Pr78 X 2 Pr79 Pr7A								
79 *	Multiplier of numerator of	0 to 17 <0>	Nut.		<ul> <li>(default)</li> <li>equals to encoder resolution, and you call scale resolution per one motor revolution</li> </ul>									
	external scale division	(Sighteria)			atio between the external scale resolutio									
7A *	Denominator of external scale division	1 to 32767 <10000>	NHH 1982	resolution per one motor revolution according to the above formula. <b>Caution&gt;</b> • Upper limit of numerator value after calculation is 131072. Sexceeding this value will be invalidated, and 131702 will be the a numerator.										
7B *	Setup of hybrid deviation excess	1 to 10000 <100>	16 x external scale pulse	• The driver	setup the permissible gap (hybrid deviator position and the present external scale will trip with Err25 (Hybrid deviation exceens is generated which exceeds the permiss	position. ss protection) when								
7C	Reversal of	0 to 1	' <u>4</u> ',0	You can set i	up the logic of the absolute data of the ext	ernal scale.								
*	direction of	<0>		Setup value	Content	12,								
	external scale	A BISHERDI	, di	2	2	20	, Š	20	20		0	0	Serial data will increase when the determine to the right viewed from the mounting sid	
				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Serial data will decrease when the dete to the right viewed from the mounting sid									
	Whitiparic			position data	use the linear scale by other manufact will be kept as it is with the setup of 0, argned position data with the setup of 1.									

## <Notes>

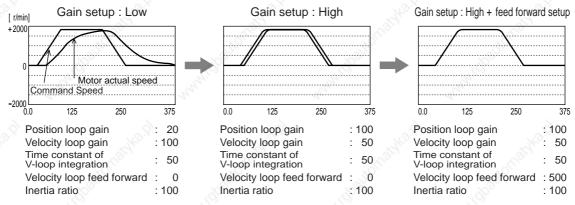


# **Gain Adjustment**

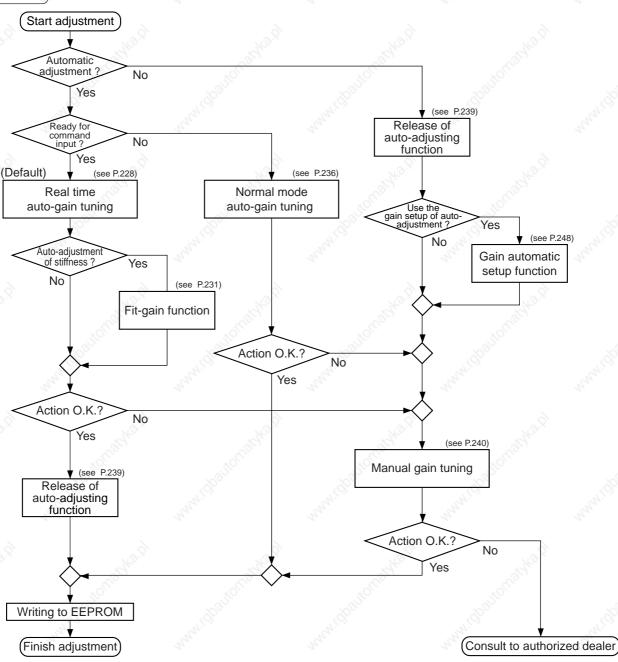
## Purpose

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**



## Type

		Function	Explanation	Pages to refer
	Real-	time auto-gain tuning	Estimates the load inertia of the machine in real time, and automatically sets up the optimum gain corresponding to this result.	P.228
Harb.		Fit-Gain function	Searches automatically the appropriate stiffness setup by entering the certain action pattern repeatedly, to set up the stiffness of real-time auto-gain tuning at position control.	P.231
Automatic adjustment	Adapt	tive 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.234
Aut	Norm	al mode auto-gain tuning	Sets up the appropriate gain automatically by calculating the load inertia from the torque required to run the motor in the command pattern automatically created in the driver.	P.236
	1,000	ise of automatic gain ting function	Describes the cautions when you invalidate the real-time autogain tuning or adaptive filter which are defaults.	P.239
e Mari	Manu	al gain tuning (basic)	Execute the manual adjustment when real-time auto-gain tuning cannot be executed due to the limitation of control mode and load condition, or when you want to obtain an optimum response depending on each load.	P.240
		'92 <sub>0</sub>	Adjustment of position control mode	P.241
	2227		Adjustment of velocity control mode	P.241
		Basic procedure	Adjustment of torque control mode	P.242
			Adjustment of full-closed control mode	P.242
ustment		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.243
Manual adjustment	nai	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.246
H2.21		Automatic gain setup function	Initializes the control parameters and gain switching parameters to the values corresponding to the automatic tuning stiffness parameters, before executing the manual auto-gain tuning.	P.248
	Manu	al 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.249
140.S	23	Instantaneous speed observer	Function which obtains both high response and reduction of vibration at stopping by estimating the motor speed with the load model, and hence improves the accuracy of speed detection.	P.249
30		Damping control	Function which reduces vibration by removing the vibration frequency component while the front end of the machine vibrates.	P.250

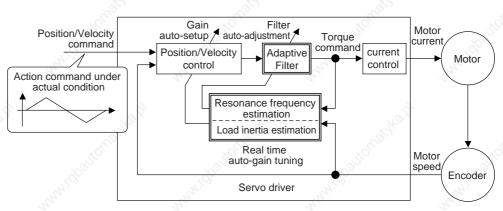
## <Remarks>

• Pay extra attention to safety, when oscillation (abnormal noise and vibration) occurs, shut off the main power, or turn to Servo-OFF.

# **Real-Time Auto-Gain Tuning Mode**

## **Outline**

Estimates the load inertia of the machine in real time and sets up the optimum gain automatically responding to the result.



## **Applicable Range**

Real time auto-gain tuning is applicable to all control modes.

## Caution

Real-time auto-gain tuning may not be executed properly under the conditions described in the table below. In these cases, use the normal mode auto-gain tuning (refer to P.236 of Adjustment), or execute the manual auto-gain tuning (refer to P.240).

7.9'S,	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)
(0)	The load inertia changes too quickly (10 [ s] or less)
Load	The machine stiffness is extremely low.
Load	A chattering such as backlash exists.
742	• 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).
Action pattern	Acceleration/deceleration torque is smaller than unbalanced weighted/viscous friction torque.
1.4°C	• When the speed condition of 100 [ r/min] or more and acceleration/deceleration condition
	2000 [ r/min] per 1 [ s] are not maintained for 80 [ ms] .

## **How to Operate**

- 1) Bring the motor to stall (Servo-OFF).
- 2) Set up Pr21 (Setup of real-time auto-gain tuning mode) to 1-7.

Setup value	Real time auto-gain tuning	Varying degree of load inertia in motion
0	(not in use)	2), <sup>20</sup> (2),
<u>(</u> [1]	, 10 <sup>1</sup>	no change
2	normal mode	slow change
3		rapid change
4	71, 71,	no change
5	vertical axis mode	slow change
6		rapid change
7	no gain switching mode	no change

When the changing degree of load inertia is large, set up 3 or 6.

When the motor is used for vertical axis, set up 4-6.

When vibration occurs during gain switching, set up 7.

- 3) Set up Pr22 (Machine stiffness at real-time auto-gain tuning) to 0 or smaller value.
- 4) Turn to Servo-ON to run the machine normally.
- 5) Gradually increase Pr22 (Machine stiffness at real-time auto-gain tuning, machine) when you want to obtain a better response. Lower the value (0-3) when you experience abnormal noise or oscillation.
- 6) Write the result to EEPROM when you want to save it.

Insert the console connector to CN X6 of the driver, then turn on the driver power. Setup of parameter, Pr21 Press (S). <u>dP\_5Pd</u> Press M PR. *00.* PR. 2 1 Match to the parameter No. to be set up with  $(\blacktriangle)(\blacktriangledown)$ . (Here match to Pr21.) Press (S). Change the setup with  $(\blacktriangle)(\blacktriangledown)$ Press (S). PR. Setup of parameter, Pr22 Match to Pr22 with (▲). 22. PR. Press (S). (default values) Numeral increases with (▲), and decreases with (▼). Press (S). **Writing to EEPROM** Press (M). EE.5EE EEPPress (S EEP Bars increase as the right fig. shows by keep pressing ( ) (approx. 5sec). 5 & 8 r & Writing starts (temporary display). F 10 15h CE5EE Error Finish Writing completes Writing error occurs Return to SELECTION display after writing finishes, referring to "Structure of each mode" (P.60 and 61 of Preparation).

# **Real-Time Auto-Gain Tuning**

## Parameters Which Are Automatically Set

Following parameters are automatically adjusted. Also following parameters are automatically set up.

PrNo.	Title
10	1st gain of position loop
11	1st gain of velocity loop
12	1st time constant of velocity loop integration
13	1st filter of velocity detection
14	1st time constant of torque filter
18	2nd gain of position loop
19	2nd gain of velocity loop
1A	2nd time constant of velocity loop integration
1B	2nd filter of speed detection
1C	2nd time constant of torque filter
20	Inertia ratio

Title	Setup value
Velocity feed forward	300
Time constant of feed forward filter	50
Setup of instantaneous speed observer	0
2nd gain setup	1
1st mode of control switching	10
1st delay time of control switching	30
1st level of control switching	50
1st hysteresis of control switching	33
Position gain switching time	20
2nd mode of control switching	0
	Velocity feed forward Time constant of feed forward filter Setup of instantaneous speed observer 2nd gain setup 1st mode of control switching 1st delay time of control switching 1st level of control switching 1st hysteresis of control switching Position gain switching time

#### <Notes>

- When the real-time auto-gain tuning is valid, you cannot change the parameters which are automatically adjusted.
- Pr31 becomes 10 at position or full closed control and when Pr21 (Setup of real-time auto-gain tuning) is 1 to 6, and becomes 0 in other cases.

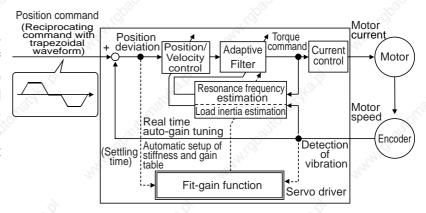
## Caution

- (1) After the start-up, you may experience abnormal noise and oscillation right after the first Servo-ON, or increase of Pr22 (Selection of machine stiffness at real-time auto-gain tuning) until the load inertia is identified (estimated) or the adaptive filter is stabilized, however, these are not failures as long as they disappear immediately. If they persist over 3 reciprocating operations, take the following measures in possible order.
  - 1) Write the parameters which have given the normal operation into EEPROM.
  - 2) Lower the setup of Pr22 (Selection of machine stiffness at real time auto-gain tuning).
  - 3) Set up the notch filter manually.
- (2) When abnormal noise and oscillation occur, Pr20 (Inertia ratio) or Pr2F (Adaptive filter frequency) 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, Pr20 (Inertia ratio) and Pr2F (Adaptive filter frequency) will be written to EEPROM every 30 minutes. When you turn on the power again, the auto-gain tuning will be executed using the latest data as initial values.
- (4) When you validate the real-time auto-gain tuning, Pr27 (Setup of instantaneous speed observer) will be invalidated (0) automatically.
- (5) During the trial run and frequency characteristics measurement of "PANATERM®", the load inertia estimation will be invalidated.

## **Fit-Gain function**

## Outline

MINAS-A4 series features the Fit-gain function which executes the automatic setup of stiffness corresponding to the machine while the real time auto-gain tuning is used at position control. This function automatically searches the optimum stiffness setup by repeating reciprocating movement at position control.



## **Applicable Range**

This function can be applicable when the following conditions are satisfied in addition to the applicable conditions for real time auto-gain tuning.

	Conditions under which the Fit-gain function is activated
Real time auto-gain tuning action	<ul> <li>The real-time auto-gain tuning has to work properly.</li> <li>At Servo-ON status</li> <li>Pr21=1-6 (Not usable when Pr21=0 or 7)</li> </ul>
Adaptive filter	The adaptive filter is validated.  Pr23=1: Validated
Control mode	At position control mode     Pr02=0: Position control     Pr02=3: 1st control mode of position/velocity control     Pr02=4: 1st control mode of position/torque control
Action pattern	<ul> <li>The position command to be for reciprocating movement</li> <li>One position command time to be 50 [ ms] or longer.</li> <li>Min. frequency of position command to be 1 [ kpps] or more.</li> <li>(To be used for judgment of start and finish of command)</li> </ul> Accel/deceleration <ul> <li>(3000r/min/0.1s)</li> <li>1 [ s] or longer</li> </ul> Positioning complete OFF — 1[ s] or longer

## Caution

This function may not work properly under the following conditions in addition to the conditions for real time auto-gain tuning. In these cases, use the normal real-time auto-gain tuning.

No.	Conditions which obstruct Fit-Gain action
Action pattern	The position command is small such as less than 2 revolutions.
	When the positioning cannot be completed before the start of the next position command even
Action pattern	though the positioning command has been completed.
	Acceleration/deceleration is rapid such as 30000 [ r/min] per 1[ s] .

# **Real-Time Auto-Gain Tuning**

## **Before Operation**

Before the start-up of the Fit-Gain function, set up the followings with the Fit-Gain screen and parameter setup mode of the front panel, or the Console or the Setup Support Software, "PANATERM®".

Parameter		Setup v	alue		Notes
6	Either o	of 1-6.	9		8
"Ma"	1	Normal mode	no change		1. Thu.
Pr21 (Setup of real-time auto-gain	2	Normal mode	slow change		You can setup
The state of the s	3	Normal mode	rapid change	- 3	parameters in the left through the
tuning mode)	4	Vertical axis mode	no change	1900	
	5	Vertical axis mode	slow change	427.	execution display of the Fit-Gain screen
	6	Vertical axis mode	rapid change		on the front panel.
Pr22 (Selection machine stiffness at real time auto-gain tuning)	(Refer to P.72 of Preparation.)		(Refer to P.72 of Preparation.)		
Pr23 (Setup of adaptive filter)	1 : Valid	A.C.			S. C. S.
Pr60 (Positioning complete range)	In case of 17bit encoder, 20 pulses or more, In case of 2500P/r encoder, 10 pulses or more,				

## **How to Operate**

### **Procedures**

- (1) Bring the front panel display to EXECUTION display of the Fit-Gain screen.
  - (For operation of the front panel, refer to P.72 of Preparation.)
- (2) Start up the Fit-Gain function by pressing ▼ for approx. 3sec after lowering the stiffness to 0 while the dot "." on the right lower corner flashes.
- (3) Enter the position command which satisfies the action pattern condition of P.228, "Applicable Range".

## <Caution 1>

The Fit-Gain movement requires max. 50 reciprocating movements. The Fit-gain function finishes when the optimum real-time stiffness No. is found in normal case.

(4) F. 1.5 N will be displayed when the Fit-Gain function finishes normally, and Error will be displayed when this finishes with error.

(You can clear Error display by operating any key.)

#### <Caution 2>

Errar will be displayed in the following cases.

- No chattering of COIN signal and real-time stiffness NO. without micro vibration, have been found.
- One of the keys of the front panel has been operated during the Fit-Gain action, or applicable condition have not been satisfied.

## SELECTION **EXECUTION** display display (set button) EXECUTION display of Fit-Gain screen Fit-Gain screen After setting up of stiffness to 0, keep pressing (▼) for approx.3sec while the dot on the right corner flashes. Front panel display Fit-Gain starts changes to 000.000 Front panel display 000.100 changes together with the machine movement. 400,400 in 15h Error

**Example of front panel display** 

## **Result of Fit-Gain**

Fin.5h will be displayed when the Fit-Gain finishes normally, and Error. will be displayed when it finishes with some error. Write the result to EEPROM when you want to apply the result after the power reset.

[EXECUTION display] Writing of the result from the Fit-Gain screen

Press for approx.3sec to save the present setup to EEPROM.

## Parameters Which Are Automatically Set

Following parameters are automatically adjusted.

Also following parameters are automatically set up.

PrNo.	Title
10	1st gain of position loop
<u>311</u>	1st gain of velocity loop
12	1st time constant of velocity loop integration
13	1st filter of velocity detection
14	1st time constant of torque filter time
18	2nd gain of position loop
19	2nd gain of velocity loop
1A	2nd time constant of velocity loop integration
1B	2nd filter of velocity detection
1C	2nd time constant of torque filter
20	Inertia ratio
22	Selection of machine stiffness at real time auto-gain tuning

PrNo.	Title	Setup value
15	Velocity feed forward	300
16	Time constant of feed forward filter	50
27	Setup of instantaneous speed observer	0
30	2nd gain setup	A 1
31	1st mode of control switching	10
32	1st delay time of control switching	30
33	1st level of control switching	50
34	1st Hysteresis of control switching	33
35	Switching time of position gain	20
36	2nd mode of control switching	0

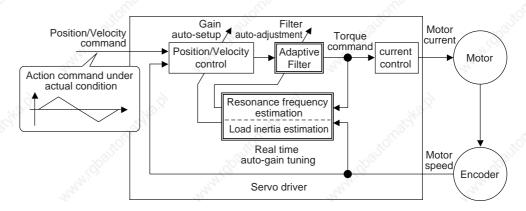
## Caution

During the Fit-Gain movement, you may experience some noise and vibration, however, these do not give any trouble since the gain is automatically lowered. If noise and vibration persist, interrupt the Fit-Gain by pressing one of the switches of the front panel.

# **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.

## Caution

The adaptive filter may not work properly under the following conditions. In these cases, take measures to resonance according to the manual adjustment procedures, using the 1st notch filter (Pr1D and 1E) and the 2nd notch filter (Pr28 to 2A).

.57	Conditions which obstruct adaptive filter action
-	Resonance frequency is lower than 300[ Hz] .
Resonance point	Resonance peak is low, or control gain is low where the motor speed is not affected by this.
"Thou	Multiple resonance points exist.
Load	<ul> <li>Motor speed variation with high harmonic component is generated due to non-linear factors such as backlash.</li> </ul>
Command pattern	Acceleration/deceleration is rapid such as 30000[ r/min] per 1[ s] .

## **How to Operate**

1) Validate the adaptive filter by setting up Pr23 (Setup of adaptive filter) to 1.

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

Setup value	Adaptive filter	Adaptive action
0	Invalid	-
[1]	Valid	Yes
2	valid	No (Hold)

When adaptation finishes (Pr2F does not change), and resonance point seems not change, set up the value to 2.

2) Write the result to EEPROM when you want to save it.

## Caution

- (1) After the start-up, you may experience abnormal noise and oscillation right after the first Servo-ON, or when you increase the setup of Pr22 (Selection of machine stiffness at real-time auto-gain tuning), until the load inertia is identified (estimated) or the adaptive filter is stabilized, however, these are not failures as long as they disappear immediately. If they persist over 3 reciprocating operations, take the following measures in possible order.
  - 1) Write the parameters which have given the normal operation into EEPROM.
  - 2) Lower the setup of Pr22 (Selection of machine stiffness at real-time auto-gain tuning).
  - 3) Invalidate the adaptive filter by setting up Pr23 (Setup of adaptive filter mode) to 0. (Reset of inertia calculation and adaptive action)
  - 4) Set up the notch filter manually.
- (2) When abnormal noise and oscillation occur, Pr2F (Adaptive filter frequency) might have changed to extreme values. Take the same measures as the above in these cases.
- (3) Pr2F (Adaptive filter frequency) will be written to EEPROM every 30 minutes. When you turn on the power again, adaptive action will be executed using the latest data as initial values.
- (4) The adaptive filter is normally invalidated at torque control, however, when you select torque control while you set up Pr02 (Control mode setup) to 4 and 5, the adaptive filter frequency before mode switching will be held.

## Invalidation of Adaptive Filter

When you set up Pr23 (Setup of adaptive filter) to 0, the adaptive filter function which automatically follows the load resonance will be invalidated.

If you invalidate the adaptive filter which have been working correctly, noise and vibration may occur due to the effect of resonance which have been suppressed.

Therefore, execute the copying function of the setup of adaptive filter (Pr2F) to the 1st notch frequency (Pr1D) from the Fit-Gain screen of the front panel (refer to P.72, "Fit-Gain Screen" of Preparation), or set up Pr1D (1st notch frequency) manually by using the table below, then invalidate this filter.

<u>"O"</u>		
Pr2F	1st notch frequency [Hz]	
0	(invalid)	
1	(invalid)	
2	(invalid)	
3	(invalid)	
4	(invalid)	
5	1482	
6	1426	
7	1372	
8	1319	
9	1269	
10	1221	
11	1174	
12	1130	
13	1087	
14	1045	
15	1005	
16	967	
17	930	
18	895	
19	861	
20	828	
21	796	

Pr2F	1st notch frequency [Hz]
22	766
23	737
24	709
25	682
26	656
27	631
28	607
29	584
30	562
31	540
32	520
33	500
34	481
35	462
36	445
37	428
38	412
39	396
40	381
41	366
42	352
43	339

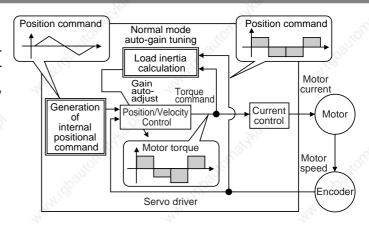
Pr2F	1st notch frequency [Hz]
44	326
45	314
46	302
47	290
48	279
49	269 (invalid when Pr22≥15)
50	258 (invalid when Pr22≥15)
51	248 (invalid when Pr22≥15)
52	239 (invalid when Pr22≥15)
53	230 (invalid when Pr22≥15)
54	221 (invalid when Pr22≥14)
55	213 (invalid when Pr22≥14)
56	205 (invalid when Pr22≥14)
57	197 (invalid when Pr22 ≥ 14)
58	189 (invalid when Pr22≥14)
59	182 (invalid when Pr22≥13)
60	(invalid)
61	(invalid)
62	(invalid)
63	(invalid)
64	(invalid)
.47	2

<sup>\*</sup>Set up 1500 to Pr1D (1st notch frequency) in case of "invalid" of the above table.

# **Normal Mode Auto-Gain Tuning**

## Outline

The motor will be driven per the command with a pattern generated by the driver automatically. The driver estimates the load inertia from the necessary torque, and sets up an appropriate gain automatically.



## **Applicable Range**

This function works under the following condition.

, Q	Conditions under which the normal mode auto-gain tuning is activated						
Control mode	Applies to all control modes.	ight.					
Othore	Servo-ON status	,0 <sup>0</sup> 0°					
Others	No entry of deviation counter clear signal						

#### <Remarks>

Set up the torque limit selection (Pr03) to 1.

When you set up other than 1, driver may not act correctly.

## Caution

Normal mode auto-gain tuning may not be work properly under the following conditions. In these cases, set up in manual gain tuning

4	Conditions which obstruct normal auto-gain tun	ing
6	Too small or too big compared to the rotor inertia	9
Load inertia	(smaller than 3 times or larger than 20 times)	
	Load inertia varies.	
All I and	Machine stiffness is extremely low.	200
Load	Chattering such as backlash exists.	

- Tuning error will be triggered when an error, Servo-OFF, the main power shutdown, validation of over-travel inhibition, or deviation counter clear occurs during the normal mode auto-gain tuning.
- If the load inertia cannot be calculated even though the normal mode auto-gain tuning is executed, gain value will not change and be kept as same as that of before the execution.
- The motor output torque during the normal auto-gain tuning is permitted to the max. torque set with Pr5E (Setup of torque limit).

Pay an extra attention to the safety. When oscillation occurs, shut off the main power or turn to Servo-OFF immediately. Bring back the gain to default with parameter setup. Refer to cautions of P.71, "Auto-Gain Tuning Mode" of Preparation as well.

## **Auto-Gain Tuning Action**

(1) In the normal mode auto-gain tuning, you can set up the response with machine stiffness No..

Machine stiffness No.

- Represents the degree of machine stiffness of the customer's machine and have values from 0 to 15. You can set a higher No. to the high stiffness machine and set up a higher gain.
- Usually start setting up with a lower value and increase gradually to repeat auto-gain tuning in the range where no oscillation, no abnormal noise, nor vibration occurs.
- (2) This tuning repeats max. 5 cycles of the action pattern set with Pr25 (Normal mode auto-gain tuning action). Action acceleration will be doubled every one cycle after third cycle. Tuning may finish, or action acceleration does not vary before 5th cycle depending on the load, however, this is nor an error.

## **How to Operate**

- (1) Set up the action pattern with Pr25.
- (2) Shift the load to the position where no hazard is expected even though the action pattern which is set with Pr25 is executed.
- (3) Prohibit the command entry.
- (4) Turn to Servo-ON.
- (5) Start up the auto-gain tuning. Use the front panel or the "PANATERM®".
  - For the operation of the front panel, refer to P.71, "Auto-Gain Tuning Mode" of Preparation.
- (6) Adjust the machine stiffness to the level at which no vibration occurs and obtain the required response.
- (7) Write the result to EEPROM, if it is satisfactory.

## **Parameters Which Are Automatically Set**

Table of auto-gain tuning

Pr	Title			40j.				S	tiffnes	ss val	ue	2	0/1				300
No.			[1]	2	3	[4]	5	6	7	8	9	10	11	12	13	14	15
10	1st gain of position loop	12	32	39	48	63	72	90	108	135	162	206	251	305	377	449	557
11	1st gain of velocity loop	9	18	22	27	35	40	50	60	75	90	115	140	170	210	250	310
12	1st time constant of velocity loop integration	62	31	25	21	16	14	12	11	9	8	7	6	5	4	4	3
13	1st filter of velocity detection	0	0	0	0	0	0	0	0	<b>0</b>	0	0	0	0	0	0	0
14	1st time constant of torque filter time *2	253	126	103	84	65	57	45	38	30	25	20	16	13	11	10	10
15	Velocity feed forward	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
16	Velocity FF filter	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
18	2nd gain of position loop	19	38	46	57	73	84	105	126	157	188	241	293	356	440	524	649
19	2nd gain of velocity loop		18	22	27	35	40	50	60	75	90	115	140	170	210	250	310
1A	2nd time constant of velocity loop integration		999	999	999	999	999	999	999	999	999	999	999	999	999	999	999
1B	2nd filter of speed detection		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1C	2nd time constant of torque filter *2	253	126	103	84	65	57	45	38	30	25	20	16	13	11	10	10
20	Inertia ratio	Estimated load inertia ratio															
27	Setup of instantaneous velocity observer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	2nd gain setup	1	7	1	1	1	1,	√ <sup>3</sup> 1	1	1	1	12	1	1	1	1,	( <sup>3)</sup> 1
31	1st mode of control switching *1	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
32	1st delay time of control switching		30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
33	1st level of control switching		50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
34	1st Hysteresis of control switching	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
35	Switching time of position gain	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
36	2nd mode of control switching	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

represents parameters with fixed value. Default for A to C-frame is 4, and 1 for D to F-frame.

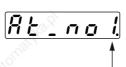
<sup>\*1</sup> Stiffness value is 10 for position control and full-closed control, and 0 for velocity control and torque control.

<sup>\*2</sup> Lower limit for stiffness value is 10 for 17-bit encoder, and 25 for 2500P/r encoder.

# **Normal Mode Auto-Gain Tuning**

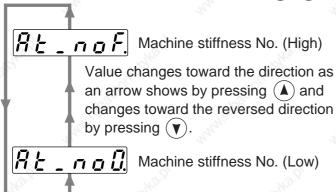
## **How to Operate from the Front Panel**

(1) Turn to the normal auto-gain tuning mode from the monitor mode, by pressing the SET button, then press the mode switching button three times. For details, refer to P.60 and 61, "Structure of Each Mode" of Preparation. Display of rotational speed of the motor (initial display)



Machine stiffness No.

(2) Enter the machine stiffness No. by pressing (A) (V)



Machine stiffness No.
8 –14
6 –12
4 –10
2-8
e 0 – 8

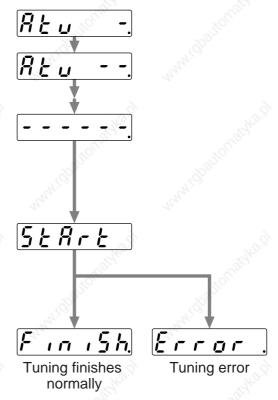
- (3) Shift to MONITOR/EXECUTION mode by pressing (\$\sigma\$).
- (4) Operation at MONITOR/EXECUTION mode Keep pressing ▲ until the display changes to 5 + 8 + 1.
  - Pin-29 of the connector, CN X5 to be Servo-ON status.

Keep pressing (A) for approx.3sec, then bar increase as the right fig. shows.

The motor starts rotating.

For approx. 15 sec, the motor repeats max. 5 cycles of CCW/CW rotation, 2 revolutions each direction per one cycle. Tuning may finish before 5th cycles, however, this is not an error.

(5) Write the gain value to EEPROM to prevent them from being lost due to the power shut off.



#### <Caution>

Do not use the normal mode auto-gain tuning with the motor and driver alone. Pr20 (Inertia ratio) becomes to 0.

#### <Notes>

Content	Cause	Measure
Display of error.	One of alarm, Servo-OFF or	Avoid an operation near the limit switch or origin proximity switch.
12.	deviation counter clear has	Turn to Servo-ON.
732	occurred.	Release the deviation counter clear
Value of parameter	Load inertia cannot be identified.	Lower Pr10 to 10 and Pr11 to 50, then execute the tuning.
related to gain (such as	~20°	Adjust the gain manually. (Calculate the load inertia, and then
Pr10) is kept as same	(4)	enter.)
as before the execution.	Try.	The
Motor does not run.	CL (Pin-30) of CN X5 is entered.	Turn off the CL (Pin-30) of CN X5.

# Release of Automatic Gain Adjusting Function [Adjustment]

## **Outline**

Cautions are described when you want to invalidate the real time auto-gain tuning of default or the adaptive filter.

## Caution

Execute the release of the automatic adjusting functions while all action stop (Servo-OFF)

## **Invalidation of Real-Time Auto-Gain Tuning**

You can stop the automatic calculation of Pr20 (Inertial ratio) and invalidate the real-time auto-gain tuning by setting up Pr21 (Real-time auto-gain tuning setup) to 0.

Note that the calculation result of Pr20 (Inertia ratio) will be held, and if this parameter becomes abnormal value, use the normal mode auto-gain tuning or set up proper value manually obtained from formula or calculation.

## **Invalidation of Adaptive Filter**

When you set up Pr23 (Setup of adaptive filter) to 0, adaptive filter function which automatically follows the load resonance will be invalidated.

If you invalidate the adaptive filter which have been working correctly, noise and vibration may occur due to the effect of resonance which have been suppressed.

Therefore, execute the copying function of the setup of adaptive filter (Pr2F) to the 1st notch frequency (Pr1D) from the Fit-gain screen of the front panel (refer to P.72, "Fit-Gain Screen" of Preparation), or set up Pr1D (1st notch frequency) manually by using the table below, then invalidate this filter.

	- 25
Pr2F	1st notch frequency [Hz]
0_0	(invalid)
21 <sup>12</sup>	(invalid)
2	(invalid)
3	(invalid)
4	(invalid)
5	1482
6	1426
7	1372
8	1319
9	1269
10	1221
11	1174
12	1130
13	1087
14	1045
15	1005
16	967
17	930
18	895
19	861
20	828
21	796

Pr2F	1st notch frequency [Hz]
22	766
23	737
24	709
25	682
26	656
27	631
28	607
29	584
30	562
31	540
32	520
33	500
34	481
35	462
36	445
37	428
38	412
39	396
40	381
41	366
42	352
43	339

Pr2F	1st notch frequency [Hz]
44	326
45	314
46	302
47	290
48	279
49	269 (invalid when Pr22≥15)
50	258 (invalid when Pr22≥15)
51	248 (invalid when Pr22≥15)
52	239 (invalid when Pr22≥15)
53	230 (invalid when Pr22≥15)
54	221 (invalid when Pr22≥14)
55	213 (invalid when Pr22≥14)
56	205 (invalid when Pr22≥14)
57	197 (invalid when Pr22≥14)
58	189 (invalid when Pr22≥14)
59	182 (invalid when Pr22≥13)
60	(invalid)
61	(invalid)
62	(invalid)
63	(invalid)
64	(invalid)

<sup>\*</sup>Set up 1500 to Pr1D (1st notch frequency) in case of "invalid" of the above table.

# **Manual Gain Tuning (Basic)**

As explained previously, MINAS-A4 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.

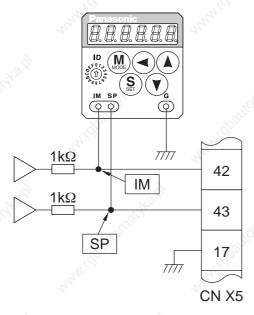
## **Before Making a Manual Adjustment**

You can adjust with the sound or motor (machine) movement by using the front panel or the console, however, you can adjust more securely by using wave graphic function of the setup support software, PANATERM®, or by measuring the analog voltage waveform using a monitoring function.

## 1. Analog monitor output

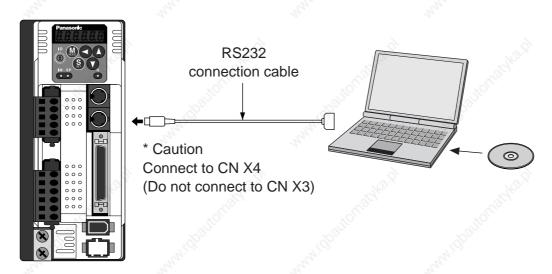
You can measure the actual motor speed, commanded speed, torque and deviation pulses by analog voltage level by using an oscilloscope. Set up the types of the signals or the output voltage level with Pr07 (Selection of speed monitor) and Pr08 (Selection of torque monitor).

For details, refer to P.41, "Wiring to the Connector, CN X5" of Preparation, and "Parameter Setup" of each control mode.



### 2. 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.276, "Outline of the Setup Support Software, PANATERM®" of Supplement.



## **Adjustment in Position Control Mode**

Position control of MINAS-A4 series is described in Block diagram of P.82. 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	
10	1st gain of position loop	27
11	1st gain of velocity loop	15
12	1st time constant of velocity loop integration	37
13	1st filter of velocity detection	0
14	1st time constant of torque filter time	152
15	Velocity feed forward	0
16	Time constant of feed forward filter	0
Š <sup>©</sup> 18	2nd gain of position loop	27
19	2nd gain of velocity loop	15
1A	2nd time constant of velocity loop integration	37
1B	2nd filter of speed detection	0
1C	2nd time constant of torque filter	152
1D	Selection of 1st notch frequency	1500
1E	Selection of 1st notch width	2

Parameter No. (Pr □□)	Title of parameter	Standard value
20	Inertia ratio	100
21	Setup of real time auto-gain tuning mode	0
23	Adaptive filter setup mode	0
2B	1st damping frequency	0
2C	Setup of 1st damping filter	0
2D	2nd damping frequency	0
2E	Setup of 2nd damping filter	0
30	2nd gain setup	0
31	Mode of position control switching	0
32	Delay time of position control switching delay	0
33	Level of position control switching	0
34	Hysteresis at position control switching	0
35	Position gain switching time	0
4C	Setup of smoothing filter	1 <
4D	Setup of FIR filter	0

- (2) Enter the inertia ratio of Pr20. Measure the ratio or setup the calculated value.
- (3) Make adjustment using the standard values below.

Order	Parameter No. (Pr □□)	Title of parameter	Standard value	How to adjust
1.11.11.11.12	Pr11	1st gain of velocity loop	30	Increase the value within the range where no abnormal noise and no vibration occur. If they occur, lower the value.
2	Pr14	1st time constant of torque filter	50	When vibration occurs by changing Pr11, change this value.  Setup so as to make Pr11 x Pr14 becomes smaller than 10000. If you want to suppress vibration at stopping, setup larger value to Pr14 and smaller value to Pr11. If you experience too large vibration right before stopping, lower than value of Pr14.
3	Pr10	1st gain of position loop	50	Adjust this observing the positioning time. Larger the setup, faster the positioning time you can obtain, but too large setup may cause oscillation.
4	Pr12	1st time constant of velocity loop integration	25	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, deviation pulses do not converge and will be remained.
5	Pr15	Velocity feed forward	300	Increase the value within the range where no abnormal noise occurs.  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 Pr16 (Feed forward filter) to larger value.

## **Adjustment in Velocity Control Mode**

Velocity control of MINAS-A4 series is described in Block Diagram of P.126 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 and the setup of velocity feed forward.

# **Manual Gain Tuning (Basic)**

## **Adjustment in Torque Control Mode**

Torque control of MINAS-A4 series is described in P.160, "Block Diagram" of Torque Control Mode. This torque control is based on velocity control while making the 4th speed of speed setup of Pr56 or SPR/SPL input as a speed limit. Here we explain the setup of speed limiting value.

## Setup of speed limiting value

Setup the speed limiting value to the 4th speed of speed setup (Pr56) (when torque command selection (Pr5B) is 0.) or to the analog speed command input (SPR/TRQR/SPL) (when torque command selection (Pr5B) is 1).

- 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 which will be determined by the 4th speed of speed setup (Pr56) or the analog speed command input (SPR/TRQR/SPL).
- 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 = 4th speed of speed setup (Pr56), the analog speed command input is too low or the velocity loop gain is too low, or when the time constant of the velocity loop integration is 1000 (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.

## Adjustment in Full-Closed Control Mode

Full-closed control of MINAS-A4 series is described in Block diagram of P.191 of Full-Closed Control. Adjustment in full-closed control is almost same as that in position control described in P.241 "Adjustment in Position Control Mode", and make adjustments of parameters per the procedures except cautions of P.190, "Outline of Full-Closed Control" (difference of command unit, necessity of position loop unit conversion and difference of electronic gear).

Here we explain the setup of external scale ratio, hybrid deviation excess and hybrid control at initial setup of full-closed control.

## 1) Setup of external scale ratio

Setup the external scale ratio using the numerator of external scale division (Pr78), the multiplier for numerator of external scale division (Pr79) and denominator of external scale division (Pr7A).

• Check the encoder 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 (Pr78), the multiplier for numerator of external scale division so that the following formula can be established.

```
\frac{\text{Pr78 } \boxed{1} \times 2^{\text{Pr79}} \boxed{17}}{\text{Pr7A } \boxed{5000}} = \frac{\text{Number of encoder pulses per motor rotation}}{\text{Number of external scale pulses per motor rotation}}
```

- If this ratio is incorrect, a gap between the position calculated from the encoder pulse counts and that of calculated from the external scale pulse counts will be enlarged and hybrid deviation excess (Err.25) will be triggered when the work or load travels a long distance.
- When you set up Pr78 to 0, the encoder pulse counts will be automatically set up.

## 2) Setup of hybrid deviation excess

Set up the minimum value of hybrid deviation excess (Pt78) within the range where the gap between the motor (encoder) position and the load (external scale) position will be considered to be an excess.

 Note that the hybrid deviation excess (Error code No.25) 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

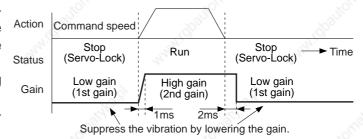
- (1) Enter the command pulses based on the external scale reference.
- (2) The external scales to used for full-closed control are as follows.
  - AT500 series by Mitutoyo (Resolution 0.05[μm], max. speed 2[ m/s] )
  - ST771 by Mitutoyo (Resolution 0.5[µm], max. speed 2[ m/s] )
- (3) To prevent the runaway and damage of the machine due to the setup of the external scale, setup the hybrid deviation excess (Pr7B) to the appropriate value, in the unit of external scale resolution.
- (4) We recommend the external scale as 1/20 ≤ external scale ratio ≤ 20.

If you setup the external scale ratio to smaller value than 50/position loop gain (Pr10 and 18), 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.

## **Gain Switching Function**

At manual gain tuning, you can set 2nd gain manually in addition to 1st gain and you can switch the gain depending on the various requirements of the action such cases as,

- you want to increase the response by increasing the gain in motion
- you want to increase the servo-lock stiffness by increasing the gain at stopping
- switch to the optimum gain according to the action mode
- · lower the gain to suppress the vibration at stopping.



