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MINIDRIVE

DMD01.1 / MMD with analog- and stepper interface

User-s Manual

DOK-MINIDR-DMD/MMD*ANA-AW02-EN-P

Title	MINIDRIVE DMD01.1
Type of documentation	User's Manual
Document code	DOK-MINIDR-DMD/MMD*ANA_EN
Internal file reference	209-0097-4301-02
The purpose of this document	<p>It serves</p> <ul style="list-style-type: none"> • to assist in the familiarization with MMD servo motors • in mechanically integrating the motor into the machine • in electrically integrating the motor into the machine • to assist in connecting the motor • in determining the motor cables and connectors required

Editing sequence

Document designation of previous editions	Date	Comments
DOK-MINIDR-DMD/MMD*ANA-ANW1-EN-P	Nov98	First Release
DOK-MINIDR-DMD/MMD*ANA-AW02-EN-P	Mar99	Sec. Release

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1 Applicability

This specifications relates to a driver section of AC servo system which consists of a driver that drives the same motor as AC servo motor delivered by Indramat.

1.1 Introduction

After opening the package

Firstly, check the following points:

- (1) If the product is the right one you ordered.
- (2) If there is no damage in the product after the shipment etc.

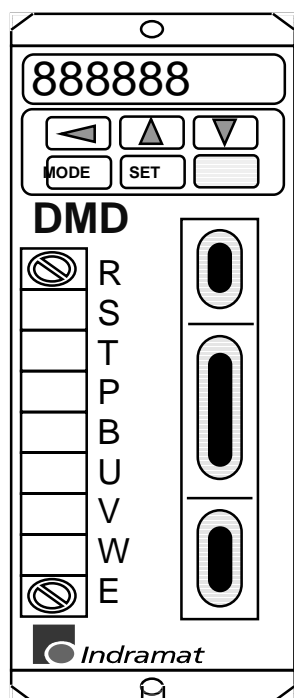
If you find any problem, please contact with the dealer or the distributor where you purchased.

Confirmation of the applicable motor.

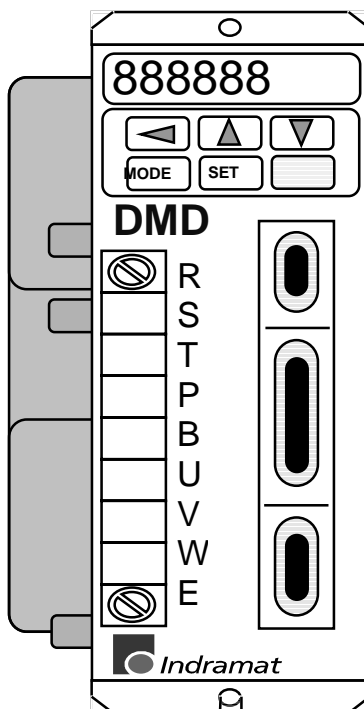
AC servo driver are designed to be used with AC servo motors by Indramat. Refer to the following table and confirm that the applicable AC servo motor output for each driver is matching with the series name, the voltage specifications, and the encoder specifications for the applicable AC servo motor.

Modell-Nr.	Motor				
Driver	Modell-Nr.	Output	Voltage-specification	Speed (rpm)	Pulse
DMD01.1-W0 12	MMD012A1*	100W	230V	3000 rpm	2500 Pulse/R
DMD01.1-W0 22	MMD022A1*	200W	230V		
DMD01.1-W0 42	MMD042A1*	400W	230V		
DMD01.1-W0 82	MMD082A1*	750W	230V		

Type of driver

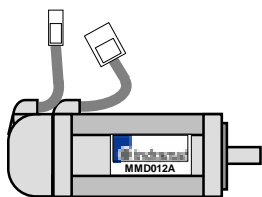


100 Watt
200 Watt

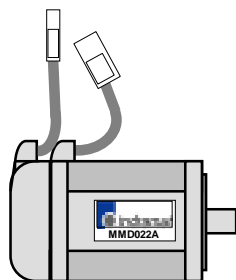


400 Watt
750 Watt

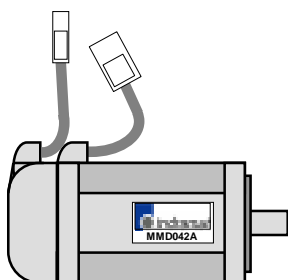
Type of motor



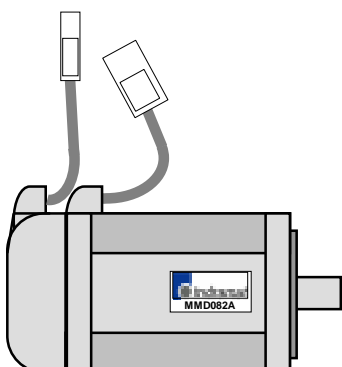
MMD012A-030-EG_-KN



MMD022A-030-EG_-KN



MMD042A-030-EG_-KN



MMD082A-030-EG_-KN

Type

without brake:

MMD012A-030-EG0-KN

MMD022A-030-EG0-KN

MMD042A-030-EG0-KN

MMD082A-030-EG0-KN

with brake:

MMD012A-030-EG1-KN

MMD022A-030-EG1-KN

MMD042A-030-EG1-KN

MMD082A-030-EG1-KN

Accessories

Accessory set for motor: SUP-E01-MMD

For connecting the motor you can use the accessory set SUP-E01-MMD.

Contents:

- Plug 15pol. (Encoder)
- Plug 4pol. (Motor connection)
- Plug 2pol. (Brake)

Accessory set for Driver: SUP-E01-DMD

For connecting encoder and I/O-signals use the accessory set SUP-E01-DMD.

Contents:

- Plug 20pol. with case
- Plug 36pol. with case

2 Safety warnings

2.1 Cautions for safety

Safety Cautions for Installation

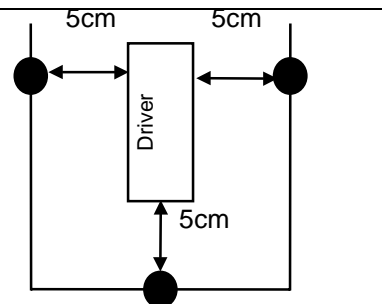
- (1) Be sure to install a no-fuse breaker to the power supply.
Also, install a ground terminal.
(For preventing electric shock and error operation, Class 3 grounding (Under 100 Ω , 1.6mm² or above) or above is recommended.)
- (2) Install the driver to noncombustible materials such as metal.
- (3) Use the motor and the driver in the designated combination.
- (4) Perform wiring correctly and firmly. Incorrect and uncertain wiring may cause motor abnormal operation or burning.
- (5) After input power supply voltage is confirmed in accordance with the driver specifications, perform power supply input and operation.
If higher voltage than the rating is applied, there may be firing and smoking inside the driver. This may cause motor abnormal operation and burning.
- (6) To cut the power supply by stopping the operation immediately at the emergency, install an emergency stop circuit outside.
- (7) Never store, install nor use the driver at places where vibration and shock (above 0.5G) are applied, there are much metal powders & dusts, water, oil and grinding fluid splash, there are combustibles nearby, and corrosive gases and inflammable gases are generated.
- (8) When storing, avoid the direct sunlight and store in temperature and humidity ranges within the specifications range.
- (9) Be careful for the radiation.
The servo driver will generate heat along with the motor operation. If it is used in the sealed control box, the temperature in the control box may abnormally increase. To satisfy the ambient temperature for the driver within the working range, consider the cooling condition.
- (10) Do not place the driver near heating element such as heater and large-size wire wound resistor.
(Try not to be affected by heating element with thermal shield etc.)

Ambient temperature of the position driver

Life time of the position driver is greatly influenced by the ambient temperature.

Check that ambient temperature of 5cm around the position driver does not exceed the maximum ambient temperature.

Ambient temperature: 0°C - 50°C



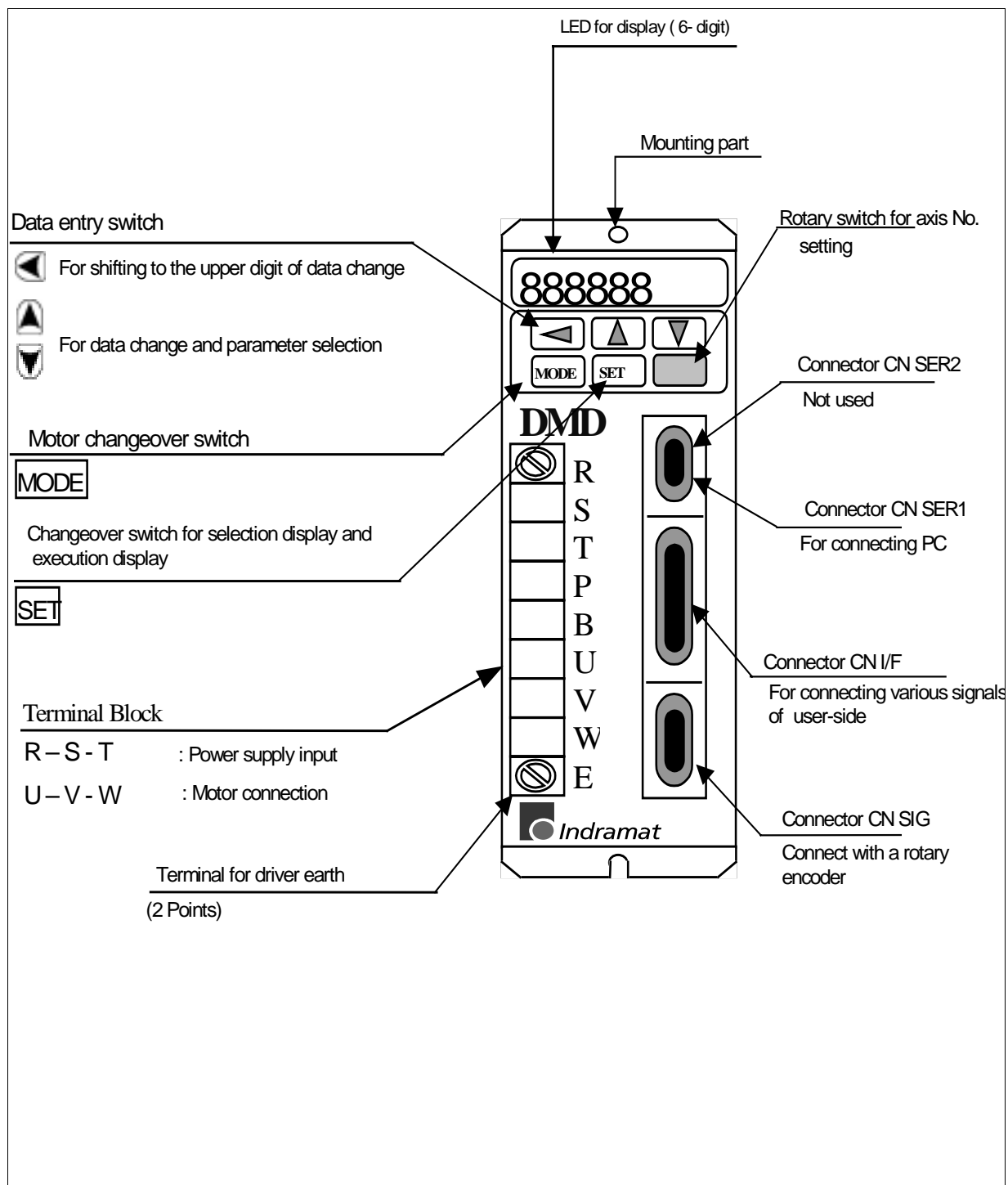
Safety cautions in operation

- (1) Never touch inside of the servo driver. If the disassembling and the repair are necessary, always ask for them to us or other stores designated by us.
- (2) After cutting the power supply, the internal circuit is charged at the high voltage for a while.
When conducting moving, wiring and inspection, completely cut the power supply input outside the driver, and perform these works after leaving it for 5 minutes.
- (3) During the input of power supply, keep away from the motor and the machine driven by it in case of the error operation etc.
- (4) If the driver is not in use it for a long time, be sure to cut the power supply.
- (5) When having the alarm, restart after removing the cause. If restarted carelessly without removing the cause, it may become a cause of motor error operation and burning.
- (6) Condenser for power supply rectification circuit will decrease its capacity by the change after the long use. To prevent the secondary accident, we recommend that the product be exchanged approximately after 5 years.
- (7) To prevent electric shock, use the front panel terminal block with a terminal block cover.




INDRAMAT-DRIVER is designed and manufactured through the highest quality control however, unexpectedly higher external noise or application of high static electricity, or wrong wire connection may cause a error operation. Please pay extra attention for the safety of your machine.

Appearance and Each Part Name



3 Wiring

3.1 Wiring Material to be Used and Maximum Length of Wiring

Name	Symbol	Maximum Length of Wiring	Electric Wire to be Used	
			DMD01.1-W012 and DMD01.1-W022	DMD01.1-W042 and DMD01.1-W082
Power Supply	R, S, T	–	HVSF 1.25mm ²	HVSF 2mm ²
External Brake		20m	HVSF 0.5mm ²	HVSF 0.5mm ²
Motor Connection	U, V, W, E	20m	HVSF 1.25mm ²	HVSF 2mm ²
Earth Cable		1m	φ2mm or more	φ2mm or more
Encoder Connection	CN SIG	20m	Collective Shield Twist Pair Line Core line Min. 0.18mm ² or more	
Input/Output Connection	CN I/F	3m		

3.2 Connection for CN I/F and CN SIG

Connector -Kid Motor: SUP-E01-MMD

Connector :15pol. (Encoder)

Connector 4pol. (Motor)

Connector 2pol. (Brake)

Connector -Kid Driver: SUP-E01-DMD

Connector 20pol. with housing (Encoder)

Connector 36pol. with housing (In.-Output)

Cabel-Kid:

Motorcabel IKL 0210

Encodercabel IKS 0196

Brakecabel IKL 0211

Interfacecabel IKS 0198

Cabel In/Output IKS 0197

3.3 Cautions in wiring

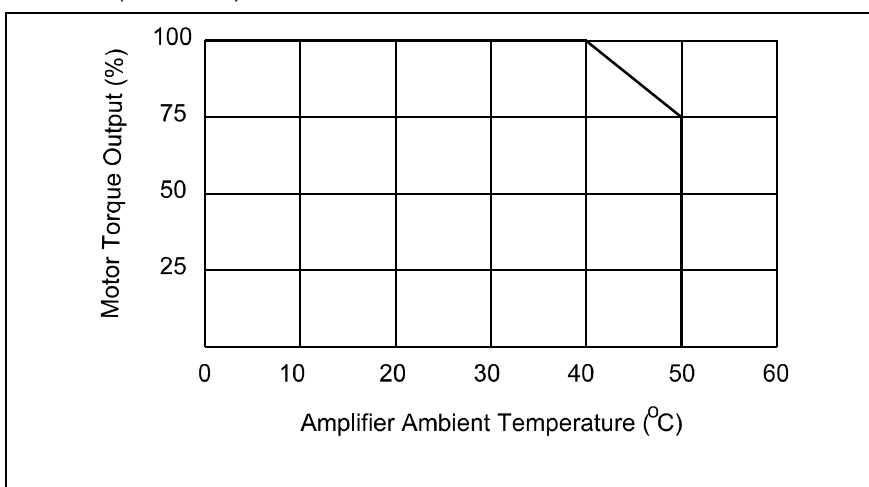
Wiring to terminal block

Fundamental

The driver is designed for single and triple phase connection.

The 200 VAC Models May Be Operated From a Single Phase Supply With the Following Derating:

- 100 Watt Model: No derating required
- 200-750 Watt Models: Derate torque output by 2.5% per °C above 40°C (see chart).



- (1) For power supply voltage, add voltage indicated on the name plate.
- (2) Do not connect inversely power supply input terminal(R,S,T) with output terminal for motor(U,V,W).
- (3) Do not perform grounding of output terminal for motor(U,V,W) and try not to have short circuit mutually.
- (4) Normally, do not connect anything to terminal P, B. Also, at power supply input, as high voltage is added to P,B, do not touch it.
- (5) AC servo motor cannot be changed for the rotation direction by exchanging 3 phase as induction motor. Be sure to use the same color for motor output terminal of the driver(U,V,W) and lead wire of the motor.
- (6) For connecting to each terminal of the terminal block, be sure to use crimp-style terminal covered with insulation.
- (7) Completely connect motor ground terminal (E) and driver ground terminal(), and perform one-point grounding with grounding terminal of the noise filter. Also, we recommend that the machine itself be grounded. For grounding, perform with Class 3 grounding or above. (Grounding resistance under 100Ω φ1.6mm)
- (8) After completing wiring to terminal block, be sure to put a cover for the terminal block to prevent electric shock.
- (9) When using electromagnetic contractor to be placed around the driver and motor with coil and brake between contact points such as relay, insert surge absorption circuit to prevent error operation in the brake coil.

- (10) Having a no-use breaker, be sure to cut power supply outside the driver at emergency. In case of using earth leakage breaker, use one which is considered for high frequency as "inverter use."
- (11) To decrease radio noise and prevent error operation, install a noise filter. (Example: LF-2, LF-3 Series by Tokin, Ltd.)

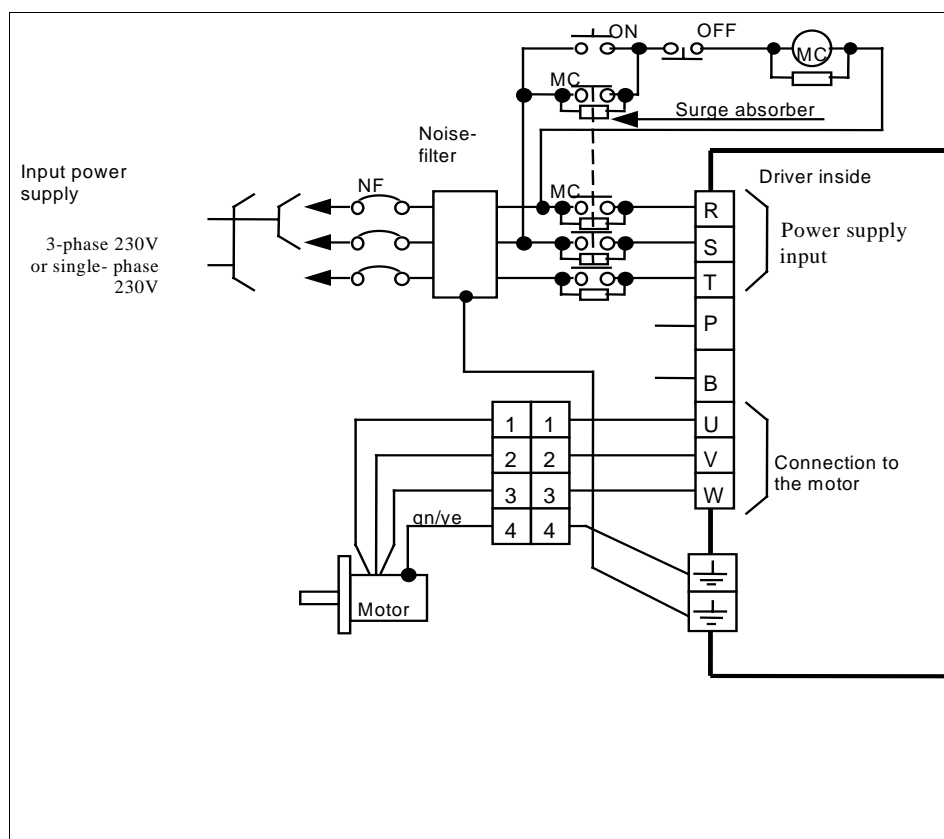



Abb. 3-1: Wiring to terminal block

Caution: In case of single phase connection look for chapter „3.3 Wiring to terminal block“

Wiring device selection:

Applicable motor			Consumed power	Overcurrent protection unit	Recommended noise filter	Main circuit electric wire diameter
Series name	Voltage	Output	(in rated loading)	(Breaker/Rated current)		(RSTUVWE)
MMD	200V	100W	Approx. 0.3kVA	5A	NFE	1.25mm ²
		200W	Approx. 0.5kVA	10A	1 Phase	1.25mm ²
		400W	Approx. 0.9kVA		NFD	1.25mm ²
		750W	Approx. 1.3kVA	15A	3 Phase	2mm ²

Wiring to Connector CN I/F

- (1) Prepare a power supply for a control signal with DC12-24V / 0,5A, used for external control connected between COM+ and COM-. Shorten the wiring of the driver and other equipment as much as possible (3m or shorter).
- (2) Separate this wiring from the power lines(R,S,T,U,V,W, ) as much as possible(30cm or more). Avoid passing both wires into the same duct or binding them together. It may cause malfunction.
- (3) Do not apply more than DC24V or 50mA, to each terminal of the control output (S-RDY, ALM, COIN), or avoid applying reverse polarity. This may cause damage to the driver.
- (4) Using the external brake (see chapter 4-8 „Selected Input signals“) polarity is equal.
- (5) When driving a relay directly with the control output terminals, install a diode in parallel with the relay as shown in the following figure. No diode installation, or in reverse installation of diode may cause damage to the driver.
- (6) As shown in the figure, use shielded, twisted pair wires for a signal line of CN I/F(analog command input, command pulse input, feedback pulse output of the encoder, etc.).Ground the shield to the signal ground (GND) of the driver.
(Shield in the peripheral equipment side is normally opened.)

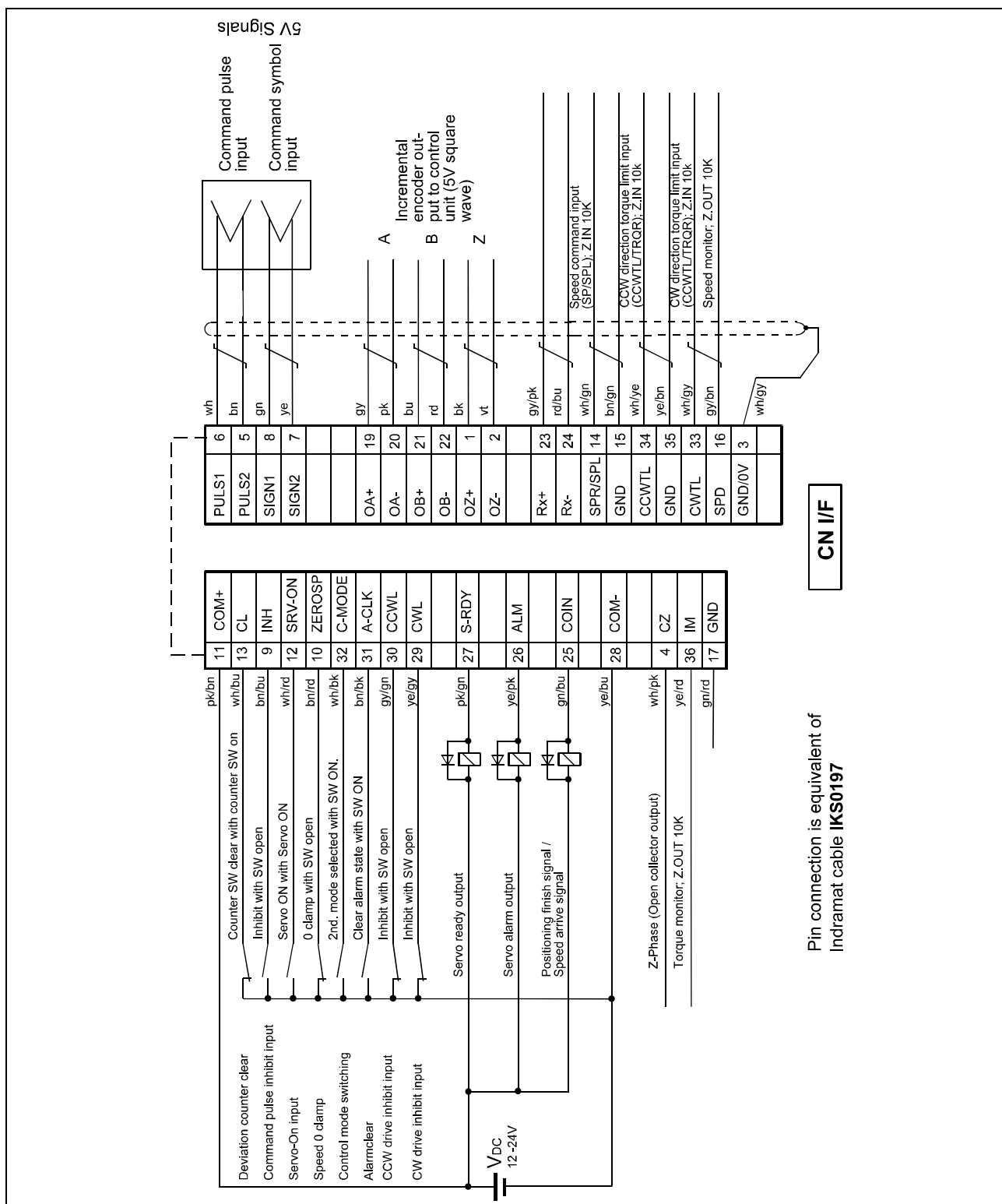


Abb. 3-2: Connector I/F in case of setting 0 to parameter No. 3F

Wiring to Connector CN SIG

- (1) For the conductor cable, use a stranded wire having core of 0.18mm^2 or larger, a twisted pair of wire having overall shield.
- (2) The length of the cable must be within 20m at the maximum. When wiring is long, we recommend double wiring in order to reduce influence by voltage fall for 5V power supply.
- (3) Shield of the driver side in the relay cable should be connected to 20pin (FG) of the CN SIG.

