Ezi-STEP®

Micro Stepping System

MINI

FASTECH

Fast, Accurate, Smooth Motion

www.fastech-motions.com

CE

Table of Contents

※ Before operation ※

· Thank you for your purchasing Ezi-STEP MINI.
· Ezi-STEP MINI is an all-in-one Unit. For high-speed and high-precision drive of a stepping motor,
  Ezi-STEP MINI is an unique drive that adopts a new control scheme owing to an on-board high-performance
  32bit digital signal processor.
· This manual describes handling, maintenance, repair, diagnosis and troubleshooting of Ezi-STEP MINI.
· Before operating Ezi-STEP MINI, thoroughly read this manual.
· After reading the manual, keep the manual near the Ezi-STEP MINI so that any user can read the manual
  whenever needed.

1. Precautions

◆ General Precautions

· Contents of this manual are subject to change without prior notice for functional im provement, change of
  specifications or user's better understanding. Thoroughly read the manual provided with the purchased
  Ezi-STEP MINI.
· When the manual is damaged or lost, please contact with Fastech's agents or our company at the address
  on the last page of the manual.
· Our company is not responsible for a product breakdown due to user's dismantling for the product, and such
  a breakdown is not guaranteed by the warranty.

◆ Put the Safety First

· Before installation, operation and repairing the Ezi-STEP MINI, thoroughly read the manual and fully understand
  the contents. Before operating the Ezi-STEP MINI please, understand the mechanical characteristics of the Ezi-
  STEP MINI and related safety information and precautions.
· This manual divides safety precautions into Attention and Warning.

⚠	**Attention :**	If user does not properly handle the product, the user may seriously or slightly injured and damages may occur in the machine.
⚠	**Warning :**	If user does not properly handle the product, a dangerous situation (such as an electric shock) may occur resulting in deaths or serious injuries.

· Although precaution is only a **Attention**, a serious result could be caused depending on the situation.
  Follow safety precautions.

◆ Check the Product

⚠ **Attention**	Check the Product is damaged or parts are missing. Otherwise, the machine may get damaged or the user may get injured.

◆ Installation

⚠ **Attention**	Carefully move the Ezi-STEP MINI. Otherwise the Product may get damaged or User's foot may get injured by dropping the product. Use non-flammable materials such as metal in the place where the Ezi-STEP MINI is to be installed. Otherwise, a fire may occur. When installing several Ezi-STEP MINI in a sealed place, install a cooling fan to keep the ambient temperature of the Ezi-STEP MINI as 50°C or lower. Otherwise, a fire or other kinds of accidents may occur due to overheating.
⚠ **Warning**	The process of Installation, Connection, Operation, Checking and Repairing should be done with qualified person. Otherwise, a fire or other kinds of accidents may occur.

◆ Connect Cables

⚠ **Attention**	Keep the rated range of lnput Voltage for Ezi-STEP MINI. Otherwise, a fire or other kinds of accidents may occur. Cable connection should follow the wiring diagram. Otherwise, a fire or other kinds of accidents may occur.
⚠ **Warning**	Before connecting cables, check if input power is off. Otherwise, an electric shock or a fire may occur. The case of the Ezi-STEP MINI is insulated from the ground of the internal circuit by the condenser. Ground the Ezi-STEP MINI. Otherwise, an electric shock or a fire may occur.

◆ Operation

⚠ **Attention**	If a protection function(alarm) occurs, firstly remove its cause and then release(alarm reset) the protection function. If you operate continuously without removing its cause, the machine may get damaged or the user may get injured. Do not make Motor Free and make input signal to ON during operation. Motor will stop and stop current will become zero. The machine may get damaged or the user may get injured. Make all input signals to OFF before supply input voltage to Ezi-STEP MINI. The machine may get damaged or the user may get injured by motor operation. All parameter values are set by default factory setting value. Change this value after reading this manual throughly. Otherwise, the machine may get damaged or other kinds of accidents may occur.

◆ Check and Repair

⚠ **Attention**	Stop to supply power to the main circuit and wait for a while before checking or repairing the Ezi-STEP MINI. Electricity remaining in the capacitor may cause danger. Do not change cabling while power is being supplied. Otherwise, the user may get injured or the product may get damaged. Do not reconstruct the Ezi-STEP MINI. Otherwise, an electric shock may occur or the reconstructed product can not get After-Service.

2. Main characteristics

① Microstep and Filtering

High precision Microstep function and Filtering

The high-performance MCU operates at step resolutions of 1.8 ° up to maximum 0.0072 °(1/250 steps) and Ezi-STEP adjusts PWM control signal in every 25 μsec, which makes it possible for more precise current control, resulting in high-precision Microstep operation.