## <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 auto-gain tuning table (P.237) as well.

	All o	all of	and the second		
Parameter No. (Pr □□)	Title of parameter	Execute manual gain-tuning without gain switching	Set up the same value as Pr10-14 (1st gain) to Pr18-1C (2nd gain)	Set up Pr30-35 (Gain switching condition)	Adjust P411 and 14 at stopping (1st gain)
10	1st gain of position loop	63			
11	1st gain of velocity loop	35	7.9.5	18	27
12	1st time constant of velocity integration	16	10%	12%	
13	1st filter of velocity detection	. 0	7,00	x0[C]	305
14	1st time constant of torque filter	65	20/1/2	23/2	84
15	Velocity feed forward	300	7:0	7/0.	710
16	Filter of velocity feed forward	50	12 2	The state of the s	77/1
18	2nd gain of position loop		63		
19	2nd gain of velocity loop	9	35		d
1A N	2nd time constant of velocity integration	Though a	16	7/3	
1B	2nd filter of velocity detection	The same of the sa	0	Car.	
31C	2nd time constant of torque filter time	"710.	65	170	170
30	Action setup of 2nd gain	0	190	.1	1900
31	1st mode of control switching		29.	7	Ty.
32	1st delay time of control switching		22	30	27,
33	1st level of control switching			0	
34	1st hysteresis of control switching	200	200	0	
35	Switching time of position gain	777	17/4	0	
20	Inertia ration	Enter the known value from load calculation     Measure the inertia ratio by executing nor mal auto-gain tuning     Default is 250	Frenhi Giranica	White partour	WHAT GO STOR

# **Manual Gain Tuning (Basic)**

## **Setup of Gain Switching Condition**

## • Positing control mode, Full-closed control mode (O: Corresponding parameter is valid, -: invalid)

	Setup of gain switching condition	Setup paramete	Setup parameters at position control, full-closed control			
	. 70		Delay time * 1	Level	Hysteresis *2	
Pr31	Switching condition to 2nd gain	Fig.	Pr32	Pr33	Pr34	
0 ,	Fixed to 1st gain		79/5	79'S	79.5 -	
180	Fixed to 2nd gain		- 2 <sub>2</sub> 2, -	29, -	-9 <sub>2</sub> / <sub>2</sub> -	
2	Gain switching input, GAIN ON	30	2c ×	5° - x	S - ,	
3	Variation of torque command is large.	A	0 0	○*3[ 0.05%/16@s]	○*3[ 0.05%/166as]	
4	Fixed to 1st gain	760.	- 20,00	- <sup>27</sup> (O)	- 4/0	
5	Speed command is large.	С	0	○ [ r/min]	○ [ r/min]	
6	Position deviation/Full-closed position deviation is large	D	0	○*4[ pulse]	○*4[ pulse]	
7	Position command exists.	Е	0	76	76	
8	Not in positioning complete nor in full-closed positioning complete	F	0	7. J.	700 - "	
9	Speed	С	0	○ [ r/min]	○ [ r/min]	
10	Command exists + velocity	G	0	○[ r/min] *6	○ [ r/min] *6	

#### Velocity control mode

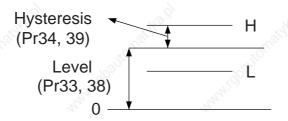
N.	Setup of gain switching condition		Setup parameters at velocity control mode			
196	Cotap of gain owntoning containon		Delay time * 1	Level	Hysteresis * 2	
Pr31,36	Switching condition to 2nd gain		Pr32, 37	Pr33, 38	Pr34, 39	
0	Fixed to 1st gain	7000	- 1000	- 108	- 28	
1	Fixed to 2nd gain	84.j.	- 11/2	- 71/0	- 7/2	
2	Gain switching input, GAIN ON		- 411	- 11/4	- 1/1/2	
	Variation of torque command is	^		○*3	○*3	
3	large.	Α		[ 0.05%/16@s]	[ 0.05%/16@s]	
124	Variation of speed command is	1	W. O	○*5	○*5	
4	large.			[ 10(r/min)/s]	[ 10(r/min)/s]	
5	Speed command is large.	C	0	○ [ r/min]	○[ r/min]	

#### Torque control mode

	Setup of gain switching condition	Setup parameters at torque control mode				
			Delay time * 1	Level	Hysteresis * 2 Pr34, 39	
Pr31,36	Setup of gain switching condition	Fig.	Pr32, 37	Pr33, 38		
0	Fixed to 1st gain					
<u></u> 1	Fixed to 2nd gain	75	- 3	5 - 3	- <u>'</u>	
2	Gain switching input, GAIN ON	703	- 702	- 200	- 700	
2	Variation of torque command is	47.0	O WHILE	○ *3	○ *3	
3	large.	A		[ 0.05%/16@s]	[ 0.05%/16@s]	

<sup>\*1</sup> Delay time (Pr32 and 37) will be valid only when returning from 2nd to 1st gain.

<sup>\*6</sup> When Pr31=10, the meanings of delay time, level and hysteresis are different from the normal. (refer to Fig. G)

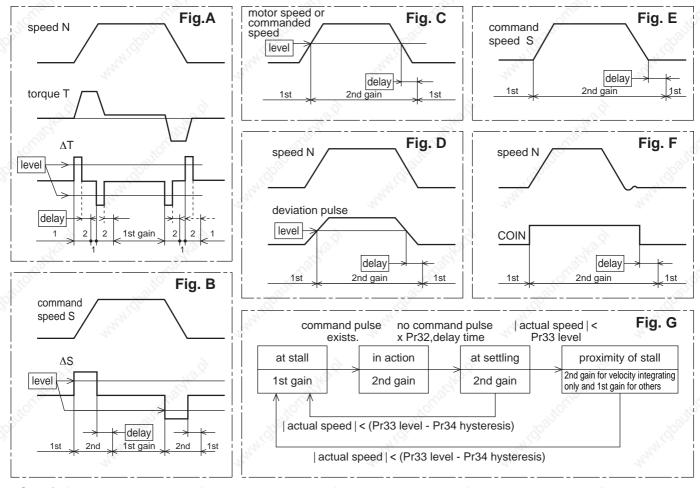


<sup>\*2</sup> Hysteresis is defined as the fig. below shows.

<sup>\*3</sup> When you make it a condition that there is 10% torque variation during 166 $\mu$ s, set up the value to 200 10%/166 $\mu$ s = Setup value 200 x [ 0.05%/16 $\mu$ s]

<sup>\*4</sup> Designate with either the encoder resolution or the external scale resolution depending on the control mode.

<sup>\*5</sup> When you make it a condition that there is speed variation of 10r/min in 1s, set up the value to 1.



## <Caution>

Above Fig. does not reflect a timing lag of gain switching due to hysteresis (Pr34 and 39).

# **Manual Gain Tuning (Basic)**

## Suppression of Machine Resonance

In case of a low machine stiffness, you cannot set up a higher gain because vibration and noise occur due to oscillation caused by axis distortion or other causes. You can suppress the resonance using two types of filter in these cases.

## 1. Torque command filter (Pr14 and Pr1C)

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 =  $1/(2\pi x)$  parameter setup value x 0.00001)

#### 2. Notch filter

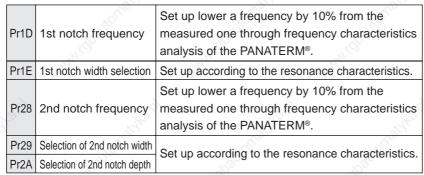
## Adaptive filter (Pr23, Pr2F)

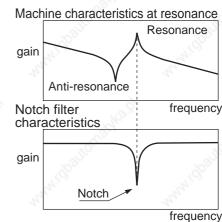
MINASA-4 series feature the adaptive filter. With this filter you can control vibration of the load which resonance points vary by machine by machine and normal notch filter or torque filter cannot respond. The adaptive filter is validated by setting up Pr23 (Adaptive filter mode setup) to 1.

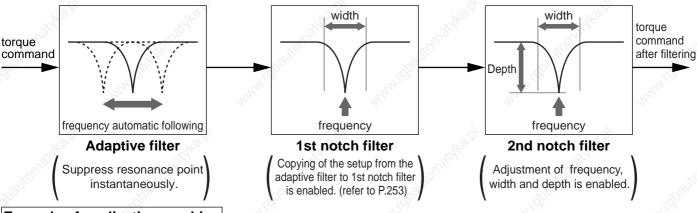
Pr23	Setup of adaptive filter mode	1 : Adaptive filter is valid.
Pr2F	Adaptive filter frequency	Displays the table No, corresponding to adaptive filter frequency (not changeable)

### • 1st and 2nd notch filter (Pr1D, 2E, 28, 29 and 2A)

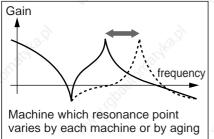
MINASA-4 series feature 2 normal notch filters. You can adjust frequency and width with the 1st filter, and frequency, width and depth with the 2nd filter.

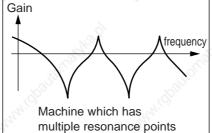


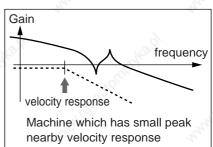




## Example of application machine







## **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 Pr11 (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 CCW with "+" and CW with "-".
  - Setup the sampling rate to 0. (setup range to be 0-7.)
- (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) x 0.017 x (sampling rate + 1)

Larger the offset, better measurement result you can obtain, however, revolutions may be increased.

• Set up Pr23 (Setup of adaptive filter mode) to 0 while you make measurement.

## <Notes>

- 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).

# **Manual Gain Tuning (Basic)**

## **Automatic Gain Setup Function**

## Outline

This function initializes control parameters and gain switching parameters to the gain setups corresponding to the stiffness during auto-gain tuning, before executing a manual tuning.

## Caution

When you execute the automatic gain setup function, stop the action first then make a change.

## How to Use

Refer to P.72, "Fit-Gain Screen" of Preparation.

- (1) Stop the action first.
- (2) Start up the automatic gain setup function from the fit-gain screen of the front panel.
- (3) [F, r, r, 5] will be displayed when the automatic gain setup completes normally, and [E, r, r, r, r, 5] will be displayed when it completes with error.

(This display can be cleared by pressing any key.)

(4) If you want to store the measurement, write it to EEPROM.

## Parameters Which Are Automatically Set

## **Parameters Which Are Automatically Set**

Parameter No.	Title of parameter
10	1st gain of position loop
11 &	1st gain of velocity loop
12	1st time constant of velocity loop integration
13	1st filter of speed detection
14	1st time constant of torque filter time
18	2nd gain of position loop
19	2nd gain of velocity loop
1A	2nd time constant of velocity loop integration
1B	2nd filter of speed detection
1C	2nd time constant of torque filter

#### Parameters Which Setup Values Are Automatically Fixed

Parameter No.	Title of parameter	Setup value
15	Velocity feed forward	300
16	Time constant of feed forward filter	50
27	Instantaneous speed observer	0
30	2nd gain setup	1 3
31	1st control switching mode	10*1
32	1st delay time of control switching	30
33	1st level of control switching	50
34	1st Hysteresis of control switching	33
35	Switching time of position gain	20
36	2nd mode of control switching	0

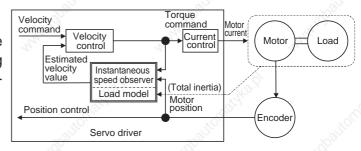
<sup>\*1</sup> In case of position and full-closed control, this becomes 10, and 0 in case of velocity and torque control.

# **Manual Gain Tuning (Application)**

## **Instantaneous Speed Observer**

## Outline

This function enables both realization of high response and reduction of vibration at stopping, by estimating the motor speed using a load model, hence improving the accuracy of the speed detection.



## **Applicable Range**

This function can be applicable only when the following conditions are satisfied.

	Conditions under which the instantaneous speed observer is activated	
Control mode	Control mode to be either or both position control or/and velocity control.  Pr02 = 0 : Position control  Pr02 = 1 : Velocity control  Pr02 = 3 : Position and Velocity control  Pr02 = 4 : Position control only  Pr02 = 5 : Position control only	, (J.)
Encoder	• 7-wire absolute encoder	

## Caution

This function does not work properly or no effect is obtained under the following conditions.

. · ·	Conditions which obstruct the instantaneous speed observer effect		
722	Gap between the estimated total load inertia (motor + load) and actual machine is large.		
e.g.) Large resonance point exists in frequency band of 300[ Hz] or below.			
Load	Non-linear factor such as large backlash exists.		
	Load inertia varies.		
	Disturbance torque with harmonic component is applied.		
Others	Settling range is very small.		

## How to Use

## (1) Setup of inertia ratio (Pr20)

### Set up as exact inertia ratio as possible.

- When the inertia ratio (Pr20) is already obtained through real-time auto-gain tuning and is applicable at normal position control, use this value as Pr20 setup value.
- When the inertia ratio is already known through calculation, enter this calculated value.
- When the inertia ration is not known, execute the normal mode auto-gain tuning and measure the inertia ratio.

#### (2) Adjustment at normal position control

Refer to P.241, "Adjustment at Position Control Mode".

#### (3) Setup of instantaneous velocity observer (Pr27)

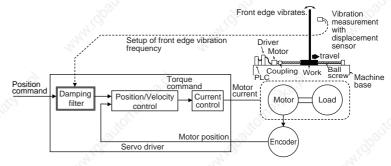
- You can switch the velocity detecting method to instantaneous velocity observer by setting up Pr27 (Setup of instantaneous speed observer) to 1.
- When you experience a large variation of the torque waveform or noise, return this to 0, and reconfirm the above cautions and (1).
- When you obtain the effect such as a reduction of the variation of the torque waveform and noise, search an optimum setup by making a fine adjustment of Pr20 (Inertia ratio) while observing the position deviation waveform and actual speed waveform to obtained the least variation. If you change the position loop gain and velocity loop gain, the optimum value of the inertia ratio (Pr20) might have been changed, and you need to make a fine adjustment again.

# **Manual Gain Tuning (Application)**

## **Damping Control**

## Outline

This function reduces the vibration by removing the vibration frequency component from the command when the load end of the machine vibrates.



## **Applicable Range**

This function can only be applicable when the following conditions are satisfied.

6	Conditions under which the damping control is activated	
.d/c	Control mode to be either or both position control or/and full-closed control.	
Ollian.	Pr02 = 0 : Position control	
Control mode	Pr02 = 3 : 1st control mode of position and velocity control	
2	Pr02 = 4 : 1st control mode of position control and torque control	
The states	Pr02 = 6 : Full-closed control	

## Caution

### When you change the parameter setup or switch with VS-SEL, stop the action first then execute.

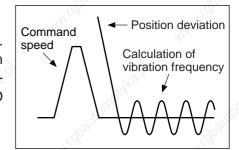
This function does not work properly or no effect is obtained under the following conditions.

The state of the s	Conditions which obstruct the damping control effect
	Vibration is triggered by other factors than command (such as disturbance).
Load	Ratio of resonance frequency and anti-resonance frequency is large.
	Vibration frequency is out of the range of 10.0-200.0 [ Hz] .

#### How to Use

## (1) Setup of damping frequency (1st : Pr2B, 2nd : Pr2D))

Measure the vibration frequency of the front edge of the machine. When you use such instrument as laser displacement meter, and can directly measure the load end vibration, read out the vibration frequency from the measured waveform and enter it to Pr2B or Pr2D (Damping frequency).



# (2) Setup of damping filter (1st : Pr2C, 2nd : Pr2E)) First, set up 0.

You can reduce the settling time by setting up larger value, however, the torque ripple increases at the command changing point as the right fig. shows. Setup within the range where no torque saturation occurs under the actual condition. If torque saturation occurs, damping control effect will be lost.

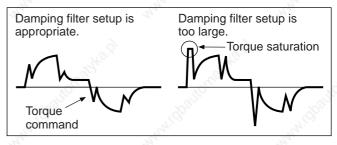


Limit the damping filter setup with the following formula.

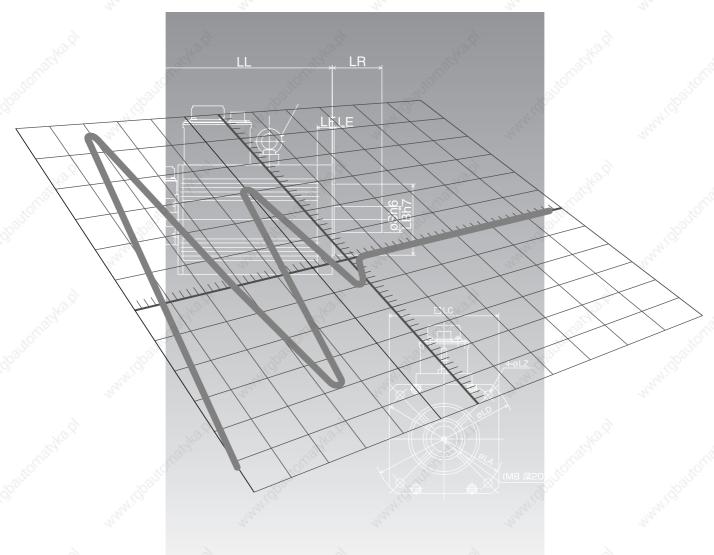
10.0 [ Hz] − Damping frequency Damping filter setup

≤ Damping frequency

# (3) Setup of damping filter switching selection (Pr24) You can switch the 1st or the 2nd damping filter depending on the vibration condition of the machine.



Pr24	Switching mode
0	No switching (Both of 2 are valid.)
The state of the s	Switch with VS-SEL input.
1 (1)	Open: 1st damping filter
140	Close : 2nd damping filter
1900	Switch with command direction.
2	CCW: 1st damping filter
200	CW : 2nd damping filter

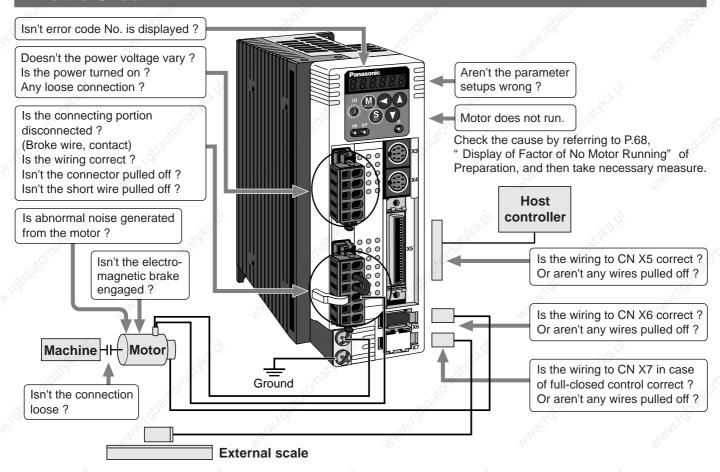


# [When in Trouble]

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# When in Trouble

## What to Check?



## **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, according to P.43, "Timing Chart (When error occurs)" of Preparation, and the driver will turn the Servo-Alarm output (ALM) to off (open).
- Error status ands 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 turning on the alarm clear input (A-CLR) for 120ms or longer.
  - When overload protection is triggered, you can clear it by turning on the alarm clear signal (A-CLR) 10 sec or longer after the error occurs. You can clear the time characteristics by turning off the connection between L1C and L2C or r and t of the control power supply of the driver.
  - You can clear the above error by operating the front panel keys. (Refer to P.73, "Alarm Clear Mode" of Preparation.)
  - You can also clear the above error by operating the "PANATERM®".

## <Remarks>

- When the protective function with a prefix of "\*" in the protective function table is triggered, you cannot clear with alarm clear input (A-CLR). For resumption, shut off the power to remove the cause of the error and re-enter the power.
- Following errors will not be stored in the error history.

Control power supply under-voltage protection	(Error code No. 11)
Main power supply under-voltage protection	(Error code No. 13)
EEPROM parameter error protection	(Error code No. 36)
EEPROM check code error protection	(Error code No. 37)
Over-travel prohibition input protection	(Error code No. 38)
Motor self-recognition error protection	(Error code No. 95)

# Protective Function (Detail of Error Code)

Protective function	Error code No.	Causes	Measures
Control power supply under- voltage protection	11	Voltage between P and N of the converter portion of the control power supply has fallen below the specified value.  1)Power supply voltage is low. Instantaneous power failure has occurred  2)Lack of power capacityPower supply voltage has fallen down due to inrush current at the main power-on.  3)Failure of servo driver (failure of the circuit)	Measure the voltage between lines of connector (L1C and L2C) and terminal block (r and t).  1)Increase the power capacity. Change the power supply.  2)Increase the power capacity.  3)Replace the driver with a new one.
Over- voltage protection	12	Voltage between P and N of the converter portion of the control power supply has exceeded the specified value 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 discharge resistor is not appropriate and could not absorb the regeneration energy.  4)Failure of servo driver (failure of the circuit)	<ul> <li>Measure the voltage between lines of connector (L1, L2 and L3).</li> <li>1)Enter correct voltage. Remove a phase-advancing capacitor.</li> <li>2)Measure the resistance of the external resistor connected between terminal P and B of the driver. Replace the external resistor if the value is ∞.</li> <li>3)Change to the one with specified resistance and wattage.</li> <li>4)Replace the driver with a new one.</li> </ul>
Main power supply under- voltage protection	13	Instantaneous power failure has occurred between L1 and L3 for longer period than the preset time with Pr6D (Main power off detecting time) while Pr65 (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. 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.	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 Pr6D (Main power off detecting time). Set up each phase of the power correctly.  3)Increase the power capacity. For the capacity, refer to P.32, "Driver and List of Applicable Peripheral Equipments" of Preparation.
* Over- current protection	14	Current through the converter portion has exceeded the specified value.  1) Failure of servo driver (failure of the circuit, IGBT or other components)  2) Short of the motor wire (U, V and W)  3) Earth fault of the motor wire  4) Burnout of the motor  5) Poor contact of the motor wire.  6) Melting of the relays for dynamic brake due to frequent Servo-ON/OFF operation  7) The motor is not applicable to the driver.  8) Timing of pulse input is same as or earlier than Servo-ON.	1)Turn to Servo-ON, while disconnecting the motor. If error occurs immediately, replace with a new driver.  2)Check that the motor wire (U, V and W) is not shorted, and check the branched out wire out of the connector. Make a correct wiring connection.  3)Measure the insulation resistance between motor wires, U, V and W and earth wire. In case of poor insulation, replace the motor.  4)Check the balance of resister between each motor line, and if unbalance is found, replace the motor.  5)Check the loose connectors. If they are, or pulled out, fix them securely.  6)Replace the driver. Prohibit the run/stop operation with Servo-ON/OFF.  7)Check the name plate and capacity of the motor and driver, and replace with motor applicable to the driver.  8)Enter the pulses 100ms or longer after Servo-ON.  9)Discontinue the run/stop operation with Servo ON-OFF. Allow approx. 3 minutes pause when the dynamic brake is activated during high-speed running.
* Over-heat protection	15	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.

# When in Trouble

Protective	Error		2011
function	code No.	Causes	Measures
Over-load protection	16	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 (Pr20) setup error.	fluctuate up an down very much on the graphic screen of the PANATERM®. Check the over-load alarm display and load factor with the PANATERM®.  1)Increase the capacity of the driver and motor. Set up longer acceleration/deceleration time. Lower the load.  2)Make a re-adjustment.
8,	ari	3)Miswiring, disconnection of the motor.  4)Machine has collided or the load has gotten heavy.	<ul> <li>3)Make a wiring as per the wiring diagram. Replace the cables.</li> <li>Connect the black (W phase), white (V phase) and red (U phase) cables in sequence from the bottom at the CN X2 connector.</li> <li>4)Remove the cause of distortion. Lower the load.</li> </ul>
Saltoll gilko r	n <sup>th</sup> n.	Machine has been distorted.  5)Electromagnetic brake has been kept engaged.  6)While wiring multiple axes, miswiring has occurred by connecting the motor cable to other axis.  7)Pr72 setup has been low.	5)Measure the voltage between brake terminals. Release the brake
* Over- regeneration load protection	18	caused by a large load inertia, converter voltage has risen, and the voltage is risen further due to the lack of capacity of absorbing this energy of the regeneration discharge resistor.	the monitor screen of the PANATERM®. 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 overregeneration warning display. Increase the capacity of the driver and the motor, and loosen the deceleration time. Use the external regenerative resistor.
Stational de la	nghi	specified time due to a high motor rotational speed.  3)Active limit of the external regenerative resistor has been limited to 10% duty.	without fail when you set up Pr6C to 2. Otherwise,
		regenerative resistor loses the protection and it may be	be heated up extremely and may burn out.
* Encoder communi- cation error protection	21	Communication between the encoder and the driver has been interrupted in certain times, and disconnection detecting function has been triggered.	<ul> <li>Make a wiring connection of the encoder as per the wiring diagram. Correct the miswiring of the connector pins. Note that the encoder cable to be connected to CN X6.</li> <li>Secure the power supply for the encoder of</li> </ul>
* Encoder communi- cation data error protection	23	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.	DC5V±5% (4.75-5.25V)pay an attention especially when the encoder cables are long.
Position deviation excess protection	24	Deviation pulses have exceeded the setup of Pr70 (Setup of position deviation excess).  1)The motor movement has not followed the command.	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 Pr5E (Setup of 1st torque limit) and Pr5F (2nd torque limit setup).
altomatika d		2)Setup value of Pr70 (Setup of position deviation excess) is small.	Make a encoder wiring as per the wiring diagram. Set up the longer acceleration/deceleration time. Lower the load and speed.
		V V	~~

Protective function	Error code No.	10 (10 m)	Causes	Measures
* Hybrid deviation excess error protection	25	Position of load by the motor by the e	the external scale and position of ncoder slips larger than the setup Setup of hybrid deviation excess) at	<ul> <li>Check the connection between the motor and the load.</li> <li>Check the connection between the external scale and the driver.</li> <li>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.</li> <li>Check that the numerator and denominator of the external scale division (Pr78, 79 and 7A) and reversal of external scale direction (Pr7C) are correctly set.</li> </ul>
Over-speed protection	26	The motor rotations value of Pr73 (Over-	al speed has exceeded the setup -speed level setup)	<ul> <li>Do not give an excessive speed command.</li> <li>Check the command pulse input frequency and division/multiplication ratio.</li> <li>Make a gain adjustment when an overshoot has occurred due to a poor gain adjustment.</li> <li>Make a wiring connection of the encoder as per the wiring diagram.</li> <li>Set up Pr73 to 0 (Set up to motor max. speed x 1.2.)</li> </ul>
Electronic gear error protection	27 	the 1st and the 2	lication ratio which are set up with nd numerator/denominator of the 8 to 4B) are not appropriate.	Check the setup values of Pr48 to 4B.     Set up the division/multiplication ratio so that the command pulse frequency after division multiplication may become less than 80Mpps at deviation counter input portion, and 3Mpps at command input portion.
* External scale com- munication data error protection	28	encoder. Mainly d	or has occurred in data from the ata error due to noise. Encoder ted, but communication date has	
Deviation counter overflow protection	29	Deviation counter va	lue has exceeded 2 <sup>27</sup> (134217728).	<ul> <li>Check that the motor runs as per the position command pulses.</li> <li>Check that the output toque has not saturated in torque monitor.</li> <li>Make a gain adjustment.</li> <li>Set up maximum value to Pr5E (1st torque limit setup) and Pr5F (2nd torque limit setup).</li> <li>Make a wiring connection of the encoder as per the wiring diagram.</li> </ul>
Software limit protection	34	software limit. 1)Gain has not mate		Refer to P.258,"Software Limit Function" before using this.  1)Check the gain (balance of position loop gain and velocity loop gain) and the inertia ratio.  2)Setup a larger value to Pr26.
* External scale com- munication error protection	35	driver has been i	tween the external scale and the nterrupted in certain times, and ting function has been triggered.	<ul> <li>Make a wiring connection of the external scale as per the wiring diagram.</li> <li>Correct the miswiring of the connector pins.</li> </ul>
* EEPROM parameter error protection	36		storage area has been damaged ata 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 protection	37		onfirmation to EEPROM has been ading the data from EEPROM at	
Over-travel inhibit input protection	38	input (CWL, Pin-8/opened, while Pr04 Or either one of the	CW and CCW over-travel inhibit CCW, Pin-9) to COM- have been (Over-travel inhibit input setup) is 0. e connection of CW or CCW over-to COM- has been opened, while	Check that there are not any errors in switches, wires or power supply which are connected to CW/CCW over-travel inhibit input. Check that the rising time of the control power supply (DC12-24V) is not slow.

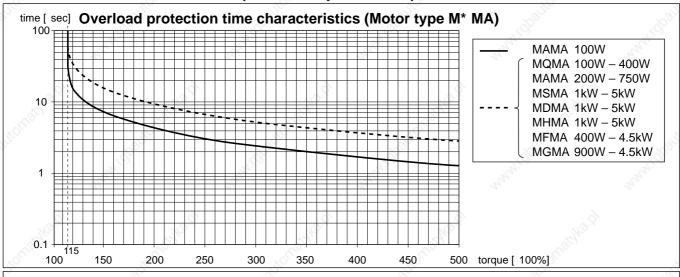
# When in Trouble

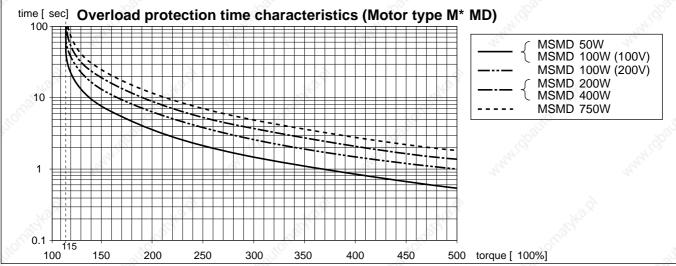
Protective	Error	-974		- 22/2	
	code No.	30,	auses	William .	Measures
Analog input excess protection	39	command input (SPR : C that has been set by Pr71 This protective function is SPL is valid such cases a 1)Velocity control	een applied to the analog N X5, Pin-14) than the value (Analog input excess setup) s validated when SPR/TRQR/s,	Check the co X5. Set up a large command). Set up Pr7	Setup of analog input excess) correction of the connector, or value to Pr57 (Filter setup of Velocation 0 and invalidate the protect
partomath.	ar <sup>it</sup>	Pr05 (Velocity setup in set to 0 or 2, and wher selected and speed zero ity command is not zero 2)Torque control when Pr02 (Control mo Pr5B (Torque command que control when Pr02 (Control mo when Pr02 (Control mo	nternal/external switching) is a analog velocity command is o clamp is invalidated. (veloc-	Saltofrairi)	
TOLUSIAL.			is invalidated (Velocity com-	tolugich.	HOLDIGH.
Absolute system down error protection	40		the power supply or battery	the absolute (Initialization) o	g the power supply for the battery, cloencoder. (Refer to P.271, "Set of Absolute Encoder" of Supplement.) lear the alarm unless you clear the set.
* Absolute counter over error protection	41	Multi-turn counter of the exceeded the specified va	17-bit absolute encoder has alue.	encoder setup	appropriate value to Pr0B (Absolute). el from the machine origin within 327
Absolute over-speed error protection	42		from the battery has been	(5V±5%) • Check the co	supply voltage at the encoder someonecting condition of the connector, of clear the alarm unless you clear toder.
* Absolute single turn counter error protection	44	has been detected.	r of 17-bit absolute encoder or of 2500[ P/r] , 5-wire seri ed.	110	otor.
* Absolute multi-turn counter error protection	45	been detected.	f 17-bit absolute encoder has of 2500[ P/r], 5-wire seried.	9	otor.
Absolute status error protection	47	17-bit absolute encoder speed than the specified v		Arrange so as t	the motor does not run at power-on.
* Encoder Z-phase error protection	48	Missing pulse of Z-phas encoder has been detected		alThe encoder m	ight be a failure. Replace the motor.
* Encoder CS signal error protection	49	CS signal logic error of 25 has been detected	500[ P/r] , 5-wire serial encode	The encoder m	ight be a failure. Replace the motor.

Protective function	Error code No.	"OUTING"	Causes	OUSE	Measures	,o <sup>f</sup>
* External scale status 0 error protection	50	turned to 1.	scale error code (ALMC) has bee	scale error fro	causes of the error, then come the front panel.  ut off the power to reset.	lear the external
* External scale status 1 error protection	51	turned to 1.	scale error code (ALMC) has bee	n		
* External scale status 2 error protection	52	turned to 1.	scale error code (ALMC) has been tions of the external scale.	n		
* External scale status 3 error protection	53	turned to 1.	scale error code (ALMC) has been tions of the external scale.	n		
* External scale status 4 error protection	54	turned to 1.	scale error code (ALMC) has been tions of the external scale.	n Johnstyka pl		
* External scale status 5 error protection	55	turned to 1.	scale error code (ALMC) has been tions of the external scale.	n		
CCWTL input excess protection	65	analog command in This protective func- valid such cases as, 1) Torque control when Pr02 (Control and when Pr5B (T 2) Position control,	n ±10V has been applied to the put (CCWTL: CN X5, Pin-16) etion is validated when CCWTL.  I mode setup) is 5, or Pr02 is 2 or Torque command selection) is 1.  Velocity control and Full-closes 3 (Torque limit selection) is 0.	• Set the CCV	connecting condition of cor NTL voltage within ±10V.	nnector, CN X5.
CWTL input excess protection	66	analog command inp This protective fund valid such case as, 1) Position control,	n ±10V has been applied to the put (CCWTL: CN X5, Pin-18) ction is validated when CCWTL.  Velocity control and Full-close (Torque limit selection) is 0.	• Set the CW	connecting condition of cor TL voltage within ±10V.	nnector, CN X5.
* Motor automatic recognition error protection	95	The motor and the d	Iriver has not been matched.	Replace the r	motor which matches to th	e driver.
* Other error	Other No.	or other causes. Some error has or	malfunctioned due to excess nois ccurred inside of the driver whi osis function of the driver.	If error repe     Stop using	power once, then re-enter ats, this might be a failure the products, and replace Return the products to er.	e the motor and

# When in Trouble

### Time characteristics of Err16 (Overload protection)





#### Software Limit Function

#### 1)Outline

You can make an alarm stop of the motor with software limit protection (Error code No.34) when the motor travels exceeding the movable range which is set up with Pr26 (Set up of software limit) against the position command input range.

You can prevent the work from colliding to the machine end caused by motor oscillation.

#### 2) Applicable range

This function works under the following conditions.

2	Conditions under which the software limit works
Control mode	• Either at position control mode or full-closed control mode  Pr02 = 0 : Position control  Pr02 = 3 : 1st control mode of Position control/Velocity control  Pr02 = 4 : 1st control mode of Position control/torque control  Pr02 = 6 : Full-closed control
10 j	<ul> <li>(1) at Servo-ON</li> <li>(2) when Pr26 (Software limit setup) is other than 0.</li> <li>(3) After the last clearance of the position command input range (0 clearance), the movable range of the motor is within 2147483647 for both CCW and CW direction.</li> </ul>
Others	Once the motor gets out of the (3) condition, the software limit protection will be invalidated until the later mentioned "5) Condition under which the position command input range is cleared" is satisfied. The position command input range will be 0-cleared when the motor gets out of the conditions of (1) and (2).

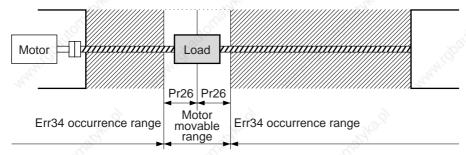
### 3) Cautions

- This function is not a protection against the abnormal position command.
- When this software limit protection is activated, the motor decelerates and stops according to Pr68 (Sequence at alarm).
  - The work (load) may collide to the machine end and be damaged depending on the load during this deceleration, hence set up the range of Pr26 including the deceleration movement.
- This software limit protection will be invalidated during the trial run and frequency characteristics functioning of the PANATERM®.

#### 4) Example of movement

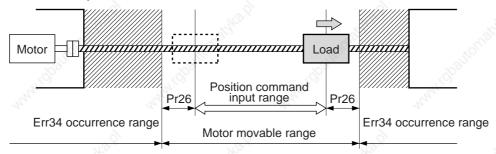
### (1) When no position command is entered (Servo-ON status),

The motor movable range will be the travel range which is set at both sides of the motor with Pr26 since no position command is entered. When the load enters to the Err34 occurrence range (oblique line range), software limit protection will be activated.



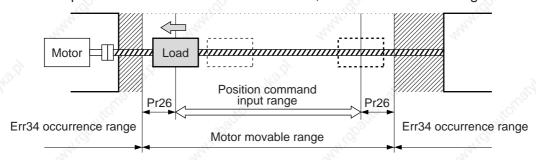
#### (2) When the load moves to the right (at Servo-ON),

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 + Pr26 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, Pr66 (Sequence at over-travel inhibition) is 2 and over-travel inhibition input is valid.)
- At the starting and the finishing of the normal auto-gain tuning.

# **Troubleshooting**

# **Motor Does Not Run**

When the motor does not run, refer to P.68, "Display of Factor of No-Motor Running" of Preparation as well.

Classification	77.00	Causes	7.00	Measures	7/000
Parameter	Setup of the control	Check that the present control	1)Set up Pr02 (Se		7/2/2
	mode is not correct	mode is correct with monitor		· -	(C-MODE) of
	3	mode of the front panel.		rect, when Pr03 is set to 3-5.	
	Selection of torque	Check that the external analog		lection of torque limit) to 0 and	
	limit is not correct	input (CWTL/CCWTL) is not		V ] to CCWTL when you use the	
770,	7/40,	used for the torque limit.		ction of torque limit) to 1 and set up	
	Setup of electronic	Check that the motor moves by		1st torque limit) when you use the pa s of Pr48-4B again.	arameter value.
	gear is not correct.	expected revolution against the			V) of CN X5 to
	(Position/Full-closed)	command pulses.		idate the division/multiplication	
	,	·		me value to Pr48 and Pr49.	
Wiring	Servo-ON input of CN	Check that the input signal No.0		a wiring so as to connect the SF	RV-ON input to
29/2c	X5 (SRV-ON) is open.	or No.03 does not show "-", with	COM		
office	CM/CCM over travel	monitor mode of the front panel.	- Ollio		
- ALIE	CW/CCW over-travel inhibit input of CN X5	Check that the input signal No.02 or No.03 does not show		e a wiring so as to connect h	ooth CWI and
30,	(CWTL/CCWTL) is	"A", with monitor mode of the			JOHN OWE WHO
	open.	front panel.	. 194.	etup of over-travel inhibit input	) to 1 (invalid)
	Command pulse input	Check that the input pulse	. 100	. 100	24
	setup is incorrect.	counts and variation of com-	'	command pulses are entered of	
13	(Position/Full-closed)	mand pulse sum does not slips,		d with Pr40 (Selection of comman	
30/2	600	with monitor mode of the front			
, offi	Command pulse input	panel. Check that the input signal		vith Pr42 (Setup of command pulse e a wiring so as to connect the	
Major.	inhibition (INH) of CN	No.08 does not show "A", with		e a willing so as to conflect the	e iivii iiiput to
5	X5 is open.	monitor mode of the front panel.		alidation of command pulse inhi	ibition input) to
	(Position/Full-closed)	THE.	1 (invalid).	The state of the s	The .
	Counter clear input	Check that the input signal		e wiring so as to open the CL	input 2)Set up
	(CL) of CN X5 is	No.0A does not show "A", with	Pr4E (Counter of	lear input mode) to 2 (invalid).	
No.	connected to COM	monitor mode of the front panel.	N		
May Control	(Position/Full-closed) Speed command is	Check that the velocity com-	1)Chook the set	ups of Pr50-52 again by set	ting up Dr05
400	invalid (Velocity)	mand input method (external		rnal switching of speed setup) t	
1000 m	invalia (volocity)	analog command/internal veloci-		analog command.	o o, whom you
(a)	M. (2)	ty command) is correct.		and Pr74-77 by setting up Pr	05 (Internal or
	The state of the s	The state of the s	external switching	ng of speed setup) to either on	e of 1, 2 or 3,
				e internal speed command.	
	Speed zero clamp	Check that the input signal		e wiring so as to connect spee	ed zero clamp
"The	input (ZEROSPD) of CN X5 is open.	No.05 does not show "A", with monitor mode of the front panel.		lection of ZEROSPD input) to 0	(invalid)
allo,	(Velocity/Torque)	monitor mode of the front parier.	2)3et up F100 (3e	lection of ZEROSFD input) to 0	(IIIvaliu).
Mic.	Torque command is	Check that the torque command	1)Check that the i	nput voltage is applied correctly	/ by setting up
800	invalid (Torque)	input method (SPR/TRQR input,		of torque command) to 0, v	
	and it	CCWTL/TRQR input) is correct.	SPR/TRQR inpu		"Tay.
	2/2	27		nput voltage is applied correctly	
			· ·	of torque command) to 1, whe	n you use the
	Velocity control is	Check that the velocity limit input	1)Set up the desir	nput. ed value to Pr56 (Speed setup	/4th speed) by
17/1-	invalid (Torque)	method (internal velocity, SPR/		(Selection of torque comman	
"Olling		TRQR/SPL input) is correct.	you use the inte		.,,
William Contraction of the Contr	~9 <sub>111</sub>	Zalle.		nput voltage is applied correctly	by setting up
87	7707	30		of torque command) to 1, whe	n you use the
I and all address	M		SPR/TRQR/SPL		(1) 10 1
installation	Main power is shut off.	Check that the output signal		oltage of main power of the driv	er (∟1, L2 and
	A	No.0 does not show "-", with monitor mode of the front panel.	L3).		
NO	The motor shaft drags,	1)Check that you can turn the motor	If you cannot turn	the motor shaft, consult with	the dealer for
Valid.	the motor does not	shaft, after turning off the power			
" FOL.	run.	and separate it from the machine.	400		8
1021	.5000	2)Check that you can turn the motor			2030
(-)	"4' <sub>(O</sub> ,	shaft while applying DC24V to the			"4'iO.
	The state of the s	brake in case of the motor with	Thu,		My.
		electromagnetic brake.		_	

# 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 Pr02 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 Pr02 to 0.		
Adjustment	Gain adjustment is not proper.	Increase the setup of Pr11, 1st velocity loop gain. Enter torque filter or Pr14 and increase the setup of Pr11 again.		
8	Velocity and position command are not stable.	Check the motor movement with check pin 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 CN X5 is chattering.  1) Servo-ON signal  2) CW/CCW torque limit input signal  3) Deviation counter input signal  4) Speed zero clamp signal  5) Command pulse inhibition input	67.		
Chigh Margh	Noise is on the velocity command.	can be entered normally. Review the controller.  Use a shield cable for connecting cable to the connector, CN X5.  Separate the power line and signal line (30cm 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. Adjust the Pr52 value so that the motor stops.		