Shield of the motor side in the relay cable should be connected to the envelope of the shield wire from the encoder.

- (4) Separate wiring to the power line (R,S,T,U,V,W, PE) as much as possible (30cm or more). Do not pass them through the same duct or bind them together to prevent error operation.
- (5) Do not connect anything to the vacant terminal (5, 6, 13, 14, 15, 16, 19 pin) of the connector CN SIG.

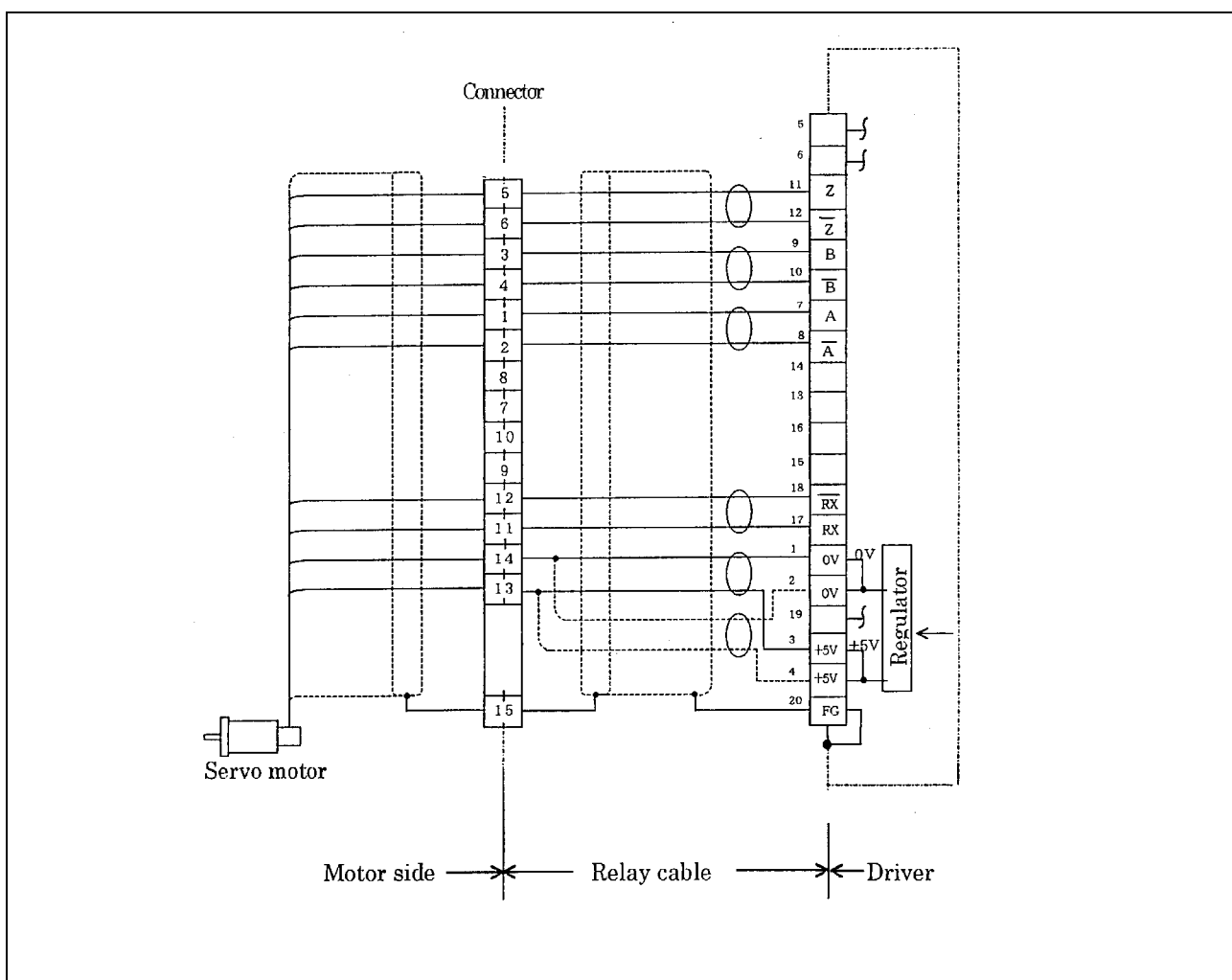



Abb. 3-3: Wiring to connector CN SIG

4 Structures of Terminal Block and Connector

4.1 Terminal Block

Terminal Mark	Name		Remarks	
R, S, (T)	Note)	200V Type	Voltage/Frequency	1- or 3-Phase 200V - 230V 50/60Hz
	Power Supply Input Terminal		Permissible voltage range	1- or 3-Phase +10% / -15%
U, V, W	Motor Connection Terminal		Connect with each phase coil of the motor. U...U-phase V...V-phase W...W-phase	
	Ground Terminal		Connect with E-terminal of the motor and ground to earth.	

Note) For the relationship of power supply voltage and model type code, refer to section 9.

4.2 Encoder Connection Connector Terminal

CN SIG

Applicability	Connector Pin No.	Contents
Power Supply Output for Encoder	1, 2	0V Note) 1
	3, 4	+5V Power Supply
Encoder Signal Input (A-phase)	7	A
	8	\overline{A}
Encoder Signal Input (B-phase)	9	B
	10	\overline{B}
Encoder Signal Input (Z-phase)	11	Z
	12	\overline{Z}
Encoder Signal Input (Serial signal)	17	RX
	18	\overline{RX}
Frame Ground	20	Frame Ground FG

Note) 1. 0V for encoder power supply output is connected with control circuit ground which is connected to the connector CN I/F.

Note) 2. For pins except pin No. shown in the above table (Pin 5, 6, 13, 14, 15, 16, 19), do not connect anything.

4.3 Interface Connector

CN I/F

Functions of signals to be inputted or outputted to the interface connector are partly different according to setting of parameter No.3F which will be described later. In the following table, setting of parameter No.3F and functions of interface connector pins are shown.

← Symbol: Input/Output is like factory setting.

PIN NO.	Parameter No.3F					
	0 (Factory setting)	1 (Position control 1)	2 (Position control 2)	3 (Position control 3)	4 (Velocity control 1)	5 (Velocity control 2)
1	OZ+ Z-phase line driver output	←	←	←	←	←
2	OZ- Z-phase line driver output	←	←	←	←	←
3	SG Signal ground	←	←	←	←	←
4	CZ Z-phase open collector output	←	←	←	←	←
5	PULS2 Command pulse input	←	←	←	←	←
6	PULS1 Command pulse input	←	←	←	←	←
7	SIGN2 Command sign input	←	←	←	←	←
8	SIGN1 Command sign input	←	←	←	←	←
9	INH Command pulse input inhibit	←	←	←	INTSPD1 Internal velocity command select 1	←
10	ZEROSPD Velocity zero clamp input	DIV Command division/ multiplication changeover	Not in use	DIV Command division/ multiplication changeover	ZEROSPD Velocity zero clamp input	←
11	COM+ Control signal power supply	←	←	←	←	←
12	SRV-ON Servo-ON	←	←	←	←	←
13	CL Deviation counter clear input	←	←	←	INTSPD2 Internal velocity command select 2	←
14	SPR/SPL Velocity command/Velocity Limit	←	←	←	←	←
15	SG Signal ground	←	←	←	←	←
16	SP Velocity monitor signal	←	←	←	←	←
17	SG Signal ground	←	←	←	←	←
18	FG Frame ground	←	←	←	←	←
19	OA+ A-phase line driver output	←	←	←	←	←
20	OA- A-phase line driver output	←	←	←	←	←
21	OB+ B-phase line driver output	←	←	←	←	←

22	OB- B-phase line driver output	←	←	←	←	←
23	Not in use	Not in use	Not in use	Not in use	Not in use	Not in use
24	Not in use	Not in use	Not in use	Not in use	Not in use	Not in use
25	COIN Positioning complete/Velocity arrival	←	←	←	←	←
26	ALM Servo alarm output	←	←	←	←	←
27	S-RDY Servo-Ready	BRK-OFF External brake release	←	←	←	Z-VEL Zero velocity detection
28	COM- Control signal power supply	←	←	←	←	←
29	CWL CW-run limit input	←	←	←	←	←
30	CCWL CCW-run limit input	←	←	←	←	←
31	A-CLR Alarm clear input	←	←	←	←	←
32	C-MODE Control mode changeover input	GAIN Gain changeover input	←	P/P Proportional control changeover	←	←
33	CWTL CW torque limit input	←	←	←	←	←
34	CCWTL/TRQR CCW torque limit input/Torque command	←	←	←	←	←
35	SG Signal ground	←	←	←	←	←
36	IM Torque monitor signal	←	←	←	←	←

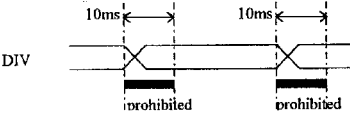
Fixed Input Signal

Application (Signal Name)	Symbol	Parameter No.3F	Connector pin No.	Contents/Function	Input/Output Signal interface
Control signal power supply	COM+	—	11	<ul style="list-style-type: none"> Connect (+) of the control signal power supply(12 - 24V) to COM+(11pin), and (-) to COM-(28pin). Power capacity for the control signal power supply varies depending on the composition of the control output circuit. 	—
	COM-	—	28		—
Servo-ON input	SRV-ON	—	12	<ul style="list-style-type: none"> The driver turns to Servo-ON state by connecting this input to COM- of the control signal power supply. By opening the connection to COM- is, the driver turns to Servo-OFF state, shutting off the power to the motor, and the dynamic brake will be activated. Also, deviation counter will be cleared. After shifting to Servo-ON state, allow 50ms or longer before entering velocity/pulse row command. 	i - 1
Alarm clear input	A-CLR	—	31	<ul style="list-style-type: none"> With this input, overcurrent(OC), encoder error (ST), system error, parameter error and CPU error cannot be cleared. In these cases, it is necessary to shut off/reenter the main power to reset error. By connected this input to COM- of the control signal power supply, alarm status will be cleared and the driver returns to operation mode. At this moment, the deviation counter will be cleared. 	i - 1
CW-run inhibit input	CWL	—	29	<ul style="list-style-type: none"> By opening the connection of this input to COM , torque will not be generated in CW-direction, viewed from the motor shaft. By setting user parameter No.09, "Run inhibit input invalidation " to „1“, this input becomes void. With this input, dynamic brake can be activated. Refer to 6-3 Dynamic Brake. 	i - 1
CCW-run inhibit input	CCWL	—	30	<ul style="list-style-type: none"> By opening the connection of this input to COM-, torque will not be generated in CCW -direction viewed from the motor shaft. By setting user parameter No.09 "Run inhibit input invalidation " to „1“, this input becomes void. With this input, dynamic brake can be activated. Refer to section 6-3, Dynamic Brake. 	i - 1

Selected input signal

The following input signals will have different functions based on the setting of parameter "No.3F".

Application (Signal name)	Symbol	Parameter No.3F	Connector pin No.	Contents/Function	Input/Output Signal interface																									
Command pulse input limit input	INH	0, 1, 2, 3	9	<ul style="list-style-type: none">By connecting this input to COM- of the control signal power supply, input of the command pulse (PULS.SIGN) becomes active. If connection to COM- is opened, the command pulse input will be limited. Therefore, if this function is not used, be sure to connect this input to COM- without fail.	i - 1																									
Internal velocity command select input 1	INTSPD1	4, 5	9	<ul style="list-style-type: none">When the internal velocity command is selected by parameter No.16 "Velocity setting internal/external changeover," the first - the forth velocity for the internal velocity setting can be selected.	i - 1																									
Internal velocity command select input 2	INTSPD2	4, 5	13	<ul style="list-style-type: none">When defining open connection to COM- as "H", and closed connection to COM- as "L", the following internal velocity will be selected.(Only at velocity control mode) <table><tr><td>INTSPD-1</td><td>INTSPD-2</td><td>Pr.No16=0</td><td>Pr.No16=1</td><td>Pr.No16=2</td></tr><tr><td>H</td><td>H</td><td>Ext.vel.</td><td>1st vel.</td><td>1st vel.</td></tr><tr><td>L</td><td>H</td><td>Ext.vel.</td><td>2nd vel.</td><td>2nd vel.</td></tr><tr><td>H</td><td>L</td><td>Ext.vel.</td><td>3rd vel.</td><td>3rd vel.</td></tr><tr><td>L</td><td>L</td><td>Ext.vel.</td><td>4th vel.</td><td>Ext.vel.</td></tr></table>	INTSPD-1	INTSPD-2	Pr.No16=0	Pr.No16=1	Pr.No16=2	H	H	Ext.vel.	1 st vel.	1 st vel.	L	H	Ext.vel.	2 nd vel.	2 nd vel.	H	L	Ext.vel.	3 rd vel.	3 rd vel.	L	L	Ext.vel.	4 th vel.	Ext.vel.	i - 1
INTSPD-1	INTSPD-2	Pr.No16=0	Pr.No16=1	Pr.No16=2																										
H	H	Ext.vel.	1 st vel.	1 st vel.																										
L	H	Ext.vel.	2 nd vel.	2 nd vel.																										
H	L	Ext.vel.	3 rd vel.	3 rd vel.																										
L	L	Ext.vel.	4 th vel.	Ext.vel.																										
Deviation counter clear input	CL	0, 1, 2, 3	13	<ul style="list-style-type: none">By connecting this input to COM-, deviation counter will be cleared and limits the feedback pulse input from command pulse and encoder. It is necessary to have 30ms or longer for the clear signal width.	i - 1																									
Control mode changeover input	C-MODE	0	32	<p>6 types of mode can be selected with parameter No.02 "Control mode setting" among single modes of ① Position control mode, ② Velocity control mode, ③ Torque control mode - as single mode, and combination modes of ④ Position(1st)/Velocity(2nd) control mode, ⑤ Position(1st)/Torque(2nd)control mode, ⑥ Velocity(1st)/Torque(2nd)control mode.</p> <ul style="list-style-type: none">If one of the above combination modes is selected among ④ - ⑥, and if connection to COM- is opened, the 1st mode will be selected.	i - 1																									
Gain changeover input	GAIN	1, 2	32	<ul style="list-style-type: none">When user parameter No.33 "2nd gain setting" is set to "2" and by connecting this input to COM- of the control signal power supply, 2nd gain which is set with user parameter No.30-32 will be selected. <table><tr><td rowspan="2">GAIN connection</td><td>Open</td><td>(-)-pole</td></tr><tr><td>1st</td><td>2nd</td></tr><tr><td>Position loop</td><td>Pr. No20</td><td>Pr. No32</td></tr><tr><td>Vel. Loop</td><td>Pr. No03</td><td>Pr. No30</td></tr><tr><td>Vel. Loop integ. Time cons.</td><td>Pr. No04</td><td>Pr. No31</td></tr></table>	GAIN connection	Open	(-)-pole	1 st	2 nd	Position loop	Pr. No20	Pr. No32	Vel. Loop	Pr. No03	Pr. No30	Vel. Loop integ. Time cons.	Pr. No04	Pr. No31	i - 1											
GAIN connection	Open	(-)-pole																												
	1 st	2 nd																												
Position loop	Pr. No20	Pr. No32																												
Vel. Loop	Pr. No03	Pr. No30																												
Vel. Loop integ. Time cons.	Pr. No04	Pr. No31																												
Proportional control changeover	P/PI	3, 4, 5	32	<ul style="list-style-type: none">By connecting this input to COM-, speed control will become proportional (P) operation only.	i - 1																									

Velocity zero clamp input	ZEROSPD	0, 4, 5	10	<ul style="list-style-type: none"> By opening the connection to COM-, external and internal velocity command will be separated. Instead, zero velocity command will be given as the data value, and the motor becomes servo-lock status. (However, this is valid only when parameter No.17 is set to "0," and the driver is in other control mode than position control mode.) External velocity command signal and the cause of the fluctuation such as offset drift of the A/D converter after that can be eliminated. 	i - 1
Command division multiplication changeover	DIV	1, 3	10	<ul style="list-style-type: none"> By shorting with COM-, it will be changed-over to command division multiplication ratio set with parameter No.35. 	i - 1

Fixed output signal

Application (Signal name)	Symbol	Parameter No.3F	Connector pin No.	Contents/Function	Input/Output Signal interface
Servo alarm output	ALM	–	26	<ul style="list-style-type: none"> If error is detected and protection function is activated, output transistor will be turned OFF. 	o - 1
Positioning complete signal output or velocity arrival signal output	COIN	–	25	<ul style="list-style-type: none"> At the position control mode, if reserved pulse amount of deviation counter becomes within the range of positioning complete set with parameter No.22, output transistor will be turned ON. At the velocity or the torque control mode, this signal becomes as velocity arrival signal. When the motor velocity reaches to a velocity set with parameter No.12, output transistor will be turned ON. 	o - 1

Selected output signal

The following output signals will have different functions based on the setting of parameter "No.3F."

Application (Signal name)	Symbol	Parameter No.3F	Connector pin No.	Contents/Function	Input/Output Signal interface
Servo ready output	S-RDY	0	27	<ul style="list-style-type: none"> When power supply is ON and the driver is not in the servo alarm status, output transistor will be turned ON. 	o - 1
Zero velocity detection	Z-VEL	5	27	<ul style="list-style-type: none"> At the velocity control mode, this signal become zero velocity arrive signal. When the motor velocity reaches to the velocity less than one set with parameter No.11, output transistor will be turned ON. 	o - 1
External brake release	BRK- OFF	1, 2, 3, 4	27	<ul style="list-style-type: none"> This is a signal output which controls external mechanical brake. Compose the external circuit so that the brake is released when the contact which will activate the external brake is ON. 	o - 1

Command input/Monitor output, etc.

Application (Signal name)	Symbol	Parameter No.3F	Connector pin No.	Contents/Function	Input/Output Signal interface
Velocity monitor signal	SP	—	16	<ul style="list-style-type: none"> Outputs voltage with polarity in proportion to the velocity or position deviation. Changeover of motor velocity and position deviation can be set with parameter No.3B "Analog monitor output changeover." Velocity +: CCW-run -: CW-run Position deviation +: Position deviation is +. -: Position deviation is -. 	Ao - 1
	GND	—	17	<ul style="list-style-type: none"> Full scale value of the velocity monitor signal can be set in two kinds with parameter No.08 "Velocity monitor gain select." Output impedance of the velocity monitor signal is 10kΩ. Pay attention to input impedance of measuring instruments and circuits to be connected. 	
Torque monitor signal	IM	—	36	<ul style="list-style-type: none"> Outputs voltage with polarity in proportion to the generated torque of the motor. + : CCW-run - : CW-run 	Ao- 1
	GND	—	17	<ul style="list-style-type: none"> The relationship between output voltage of the torque monitor signal and the generated torque is; Approx.3V/100% torque Output impedance of the torque monitor signal is 10kΩ. Pay attention to input impedance of measuring instruments and circuits to be connected. 	

Application (Signal Name)	Symbol	Parameter No.3F	Connector pin No.	Contents/Function	Input/Output Signal interface
Command pulse input	PULS1	—	6	<ul style="list-style-type: none"> Input terminal of the command pulse, and driver side is high speed photo coupler input. Command pulse input style can be selected from the following three methods with parameter No.29. <ul style="list-style-type: none"> ① 2-phase(A-phase/B-phase) input ② CW(PULS)/CCW(SIGN) pulse input ③ Command pulse(PULS)/Sign (SIGN) input With the parameter, it is possible to select and set of multiplier at 2-phase input(1, 2, 4 times) and input command pulse polarity. Input impedance of the command pulse input signal and command symbol input signal is 220Ω. 	Di- 1
	PULS2	—	5		
Command sign input	SIGN1	—	8		
	SIGN2	—	7		

Application (Signal Name)		Symbol	Parameter No.3F	Connector pin No.	Contents/Function	Input/Output Signal interface
Pulse output	A- Phase Output	OA+	—	19	<ul style="list-style-type: none">Output pulse of the rotary encoder will be fed out in line driver(AM26LS31) after being processed by division processing circuit of the driver.Logical relationship of B-phase and Z-phase pulse against A-phase pulse can be selected with parameter No.0D.	Do - 1
		OA-	—	20		
	B- Phase Output	OB+	—	21		
		OB-	—	22		
	Z- Phase Output	OZ+	—	1		
		OZ-	—	2		
	Z- Phase Output	CZ	—	4	<ul style="list-style-type: none">Open collector output.(Signal ground common)	Do- 2
GND		—	3			
Signal ground		GND	—	3 ,15 17, 35	<ul style="list-style-type: none">A register (1MΩ) is connected between GND and FG to avoid static electricity.	—
Frame ground		FG	—	18	<ul style="list-style-type: none">It is connected with grounding terminal for the driver.	—
Velocity command input		SPR/SP L	—	14	<p>At velocity control mode,</p> <ul style="list-style-type: none">this input is external analog velocity command inputvelocity command input gain(relationship of command input level and motor speed), and polarity of velocity command input can be set with parameters No.13 and No.14. <p>At torque control mode</p> <ul style="list-style-type: none">this input is velocity limit command input. Motor speed can be limited by the speed which corresponds to input signal level given externally.The relationship of the input signal level and the limit speed is the same as the relationship between the command voltage level and the speed on "Velocity command gain" of parameter No.13.Polarity of the velocity limit input is valid both for positive and negative, and limits velocity both CW and CCW direction. <p>At position control mode, this input is void.</p>	Ai - 1
		GND	—	15		
CW-torque limit input		CWTL	—	33	<ul style="list-style-type: none">At velocity/position control mode, this input externally limits CW and CCW-torque(current) individually to the value which corresponds to input signal level.By inputting negative command voltage(0 - -10V) to CWTL(33 pin), it will limit torque of CW direction.Limit rate:Approx.-3V/100% torqueThis input is valid for speed/position control mode.	Ai - 2
		GND	—	35		
CCW-torque limit input		CCWTL	—	34	<ul style="list-style-type: none">By inputting positive command voltage(0 - +10V) to CCWTL(34 pin), it will limit torque of CCW direction.Control rate: Approx.+3V/100% torqueIn case of using this function, it is necessary to release the mask with parameter No.07 "Torque limit input inhibition."This input is valid for speed/position control mode.	Ai - 2
		GND	—	35		

Torque command input	TRQR	—	34	<ul style="list-style-type: none"> This is a torque command input at torque control mode. For torque command input gain (relationship of command input level and motor torque) and polarity of the torque command input, execute the setting with parameter No.1A "Torque command input gain and 1B "Torque command input reversal". 	Ai - 2
	GND	—	35	<ul style="list-style-type: none"> This input is used in common with torque limit input of CCW direction (CCWTL). 	