② Software Damping

Vibration suppression and high-speed operation

Vibration suppression and High-speed operation (Patent pending) Motor vibration is created by magnetic flux variations of the motor, lower current from the drive due to back-emf from the motor at high speeds and lowering of phase voltages from the drive.
Ezi-STEP drive detects these problems and the MCU adjusts the phase of the current according to the pole position of the motor, drastically suppressing vibration.
This allows the smooth operation of the motor at high speeds.

Software Damping OFF   Software Damping ON

※ This is real measured speed that using 100,000 [pulse/rev] encoder.

③ Drive Output Signal Monitoring

Ezi-STEP MINI provides loss of step, run/stop, over-current, over-heat, over-voltage, power and motor connection alarms that can be monitored by the controller and visible by a motor-mounted flashing LED indicator.

3. Ezi-STEP MINI Part Numbering

Ezi-STEP-MI-42M-BK-☐

Product Name

Drive Series Type
MI : Mini Type

Motor Flange Size
20 : 20mm 28 : 28mm 42 : 42mm

Motor Length
S : Small M : Medium L : Large XL : Extra Large

Brake
Blank : Without Brake BK : Brake

User Code

4. Standard Combination

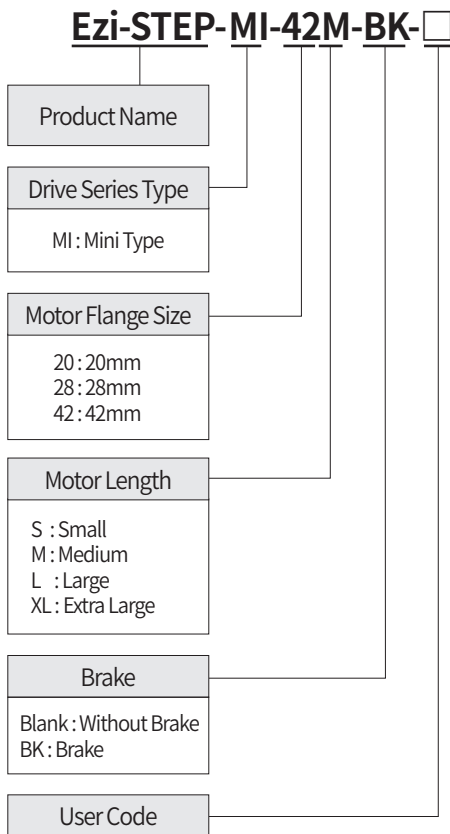| Unit Part Number	Motor Model Number	Drive Model Number
Ezi-STEP-MI-20M	BM-20M	EzStep-MI-20M
Ezi-STEP-MI-20L	BM-20L	EzStep-MI-20L
Ezi-STEP-MI-28S	BM-28S	EzStep-MI-28S
Ezi-STEP-MI-28M	BM-28M	EzStep-MI-28M
Ezi-STEP-MI-28L	BM-28L	EzStep-MI-28L
Ezi-STEP-MI-42S	BM-42S	EzStep-MI-42S
Ezi-STEP-MI-42M	BM-42M	EzStep-MI-42M
Ezi-STEP-MI-42L	BM-42L	EzStep-MI-42L
Ezi-STEP-MI-42XL	BM-42XL	EzStep-MI-42XL

5. Combination with Brake

Unit Part Number	Motor Model Number	Drive Model Number
Ezi-STEP-MI-42S-BK	BM-42S-BK	EzStep-MI-42S
Ezi-STEP-MI-42M-BK	BM-42M-BK	EzStep-MI-42M
Ezi-STEP-MI-42L-BK	BM-42L-BK	EzStep-MI-42L
Ezi-STEP-MI-42XL-BK	BM-42XL-BK	EzStep-MI-42XL