# **Troubleshooting**

# Positioning Accuracy Is Poor

Classification	Causes	Measures
System	Position command is not correct.	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.
Saltoffagike .	Captures the positioning complete signal at the edge.	Monitor the deviation at positioning complete signal reception with a check pin (IM) or the waveform graphic function of the PANATERM®. Make the controller capture the signal not at the edge but with some time allowance.
9	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 (CN X5, Pin-5).	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.
Parameter	Setup of the positioning complete range is large.	Increase the setup of Pr10 within the range where no oscillation occurs.  Lower the setup of Pr60 within the range where no chattering of complete signal occurs.
3	Command pulse frequency have exceeded 500kpps or 2Mpps.	Lower the command pulse frequency. Change the division/multiplication ratio of 1st and 2nd numerator of command division/multiplication, Pr48 and Pr4B. Use a pulse line interface exclusive to line driver when pulse line interface is used.
" gho's	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.
Politicus.	Velocity loop gain is proportion action at motor in stall.	<ul> <li>Set up Pr12 and Pr1A of time constant of velocity loop integration to 999 or smaller.</li> <li>Review the wiring and connection so that the connection between Pin-27 and 41 of the gain switching input connector, CN X5 becomes off while you set up Pr30 of 2nd gain setup, to 1.</li> </ul>
Wiring	Each input signal of CN X5 is chattering.  1) Servo-ON signal  2) Deviation counter clear input signal	1) Check the wiring and connection between Pin29 and 41 of the connector, CN X5 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.  2) Check the wiring and connection between Pin-30 and 41, 16 and 17 of the connector, CN X5 using display function of I/O signal status. Correct the wiring and connection so that the deviation counter clear.
Patroughtwo'd	3) CW/CCW torque limit input signal     4) Command pulse inhibition input	<ul> <li>input can be turned on normally. Review the controller.</li> <li>3 Check the wiring and connection between Pin-18 and 17, 16 and 17 of the connector, CN X5 using tester or oscilloscope. Correct the wiring and connection so that CW/CCW torque limit input can be entered normally.</li> <li>4)Check the wiring and connection between Pin-33 and 41of the connector, CN X5 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.</li> </ul>
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.

# **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, CN X5 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.

# **Abnormal Motor Noise or Vibration**

	0.0	A.S		
Classification	Causes	Measures		
Wiring	Noise is on the speed command.	Measure the speed command inputs of Pin-14 and 15 of the connector, CN X5 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 Pr11 and 19, of velocity loop gain and Pr10 and 18 of position loop gain.		
Installation	Velocity detection filter is changed.	Enlarge the setup of Pr13 and 1B, velocity detection filter within the range where noise level is acceptable, or return to default value.		
J. T. C. Louis	Resonance of the machine and the motor.	Re-adjust Pr14 and 1C (Torque filter). Check if the machine resonance exists or not with frequency characteristics analyzing function of the PANATERM®. Set up the notch frequency to Pr1D or Pr28 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.		

# **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 velocity monitor (SP) or torque monitor (IM). Make a correct gain adjustment. Refer to P.226 of Adjustment.
Installation	Load inertia is large.	Check with graphic function of PANATERM® or velocity monitor (SP) or torque monitor (IM). Make an appropriate adjustment. Increase the motor and driver capacity and lower the inertia ratio. Use a gear reducer.
Southo.	Looseness or slip of the machine	Review the mounting to the machine.
-5	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.
.3/E.S.	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.
pattonio	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 (DC24V) 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.
92/4015.	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.

# Motor Speed Does Not Reach to the Setup

# Motor Revolutions (Travel) Is Too Large or Small

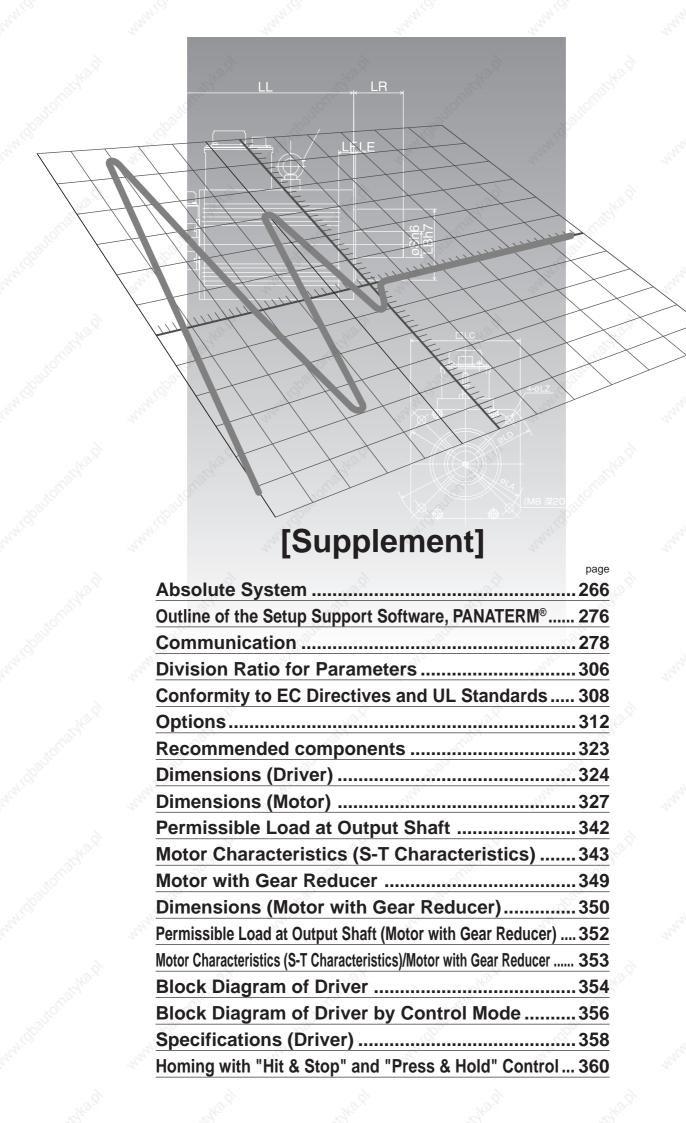
Classification	Causes	Measures
Parameter	Velocity command input gain is not correct.	Check that the setup of Pr50, speed command input gain, is made so as to make the setup of 500 makes 3000 r/min.
Adjustment	Position loop gain is low.	Set up Pr10, position loop gain to approx. 100.
	Division/Multiplication is not proper.	Set up correct values to Pr48, 1st numerator of electronic gear, 4A, numerator multiplier of electronic gear and 4B, denominator of electronic gear. Refer to parameter setup at each mode.

# 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.70, "How to Operate-EEPROM Writing" of Preparation.

# Display of "Communication port or driver cannot be detected" Appears on the Screen While Using the PANATERM®.

Classification	Causes		Measures
Wiring	Communication cable (for RS232C)	is	Connect the communication cable (for RS232C) to connector, CN X4.
	connected to the connector, CN X3.		



# **Absolute System**

# **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.

Connect the host controller with the Minas A4 with absolute specifications. (motor with absolute encoder and driver with absolute spec) and set up the parameter, Pr0B to 0, then connect the battery for absolute encoder to compose an absolute system with which you can capture the exact present position information after the power-ON.

Shift the system to origin once after installing the battery and clear the multi-turn data by clearing the absolute encoder, then you can detect the absolute position without carrying out homing operation.

Via RS232 or RS485 communication, the host controller can connect up to 16 MINAS-A4 and capture the present position information as serial data to obtain the absolute position of each axis by processing. each data.

# **Applicable Mode**

You can use all of MINAS A4 series driver in absolute specifications by setting up parameter. Use the motor which 8th place (designated for rotary encoder specifications) is "S" (7-wire type).

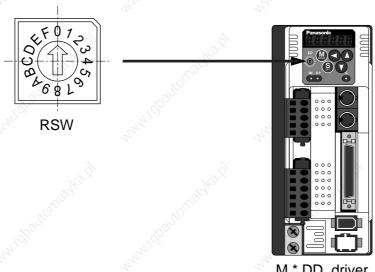
$$M * M * * * * S * * * *$$
8th place Rotary encoder specifications

# **Absolute Specifications**

There are 3 connecting methods of the host controller and MINAS-A4 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 RSW of each MINAS-A4 driver when you connect multiple MINAS-A4 in communication to one host controller as shown below.

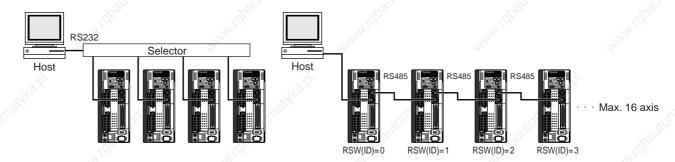
# Module ID (RSW)

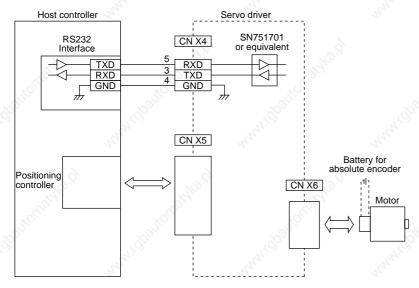
- When you connect each MINAS-A4 to the host separately with RS232 and switch the communication individually, designate 0 to F to each MINAS-A4. (Max. 16 axis are connectable.)
- When you connect one MINAS-A4 to the host with RS232 and connect each MINAS-A4 with RS485, designate 0 to the MINAS-A4 connected with the host, and designate 1 to F to other MINAS-A4.
- When you connect MINAS-A4 to the host with RS485, the host is given module ID of 0, and designate 1 to F to MINAS-A4. (Max 15 axis are connectable.)



M \* DD driver

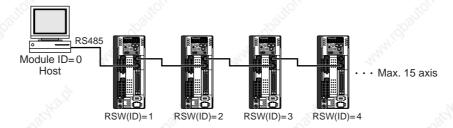
# **Absolute System Configuration with RS232 Communication**

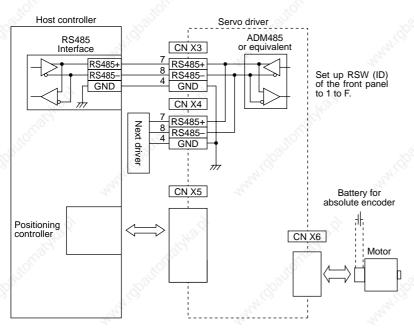




\* Battery for absolute encoder is required to store the multi-turn data into the encoder. Connect the battery between BAT+ and BAT- of the motor.

# **Absolute System Configuration with RS485 Communication**





\* 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.

# **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.271, "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.

# 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.275, "How to Clear the Battery Alarm".

#### <Caution>

When you execute the absolute encoder with the front panel (refer to P.77 of Preparation), or via communication (refer to P.302), 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.271).

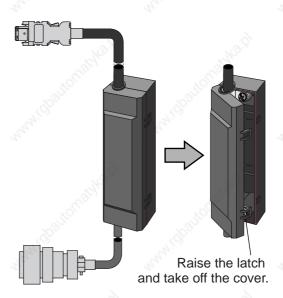
### How to Replace the Battery

#### 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.

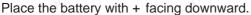


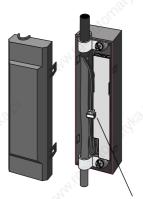
#### 2) Take off the cover of the battery box.



### 3) Install the battery to the battery box.







Connect the connector.

### 4) Close the cover of the battery box.



Close the cover not to pinch the connector cable.





#### <Caution>

Use the following battery for absolute encoder.

Part No.: DV0P2990 (Lithium battery by Toshiba Battery Co., Ltd. ER6V, 3.6V 2000mAh)

#### <Cautions>

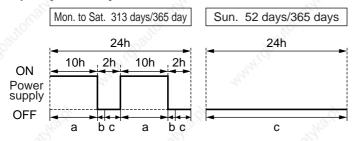
- Be absolutely sure to follow the precautions below since improper use of the battery can cause electrolyte to leak from the battery, giving rise to trouble where the product may become corroded, and/or the battery itself may rupture.
  - 1) Insert the battery with its " +" and " -" electrodes oriented 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.
- The disposal of used batteries after they have been replaced may be subject to restrictions imposed by local governing authorities. In such cases, ensure that their disposal is in accordance with these restrictions.

# **Absolute System**

#### < Reference>

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. 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  $3.6[\mu A]$
- b : Current consumption at power failure timer mode 280[µA]
  - \* Power failure timer mode...Action mode in time period when the motor can respond to max. speed even the power is off (5sec).
- c : Current consumption at power failure mode 110[μA]

Annual consumption capacity =  $(10h \times a + 0.0014h \times b + 2h \times c) \times 2 \times 313 \text{ days} + 24h \times c \times 52 \text{ days} = 297.8[ mAh]$ Battery life = 2000[ mAh] /297.8[ mAh] = 6.7 (6.7159) [ year]

#### 2) 1 cycle/day

(2nd cycle of the above 1) is for rest.

Annual consumption capacity =  $(10h \times a + 0.0014h \times b + 14h \times c) \times 313 \text{ days} + 24h \times c \times 52 \text{ days} = 640.6[ mAh]$ Battery life = 2000[ mAh] /630.6[ mAh] = 3.1 (3.1715)[ year]

### When you make your own cable for 17-bit absolute encoder

When you make your own cable for 17-bit absolute encoder, connect the optional battery for absolute encoder, DV0P2060 or DV0P2990 as per the wiring diagram below. Connector of the battery for absolute encoder shall be provided by customer as well.

#### <Cautions>

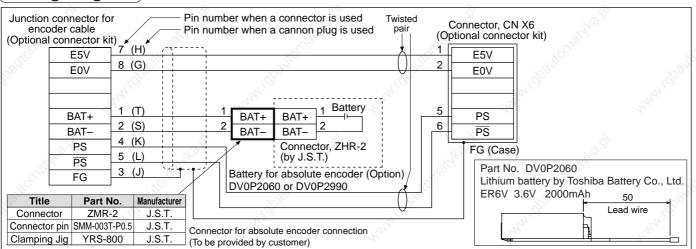
Install and fix the battery securely. If the installation and fixing of the battery is not appropriate, it may cause the wire breakdown or damage of the battery.

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



# **Setup (Initialization) of Absolute Encoder**

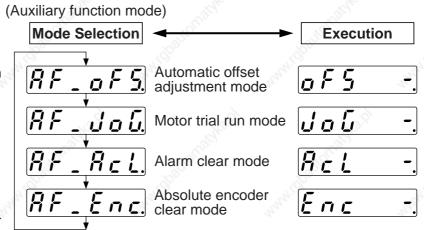
Execute the setup of absolute encoder in the following cases.

- Initial setup of the machine
- When absolute system down error protection (alarm No. 40) occurs
- When the encoder cable is pulled out

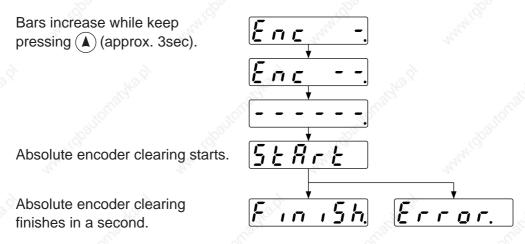
In the above setup, it is required to make multi-turn data to 0 after clearing the encoder error by clearing absolute encoder while the machine stops at the origin position with homing operation. Clear the absolute encoder with the front panel operation or with the PANATERM operation. After the clearing, turn off the power and turn on the power again.

# **Setup Operation of Absolute Encoder**

- (1) Turn on the power to bring he machine to origin position by homing operation.
- (2) Make the front panel to auxiliary function mode and bring EXECUTION display of "Absolute encoder clear mode". Refer to P.51, "Setup of Parameter and Mode" of Preparation.



(3) Execute the following key operation at EXECUTION DISPLAY



Note) In case of incremental encoder, *[Frrar.*] display appears when absolute encoder clear starts.

(4) Turn off the control power once, then re-enter the power.

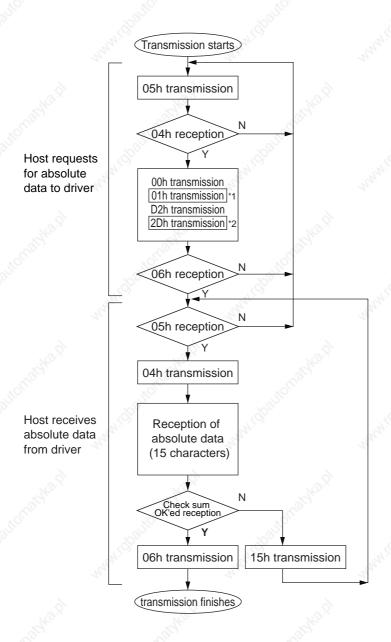
# **Absolute System**

# **Transmission and Reception Sequence of Absolute Data**

Servo-Ready output will be turned on 2sec. after the control power is turned on. Capture the absolute data in the following communication protocol while the Servo-Ready output is on and the fix the motor with brake by Servo-Off (when the motor is at complete stall.).

### **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 RSW (ID) of the front panel.

RSW(ID)	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
Α	0Ah	24h
B <sub>0</sub> ,Q	0Bh	23h
С	0Ch	22h
O D	0Dh	21h
E	0Eh	20h
F	0Fh	1Fh

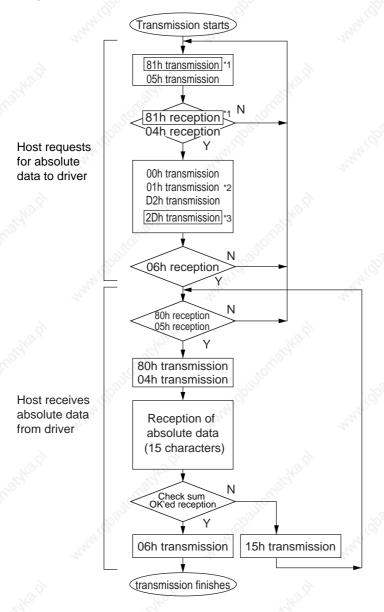
Check sum becomes OK'ed when the lower 8-bit of the sum of the received absolute data (15 characters) is 0.

Enter the RSW 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.278, "Communication".

- Allow 500ms 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 RSW (ID).



Data of \*1 and \*2 are determined by the setup of RSW (ID) of the front panel.

RSW(ID)	Data of * 1	Data of * 2	Data of * 3
0	not usable	with RS485 com	munication
1	81h	01h	2Dh
2	82h	02h	2Ch
3 8	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
Α	8Ah	0Ah	24h
В	8Bh	0Bh	23h
С	8Ch	0Ch	22h
D	8Dh	் 0Dh	21h 💉
Е	8Eh	0Eh	20h
F	8Fh	0Fh	1Fh

Check sum becomes OK'ed when the lower 8-bit of the sum of the received absolute data (15 characters) is 0.

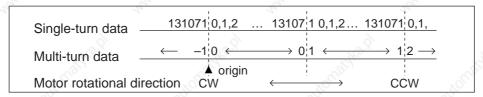
Command from the host will be transmitted to the desired driver based on RS485 transmission protocol. For details of communication, refer to P.278, "Communication".

- Allow 500ms 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.

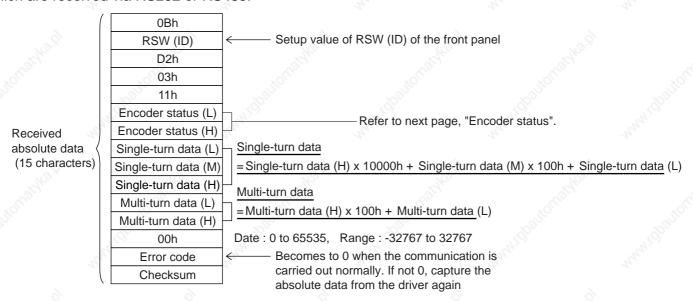
# **Absolute System**

### **Composition of Absolute Data**

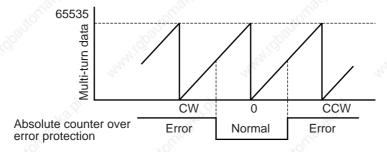
Absolute data consists of singe-turn data which shows the absolute position per one revolution and multiturn data which counts the number of revolution of the motor after clearing the encoder.



Single-turn data and multi-turn data are composed by using 15-character data (hexadecimal binary code) which are received via RS232 or RS485.



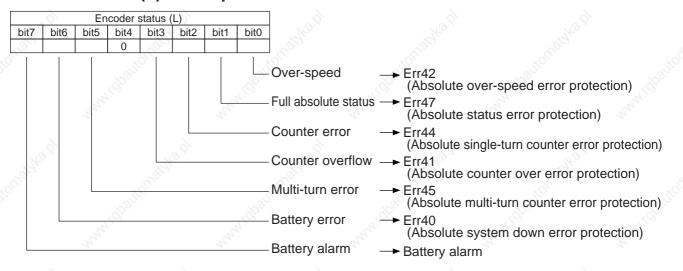
#### Details of multi-turn data



#### <Remark>

If the multi-turn data of the above fig. is between 32768 and 65535, convert it to signed date after deducting 65536.

• Encoder status (L)----1 represents error occurrence.



# • Encoder status (L)----1 represents error occurrence.

		Er	coder	status (	(L)		50	. Ki°
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	
0	0	4		0	0	0	0	
		200	Julion e	igi <mark>ko (i</mark> )		×	BITOR	Battery error One of the following has occurred. Battery alarm, multi-turn error, counter overflow, counter error, full absolute status, Counter overflow multi-turn error, battery error or battery alarm

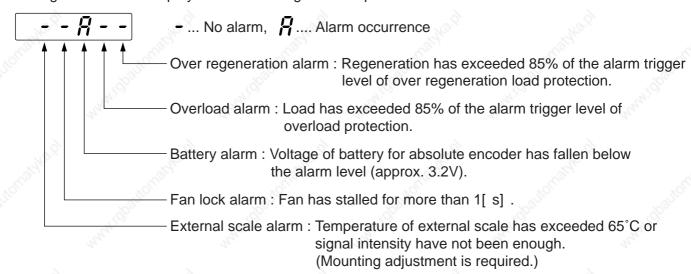
• Transmit the absolute data while fixing the motor with brake by turning to Servo-Off.

#### <Note>

For details of the above error protection, refer to P.252, "Protective Function" of When in Trouble, and for contents of alarms, refer to the following "Display of Battery Alarm".

# **Display of Battery Alarm**

Following alarm will be displayed when making the front panel to alarm execution mode of monitor mode.



# **How to Clear the Battery Alarm**

Replace the battery for absolute encoder when battery alarm occurs according to P.268, "How to Replace the Battery". After replacement, clear the battery alarm in the following 3 methods.

- (a) "CN X5" Connecting Alarm clear input (A-CLR) to COM- for more than 120ms.
- (b) Executing the alarm clear function in auxiliary function mode by using the console (option).
- (c) Click the "Battery warning" Clear button, after select the "Absolute encoder" tab in the monitor display window by using the PANATERM (option).

# Outline of Setup Support Software, "PANATERM®"

# **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.

### **How to Connect**



#### <Caution>

\* Don't connect to CN X3.

Display of "Communication port or driver cannot be detected." appears even though you log on "PANATERM®".

### Install the "PANATERM®" to Hard Disc

#### <Cautions/Notes>

- 1. 15MB capacity of hard disc is required. OS to be Window® 98, Windows® 2000, Windows® Me or Windows® XP.
- 2. Install the "PANATERM®" to a hard disc, using the setup disc according to the procedures below to log on.
- 3. Part No. of the "PANATERM®" may be changed based on the version up. Refer to the catalog for the latest part No.

### Procedure of install

- 1) Turn on the power of the computer to log on the supporting OS. (Exit the existing logged on software.)
- 2) Insert the setup disc of the "PANATERM®" to CD-ROM drive.
- 3) The window opens automatically so click the name of the file required.
  - \* If the window fails to appear automatically, start up Explorer, and run the targeted setup file.
- 4) Operate according to the guidance of the setup program.
- 5) Click OK on the installation verification window to start the setup.
- 6) Exit all applications and log on Windows® again.
  - "PANATERM®" will be added on program menu when you log on again.

# Log on of the "PANATERM®".

#### <Cautions/Notes>

- 1. Once the "PANATERM®" is installed in the hard disc, you do not need to install every time you log on.
- 2. Connect the driver to a power supply, the motor and encoder before you log on. Refer to the instruction manual of supporting OS for start.

### Procedure of log on

- 1) Turn on the power of the computer and log on the supporting OS.
- 2) Turn on the power of the driver.
- 3) Click the start bottom of the supporting OS.

  (Refer to the instruction manual of supporting OS for start.)
- 4) Select the "PANATERM®" with program ▶ and click.
- 5) The screen turns to "PANATERM®" after showing opening splash for approx. 2sec.

For more detailed information for operation and functions of the "PANATERM®", refer to the instruction manual of the Setup Support Software, "PANATERM®".

<sup>\*</sup> Windows®, Windows® 98, Windows® 2000, Windows® Me and Windows® XP are trade marks of Microsoft Corp.

# Communication

# **Outline of Communication**

You can connect up to 16 MINAS-A4 series with your computer or NC via serial communication based on RS232 and RS484, and can execute the following functions.

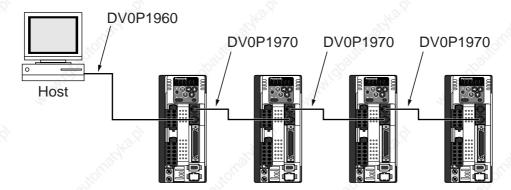
- (1) Change over of the parameters
- (2) Referring and clearing of alarm data status and history
- (3) Monitoring of control conditions such as status and I/O.
- (4) Referring of the absolute data
- (5) Saving and loading of the parameter data

#### **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.

Following application software and cables are prepared as options. For the operation of the "PANATERM®, refer to the instruction manual of the PANATERM®.

"PANATERM®" English/Japanese version (Windows 98/Me/2000/XP)	DV0P4460
Connecting cable for PC (DOS/V)	DV0P1960
	DV0P1970 (200[mm])
Connecting cable between drivers	DV0P1971 (500[mm])
	DV0P1972 (1000[mm])

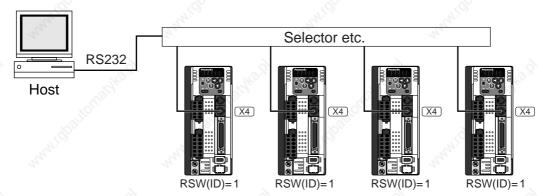


### **Connection of Communication Line**

MINAS-A4 series provide 2 types of communications ports of RS232 and RS485, and support the following 3 types of connection with the host.

#### RS232 communication

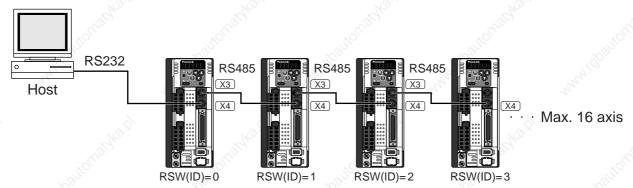
Connect the host and the driver in one to one with RS232, and communicate according to RS232 transmission protocol.



• Set up the module ID of MINAS-A4 to RSW of the front panel. In the above case, you can set any value of 0 to F. You can set the same module ID as long as the host has no difficulty in control.

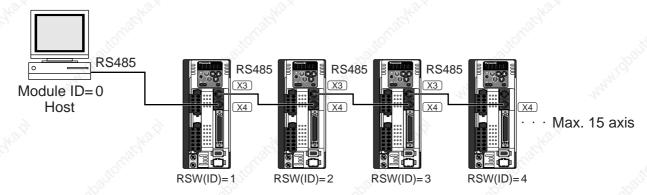
#### RS232 and RS485 communication

When you connect one host to multiple MINAS-A4s, connect the host to connector X4 of one driver with RS232 communication, and connect each MINAS-A4 with RS485 communication. Set up the RSW of the driver to 0 which is connected to the host, and set up 1 to F to other drivers each.



#### RS485 communication

Connect the host to multiple MINAS-A4s with RS485 communication, set up the RSW of each front panel of MINAS-A4 to 1 to F.

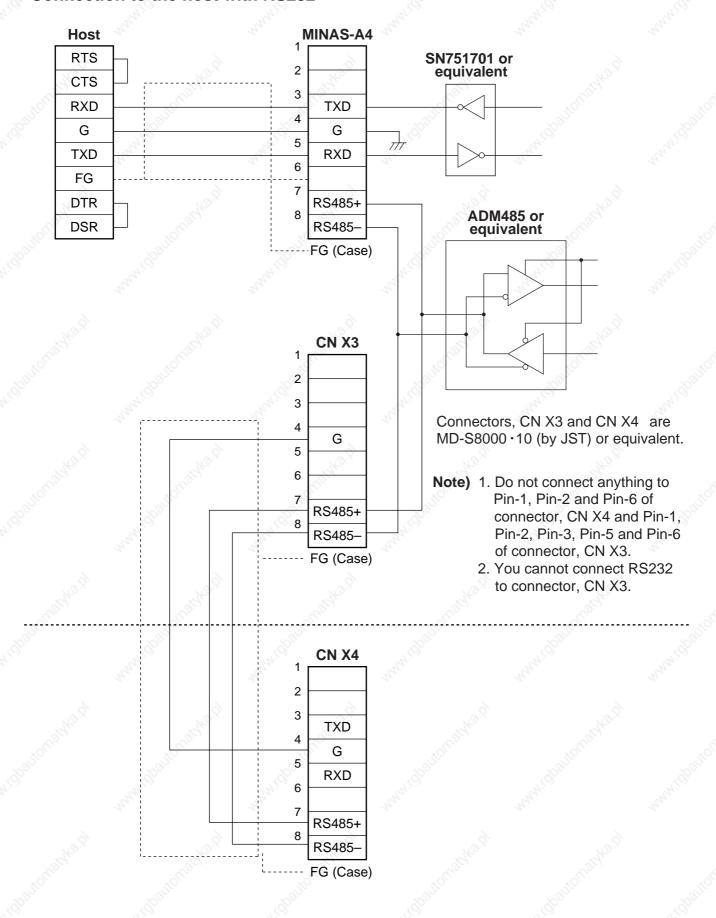


Allow 500ms or longer interval for switching the axes while capturing data of multiple axes.

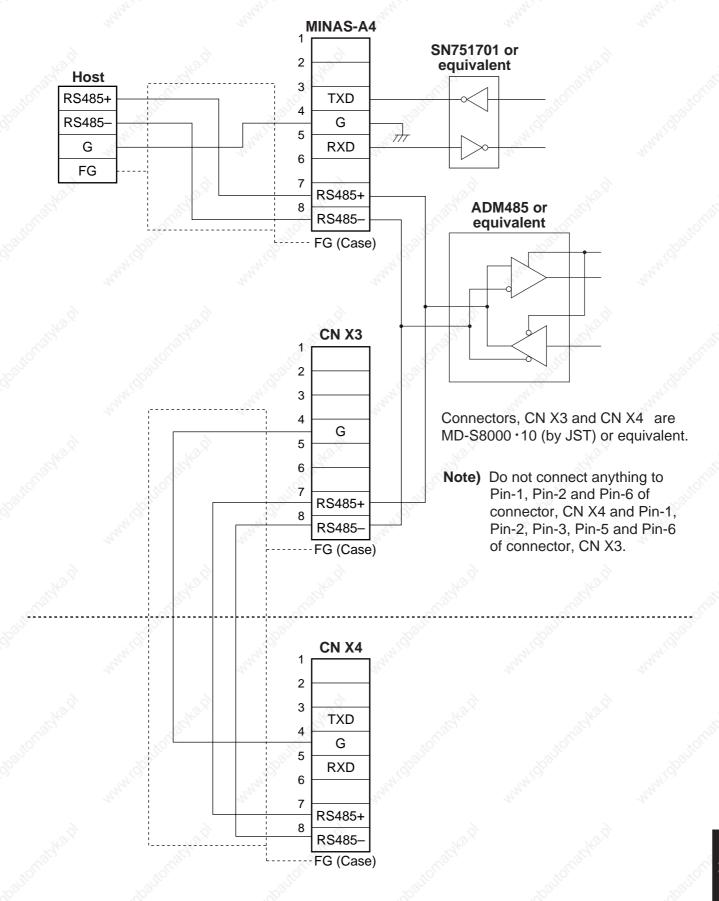
# Communication

### **Interface of Communication Connector**

Connection to the host with RS232



# Connection to the host with RS485



# **Communication**

#### **Communication Method**

70° X	R\$232	RS485		
, 147.C.	Full duplex, asynchronous	Half duplex, asynchronous		
Communication baud rate	2400,4800,9600,19200,38400,57600bps	2400,4800,9600,19200,38400,57600bps		
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 Pr0C, and RS485 communication baud rate with Pr0D. 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**

PrNo.	Title of parameter	Setup range	Functions/contents
00	Axis address	0 – 15	Check the RSW (ID) value of the front panel at control power-on. This value becomes the axis number at serial communication. Setup value of this parameter has no effect to servo action.
0C	Baud rate setup of RS232 communication	0-5	Set up the communication speed of RS232C communication. 0:2400[ bpps], 1:4800[ bps], 2:9600[ bps], 3:19200[ bps], 4:38400[ bps], 5:57600[ bps] Change will be validated after the control power-on
0D	Baud rate setup of RS485 communication	0 – 5	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] Change will be validated after the control power-on

• 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 RSW value of the front panel as a module ID, and data which makes its bit7 as 1, becomes a module recognition byte.

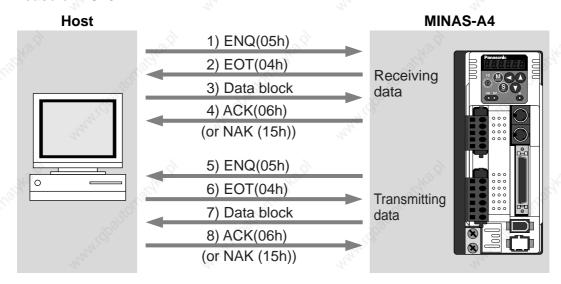
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
1	0	0	0	10/3/2	Modu	ıle ID	8

Module ID: The module ID of the host side will be 0 in case of RS485 communication, therefore set up RSW of MINAS-A4 to 1- F.

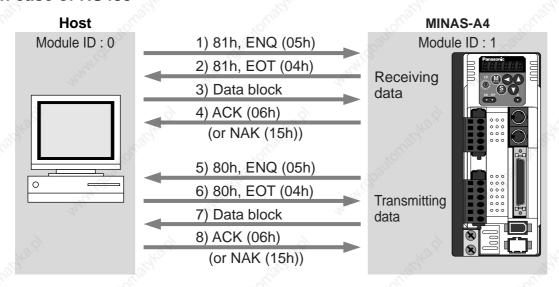
### **Transmission Sequence**

#### 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.

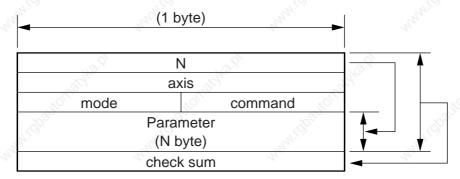
#### Reception control

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.

# Communication

### 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 RSW of the front panel (Module ID,

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	1/2,	Initial value	Setup range	Unit
T10	Time out between characters	RS232	5 (0.5 sec)	1–255	0.1 sec
15 S.	Time out between characters	RS485	1 (0.1 sec)		
T2	Dunta oldina a sut	RS232	5 (0.5 sec)	1–255	1 sec
12	Protocol time out	RS485	1 (0.1 sec)		
RTY	Retry limit		1 (once)	1–8	. (6)
M/S	Master/Slave	The state of	0 (Slave)	0, 1 (Master)	Once

- 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 exceeded 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.
- 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.

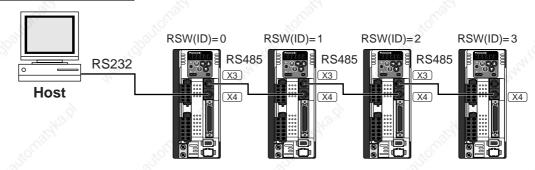
Priority is given to the transmitter which is set up as a master. (0: Slave mode, 1: Master mode)

# **Example of Data Communication**

#### • e.g. Reference of Absolute Data

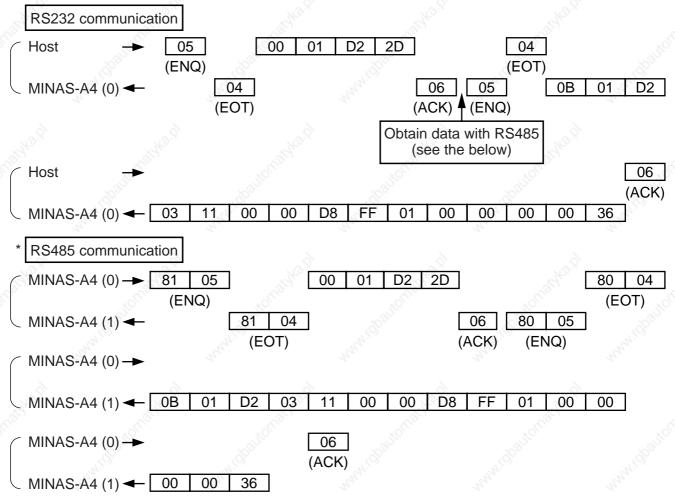
When you connect the host to one driver with RS232 communication, and connect multiple MINAS-A4s with RS485 communication. Following flow chart describes the actual flow of the communication data when you want to capture the absolute data of the module ID=1.

# 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.299, "Read out of Absolute Encoder" of details of communication command, for the data composition.