Input/Output Signal Interface

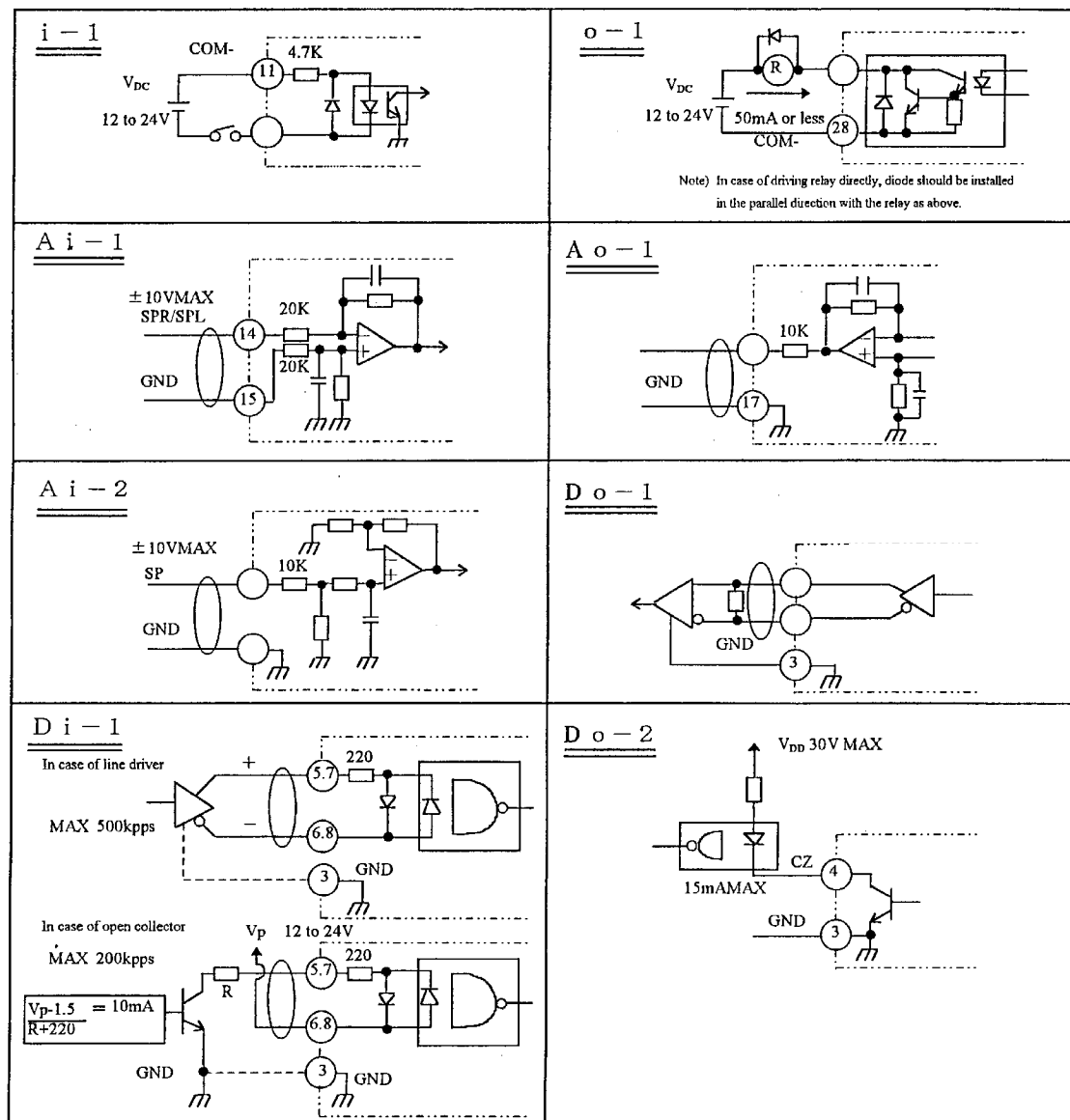


Abb. 4-4: I/O Signal Interface

4.4 Connector for Serial Communication

Connector CN SER

- (1) To perform parameter setting/change, monitoring control condition, referring to error condition/history, operating save/load etc. of parameter on CRT in the arrangement with a generally sold personal computer to be designated, connect to "RS-232C" connector installed in the personal computer with a exclusive cable supplied as option.
- (2) Prepare MINITERM (option) for DMD*.
For the operation method, refer to „MINITERM Instruction Manual“ attached to MINITERM.



Caution

It is strictly necessary to use the „American Standard Scriptdriver“ (ANSI.SYS). Otherwise your lines will get out of place. Enter the ansi.sys into the Config.sys of your Computer. Normally, it is enough to enter the following line:
- „DEVICE=C:\WINDOWS\COMMAND\ANSI.SYS“

As an option, a cable to connect connector for position driver front panel section with connector for RS-232C of personal computer is prepared.

You can take the Indramat cable IKS 0198 Part – No 281 539

5 Parameter

5.1 User Parameter

Nr.	Parameter	Factory setting	Nr.	Parameter	Factory setting	Nr.	Parameter	Factory setting
00	Axis	0	20	Position loop gain	*	40	(not in use)	-
01	LED initial state	1	21	Velocity feed forward	0	41	(not in use)	-
02	Control mode setting	1	22	Positioning complete range	10	42	(not in use)	-
03	Velocity loop gain	*	23	Excess deviation setting	30000	43	(not in use)	-
04	Vel. loop integration time const.	*	24	Inactive / excess deviation	0	44	(not in use)	-
05	Velocity detection filter	4	25	Numerator/command div/mltpl	10000	45	(not in use)	-
06	Torque limit setting	*	26	Denominator/cmnd div/mltpl	10000	46	(not in use)	-
07	Torque limit input limit	1	27	Command pulse mltpl. setting	4	47	(not in use)	-
08	Vel.monitor gain select	0	28	Command logic reversal	0	48	(not in use)	-
09	Run-limit input inactive	1	29	Command pulse input mode setting	1	49	(not in use)	-
0A	Sequence at run-limit input	0	2A	(not in use)	-	4A	(not in use)	-
0B	Numerator/pulse division	10000	2B	Feed forward filter time const.	0	4B	(not in use)	-
0C	Denominator/pulse division	10000	2C	(not in use)	-	4C	(not in use)	-
0D	Pulse logic reversal	0	2D	(not in use)	-	4D	(not in use)	-
0E	Brake action setting at stopp	0	2E	(not in use)	-	4E	(not in use)	-
0F	Brake action setting at running	0	2F	(not in use)	-	4F	EEPROM check sum	-
10	Acceleration time setting	0	30	2 nd . velocity loop gain	50			
11	Zero velocity	50	31	2 nd . vel. loop integration time const.	50			
12	Arrival velocity	1000	32	2 nd . position loop gain	50			
13	Vel. command input limit gain	*	33	2 nd . gain setting	0			
14	Vel. command logic reversal	0	34	2 nd . gain delay time setting	10000			
15	Velocity command offset	0	35	Numerator/2 nd . pulse div/mltpl	10000			
16	Changeover /int-ext vel. setting	0	36	Smoothing filter setting	3			
17	Inactive / vel. zero-cramp	1	37	JOG speed setting	300			
18	Vel. command /1 st . speed	0	38	Velocity setting/3 rd . speed	0			
19	Vel command /2 nd . speed	0	39	Velocity setting/4 th . speed	0			
1A	Torque command input gain	250	3A	(not in use)	-			
1B	Torque command input reversal	0	3B	Analog monitor output change	0			
1C	Torque command offset	0	3C	Counter clear input mode	0			
1D	Torque filter time constant	0	3D	Sequence at alarm	0			
1E	(not in use)	-	3E	Sequence at Servo-Off	0			
1F	Deceleration time setting	0	3F	I/F function selection	0			

Parameter No.		Parameter	Set range	Functions/Contents
Page	No.			
0	0	Axis	0 to 31	<ul style="list-style-type: none"> When personal computer is used for referring, setting or monitoring in multi-axis application, use this to identify which axis the PC is accessing.
0	1	LED initial display	<p>0 →</p> <p>1 →</p> <p>2 →</p> <p>3 →</p>	<ul style="list-style-type: none"> On the initial state when turning on the power supply etc., select the data to be displayed at 7 segment LED, from the following 3 types; <p>Displays the reserved pulse amount of position deviation counter.</p> <p>(1) Display range is -32767 - +32767(P). If the reserved pulse amount exceeds the range, the display will be saturated at the upper/lower limit value of the above range.</p> <p>(2) Polarity display</p> <p>(+) : Generates CCW torque.</p> <p>- : Generates CW torque.</p> <p>Displays the motor speed with polarity. Unit(r/min.)</p> <p>Polarity display</p> <p>(+) : Runs at CCW viewed from the shaft end.</p> <p>- : Runs at CW viewed from the shaft end.</p> <p>Displays the motor torque with polarity.</p> <p>(1) Display range is 0 - +/-1500.</p> <p>(Displayed value) × 0.2 represents the actual generated torque (in % against the rated torque).</p> <p>Ex.) If the displayed value is +1500, 300% torque will be generated at CCW against the rated torque.</p> <p>(2) Polarity display</p> <p>(+) : Generates CCW torque.</p> <p>- : Generates CW torque.</p> <p>Note) If the polarity is positive, + sign will not be displayed.</p> <p>Display of Servo-On, error code</p> <p> Error code CCW-limit input — :COM-close A: Open CW-limit input -:COM-close A: Open Servo-On input -:open A: -:COM-close Servo-On state -:Servo-Off A: Servo-On </p>

0	2	Control mode setting	<ul style="list-style-type: none"> • Select/Set the control mode for this driver among the following 6 kinds; <ul style="list-style-type: none"> 0 → Position (pulse row) control mode 1 → Velocity(analog) control mode 2 → Torque (analog) control mode 3 → Position (1st) /Velocity (2nd) control mode 4 → Position (1st) /Torque (2nd) control mode 5 → Velocity (1st) /Torque (2nd) control mode • If any combination mode of "3", "4" or "5" is set among the above six kinds of modes, either of 1st. or 2nd. mode can be selected with control mode changeover input(C-MODE). <ul style="list-style-type: none"> When C-MODE is opened : 1st. mode selection When C-MODE is connected to COM- :2nd.mode selection <p>Note) For accepting control mode changeover input(C-MODE), no interlock function between the command (pulse row command, speed/torque command) existence and the reserved pulse amount in the deviation counter is taken. Therefore, C-MODE input should be entered when the command signal corresponding to the transitional control mode is 0 or the motor is completely stopped.</p>
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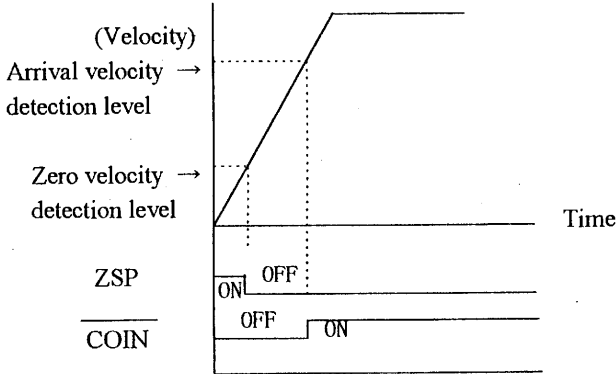
Parameter No.		Parameter	Set range	Functions/Contents
Page	No.			
0	3	Velocity loop gain	25 to 3500	<ul style="list-style-type: none"> Proportional gain of the velocity amplifier. The larger the setting value, the larger the gain. Optimum value for speed loop gain differs depending on the type of load inertia and motor model.
0	4	Velocity loop integration time constant	1 to 1000 (ms)	<ul style="list-style-type: none"> Integration time constant of the velocity amplifier. The larger the setting value, the faster the integration. <p>Note) If integration time constant is set to the maximum value (1000) of the setting range, integration time constant becomes infinite (no integration effect).</p>
0	5	Velocity detection filter	0 to 7	<ul style="list-style-type: none"> Select a kind (time constant) of digital filter for the velocity detection signal. The larger the setting value, the larger the time constant, and decrease the noise generated by the motor. Except the case requiring high speed response, set this parameter to "4." For normal application.
0	6	Torque limit setting	0 to 300 (%)	<ul style="list-style-type: none"> Normal specifications of this driver allows approx. three times of the rated torque as a peak torque for a short duration. If there is a possibility that this 3 times torque mode generates a problem for intensity of the motor load (machine), the peak torque can be limited with this parameter. For setting value, provide % value against the rated torque(100%). Ex.) If setting value is 200 200% (2 times) allowable output of the rated torque <p>Note) This parameter cannot be set with value which exceeds the setting value with system parameter No.66 (Maximum output torque setting) as factory setting. If set with value which exceeds the maximum output torque settling value, it will be automatically corrected to the setting value of the maximum output torque.</p>
0	7	Torque limit input inhibit	0/1	<ul style="list-style-type: none"> By setting this parameter to "1," it ignores analog torque limit input(CWTL/CCWTL) signal. <p>Note) If this parameter is set to "0" and the torque limit input(CWTL/CCWTL) is open , no torque will be generated.</p>

0	8	Velocity monitor gain	0/1	<ul style="list-style-type: none"> Set the motor speed which velocity monitor signal(SP) outputs, or full scale value of the position deviation. For changeover of the motor speed and the position deviation, execute with parameter No.3B, „ Analog monitor output changeover“. <p> "0" : 4095 (r/min.) Motor speed "1" : 16383 (r/min.) (parameter No.3B=0) "0" : 255 (P) Position deviation "1" : 32767 (P) (parameter No.3B=1) </p> <ul style="list-style-type: none"> On the normal specifications, "0"(4095(r/min.) or 255(P)full scale) is set. However, if it is not enough, set this parameter to "1." The following figure shows the relationship between motor speed/position deviation and monitor voltage. <div data-bbox="727 591 1420 810"> <p>Speed monitor voltage</p> <p>Motor speed(r/min)</p> </div> <div data-bbox="727 819 1420 978"> <p>Speed monitor voltage</p> <p>Position deviation [P]</p> </div>
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Parameter No.		Parameter	Set range	Functions/Contents																								
Page	No.																											
0	9	Invalidation of run inhibit input	0/1	<ul style="list-style-type: none">By setting this parameter as "1," CW drive inhibit input (CWL)/CCW drive inhibit input (CCWL) will be ignored and operates by judging it not in the drive inhibit state. <p>Note) If this parameter is set to "0" and CW-run inhibit input (CWL) is open, no torque will be generated in that direction. This is same for a case that CCW-run inhibit input (CCWL) is open. Also, if both CWL and CCWL are open, the driver trips as "Run inhibit input error."</p>																								
0	A	Sequence at run inhibit input	0/1	<ul style="list-style-type: none">At deceleration while CW-run inhibit input (CWL) or CCW-run inhibit input (CCWL) is activated, select the dynamic operation with this parameter as follows; "0" : Stop by activating the dynamic brake. "1" : Free run stop without the dynamic brake.																								
0	B	Numerator of pulse output division	1 - 10000	<ul style="list-style-type: none">Set numerator of the division ratio on feedback pulse division from the rotary encoder.																								
0	C	Denominator of pulse output division	1 - 10000	<ul style="list-style-type: none">Set denominator of the division ratio on feedback pulse division from the rotary encoder. <p>Note) 1. The feedback pulse division ratio should be lower than 1 by reducing to a common denominator.</p> $\text{Division ratio} = \frac{\text{Numerator}}{\text{Denominator}} \leq 1$ <p>Note) 2. Do not set with extreme division ratio (Ex. 1/10000). As a standard of appropriate division ratio, use it within the approximate range of $1/32 \leq \text{division ratio} \leq 1$. However, depending on the set division ratio, duty ratio of the output pulse after the division may not always be 50%.</p> <p>Note) 3. This driver supports a motor installing a rotary encoder with 2500P/r as standard. For this case, the table below shows examples of division ratio setting, to meet necessary number of pulse for user side system</p> <table><tr><th></th><th colspan="5">Necessary feedback pulse at System (P/r)</th></tr><tr><td>Setting Value</td><td>500</td><td>1000</td><td>1500</td><td>2000</td><td>2500</td></tr><tr><td>Numerator</td><td>2000</td><td>4000</td><td>6000</td><td>8000</td><td>10000</td></tr><tr><td>Denominator</td><td>10000</td><td>10000</td><td>10000</td><td>10000</td><td>10000</td></tr></table> <p>Note) 4. In case of using division function of feedback pulse, if division ratio is "1," Z-phase pulse synchronizes with A-phase pulse. However, if it is not "1," it doesn't synchronize (asynchronous). Therefore, when positioning the origin by a logical expression of A-phase pulse and Z-phase pulse, be careful as there may be mispositioning.</p>		Necessary feedback pulse at System (P/r)					Setting Value	500	1000	1500	2000	2500	Numerator	2000	4000	6000	8000	10000	Denominator	10000	10000	10000	10000	10000
	Necessary feedback pulse at System (P/r)																											
Setting Value	500	1000	1500	2000	2500																							
Numerator	2000	4000	6000	8000	10000																							
Denominator	10000	10000	10000	10000	10000																							

Parameter No.		Parameter	Set range	Functions/Contents																																			
Page	No.																																						
0	D	Pulse output logic reversal	0 - 3	<ul style="list-style-type: none">• In the relationship of position for the output pulse from the rotary encoder, B-phase is behind of A-phase pulse at CW direction. (At CCW, B-phase is ahead of the A-phase pulse.)• By reversing the B-phase pulse logic with this parameter, the positional relationship of B-phase and the above A-phase pulse can be inverted. Also, Z-phase pulse logic also can be reversed.• The above relationship is shown in the following table. <table><tr><th>Pr.No.0D</th><th></th><th>CCW-run</th><th>CW-run</th></tr><tr><td rowspan="3">0</td><td>OA</td><td></td><td></td></tr><tr><td>OB non-reversal</td><td></td><td></td></tr><tr><td>OZ non-reversal</td><td></td><td></td></tr><tr><td rowspan="2">1</td><td>OB reversal</td><td></td><td></td></tr><tr><td>OZ non-reversal</td><td></td><td></td></tr><tr><td rowspan="2">2</td><td>OB non-reversal</td><td></td><td></td></tr><tr><td>OZ reversal</td><td></td><td></td></tr><tr><td rowspan="2">3</td><td>OB reversal</td><td></td><td></td></tr><tr><td>OZ reversal</td><td></td><td></td></tr></table>	Pr.No.0D		CCW-run	CW-run	0	OA			OB non-reversal			OZ non-reversal			1	OB reversal			OZ non-reversal			2	OB non-reversal			OZ reversal			3	OB reversal			OZ reversal		
Pr.No.0D		CCW-run	CW-run																																				
0	OA																																						
	OB non-reversal																																						
	OZ non-reversal																																						
1	OB reversal																																						
	OZ non-reversal																																						
2	OB non-reversal																																						
	OZ reversal																																						
3	OB reversal																																						
	OZ reversal																																						
0	E	Setting of mechanical brake action at stopping	0 to 100	<ul style="list-style-type: none">• This driver has an output signal which controls the brake of the motor with brake. (Only if parameter "No.3F" is 1,2,3 or 4).• With this parameter, set time T_B which is for until the motor non-power state after turning external brake release signal (BRK-OFF) off(Brake operation) when stopping the motor (servo lock). <p>The relationship between the setting value of this parameter and T_B is;</p> <p style="text-align: center;">Setting value = $T_B(\text{ms})/2$</p> <table><tr><td>SRV-ON</td><td></td></tr><tr><td>Power to motor</td><td></td></tr><tr><td>BRK-OFF</td><td></td></tr></table> <p style="text-align: center;">Release Not released</p> <p>Note) If the motor becomes non-power state from power-on state by operating the protection function, BRK-OFF signal will be OFF with $T_B=0$, not depending on this parameter.</p>	SRV-ON		Power to motor		BRK-OFF																														
SRV-ON																																							
Power to motor																																							
BRK-OFF																																							

Parameter No.		Parameter	Set range	Functions/Contents
Page	No.			
0	F	Setting of mechanical brake action at running	0 - 100	<ul style="list-style-type: none"> If the motor becomes in alarm state with SRV-ON signal off or protection function operated during running and the motor becomes in non-power state from power-state, BRK-OFF signal will be turned off (brake operation) when the motor speed becomes approx. 30r/min. or lower, or when T_B passed after the motor becomes in non-power state. <p>Timing chart with this situation is shown as below.</p> <p>The relationship between setting value and T_B of this parameter is; Setting value = T_B (ms.)/2</p> <p>Velocity (r/min)</p> <p>30</p> <p>0</p> <p>Time</p> <p>Stopped dynamic brake</p>
1	0	Acceleration time setting	0 to 5000	<ul style="list-style-type: none"> Set the acceleration time with this parameter at velocity control mode. Relationship of setting value and acceleration time is shown as below; $\text{Setting value} = (\text{Acceleration time from 0r/min. to 1000r/min.}) (s) \times 500$ <p>E.g.) When start up in 6 seconds from 0r/min. to 3000r/min., 0r/min. to 1000r/min. in 2 seconds</p> <p style="text-align: center;">↓</p> $\text{Setting value} = 2 \times 500 = 1000$ <p>Note) Acceleration/deceleration limit function is void at position control mode and the torque control mode. Do not use the acceleration/deceleration limit function even if this driver is used at velocity control mode and the position control loop is composed outside the driver. (Set this parameter to "0.")</p> <p>There is a possibility of oscillation.</p>
1	1	Zero velocity	0 to 10000 (r/min)	<ul style="list-style-type: none"> Set the detection judgment level of the zero-velocity detection signal output (Z-VEL) directly with the motor speed (r/min.). If the motor speed is lower than the setting value, ZSP will be turned on. <p>(Only when parameter "No.3F" is 5)</p>

Parameter No.		Parameter	Set range	Functions/Contents				
Page	No.							
1	2	Arrival velocity	0 to 10000 (r/min)	<ul style="list-style-type: none">Set the detection judgment level of the velocity arrival signal output (COIN) at velocity or torque control mode, directly with the motor speed (r/min.). If the motor speed exceeds its setting value, COIN will be turned on. <p>Note) 1. Output "COIN" is used by the control mode as follows;</p> <table><tr><td>Velocity/Torque mode</td><td>Velocity arrival signal</td></tr><tr><td>Position control mode</td><td>Positioning complete signal</td></tr></table> <p>Therefore, this parameter is invalid in position control mode.</p> <p>Note) 2. Relationship of parameter "zero-velocity" in the previous section and "Velocity arrival" with Z-VEL.COIN is shown as below;</p> 	Velocity/Torque mode	Velocity arrival signal	Position control mode	Positioning complete signal
Velocity/Torque mode	Velocity arrival signal							
Position control mode	Positioning complete signal							
1	3	Input gain of velocity command	10 to 2600	<ul style="list-style-type: none">Set an input gain (Relationship between necessary motor speed and velocity command voltage value) of analog velocity command (SPR).Calculate the setting value with the following formula. Setting value = 10 × Necessary speed (r/min.) at 6V of command application60 E.g.) Number of encoder pulse 2500 (P/r) Necessary speed at 6V of command application 3000 (r/min) Setting value = 10 × 300060 = 500 <p>Note) If the driver is used at velocity control mode and the position control loop is composed outside the driver, servo system position gain will vary by the setting value of this parameter. Therefore, be careful for oscillation etc.</p>				
1	4	Reversal of velocity command input	0/1	<ul style="list-style-type: none">Reverse of the polarity(Direction of motor revolution) for the analog velocity command signal(SSR) with this parameter. "0" : Runs at CW(viewed from the shaft) with velocity command of (+). "1" : Runs at CCW(viewed from the shaft) with velocity command of (+). <p>Note) If this driver set at velocity control mode is used in combination with external positioning unit, and when the polarity of velocity command signal of the position unit and that of this parameter are not identical, note that the motor will make abnormal operation.</p>				

1	5	Offset of velocity command	-127 to 127	<ul style="list-style-type: none">• Execute an offset adjustment of the analog velocity command input circuit system with this parameter.• To execute an offset adjustment with the driver alone, follow the procedures below; Enter OV correctly to the velocity command input(SCR).(or connect SCR to the signal ground) Set such a value with which the motor does not rotate with this parameter.
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Parameter No.		Parameter	Set range	Functions/Contents																												
Page	No.																															
1	6	Internal/ External velocity setting changeover	0/1	<ul style="list-style-type: none"> By setting this parameter to "1", analog velocity command input (SPR) will be separated and internal 4 kinds of velocity command set in parameters No.18, No.19, No.48, No.49 becomes valid. By setting this to „2“, vel. command among int. 3rd. speed and ext. analog 4th. speed can be selected. Changeover of motor stop, analog input for 1st. to 4th. speed can be conducted with 3 control inputs of vel. zero –cramp (ZEROSPD), int. vel. selected 1 and int. vel. select 2. (when setting parameter No. 3F to „4“ or „5“) Refer to section 6-4. If parameter No.3F is not set to "4" or "5", only motor stop with zero-velocity clamp input (ZEROSPD) and changeover of the 1st. speed set with parameter No.18 become possible. <table border="1"> <thead> <tr> <th rowspan="2">INTSPD-1</th><th rowspan="2">INTSPD-1</th><th colspan="3">Setting Value</th></tr> <tr> <th>0</th><th>1</th><th>2</th></tr> </thead> <tbody> <tr> <td>Open</td><td>Open</td><td>Analog Vel. Command</td><td>Vel. set 1st</td><td>1st Vel.</td></tr> <tr> <td>COM(-)</td><td>Open</td><td>↑</td><td>Vel. set 2nd</td><td>2nd Vel.</td></tr> <tr> <td>Open</td><td>COM(-)</td><td>↑</td><td>Vel. set 3rd</td><td>3rd Vel.</td></tr> <tr> <td>COM(-)</td><td>COM(-)</td><td>↑</td><td>Vel. set 4th</td><td>Analog Vel. Command</td></tr> </tbody> </table> <ul style="list-style-type: none"> Example of variable speed run at int. vel. command is selected; 	INTSPD-1	INTSPD-1	Setting Value			0	1	2	Open	Open	Analog Vel. Command	Vel. set 1 st	1 st Vel.	COM(-)	Open	↑	Vel. set 2 nd	2 nd Vel.	Open	COM(-)	↑	Vel. set 3 rd	3 rd Vel.	COM(-)	COM(-)	↑	Vel. set 4 th	Analog Vel. Command
INTSPD-1	INTSPD-1	Setting Value																														
		0	1	2																												
Open	Open	Analog Vel. Command	Vel. set 1 st	1 st Vel.																												
COM(-)	Open	↑	Vel. set 2 nd	2 nd Vel.																												
Open	COM(-)	↑	Vel. set 3 rd	3 rd Vel.																												
COM(-)	COM(-)	↑	Vel. set 4 th	Analog Vel. Command																												
1	7	Invalidation of velocity zero- clamp	0/1	<ul style="list-style-type: none"> Zero-velocity clamp input (ZEROSPD) will be ignored by setting this to "1" and the driver operate judging that it is not in the zero-velocity clamp state. <p>Note) As described in section 6-2, zero-velocity clamp input (10 pin of ZEROSPD CN I/F) becomes valid by opening this connection to (-) pole (COM-28 pin) of the control signal power supply.</p> <p>Therefore, if this parameter is set to "0" and ZEROSPD input is opened, note that the driver always becomes zero-velocity clamp state and the motor will not rotate.</p>																												
1	8	1 st . speed of velocity setting	-7000 to 7000	<ul style="list-style-type: none"> When the internal velocity command becomes valid (refer to the section of parameter No.16.), set by calculating the 1st. speed (r/min.) with the following formula. <p style="text-align: center;">Setting value = Necessary speed</p> <p>Note) Polarity of the setting value indicates polarity of the internal velocity command.</p> <p>+ : Runs at CCW, viewed from the motor shaft</p> <p>- : Runs at CW, viewed from the motor shaft</p>																												