Multi-turn data : 0000h = 0

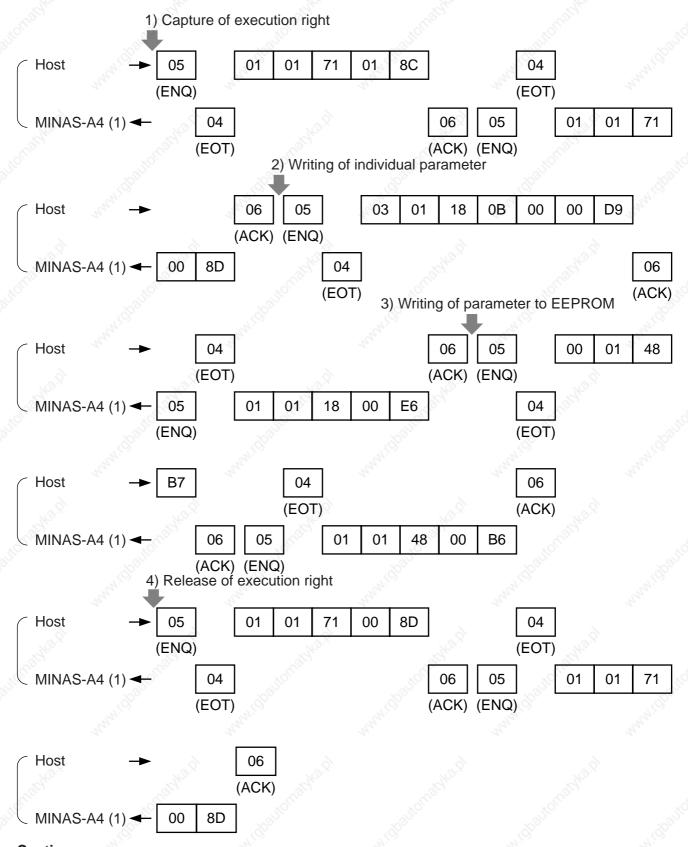
Single turn data: 01FFD8h = 131032

Allow 500ms or longer interval for switching the axis while capturing data of multiple axes.

# Communication

### Example of Parameter Change

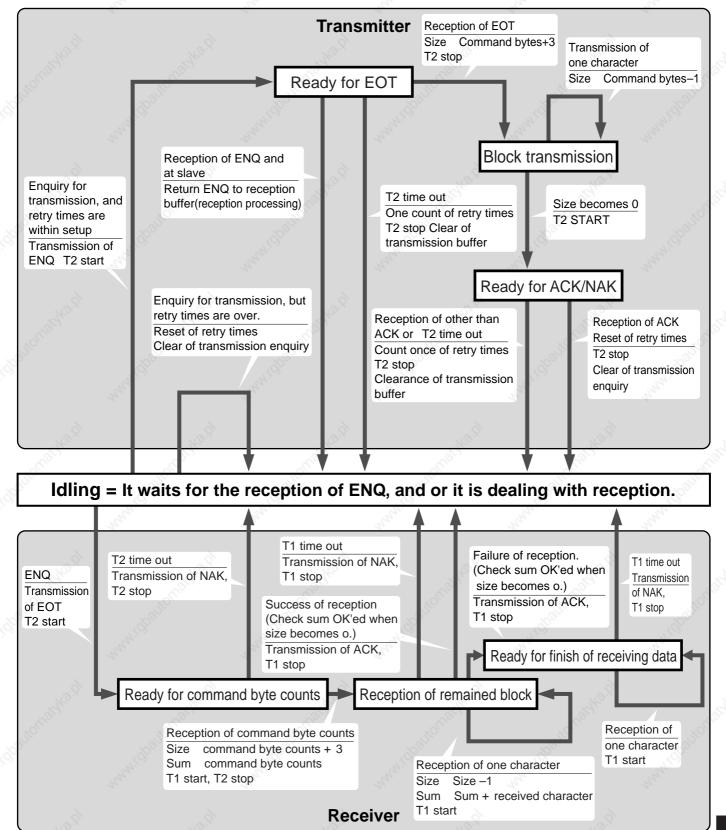
Following shows the communication data in time series when you change parameters. Communication in general will be carried out in sequence of (1) Request for capturing of execution right, (2) Writing of individual parameter, and (3) Writing to EEPROM when saving of data is required, and (4) Release of execution right. Here the hardware connection shows the case that the driver (user ID=1) is directly connected to the host with RS232C. Date is presented in hexadecimals.



#### <Caution>

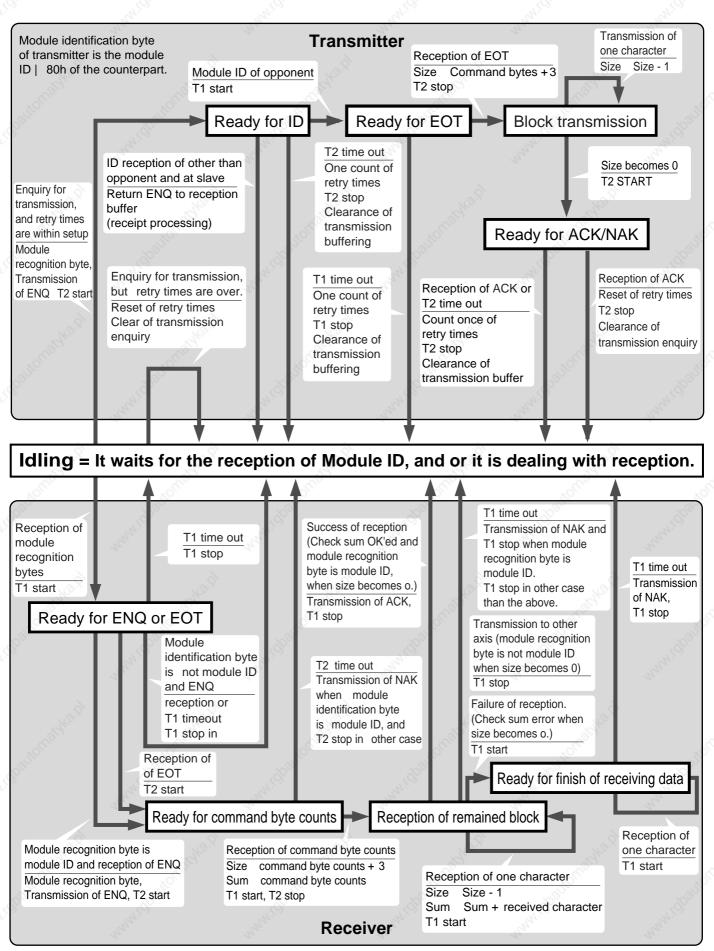
For details of command, refer to P.290, "Details of Communication Command".

#### RS232 Communication



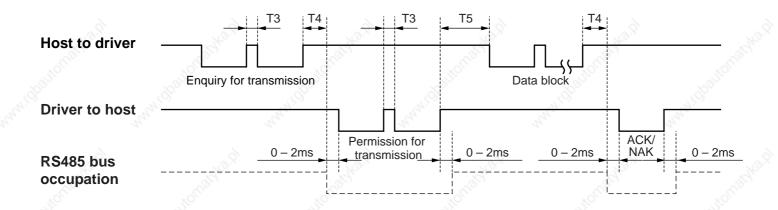
# **Communication**

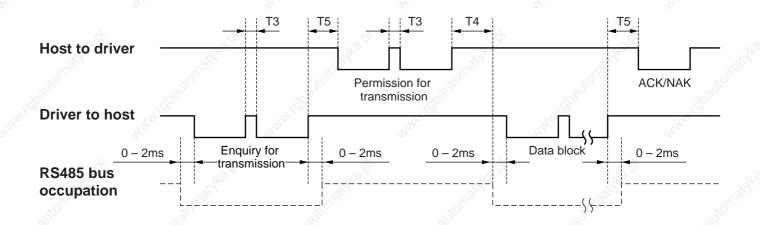
#### RS485 Communication



# **Timing of Data Communication**

# • In case of RS485 (RS232 to follow)





Symbol	Title	Minimum	Maximum
T3	Continuous inter-character time	Stop bit length	Protocol parameter T1
T4	Response time of driver	4ms	Protocol parameter T2
T5	Response time of host	2ms	Protocol parameter T2

# <Caution>

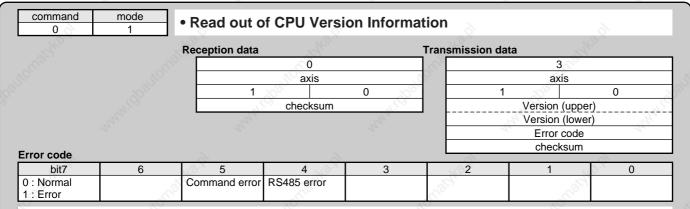
Above time represents a period from the rising edge of the stop bit.

# **List of Communication Command**

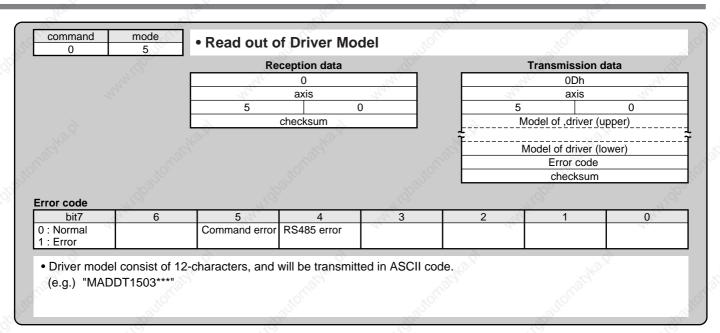
command	mode	Content	2000	
	.4.59	NOP	'4' <sub>(O)</sub>	.4.
0	222	Read out of CPU version	27,	The
0	5	Read out of driver model		
	6	Read out of motor model		
		INIT AND	795	
THE STATE OF	1	Setup of RS232 protocol parameter	10%	
The I	2	Setup of RS485 protocol parameter	760	
	7	Capture and release of execution right	770	
	- 20	POS, STATUS, I/O	1200	,
	0	Read out of status	141	47
	252	Read out of command pulse counter	120	7/1/4
	2	Read out of feedback pulse counter		
	4	Read out of present speed	A	
	5	Read out of present torque output	70,5	
and a	6	Read out of present deviation counter	20	
2	7	Read out of input signal	- 200	
	8	Read out of output signal	200	
	9	Read out of present speed, torque and deviation counter	(3)	-
	Α	Read out of status, input signal and output signal	74,	
	₹ C	Read out of external scale	7.	24
	D	Read out of absolute encoder		
	E	Read out of external scale deviation and sum of pulses	9	
This.		PARAMETER® NO	16.	
	0	Individual read out of parameter	- A	
8	1	Individual writing of parameter	×0,	
	4	Writing of parameter to EEPROM	1000	
	720.	ALARM	77,0	- 1
	0	Read out of present alarm data	100	120
	1	Individual read out of user alarm history		20
9	2	Batch read out of alarm history		
	3	Clear of user alarm history (in EEPROM as well)	28,	
	4	Alarm clear	"The	
	В	Absolute clear	500	
5.		PARAMETER® S	720.	
Ъ	0 🗴	Individual read out of user parameter	100	
В	1,50	Page read out of user parameter	'4' <sub>[S</sub>	-4
	2	Page writing of parameter	24	744

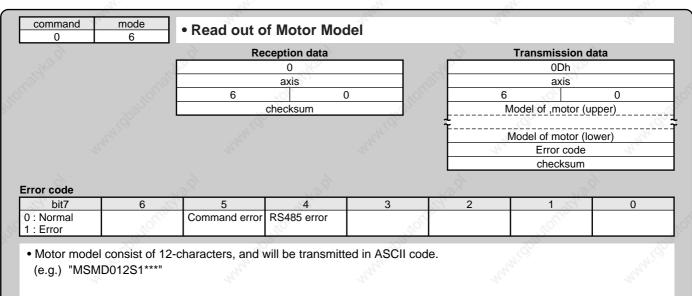
- Use the above commands only. If you use other commands, action of the driver cannot be guaranteed.
- When the reception data counts are not correct in the above command, transmission byte1 (Error code only) will be returned regardless of communication command.

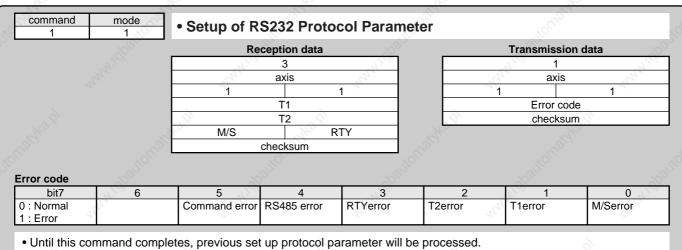
# **Details of Communication Command**



- Version information will be returned in upper data and lower data. (Decimal point will be returned by making the lower 4 bit of the upper data as 0.)
- Version will be displayed in figures from 0 to 9. (e.g. Version 3.1 will be upper data 30h, lower data 13h.)







- 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.
   For M/S, 0 represents SLAVE and 1 represents MASTER.
- RTY is 4-bit, and M/S is 1-bit.
- Unit... T1: 0.1s, T2: 1s

command 1	mode 2	<ul> <li>Setup of R</li> </ul>	S485 Proto	col Parame	eter		
		Re	ception data			Transmissio	n data
		147	3	The same		.ch. 1	Ty.
		20,	axis	7/2,		axis	Ha.
		2		1		2	1
		A	T1		2	Error cod	de 🔍
		183	T2		J8X	checksui	m, o <sup>X</sup>
		M/S	all F	RTY			
			checksum				
Error code							
bit7	6	5	4	3	2	, dV 1	0
0 : Normal 1 : Error	Talay.	Command error	RS485 error	RTYerror	T2error	T1error	M/Serror

- 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.
   For M/S, 0 represents SLAVE and 1 represents MASTER.
- RTY is 4-bit, and M/S is 1-bit.

command 1	mode 7	Capture ar	nd Release	of Executi	on Right			
160,0		Re	ception data		140.7	Trai	nsmission d	ata
	A	0	1 🔊		_@^		1,3	
	70x		axis		10x		axis	
	35	7		1	377	7	~80	1
	(9)	4	mode		>-	3	Error code	Z.
	747.	74,	checksum	74,		74,	checksum	Th.
	The state of the s	2/2		27,		1/4		1/2,
Error code								
bit7	6	5	4	3	2		1 ,	o 0
0 : Normal 1 : Error	, i	Command error	RS485 error	mode error	Caje)		Agirl.	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.

#### Readout of Status

#### Reception data 0 axis 0 checksum

Transmis	sion data
747.	3 """
ax	kis 🔏 💮
0	2
contro	l mode
sta	tus
error	code
chec	ksum

อเลเนอ		.(1)					.02
bit7	6	5	4	3	2	1	0
1,000	E.	CCW torque generating	CW torque generating	CCW running	CW running	Slower than DB permission	Torque in-limit
Error code							
bit7	6	5	4	3	2	1 <	0
0 : Normal 1 : Error	16	Command error	RS485 error		29/20.	sights.	
I. LIIOI		<u> </u>			0		

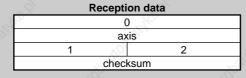
· Control modes are defined as follows.

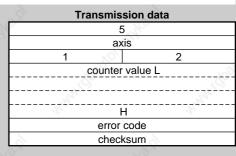
0	Position control mode
1	Velocity control mode
2	Torque control mode
3	Full-closed control mode

- CCW/CW torque generating: This becomes 1 when torque command is positive (CCW) or negative (CW).
- CCW/CW running: This becomes 1 when motor speed (after converted to r/min) is positive (CCW or negative (CW).
- Slower than DB permission: This becomes 1 when motor speed (after converted to r/min) is below 30r/min.
- Torque in-limit: This becomes 1 when torque command is limited by analog input or parameter.

command

#### Read out of Command Pulse Counter





Error	code
1000	1 ::-

Life code	N-	y	N.º		N.º	N.º	
bit7	6	5	4	3	2	1 💥	0
0 : Normal	AL.	Command error	RS485 error	200		The state of the s	
1: Error	100		110	100		100	

- 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 CW and "+" for CCW.

#### command mode Read out of Feedback Pulse Counter Reception data Transmission data 0 5 axis axis checksum counter value error code checksum Error code 0 bit7 0 : Normal RS485 error Command error 1: Error

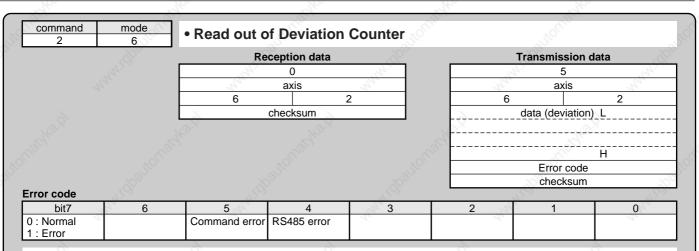
- Module returns the present position of feedback pulse counter in absolute coordinates from the staring point.
- Counter value will be "-" for CW and "+" for CCW.
- Feedback pulse counter is the total pulse counts of the encoder and represents the actual motor position traveled

2	4	• Read out o		•			\
		Re	ception data	5,	0	Transmission da	ta
		7/40.	0 1		The same	3	7
	2	20	axis		200	axis	
	2017	4	30,	2	4	×0,,	2
	792		checksum	\D)		ata (present spee	d) L
	. B	.3	0,	.0		.07	Н
						error code	.47
					3	checksum	7/2
rror code							
bit7	6	5	4	3	2	1 (3)	0
0 : Normal 1 : Error	, NOTO:	Command error	RS485 error	3	in the same of the	TOLLIN	

- Speed will be "-" for CW and "+" for CCW.

command 2	mode 5	• Read out of	of Present T	orque Output			
	700	Re	ception data	70gg		Transmission	data
		la.	0	-4/2		3	la.
		The state of the s	axis	120		axis	24
		5		2		5	2
			checksum			Data (present to	que) L
		25,	28		25,		Ĥ
					1/20	error code	160
					0	checksum	
rror code							
bit7	6	5	4	3	2	£ 1	0
) : Normal I : Error	27	Command error	RS485 error	27		4	77

- Reads out the present torque output. (Unit: Converted with "Rated motor torque = 2000)
- Output value in 16 bit
- Torque command will be "-" value for CW and "+" value for CCW.

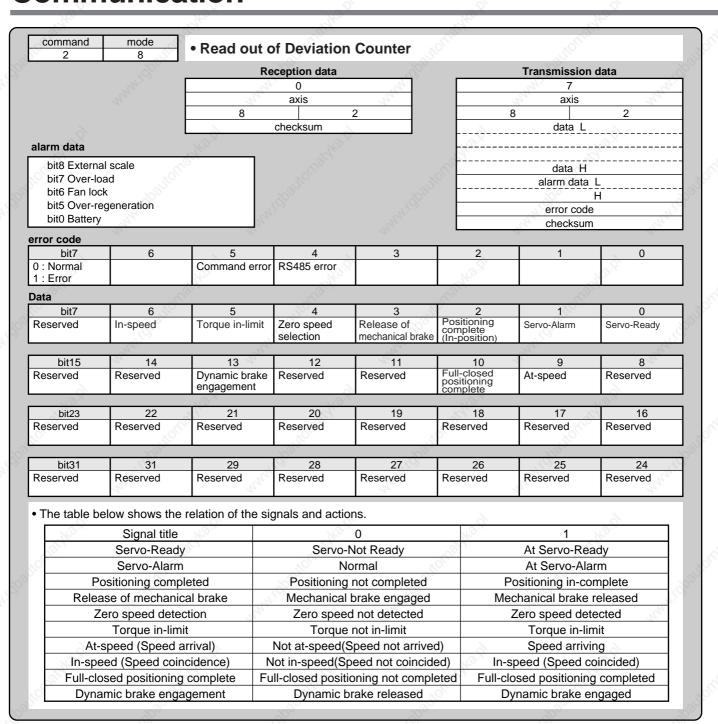


- Reads out the present deviation counter value. (Unit : [ pulse]
- Output value in 32 bit
- Becomes "+" when the encoder is located at CW direction against position command, and "-" when it is located at CCW direction.

command 2	mode 7	<ul> <li>Read out o</li> </ul>	of Input Sign	nal			
195		Re	eception data			Transmission of	lata
	25		0 3		201	5	
	all of		axis		10	axis	
		7	027	2	7		2
	L		checksum			data L	&
						7,	
						data H	
						Error code	
					0	checksum	>
					Man.	CHECKSCHI	
Error code							
bit7	6	5	4	3	2	37	0
0 : Normal 1 : Error	. (1)	Command error	RS485 error	(90 m)		, All San	.89
Data							
bit7	6	5	4	3	2	1	0
Reserved	Switching of electronic gear	Speed zero clamp	Control mode switching	CCW over-travel inhibit	CW over-travel inhibit	Alarm clear	Servo-ON
bit15	14	13	12	11	10	9	8
Reserved	Reserved	Internal speed command selection 2	Internal speed command selection 1	Reserved	Counter clear	Gain switching	Command pulse input inhibition
bit23	22	21	20	19	18	17	16
Reserved	Reserved	Torque limit switching	Internal speed command selection 3	Damping control switching	Reserved	Reserved	Reserved
73.5.	SI	9.2	73.5.		73.5	<u> </u>	8.
bit31	31	29	28	27	26	25	24
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
			20.		l .		1

• CW over-travel inhibit, CCW over-travel inhibit, speed zero clam and command pulse input inhibit become 1 when opened.

Other input signals are 0 when opened.



- Output value of speed and torque are in 16 bit and deviation in 32 bit.
- 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).

		Reception	n data	Transm	ission data
	410	7/2 0	77,00		0Dh
	The same of the sa	axis		The state of the s	axis
		Α	2	A	2
		checks	um	conti	rol mode
				s	tatus
				input	t signal L
				~~	
				» <u>-</u>	<u> </u>
					signal H
				outpu	t signal L
				225	
					t signal H
				F	n data L
					n data H
					or code
				che	ecksum
ror cod					
ror coa					

• 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).

2	C	• Read out o	V.O.	- CO			
		Re	ception data			Transmission	data
	7774	40,	0	460		0Bh	
	7,	С	axis	2		axis	2
	-		checksum			encoder ID (	
	_		onconsum		8		(H)
					38	status (L)	
						- CO	(H)
					·		<u>(L)</u>
							T-775555
					ab:	solute position da	ata (48bit)
						 (H)	
					0	error code	9
					The .	checksum	
ncoder ID	A. P.	0.1			Mary.		'
	(0)	Encode	er ID (L)	Encode	er ID (H)	XO, .	
	774	A -1 -1 "O" '	t- (EEDDOM	-\2	OI:	-0,	
	771	Address "0" da			2h	- Way	
• Command 6	7771 Oseries error occurs at o	Address "0" da	ta of EEPROM	3	2h 1h	Trumliggan.	ne <sup>re</sup>
AT50	Oseries error occurs at o	Address "0" dather control mod	ta of EEPROM des than full-clo	sed control.		1	0
AT50 • Command 6 ST771 Status (L) bit7	Oseries error occurs at o  6 Signal intensity	Address "0" da ther control mod 5 Signal intensity	ta of EEPROM des than full-clo 4 Transducer	sed control.  3 ABS detection	1h 2 Hardware	Initialization	0 Over speed
AT50 • Command 6 ST771 Status (L) bit7 Thermal alarm	Oseries error occurs at o	Address "0" dather control mod	ta of EEPROM des than full-clo	sed control.	1h		
AT50 • Command 6 ST771 Status (L) bit7 Thermal alarm Status (H)	oseries error occurs at o	Address "0" dather control mod	ta of EEPROM  des than full-clo  4  Transducer error	sed control.  3 ABS detection error	1h 2 Hardware error	Initialization error	Over speed
• Command e ST771 Status (L)	Oseries error occurs at o  6 Signal intensity	Address "0" da ther control mod 5 Signal intensity	ta of EEPROM des than full-clo 4 Transducer	sed control.  3 ABS detection	1h 2 Hardware	Initialization	
AT50 • Command 6 ST771 Status (L) bit7 Thermal alarm Status (H) bit7 0	Oseries error occurs at o  6 Signal intensity alarm	Address "0" dather control modes ther control modes of the control modes	ta of EEPROM  des than full-clo  4  Transducer error  4  Encoder error *2	sed control.  3 ABS detection error	2 Hardware error	Initialization error	Over speed 0
AT50 • Command 6 ST771 Status (L) bit7 Thermal alarm Status (H) bit7 0	6 Signal intensity alarm	Address "0" dather control modes ther control modes of the control modes	ta of EEPROM  des than full-clo  4  Transducer error  4  Encoder error *2	sed control.  3 ABS detection error  3 0	2 Hardware error	Initialization error	Over speed 0
AT50  • Command e  ST771  Status (L)  bit7  Thermal alarm  Status (H)  bit7  0  1 bit5 : Logica  AT500 series  Status (L)	6 Signal intensity alarm  6 0	Address "0" dather control modes  5 Signal intensity error  5 Encoder error *1 5 of status (L)	ta of EEPROM  des than full-clo  4  Transducer error  4  Encoder error *2  *2 bit4	ased control.  3 ABS detection error  3 0 : logical sum of b	2 Hardware error 2 0 iit6 and bit 7 of st	Initialization error  1 0 catus (L)	Over speed  0 0
AT50 • Command 6 ST771 Status (L) bit7 Thermal alarm Status (H) bit7 0 1 bit5 : Logica AT500 series Status (L) bit7	6 Signal intensity alarm  6 0  1 sum of bit0 to bit	Address "0" dather control modes  5 Signal intensity error  5 Encoder error *1 t 5 of status (L)	ta of EEPROM  des than full-clo  4 Transducer error  4 Encoder error *2  *2 bit4	3 ABS detection error 3 0 : logical sum of b	2 Hardware error 2 0 oit6 and bit 7 of st	Initialization error  1 0 catus (L)	Over speed  0 0
AT50  • Command 6  ST771  Status (L)  bit7  Thermal alarm  Status (H)  bit7  0  1 bit5 : Logica  AT500 series  Status (L)  bit7	6 Signal intensity alarm  6 0	Address "0" dather control modes ther control modes of the control modes	ta of EEPROM  des than full-clo  4 Transducer error  4 Encoder error *2  *2 bit4  CPU, memory	3 ABS detection error 3 0 : logical sum of b	2 Hardware error  2 0 iit6 and bit 7 of st  Encoder non-matching	Initialization error  1 0 catus (L)  Initialization	Over speed  0 0
AT50  • Command 6  ST771  Status (L)  bit7  Thermal alarm  Status (H)  bit7  0  1 bit5 : Logica  AT500 series  Status (L)  bit7  Thermal alarm	6 Signal intensity alarm  6 0  8 sum of bit0 to bit	Address "0" dather control modes  5 Signal intensity error  5 Encoder error *1 t 5 of status (L)	ta of EEPROM  des than full-clo  4 Transducer error  4 Encoder error *2  *2 bit4	3 ABS detection error 3 0 : logical sum of b	2 Hardware error  2 0  bit6 and bit 7 of st	Initialization error  1 0 catus (L)	Over speed  0 0
AT50  • Command 6  ST771  Status (L)  bit7  Thermal alarm  Status (H)  bit7  0  1 bit5 : Logica  AT500 series  Status (L)  bit7  Thermal alarm	6 Signal intensity alarm  6 0  8 sum of bit0 to bit	Address "0" dather control modes ther control modes of the control modes	ta of EEPROM  des than full-clo  4 Transducer error  4 Encoder error *2  *2 bit4  CPU, memory	3 ABS detection error 3 0 : logical sum of b	2 Hardware error  2 0 iit6 and bit 7 of st  Encoder non-matching	Initialization error  1 0 catus (L)  Initialization	Over speed  0 0
AT50  • Command 6  ST771  Status (L)  bit7  Thermal alarm  Status (H)  bit7  0  1 bit5 : Logica  AT500 series  Status (L)  bit7  Thermal alarm	6 Signal intensity alarm  6 0  1 sum of bit0 to bit  6 0	Address "0" dather control mod  5 Signal intensity error  5 Encoder error *1 5 of status (L)  5 Communication error	ta of EEPROM  des than full-clo  4 Transducer error  4 Encoder error *2  *2 bit4  CPU, memory error	3 ABS detection error  3 O : logical sum of b	2 Hardware error  2 0 iit6 and bit 7 of st  2 Encoder non-matching error	Initialization error  1 0 atus (L)  1 Initialization error	Over speed  0 0 Over speed
AT50  • Command 6  ST771  Status (L)  bit7  Thermal alarm  Status (H)  bit7  0  1 bit5 : Logica  AT500 series  Status (L)  bit7  Thermal alarm  Status (H)  bit7  Thermal alarm	6 Signal intensity alarm  6 0  1 sum of bit0 to bit  6 0	Address "0" dather control modes ther control modes there control modes there control modes there control modes to be a signal intensity error *5  Encoder error *1  5 Communication error  5  Encoder error *3	ta of EEPROM  des than full-clo  4 Transducer error  4 Encoder error *2  *2 bit4  CPU, memory error  4 Encoder alarm *4	3 ABS detection error  3 O : logical sum of b	2 Hardware error  2 0  iit6 and bit 7 of st  2 Encoder non-matching error	Initialization error  1 0  catus (L)  1 Initialization error	Over speed  0 0 Over speed  0 Over speed
AT50  • Command 6  ST771  Status (L)  bit7  Thermal alarm  Status (H)  bit7  0  1 bit5 : Logica  AT500 series  Status (L)  bit7  Thermal alarm  Status (H)  bit7  Thermal alarm	6 Signal intensity alarm  6 0  al sum of bit0 to bit  6 0	Address "0" dather control modes ther control modes there control modes there control modes there control modes to be a signal intensity error *5  Encoder error *1  5 Communication error  5  Encoder error *3	ta of EEPROM  des than full-clo  4 Transducer error  4 Encoder error *2  *2 bit4  CPU, memory error  4 Encoder alarm *4	3 ABS detection error  3 O : logical sum of b  Capacity and photoelectric error	2 Hardware error  2 0  iit6 and bit 7 of st  2 Encoder non-matching error	Initialization error  1 0  catus (L)  1 Initialization error	Over speed  0 0 Over speed  0 Over speed
AT50 • Command 6 ST771 Status (L) bit7 Thermal alarm Status (H) bit7 0  1 bit5 : Logica AT500 series Status (L) bit7 Thermal alarm Status (H) bit7 0 3 bit5 : Logica	6 Signal intensity alarm  6 0  al sum of bit0 to bit  6 0	Address "0" dather control modes ther control modes there control modes there control modes there control modes to be a signal intensity error *5  Encoder error *1  5 Communication error  5  Encoder error *3	ta of EEPROM  des than full-clo  4 Transducer error  4 Encoder error *2  *2 bit4  CPU, memory error  4 Encoder alarm *4  *4 bit4	3 ABS detection error  3 O : logical sum of b  Capacity and photoelectric error	2 Hardware error  2 0  iit6 and bit 7 of st  2 Encoder non-matching error	Initialization error  1 0  catus (L)  1 Initialization error	Over speed  0 0 Over speed  0 Over speed

command mode

Read out of Absolute Encoder

0Bh axis  D 2 encoder ID (L) (H) status (L) (H) (L) single-turn data (H) multi-turn data (L)
D 2 encoder ID (L) (H) status (L) (H) (L) single-turn data (H)
encoder ID (L) (H) status (L) (H) (L) single-turn data (H)
(H)status_(L)(H)(L)single-turn data(H)
(H)status_(L)(H)(L)single-turn data(H)
(H) (L) single-turn data (H)
(L) single-turn data (H)
single-turn data (H)
(H)
multi-turn data (L)
(H)
0
Error code
checksum

*O*	Encoder ID (L)	Encoder ID (H)
17bit absolute	3	11h

Status (L

Otatus (L)	-121	-64		-64.	2-	4.	-64.
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	

#### Status (H)

- bit4 : System down
- bit5: Battery alarm, multi-turn error, counter overflow, count error, full absolute status and logical sum of over speed

#### rror code

	(~)	(10)		( 00)		( )	( 0)
bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error	6.	Command error	RS485 error	n	The state of the s		age,

- Command error will occur when you use the above encoder or absolute encoder as an incremental encoder.
- Single turn data = 17bit (000000h to 01FFFFh)
- Multi-turn data = 16bit (0000h to FFFFh)

command	mode
2	Е

# • Read out of External Scale Accumulation and Deviation

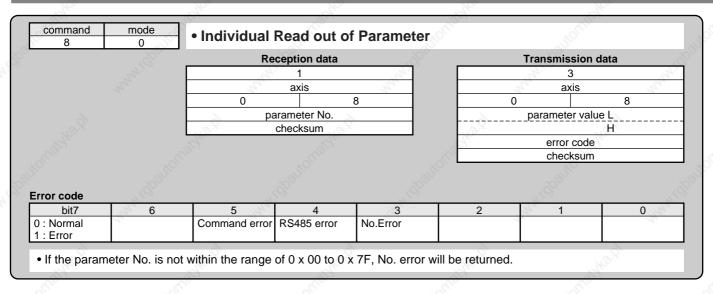
. a.S.	Reception data	
	0	
	axis	
E	2	
	checksum	- 56

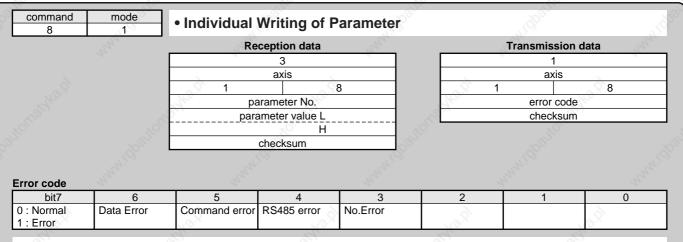
Iransn	nission data							
~	9							
axis								
E N	2							
700	(L) 📈							
exte	rnal scale							
FB p	oulse sum							
1	(H)							
	(L)							
external	scale deviation							
·	<del>/</del> 2							
	(H)							
eri	ror code							
ch	ecksum							
.20								

#### Error code

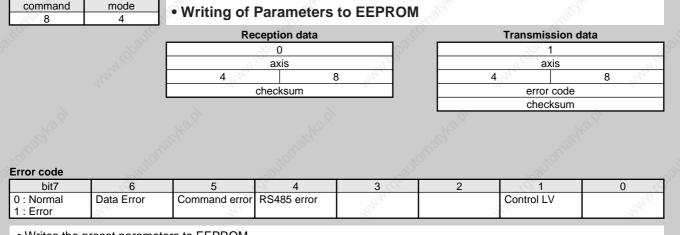
bit7	6	5 5	4	3	2	<u> 1</u>	00
0 : Normal 1 : Error	12.	Command error	RS485 error	No.	Tr,		272

- 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 CW and "+" for CCW.
- External scale deviation becomes "+" when the external scale is positioned at CW direction against position command, and "-" when it is positioned at CCW direction.





- If the parameter No. is not within the range of 0 x 00 to 0 x 7F, No. error will be returned.
- This command change parameters only temporarily. If you want to write into EEPROM, execute the parameter writing to EEPROM (mode = 4).
- Set up parameters not in use to 0 without fail, or it leads to data error. Data error also occurs when the parameter value exceeds the setup range.



• Writes the preset parameters to EEPROM.

mode

- Transmission data will be returned after EEPROM writing completes. It may take max. 5sec for EEPROM writing (when all parameters have been changed.)
- Data error will occur when writing fails.
- When under-voltage occurs, error code of control LV will be returned instead of executing writing.

command mode 9 0

• Read out of Present Alarm Data

Transmission data

2

axis
0 9

alarm No.
error code
checksum

Error code

	. 164.1	163.1		. 60.0		100	163.7
bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error		Command error	RS485 error	A.	170		4,

• If no alarm occurs, alarm No. becomes 0. (For alarm No., refer to P.252, "Protective function (What is alarm code ?)" of When in Trouble.

command mode

• Individual Read out of Alarm History

	R	eception data		
Fo		1 4		
		axis		
	1	,xO^`	9	
		history No.		
	. 40	checksum		(0)
				63.1

	Transm	ission data
1	9	3
		axis
	1 💉	9
	hist	tory No.
	ala	ırm No.
	erro	or code
	che	ecksum

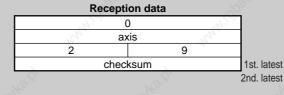
Error code

Error code		0	Z1,0,,		1,0,0	\L'O`	
bit7	6	5	4	3	2	1 25	0
0 : Normal 1 : Error	10000	Command error	Command error	No.Error	Ç.	TO LOW	

- History No. 1 to 14 represents latest to 14th latest error event.
- No. error will occur when you enter other value than 1 to 14.

command mode

Batch Read out of Alarm History



	11	ansmis	sion data	
	14.	OF	-h	7/1/2
	42	ax	(is	124
	2			9
		alarn	n No.	
5,		alarn	n No.	
		-	- 7/6°	

alarm No. Error code checksum

Frror code

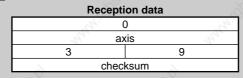
bit7	6	5	4	3	2	1	0
0 : Normal		Command error	Command error	24,	14,		27
1 : Error							

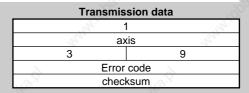
14th. latest

• You can read out last 14 error events.

# command mode

# Alarm History Clear





#### Error code

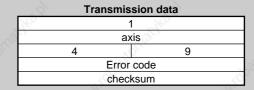
bit7	6	5	4	3	2	3 <sup>1</sup> 1	0
0 : Normal 1 : Error	Data Error	Command error	RS485 error	h	7	Control LV	17
I . EIIOI							

- Clears the alarm data history.
- Data error will occur when you fail to clear.
- When under-voltage of control power supply occurs, error code of control LV will be returned instead of executing writing.

command	mode
9	3

# Alarm Clear

~ O,	Re	ception data	
7/50		0 1/20	
(1)		axis	
	4	9	
		checksum	



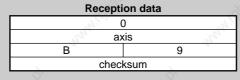
#### Error code

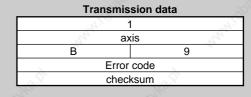
		VI.V	31.7		31.5	\ \	~
bit7	6	5	4	3	2	1 30	0
0 : Normal 1 : Error	JOHN.	Command error	RS485 error	38		"Itologo	

• Clears the present alarm. (only those you can clear)

- AVI	
command	mode
O 9	B 30

# Absolute Clear

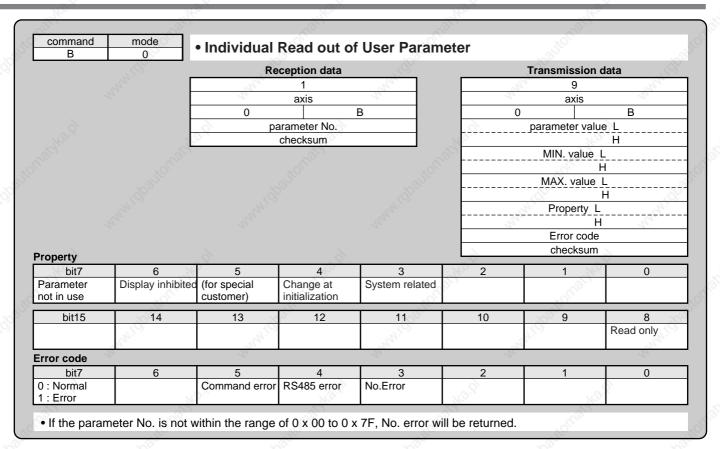


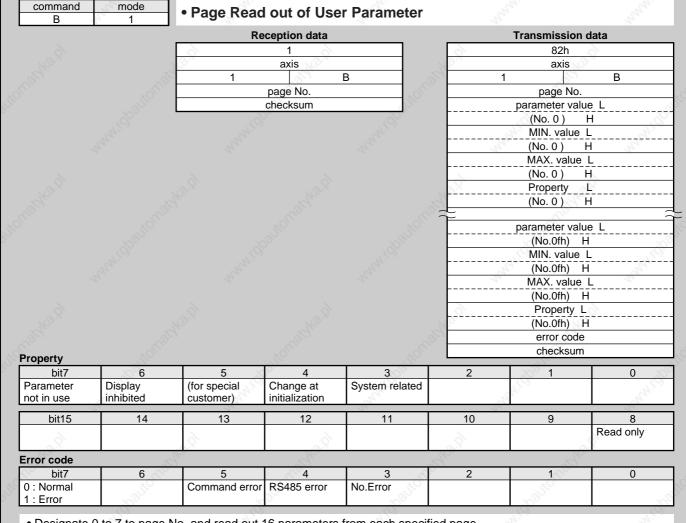


#### Error code

	1 7 7		\ . ·				
bit7	6	5	4	3	2	<u> </u>	0
0 : Normal 1 : Error	Ty.	Command error	RS485 error	19,	7		11,

- Clears absolute encoder error and multi-turn data
- Command error will be returned when you use other encoder than 17bit absolute encoder.