1	9	2 nd . speed	-7000 to 7000	<ul style="list-style-type: none">• Set the 2nd. speed when the internal velocity command becomes valid as same as parameter No.18.
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Parameter No.		Parameter	Set range	Functions/Contents
Page	No.			
1	A	Input gain in torque setting	25 to 2500	<ul style="list-style-type: none"> Set an input gain (relationship between the generated torque of the motor and the torque command input voltage value) of the torque command (TRQR) at torque control mode. Calculate the setting value with the following formula. $\text{Torque command input gain (V/100\%)} \times 3 \times \frac{250}{\text{Setting value}}$ <p>E.g.) Setting value to obtain the rated torque with the torque command input of 1.5V;</p> $\text{Setting value} = \frac{3 \times 250}{1.5 (\text{V} / 100\%)} = 500$ <p>Note) When torque command input equivalent to 200 (%) or more of the rated torque is applied, generated torque may be saturated regardless of the above formula.</p>
1	B	Reversal of torque command	0/1	<ul style="list-style-type: none"> Set a reversal of polarity (direction of generated torque of motor corresponding to the command) of the analog torque command (TRQR) with this parameter. <p>"0" : Runs at CW, viewed from the motor shaft with a torque command of (+).</p> <p>"1" : Runs at CCW, viewed from the motor shaft with a torque command of (+).</p>
1	C	Offset of torque command	-127 to 127	<ul style="list-style-type: none"> Execute an offset adjustment of the analog torque command input system with this parameter. Execute an offset adjustment with the driver alone, follow the procedures below; Enter exactly OV to the torque command input (TRQR), after setting to torque control mode (or connect TRQR to the signal ground.) Set such a value with which the motor does not rotate.
1	D	Torque filter time constant	0 to 2500	<ul style="list-style-type: none"> Set the first-order lag filter for the torque command by calculating with the following formula. $\text{Time constant of filter } (\mu\text{s}) = \text{Setting value} \times 10 (\mu\text{s})$ <p>Note) If the setting value is 0~39, time constant of the filter becomes 0 (μs).</p> <p>Note) In case of using this filter, set parameter No.05 (velocity detection filter) to "0."</p>
1	F	Deceleration time setting	0 to 5000	<ul style="list-style-type: none"> Sets the deceleration time at velocity control mode. The relationship of setting value and deceleration time is shown as below; $\text{Setting value} = (\text{Deceleration time from } 1000 \text{ r/min. to } 0 \text{ r/min.}) (\text{s}) \times 500$ <p>Note) Acceleration/deceleration limit function becomes void at position control mode and torque control mode. Do not use acceleration/deceleration limit function even if this driver is used at velocity control mode and the position control loop is composed outside the driver. (Set this parameter to "0.")</p> <p>There is a possibility of oscillation.</p>

Parameter No.		Parameter	Set range	Functions/Contents
Page	No.			
2	0	Position loop gain	10 to 1000 (1/s)	<ul style="list-style-type: none"> Set a position gain in position control mode. Unit of the setting value is (1/s). The larger the set value, higher the position gain and servo stiffness at position control (represented as hardness at servo lock) increases. <p>Note) Note that too large setting may cause an oscillation.</p>
2	1	Velocity feed forward	0 to 100 (%)	<ul style="list-style-type: none"> If high speed response is especially necessary, speed feed forward function can be added with this driver. Set feed forward volume in the rate (%) against the command volume. <p>Note) If the velocity feed forward volume is set excessively, unstable situation will be increased and oscillation will be generated. Except the case when high speed response is required, set this parameter to „0“.</p>
2	2	Positioning complete range	- 0 32766 (P)	<ul style="list-style-type: none"> Set a detection level with number of pulses when judging the positioning complete. When the number of reserved pulses of the deviation counter becomes within \pm (setting value), the driver judges that the positioning is completed and outputs (output transistor is on.) the positioning complete signal (COIN). <p>Note) As feedback pulses of the rotary encoder is entered to the deviation counter after being multiplied by 4 times, 1 pulse of the deviation counter have 1/4th. of resolution of the that by the number for the encoder pulse.</p>
2	3	Over-setting of position deviation	0 to 32766	<ul style="list-style-type: none"> Set the detection level with reserved pulses in the deviation counter, when judging the over-position deviation. Calculate the setting value with the following formula. $\text{Setting value} = \frac{\text{Over-position deviation detecting level [Pulse]}}{16}$ <ul style="list-style-type: none"> When the number of reversed pulse for the deviation counter exceeds the judgment level indicated with the above setting value, the driver will be tripped by judging it as an error.
2	4	Invalidation of over-position deviation error	0/1	<ul style="list-style-type: none"> With this parameter, protective function of the over-position deviation error can be masked. By setting this parameter to "1," detection of the over-position deviation error will be canceled and the operation will continue without taking it as an error (No TRIP) even the reserved pulses of the deviation counter exceed the detection level set by parameter No.23(Over-position deviation error).
2	5	Numerator of command pulse division multiplication	1 to 10000	<ul style="list-style-type: none"> Set the numerator of command pulse input division multiplication ratio. The setting value can be any value between 1 - 10000. However, if it is set to extreme division ratio or multiplication ratio, the operation will not be guaranteed. For the possible range of division and multiplication ratio, follow Note) refer to the next section for parameter No.26.

Parameter No.		Parameter	Set range	Functions/Contents
Page	No.			
2	6	Denominator of command pulse division/multiplication	1 to 10000	<ul style="list-style-type: none"> Set the denominator of command pulse input division/multiplication ratio. <p>Note) 1. The setting value can be any value from 1-10000. However, if it is set to extreme division ratio or multiplication ratio, the operation will not be guaranteed. For the possible range of division and multiplication ratio, set it within the following range.</p> $\frac{1}{50} \leq \frac{\text{Setting value of numerator}}{\text{Setting value of denominator}} \leq 20$ <p>Note) 2. For command pulse frequency for input when giving command of necessary maximum motor speed, set multiplication ratio which does not exceed the maximum command pulse frequency;</p> <p style="padding-left: 40px;">In case of line driver output 500 (kpps)</p> <p style="padding-left: 40px;">In case of open collector output 200 (kpps)</p>
2	7	Multiplier setting	1 to 4	<ul style="list-style-type: none"> Set the multiplier in when "2-phase pulse input mode" is selected as the style of command pulse with parameter No.29 (Command pulse input mode setting) . Setting value and multiplier are used as follows; <p style="padding-left: 40px;">"1" Multiplication of 1</p> <p style="padding-left: 40px;">"2" Multiplication of 2</p> <p style="padding-left: 40px;">"3" and "4" Multiplication of 4</p>
2	8	Reversal of command logic	0 to 3	<ul style="list-style-type: none"> With setting of this parameter, logic of command input for two systems (PULS/SIGN) can be set individually inside the driver as follows; <p>"0" "PULS" signal logic non-reverse / "SIGN" signal logic non-reverse</p> <p>"1" reverse / non-reverse</p> <p>"2" non-reverse / reverse</p> <p>"3" reverse / reverse</p>

2	9	Command pulse input mode setting	0 to 3	<ul style="list-style-type: none">Select command pulse status among the following 3 types with this parameter setting: „0“ or „2“2-phase pulse input with 90° difference (A/B-phase) „1“CW and CCW-direction command pulse input „3“Pulse row command and sign input <table><tr><th>Value</th><th>Command pulse</th><th>CN I/F Signals</th><th>C C W-command</th><th>C W-command</th></tr><tr><td>“ 0 ” or “ 2 ”</td><td>90° difference 2-phase pulse (A/B-phase)</td><td>PULS SIGN</td><td><p>B-phase advance 90° to A-phase</p></td><td><p>B-phase delays 90° from A-phase</p></td></tr><tr><td>“ 1 ”</td><td>CW pulse row + CCW pulse row</td><td>PULS SIGN</td><td><p>t2 t2</p></td><td><p>t3 t2 t2</p></td></tr><tr><td>“ 3 ”</td><td>Pulse row + Sign</td><td>PULS SIGN</td><td><p>t4 t5 t5 “H”</p></td><td><p>t4 t5 t5 “L”</p></td></tr></table> <p>Minimum necessary time:</p> <table><tr><th></th><th>Line driver I/F</th><th>Open collector I/F</th></tr><tr><td>t 1</td><td>2(μ s) or longer</td><td>5(μ s) or longer</td></tr><tr><td>t 2</td><td>1(μ s) or longer</td><td>2.5(μ s) or longer</td></tr><tr><td>t 3</td><td>1(μ s) or longer</td><td>2.5(μ s) or longer</td></tr><tr><td>t 4</td><td>1(μ s) or longer</td><td>2.5(μ s) or longer</td></tr><tr><td>t 5</td><td>1(μ s) or longer</td><td>2.5(μ s) or longer</td></tr><tr><td>t 6</td><td>1(μ s) or longer</td><td>2.5(μ s) or longer</td></tr></table> <p>If 2-phase pulse with 90° deg. Dif. is selected, multiplication can be changed with parameter No. 27 „Command pulse multiplication setting“, and count command pulses with signal logic described in the fig. below. At other setting, count command pulsed with it starting (in logic reversal, descending)</p> <p>2 : counts at multiplication of 2 and 4 4 : counts at multiplication of 4</p> <ul style="list-style-type: none">By changing parameter No. 28 „Command pulse logic reversal“, command input logic (PULS/SIGN) can be reversed individually for 2 systems, based on the above figure.	Value	Command pulse	CN I/F Signals	C C W-command	C W-command	“ 0 ” or “ 2 ”	90° difference 2-phase pulse (A/B-phase)	PULS SIGN	<p>B-phase advance 90° to A-phase</p>	<p>B-phase delays 90° from A-phase</p>	“ 1 ”	CW pulse row + CCW pulse row	PULS SIGN	<p>t2 t2</p>	<p>t3 t2 t2</p>	“ 3 ”	Pulse row + Sign	PULS SIGN	<p>t4 t5 t5 “H”</p>	<p>t4 t5 t5 “L”</p>		Line driver I/F	Open collector I/F	t 1	2(μ s) or longer	5(μ s) or longer	t 2	1(μ s) or longer	2.5(μ s) or longer	t 3	1(μ s) or longer	2.5(μ s) or longer	t 4	1(μ s) or longer	2.5(μ s) or longer	t 5	1(μ s) or longer	2.5(μ s) or longer	t 6	1(μ s) or longer	2.5(μ s) or longer
Value	Command pulse	CN I/F Signals	C C W-command	C W-command																																									
“ 0 ” or “ 2 ”	90° difference 2-phase pulse (A/B-phase)	PULS SIGN	<p>B-phase advance 90° to A-phase</p>	<p>B-phase delays 90° from A-phase</p>																																									
“ 1 ”	CW pulse row + CCW pulse row	PULS SIGN	<p>t2 t2</p>	<p>t3 t2 t2</p>																																									
“ 3 ”	Pulse row + Sign	PULS SIGN	<p>t4 t5 t5 “H”</p>	<p>t4 t5 t5 “L”</p>																																									
	Line driver I/F	Open collector I/F																																											
t 1	2(μ s) or longer	5(μ s) or longer																																											
t 2	1(μ s) or longer	2.5(μ s) or longer																																											
t 3	1(μ s) or longer	2.5(μ s) or longer																																											
t 4	1(μ s) or longer	2.5(μ s) or longer																																											
t 5	1(μ s) or longer	2.5(μ s) or longer																																											
t 6	1(μ s) or longer	2.5(μ s) or longer																																											
2	B	Feed forward filter	0 to 6400	<ul style="list-style-type: none">Set a time constant of the feed forward filter. Time constant of filter (μs) = Setting value × 10 (μs) Note) If the setting value is 0 - 39, time constant of filter will be 0 (μs).																																									

Parameter No.		Parameter	Set range	Functions/Contents
Page	No.			
3	0	2 nd . velocity loop gain	25 to 3500	<ul style="list-style-type: none"> This is a proportional gain of velocity loop. The larger the setting value, the larger the gain. Optimum value of the velocity loop gain differs depending on the load inertia and the motor type. Changeover setting to the 2nd. gain can be set with the 2nd. gain setting of parameter No.33.
3	1	2 nd . loop integration time constant	1 to 1000	<ul style="list-style-type: none"> This is an integration time constant of velocity amplifier. The smaller the setting, the faster the integration. <p>Note) If integration time constant is set to the maximum value (1000) of the setting range, it will be infinite.</p>
3	2	2 nd . position loop gain	10 to 1000	<ul style="list-style-type: none"> Sets the 2nd. position loop gain. Unit of the setting value is [1/s]. The larger the setting, the higher the servo stiffness (represented by hardness at servo lock) at position control. <p>Note) Note that too large setting may cause an oscillation.</p> <ul style="list-style-type: none"> Changeover to the 2nd. gain can be set with the 2nd. gain setting of parameter No.33.
3	3	2 nd . gain setting	0 to 2	<ul style="list-style-type: none"> Set the changeover mode of the 2nd. gain setting for parameters No. 30 - 32. <p>0 : No changeover to the 2nd. gain. 1 : Automatic changeover to the 2nd. gain. 2 : Changeover to the 2nd. gain with I/F input signal (in preparation).</p>
3	4	Delay time setting for automatic changeover to 2 nd . gain	0 to 10000	<ul style="list-style-type: none"> Set delay time until changeover to the 2nd. gain in case of setting 1 with parameter No.33. This will be the delay time after no command pulse input remains. <p>Unit: [2ms.]</p>
3	5	2 nd . numerator of pulse division/ multiplication	1 to 10000	<ul style="list-style-type: none"> Set the numerator of command pulse division/multiplication ratio. Changeover to the 2nd. numerator of division/multiplication can be set with I/F input signal (in preparation).

Parameter No.		Parameter	Set range	Functions/Contents																																				
Page	No.																																							
3	6	Smoothing filter setting	0 to 5	<ul style="list-style-type: none">• Select a kind of digital filter for the command pulse.• The larger the figure, the slower the response to input pulse.																																				
3	7	Jogging speed setting	0 to 500	<ul style="list-style-type: none">• Set jogging speed.• Set with necessary jogging speed (unit [r/min])																																				
3	8	3 rd . speed/velocity setting	-7000 to 7000	<ul style="list-style-type: none">• Set 3rd. speed, when internal velocity command becomes active as same as parameter No.18.																																				
3	9	4 th . speed/velocity setting	-7000 to 7000	<ul style="list-style-type: none">• Set 4th. speed, when internal velocity command becomes active as same as parameter No.18.																																				
3	B	Analog monitor output signal changeover	0 to 1	<ul style="list-style-type: none">• Changeover the content to be outputted to the analog monitor. 0 : Motor speed (r/min.) 1 : Position deviation (P)																																				
3	C	Counter clear input mode	0 to 1	<ul style="list-style-type: none">• With this parameter, deviation counter clear can be made either with the edge of the deviation counter clear signal or with the level. "0" : Clears with the level. "1" : Clears with the edge.																																				
3	D	Sequence at alarm	0 to 3	<ul style="list-style-type: none">• Set control pattern to stop motor at alarm <table border="1"><tr><td>0</td><td>DB ON</td><td>DB ON</td></tr><tr><td>1</td><td>Free-run</td><td>DB ON</td></tr><tr><td>2</td><td>DB ON</td><td>Free-run</td></tr><tr><td>3</td><td>Free-run</td><td>Free-run</td></tr></table> <p>DB: Dynamic brake</p> <p>Note) When parameter is changed, write-in to EEPROM, then re-enter the power.</p>	0	DB ON	DB ON	1	Free-run	DB ON	2	DB ON	Free-run	3	Free-run	Free-run																								
0	DB ON	DB ON																																						
1	Free-run	DB ON																																						
2	DB ON	Free-run																																						
3	Free-run	Free-run																																						
3	E	Seaquake at Servo-Off	0 to 7	<ul style="list-style-type: none">• Set action pattern at Servo-Off. <table border="1"><tr><th>Value</th><th>Action at decel.</th><th>Action at stop</th><th>Dev. Counter</th></tr><tr><td>0</td><td>DB ON</td><td>DB ON</td><td>Clear</td></tr><tr><td>1</td><td>Free-run</td><td>DB ON</td><td>Clear</td></tr><tr><td>2</td><td>DB ON</td><td>Free-run</td><td>Clear</td></tr><tr><td>3</td><td>Free-run</td><td>Free-run</td><td>Clear</td></tr><tr><td>4</td><td>DB ON</td><td>DB ON</td><td>Retain</td></tr><tr><td>5</td><td>Free-run</td><td>DB ON</td><td>Retain</td></tr><tr><td>6</td><td>DB ON</td><td>Free-run</td><td>Retain</td></tr><tr><td>7</td><td>Free-run</td><td>Free-run</td><td>Retain</td></tr></table> <p>Note) When parameter is changed, write-in to EEPROM, then re-enter the power.</p>	Value	Action at decel.	Action at stop	Dev. Counter	0	DB ON	DB ON	Clear	1	Free-run	DB ON	Clear	2	DB ON	Free-run	Clear	3	Free-run	Free-run	Clear	4	DB ON	DB ON	Retain	5	Free-run	DB ON	Retain	6	DB ON	Free-run	Retain	7	Free-run	Free-run	Retain
Value	Action at decel.	Action at stop	Dev. Counter																																					
0	DB ON	DB ON	Clear																																					
1	Free-run	DB ON	Clear																																					
2	DB ON	Free-run	Clear																																					
3	Free-run	Free-run	Clear																																					
4	DB ON	DB ON	Retain																																					
5	Free-run	DB ON	Retain																																					
6	DB ON	Free-run	Retain																																					
7	Free-run	Free-run	Retain																																					
3	F	I/F function select	0 to 5	<ul style="list-style-type: none">• Input/output function of interface can be selected. 0 : Factory setting 1 : Position control 1 2 : Position control 2 3 : Position control 3 4 : Velocity control 1 5 : Velocity control 2 <p>For functions of each pin when setting this parameter, refer to 4-3, „Interface connector for selected Input/Output Signals“.</p>																																				

5.2 System Management Parameter, System Parameter

Since parameters with parameter No. other than user parameter No. indicated in Section 5-1 are used to set the control conditions of the driver and are decided/set by the Indramat according to the type of the driver and the specifications of applicable motor, etc. do not change the setting values.

No.	Parameter	No.	Parameter
50	Motor pole setting	60	(own use)
51	Encoder pulse setting	61	(own use)
52	J/T ratio	62	(own use)
53	Current proportional gain	63	(own use)
54	Current integration gain	64	(own use)
55	Overspeed level	65	(own use)
56	Max. output torque setting	66	(own use)
57	Overload time constant	67	(own use)
58	Overload level	68	(own use)
59	(own use)	69	(own use)
5A	(own use)	6A	(own use)
5B	(own use)	6B	(own use)
5C	(own use)	6C	(own use)
5D	(own use)	6D	(own use)
5E	System control parameter X	6E	(own use)
5F	EEPROM check sum	6F	(own use)
70	(own use)		
71	(own use)		
72	(own use)		
73	(own use)		
74	(own use)		
75	(own use)		
76	(own use)		
77	(own use)		
78	(own use)		
79	(own use)		
7A	(own use)		
7B	(own use))		
7C	(own use)		
7D	(own use)		
7E	(own use)		
7F	(own use)		

6 Function

6.1 Protective function

(1) Summary

This driver has various protective functions. If these functions are activated, the servo driver will TRIP while the alarm output signal (ALM) changes from ON to OFF.

Note) In case of TRIP

7 segment LED on the front panel displays an error code which indicates the main cause and all the digits will flash.

Details of protective functions / Alarm list

Protective function	Error code No.	Contents	Solution
Overvoltage protection	12	Voltage of the converter section increased to approx. 200V or more (for 100V type) and approx. 400V or more (for 200V type), due to regenerative energy.	<ul style="list-style-type: none"> Make the deceleration time longer or lower the load inertia. <p>Note) Regenerative braking cannot be used continuously.</p>
Undervoltage protection	13	Power supply voltage dropped because of instantaneous power failure or lack in the power supply capacity.	<ul style="list-style-type: none"> Confirm if the power supply voltage is within the allowable range. <p>Note) Pay attention to voltage drop or open-phase of the power due to the lack of power supply capacity, or rush current at power-ON.</p>
Overcurrent protection	14	Output current of converter section increased abnormally.	<ul style="list-style-type: none"> After turning off the power supply completely, check connecting lines U,V,W of the motor if they shorted mutually. Confirm the insulation resistance between the motor connecting lines U,V,W and motor earth E, and check the existence of the deterioration of the motor insulation. If overcurrent protection is activated even with turning on the power supply again after the checking, shut off the power supply immediately as there is a possibility of having a failure.

Protective Function	Error code No.	Contents	Solution
Overload protection	16	<ul style="list-style-type: none"> • Driver is used continuously with output current exceeding its rated current. • Miswriting and breaking of wire were found in the connection with the motor connecting lines U, V, W. 	<ul style="list-style-type: none"> • Set acceleration/deceleration time longer or lower the load. Or use the larger capacity motor and driver. • Confirm connection of the motor connecting lines U,V, W. • Per the adjusting procedure, set position loop gain and velocity loop gain smaller and also set velocity loop integration time constant larger.
Encoder Error Protection	22	<ul style="list-style-type: none"> • Error such as broken wire was found in the connection with the encoder. • Failure of the encoder 	<ul style="list-style-type: none"> • Confirm connection error of the encoder and connection state of the connector CN SIG. • Check the power supply voltage($5V \pm 5\%$) at the encoder side. • (Especially, pay attention if the encoder cable is long.)
Over-position deviation protection	24	Position deviation pulses exceeds the permissible range set with parameter No.23 (Over-position deviation setting).	<ul style="list-style-type: none"> • Confirm if the motor runs per the position command pulses. • Confirm the output torque with the torque monitor and check if the output torque is not saturated. • Set user parameter No.06 "Torque limit setting" to the maximum value(300%). • Confirm the gain adjustment per the adjusting procedure. • If no problem is found per the above, set acceleration/deceleration time longer and reduce the velocity by lowering the load.
Deviation counter overflow protection	29	Position deviation pulse became more than 2^{27} (= 134217728).	Confirm the same in the above item.
Overvelocity protection	26	The motor speed exceeds the velocity limit value set with system parameter No.65.	<ul style="list-style-type: none"> • Confirm if excessive velocity command is not given and also confirm the input frequency of the command pulse and the division/multiplication ratio. • Confirm if overshoot is not generated at acceleration, because of gain adjustment failure.

Protective function	Error code No.	Contents	Solution
Run limit input error protection	38	Both CW and CCW-run limit input are turned off.	<ul style="list-style-type: none"> Confirm if there is no error for the switch, the electric line and the power supply which are connected to CW and CCW-run limit input. Especially, confirm if startup of the control signal power supply (12 - 24V) is not late.
Command pulse multiplication protection	27	Division multiplication ratio setting set with parameters No.25 and 26 is not appropriate. (Multiplication ratio is too high.)	Set the division multiplication ratio so that the setting of the division multiplication becomes lower than 20 times.
EEPROM parameter error protection	36	Data is broken when reading-out data from EEPROM at power-ON.	Reset all parameters and write into EEPROM.
Other error protection	30 97 98 99	Judged that there is a possibility of having some errors with self-diagnostic function of the internal system.	Cut the power supply once, and turn it on again. If its tripped with the display written in the left, there is a possibility of the failure. Immediately cut the power supply.

Note1) To return from the TRIP, shutoff the power supply , and turn it on again after removing the cause. Or it is also possible by entering alarm clear signal (A-CLR). However, if the following protection function are activated, they cannot be cleared with A-CLR signal.

- Overcurrent protection
- Encoder error
- Self-diagnostic TRIP (system error, CPU error, other error)

In these cases, reset by turning on the power supply again.

Note2) If the overload protection is activated, it is possible to clear with alarm clear signal after approx. 10 seconds of alarm generated.

Note3) If EEPROM parameter error protection (Error code No.36) is activated, check all parameters and reset after turning on the power supply again.

Note4) The most possible cause which activates encoder error protection (Error code No.22) at the startup is based on errors of the connection between the driver and the encoder. Refer to page 3-6 "Wiring to connector CN SIG" , and check it again.

6.2 Automatic gain tuning

Note) For the availability of this function, refer to "Specifications for each model."

Outline

This function set appropriate gain automatically, by running the motor at certain pattern, presuming the load inertia from the required torque.

Applicability

The following conditions must be satisfied to apply this function.

Also, even if the following conditions are satisfied, there is a case this function cannot be applied depending on the loaded condition.

In that case, conduct the gain adjustment manually under the conventional method.

	Applicable Conditions
Load inertia	It should be more than 2 times of the motor rotor inertia and less than 15 times, with less fluctuation.
Load	<p>Stiffness of the machine should be high including coupling with the motor. (Belt driving etc. should not be used.)</p> <p>Backlash of gear etc. should be small.</p> <p>There should not be unbalanced load of more than 1/4 of the rated torque. (Especially, pay attention for the use with vertical shift axis.)</p> <p>Viscous load torque should be less than 1/4 of the rated torque.</p> <p>Even with oscillation state, the machine should be with no damage and safety problem.</p>

Cautions

Pay extra attention to safety. Shut off the power at oscillation, or turns to Servo-Off, then return the gain to factory setting with parameter

- (1) When error, Servo-Off or deviation counter clear occurs during automatic gain tuning, it turns to tuning error
- (2) The motor output torque during automatic gain tuning, is allowed to the max. torque, set with parameter No.06 „Torque limit setting“, and CW and CCW-run inhibit input will be ignored.
- (3) Oscillation may occur depending on the load, and the motor speed varies extremely.
- (4) If any error occurs during automatic gain tuning, shut off the power or turn to Servo-OFF immediately.
- (5) Though automatic gain tuning is executed, if the load inertia can't be presumed, the gain can't be changed, and remains its previous value before execution.

Automatic gain tuning action

- (1) Set machine stiffness No. and execute it (Higher the setting No. the harder the tuning can be made) to activate automatic gain tuning action
- (2) Rotate the motor 2 revolutions to CCW, 2 revolutions to CW. Make this as 1 cycle, and repeat this cycle 5 times max.
- (3) Operating acceleration increases two times per every cycle for the 3rd cycle. There are some cases when tuning will be completed before 5th cycle, or acceleration will not increase depending on the load. These cases are not malfunction.

Machine stiffness No.

- Represents the machine stiffness ratio and ranges from 1 to 9. To higher stiffness machine, higher No. can be set, hence the higher gain.
- Set this No. from lower one to higher one to repeat automatic gain tuning to stop till oscillation, noise and vibration occurs.

Operation

- (1) Travels the load where no problem to be seen if the motor makes 2 revolutions.
- (2) Prohibited the command
- (3) Turn to Servo-On
- (4) Activate automatic gain tuning
- (5) Write-in to EEPROM if no problem to be seen

Note) When such inputs as alarm, Servo-Off and deviation counter clear are entered during automatic gain tuning, it activates automatic gain tuning error.

6.3 Dynamic brake

This driver has an built-in dynamic brake for the emergency stop.

The dynamic brake will be activated in the following cases;

- (1) When the power supply is OFF
- (2) When it is Servo-OFF
- (3) When protective function is activated
- (4) During decelerating operation when CW-run limit input (CWL) is opened at the CW rotation.
- (5) During decelerating operation when CCW-run limit input (CCWL) is opened at the CCW rotation.

Note) 1. In case of the above (4) and (5), whether the dynamic brake should be operated or not can be selected by setting parameter No.0A.

Parameter No. 0A DB inaction at run limit	Dynamic brake
0	The brake will be activated and motor stops.
1	The brake will not be activated and motor makes free run stop.

6.4 Gain switch

Outline

Switches to 2nd. gain per the condition set with 2nd. gain setting (Parameter No.33).

Normal gain	2 nd gain
No.03 Velocity loop gain	No.30 2 nd . vel. loop gain
No.04 Vel. loop integration time constant	No.31 2 nd . loop integration time constant
No.20 Position loop gain	No.32 2 nd . position loop gain

2 nd . gain setting (No.33) value	Contents
0	No switch to 2 nd . gain
1	Automatic switch to 2 nd . gain
2	Switch to 2 nd . gain with external input signal (GAIN)

Automatic switch

Switched to 2nd. gain after preset time (set with parameter No.34 „Automatic 2nd. gain switch delay time setting“).

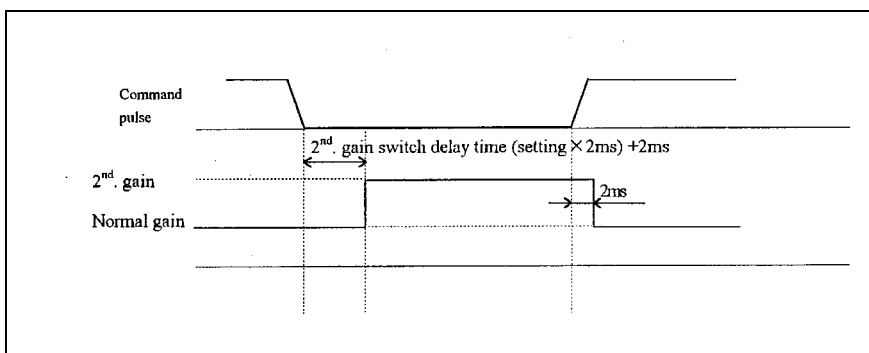


Fig. 6-5: Automatic switch

Manual switch

Switches to 2nd. from normal gain by entering (connection to COM-) gain switch input (GAIN, connector pin, when I/F function selection (parameter No. 3F) is set to „1“ or „2“.

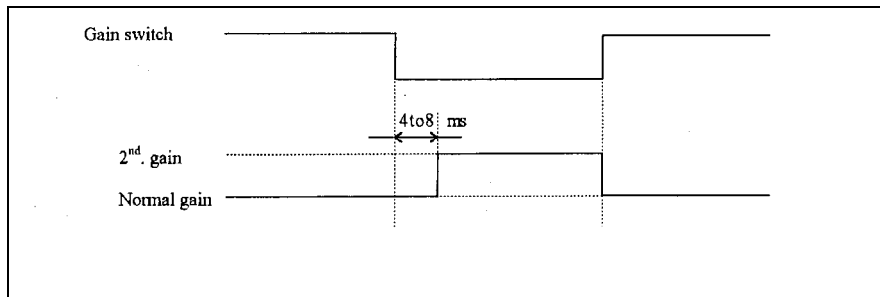


Fig. 6-6: Manual switch

Torque control mode

- Motor output torque can be commanded by torque command (TRQR) in this mode.
- Relation between torque command voltage and actual torque command can be specified with torque command input gain of parameter No. 1A.

$$\text{Torque command input gain [V/100\%]} = 3 \times \frac{250}{\text{Set Value}}$$

- Velocity limit has to be set at torque control mode. Velocity limit can be set with selected input among external analog/internal speed of 1 to 4.

Note) When motor speed get close to vel. limit value, torque output may not follow to torque command.

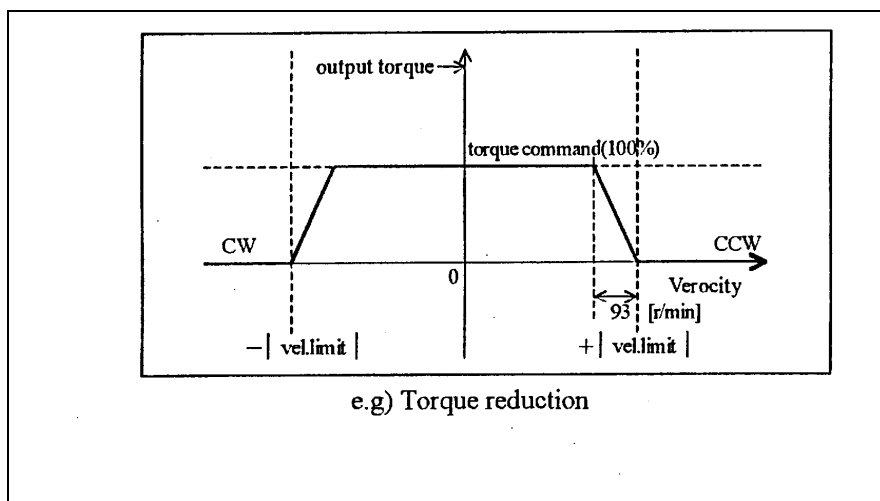




Fig. 6-7: Torque reduction

Trial function

Trial run with motor alone can be performed with front panel operation. Set front panel to JOG mode to get „SrV_on“ display, and press  or  to execute Jogging.

Jogging speed can be set with parameter No.37, „Jog speed setting“ from 0 to 500 (r/min).

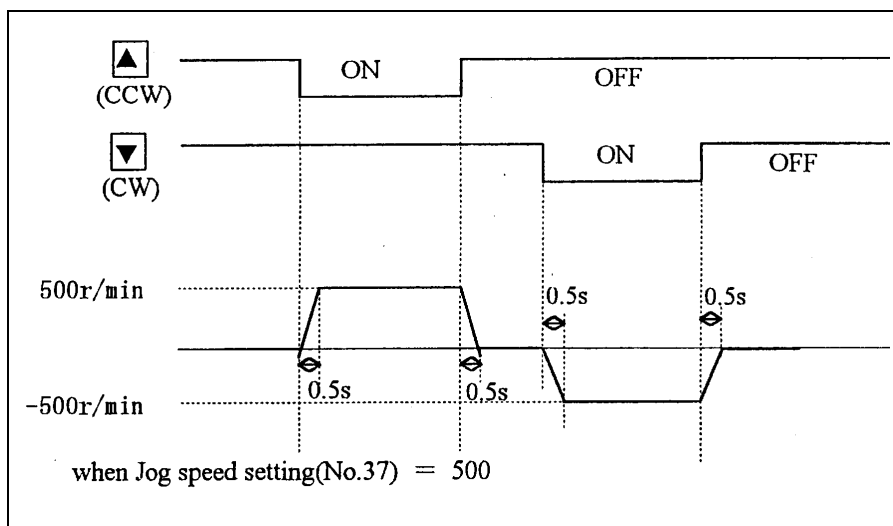


Fig. 6-8: Trial run function by parameter No. 37 = 500

Note1) When executing trial run, separate the motor from the load.

Note2) Jogging can't be executed while Servo-On signal being entered

Note3) Set parameter No.3E (Sequence at Servo-Off) to „0“ to „3“ (Counter clear), while executing Jogging.

7 Operation

7.1 Operation / Display of front panel

Composition of front panel

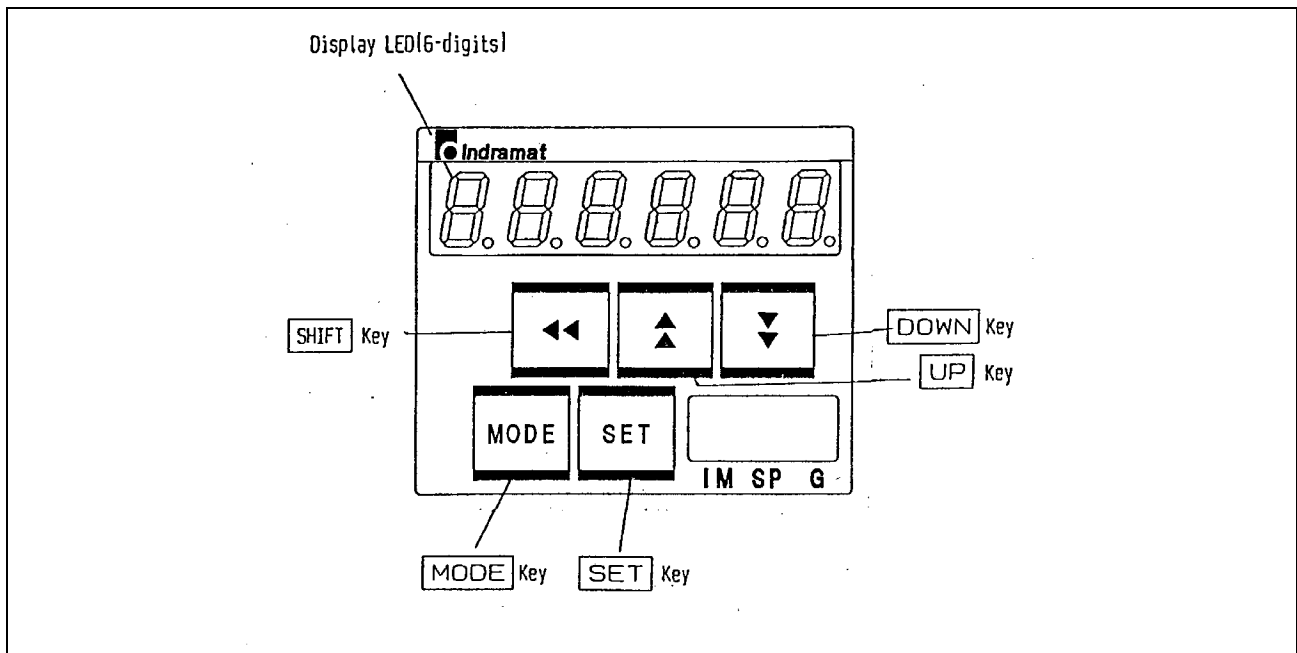








Abb. 7-9: Operation display




Outline of operation

- Use **MODE** switch to select a mode among Monitor mode, parameter setting mode, EEPROM write-in mode, Automatic tuning mode and JOG mode.

Each mode consists of [Selection display] and [Execution display]. Use **SET** switch to select these.

For selection or execution at each mode, use   

- Data can be changed at figure with flashing decimal. When there is no flashing,    operation becomes void.

Switch	Active condition	Function
MODE	Valid with selection display	Mode switching
SET	Valid anytime	Selection and execution display switching
 	Valid when flashing decimal is displayed	Data change, Parameter selection, execution
		Shift to upper figure of data change

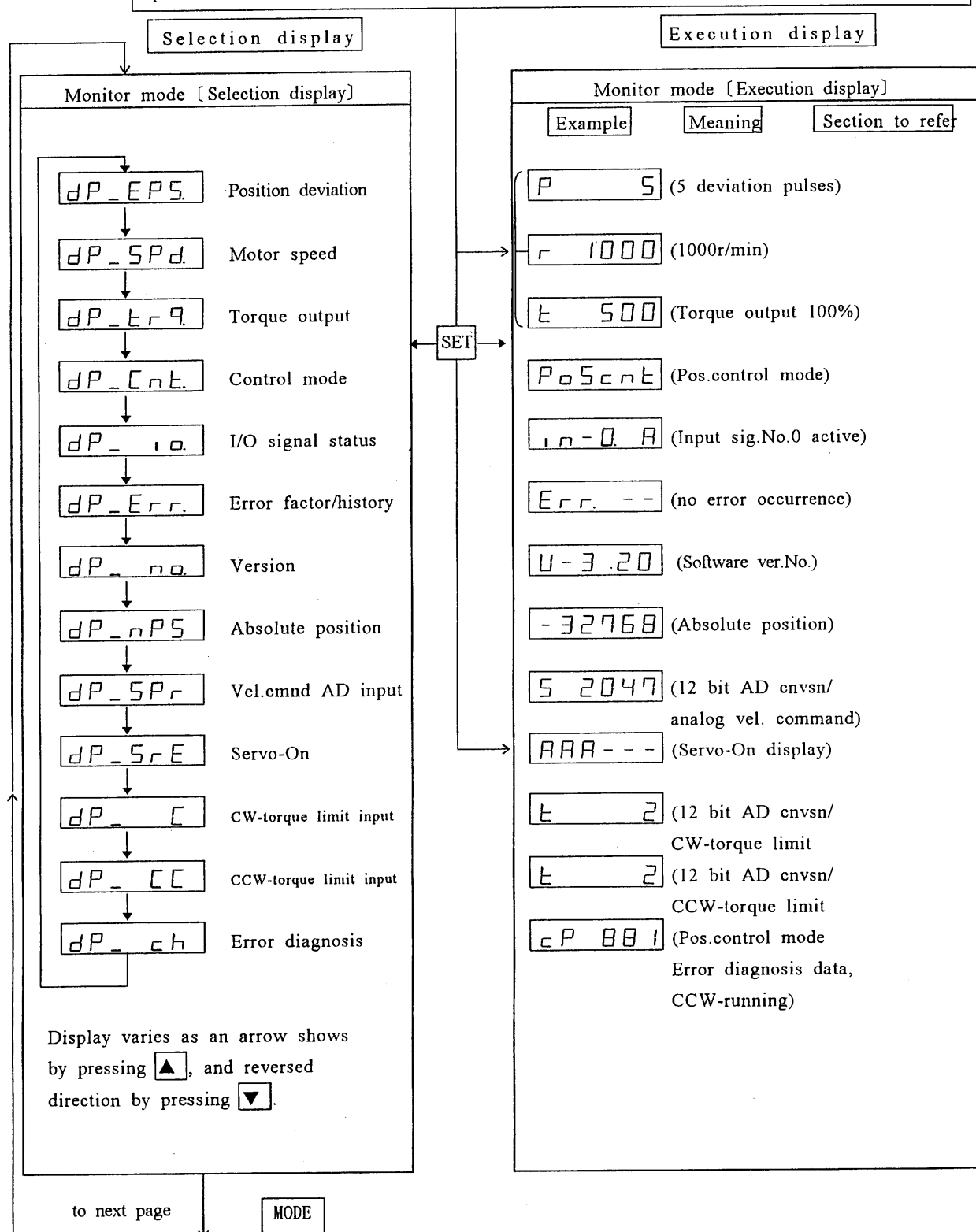
- At selection display of each mode, upper figures are represented with 2 alphabetical letters + under bar.

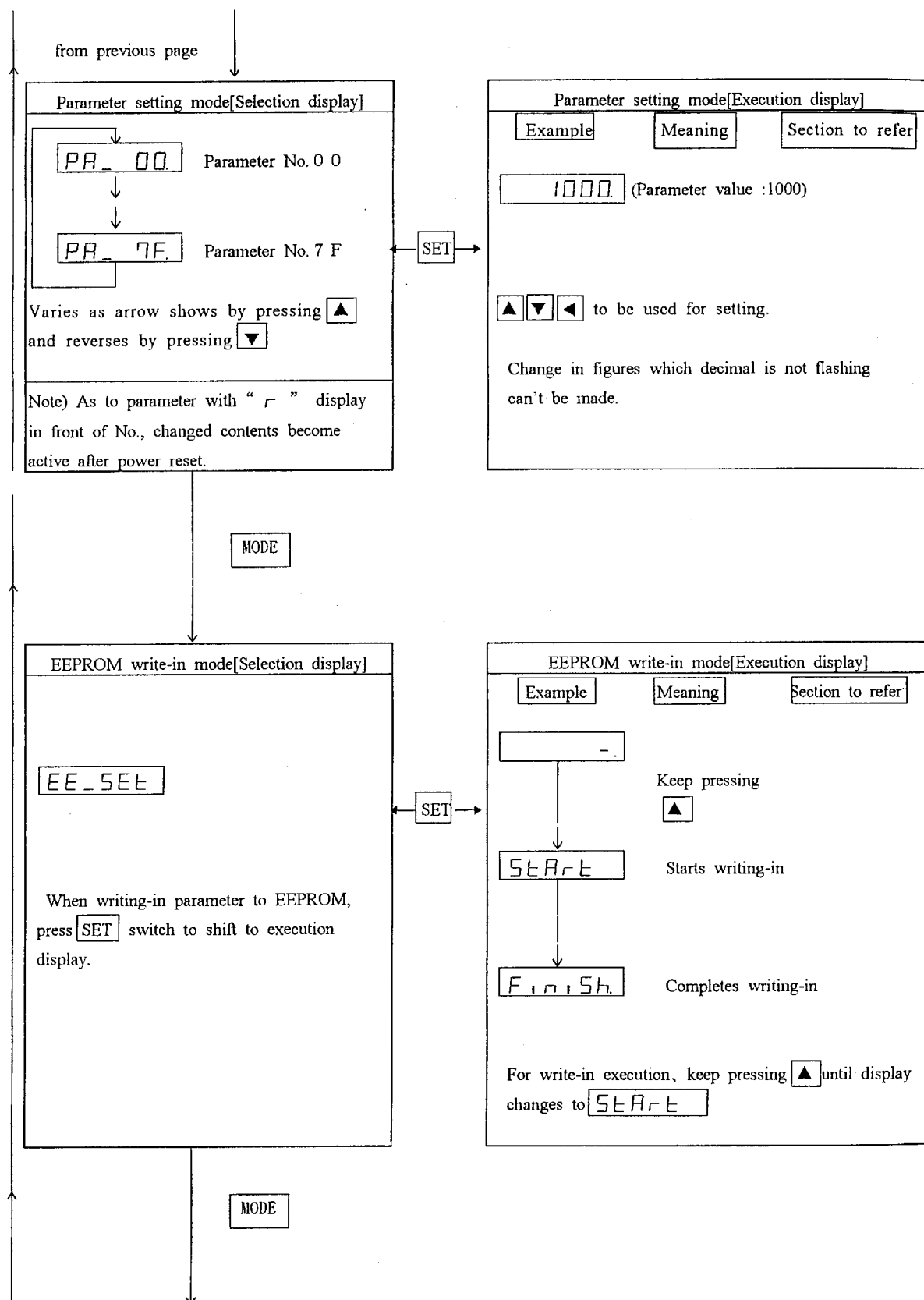
Mode	Upper figures at selection display
Monitor mode	d P _
Parameter setting mode	P A _
EEPROM write-in mode	E E _
Automatic gain tuning mode	A t _
JOG mode	J o G

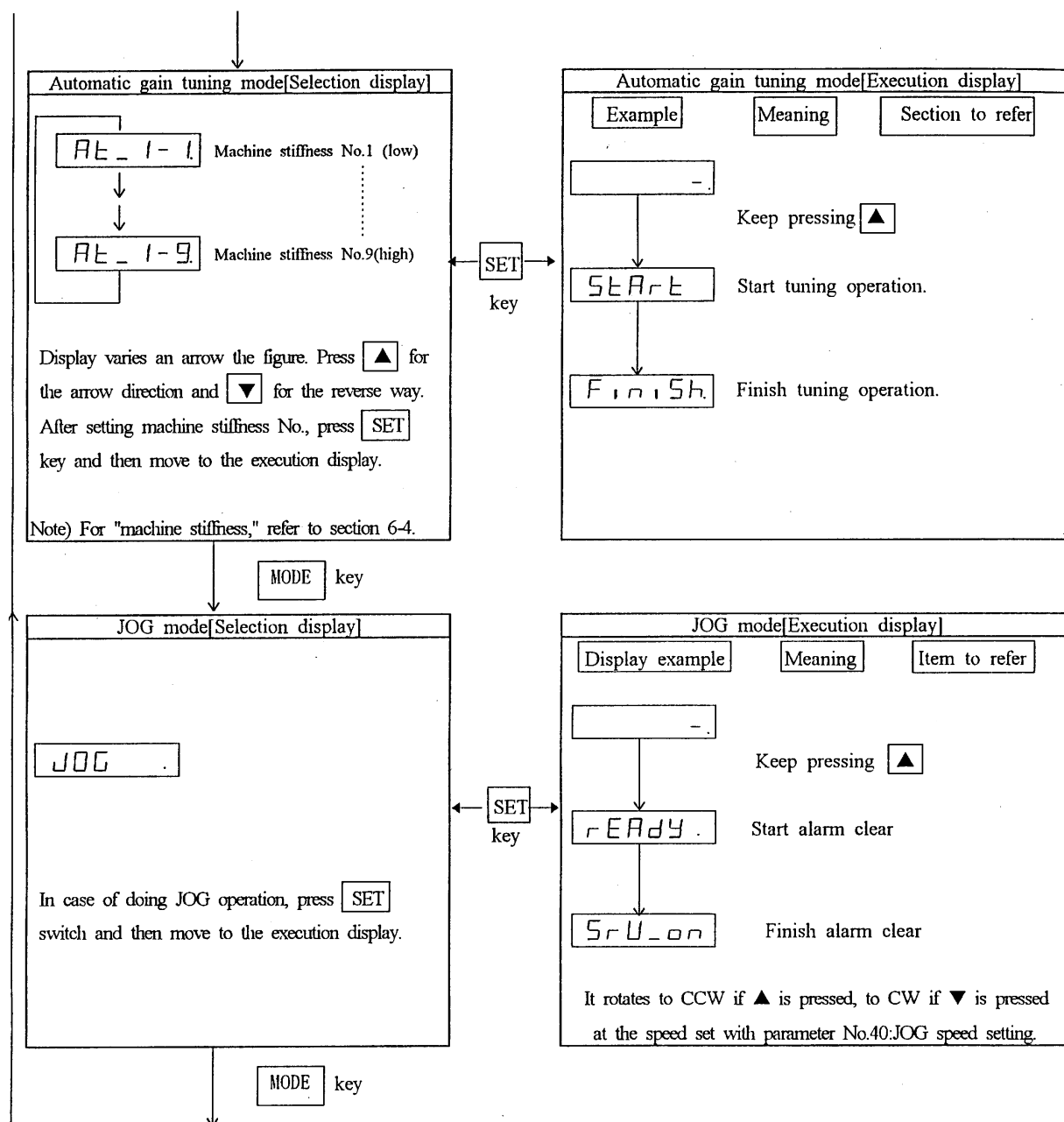
- When all of the figures flash, it means driver TRIP.