- Designate 0 to 7 to page No. and read out 16 parameters from each specified page.
- No. error will be returned when other No. than 0 to 7 is entered to page No.

command B	mode 2	Page Writing	ng of User	Parameter				
	.350	Re	ception data	.70	·	Transmission d	ata	
		14.	21h	'Ay.		. 2	-(4)	
		24,	axis	774	- 3	axis	20,	
		2		В	2		В	
		2	page No.	ae No.		page No.		
		parameter L			Error code			
		(value	(value of No. 0 ) H			checksum		
		parameter value L (value of No. 1 ) H			-40	74,0		
			10°-	103				
		para	ameter value L	77.0				
		(value	of No. 0th )	- E				
		17.	checksum	4.				
rror code								
bit7	6	5	4?	3	2	1	0	
: Normal : Error	Data Error	Command error	RS485 error	No.Error	"The	125	~	

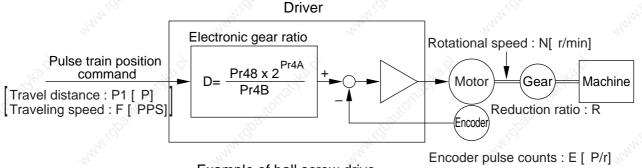
- Designate 0 to 7 to page No. and write 16 parameters from each specified page.
- Set up o to parameters not in use without fail, or data error will occur. Data error will also occurs when data exceeding the setup range is transmitted.
- No. error will be returned when other No. than 0 to 7 is entered to page No.

[Su	qq	lem	en	ıt]

. patronarik.	- stationatyle	ME	EMO	a baitomatyk	dlattoma
	- Arabay	- study	- 24,24,1		344
<del></del>					
	White -	Hilling .	and the second	Thurst	NAMA !
, <sub>H</sub> ,(d) <sub>2</sub> ,			dilettier	**************************************	
	<u>, 1</u>				
2 <sub>011</sub> db <sub>ll144</sub>	44444470000000000000000000000000000000	mula (g)glifat		**************************************	
<del>/2</del> 2/					<sup>1</sup>
"(qpg/10Lgg,	aghallangh	<u>-</u>			

# **Division Ratio for Parameters**

# Relation between Electronic Gear and Position Resolution or Traveling Speed



Example of ball screw drive by servo motor

Encoder pulse counts : E [ P/r] \* 10000 (= A/B-phase 2500 [ P/r] x 4)

\* 131072 (= 17-bit)

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).

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

#### <Notes>

- 1) Make a position resolution,  $\Delta M$  as approx. 1/5 to 1/10 of the machine positioning accuracy,  $\Delta \varepsilon$ , considering a mechanical error.
- 2) Set up Pr48 and Pr4B to any values between 1 to 10000.
- 3) You can set up any values to a numerator and denominator, however, action by an extreme division ratio or multiplication ratio cannot be guaranteed. Recommended range is 1/50 to 20 times.

0241	
2 <sup>n</sup>	Decimal
20	1,35
2 <sup>1</sup>	2
<b>2</b> <sup>2</sup>	4
$ \begin{array}{c c} 2^1 \\ 2^2 \\ 2^3 \\ 2^4 \end{array} $	8
24	16
<b>2</b> <sup>5</sup>	32
<b>2</b> <sup>6</sup>	64
27	128
28	256
<b>2</b> <sup>9</sup>	512
2 <sup>10</sup>	1024
211	2048
2 <sup>12</sup>	4096
2 <sup>13</sup>	8192
214	16384
2 <sup>15</sup>	32768
2 <sup>16</sup> 2 <sup>17</sup>	65536
217	131072

itpattetuse,	Electronic gear ratio $D = \frac{\Delta M \times L}{L}$	$D = \frac{Pr48 \times 2^{Pr4A}}{Pr4B}$
Lead of ball screw, L = 10mm Gear reduction ratio, R = 1 Position resolution, $\Delta M = 0.005$ mm Encoder, 2500P/r (E= 10000P/r)	$\frac{0.005 \times 10000 \times 1}{10} = 5$	10000 x 2° 2000 Pr4A = 0 Pr4B = 2000
Lead of ball screw, L = 20mm Gear reduction ratio, R = 1 Position resolution, $\Delta M = 0.0005$ mm Encoder, 2500P/r (E= 10000P/r)		<pre>"D = 1" is the condition for minimum resolution.</pre>
Encoder : 17-bit (E = 2 <sup>17</sup> P/r)	$\frac{0.0005 \times 2^{17} \times 1}{20}$ $= \frac{1 \times 2^{17}}{40000} = \frac{1 \times 2^{2} \times 2^{15}}{2^{2} \times 10000}$	Pr48 = 1 Pr4A = 15 Pr4B = 10000

	- 16 <sub>5</sub>		Б.	"% <sub>5.</sub>
3	itchot,	Motor rotational speed (r/min), N = F	$x \frac{D}{E} \times 60$	Nicht,
00	Lead of ball screw, L = 10mm Gear reduction ratio, R = 1 Position resolution, $\Delta M = 0.0005$ mm	500000 x $\frac{1 \times 2^{15}}{10000}$ x $\frac{1}{2^{17}}$ x 60	NANI JOS	of whiteled
9	Line driver pulse input, 500kpps Encoder, 17-bit	$= 50 \times 60 \times \frac{1}{2^2} = 750$		Marko.
8	The state of the s	Electronic gear ratio D = $\frac{N \times E}{F \times 60}$	- NAMICE	$D = \frac{Pr48 \times 2P^{Pr4A}}{Pr4B}$
300	Ditto To make it to 2000r/min.	$D = \frac{2000 \times 2^{17}}{500000 \times 60} = \frac{2^{1} \times 1000 \times 2^{17}}{30000000}$ $= \frac{1 \times 2^{3} \times 2^{15}}{2^{3} \times 3750} = \frac{1 \times 2^{15}}{3750}$	. wildfall	Pr48=1 Pr4A=15 Pr4B=3750
	iousphois	Travel distance per command pulse (mn (Position resolution) $\Delta M = \frac{D}{E} \times \frac{1}{R} \times L$	n) *****	10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
S	"Mahari paga	$\frac{2^{15}}{3750} \times \frac{1}{2^{17}} \times \frac{1}{1} \times 20 = \frac{1}{3750} \times \frac{20}{2^2}$	$=\frac{20}{3750 \text{ x}}$	$\frac{1}{4} = 0.00133$ mm

# Conformity to EC Directives and UL Standards

# **EC Directives**

The EC Directives apply to all such electronic products as those having specific functions and have been exported to EU and directly sold to general consumers. Those products are required to conform to the EU unified standards and to furnish the CE marking on the products.

However, our 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.

# **Conformed Standards**

Subject	Zalie.	Conformed Standard					
Motor	IEC60034-1 IEC	EC60034-1 IEC60034-5 UL1004 CSA22.2 No.100					
	EN50178 UL508C						
	EN55011	Radio Disturbance Characteristics of Industrial, Scientific					
20	EIVOCONI	and Medical (ISM) Radio-Frequency Equipment					
Motor/	EN61000-6-2 Immunity for Industrial Environments						
Motor	IEC61000-4-2	00-4-2 Electrostatic Discharge Immunity Test Sta					
and	IEC61000-4-3	C61000-4-3 Radio Frequency Electromagnetic Field Immunity Test					
driver	IEC61000-4-4	Electric High-Speed Transition Phenomenon/Burst Immunity Test	EMC Directives				
	IEC61000-4-5	Lightening Surge Immunity Test	The state of				
	IEC61000-4-6	High Frequency Conduction Immunity Test					
20	IEC61000-4-11	Instantaneous Outage Immunity Test	20,				

IEC: International Electrotechnical Commission

EN: Europaischen Normen

EMC: Electromagnetic Compatibility
UL: Underwriters Laboratories
CSA: Canadian Standards Association

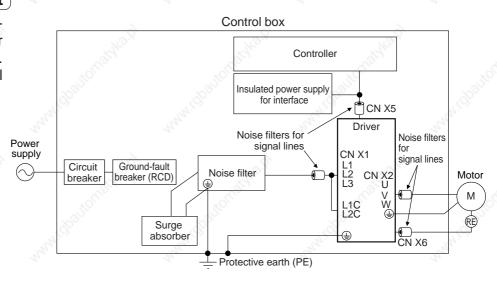
# <Pre><Pre>cautions in using options>

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

# **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.)



Power Supply						
100V type : Single phase, (A, B and C-frame)	100V	+10% -15%	to	115V	+10% -15%	50/60Hz
200V type : Single phase, (B, C-frame)	200V	+10% -15%	to	240V	+10% -15%	50/60Hz
200V type : Single/3-phase, (C, D-frame)	200V	+10% -15%	to	240V	+10% -15%	50/60Hz
200V type : 3-phase,	200V	+10% -15%	to	230V	+10% -15%	50/60Hz
(E, F-frame)	2001	-15%	.0	2001	-15%	00,00112

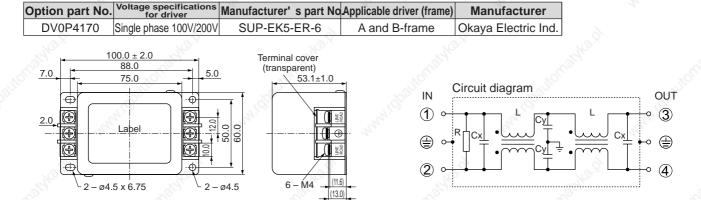
- (1) This product is designed to be used at over-voltage category (Installation category) II of EN 50178:1997. If you want to use this product un over-voltage category (Installation category) III, install a surge absorber which complies with EN61634-11:2002 or other relevant standards at the power input portion.
- (2) Use an insulated power supply of DC12 to 24V which has CE marking or complies with EN60950

# **Circuit Breaker**

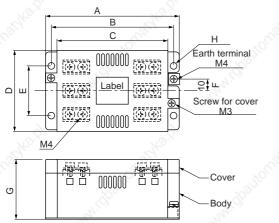
Install a circuit breaker which complies with IEC Standards and UL recognizes (Listed and marked) between power supply and noise filter.

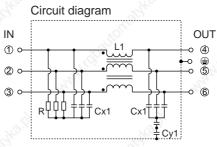
# **Noise Filter**

When you install one noise filter at the power supply for multi-axes application, contact to a manufacture of the noise filter.



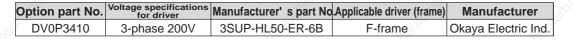
Option part No.	Voltage specifications for driver	Manufacturer' s part No	.Applicable driver (frame)	Manufacturer
DV0P4180	2 phase 200\/	3SUP-HQ10-ER-6	C-frame	Okova Flactria Ind
DV0P4220	3-phase 200V	3SUP-HU30-ER-6	D and E-frame	Okaya Electric Ind.

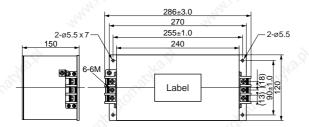


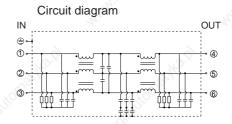


	Α	В	C	D	ш	F	G	Ι	K	L
DV0P4180										
DV0P4220	145	135	125	70	50	10	52	5.5	M4	M4
		_								

# Conformity to EC Directives and UL Standards

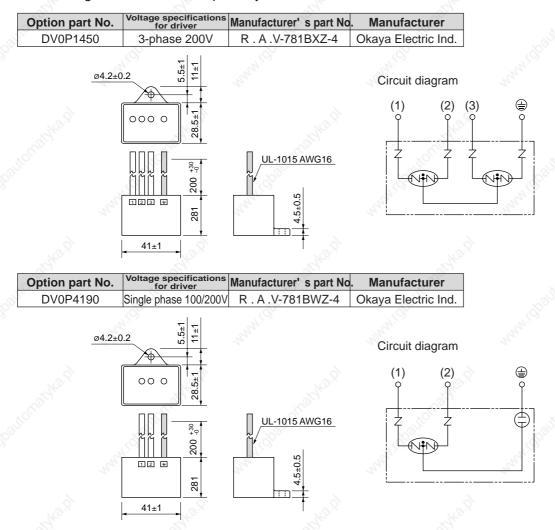






# **Surge Absorber**

Provide a surge absorber for the primary side of noise filter.



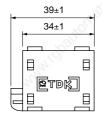
#### <Remarks>

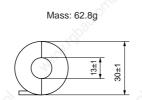
Take off the surge absorber when you execute a dielectric test to the machine or equipment, or it may damage the surge absorber.

# **Noise Filter for Signal Lines \***

Install noise filters for signal lines to all cables (power cable, motor cable, encoder cable and interface cable)
\* In case of D-frame, install 3 noise filters at power line.

Option part No.	Manufacturer' s part No.	Manufacturer
DV0P1460	ZCAT3035-1330	TDK Corp.





#### <Caution>

Fix the signal line noise filter in place to eliminate excessive stress to the cables.

# Grounding

- (1) Connect the protective earth terminal ( ) of the driver and the protective earth terminal (PE) of the control box without fail to prevent electrical shocks.
- (2) Do not make a joint connection to the protective earth terminals ( ). 2 terminals are provided for protective earth.

# **Ground-Fault Breaker**

Install a type B ground fault breaker (RCD) at primary side of the power supply.

#### <Note>

For driver and applicable peripheral equipments, refer to P.32 "Driver and List of Applicable Peripheral Equipments" of Preparation.

# **Driver and List of Applicable Peripheral Equipments (EC Directives)**

Refer to P.28 to 41, "System Configuration and Wiring"

# **Conformity to UL Standards**

Observe the following conditions of (1) and (2) to make the system conform to UL508C (File No. E164620).

- (1) Use the driver in an environment of Pollution Degree 2 or 1 prescribed in IEC60664-1. (e.g. Install in the control box with IP54 enclosure.)
- (2) Install a circuit breaker or fuse which are UL recognized (LISTED ® marked) between the power supply and the noise filter without fail.

For the rated current of the circuit breaker or fuse, refer to P.32, "Driver and List of Applicable Peripheral Equipments" of Preparation.

Use a copper cable with temperature rating of 60°C or higher.

Tightening torque of more than the max. values (M4:1.2N·m, M5: 2.0N·m) may break the terminal block.

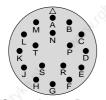
(3) Over-load protection level

Over-load protective function will be activated when the effective current exceeds 115% or more than the rated current based on the time characteristics. Confirm that the effective current of the driver does not exceed the rated current. Set up the peak permissible current with Pr5E (Setup of 1st torque limit) and Pr5F (Setup 2nd torque limit).

# **Specifications of for Motor Connector**

### Pin disposition for encoder connector

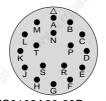
# MSMA MDMA MFMA MHMA MGMA



N/MS3102A20-29P
• Specifications of 2500P/r incremental encoder

Pin No.	Content	Pin No.	Content
Α	NC	K	PS
В	NC	L	PS
С	NC	M	NC
D	NC	N	NC
EX	NC	Р	NC
x <b>5</b> ℃	NC	R	NC s
G	EOV	S	NC
Н	E5V	Т	NC
J	Frame		The same

MSMA MDMA MFMA MHMA MGMA



N/MS3102A20-29P
• Specifications of 17b

 Specifications of 17bit absolute/incremental encoder

Pin No.	Content	Pin No.	Content
Α	NC	K	PS
В	NC	L	PS
C	NC	M	NC
D	NC	N	NC
ΞE	NC	Р	NC
F	NC	R	NC
G	EOV	S	BAT-*
Н	E5V	্ক	BAT+*
7	Frame GND	20.	

\*Connection to Pin-S and T are not required when used in incremental.

### • Pin disposition for motor/brake connector (with brake)

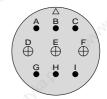
MSMA 1kW, 1.5kW, 2kW MDMA 1kW, 1.5kW, 2kW MFMA 400W, 1.5kW MHMA 500W, 1kW, 1.5kW MGMA 900W



JL04V-2E20-18PE-B-R (by Japan Aviation Electronics or equivalent)

Pin No.	Content		
G	Brake		
Н	Brake		
Α	NC.		
F	U-phase		
	V-phase		
В	W-phase		
E	Earth		
D .50	Earth		
C(A)	NC		

MSMA 3kW, 4kW, 5kW
MDMA 3kW, 4kW, 5kW
MFMA 2.5kW, 4.5kW
MHMA 2kW,3kW,4kW,5kW
MGMA 2kW, 3kW, 4.5kW

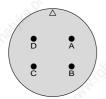


JL04V-2E24-11PE-B-R (by Japan Aviation Electronics or equivalent)

Pin No.	Content
Α	Brake
В	Brake
С	NC
D	U-phase
E 20	V-phase
Ecco	W-phase
G	Earth
ďΉ	Earth
) I	NC 2

## Pin disposition for motor/brake connector (without brake)

MSMA 1kW, 1.5kW, 2kW MDMA 1kW, 1.5kW, 2kW MHMA 500W, 1kW, 1.5kW MGMA 900W



JL04V-2E20-4PE-B-R (by Japan Aviation Electronics or equivalent)

PIN No.		Content
	Α	U-phase
	В	V-phase
)	С	W-phase
	D	Earth

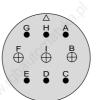
MSMA 3kW, 4kW, 5kW MDMA 3kW, 4kW, 5kW MHMA 2kW,3kW,4kW,5kW MGMA 2kW, 3kW, 4.5kW



JL04V-2E22-22PE-B-R (by Japan Aviation Electronics or equivalent)

PIN No.	Content
Α	U-phase
В	V-phase
C	W-phase
D	Earth

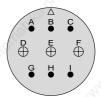
MFMA 400W, 1.5kW



JL04V-2E20-18PE-B-R (by Japan Aviation Electronics or equivalent)

Content	
NC	
NC	
NC	
U-phase	
V-phase	
W-phase	
Earth	
Earth	
NC	

MFMA 2.5kW, 4.5kW



JL04V-2E24-11PE-B-R (by Japan Aviation Electronics or equivalent)

PIN No.	Content	
Α	NC	
В	NC	
0 C	NC 🚫	
D	U-phase	
E	V-phase	
F	W-phase	
G	Earth	
Н	Earth	
- 3	NC	

Do not connect anything to NC pins.

# Table for junction cable by model of MINAS A4 series

Motor type		700	Type of junction cable	Part No of junction cable	Fig.No.
MAMA 100W to 750W	Encoder	17bit, 7-wire	With battery holder for absolute encoder	MFECA0**0EAE	Fig.2-1
MSMD 50W to 750W			Without battery holder for absolute encoder	MFECA0**0EAD	Fig.2-2
MQMA 100W to 400W	6.	2500P/r, 5-wir	re å	MFECA0**0EAM	Fig.2-3
Mr.	Motor		"The "	MFMCA0**0EED	Fig.3-1
Mar,	Brake	35	E. C.	MFMCB0**0GET	Fig.5-1
MSMA 1.0kW, 1.5kW	Encoder	17bit, 7-wire	With battery holder for absolute encoder	MFECA0**0ESE	Fig.2-4
MDMA 1.0kW, 1.5kW		7/02	Without battery holder for absolute encoder	MFECA0**0ESD	Fig.2-5
MHMA 0.5kW to 1.5kW		2500P/r, 5-wir	re white	MFECA0**0ESD	Fig.2-5
MGMA 900W	Motor	without Brake		MFMCD0**2ECD	Fig.3-2
\$	9	Brake	ġ ġ	MFMCA0**2FCD	Fig.4-1
MSMA 2.0kW	Encoder	17bit, 7-wire	With battery holder for absolute encoder	MFECA0**0ESE	Fig.2-4
MDMA 2.0kW	Ollio	200	Without battery holder for absolute encoder	MFECA0**0ESD	Fig.2-5
	500	2500P/r, 5-wir	re	MFECA0**0ESD	Fig.2-5
11. CO.	Motor without Brake		MFMCD0**2ECT	Fig.3-3	
The state of the s	Brake	un, mu	MFMCA0**2FCT	Fig.4-2	
MSMA 3.0kW to 5.0kW	Encoder	17bit, 7-wire	With battery holder for absolute encoder	MFECA0**0ESE	Fig.2-4
MDMA 3.0kW to 5.0kW	9		Without battery holder for absolute encoder	MFECA0**0ESD	Fig.2-5
MHMA 2.0kW to 5.0kW	de	2500P/r, 5-wii	re	MFECA0**0ESD	Fig.2-5
MGMA 2.0kW to 4.5kW	Motor	without Brake	, of the	MFMCA0**3ECT	Fig.3-4
100	5	Brake	2007	MFMCA0**3FCT	Fig.4-3
MFMA 0.4kW, 1.5kW	Encoder	17bit, 7-wire	With battery holder for absolute encoder	MFECA0**0ESE	Fig.2-4
Ny.		The state of	Without battery holder for absolute encoder	MFECA0**0ESD	Fig.2-5
		2500P/r, 5-wir	re	MFECA0**0ESD	Fig.2-5
a di	Motor	without Brake		MFMCA0**2ECD	Fig.3-5
20th	"affe	Brake	19 19 19 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	MFMCA0**2FCD	Fig.4-1
MFMA 2.5kW, 4.5kW	Encoder	17bit, 7-wire	With battery holder for absolute encoder	MFECA0**0ESE	Fig.2-4
70g)	>-	30800	Without battery holder for absolute encoder	MFECA0**0ESD	Fig.2-5
"M;O.		2500P/r, 5-wir	re Miles	MFECA0**0ESD	Fig.2-5
My	Motor	without Brake	Mr. Mr.	MFMCD0**3ECT	Fig.3-6
		Brake		MFMCA0**3FCT	Fig.4-3

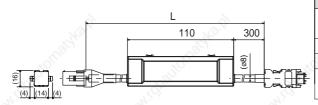
# **Options**

# **Junction Cable for Encoder**

# MFECA0\*\*0EAE

MSMD 50W to 750W, MQMA 100W to 400W, MAMA 100W to 750W 17-bit absolute encoder with battery holder

Fig. 2-1



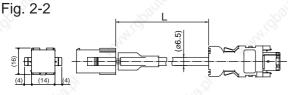
Title	Part No.	Manufacturer	L(m)	Part No
Connector	551055100-0600 or	Molex Inc.	3	MFECA0030
Connector	55100-0670 (lead-free)	Willex IIIC.	5	MFECA0050
Connector	172161-1	Tyco	10	MFECA0100
Connector pin	170365-1	Electronics AMP	20	MFECA0200
Cable	0.20mm <sup>2</sup> x 4P	Oki Electric Cable Co.		
		Licetile Cable Co.		

Note) Battery for absolute encoder is an option.

# MFECA0\*\*0EAD

MSMD 50W to 750W, MQMA100W to 400W, MAMA 100W to 750W

17-bit incremental encoder without battery holder

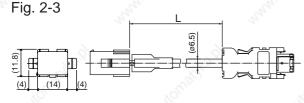


Title	Part No.	Manufacturer	
Connector	55100-0600 or	Molex Inc.	
Connector	55100-0670 (lead-free)	Molex IIIC.	
Connector	172161-1	Tyco	
Connector pin	170365-1	Electronics AMP	
Cable	0.20mm <sup>2</sup> x 3P	Oki Electric Cable Co.	

r	L(m)	Part No.	
	3	MFECA0030EAD	
	5	MFECA0050EAD	
	10	MFECA0100EAD	
ΙP	20	MFECA0200EAD	
	200		

# MFECA0\*\*0EAM

MSMD 50W to 750W, MQMA 100W to 400W, MAMA 100W to 750W 2500P/r encoder



	Title	Part No.	Manufacturer
	Connector	55100-0600 or	Molex Inc.
	Connector	55100-0670 (lead-free)	Molex IIIC.
	Connector	172160-1	Tyco
	Connector pin	170365-1	Electronics AMP
S	Cable	0.20mm <sup>2</sup> x 3P	Oki Electric Cable Co.

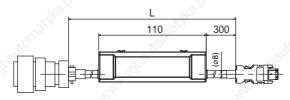
•	L(m) Part No.	
	3	MFECA0030EAM
	5	MFECA0050EAM
	10	MFECA0100EAM
Р	20	MFECA0200EAM
,		

# MFECA0\*\*0ESE

MSMA, MDMA, MHMA, MGMA, MFMA

17-bit absolute encoder with battery holder

Fig. 2-4



Title	Part No.	Manufacturer
Connector	55100-0600 or	Molex Inc.
Connector	55100-0670 (lead-free)	Molex IIIC.
Straight plug	N/MS3106B20-29S	Japan Aviation
Cable clamp	N/MS3057-12A	Electronics Ind.
Cable	0.20mm <sup>2</sup> x 4P	Oki
Cable	0.20IIIII X 4P	Electric Cable Co.

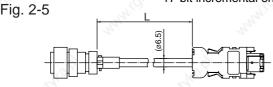
	L(m)	Part No.
	3	MFECA0030ESE
\\	5	MFECA0050ESE
	10	MFECA0100ESE
	20	MFECA0200ESE
		77

Note) Battery for absolute encoder is an option.

# MFECA0\*\*0ESD

MSMA, MDMA, MHMA, MGMA, MFMA

17-bit incremental encoder without battery holder, 2500P/r encoder



Title	Part No.	Manufacturer
Connector	55100-0600 or	Molex Inc.
Connector	55100-0670 (lead-free)	Molex IIIC.
Straight plug	N/MS3106B20-29S	Japan Aviation
Cable clamp	N/MS3057-12A	Electronics Ind.
Cable	0.20mm <sup>2</sup> x 3P	Oki
Cable	0.20Hill X 3F	Electric Cable Co.

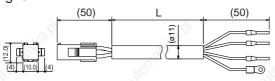
•	L(m)	Part No.
	3	MFECA0030ESD
	5	MFECA0050ESD
n	10	MFECA0100ESD
۱. ا	20	MFECA0200ESD
6	7	

# Junction Cable for Motor (ROBO-TOP® 105°C 600V·DP)

ROBO-TOP® is a trade mark of Daiden Co.,Ltd.

MSMD 50W to 750W, MQMA 100W to 400W, MAMA 100W to 750W

Fig. 3-1



Title	Part No.	Manufacturer
Connector	172159-1	Tyco
Connector pin	170366-1	Electronics AMP
Rod terminal	AI0.75-8GY	Phoenix
Nylon insulated round terminal	N1.25-M4	J.S.T Mfg. Co., Ltd.
Cable	ROBO-TOP 600V 0.75mm <sup>2</sup>	Daiden Co.,Ltd.

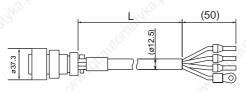
L(m) Part No.	
3	MFMCA0030EED
5	MFMCA0050EED
10	MFMCA0100EED
20	MFMCA0200EED

# MFMCD0\*\*2ECD

MFMCA0\*\*0EED

MSMA 1.0kW to 1.5kW, MDMA 1.0kW to 1.5kW MHMA 500W to 1.5kW, MGMA 900W

Fig. 3-2



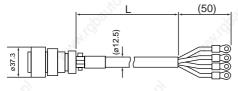
l itle	Part No.	Manufacturer
Straight plug	JL04V-6A20-4SE-EB-R	Japan Aviation
Cable clamp	JL04-2022CK(14)-R	Electronics Ind.
Rod terminal	AI2.5-8BU	Phoenix
Nylon insulated round terminal	N2-M4	J.S.T Mfg. Co., Ltd.
Cable	ROBO-TOP 600V 2.0mm <sup>2</sup>	Daiden Co.,Ltd.

L(m)	Part No.
3	MFMCD0032ECD
5	MFMCD0052ECD
10	MFMCD0102ECD
20	MFMCD0202ECD

# MFMCD0\*\*2ECT

MSMA 2.0kW, MDMA 2.0kW

Fig. 3-3

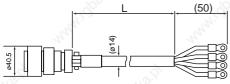


Title	Part No.	Manufacturer	L(m)	Part No.
Straight plug	JL04V-6A20-4SE-EB-R	Japan Aviation	3	MFMCD0032ECT
Cable clamp	JL04-2022CK(14)-R	Electronics Ind.	5	MFMCD0052ECT
Nylon insulated	N2-5	J.S.T Mfg. Co., Ltd.	10	MFMCD0102ECT
round terminal	112-5	J.S.1 Wilg. Co., Ltd.	20	MFMCD0202ECT
Cable	ROBO-TOP 600V 2.0mm <sup>2</sup>	Daiden Co.,Ltd.	9	

# MFECA0\*\*3ECT

MSMA 3.0kW to 5.0kW, MDMA 3.0kW to 5.0kW MHMA 2.0kW to 5.0kW, MGMA 2.0kW to 4.5kW

Fig. 3-4



	Title	Part No.	Manufacturer	
	Straight plug	JL04V-6A22-22SE-EB-R	Japan Aviation	
	Cable clamp	JL04-2022CK(14)-R	Electronics Ind.	
Ś	Nylon insulated round terminal	N5.5-5	J.S.T Mfg. Co., Ltd.	o
	Cable	ROBO-TOP 600V 3.5mm <sup>2</sup>	Daiden Co.,Ltd.	

L(m)	Part No.
3	MFMCA0033ECT
5	MFMCA0053ECT
10	MFMCA0103ECT
20	MFMCA0203ECT
-	

# MFMCA0\*\*2ECD

MFMA 400W to 1.5kW

Fig. 3-5

·5			
	My.	L	(50)
ø37.3		(ø12.5)	

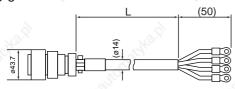
Title	Part No.	Manufacturer
Straight plug	JL04V-6A20-18SE-EB-R	Japan Aviation
Cable clamp	JL04-2022CK(14)-R	Electronics Ind.
Rod terminal	AI2.5-8BU	Phoenix
Nylon insulated round terminal	N2-M4	J.S.T Mfg. Co., Ltd.
Cable	ROBO-TOP 600V 2.0mm <sup>2</sup>	Daiden Co.,Ltd.

_		
	L(m)	Part No.
	3	MFMCA0032ECD
	5	MFMCA0052ECD
	10	MFMCA0102ECD
١	20	MFMCA0202ECD
		2

## MFMCD0\*\*3ECT

MFMA 2.5kW to 4.5kW

Fig. 3-6



Title	Part No.	Manufacturer	
Straight plug	JL04V-6A24-11SE-EB-R	Japan Aviation	
Cable clamp	JL04-2428CK(17)-R	Electronics Ind.	
Nylon insulated round terminal	N5.5-5	J.S.T Mfg. Co., Ltd.	
Cable	ROBO-TOP 600V 3.5mm <sup>2</sup>	Daiden Co.,Ltd.	

	L(m)	Part No.
1	3	MFMCD0033ECT
. N	5	MFMCD0053ECT
d.	10	MFMCD0103ECT
u.	20	MFMCD0203ECT
7		90

# **Options**

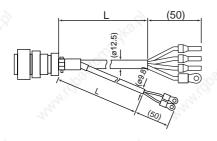
# Junction Cable for Motor with Brake (ROBO-TOP® 105°C 600V·DP)

MFMCA0\*\*2FCD

MSMA 1.0kW to 1.5kW, MDMA 1.0kW to 1.5kW MHMA 500W to 1.5kW, MFMA 400W to 1.5kW MGMA 900W

ROBO-TOP® is a trade mark of Daiden Co.,Ltd.

Fig. 4-1



		Part No.	Manufacturer		
Straight p	lug	JL04V-6A20-18SE-EB-R	Japan Aviation		
Cable clar	mp	JL04-2022CK(14)-R	Electronics Ind.		
Rod termi	nal	AI2.5-8BU	Phoenix		
Nylon insulated	Earth	N2-M4	J.S.T Mfg. Co., Ltd.	L(m)	
round terminal	Brake	N1.25-M4	24.0	3	N
- 3		ROBO-TOP 600V 0.75mm <sup>2</sup>	Ny.	5	N
Cable		and	Daiden Co.,Ltd.	10	N
6		ROBO-TOP 600V 2.0mm <sup>2</sup>		20	N

L(m) Part No.

3 MFMCA0032FCD

5 MFMCA0052FCD

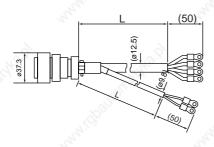
10 MFMCA0102FCD

20 MFMCA0202FCD

MFMCA0\*\*2FCT

MSMA 2.0kW, MDMA 2.0kW

Fig. 4-2



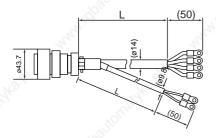
	Title		Part No.	Manufacturer	
	Straight plug		JL04V-6A20-18SE-EB-R	Japan Aviation	
200	Cable clamp		JL04-2022CK(14)-R	Electronics Ind.	
	Nylon insulated	Earth	N2-5	J.S.T Mfg. Co., Ltd.	
	round terminal	Brake	N1.25-M4	J.S.1 Wilg. Co., Lit	
	Cable		ROBO-TOP 600V 0.75mm <sup>2</sup>	a di la	
			and	Daiden Co.,Ltd.	
			ROBO-TOP 600V 2.0mm <sup>2</sup>	24/2	

+		
c	L(m)	Part No.
	3	MFMCA0032FCT
	5	MFMCA0052FCT
	10	MFMCA0102FCT
	20	MFMCA0202FCT

### MFMCA0\*\*3FCT

Fig. 4-3

MSMA 3.0kW to 5.0kW, MDMA 3.0kW to 5.0kW MHMA 2.0kW to 5.0kW, MFMA 2.5kW to 4.5kW MGMA 2.0kW to 4.5kW

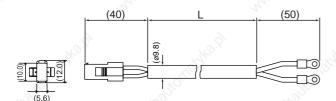


Title		Part No.	Manufacturer
Straight plug		JL04V-6A24-11SE-EB-R	Japan Aviation
Cable clamp		JL04-2428CK(17)-R	Electronics Ind.
Nylon insulated	Earth	N5.5-5	J.S.T Mfg. Co., Ltd.
round terminal	Brake	N1.25-M4	J.S. I Wilg. Co., Ltd.
Cable		ROBO-TOP 600V 0.75mm <sup>2</sup>	
		and	Daiden Co.,Ltd.
		ROBO-TOP 600V 3.5mm <sup>2</sup>	200
	Cable cla Nylon insulated round terminal	Straight plug Cable clamp Nylon insulated Earth round terminal Brake	Straight plug         JL04V-6A24-11SE-EB-R           Cable clamp         JL04-2428CK(17)-R           Nylon insulated round terminal round terminal classes         Earth N5.5-5           Nylon insulated round terminal round

	L(m)	Part No.
	3	MFMCA0033FCT
	5	MFMCA0053FCT
	10	MFMCA0103FCT
	20	MFMCA0203FCT

# Junction Cable for Brake (ROBO-TOP® 105°C 600V·DP)

MFMCB0\*\*0GET Fig. 5-1 MSMD 50W to 750W MQMA 100W to 400W MAMA 100W to 750W ROBO-TOP® is a trade mark of Daiden Co.,Ltd

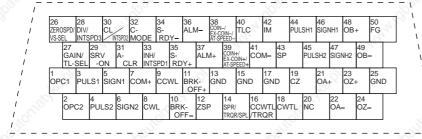


	74				
	Title	Part No.	Manufacturer	L(m)	Part No.
	Connector	172157-1	Tyco	3	MFMCB0030GET
	Connector pin	170366-1,170362-1	Electronics AMP	5	MFMCB0050GET
	Nylon insulated	NA OF MA	LC T Mfa Co Ltd	10	MFMCB0100GET
round terminal		N1.25-M4	J.S.T Mfg. Co., Ltd.	20	MFMCB0200GET
	Cable	DODO TOD 000V 0.752	Daiden Co. Ltd		

# Connector Kit for External Peripheral Equipments

- 1) Par No. (DV0P4350)
- Quantity Title Manufacturer Note 2) Components Part No. 54306-5011 or Connector 54306-5019 (lead-free) Molex Inc. For CN X5 (50-pins) Connector cover 54331-0501

3) Pin disposition (50 pins) (viewed from the soldering side)

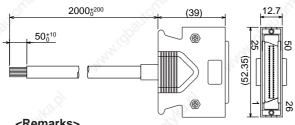


#### <Cautions>

- 1) Check the stamped pin-No. on the connector body while making a wiring.
- 2) For the function of each signal title or its symbol, refer to the wiring example of the connector CN I/F.
- 3) Check the stamped pin-No. on the connector body while making a wiring.

# **Interface Cable**

- 1) Par No. (**DV0P4360**)
- 2) Dimensions



<Remarks>

Color designation of the cable e.g.) Pin-1 Cable color: Orange

(Red1): One red dot on the cable

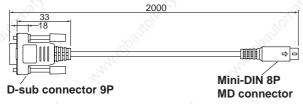
# 3) Table for wiring

Cable of 2m is connected.

4	Pin No.	color	Pin No.	color	Pin No.	color	Pin No.	color	Pin No.	color
	1	Orange (Red1)	11	Orange (Black2)	21	Orange (Red3)	31	Orange (Red4)	41	Orange (Red5)
	2	Orange (Black1)	12	Yellow (Black1)	22	Orange (Black3)	32	Orange (Black4)	42	Orange (Black5)
	3	Gray (Red1)	13	Gray (Red2)	23	Gray (Red3)	33	Gray (Red4)	43	Gray (Red5)
	4	Gray (Black1)	14	Gray (Black2)	24	Gray (Black3)	34	White (Red4)	44	White (Red5)
	5	White (Red1)	15	White (Red2)	25	White (Red3)	35	White (Black4)	45	White (Black5)
	6	White (Black1)	16	Yellow (Red2)	26	White (Black3)	36	Yellow (Red4)	46	Yellow (Red5)
	7	Yellow (Red1)	17	Yel (Blk2)/ Pink (Blk2)	27	Yellow (Red3)	37	Yellow (Black4)	47	Yellow (Black5)
1	8	Pink (Red1)	18	Pink (Red2)	28	Yellow (Black3)	38	Pink (Red4)	48	Pink (Red5)
	9	Pink (Black1)	19	White (Black2)	29	Pink (Red3)	39	Pink (Black4)	49	Pink (Black5)
	10	Orange (Red2)	20	F	30	Pink (Black3)	40	Gray (Black4)	50	Gray (Black5)

# Communication Cable (for connection to PC)

# Par No. (DV0P1960) (DOS/V machine)



# Communication Cable (for RS485)



Part No.	L[mm]
DVOP1970	200
DVOP1971	500
DVOP1972	1000

# Setup Support Software "PANATERM®"

- 1) Part No. (DV0P4460) (English/Japanese version)
- 2) Supply media: CD-ROM

#### <Caution>

For setup circumstance, refer to the Instruction Manual of [PANATERM®].

# **Options**

# **Connector Kit for Motor/Encoder Connection**

These are required when you make your own encoder and motor cables.

 Applicable motor models : MSMD 50W to 750W

MQMA 100W to 400W MAMA 100W to 750W 17-bit absolute

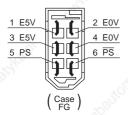
For brake, purchase our optional brake cable.

1) Part No. (DV0P4290

2) Components

Title	Part No.	Number	Manufacturer	Note	
Connector	55100-0600 or 55100-0670 (lead-free)	1 1 1	Molex Inc.	For CN X6 (6-pins)	
Connector	172161-1	1	Tues Flacturation AMD	For junction cable to	
Connector pin	170365-1	9	Tyco Electronics AMP	encoder (9-pins)	
Connector	172159-1	1	Type Flectronics AMD	For junction cable to	
Connector pin	170366-1	4 3	Tyco Electronics AMP	motor (4-pins)	

3) Pin disposition of connector, CN X6 4) Pin disposition of junction cable

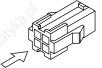


for encoder

		1	
1	2	3	
BAT+	BAT–	FG	
4	5	6	
PS	PS	NC	
7	8	9	
E5V	E0V	NC	

5) Pin disposition of junction cable for motor power





\*When you connect the battery for absolute encoder, refer to P.270,

"When you make your own cable for 17-bit absolute encoder"

Applicable motor models : MSMD 50W to 750W

**MQMA 100W to 400W** MAMA 100W to 750W 2500P/r incremental encoder

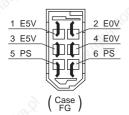
For brake, purchase our optional brake cable.