Display	Motor status
All figures flashing	TRIP
Normal display	Normal run

At Power-ON, LED display after LED check display (approx. 2 seconds) shows execution display (position deviation, motor speed or torque output) in monitor mode in accordance with setting of parameter No.01, "LED initial status".



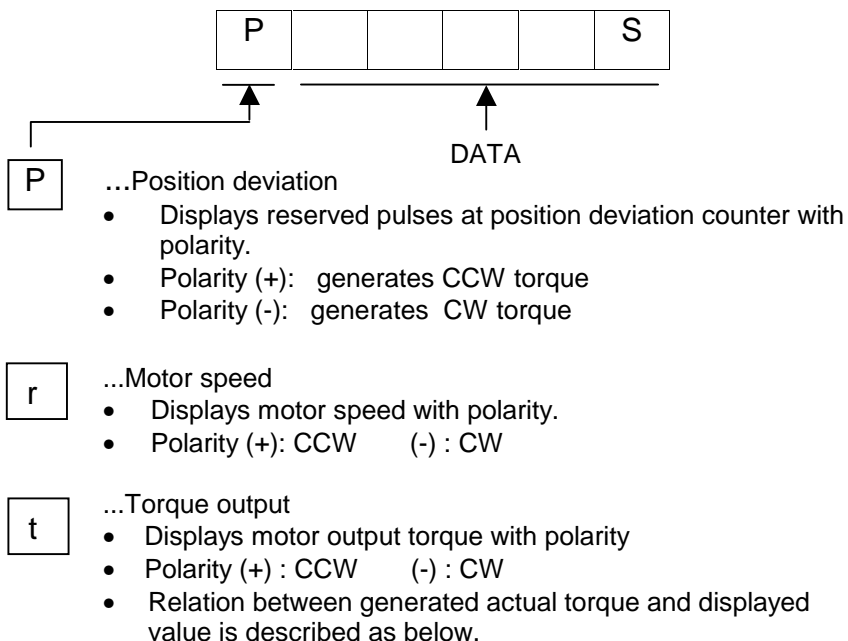




Details of Operation

1) Detail of monitor mode

(1) Display of position deviation, motor speed and torque output

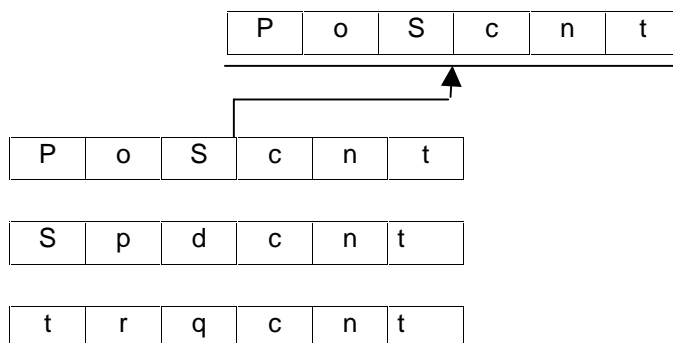


$$\text{Torque output (\%)} = \text{Displayed value} \times 0.2$$

Note) If polarity is (+), + symbol will not appear.

(2) Display of control mode

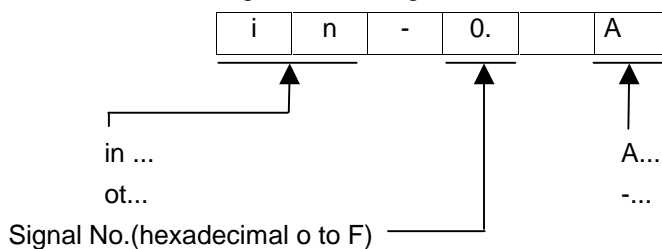
Displays present control mode



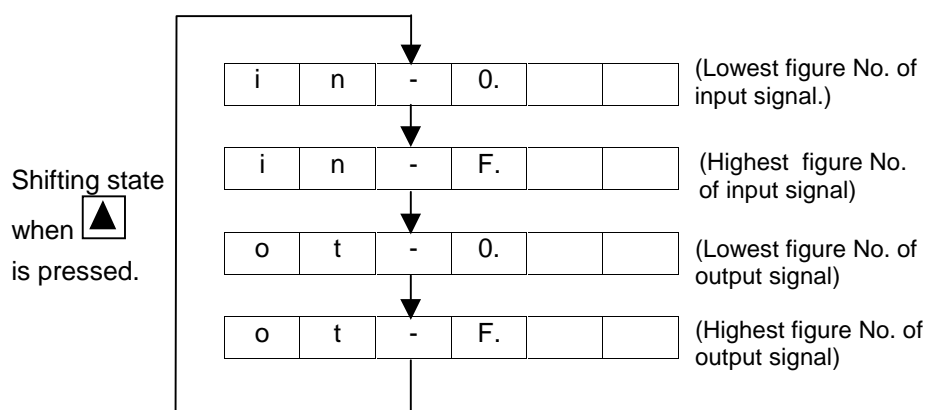
(3) Display of I/O signal status

- Displays control input/output signal status

Use this for checking correct wiring of connector CN I/F



- Press   to select signal to be monitored.



- Signal No. and its title

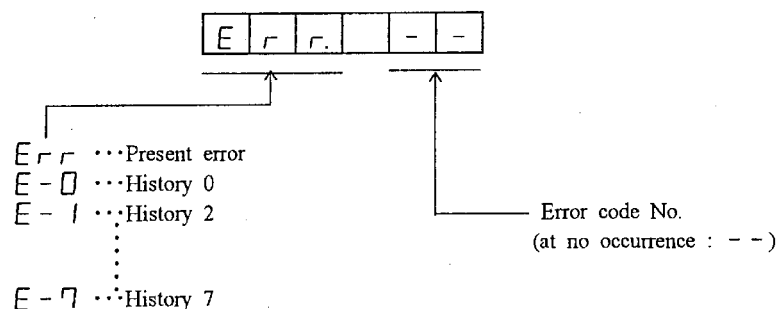
Input Signal				Output Signal			
No.	Title	Symbol	CN I/F PIN No.	No.	Title	Symbol	CN I/F PIN No.
0	Servo-On	SRV-ON	12 (o to 5)	0	Servo-Ready	S-RDY	27 (0)
1	Alarm clear	A-CLR	31 (o to 5)	1	Servo alarm	ALM	26 (0 to 5)
2	CW-run limit	CWL	29 (o to 5)	2	not in use	-	-
3	CCW-run limit	CCWL	30 (0 to 5)	3	not in use	-	-
4	C-mode switching	C-MODE	32 (0)	4	not in use	-	-
5	Vel. zero-cramp	ZEROSPD	10 (0,4,5)	5	Ext. brake release	BRK-OFF	27 (1 to 4)
6	Int. vel cmnd select 1	INTSPD-1	9 (4,5)	6	Positioning cmplt/Spd arvl.	COIN	25 (o to 5)
7	not in use	-	-	7	not in use	-	-
8	Cmnd pulse input limit	INH	9 (o to 3)	8	Zero-vel. detection	ZSP	27 (5)
9	Proportional action cmnd	P-CON	32 (3 to 5)	9	not in use	-	-
A	Deviation counter clear	CL	13 (0 to 3)	A	not in use	-	-
B	Switch to 2 nd . gain	GAIN	32 (1,2)	B	not in use	-	-
C	Cmnd div/multplctn switch	DIV	10 (1,3)	C	not in use	-	-
D	not in use	-	-	D	not in use	-	-
E	Int. vel.cmnd selection 2	INTSPD-2	13 (4,5)	E	not in use	-	-
F	not in use	-	-	F	Dynamic brake release	DB	-

Note1) Output signal on CN I/F pin No. with “-” is internal signal, and will not be fed out.

Note2) Figure in () of CN I/F pin No. is set value of parameter No. 3F.

④ Error factor and reference to history

- Past 8 errors can be traced back, including present error.



- Press to select history No to be referred.

(Press to go back older history.)

Note) If present error is as same as the past error (stored in history), present error and history 0 shows the same error code.

- Error and its content

Error code No.	Error contents	Error code No.	Error contents
12	Overvoltage error	30	CPU error
13	Undervoltage error	36	EEPROM parameter error
14	Overcurrent error	38	Run-limit input error
16	Overload error	97	Other error
22	Encoder signal error	98	Other error
24	Excess position deviation error	99	Other error
26	Overspeed error		
27	Command pulse division error		
29	Deviation counter overflow error		

Note) Error history can't be deleted.

⑤ Version No. display

Display version No. of software.

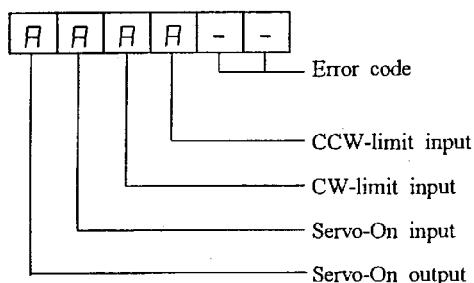
⑥ Absolute position display

Displays absolute position, referring the position at power entry as "0" (−32768 to 32767)

⑦ Velocity command AD value

Approx. 600 digit with AD value of 3V (−2048 to 2047)

⑧ Servo-On display



- : Inactive(signal is void)

H : Active(signal is valid)

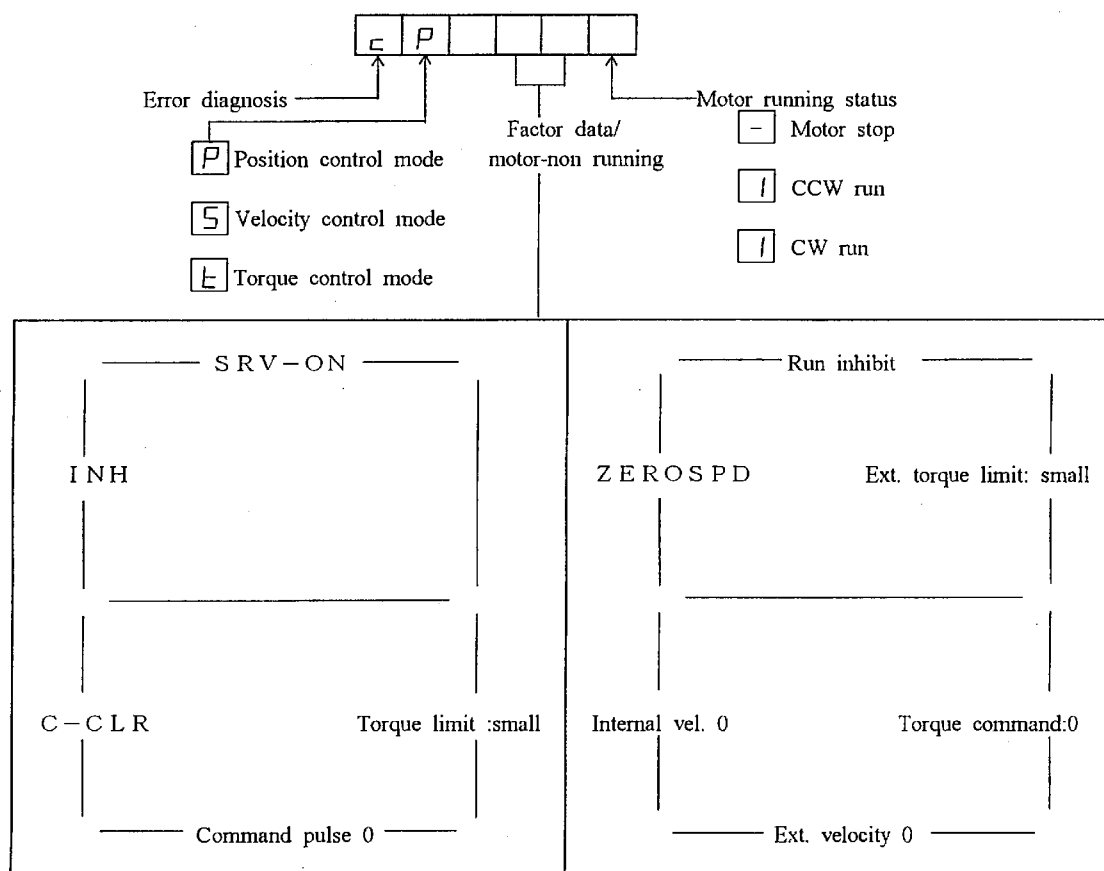
-	H
Open	COM—closed
Open	COM—close
Open	COM—close
Servo-Off	Servo-On

⑨ CW/CCW torque control AD value

Approx. 500 digit with AD value of 3V(−2048 to 2047)

⑩ Error diagnosis

Displays factors for motor non-running.



Corresponding LED turns off.

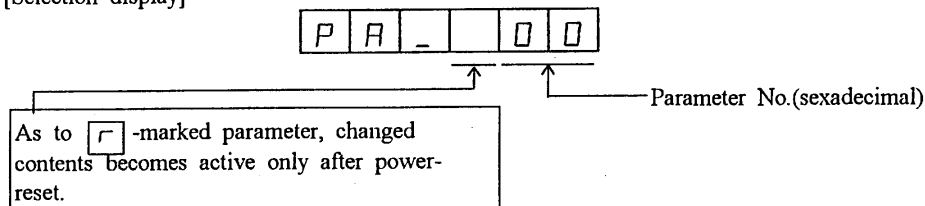
When motor runs, all LED becomes 8 8.

• Factors for each LED-turn-off

SRV-ON	Servo-On signal is not entered.
INH	Command pulse input inhibit signal(INH) is entered.
C-CLR	Deviation counter clear signal(CL) is entered.
Torque limit small	Setting value of parameter No.06 "Torque limit setting" is small.
Command pulse 0	No command is entered, or not in input status of setting value with parameter No.29, "Command pulse input mode setting".
Run inhibit	Parameter No.09, "Run inhibit input inactive" is set to "0", and CW or CCW run inhibit input signal is entered.
ZEROSPD	Parameter No.17, "Vel.zero-cramp inactive" is set to "0", and vel. zero-cramp signal is entered.
External torque limit: small	Parameter No.07"Torque limit input inhibit" is set to "0", and analog torque limit input (CWTL or CCWTL) is "0".
Internal vel.: 0	Internal velocity command is set to "0".
External vel.: 0	Analog velocity command input(SPR) is small.
Torque command:0	Analog torque command input(TRQR) is small.

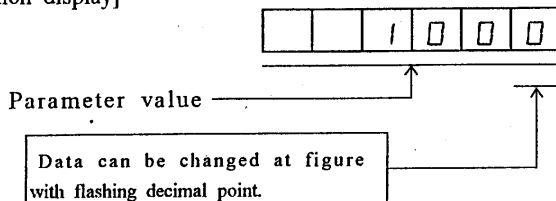
(2) Details of parameter setting mode

[Selection display]



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

[Execution display]



- Set parameter value by pressing ▲ ▼.
Increase value with ▲, and decrease with ▼.
- Shift a flashing decimal point to upper figure with ◀ and value can be changed.

Note) There is limit of shifting figures by parameter.

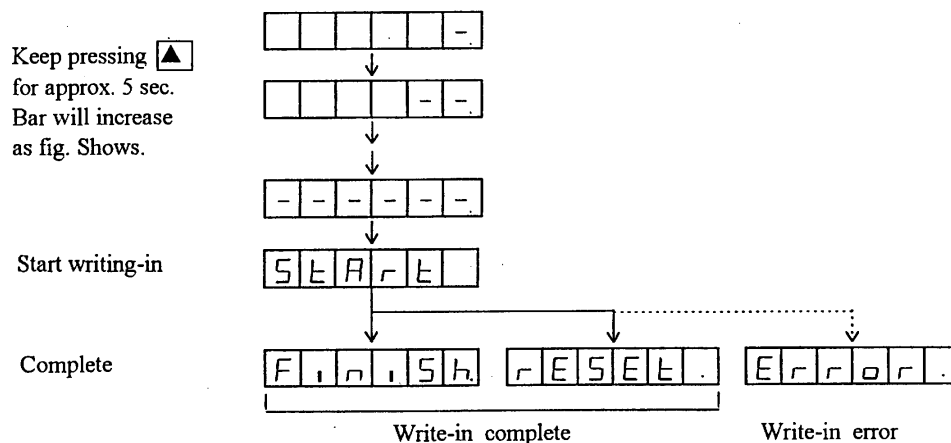
- As soon as parameter value is changed, its content will be reflected in control.

Note)1. Don't make a large value change to parameters which affect motor action(such as velocity loop gain and position loop gain), but change it incrementally.
Some parameters do not accept ◀ (shift key).

Note)2. Some parameters change motor action greatly depending on functions.(such as parameter No.02, "Control mode setting", parameter No.14, "Vel. command input reversal" and parameter No. 25/26, "Numerator/Denominator of command pulse division/multiplication" etc.). On changing these parameters, execute at Servo-Off status.

(3) Detail of EEPROM write-in mode

- To execute write-in, keep pressing ▲ until display changes to SETArt.



- When changing setting of parameter which content becomes active after resetting, will be displayed at write-in completion.

Turn off power supply and reset.

Note) Parameters which changed content become active after power reset are:

- Parameter No.27, "Command pulse multiplication setting"
- Parameter No.28, "Command logic reversal"
- Parameter No.29, "Command pulse input mode setting"

- After parameter write-in in completed, keep pressing to execute write-in again.

Note) 1. When write-in error occurs, execute write-in again. If error repeats several times, driver may be a failure. Contact to a distributor.

Note) 2. Don't shut off the power during writing-in.

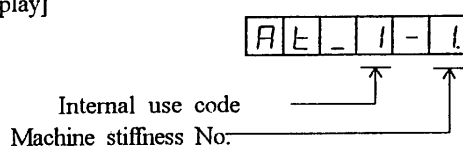
Wrong data may be written-in. In such a case, set all of parameters, then execute write-in again after careful check.

(4) Details of automatic gain tuning

Note) 1. For details, refer to section 6-4, 『Automatic gain tuning』

At automatic gain tuning mode, the motor makes 2 revolution each to CW and CCW. Travel the load so that 2 revolutions of the motor may not interfere.

[Selection display]



- Press to select machine stiffness No. Refer to section 6-4 for machine stiffness No.

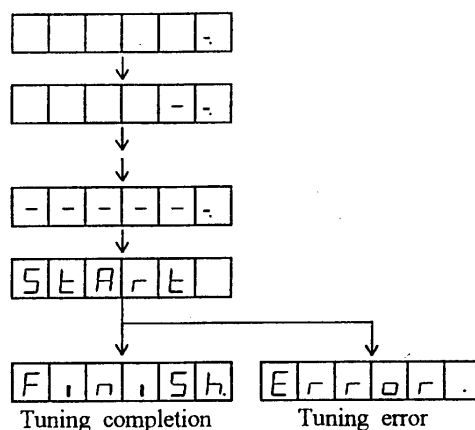
[Execution display]

- To execute automatic gain tuning, turn to Servo-On, then keep pressing until display changes to

Keep pressing for approx. 5 sec. Bar will increase as fig. Shows.

Motor start

Complete



- Keep pressing at completion, re-start can be made.

Note) 1. Automatic gain tuning error




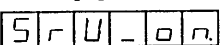
Error occurs when the following status occurs during tuning;

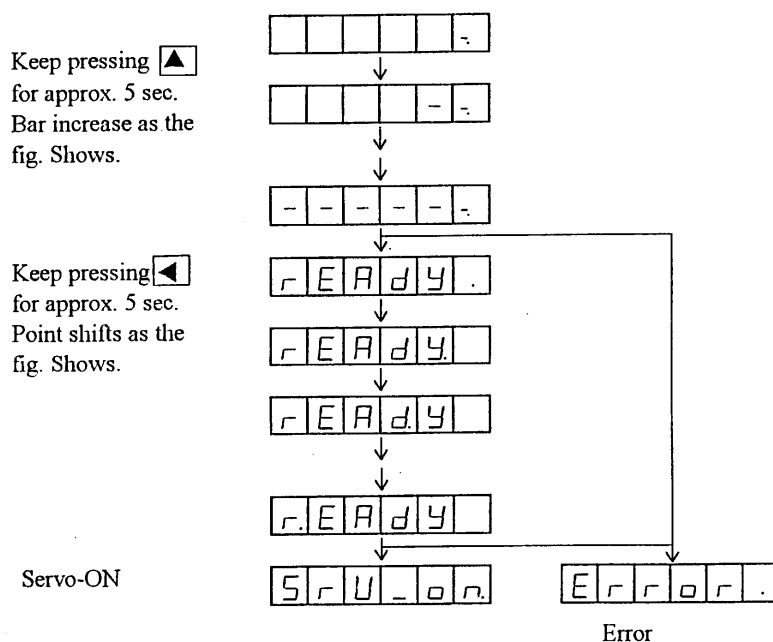
- ① while tuning:
 - error occurs
 - turns to Servo-Off
 - deviation counter is cleared
- ② output torque saturates because of too large inertia and load
- ③ tuning can't be executed correctly due to oscillation




When tuning error occurs, each gain returns to previous value before execution.
Except an error, the driver does not trip, therefore pay much attention especially to oscillation.

Note) 2. Parameter data related servo gain at tuning execution, will not be written-in to EEPROM.
Instead, it will return to previous data before tuning execution at power shut off. If tuning result is to be reflected to control, write-in data to EEPROM before shutting off the power.

(5) Details of JOG mode

- To execute Jogging, turns to Servo-OFF, and keep pressing  till  appears.
Then press  till display changes to .



- While pressing  at Servo-ON, the motor runs to CCW at JOG speed.
The motor runs to CW, by pressing  at the same time.
- Turns to Servo-OFF by pressing .

Note) 1. Don't enter Servo-ON signal(SRV-ON) during jogging.

Note) 2. Set parameter No.3E, "Sequence at Servo-OFF" to 0 to 3(counter clear) during jogging.

8 Specifications

8.1 Specification for each model

Indramat Model Name			DMD01.1	DMD-W012	DMD-W022	DMD-W042	DMD-W082
Output			W	100	200	400	750
Cont. input current (3-phase)			A	0.7	1.1	1.8	4.0
Continuous Output Current			Arms	1.0	1.6	2.5	4.3
Momentary Max. Output Current			Ao-p	4.3	6.9	10.5	18.3
Rotary Encoder Feedback Signal			P/r	2500	2500	2500	2500
Overcurrent Protection Level			A	(20)	(20)	(20)	(40)
Overvoltage Protection Level			VDC	(400)	(400)	(400)	(400)
Undervoltage Protection Level			VDC	(190)	(190)	(190)	(190)
Overspeed Protection Level			r/min	6000	6000	6000	6000
External power supply			24V / 0.5A				
Parameter Setting at Delivery	03	Speed loop gain	Setting value	100	100	100	100
	04	Speed loop integration time constant	Setting value	50	50	50	50
	06	Torque limit setting	%	300	300	300	300
	13	Speed command input gain	Setting value	500	500	500	500
			V/kr/min	2	2	2	2
	20	Position loop gain	Setting value	50	50	50	50
Automatic Gain Tuning Function			-	Available	Available	Available	Available
Dynamic Brake Function			-	Available	Available	Available	Available
Product Weight			kg	Approx. 0.9	Approx. 0.9	Approx. 1.0	Approx. 1.2

8.2 General Specifications

Basic Specifications	Input power supply	200V Type		1- or 3-phase 200 - 230V (+10% - -15%), 50/60Hz
	Control Method			IGBT PWM Method (Sine-wave driving)
	Driver accuracy			Speed and torque controll: 5mV ± 2%
	Feedback			Incremental encoder(2,500P/r) 10-line wire saving type
	Ambient condition	Temperature		Working : 0 - +50 Storage :-20 - +80
		Humidity		Working/storage : 90%RH or less (No condensation)
Vibration		4.9m/s ² or less (0.5G) 10 - 60Hz (No continuous operation at resonance point)		
Function	Control mode			① Position control ② Analog velocity control ③ Torque control ④ Position/Velocity control ⑤ Position/Torque control ⑥ Velocity/Torque control Select by parameters.
	Input signal	Control input		Fixed input ① Servo-ON ② Alarm clear ③ CW-run limit ④ CCW- run limit Selected input ① Counter clear ② Command pulse input limit ③ Zero velocity command ④ Control mode changeover ⑤ Gain changeover ⑥ Proportional control changeover ⑦ Internal velocity command changeover 1 ⑧ Internal velocity command changeover 2 ⑨ Command division multiplication changeover * For allocating selected input signal to I/F connector pin, select with parameters.
		Analog command input	Velocity command input	Scale setting and command polarity through parameters. (2 (V)/1000 (r/min) standard)
		Pulse row command input	Input pulse row status	Recommended differential input Max.500KPPS. Open Collector Max.200KPPS Input status can be selected by parameters. (① Forward/reverse run ② A/B-phase ③ Command/Direction)
	Output signal	Control output		Fixed output ① Servo-alarm ② Positioning-complete/ Velocity arrival Selected output ① Servo-ready ② External brake release ③ Zero velocity detection * For allocating selected output signal to I/F connector pin, select with parameters.
		Encoder feedback signal		Line driver output of encoder pulse (A, B, Z) Open collector output of Z-phase pulse
		Monitor output		① Velocity/Deviation monitor ② Torque monitor Scale setting through parameters.
	Built-in function	Regenerative resistor		Built-in regenerative resistor (see “11.3 Regenerative energy”)
		Dynamic brake function		Available
		Zero-velocity clamp		Turns to servo-lock status with zero-velocity clamp command input. (Select function through parameters. Applicable only to velocity control mode)

		Division/Multiplication of command pulse		1 - 10,000/1 - 10,000 Setting can be changed in two ways by external signals. (Valid only when "1" or "3" is set with parameter No.3F.)
		Division function of RE feedback pulse		1 - 10,000/1 - 10,000 (It is less than 1 by reducing to a common denominator.)
		Control gain changeover function		Changeover of 1st and 2nd control gain is possible by external signals (for position, velocity proportion/velocity integration) (Valid only when "1" or "2" is set with parameter No.33.)
		Protective function	Hardware Error	Overvoltage, Undervoltage, Overspeed, Overload, Overcurrent, Encoder error
			Software Error	CPU error, system error, etc.
		Trace back function of alarm data	Traceable back to the past 8 alarm data including current alarm data.	
		Setting Key, LED Display	① 5 Keys (MODE, UP, DOWN, SHIFT, SET) ② 6-Digit LED	
Performance	Applicable load inertia		Less than 30 times the inertia of motor (Less than 20 times for 750W)	
	Frequency characteristics		300Hz or more (at $J_M = J_L$)	

Regenerative energy

Condition: Permissible regenerative energy (Continuous regen) is determined, considering the temperature-rise of the driver at the rating output.

Driver/Motor combination	Capacitor (F)	Stored energy of Capacitor (J)	Peak regen power (W)	Continuous regen power (W)
DMD01.1-W012N with MMD012A	270	8.91	1600	10
DMD01.1-W022N with MMD022A	270	8.91	1600	5
DMD01.1-W042N with MMD042A	540	17.82	1600	7
DMD01.1-W082N with MMD082A	810	26.73	1600	5

8.3 Dimensions

Driver – DMD01.1-W012 / DMD01.1-W022

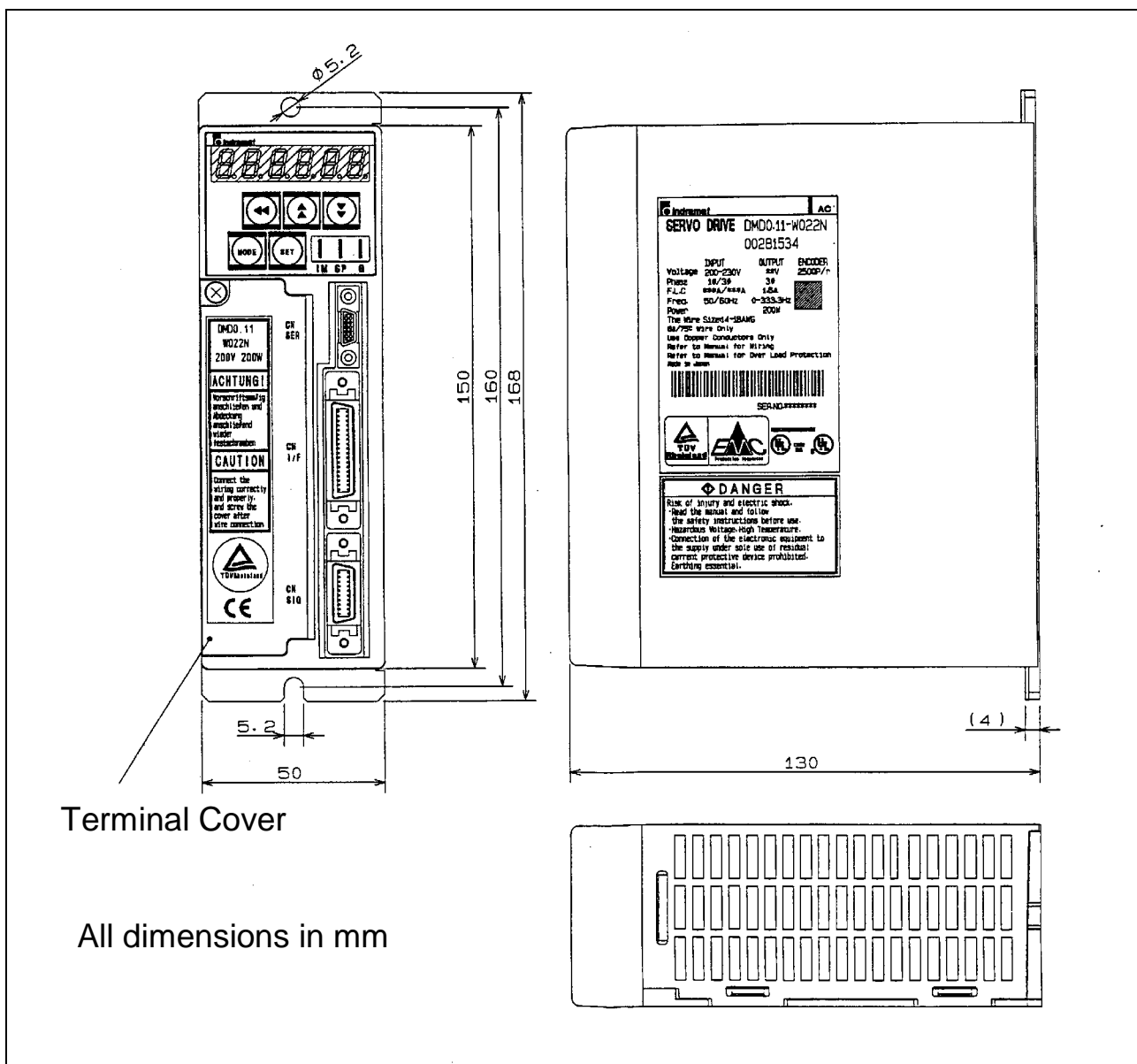


Fig. 8-10: Dimensions DMD-01.1-W012 & DMD-01.1-W022

Driver – DMD01.1-W042

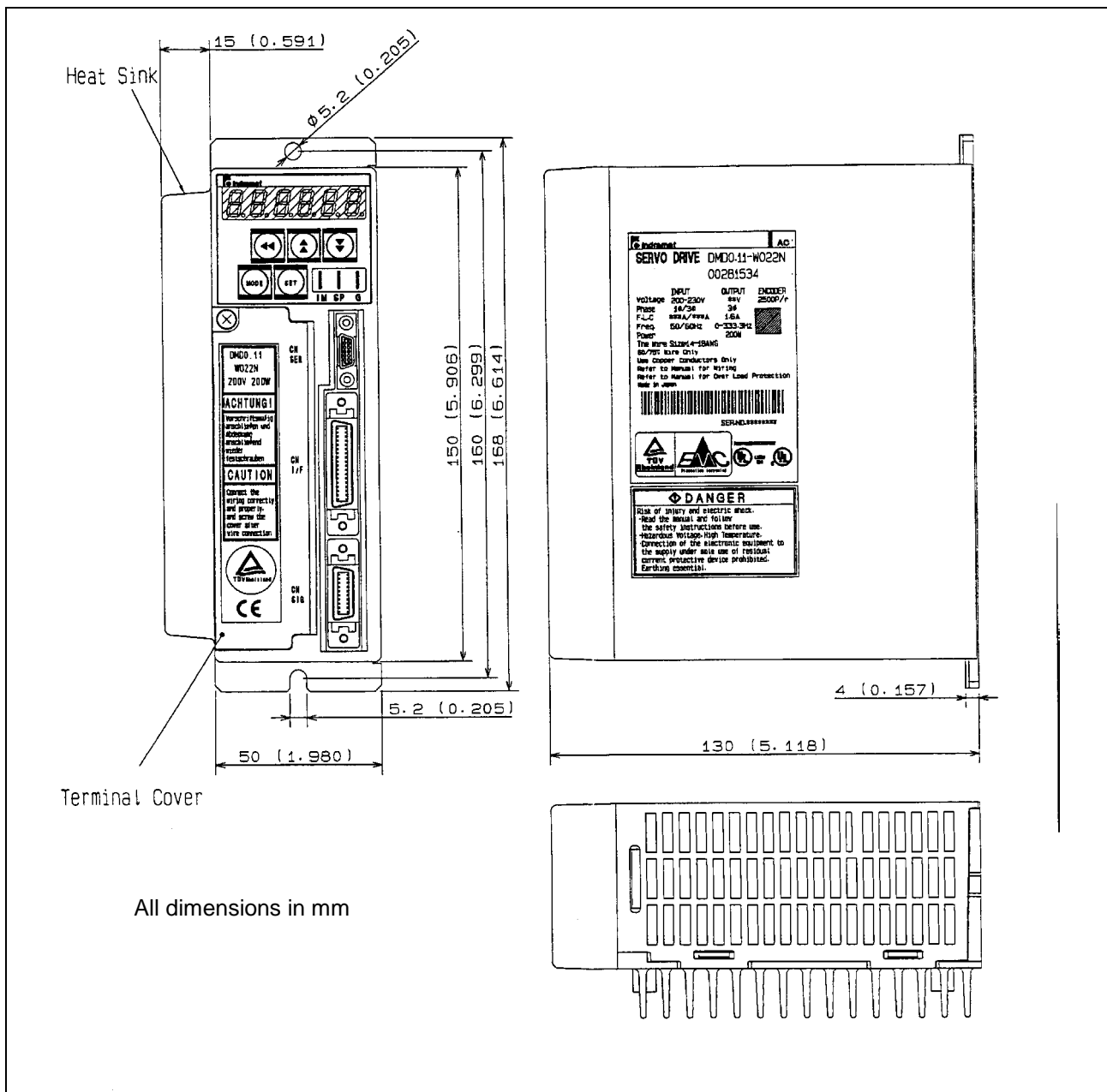


Fig. 8-11: Dimensions DMD-01.1-W042

Driver – DMD01.1-W082

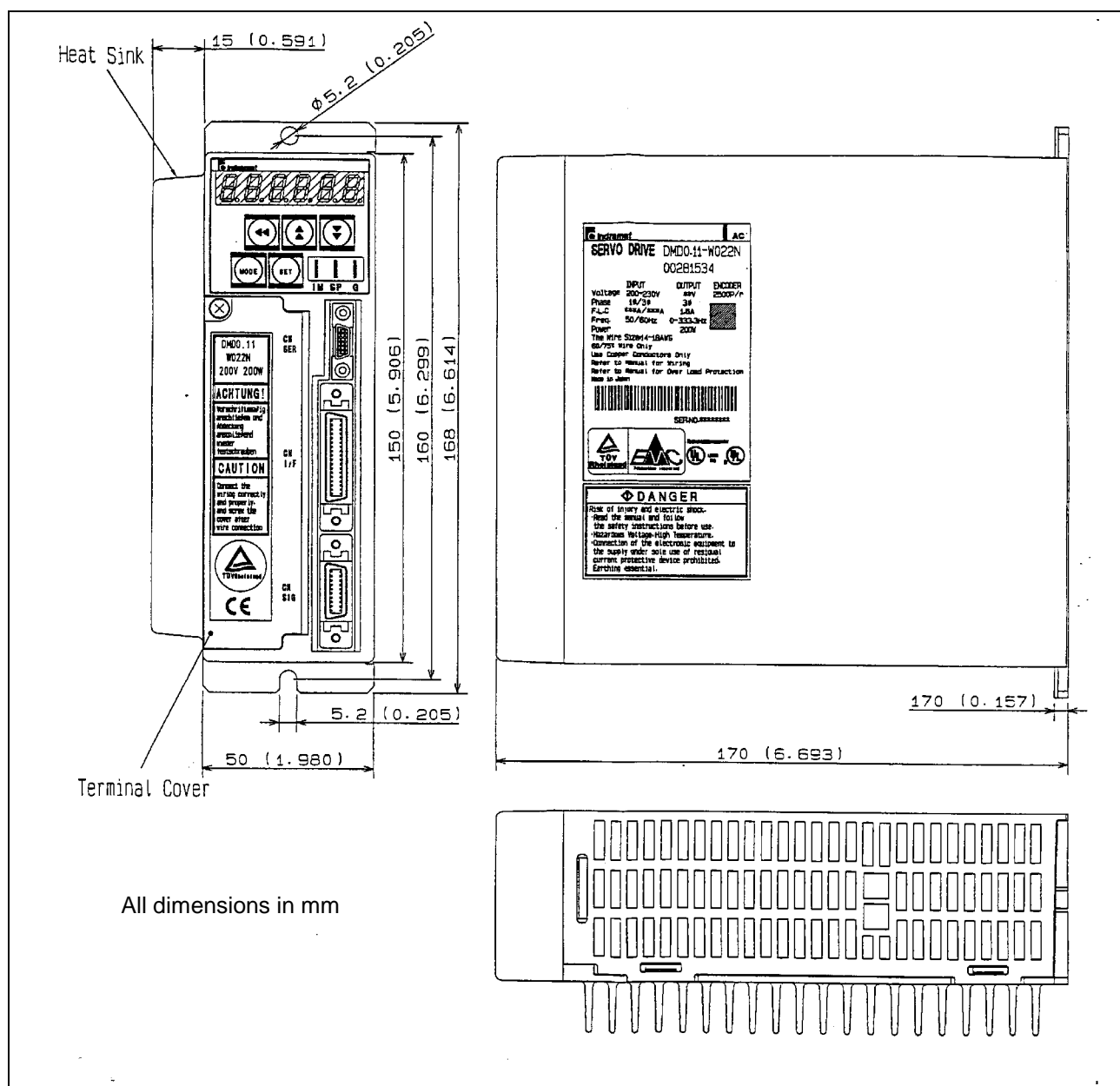


Fig. 8-12: Dimensions DMD01.1-W082

9 Type code

9.1 Type code – Drive controller

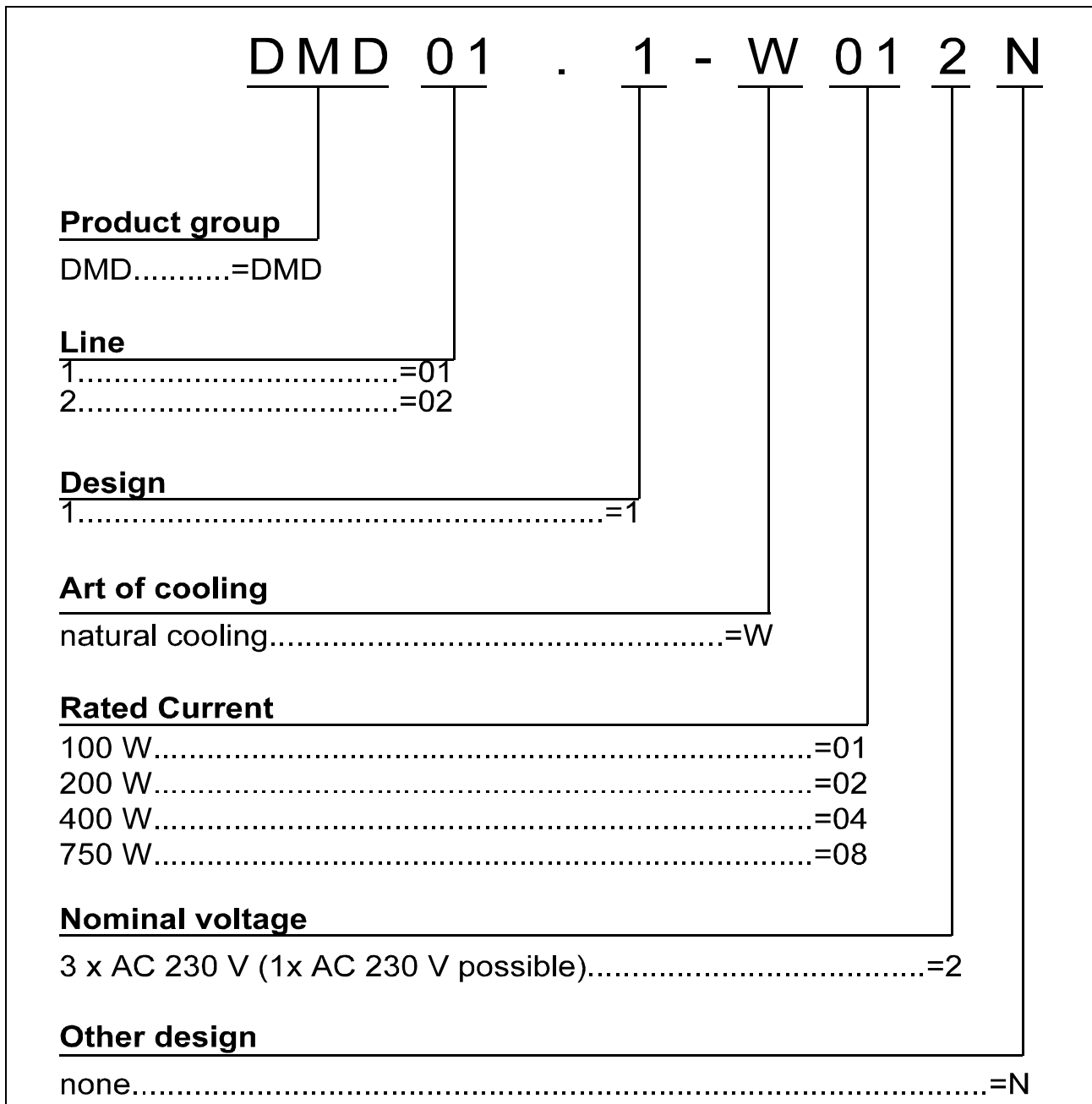


Fig. 9-13: Type code – drive controller

9.2 Type code – Motor

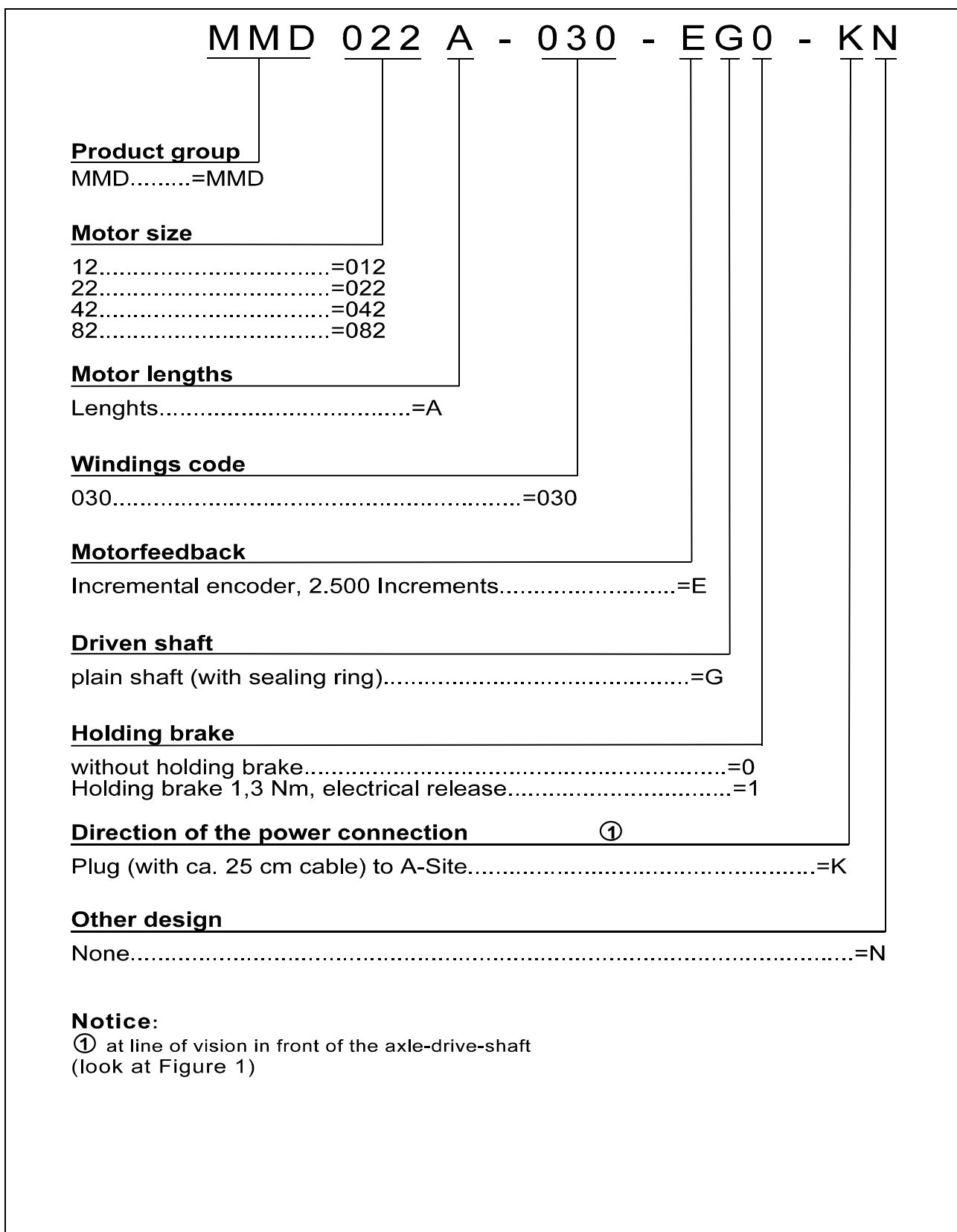


Fig. 9-14: Type code – motor

10 MMD - Motor

10.1 Mechanical integration into the machine

Conditions of use

Nominal data

Maximum installation elevation and ambient temperatures

The performance data specified for the motor apply to:

- an ambient temperature range of 0° to $+40^{\circ}$ C
- and an installation elevation of 0 to 1000 m above sea level.

Exceeding nominal data

If the motors are used above this range then the "load factors" must be taken into consideration. This derates the performance data.

⇒ In such cases, check whether the performance data still suffice for your specific application. To determine load factors, use Fig. 13.1. Values that are higher than depicted for temperature or installation are not permissible!



WARNING

Motor damage and forfeiture of guarantee!

Motors used outside of their specific applications can be damaged. The guarantee is then forfeited.

⇒ Therefore, please note the following instructions!

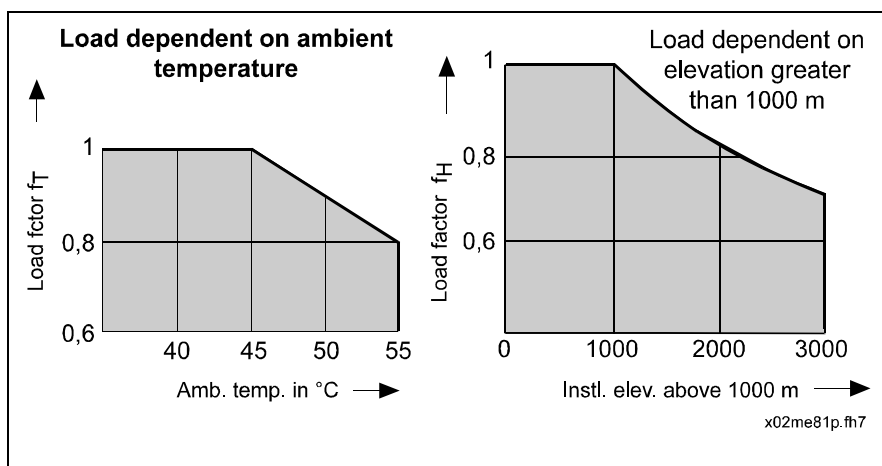


Fig. 10-15: Load factor in terms of ambient temperature and installation elevation

If **either** ambient temperature **or** installation elevation exceed nominal ratings then:

- ⇒ Multiply the continuous standstill torque listed in the selection data with the determined load factor.
- ⇒ Make sure that the derated torque is not exceeded by your application.

If **both** ambient temperature **and** installation elevation exceed nominal data:

- ⇒ multiply the determined load factors f_T and f_H

- ⇒ multiply the determined value by the continuous standstill torque of the motor indicated in the selection data
- ⇒ make sure that the derated torque data is not exceeded by your application.

Protection category

The design of the MMD motors meets the protection category requirements as described in DIN VDE 0470, section 1, edition dated 11/1992:

The areas of the motor	Protection category
motor housing, output shaft, power and feedback cables and brake cable (without connector and only with proper mounting)	IP 65

Fig. 10-16: Parts of the MMD motors for which protection categories apply

The protection category is coded with the abbreviation IP (international **pro**tection) and two distinctive numbers for the degree of protection.

The **first distinctive number** describes the level of protection against contact and penetration by extrinsic objects.

Number 6 means

- protection against penetration by dust (dust-proof)
- and complete contact protection

Number 4 means

- protection against penetration by extrinsic objects with a diameter exceeding 1 mm.

Number 2 means

- protection against penetration by extrinsic objects with a diameter exceeding 12 mm
- as well as keeping fingers or similar objects out.

The **second distinctive number** describes the protection category against water.

Number 5 means

- protection against a jet of water out of a nozzle sprayed at the housing from all directions (jet of water).

Number 4 means

- protection against water being sprayed at the housing from all directions (spray of water).



WARNING

Danger to personnel or damage to property!

Improperly mounted power and feedback connections can injure personnel or damage the motor!