1) Part No. **DV0P4380** 

2) Components

Title Part No.		Number	Manufacturer	Note	
Connector	55100-0600 or 55100-0670 (lead-free)	1	Molex Inc.	For CN X6 (6-pins)	
Connector	172160-1	1 3	Tues Flactures AMD	For junction cable to	
Connector pin	170365-1	6	Tyco Electronics AMP	encoder (6-pins)	
Connector	172159-1	2 <sup>22<sup>23</sup></sup> 1	Tues Flactronies AMD	For junction cable to encoder (4-pins)	
Connector pin	170366-1	4	Tyco Electronics AMP		

3) Pin disposition of connector, CN X6

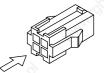


4) Pin disposition of junction cable for encoder



5) Pin disposition of junction cable for motor power





For DVOP2490, DV0P3480,

 recommended manual crimp tool

(to be prepared by customer)

Title	Part No.	Manufacturer	
For junction cable to encoder	755330 - 1	Type Floatronics AMD	
For junction cable to motor	755331 - 1	Tyco Electronics AMP	

Applicable motor models: MSMA 1.0kW to 2.0kW

MDMA 1.0kW to 2.0kW

17-bit absolute incremental encoder, 2500P/r incremental encoder

Without brake

MHMA 500W to 1.5kW MGMA 900W

1) Part No. **DV0P4310** 

2) Components

Title	Part No.	Number	Manufacturer	Note
Connector	55100-0600 or 55100-0670 (lead-free)	11010	Molex Inc.	For CN X6 (6-pins)
Straight plug	raight plug N/MS3106B20-29S		Japan Aviation Electronics	For junction cable to
Cable clamp	Cable clamp N/MS3057-12A		Industry Ltd.	encoder
Straight plug N/MS3106B20-4S		1	Japan Aviation Electronics	For junction cable to
Cable clamp N/MS3057-12A		1	Industry Ltd.	motor power

Applicable motor models: MSMA 3.0kW to 5.0kW

MDMA 3.0kW to 5.0kW MHMA 2.0kW to 5.0kW

17-bit absolute incremental encoder, 2500P/r incremental encoder

Without brake

MGMA 2.0kW to 4.5kW

1) Part No. (DV0P4320)

2) Components

۶ [	Title	Part No.	Number	Manufacturer	Note	
	Connector	55100-0600 or 55100-0670	1 N	Molex Inc.	For CN X6 (6-pins)	
	Connector	(lead-free)	30)	IVIOLEX IIIC.		
	Straight plug	N/MS3106B-20-29S	, 1	Japan Aviation Electronics	For junction cable to	
ų	Cable clamp	N/MS3057-12A	<i>⊗</i> 1	Industry Ltd.	encoder	
S	Straight plug	N/MS3106B22-22S	1	Japan Aviation Electronics	For junction cable to	
	Cable clamp	N/MS3057-12A	1	Industry Ltd.	motor power	

Applicable motor models: MSMA 1.0kW to 2.0kW

MDMA 1.0kW to 2.0kW 17-bit absolute incremental encoder,

With brake

MHMA 0.5kW to 1.5kW 2500P/r incremental encoder

**MGMA 900W** 

MFMA 0.4kW to 1.5kW

17-bit absolute incremental encoder, Without brake 2500P/r incremental encoder

With brake

1) Part No. **DV0P4330** 

2) Components

Title	Part No.	Number	Manufacturer	Note
Connector	55100-0600 or 55100-0670 (lead-free)	1	Molex Inc.	For CN X6 (6-pins)
Straight plug	N/MS3106B20-29S	્રા	Japan Aviation Electronics	For junction cable to
Cable clamp	N/MS3057-12A	్ 1	Industry Ltd.	encoder
Straight plug	Straight plug N/MS3106B20-18S		Japan Aviation Electronics	For junction cable to
Cable clamp N/MS3057-12A		1	Industry Ltd.	motor power

Applicable motor models: MSMA 3.0kW to 5.0kW

MDMA 3.0kW to 5.0kW MHMA 2.0kW to 5.0kW

17-bit absolute incremental encoder, 2500P/r incremental encoder

With brake

MGMA 2.0kW to 4.5kW

MFMA 2.5kW to 4.5kW

17-bit absolute incremental encoder, Without brake 2500P/r incremental encoder

With brake

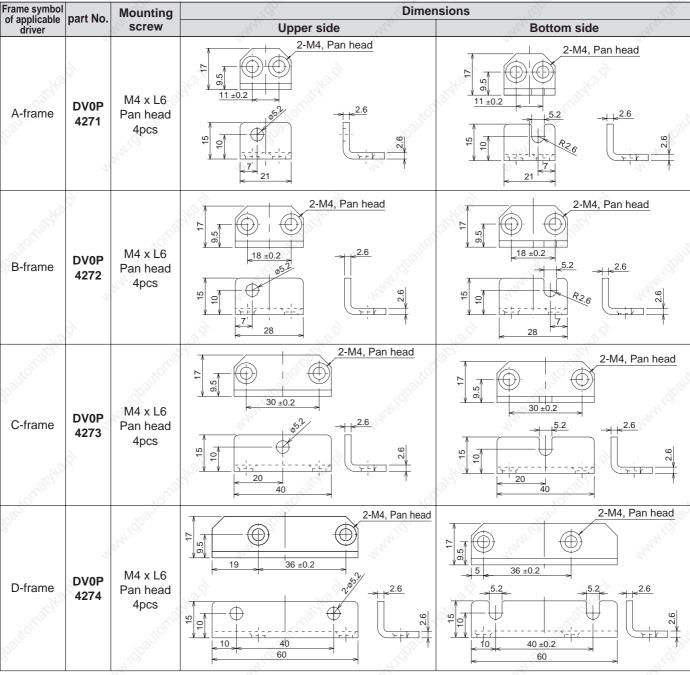
1) Part No. **DV0P4340** 

2) Components

ts 🛭	Title	Part No.	Number	Manufacturer	Note
	Connector	55100-0600 or 55100-0670 (lead-free)	1,3	Molex Inc.	For CN X6 (6-pins)
	Straight plug	N/MS3106B20-29S	JE1	Japan Aviation Electronics	For junction cable to
265	Cable clamp	N/MS3057-12A	ຼິ 1	Industry Ltd.	encoder
4.	Straight plug	N/MS3106B24-11S	1	Japan Aviation Electronics	For junction cable to
	Cable clamp	N/MS3057-16A	1	Industry Ltd.	motor power

# **Options**

# **Mounting Bracket**

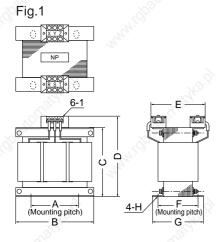


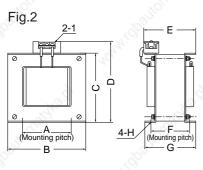
#### <Caution>

For E and F-frame, you con make a front end and back end mounting by changing the mounting direction of L-shape bracket (attachment).

# Part No. DV0P4420 (62) (888.888) (888.888) (888.888) (988.888) (1500) MD connector Mini DIN-8P

# Reactor





	Part No.	Α	В	C	D	E	F	G	H	ı	Inductance (mH)	Rated current (A)
	DV0P220	65	125	83	118	145	70	85	7(w) x 12(L)	M4	6.81	3
	DV0P221	60	150	113	137	120	60	75	7(w) x 12(L)	M4	4.02	5
7.1	DV0P222	60	150	113	137	130	70	95	7(w) x 12(L)	M4	2	8
Fig.	DV0P223	60	150	113	137	140	79	95	7(w) x 12(L)	M4	1.39	11
	DV0P224	60	150	113	137	145	84	100	7(w) x 12(L)	M4	0.848	16
	DV0P225	60	150	113	137	160	100	115	7(w) x 12(L)	M5	0.557	25
	DV0P226	55	80	68	90	90	41	55	ø7.0	M4	6.81	3
Fig.2	DV0P227	55	80	68	90	90	41	55	ø7.0	M4	4.02	<b>0</b> 5
Fig	DV0P228	55	80	68	90	95	46	60	ø7.0	M4	2	8
	DV0P229	55	80	68	90	105	56	70	ø7.0	M4	1.39	11

Motor series	Power supply	Rated output	Part No.
MSMD	Cinalo	50W to 100W	DV0P227
MQMA	Single	100W	DVUPZZI
MSMD	phase,	200W to 400W	DV0P228
MQMA	01000	20000 10 40000	DVUPZZO
MSMD	7	50W to 200W	
MQMA		100W to 200W	
MAMA	Single	10000 to 20000	DV0P220
MFMA		400W	
MHMA	phase,	500W	
MSMD	2000	400W to 750W	'90)
MQMA	.01710	400W	DV0P221
MAMA	all.	400W to 750W	200
MAMA	25.	400W	90
MFMA	3-phase,	40000	DV0P220
MHMA		500W	
MSMD	2007	750W	DV0P221
MAMA		73000	DVUFZZI

Motor series	Power supply	Rated output	Part No.
MGMA		900W	
MSMA		1.0kW	- 3
MDMA	~37		DV0P222
MHMA	90,0	1.5kW	1900
MFMA	41,100	1.5kW	41/10
MSMA	17		3,20
MDMA	0.0141/	DV0P223	
MHMA	3-phase, 200V	2.0kW	
MGMA	2000		
MFMA		2.5kW	
MSMA	-65	3.0kW	
MDMA	- 200		DV0P224
MHMA	195.		.00
MGMA	Egy.		24.
MSMA			3
MDMA		4.0kW	DV0P225
MHMA			

#### Harmonic restraint

On September, 1994, "Guidelines for harmonic restraint on heavy consumers who receive power through high voltage system or extra high voltage system" and "Guidelines for harmonic restraint on household electrical appliances and general-purpose articles" established by the Agency for Natural Resources and Energy of the Ministry of Economy, Trade and Industry (the ex-Ministry of International Trade and Industry). According to those guidelines, the Japan Electrical Manufacturers' Association (JEMA) have prepared technical documents (procedure to execute harmonic restraint: JEM-TR 198, JEM-TR 199 and JEM-TR 201) and have been requesting the users to understand the restraint and to cooperate with us. On January, 2004, it has been decided to exclude the general-purpose inverter and servo driver from the "Guidelines for harmonic restraint on household electrical appliances and general-purpose articles". After that, the "Guidelines for harmonic restraint on household electrical appliances and general-purpose articles" was abolished on September 6, 2004.

We are pleased to inform you that the procedure to execute the harmonic restraint on general-purpose inverter and servo driver was modified as follows.

- 1. All types of the general-purpose inverters and servo drivers used by specific users are under the control of the "Guidelines for harmonic restraint on heavy consumers who receive power through high voltage system or extra high voltage system". The users who are required to apply the guidelines must calculate the equivalent capacity and harmonic current according to the guidelines and must take appropriate countermeasures if the harmonic current exceeds a limit value specified in a contract demand. (Refer to JEM-TR 210 and JEM-TR 225.)
- 2. The "Guidelines for harmonic restraint on household electrical appliances and general-purpose articles" was abolished on September 6, 2004. However, based on conventional guidelines, JEMA applies the technical documents JEM-TR 226 and JEM-TR 227 to any users who do not fit into the "Guidelines for voltage system" from a perspective on enlightenment on general harmonic restraint. The purpose of these guidelines is the execution of harmonic restraint at overside the harmonic restraint on heavy consumers who receive power through high voltage system or extra high guidelines is the execution of harmonic restraint at every device by a user as usual to the utmost extent.

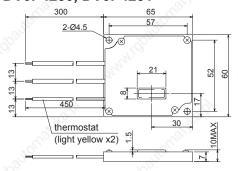
# **External Regenerative Resistor**

800	'920,		Spe	cifications	800		80	
Dowt No.	Manufacturer's	Resistance	Rate	ed power (r	Activation			
Part No.	part No.	Resistance	Free air	2,	with fan [W	1 2	temperature of built-in thermostat	
		Ω	[W]	1m/s	2m/s	3m/s	Duit-in thermostat	
DV0P4280	RF70M	50	10	25	35	45	140±5°C	
DV0P4281	RF70M	100	10	25	35	45	B-contact	
DV0P4282	RF18B	25	17	50	60	75	Open/Close capacity	
DV0P4283	RF18B	50	. 17	50	60	75	(resistance load)	
DV0P4284	RF240	30	40	100	120	150	4A 125VAC 10000 times	
DV0P4285	RH450F	20	52	130	160	200	2.5A 250VAC 10000 times	

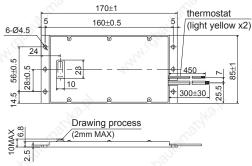
Manufacturer: Iwaki Musen Kenkyusho

\* Power with which the driver can be used without activating the built-in thermostat.

#### DV0P4280, DV0P4281

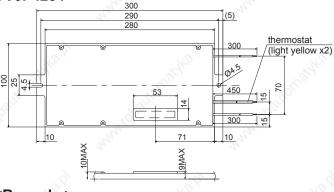




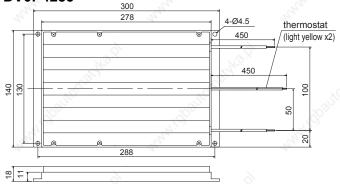


	Power supply						
Frame	Single phase, 100V	Single phase, 200V					
	omgro pridoc, rect	3-phase, 200V					
. <	DV0P4280	DV0P4281					
Α	DV0P4280	Tel.					
В	DV0P4283	DV0P4283					
С	DV0P4282						
D	13.5,	DV0P4284					
Е	ight.	DV0P4285					
	-000-	Arrange 2					
F	all control	DV0P4285					
	000	in a parallel					

# DV0P4284



#### DV0P4285



#### <Remarks>

Thermal fuse is installed for safety. Compose the circuit so that the power will be turned off when the thermostat is activated. The thermal fuse may blow due to heat dissipating condition, working temperature, supply voltage or load fluctuation.

Make it sure that the surface temperature of the resistor may not exceed 100°C at the worst running conditions with the machine, which brings large regeneration (such case as high supply voltage, load inertia is large or deceleration time is short) Install a fan for a forced cooling if necessary.

#### <Caution>

Regenerative resistor gets very hot.

Take preventive measures for fire and burns.

Avoid the installation near inflammable objects, and easily accessible place by hand.

# **Battery For Absolute Encoder**

# **Battery**

- (1) Part No. **DV0P2990**
- (2) Lithium battery by Toshiba Battery Co. ER6V, 3.6V 2000mAh

# Lead wire length 50mm DV0P2990 00090001 ZHR-2 (J.S.T Mfg. Co., Ltd.) BAT+ BAT Paper insulator

# <Caution>

This battery is categorized as hazardous substance, and you may be required to present an application of hazardous substance when you transport by air (both passenger and cargo airlines).

# **Recommended components**

# **Surge Absorber for Motor Brake**

Motor			Surge absorber for motor brake		7/900		
MSMD	50W to 1	.0kW	274		77.11	71,4	77/4
MAMA	100W to	750W		C-5A2 or Z15D151     Ishizuka Electronics Co.			
MHMA	2.0kW to 5	5.0kW	3,				
MGMA	900W to 2	2.0kW		313/2			
MSMA	1.5kW to 5	5.0kW		101	100	100	10
MDMA	4.0kW to 5	5.0kW		C-5A3 or Z15D151     Ishizuka Electronics Co.			
MFMA	1.5kW		- 12				
MGMA	3.0kW to 4	I.5kW	The same	]			
MDMA	1.0kW to 3	3.0kW	2		2		2
MFMA	400W	16	3	10,5	• TNR9V820	K 🙋	
MFMA	2.5kW to 4	I.5kW		"Sign"	Nippon Chemi_Con Co.		
МНМА	500W to 1	.5kW		"Ito, "Ito, "Ito, "Ito,			

# **List of Peripheral Equipments**

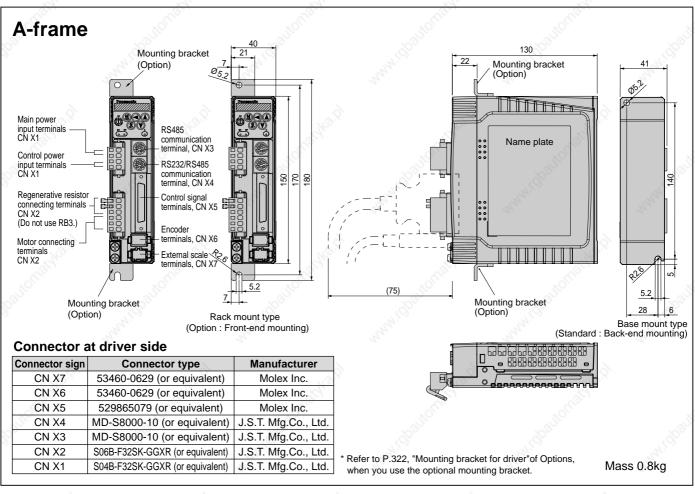
# (reference only)

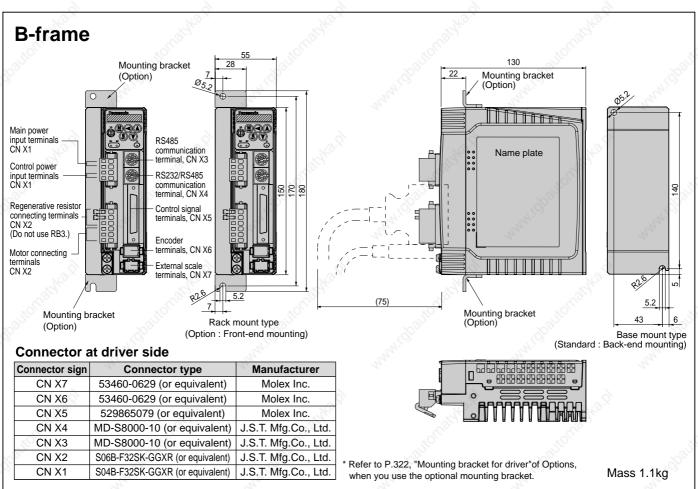
As of Nov.2004

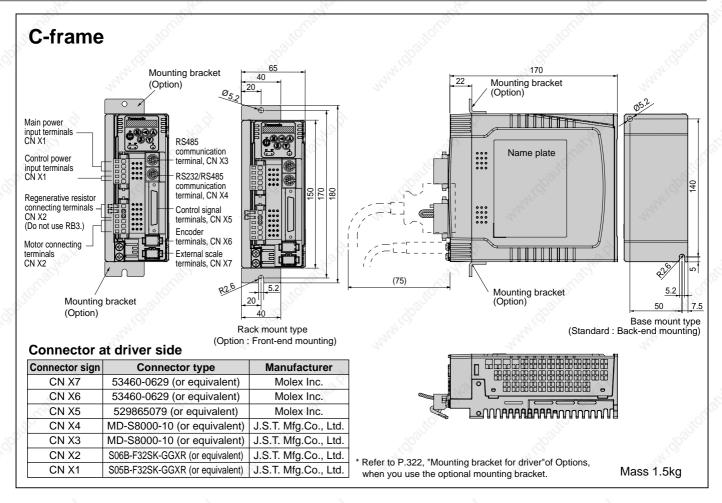
Manufacturer	Tel No./URL	Peripheral components	
Automation Controls Company Matsushita Electric Works, Ltd.	81-6-6908-1131 http://www.mew.co.jp	Non-fuse breaker Magnetic contactor Surge absorber	
Iwaki Musen Kenkyusho Co., Ltd.	81-44-833-4311 http://www.iwakimusen.co.jp/	Regenerative resistor	
Nippon Chemi_Con Corp.	81-3-5436-7608 http://www.chemi_con.co.jp/	Surge absorber for holding brake	
Ishizuka Electronics Corp.	81-3-3621-2703 http://www.semitec.co.jp/		
Renesas Technology Corp.	81-6-6233-9511 http://www.renesas.com/jpn/		
TDK Corp.	81-3-5201-7229 http://www.tdk.co.jp/	Noise filter for signal lines	
Okaya Electric Industries Co. Ltd.	81-3-3424-8120 http://www.okayatec.co.jp/	Surge absorber Noise filter	
Japan Aviation Electronics Industry, Ltd.	81-3-3780-2717 http://www.jae.co.jp	Connector	
Sumitomo 3M	81-3-5716-7290 http://www.mmmco.jp		
Tyco Electronics AMP k.k,	81-44-844-8111 http://www.tycoelectronics.com/japan/amp		
Japan Molex Inc.	81-462-65-2313 http://www.molex.co.jp		
Hirose Electric Co., Ltd.	81-3-3492-2161 http://www.hirose.co.jp/		
J.S.T Mfg. Co., Ltd.	81-45-543-1271 http://www.jst-mfg.com/		
Daiden Co., Ltd.	81-3-5805-5880 http://www.dyden.co.jp/	Cable	
Mitutoyo Corp.	81-44-813-5410 http://www.mitutoyo.co.jp	Linear scale	

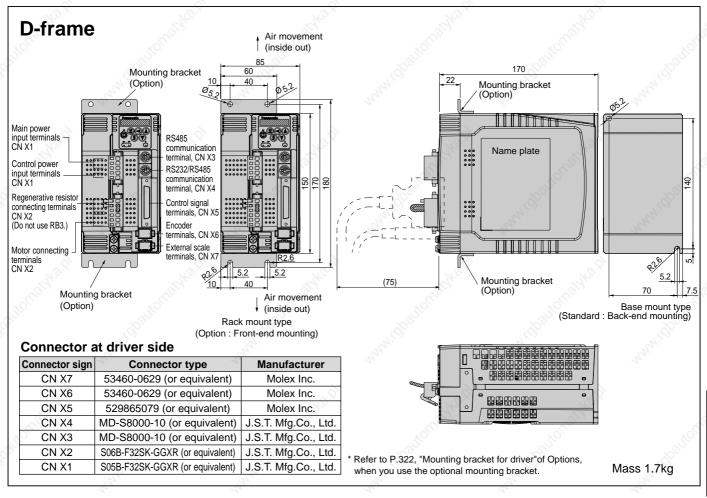
<sup>\*</sup> The above list is for reference only. We may change the manufacturer without notice.

# **Dimensions (Driver)**

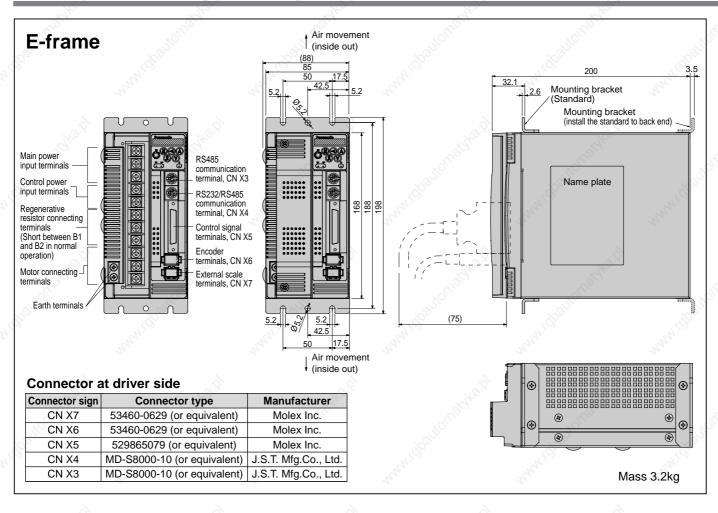


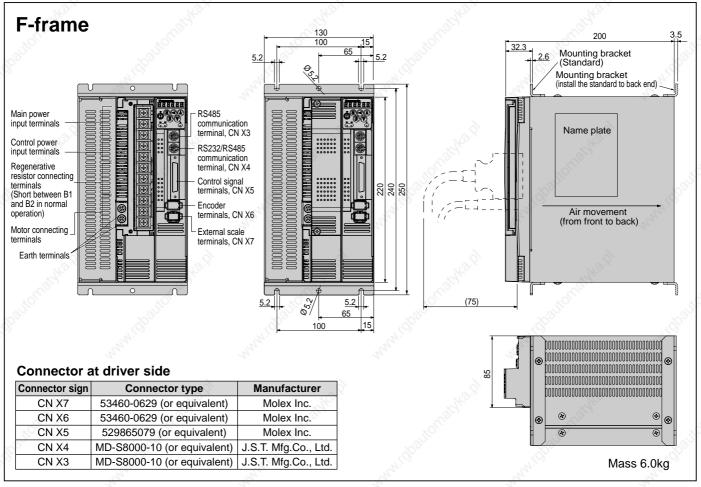






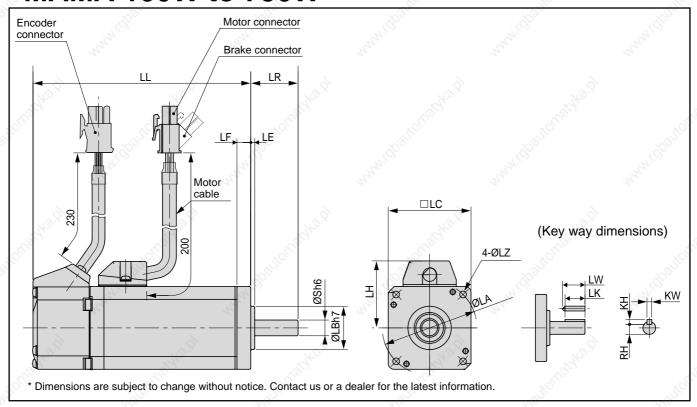
## **Dimensions (Driver)**





# upplement

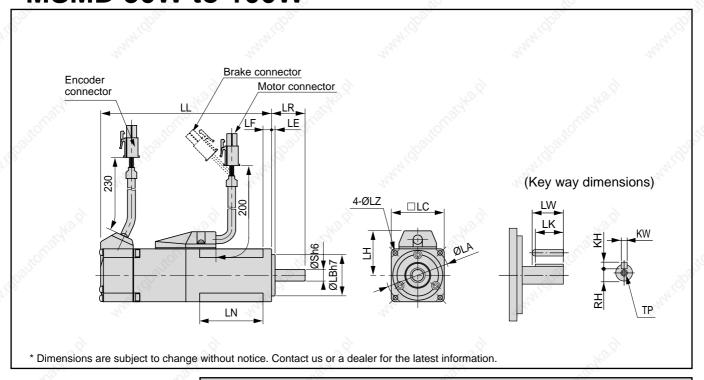
## •MAMA 100W to 750W



				and the		MAMA	series	(Ultra low	v inertia)		
Mot	or outpu	ıt		100W		200W		400W		750W	
Mot	Motor model MAMA		012P1 *	012S1 *	022P1 *	022S1 *	042P1 *	042S1 *	082P1 *	082S1 *	
Rota	Rotary enc		specifications	2500P/r Incremental	17-bit Absolute/ Incremental	2500P/r Incremental	17-bit Absolute/ Incremental	2500P/r Incremental	17-bit Absolute/ Incremental	2500P/r Incremental	17-bit Absolute/ Incremental
	LL		Without brake	110.5	127	111	126	139	154	160	175
	LL		With brake	138	154.5	139	154	167	182	192.5	207.5
		LR		2	4	3	0	3	30	3	35
	s s				3	2 1	1	<u>2</u> 1	4	20 1	9
20	1	LA	10%	4	·8	7	0 2	7	0	90	
OLL		LB	70%	2	2 .0	50		50		70	
		LC	7027	42		60		60		8	30 🚕
		LD	100							_	-41/O
		ÆΈ		N	2	174	3	12	3	-	3
		LF		7		7		7			8
	19:5	LG	2,62	_		8 —		~Z, —			
~ 30°	J.	LH	John State	3	4	4	3 3	4	3	5	3
Ò.		LZ	10/1	3	.4 💉	4	.5	4	.5		6 😿
		LW	1000	.1	4	20		25		25	
ay ons		LK		12	2.5		8	22	2.5	2	22
Key way dimensions		ΚW	,	31	า9	4l	า9	51	h9	6	h9
중불		ΚH		;	3	4	1	_ :	5		6
	13.5	RH	10.5	6	.2	8	.5	్ర 1	1	15	5.5
Me	) ) (kg)		Without brake	0.65	0.71	1.1	1.2	1.5	1.6	3.3	3.4
ivias	Mass (kg)  With brake		0.85	0.91	1.5	1.6	1.9	2.0	4.0	4.1	
Con	nector/F	Plug sp	pecifications	.6	50	F	Refer to P.3	18, "Options	3""	•	1900
		_									

#### <Cautions>

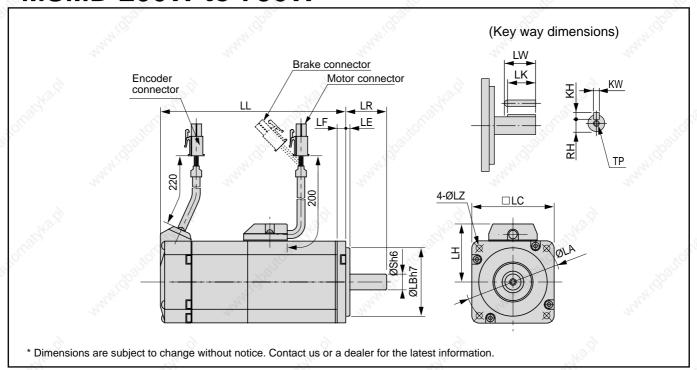
## • MSMD 50W to 100W



		" SITION"					
Moto	Motor output		50W		100	W ~	
Moto	r model	MSMD	5A * P1 *	5A * S1 *	01 * P1 * 01 * S1 *		
Rota	Rotary encoder specifications		2500P/r Incremental	2500P/r Incremental 17-bit Absolute/ Incremental 2		17-bit Absolute/ Incremental	
	L L Without brake		72	2 ,5	92	2	
290		With brake		2	12	2	
	LR M		2!	5 24.50	25	5 21/0	
	S		477	272,	8	- An	
	LA		4:	5	45	5	
	LB	3	30		30	)	
	LC N		38		38		
705	LC		3 200		, <u>ze</u>	₽`	
29,0	LE	1000			3		
	LF	"Ayin	6		6	1. In.	
	LG	F	32		11, — 1		
	LF	ł			32		
	™ <sub>S.</sub> FV	I N	26	.5	46.5		
	<i>∰</i> LZ		3.	4	3.4	4	
700	LW	1 30		4 (6)	14	1	
ွင	LK	(1900)	12	.5	12.	.5	
Key way dimensions	K۷	A " 12/17.	3h	9	3h	9	
ned	KF	l l	3	14,	3	2,	
호등	RH	1	6.	2	6.3	2	
	√2 <sup>,∀</sup> TF	,	M3 x 6	(depth)	M3 x 6 (	(depth)	
N4-6	- (kg)	Without brake	0.3	32	0.4	17	
ivias	s (kg)	With brake	0.53		0.6	88	
Conr	nector/Plug s	pecifications	1900	Refer to P.3	318, "Options".	36,	

#### <Cautions>

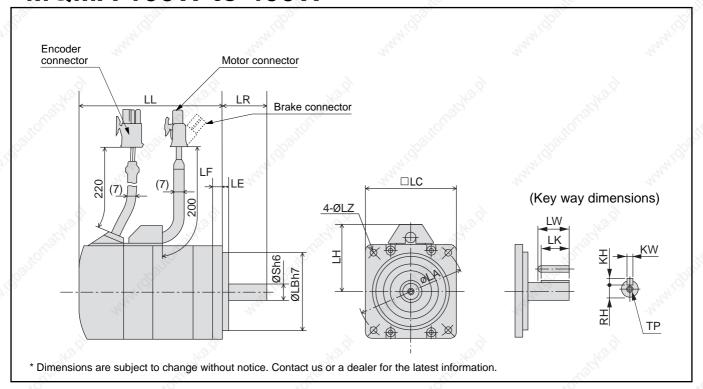
## •MSMD 200W to 750W



		autorni	25	M	SMD seri	es (low inertia	a)	
Mot	Motor output		200	DW W	40	0W	75	OW
Mote	or model	MSMD	02 * P1 *	02 * S1 *	04 * P1 *	04 * S1 *	08 * P1 *	08 * S1 *
Rota	Rotary encoder specification		2500P/r Incremental	17-bit Absolute/ Incremental	2500P/r Incremental	17-bit Absolute/ Incremental	2500P/r Incremental	17-bit Absolute/ Incremental
Olle	LL	Without brake	7	9	98	3.5	, of 1	12
	With brake L R		11	5.5		35	14	19
			<sup>74</sup> 1/2 3	0	741/2 3	30	3	5
	S		3 <sup>13</sup> 1	1 3	1	4 4	1	9 🚜
	LA		7	0	7	0	9	0
	LB		5	0 %	5	50	7	0
260	LC	10%	60		6	0	80	
95,	LD	LD w		<u> </u>			10ft —	
	LE	7027	7027	3	70 <sub>21</sub>	3	OBE :	3 192
	L,F	4.5	6	.5	6	.5	8	3 (4)
	LG	i	17, -	_ 4	_		_	- 11°
	LH	_	4	3	4	13	5	3
	LN LN	202		- <sub>12</sub> ,2'	_	<u> 19</u> 8	12:2 <u>-</u>	<u> </u>
- ASC	LZ	- 180.	4	.5	4	.5	Sign.	5
Ò,,	LW	1 30		0		25	2	
\ SI	LK	(%)°	. స <sup>°</sup> 1	8	22	2.5	2	2
wai	ΚW	1	41	19	5	h9	61	19
Key way dimensions	KH	l		1		5	(	3
∸∵등∣	RH	l a	8	.5	1	1	15	5.5
	LO. <sup>™</sup> TP	160.5	M4 x8	(depth)	M5 x 10	(depth)	M5 x 10	(depth)
Mac	es (ka)	Without brake	0.	82	<u></u> 201	.2	2	.3
Mass (kg) With brake		1	.3	1	.7	3.	.1 350	
Con	nector/Plug s	pecifications	1900		Refer to P.318, "Options".		800	(900

#### <Cautions>

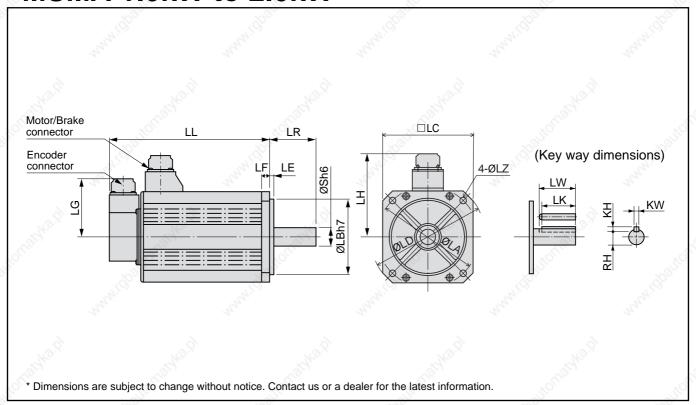
## •MQMA 100W to 400W



		71/qp <sub>00</sub>		M	QMA seri	<b>es</b> (low inertia	a)	
Moto	r output	44	10	0W	20	oW	40	ow
Moto	r model	MQMA	01 * P1 *	01 * S1 *	02 * P1 *	02 * S1 *	04 * P1 *	04 * S1 *
Rota	ry encoder	specifications	2500P/r Incremental	17-bit Absolute/ Incremental	2500P/r Incremental	17-bit Absolute/ Incremental	2500P/r Incremental	17-bit Absolute/ Incremental
990	LL	Without brake	60	87	67	94	82	109
	LL	With brake	84	111	99.5	126.5	114.5	141.5
	LF	51 <sub>22</sub>	2	25	47,4	30	3	0 4
	S			8	1	11	1	4
	LA S	١	, ? 7	0 0	9	90	g	00
	JOY LE	3 (2)	5	00 00	7	70	7	0
705	LC	: 201	60		80		80	
090	LD	) 725	<del>-</del>	<del>,</del>	7025-		70gg -	%
)	LE	''4 <sub>1</sub> ''	. ch!	3	74/2	5	7/2	5 H
	LF	2/2	77.	7	77,0	8		8 44
	LC	}	_	_	_		_	_
	JOS LE	1	6 <sup>2</sup> 4	3 (8.2)	5	53	5	i3
,	LZ أ	<u> </u>	4	.5	5	5.5	5	.5
. 10	LV	v 🧬	1	4 (0)		20	<u> </u>	25
ိပ္ထ	Lŀ	( '%)	12	2.5	. John 1	18	22	2.5
Key way dimensions	K۷	A 724	31	h9	4	h9	5	n9
ey	KH	1	700	3	14,	4		5
ᄎᄩై	RI	1	6	.2	8	3.5	1	1
	√2 <sup>®</sup> TE		M3 x 6	(depth)	M4 x 8	B(depth)	M5 x 10	O(depth)
		Without brake	0.65	0.75	1.3	1.4	1.8	1.9
Mass	s (kg)	With brake	0.90	1.00	2.0	2.1	2.5	2.6
Conr	nector/Plua s	pecifications	.8	500	- 202	18, "Options".	-30	.85

#### <Cautions>

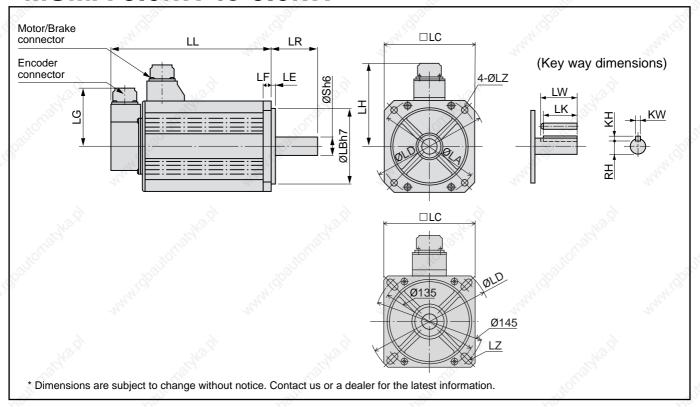
## •MSMA 1.0kW to 2.0kW



		100	Reserved.	М	SMA seri	es (low inertia	a)	Nath .
Motor output		1.0kW		1.5kW		2.0kW		
Motor mode	el	MSMA	10 * P1 *	10 * S1 *	15 * P1 *	15 * S1 *	20 * P1 *	20 * S1 *
Rotary encoder		specifications	2500P/r Incremental	17-bit Absolute/ Incremental	2500P/r Incremental	17-bit Absolute/ Incremental	2500P/r Incremental	17-bit Absolute/ Incremental
LL	- 3	Without brake	175	175	180	180	205	205
LL		With brake	200	200	205	205	230	230
	LR		5	55	5	5	5	55
. 3.2	S		1	9	1	9	. 21	9
201	LA	29	10	00	115		115	
26,	LB	100	8	80	و آن	5	10 <sup>1</sup> 9	)5
	LC	722	700,0	0		00	ر 10	00
	LD	160	1	20		35	1:	35
	£Έ		Tr.	3		3 424	;	3
	LF		-	7	1	0	1	0
73.5,	LG	20.5	8	34 (S)	8	4	3 <sup>12</sup> 8	34
Valey,	LH	Capp.	9	18 154		03		03
35	LZ	101	6	.6	101 9	9	30	9
	LW	1.00°	, S <sup>©</sup> 4	5	4	5	\(\sigma^{2}\)	l5 200°
<u> </u>	LK	7.5	4	2	4	.2	4	2
Aey way character with the control of the control o		61	h9	61	า9	6h9		
Z <u>i</u>	ΚH			6	(	3		6
163.4	RH	16.4	15	5.5	15	5.5	2 1t	5.5
Mass (kg)		Without brake	4.5	4.5	5.1	5.1	6.5	6.5
With brake		5.1	5.1	6.5	6.5	7.9	7.9	
Connector/F	Connector/Plug specifications		900		Refer to P.31	2, "Options".	8	900

#### <Cautions>

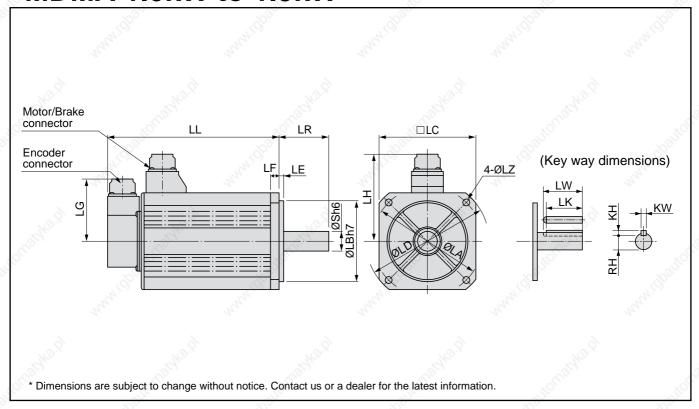
## • MSMA 3.0kW to 5.0kW



		.07		Y				
		unn!	all the last	M	SMA seri	es (low inertia	a)	Hara L.
Moto	Notor output		3.0kW		4.0kW		5.0kW	
Moto	r model	MSMA	30 * P1 *	30 * S1 *	40 * P1 *	40 * S1 *	50 * P1 *	50 * S1 *
Rota	ry encoder	specifications	2500P/r Incremental	17-bit Absolute/ Incremental	2500P/r Incremental	17-bit Absolute/ Incremental	2500P/r Incremental	17-bit Absolute/ Incremental
)	LL	Without brake	217	217	240	240	280	280
	LL	With brake	242	242	265	265	305	305
	LR		5	5	6	S5	6	§5
	S		. 2	2	2	24	2	24
	LA TA	1250	130/14	5 (slot)	145		145	
100	LB	100	110		110		110	
200	LC	70,00	12	20	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	30	130	
	LD	" Miles	16	62	1	65	1	65
	LE	to.	20,	3	The state of the s	6 4		6
	LF		12		12		12	
	LG	N	<sub>0</sub> . (2)	4 🚜 🤼	84		84	
	(g) LH	Mig.	1.	11 Jac	1	18	(A) 1	18
100	LZ	101	,	9 70	(10)	9	101	9
50	LW	1900	4	5	.3000 5	55	[ B	55
<u>o</u> g	LK	"May"	4	1	- My . 5	51	A	51
LK KW KW KH			81	า9	8	h9	8	h9
9 1	KH		2	7		7		7
	RH	. %	۶ <sup>×</sup> 1	8	2	20	2	20
Mass	: (ka)	Without brake	09.3	9.3	12.9	12.9	17.3	17.3
iviass	Mass (kg)  With brake		11.0	11.0	14.8	14.8	19.2	19.2
Conr	nector/Plug sp	pecifications			Refer to P.3	12, "Options".		