- ⇒ Make sure that the power and feedback connections are mounted by properly trained personnel.
- ⇒ Use MMD motors only in an environment where the indicated protection categories can be ensured.

10.2 Technical data

Designation	Sym- bol	Unit	Data			
Motortype			MMD012A	MMD022A	MMD042A	MMD082A
To work with drive controller family			DMD	DMD	DMD	DMD
Drive controller			DMD01.1-W0 12	DMD01.1-W0 22	DMD01.1-W0 42	DMD01.1-W0 82
Nominal motor speed ¹⁾	n	min ⁻¹	3000	3000	3000	3000
Maximum theoretical speed	n _{max}	min ⁻¹	5000	5000	5000	4500
Continuous torque at standstill ²⁾	M _{dN}	Nm	0.32	0.64	1.3	2.4
Maximum theoretical torque	M _{dN}	Nm	0.95	1.91	3.36	6.9
Rotor moment of inertia without brake	J _M	kgm ²	0.063 x 10 ⁻⁴	0.17 x 10 ⁻⁴	0.37 x 10 ⁻⁴	1.33 x 10 ⁻⁴
Rotor moment of inertia with brake	J _M	kgm ²	0.067 x 10 ⁻⁴	0.2 x 10 ⁻⁴	0.4 x 10 ⁻⁴	1.41 x 10 ⁻⁴
Impulses of incremental Encoder	I	I/min ⁻¹	2500			
Brake power supply	24V / 0,4A					
Weight without brake	m _M	kg	0.53	0.96	1.6	3.1
Weight with brake	m _M	kg	0.73	1.4	2.0	3.7
Electrical connection			Plugin Connector	Plugin Connector	Plugin Connector	Plugin Connector
Working and storage humidity		%	85			
Permissible ambient temperature ²⁾	T _{um}	°C	0 to +40			
Permissible storage and transport temperature	T _L	°C	-20 to +80			
Maximum installation elevation ³⁾		m	1000 above NN			
Protection category ⁴⁾			IP 65			
Housing finish			Primary beige coat			
1) Depends on torque requirements of application. For applications determine the usable speed in terms of the required torque via the speed/torque characteristics.						
2) With deviating ambient temperatures see Fig. 10-15.						
3) With deviating installation elevations see Fig. 10-15.						
4) With correct mounting of power and feedback cables.						

Fig. 10-17: Load factor in terms of ambient temperature and installation elevation

10.3 Characteristics

MMD012A – 100W

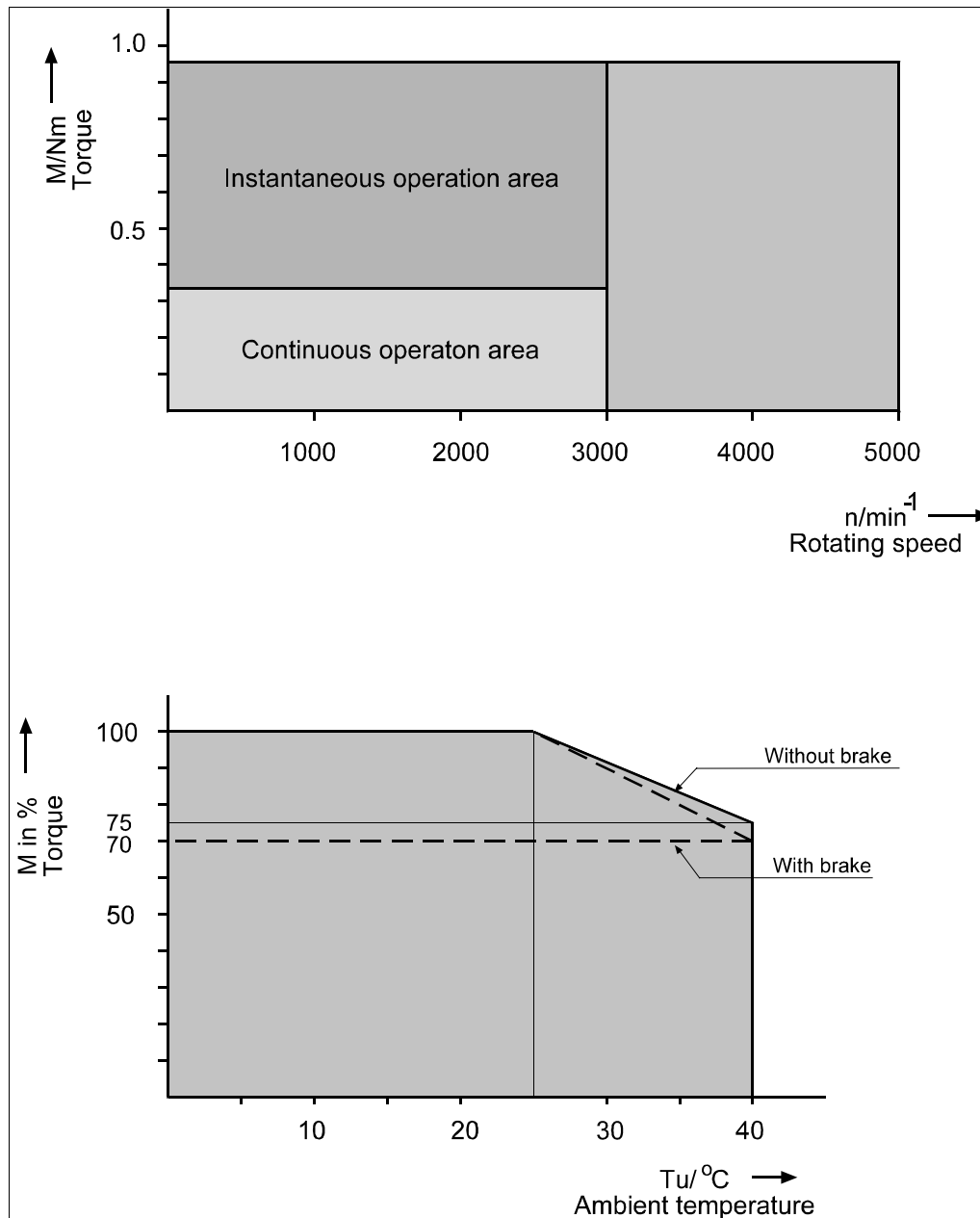


Fig. 10-18: Load factor in terms of ambient temperature and installation elevation

MMD022A – 200W

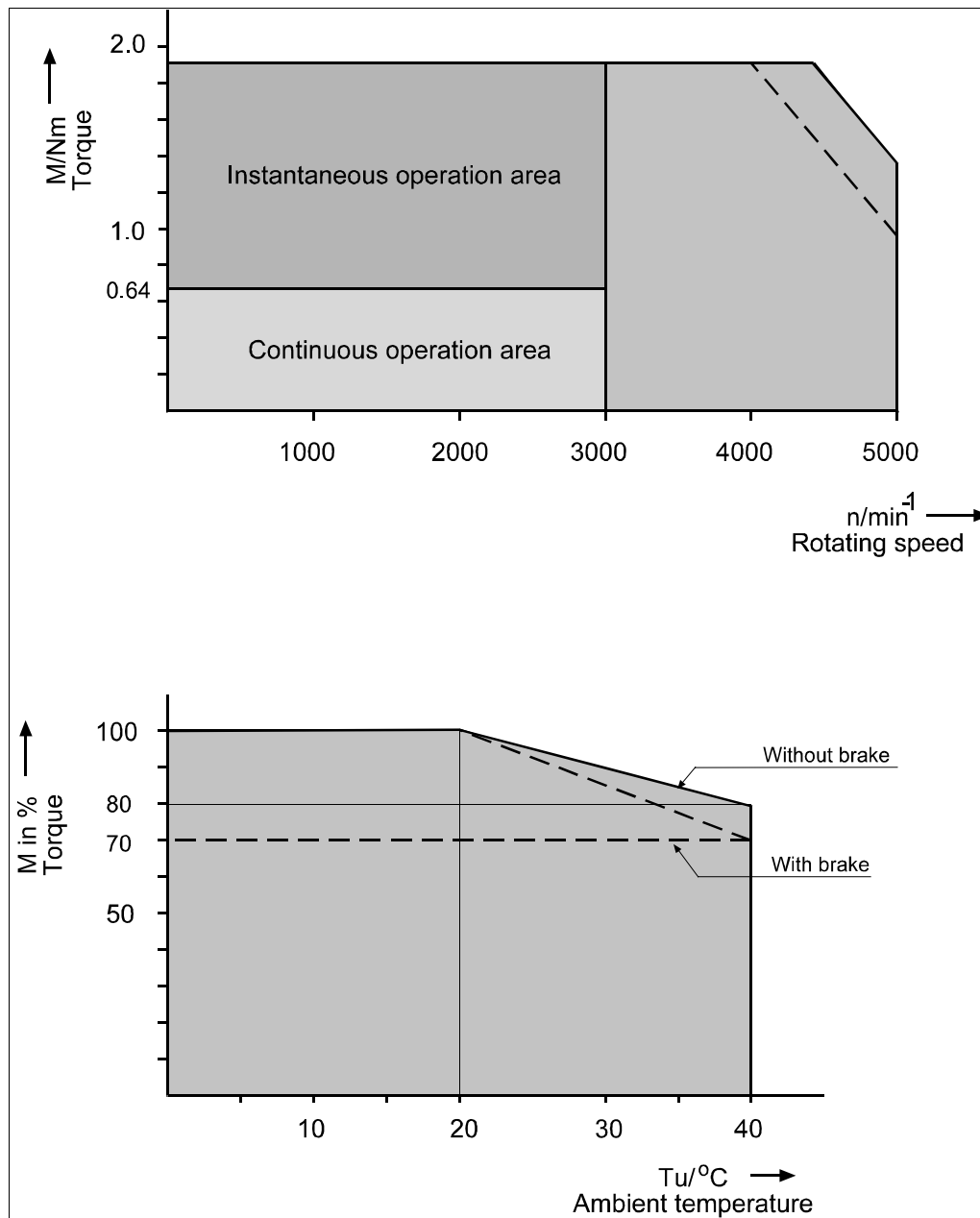


Fig. 10-19: Load factor in terms of ambient temperature and installation elevation

MMD042A – 400W

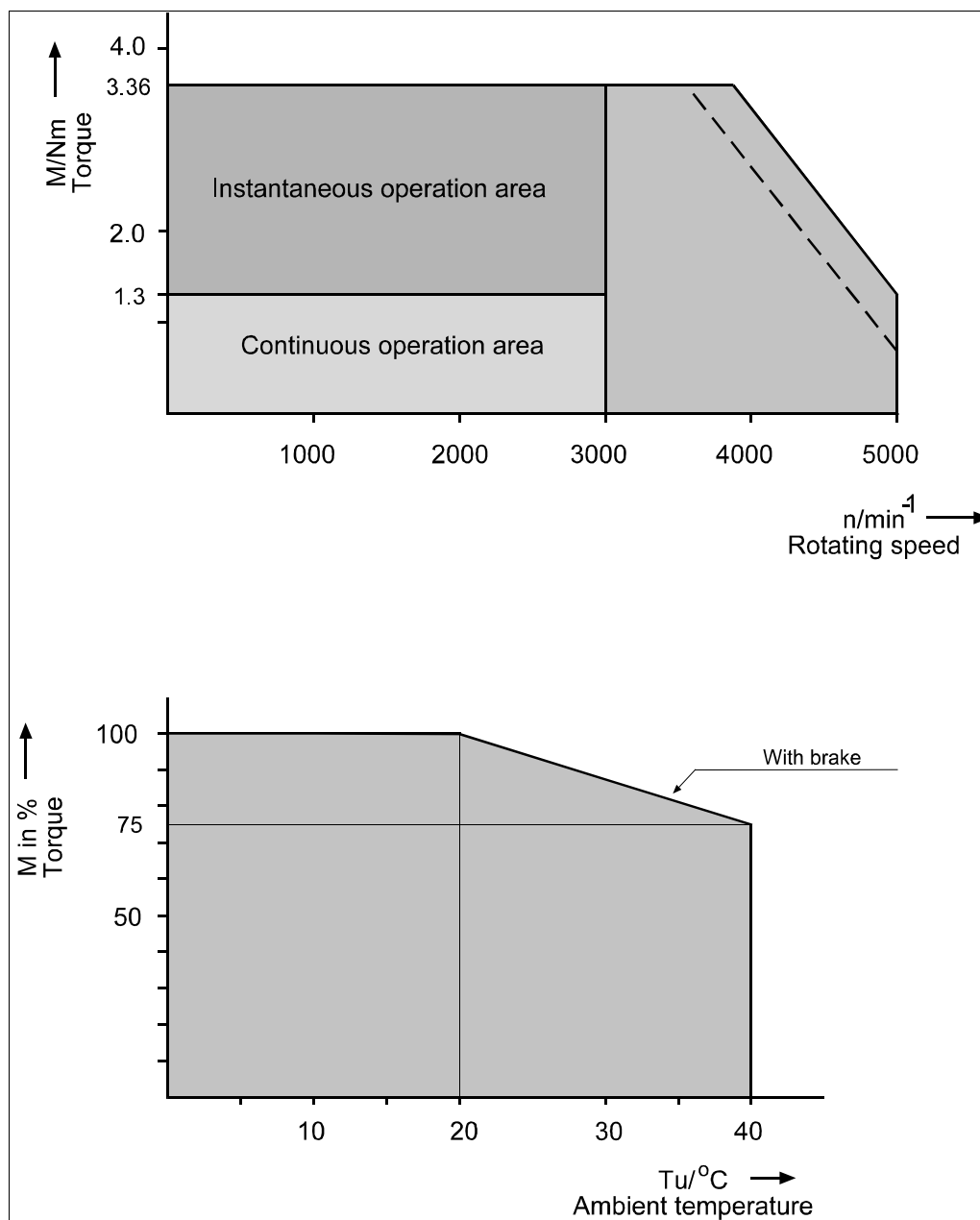


Fig. 10-20: Load factor in terms of ambient temperature and installation elevation

MMD082A – 750W

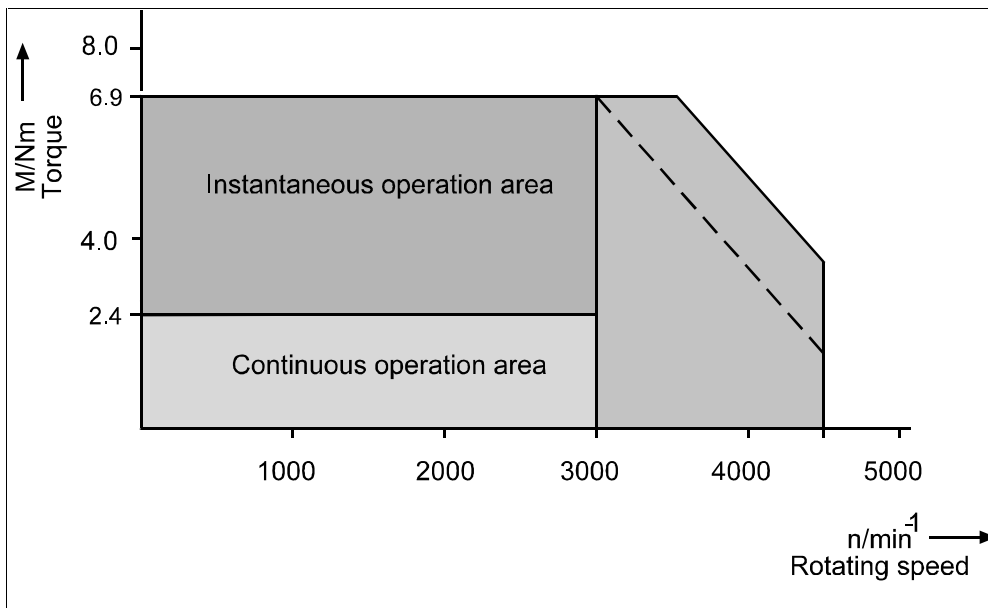
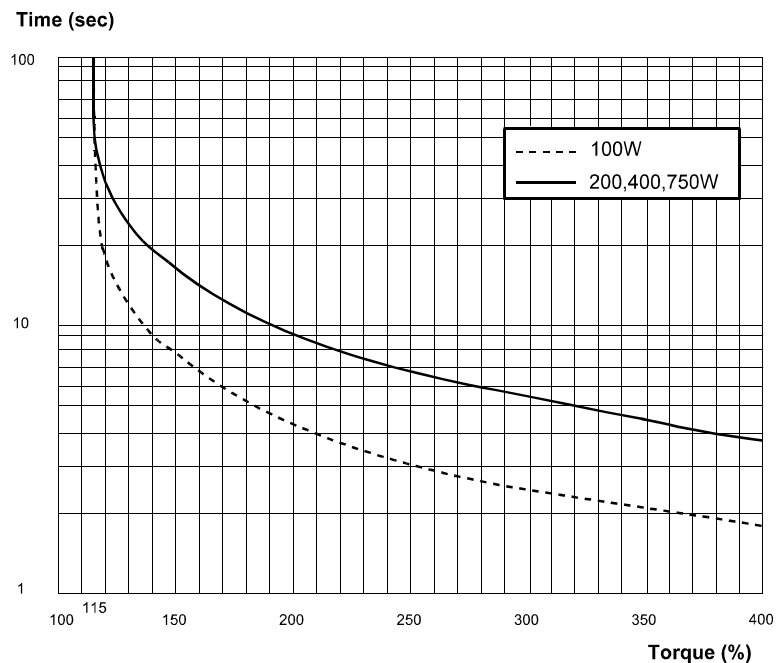


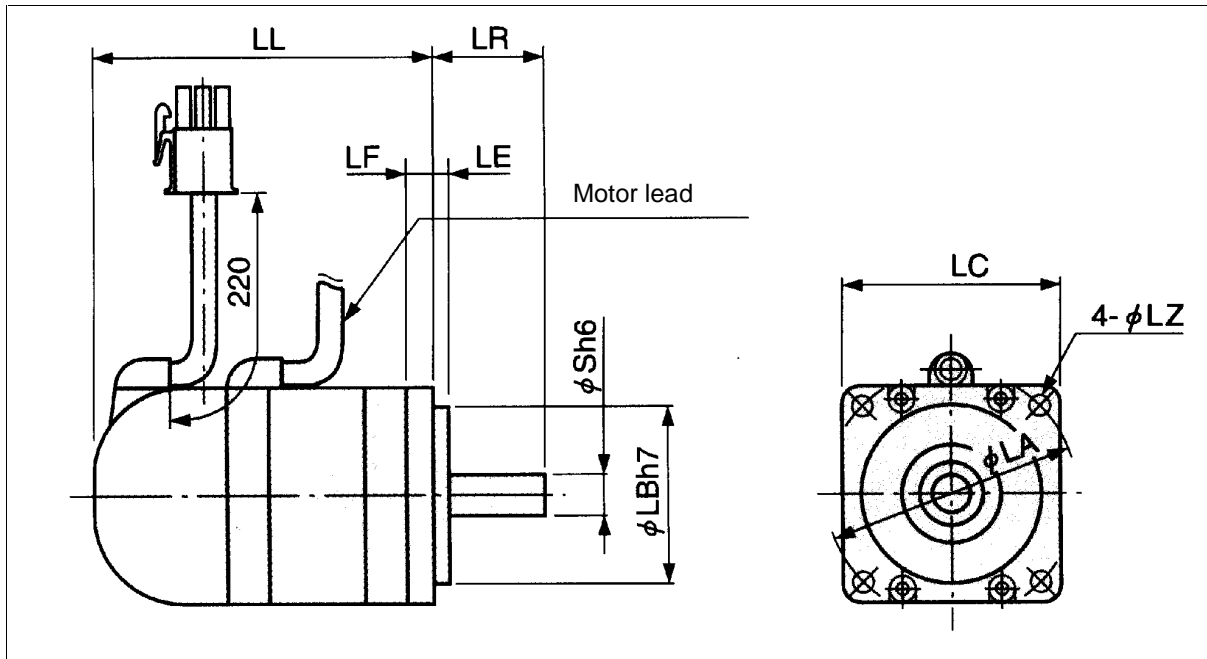
Fig. 10-21: Load factor in terms of ambient temperature and installation elevation

Instantaneous operation area

MMD Series Over Load Protection Time-Torque-Curve



10.4 Dimensional data



All dimensional data in mm				
	MMD012A	MMD022A	MMD042A	MMD082A
LL (Incremental encoder with brake)	135	128	157	178
LL (Incremental encoder without brake)	103	95	124	143
LR	25	30	30	35
ϕS^{h6}	8	11	14	19
LA	45	70	70	90
ϕLB^{h7}	30	50	50	70
LC	38	60	60	80
LE	3	3	3	3
LF	6	7	7	8
LZ	3.4	4.5	4.5	6

Fig. 10-22: Dimensional data MMD-Motor

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China <input checked="" type="checkbox"/> V/S <input type="checkbox"/> Service Mannesmann Rexroth (China) Ltd. 15/F China World Trade Center 1, Jianguomenwai Avenue PRC - Beijing 100004 Telefon: +86 10/65 05 03 80 Telefax: +86 10/65 05 03 79	China <input checked="" type="checkbox"/> V/S <input type="checkbox"/> Service Mannesmann Rexroth (China) Ltd. A-5F., 123 Lian Shan Street Sha He Kou District PRC - Dalian 116 023 Telefon: +86 411/46 78 930 Telefax: +86 411/46 78 932	Hongkong <input checked="" type="checkbox"/> V/S <input checked="" type="checkbox"/> Service Rexroth (China) Ltd. 19 Cheung Shun Street 1st Floor, Cheung Sha Wan, Kowloon, Hongkong Telefon: +852 22 62 51 00 Telefax: +852 27 41 33 44	India <input checked="" type="checkbox"/> V/S <input checked="" type="checkbox"/> Service Mannesmann Rexroth (India) Ltd. INDRAMAT Division Plot. 96, Phase III Peenya Industrial Area IND - Bangalore - 560058 Telefon: +91 (0)80/8 39 21 01 Telefax: +91 (0)80/8 39 43 45
India <input checked="" type="checkbox"/> V/S <input checked="" type="checkbox"/> Service Mannesmann Rexroth (India) Ltd. INDRAMAT Division Plot. A-58, TTC Industrial Area Thane Turbhe Midc Road Mahape Village IND - Navi Mumbai - 400 701 Telefon: +91 (0)22/7 61 46 22 Telefax: +91 (0)22/7 68 15 31	Indonesia <input checked="" type="checkbox"/> V/S <input type="checkbox"/> Service PT. Rexroth Wijayakusuma Jl. Raya Bekasi Km 21 Pulogadung RI - Jakarta Timur 13920 Telefon: +62 21/4 61 04 87 +62 21/4 61 04 88 Telefax: +62 21/4 60 01 52	Japan <input checked="" type="checkbox"/> V/S <input checked="" type="checkbox"/> Service Rexroth Automation Co., Ltd. INDRAMAT Division 1F, I.R. Building Nakamachidai 4-26-44 Tsuzuki-ku, Yokohama-shi J - Kanagawa-ken 224-004 Telefon: +81 459/42-72 10 Telefax: +81 459/42-03 41	Mexico <input checked="" type="checkbox"/> V/S <input type="checkbox"/> Service Rexroth Mexico S.A. de C.V. Calle Neptuno 72 Unidad Ind. Vallejo MEX - 07700 Mexico, D.F. Telefon: +52 5 754 17 11 +52 5 754 36 84 +52 5 754 12 60 Telefax: +52 5 754 50 73 +52 5 752 59 43
Korea <input checked="" type="checkbox"/> V/S <input checked="" type="checkbox"/> Service Mannesmann Rexroth-Seki Co Ltd. 1500-12 Da-Dae-Dong ROK - Saha-Ku, Pusan, 604-050 Telefon: +82 (0)51/2 60 06 18 Telefax: +82 (0)51/2 60 06 19	Korea <input checked="" type="checkbox"/> V/S <input checked="" type="checkbox"/> Service Seo Chang Corporation Ltd. Room 903, Jeail Building 44-35 Yeouido-Dong Yeoungdeungpo-Ku C.P.O.Box 97 56 ROK - Seoul Telefon: +82 (0)2/7 80 82 08 +82 (0)2/7 80 82 09 Telefax: +82 (0)2/7 84 54 08	South Africa <input checked="" type="checkbox"/> V/S <input checked="" type="checkbox"/> Service HYTEC Automation (Pty) Ltd. 28 Banfield Road, Industria North RSA - Maraisburg 1700 Telefon: +27 (0)11/673 20 80 Telefax: +27 (0)11/673 72 69	Taiwan <input checked="" type="checkbox"/> V/S <input type="checkbox"/> Service Rexroth Uchida Co., Ltd. No.1, Tsu Chiang Street Tu Cheng Ind. Estate Taipei Hsien, Taiwan, R.O.C. Telefon: +886 2/2 68 13 47 Telefax: +886 2/2 68 53 88

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USA <input checked="" type="checkbox"/> V/S <input checked="" type="checkbox"/> Service Mannesmann Rexroth Corporation INDRAMAT Division Charlotte Regional Sales Office 14001 South Lakes Drive USA - Charlotte, North Carolina 28273 Telefon: +1 704/5 83 97 62 +1 704/5 83 14 86			

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