#### <Cautions>

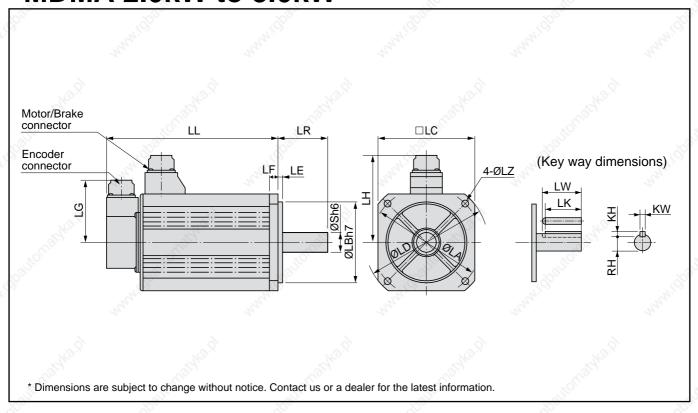
## • MDMA 1.0kW to 1.5kW



		. (***								
		8	"May"	MDMA series (Middle inertia)						
Motor output			1.0	DkW	1.5kW					
Motor model		MDMA	10 * P1 *	10 * S1 *	15 * P1 *	15 * S1 *				
Rotary enco	oder	specifications	2500P/r Incremental	17-bit Absolute/Incremental	2500P/r Incremental	17-bit Absolute/Incremental				
LL		Without brake	150	150	175	175				
With brake		175	175	200	200					
	LR		5	55	5	55				
	S	5	2	22	2	22				
LA LA			, 18 <sup>1</sup> 1.	45	145					
2/1	LΒ	707	110		110 130					
	LC	70,90								
	LD	Ö	165		1	65				
	ÆΕ		6 12		6					
	LF				12					
70'5,	LG	79·3.	.8	34	84					
VIII.	LH	~9 <u>;</u> 9,	, A <sup>(2)</sup> 1	18	1	18				
200	LZ	101	1000	9 (10)	100	9 📈				
	LW	. 20°2.	.80° 4	15	200 4	ļ5 <u>N</u>				
Kew way man densions LK KW KW KH KH		14 <sup>1</sup> 4	11 a <sup>n</sup>	13h Z	11 a <sup>1</sup>					
		8	h9	8	h9					
2 <u>2</u> 2	KH		7			7				
10.7	o <sup>®</sup> RH √o <sup>®</sup>		118 N		18.00					
Mass (kg)		Without brake	6.8	6.8	8.5	8.5				
Mass (kg)  With brake		8.7	8.7	10.1	10.1					
Connector/Pl	lug sp	ecifications	'%,	Refer to P.31	2, "Options".	'92'				

#### <Cautions>

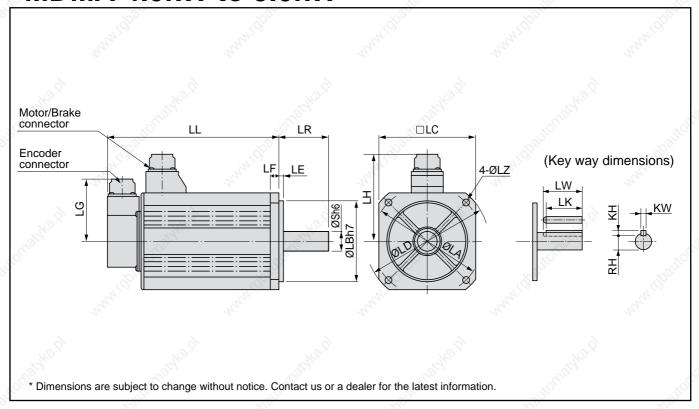
## • MDMA 2.0kW to 3.0kW



		HAMA!	MDMA series (Middle inertia)						
Mot	Motor output		2.0	kW	3.0kW				
Mot	or model	MDMA	20 * P1 *	20 * S1 *	30 * P1 *	30 * S1 *			
Rota	Rotary encoder specifications		2500P/r Incremental	17-bit Absolute/Incremental	2500P/r Incremental	17-bit Absolute/Incremental			
9	LL	Without brake	200	200	250	250			
	LL	With brake	225	225	275	275			
	LR		5	55	6	35			
	S		, Ç <sup>^</sup>	22	2	24			
	LA	1282	145		145				
30	LB	100	110 130		110 130				
S. S	LC	700							
7	LD	"di	165		1	65			
	LE		6		22,	6			
	LF		12		1	12			
	LG	8	8	34	120.50	34			
	√aj <sub>CA</sub> , ΓΗ	197	118		118				
770	LZ	1101	10	9	. 3	9			
Ç.,	LW		. 800 4	15 (V) <sup>(2)</sup>	, J ° 5	55			
ions	LK		11/11/11	11 34	M41. E	51			
Key way dimensions LK KW KW KH		8	h9	8	h9				
ᇫᄩ	KH		A	7	A	7			
	RH	.3		8	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	20			
Mad	Mass (kg)  Without brake With brake		10.6	10.6	14.6	14.6			
ivias			12.5	12.5	16.5	16.5			
Con	nector/Plug sp	ecifications	190	Refer to P.31					

#### <Cautions>

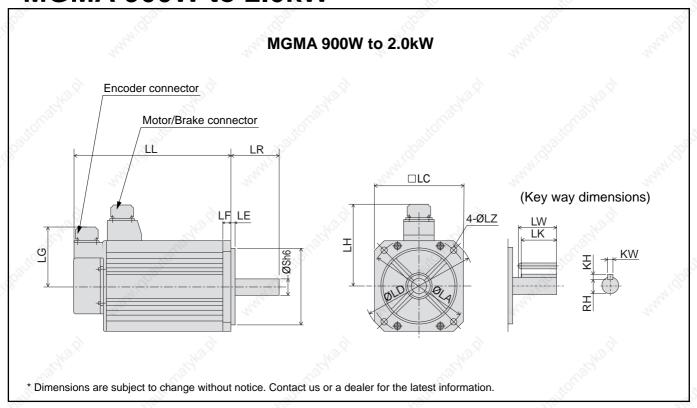
## • MDMA 4.0kW to 5.0kW



			~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~						
May			"May 12	MDMA serie	S (Middle inertia)	, and h			
Mot	or output		4.0	kW	5.0kW				
Mot	or model	MDMA	40 * P1 *	40 * S1 *	50 * P1 *	50 * S1 *			
Rot	ary encoder	specifications	2500P/r Incremental	17-bit Absolute/Incremental	2500P/r Incremental	17-bit Absolute/Incremental			
	LL _g²	Without brake	242	242	225	225			
	With brake		267 267		250	250			
	LR	1	6	5	7	70			
	s (S		2	8	, <u>?</u>	35			
26	LA	100		65 <sub>8</sub> 8	2	00			
05,	LB	305	130 150		114.3 176				
	LC	1080							
	LD	). [S	. A. 19	90	2	33			
	Æ.E		3	.2	3.2 18 84				
	LF		1	8					
	ω <sup>Ω</sup> LG	, S	. 8	4					
~85	LF.	200	12	128		43			
O.	LZ	10/1	<u> </u>	1 (6)	(0)1:	3.5			
	LW	1.30	,X <sup>20</sup> 5	5 200	,X <sup>2</sup> 5	55			
ay	LK	4.5	, <sub>4</sub> h, 5	1 24	74/2 6	50			
Key way dimensions H M M H		81	n9	10	)h9				
		1	-	7		8			
	R⊦	1 10°S	. 2	4	ð. <sup>R</sup> 3	30			
000	) (lea)	Without brake	18.8	18.8	25.0	25.0			
vias	ss (kg)	With brake	21.3	21.3	28.5	28.5			
Cor	nector/Plug s	pecifications	.85°	Refer to P.31	2, "Options".	1900			
	Connector/Plug specifications				z, Options .				

#### <Cautions>

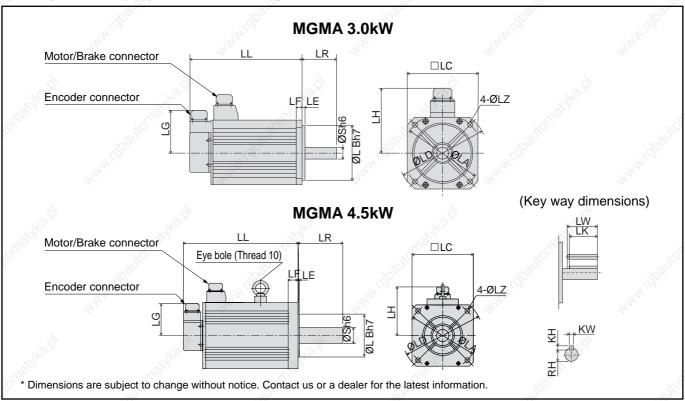
## • MGMA 900W to 2.0kW



		Halah I. S.	"Andry"	MGMA serie	S (Middle inertia)	"Hally.	
Moto	or output		90	00W	2.0kW		
Moto	or model	MGMA	09 * P1 *	09 * S1 *	20 * P1 *	20 * S1 *	
Rota	ary encoder	specifications	2500P/r Incremental	17-bit Absolute/Incremental	2500P/r Incremental	17-bit Absolute/Incremental	
)	LL	Without brake	175	175	182	182	
	With brake		200	200	207	207	
	LR		7	0	8	30	
	S		a.C. 2	22	J&S 3	35	
	LA	1985	1	45	2	00	
30	LB	10°	110 130		114.3 176		
200	LC	70gs					
	LD	24/2	165		2	33	
	LE	No.	6 44		3	.2	
	LF		12 84		18		
	LG	SI SI			33	34	
	لاً LH	79/2	, t	18	1-	43	
1/10	LZ	10	100	9 (10)	10	3.5	
\$0	LW	1900	, 35° 4	15	, X <sup>2</sup> 5	55	
ons	LK	"Hy		11 a <sup>nd</sup>	- 12 m	50	
Key way dimensions KM KH		8	h9	10	)h9		
		2	7		8		
	RH		18		30		
Mod	Mass (kg)  Without brake  With brake		8.5	8.5	17.5	17.5	
ivias			10.0	10.0	21.0	21.0	
Coni	nector/Plug sp	pecifications	'92,0	Refer to P.31	12, "Options".	.00	

#### <Cautions>

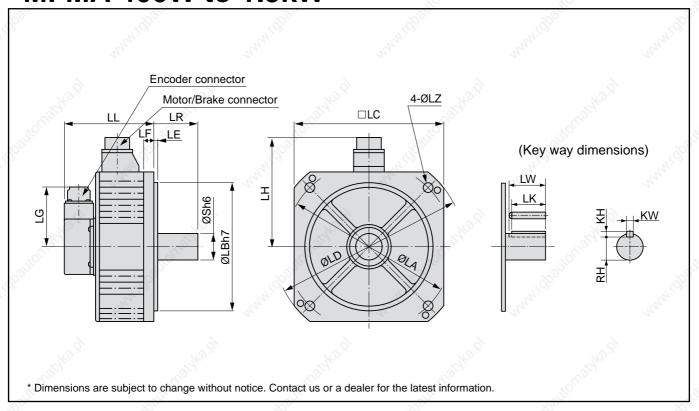
## •MGMA 3.0kW to 4.5kW



		110	and .	MGMA serie	<b>S</b> (Middle inertia)		
Mot	or output		3.0	kW	4.5	5kW	
Moto	or model	MGMA	30 * P1 *	30 * S1 *	45 * P1 *	45 * S1 *	
Rota	ary encoder	specifications	2500P/r Incremental	17-bit Absolute/Incremental	2500P/r Incremental	17-bit Absolute/Incremental	
	LL ed	Without brake	222	222	300.5	300.5	
	- 124,	With brake	271	271	337.5	337.5	
	LR		8	30	1	13	
	s (S	J. 2	.3	35	, P 4	12	
26.	LA	201	20	00	2	00	
Ò.	LB	705	114.3		114.3		
	LC	7025	,5 <sup>6</sup> 1	76	,5 <sup>6</sup> 1	76	
	LD	1.10	233		2	33	
	ÆΕ		3.2		3.2		
	LF	_	1	8	24		
,	LG	73.5	8	84	8	34	
1	LH.	Nigh.	(A) 14	43	1	43	
Ò,	LZ	720,	13	3.5	1C	3.5	
	LW	1.000	.80	55	1900 B	96	
ons ons ons	LK	7.	<i>n</i> h <sup>1</sup> 5	50	71 <sub>217</sub> 6	90	
Key way dimensions H M M H		10	)h9	12	2h9		
		8		8			
	RH	RH 30		37			
Mac	es (ka)	Without brake	25.0	25.0	34.0	34.0	
ivias	Mass (kg)  With brake		28.5	28.5	39.5	39.5	
Con	nector/Plug sp	pecifications	1900	Refer to P.31	12, "Options".	.600	

#### <Cautions>

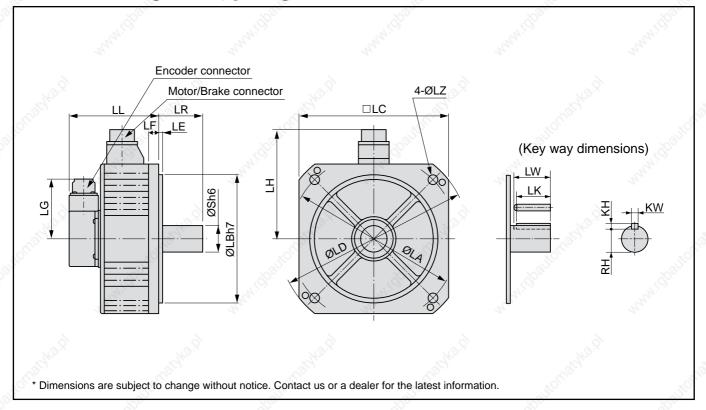
## •MFMA 400W to 1.5kW



			"Any	MFMA serie	<b>S</b> (Middle inertia)		
Moto	r output		40	0W	1.5	škW	
Moto	r model	MFMA	04 * P1 *	04 * S1 *	15 * P1 *	15 * S1 *	
Rota	ry encoder	specifications	2500P/r Incremental	17-bit Absolute/Incremental	2500P/r Incremental	17-bit Absolute/Incremental	
)	LL	Without brake	120	120	145	145	
	LL	With brake	145	145	170	170	
	LR		5	55	6	55	
	s 🧟		, Š	9	3	35	
	LA The	196	1-	45	20	00	
103	LB	100	110		114.3		
020	LC	7000			176		
2	LD	7410	165		2:	33	
	LE	Ila.	Ma,	6	3.2 18 84		
	LF		1	2			
	LG LG		8	34			
	<sup>(g)</sup> LΗ	~9.04	1	18	J.	43	
100	LZ	100	100	9 (6)	13	3.5	
00	LW	1920	. 200 4	15 <u>K</u>	5	55	
ay	LK	"Hay:	4	2	, H <sup>1</sup> 5	90 Edy	
K W		6	h9	10	)h9		
Key way dimensions	KH		A	6	2	8	
	RH	. 1	3 <sup>33</sup> 15	5.5	16 No. 3	30 10 1	
Macs	Mass (kg)  Without brake  With brake		4.7	4.7	11.0	11.0	
ivias			6.7	6.7	14.0	14.0	
Conr	nector/Plug sp	pecifications	190,	Refer to P.3	12, "Options".	-36	

#### <Cautions>

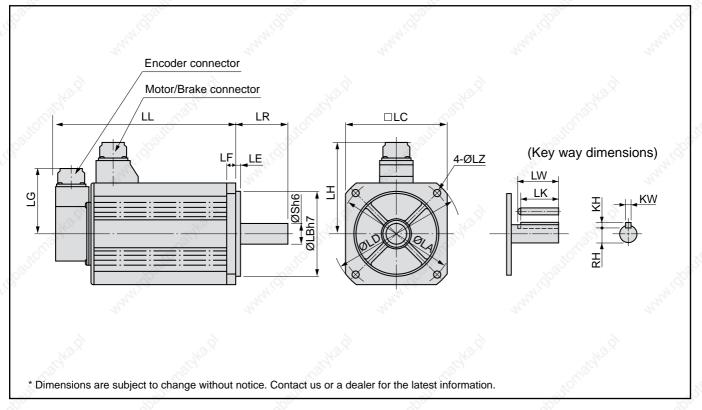
## •MFMA 2.5kW to 4.5kW



					.00			
			"Anthy"	MFMA serie	<b>S</b> (Middle inertia)	NAM!		
Motor output			2.5	5kW	4.5kW			
Moto	or model	MFMA	25 * P1 *	25 * S1 *	45 * P1 *	45 * S1 *		
Rota	ary encoder	specifications	2500P/r Incremental	17-bit Absolute/Incremental	2500P/r Incremental	17-bit Absolute/Incrementa		
	LL .si	Without brake	139	139	163	163		
	FF 722,	With brake	166	166	194	194		
	LF	₹	6	65	7	<b>7</b> 0		
	s S	2.0	.3	35	3	35		
26.	L/	A 35	2	35	2	35		
05,	LE	3 30	. 2	00	200			
	L(	C 1682	2	20	2	20		
	L[	J. (2)	2	68	2	68		
	1	<b>=</b>	20,0	4	20,00	4		
	LI	=	1	16	16 84 164			
	ு.? L(	3 (8)		34				
785	LH	4 250	, del 1	64				
Ò,	L	Z (10)	, to 1:	3.5	<b>1</b> 3	3.5		
	LV	V	. % 5	55	. 200	55		
ay ons	Li	<	541	50	, al. 5	50		
Key way dimensions	K۱	V	10	)h9	10	)h9		
<u>a</u> &	KI	1		8		8		
	₽ RI	H 120.5	M3	30	₽ <sup>®</sup> 3	30.08		
000	- (1)	Without brake	14.8	14.8	19.9	19.9		
was	ss (kg)	With brake	17.5	17.5	24.3	24.3		
Con	nector/Plug	specifications	12/0	Refer to P.31	2, "Options".	,300		
		74.	743	· M.	763	757		

#### <Cautions>

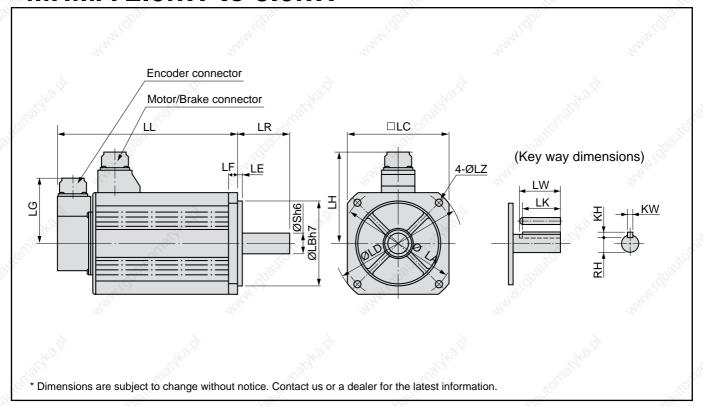
## • MHMA 500W to 1.5kW



		and the second	and the second	MHMA series (High inertia)								
Moto	or output		50	OW	1.0	)kW	1.5kW					
Moto	r model	MHMA	05 * P1 *	05 * S1 *	10 * P1 *	10 * S1 *	15 * P1 *	15 * S1 *				
Rota	ry encoder	specifications	specifications 2500P/r Incremental		2500P/r Incremental	17-bit Absolute/ Incremental	2500P/r Incremental	17-bit Absolute/ Incremental				
	LL	Without brake	150	150	175	175	200	200				
	LL	With brake	175	175	200	200	225	225				
	LR		7	0	7	0	7	<b>'</b> 0				
	S		. 2	2 (2)	2	22	2	22				
	JA LA	1250	14	15	1-	45	145 110 130 165 6 12 84					
30	LB	101	1	10	્રત	10						
200	LC	1000	13	30	13 <sup>00</sup> 13	30						
	LD	74/10	. A 10	65	1	65						
	LE	tr.	20,	6	IL.	6 4						
	LF		1	2	1	2						
	LG	S	8	4	8	34						
	<i>∰</i> LH	197	1	18	1	18	1	18				
110	LZ	101	,	9 1101	10	9	101	9				
500	LW	1900	4	5	4	<b>!</b> 5	4	ļ5 . Š				
ig jois	LK	"HAI"	4	1	4	l1	4	11 <u></u>				
sy w ens	KW	1 <sup>2</sup> / <sub>2</sub>	81	า9	8	h9	8	h9				
Key way dimensions	KH		>	7		7		7				
	√e <sup>X</sup> RH	- 3	3 <sup>×</sup> 1	8 (4)	1	8	<u>%</u> 1	8				
Mass	s (kg)	Without brake	5.3	5.3	8.9	8.9	10.0	10.0				
ivias	<i>y</i> (Ng)	With brake	6.9	6.9	9.5	9.5	11.6 11.6					
Conr	nector/Plug sp	pecifications			Refer to P.3	12, "Options".						

#### <Cautions>

## • MHMA 2.0kW to 5.0kW



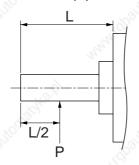
	"Any		MHN	1A serie	es (High in	nertia)		n <sub>n</sub> ,	
	2.0	)kW	3.0	)kW	4.0	)kW	5.0kW		
MHMA	20 * P1 *	20 * S1 *	30 * P1 *	30 * S1 *	40 * P1 *	40 * S1 *	50 * P1 *	50 * S1 *	
r specifications	2500P/r Incremental	17-bit Absolute/ Incremental	2500P/r Incremental	17-bit Absolute/ Incremental	2500P/r Incremental	17-bit Absolute/ Incremental	2500P/r Incremental	17-bit Absolute/ Incrementa	
Without brake	190	190	205	205	230	230	255	255	
With brake	215	215	230	230	255	255	280	280	
R	8	30	8	80	8	30	8	30	
S	3	35	§ 3	35	, <sup>(2)</sup> 3	35		<b>3</b> 5	
A A	20	00	20	00	20	00	200 114.3		
В	11	4.3	11	4.3	11	4.3			
C 7000	1	176		76	1.	76	176		
D	2:	33	2:	33	2:	33	233		
E	3	3.2			3	.2	3.2		
F	1	8	1	8	1	8	1	8	
G 🚕 🤉	8	34 🔎	8	34	o. <sup>2</sup> 8	34	84		
H N	14	43	1.	43	1	43	143		
Z MO	13	3.5	13	3.5	13	3.5	13	3.5	
W	5	55	5	55	5	55 🔊	5	55 👋	
K	. M 5	50	3/2	50	5	50	5	50	
Suspension LK KW KH		)h9	10	)h9	10	)h9	10	h9	
H >	8		A	8	A .	8	8		
H 182×	3	80	3	80	<i></i>	30	. 10 × 3	80	
Without brake	16.0	16.0	18.2	18.2	22.0	22.0	26.7	26.7	
With brake	19.5	19.5	21.7	21.7	25.5 25.5		30.2	30.2	
specifications	5.	8	F	Refer to P.31		s". 🐠			
	Without brake With brake R S A B C D E F G H Z W K W H H H Without brake	MHMA         20 * P1 *           er         specifications         2500P/r Incremental           Without brake         190           With brake         215           R         8           S         3           A         2           B         11           C         1           D         2           E         3           F         1           G         8           H         1           Z         13           W         5           K         5           W         10           H         3           Without brake         16.0           With brake         19.5	Second   S	2.0kW   3.0   30 * P1 *   20 * S1 *   30 * P1 *   2500P/r   Incremental   Absolute/ Incremental   2500P/r   2500P/r   Incremental   2500P/r   Increm			MHMA         20 * P1 *         20 * S1 *         30 * P1 *         30 * S1 *         40 * P1 *         40 * S1 *           or specifications         2500P/r Incremental or specifications         17-bit Absolute/ Incremental Absolute/ Incremental         2500P/r Incremental Absolute/ Incremental         17-bit Absolute/ Incremental Absolute/ Incremental         2500P/r Incremental Absolute/ Incremental         2500P/r Incremental         17-bit Absolute/ Incremental Incremental         2500P/r Incr	Name	

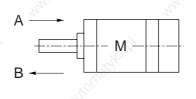
#### <Cautions>

## **Permissible Load at Output Shaft**

Radial load (P) direction

Thrust load (A and B) direction



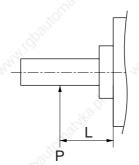


Unit: N (1kgf=9.8N)

			At assembly	During running		
Motor series	Motor output	Dadiel thrust	Thrus	st load	Radial thrust	Thrust load A
Series	Sales,	Radial thrust	A-direction	B-direction	Radiai thrust	and B-direction
Night.	50W, 100W	147	88	117.6	68.6	58.8
MSMD	200W, 400W	392	147	196	245	98
	750W	686	294	392	392	147
	1kW	686	392	490	392	147
MSMA	1.5kW to 3.0kW	000 0		200	490	196
	4.0kW to 5.0kW	980	588	686	784	343
20014	100W	147	88	117.6	68.6	58.8
MQMA	200W, 400W	392	147	196	245	98
Š	1.0kW to 2.0kW	31/0			490	196
MDMA	3.0kW	980	588	686		37,0
MDMA	4.0kW	4000	-0.4	300	784	343
	5.0kW	1666	784	980	125	
N.41 IN.4.A	500W to 1.5kW	980	588	686	490	196
MHMA	2.0kW to 5.0kW	1666	784	980	784	343
5°	400W	S	500		392	147
MFMA	1.5kW	980	588	000	490	196
	2.5kW, 4.5kW	1862	686	686	784	294
9	900W	980	588	6	686	196
MGMA	2.0kW	1666	784	980	1176	400
	3.0kW, 4.5kW	2058	980	1176	1470	490

#### <Note>

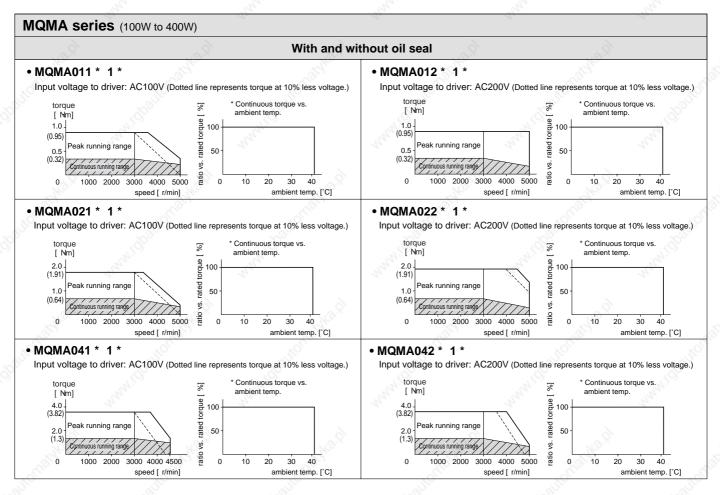
When the load point varies, calculate the permissible radial load, P (N) from the distance of the load point, L (mm) from the mounting flange based on the formula of the right table, and make it smaller than the calculated result.

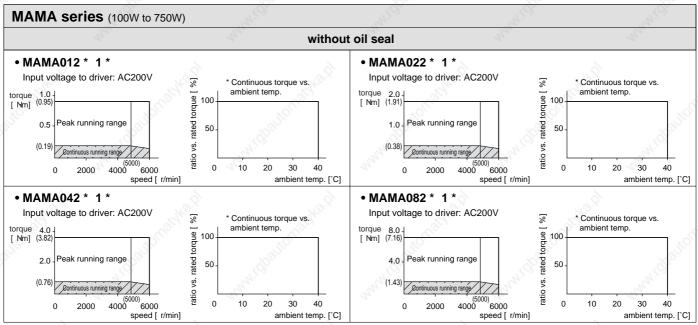


Motor series	Motor output	Formula of Load and load point relation				
Kaleka S	50W	$P = \frac{3533}{L+39}$				
Elifor,	100W	$P = \frac{4905}{L+59}$				
MSMD	200W	$P = \frac{14945}{L+46}$				
17 <sup>1</sup> /2.0	400W	$P = \frac{19723}{L + 65.5}$				
BIRCULO	750W	$P = \frac{37044}{L+77}$				

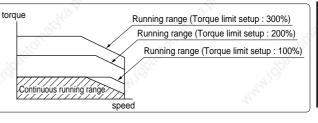
## Motor Characteristics (S-T Characteristics) [Supplement]

- Note that the motor characteristics may vary due to the existence of oil seal or brake.
- Continuous torque vs. ambient temperature characteristics have been measured with an aluminum flange attached to the motor (approx. twice as large as the motor flange).

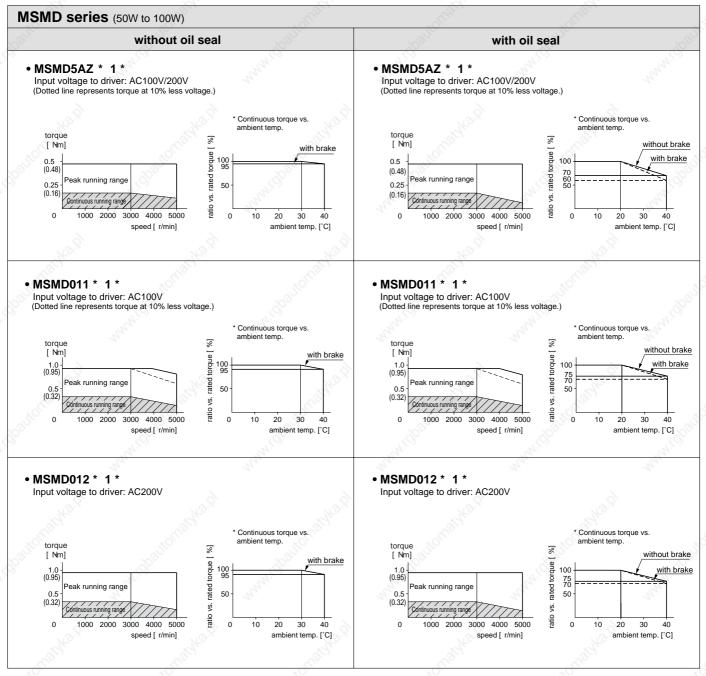




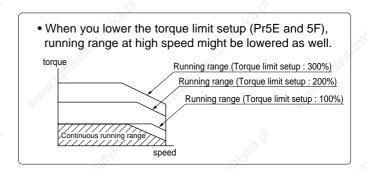
- \* These are subject to change. Contact us when you use these values for your machine design.
- \* Ratio to the rated torque at ambient temperature of 40°C is 100% in case of without oil seal, without brake.
- When you lower the torque torque limit setup (Pr5E and 5F), running range at high speed might be lowered as well.

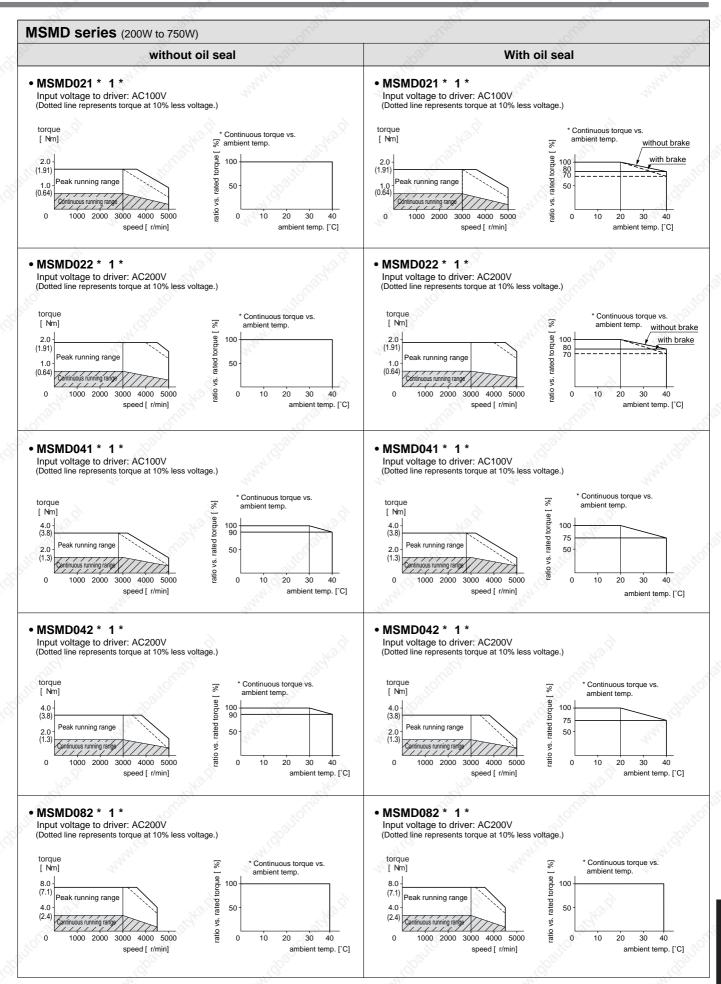


## **Motor Characteristics (S-T Characteristics)**



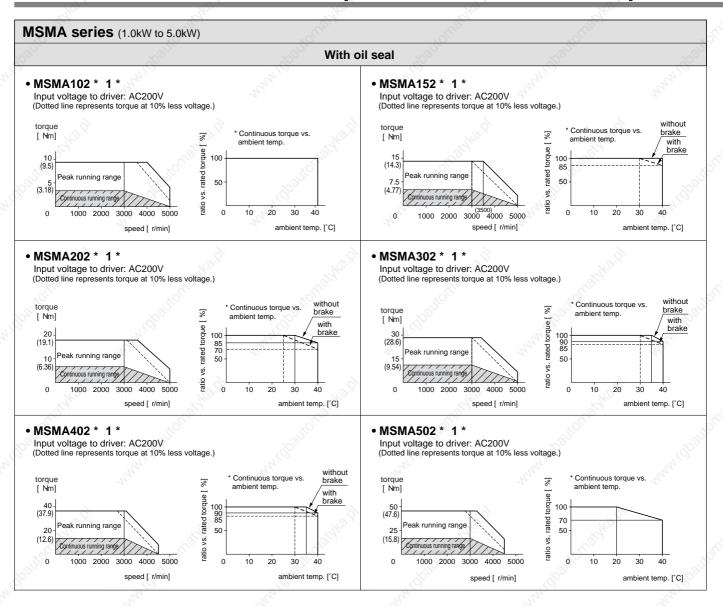
- \* These are subject to change. Contact us when you use these values for your machine design.
- \* Ratio to the rated torque at ambient temperature of 40°C is 100% in case of without oil seal, without brake.

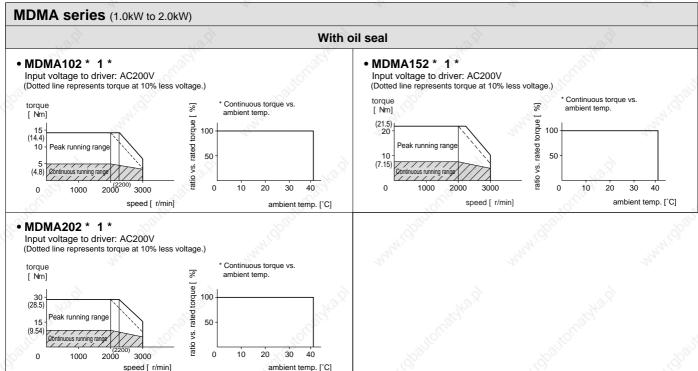




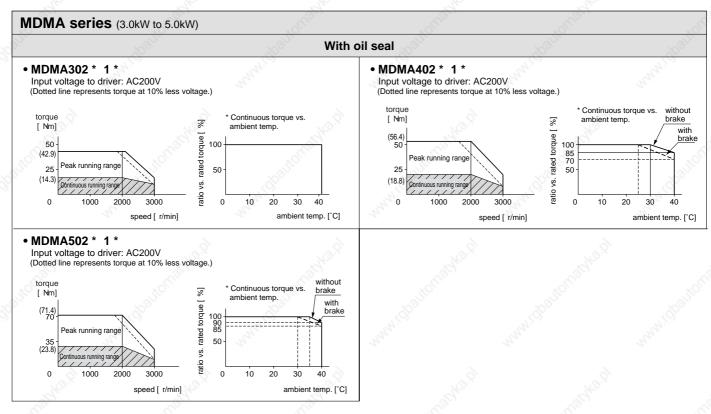
<sup>\*</sup> These are subject to change. Contact us when you use these values for your machine design.

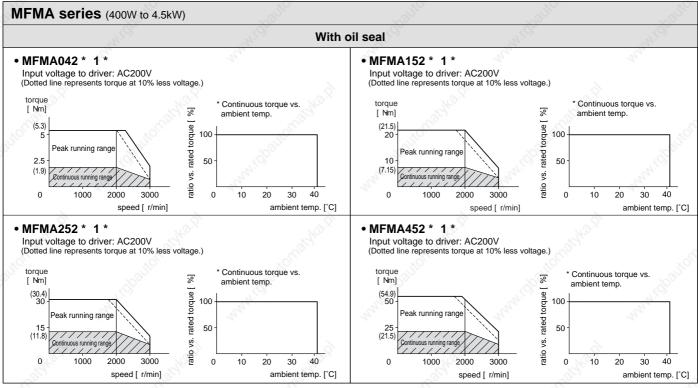
## **Motor Characteristics (S-T Characteristics)**



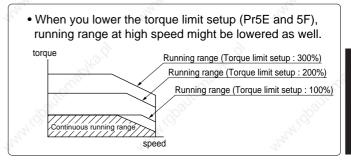


<sup>\*</sup> These are subject to change. Contact us when you use these values for your machine design.

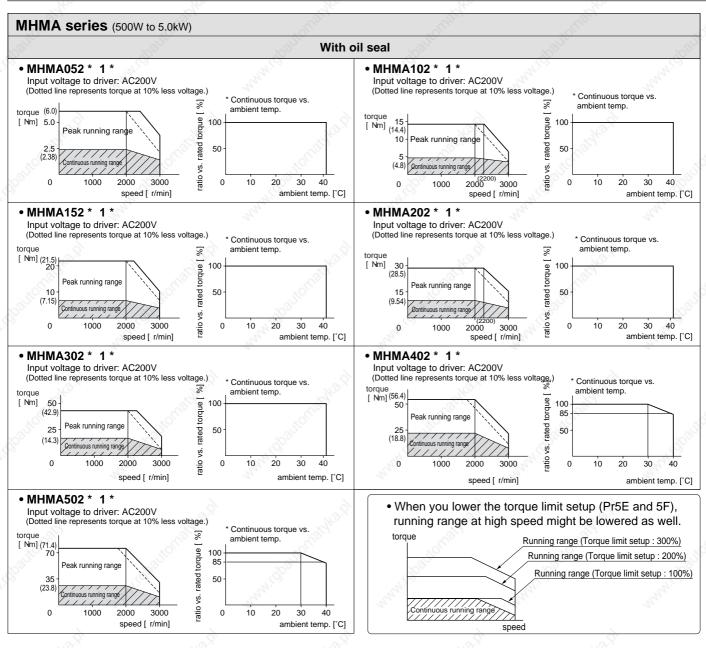


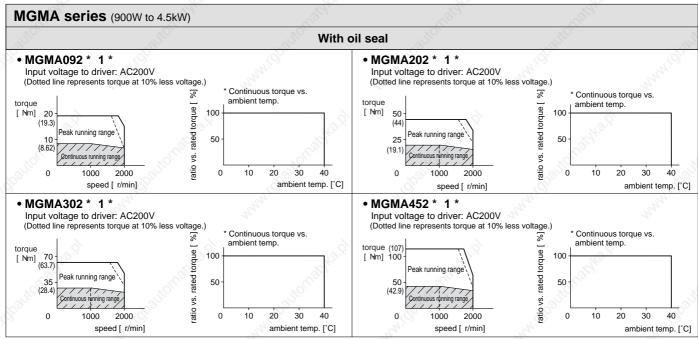


<sup>\*</sup> These are subject to change. Contact us when you use these values for your machine design.



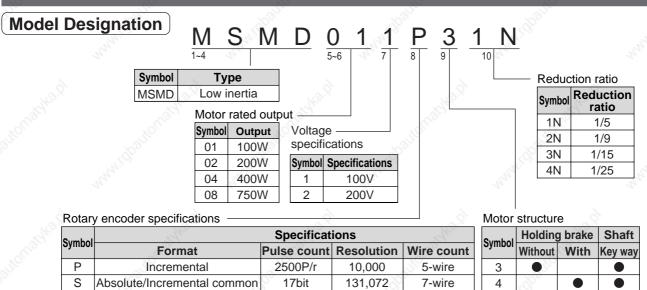
## **Motor Characteristics (S-T Characteristics)**





<sup>\*</sup> These are subject to change. Contact us when you use these values for your machine design.

#### Model No. of Motor with Gear Reduce



#### **Combination of Driver and Motor with Gear Reducer**

This driver is designed to be used in the combination with the specified motor model.

Check the series name, rated output and voltage specifications and the encoder specifications of the applicable motor.

#### Incremental Specifications, 2500P/r

#### <Remark>

Do not use the driver and the motor with gear reducer in other combinations than the one in the following table.

Incremental specifications, 2500P/r

The same		App	licable motor with	gear reducer	Yr.	Applicable	driver
Power supply	Rated output of motor	Reduction ratio of 1/5	Reduction ratio of 1/9	Reduction ratio of 1/15	Reduction ratio of 1/25	Model No. of driver	Frame of driver
Cin ala ala aa	100W	MSMD011P * 1N	MSMD011P * 2N	MSMD011P * 3N	MSMD011P * 4N	MADDT1107	A-frame
Single phase,	200W	MSMD021P * 1N	MSMD021P * 2N	MSMD021P * 3N	MSMD021P * 3N	MBDDT2110	B-frame
100V	400W	MSMD041P * 1N	MSMD041P * 2N	MSMD041P * 3N	MSMD041P * 4N	MCDDT3120	C-frame
200	100W	MSMD012P * 1N	MSMD012P * 2N	MSMD012P * 3N	MSMD012P * 4N	MADDT1205	Λ
Single phase,	200W	MSMD022P * 1N	MSMD022P * 2N	MSMD022P * 3N	MSMD022P * 3N	MADDT1207	A-frame
200V	400W	MSMD042P * 1N	MSMD042P * 2N	MSMD042P * 3N	MSMD042P * 4N	MBDDT2210	B-frame
87	750W	MSMD082P * 1N	MSMD082P * 2N	MSMD082P * 3N	MSMD082P * 4N	MCDDT3520	C-frame
3-phase, 200V	750W	MSMD082P * 1N	MSMD082P * 2N	MSMD082P * 3N	MSMD082P * 4N	MCDDT3520	C-frame

Absolute/Incremental specifications, 17bit

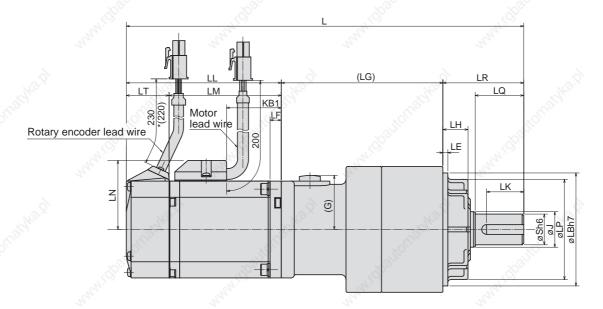
0		App	9	Applicable	driver		
Power supply	Rated output of motor	Reduction ratio of 1/5	Reduction ratio of 1/9	Reduction ratio of 1/15	Reduction ratio of 1/25	Model No. of driver	Frame of driver
Ois als also	100W	MSMD011S * 1N	MSMD011S * 2N	MSMD011S * 3N	MSMD011S * 4N	MADDT1107	A-frame
Single phase,	200W	MSMD021S * 1N	MSMD021S * 2N	MSMD021S * 3N	MSMD021S * 3N	MBDDT2110	B-frame
100V	400W	MSMD041S * 1N	MSMD041S * 2N	MSMD041S * 3N	MSMD041S * 4N	MCDDT3120	C-frame
	100W	MSMD012S * 1N	MSMD012S * 2N	MSMD012S * 3N	MSMD012S * 4N	MADDT1205	A (
Single phase,	, 200W	MSMD022S * 1N	MSMD022S * 2N	MSMD022S * 3N	MSMD022S * 3N	MADDT1207	A-frame
200V	400W	MSMD042S * 1N	MSMD042S * 2N	MSMD042S * 3N	MSMD042S * 4N	MBDDT2210	B-frame
10000	750W	MSMD082S * 1N	MSMD082S * 2N	MSMD082S * 3N	MSMD082S * 4N	MCDDT3520	C-frame
3-phase, 200V	750W	MSMD082S * 1N	MSMD082S * 2N	MSMD082S * 3N	MSMD082S * 4N	MCDDT3520	C-frame

#### <Note>

• "\*" of the model No. represents the structure of the motor.

## **Dimensions/Motor with Gear Reducer**

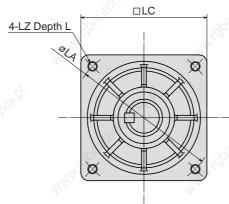
## **Motor with Gear Reducer**



(unit : mm)

		Model	Motor output	Reduction ratio	L	LL	LM	LT	KB1	LF	LR	LQ	LB	S	LP	LH	J	(LG)	LE	(G)
		MSMD01 * P31N	á	1/5	101 5		Silver				250	20	F0	40	45	10	1.1	67 F		
	O	MSMD01 * P32N	100W	1/9	191.5	000	00	0.4	40.0	6	32	20	50	12	45	10	14	67.5		25
00		MSMD01 * P33N	10000	1/15	202	92	68	24	40.8	000					1000			78	,	25
(9)		MSMD01 * P34N		1/25	234	9			145	0	50	30	70	19	62	17	22	92	41	0
		MSMD02 * P31N		1/5	183.5				27,0		32	20	50	12	45	10	14	72.5	200	
		MSMD02 * P32N	200W	1/9	218.5	70	FC F		00.5	6.5								89.5	3	
	ş Ş	MSMD02 * P33N	20000	1/15	220	79	56.5	5,	22.5			3.5					10.9	400		
	وتق	MSMD02 * P34N	, di	1/25	229		Sept.	00.5			50	20	70	10	62	17	22	100		
	Without brake	MSMD04 * P31N	40/	1/5	220			22.5		. 85	50	30	70	19	62	Sty	22	00.5		
60	¥.	MSMD04 * P32N	400W	1/9	238	00.5	76		40.8	600					1000			89.5	. (	24
10	>	MSMD04 * P33N	40000	1/15	248.5	98.5	76		42	9				247				100	THI.	34
		MSMD04 * P34N		1/25	263.5				27.0		61	40	90	24	75	18	28	104	5	
		MSMD082P31N		1/5	255.5						50	30	70	19	62	17	22	93.5	3	
		MSMD082P32N	750W	1/9	270.5	110	06 F	05.5	50.0	8	,	5.					13.S.	97.5		
	_	MSMD082P33N	73000	1/15	202	112	86.5	25.5	52.2		61	40	90	24	75	18	28	440	5	
ę	600	MSMD082P34N	100	1/25	283	110				10	20.				1	200		110		- 3
MSMD		MSMD01 * P41N	50	1/5	221.5	.000			.6	O.				,	900			67.5	- 20	300
_		MSMD01 * P42N	100W	1/9	221.5	100	00	0.4	10.0	6	32	20	50	12	45	10	14	67.5	Up.	25
		MSMD01 * P43N	10000	1/15	232	122	98	24	40.8				-	70				78		25
		MSMD01 * P44N		1/25	264						50	30	70	19	62	17	22	92		
		MSMD02 * P41N		1/5	220		160	Κ.			32	20	50	12	45	10	14	72.5		
	~	MSMD02 * P42N	200W	1/9	255	115.5	93		22.5	6.5	V.					Jan Jan	)	89.5	3	
	e	MSMD02 * P43N	20000	1/15	26E E	115.5	93		22.5	.35	2.				5	9,		100		.3
800	brake	MSMD02 * P44N	50	1/25	265.5	900		00.5	55	0,0	50	30	70	100	62	17	22	100		800
		MSMD04 * P41N		1/5	274.5			22.5	My.		50	30	70	19	02	17	22	89.5	Ezy.	
	With	MSMD04 * P42N	400W	1/9	274.5	105	110 5		40				-	2				09.5		34
		MSMD04 * P43N	40000	1/15	285	135	112.5		42									100		34
		MSMD04 * P44N		1/25	300		16	8			61	40	90	24	75	18	28	104	5	
	~	MSMD082P41N	100	1/5	292.5		190				50	30	70	19	62	17	22	93.5	3	
-	10,	MSMD082P42N	750W	1/9	307.5	140	122.5	25.5	F0.0	8	),				, Š	5,		97.5		20
800		MSMD082P43N	73000	1/15	220	149	123.5	25.5	52.2	ç <sub>o</sub>	61	40	90	24	75	18	28	110	5	800
		MSMD082P44N	]	1/25	320				My.					200				110	Un;	





(unit:mm)

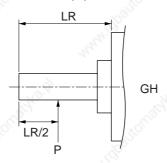
		LC	LA	LZ	LD	Kew way dimensions (B x H x LK)	8, <b>T</b>	LN	Mass (kg)	Moment of inertia (x 10 <sup>-4</sup> kg⋅m²)
	Š	1		ź	9.	, John J.			4.00	0.0910
		52	60	M5	12	4 x 4 x 16	2.5	-00	1.02	0.0853
			×	397		1000		32	1.17	0.0860
		78	90	M6	20	6 x 6 x 22	3.5	14/6	2.17	0.0885
		52	60	M5	12	4 x 4 x 16	2.5	200	1.54	0.258
										0.408
	ke	(3.S)			13.5	10	8		2.52	0.440
	Without brake	70	00	Mo	e).	0 0 000	0.5	40	Side	0.428
	out	78	90	M6		6 x 6 x 22	3.5	43	300	0.623
	/ith			300	00	1000 m		. 3	2.9	0.528
	5		" Aji		20	Tyles		74/	3.3	0.560
		98	115	M8		8 x 7 x 30	4	E.c.	4.4	0.560
		78	90	M6		6 x 6 x 22	3.5		4.4	1.583
		13.5			13.9	N <sub>2</sub>	8.		5.7	1.520
	Z.S.	98	115	M8	G),	8 x 7 x 30	4	53	6.1	1.570
9				7101		101			8.1	1.520
MSMD			.8	30		'92 <sub>00</sub>		6,	1.23	0.0940
		52	60	M5	12	4 x 4 x 16	2.5	32	1.23	0.0883
			27			27		32	1.38	0.0890
		78	90	M6	20	6 x 6 x 22	3.5		2.38	0.0915
		52	60	M5	12	4 x 4 x 16	2.5		2.02	0.278
	4	n e		, di	63	1970			No.	0.428
	e			770		270			3.00	0.460
	rak	70	000			200	0.5	400	00	0.448
	With brake	78	90	M6		6 x 6 x 22	3.5	43	0.4	0.643
	Š		2,		00	24	-	15,	3.4	0.548
					20		1		3.8	0.580
		98	115	M8	15.7	8 x 7 x 30	4		4.9	0.580
	100	78	90	M6	G	6 x 6 x 22	3.5		5.2	1.683
				770,	1	"7 <sub>10</sub> ,			6.5	1.620
		98	115	M8		8 x 7 x 30	4	53	0.0	1.670
			The same			"My;		MAY.	6.9	1.620

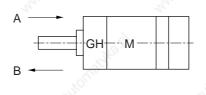
Moment of inertia is combined value of the motor and the gear reducer, and converted to that of the motor shaft .

## **Permissible Load at Output Shaft**

Radial load (P) direction

Thrust load (A and B) direction





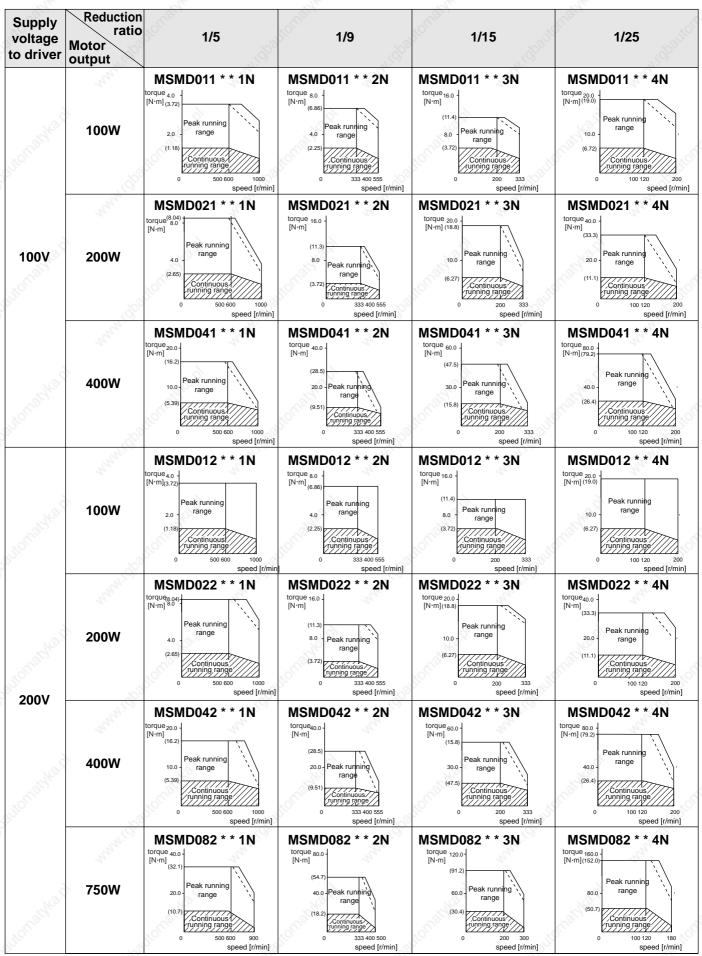
Unit: N (1kgf=9.8N)

		Permissible	load at shaft	
Motor output	Motor output	Radial thrust	Thrust load A and B-direction	
5C.c.	1/5	490	245	
400\\	1/9	588	294	
100W	1/15	784	392	
	1/25	1670	833	
	1/5	490	245	
000144	1/9	1180	588	
200W	1/15	1470	735	
	1/25	1670	833	
	1/5	980	490	
400)44	1/9	1180	588	
400W	1/15	1470	735	
	1/25	2060	1030	
S. C.	1/5	980	490	
750\4	1/9	1470	735	
750W	1/15	1760	882	
	1/25	2650	1320	

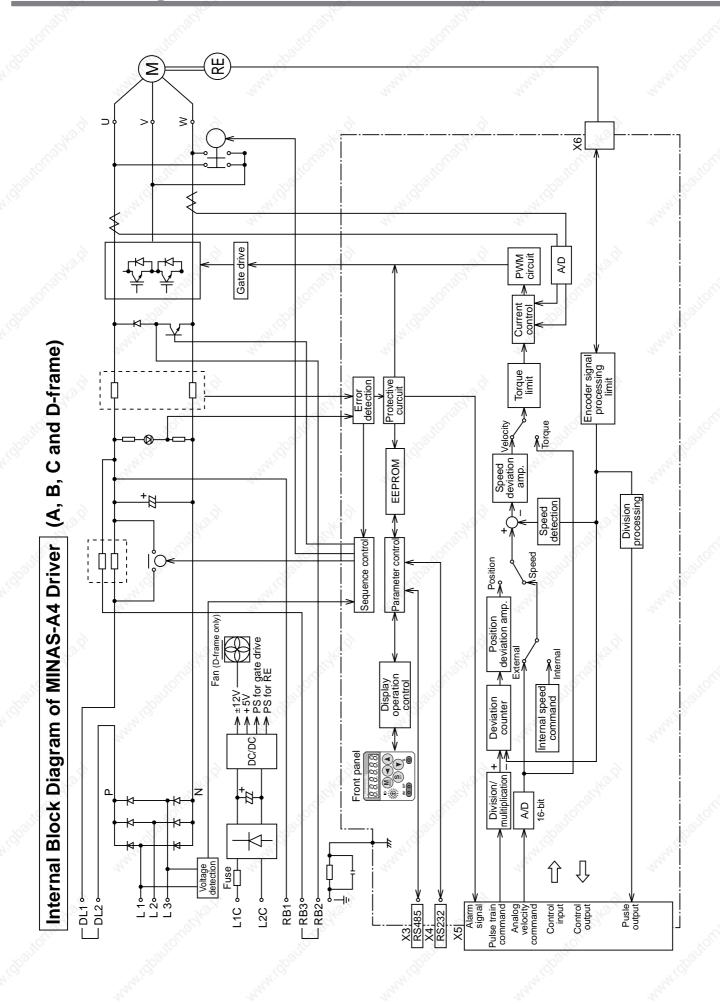
#### Remarks on installation

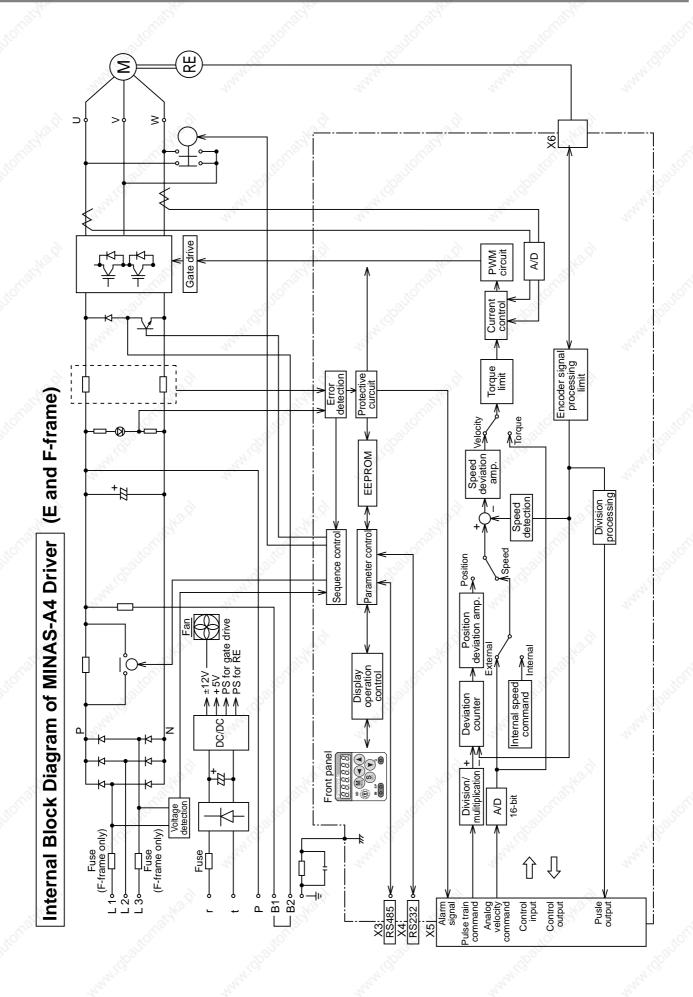
- (1) Do not hit the output shaft of the gear reducer when attaching a pulley or sprocket to it. Or it may cause an abnormal noise.
- (2) Apply the load of the pulley or the sprocket to as close to the base of the output shaft as possible.
- (3) Check the mounting accuracy and strength of the stiff joint, when you use it.
- (4) The encoder is built in to the motor. If an excessive impact is applied to the motor while assembling it to the machine, the encoder might be damaged. Pay an extra attention at assembly.

## Characteristics of Motor with Gear Reducer [Supplement]



Dotted line represents the torque at 10% less supply voltage.

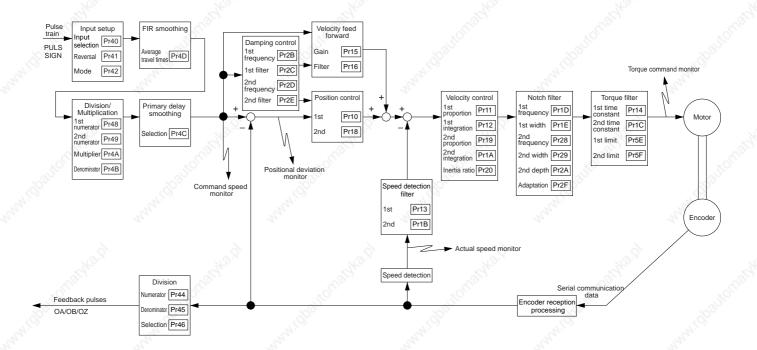




## **Block Diagram by Control Mode**

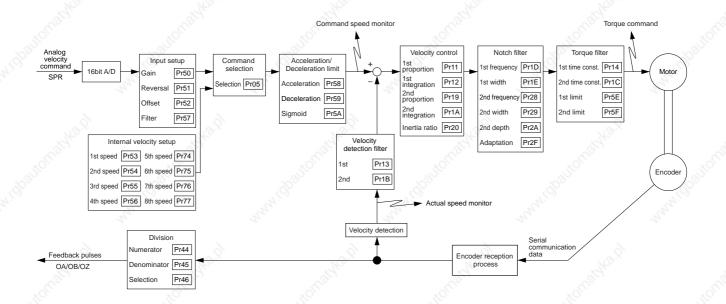
#### **Position Control Mode**

when Pr02 (Setup of control mode) is 0,
 when Pr02 (Setup of control mode) is 3 and 1st control mode
 when Pr02 (Setup of control mode) is 4 and 1st control mode



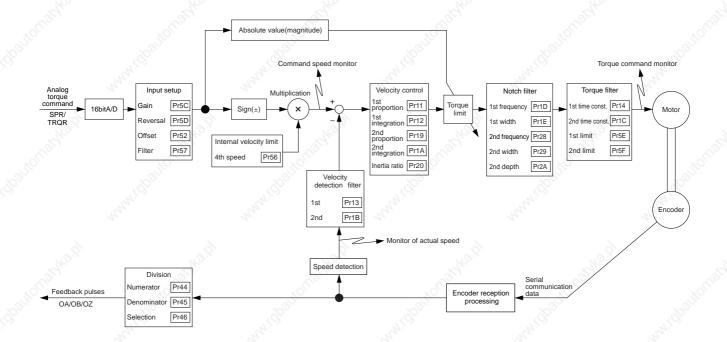
#### **Velocity Control Mode**

when Pr02 (Setup of control mode) is 1,
when Pr02 (Setup of control mode) is 3 and 2nd control mode when Pr02 (Setup of control mode) is 5 and 1st control mode



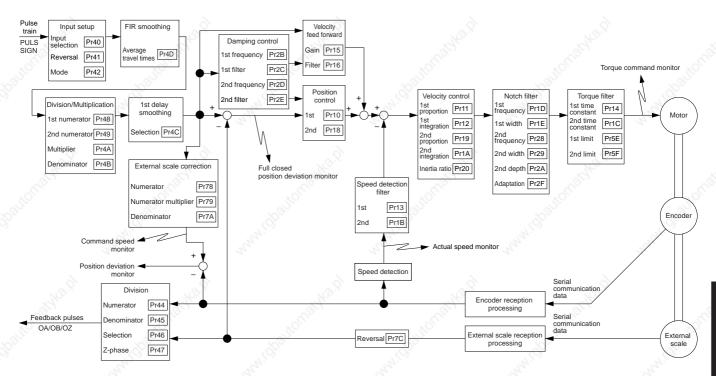
### **Torque Control Mode**

when Pr02 (Setup of control mode) is 2,
 when Pr02 (Setup of control mode) is 4 and 2nd control mode
 when Pr02 (Setup of control mode) is 5 and 2nd control mode



#### **Full-closed Control Mode**

• when Pr02 (Setup of control mode) is 6,



# **Specifications**

	- The		L.							
N. C.	100V	Mair	n circuit	Single phase, 100 – 115V +10% 50/60Hz						
	1007	Con	trol circuit	Single phase, 100 – 115V +10% 50/60Hz						
_	8	±	A and B-frame	Single phase, 200 – 240V +10% 50/60Hz						
Input power	acher.	Main circuit	C and D-frame	Single/3-phase, 200 – 240V +10%						
dul	200V	Š	E and F-frame	3-phase, 200 – 230V +10% 50/60Hz						
		Control circuit	A to D-frame	Single phase, 200 – 240V +10% 50/60Hz						
	24. j	Control	E and F-frame	Single phase, 200 – 230V +10%						
~	10	Tem	perature	Operating: 0 to 55°C, Storage: -20 to +80°C						
30		Hum	10	Both operating and storage : 90%RH or less (free from condensation)						
Er	nvironment	Altitu	- XX	1000m or lower						
		- 2	ation	5.88m/s2 or less, 10 to 60Hz (No continuous use at resonance frequency)						
	ontrol meth	11.	20011	IGBT PWM Sinusoidal wave drive						
	Jilioi illetii	ou								
Er	ncoder feed	lback	Éir	17-bit (131072 resolution) absolute/incremental encoder, 2500P/r (10000 resolution) incremental encoder						
Ex	xternal scale feedback			AT500 series by Mitutoyo (Resolution 0.05[μm] , max. speed 2[ m/s] ) ST771 by Mitutoyo (Resolution 0.5[μm] , max. speed 2[ m/s] )						
	Control		Input	10 inputs (1) Servo-ON, (2) Control mode switching, (3) Gain switching/Torque limit switching, (4) Alarm clea Other inputs vary depending on the control mode.						
g sig	gnal		Output	6 outputs (1) Servo alarm, (2) Servo ready, (3) Release signal of external brake (4) Zero speed detection, (5) Torque in-limit. Other outputs vary depending on the control mode.						
817			Input	3 inputs (16Bit A/D : 1 input, 10Bit A/D : 2 inputs)						
	nalog gnal	n	Output	2 outputs (for monitoring) (1) Velocity monitor (Monitoring of actual motor speed or command speed is enabled. Select the content and scale with parameter.), (2) Torque monitor (Monitoring of torque command, (approx 3V/rated torque)), deviation counter or full-closed deviation is enabled.  Select the content or scale with parameter.)						
, jeor	The state of the s		Input	4 inputs Select the exclusive input for line driver or photo-coupler input with parameter.						
Pu	Pulse signal		Output	4 outputs Feed out the encoder pulse (A, B and Z-phase) or external scale pulse (EXA, EXB and EXZ-phase) in line driver. Z-phase and EXZ-phase pulse is also fed out in open collector.						
Со	mmunication		RS232	1 : 1 communication to a host with RS23 interface is enabled.						
	nction		RS485	1 : n communication up to 15 axes to a host with RS485 interface is enabled.						
Fr	ont panel		3010	(1) 5 keys (MODE, SET, UP, DOWN, SHIFT), (2) LED (6-digit)						
Re	egeneration	1	Mildbar	A and B-frame : no built-in regenerative resistor (external resistor only) C to F-frame : Built-in regenerative resistor (external resistor is also enabled.)						
Dy	ynamic brak	ce		Setup of action sequence at Power-OFF, Servo-OFF, at protective function activation and over-travel inhibit input is enabled.						
Co	Control mode			Switching among the following 7 mode is enabled, (1) Position control, (2) Velocity control, (3) Toque control, (4) Position/Velocity control, (5) Position/Torque control, (6) Velocity/Torque control and (7) Full-closed control.						

	-00	7	_# <sup>2</sup>	Investor of 4) Comes ON O Alamas along 2) Coin southhing 4) Control and a suitabing
χC	C	antrol innu		Inputs of 1) Servo-ON, 2) Alarm clear, 3) Gain switching, 4) Control mode switching,
37.		ontrol inpu	u Maria	5) CW over-travel inhibition and 7) CCW over-travel inhibition are common,
				and other inputs vary depending on the control mode.
		Control i	nput	(1) Deviation counter clear, (2) Command pulse inhibition, (3) Damping control switching,
		Control	output	(4) Gain switching or Torque limit switching
	_	Control		Positioning complete (In-position)
	Pog	13.X	Max. command pulse frequency	Exclusive interface for line driver : 2Mpps, Line driver : 500kpps, Open collector : 200kpps
	sitio	9	Input pulse signal format	Support (1) RS422 line drive signal and (2) Open collector signal from controller.
	on c		Type of input pulse	(1) CW/CCW pulse, (2) Pulse signal/rotational direction signal, (3) 90°C phase difference signal
	Position control	Pulse input	Electronic gear (Division/ Multiplication of command pulse)	Process the command pulse frequency $x = \frac{(1 \text{ to } 10000) \times 2^{(0 \text{ to } 17)}}{1 \text{ to } 10000}$ as a position command input
	_		The state of the s	Primary delay filter is adaptable to the command input
			Smoothing filter	Selectable of (1) Position control for high stiffness machine and
				(2) FIR type filter for position control for low stiffness machine.
		Analog input	Torque limit command input	Individual torque limit for both CW and CCW direction is enabled. (3V/rated torque)
	8	Control i	nnut	(1) Speed zero clamp, (2) Selection of internal velocity setup,
	Sec.	Control	Прис	(3) Gain switching or Torque limit switching input
		Control	output	(1) Speed arrival (at-speed)
	<u></u>	۸۳۵۱۵۳	Velocity command input	Setup of scale and rotational direction of the motor against the command voltage is enabled with
	control	Analog input	velocity command input	parameter, with the permissible max. voltage input = $\text{Å}$ } 10V and 6V/rated speed (default setup).
	c S	"iput	Torque limit command input	Individual torque limit for both CW and CCW direction is enabled. (3V/rated torque)
	Velocity	Speed c	ontrol range	1:5000
	Ş	Internal	velocity command	8-speed with parameter setup
	ăS.	C-44 -4-	t/day on from the a	Individual setup of acceleration and deceleration is enabled, with 0 to 10s/1000r/min. Sigmoid
	U.	Soit-stai	t/down function	acceleration/deceleration is also enabled.
		Zero-spe	eed clam	0-clamp of internal velocity command with speed zero clamp input is enabled.
		Control i	nput	(1) CW over-travel inhibition, (2) CCW over-travel inhibition, (3) Speed zero clamp
	<del> </del>	Control	output	(1) Speed arrival (at-speed)
Z	control		4,	Setup of scale and CW/CCW torque generating direction of the motor against the command
Function	Torque cor	Analog input	Velocity command input	voltage is enabled with parameter, with the permissible max. voltage input = Å} 10V and 3V/rated speed (default setup).
_	Ιō	Mr.	Speed limit input	Speed limit input by analog voltage is enabled. Scale setup with parameter.
	40	Speed li	mit function	Speed limit value with parameter or analog input is enabled.
			No.	(1) CW over-travel inhibition, (2) CCW over-travel inhibition (3) Deviation counter clear, (4)
		Control i	nput	Command pulse input inhibition, (5) Electronic gear switching, (6) Damping control switching
		Control	output	(1) Full-closed positioning complete (in-position)
	_		Max. command pulse frequency	500kpps (photo-coupler input), 2Mpps (Exclusive input for line driver)
	control		max. cerimiana paice nequency	Differential input. Selectable with parameter ((1) CCW/CW, (2) A and B-phase, (3) Command
	oo pe	Pulse	Input pulse signal format	and direction
	Full-closed	input	Electronic gear (Division/ Multiplication of command pulse)	Process the command pulse frequency $x = \frac{(1 \text{ to } 10000) \times 2^{(0 \text{ to } 17)}}{1 \text{ to } 10000}$ as a position command input
	Ē		Smoothing filter	Primary delay filter is adaptable to the command input.
		Analog input	Torque limit command input	Individual torque limit for both CW and CCW direction is enabled. (3V/rated torque)
		Setup ra external	nge of division/multiplication of scale	Setting of ratio between encoder pulse (denominator) and external scale pulse (numerator) is enabled within a range of $(1 \text{ to } 10000) \times 2^{(0-17)} / (1 \text{ to } 10000)$ .
		20	Real-time	Corresponds to load inertia fluctuation, possible to automatically set up parameters related to notch filter.
	1	Auto-gain tuning	Normal mode	Estimates load inertia and sets up an appropriate servo gain.
		turning	Fit-gain function	Automatically searches and sets up the value which makes the fastest settling time with external command input.
	Ľ	Masking	of unnecessary input	Masking of the following input signal is enabled.  (1) Over-travel inhibition, (2) Torque limit, (3) Command pulse inhibition, (4) Speed-zero clamp
	Common	Division	of encoder feedback pulse	Set up of any value is enabled (encoder pulses count is the max.).
	Son		Soft error	Over-voltage, under-voltage, over-speed over-load, over-heat, over-current and encoder error etc.
		Protective function	Hard error	
	Š	1	44,	Excess position deviation, command pulse division error, EEPROM error etc.
	100		ility of alarm data	Traceable up to past 14 alarms including the present one.
	1	Dampin	g control function	Manual setup with parameter
		Cotu-	Manual	5push switches on front panel MODE SET △ ✓ ✓
		Setup	Setup support software	PANATERM® (Supporting OS: Windows95, Windows98, Windows ME, Windows2000,
			4, 4,	Windows.NET and Windows XP)

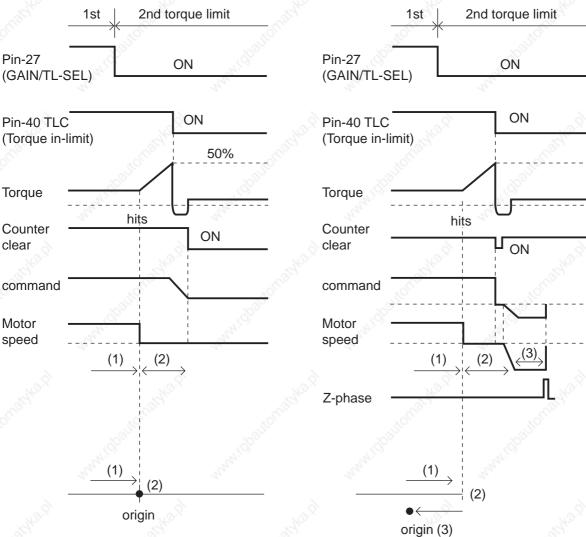
## "Hit & Stop" Homing and "Press & Hold" Control

#### **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.



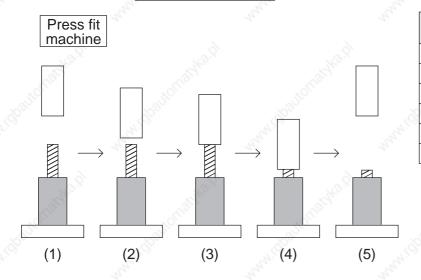
Parameter No.	Title	Setup example
5F	Setup of 2nd torque limit	50 (Set up to less than 100%)
70	Excess setup of position deviation	25000
73	Setup of over-speed level	0 (6000r/min)
03	Selection of torque limit	3
09	Selection of alarm output	0 (Torque in-limit)

#### <Remarks>

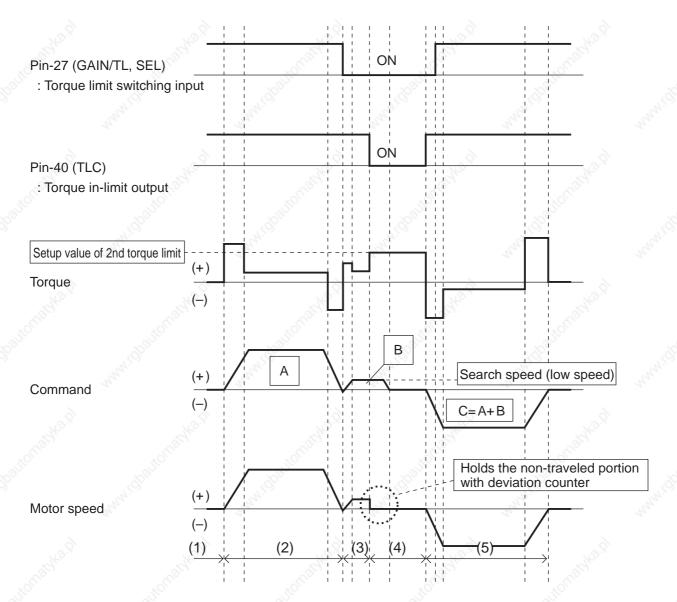
Make the Pin-27 H (Off=Open) after the Hit & Stop Homing is completed.

#### Press & Hold Control

#### Application example



Parameter No.	Title	Setup example
03	Setup of 2nd torque limit	3
09	Selection of alarm output	0
5E	Setup of 1st torque limit	200
5F	Setup of 2nd torque limit	50
70	Excess setup of position deviation	25000
73	Setup of over-speed level	0



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# Motor Company, Matsushita Electric Industrial Co.,Ltd.Marketeing Group Tokyo: Kyobashi MID Bldg, 2-13-10 Kyobashi, Chuo-ku, Tokyo 104-0031 TEL (03)3538-2961 FAX (03)3538-2964 Osaka: 1-1, Morofuku 7-chome, Daito, Osaka 574-0044 TEL (072)870-3065 FAX (072)870-3151

## **After-Sale Service (Repair)**

#### Repair

Consult to a dealer from whom you have purchased the product for details of repair.

When the product is incorporated to the machine or equipment you have purchased, consult to the manufacture or the dealer of the machine or equipment.

#### **Cautions for Proper Use**

- This product is intended to be used with a general industrial product, but not designed or manufactured to be used in a machine or system that may cause personal death when it is failed.
- Install a safety equipments or apparatus in your application, when a serious accident or loss of property is expected due to the failure of this product.
- Consult us if the application of this product is under such special conditions and environments as nuclear energy control, aerospace, transportation, medical equipment, various safety equipments or equipments which require a lesser air contamination.
- We have been making the best effort to ensure the highest quality of the products, however, application of exceptionally larger 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 the motor shaft is not electrically grounded, it may cause an electrolytic corrosion to the bearing, depending on the condition of the machine and its mounting environment, and may result in the bearing noise. Checking and verification by customer is required.
- Failure of this product depending on its content, may generate smoke of about one cigarette. Take this into consideration when the application of the machine is clean room related.
- Please be careful when using in an environment with high concentrations of sulphur or sulphuric gases, as sulphuration can lead to disconnection from the chip resistor or a poor contact connection.
- Take care to avoid inputting a supply voltage which significantly exceeds the rated range to the power supply of this product. Failure to heed this caution may result in damage to the internal parts, causing smoking and/or a fire and other trouble.

#### **Technical information**

Electric data of this product (Instruction Manual, CAD data) can be downloaded from the following web site. http://industrial.panasonic.com/ww/i\_e/25000/motor\_fa\_e/motor\_fa\_e.html

MEMO (Fill in the blanks for reference in case of inquiry or repair.)

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