6. Specifications of Drive

Motor Model		BM-20 series	BM-28 series	BM-42 series
Driver Model		EzStep-MI-20 series	EzStep-MI-28 series	EzStep-MI-42 series
Input Voltage		DC24V ±10%		
Control Method		Bipolar PWM drive with 32bit MCU		
Current Consumption		Max 500mA (Except motor current)		
Operating Condition	Ambient Temperature	· In Use: 0~50°C · In Storage: -20~70°C		
	Humidity	· In Use: 35~85% RH (Non-Condensing) · In Storage: 10~90% RH (Non-Condensing)		
	Vib. Resist.	0.5g		
Function	Rotation Speed	0~3,000 [rpm] [1]		
	Resolution [ppr]	500 1,000 1,600 2,000 3,200 3,600 4,000 5,000 6,400 8,000 10,000 20,000 25,000 36,000 40,000 50,000 * Default: 10,000		
	Maximum Frequency	500kHz (Duty 50%)		
	Protection Functions	Over Current Error, Over Speed Error, Step Out Error, Over Temperature Error, Over Regenerated Voltage Error, Motor Connect Error, Motor Voltage Error, System Error, ROM Error		
	LED Display	Power Status(Green), Alarm Status(Red), CW Rotation(Yellow), CCW Rotation(Orange)		
	STOP Current	10%~100% (Selectable with DIP Switch) Be setted to set value of STOP Current after 0.1 second after motor stop. * Default: 50%		
	Pulse Input Method	1 Pulse / 2 Pulse (Selectable with DIP Switch) * Default: 2 Pulse		
	Rotational Direction	CW/CCW (Selectable with DIP Switch) * Default: CW		
	Speed/Position Control Command	Pulse Train Input (Photocoupler Input)		
I/O Signal	Input Signals	Alarm Reset, Motor Free (Photocoupler Input)		
	Output Signals	Alarm, Run/Stop (Photocoupler Output)		

[1] : Up to the resolution of 10,000[ppr], maximum speed can be reached by 3,000[rpm] and with the resolution more than 10,000[ppr], maximum speed shall be reduced accordingly.
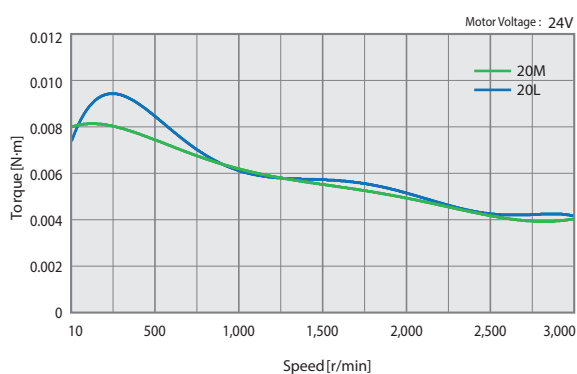

7. Dimensions of Drive [mm]
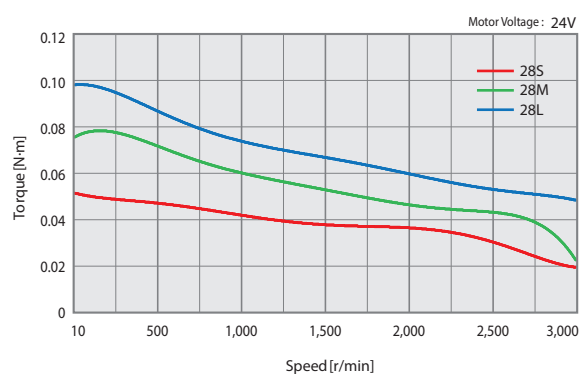
8. Specifications of Motor

MODEL		BM-20 series		BM-28 series			BM-42 series			
	UNIT	20M	20L	28S	28M	28L	42S	42M	42L	42XL
DRIVE METHOD	-	BI-POLAR								
NUMBER OF PHASES	-	2	2	2	2	2	2	2	2	2
VOLTAGE	VDC	2.75	3.0	3.0	3.0	3.0	3.36	4.32	4.56	7.2
CURRENT per PHASE	A	0.5	0.5	0.95	0.95	0.95	1.2	1.2	1.2	1.2
RESISTANCE per PHASE	Ohm	5.5	6.0	3.2	3.2	3.2	2.8	3.6	3.8	6.0
INDUCTANCE per PHASE	mH	2.0	2.6	2.0	2.7	3.2	5.4	7.2	8.0	15.6
HOLDING TORQUE	N·m	0.016	0.025	0.069	0.098	0.118	0.32	0.44	0.5	0.65
ROTOR INERTIA	g·cm^2	2.5	3.3	9.0	13	18	35	54	77	114
WEIGHTS	g	50	80	110	140	200	250	280	350	500
LENGTH(L)	mm	28	38	32	45	50	34	40	48	60
PERMISSIBLE OVERHUNG LOAD (DISTANCE FROM END OF SHAFT)	3mm	18	18	30	30	30	22	22	22	22
	8mm	30	30	38	38	38	26	26	26	26
	13mm	-	-	53	53	53	33	33	33	33
	18mm	-	-	-	-	-	46	46	46	46
PERMISSIBLE THRUST LOAD	N	Lower than motor weight								
INSULATION RESISTANCE	Mohm	100 MIN.(at 500VDC)								
INSULATION CLASS	-	CLASS B(130°C)								
OPERATING TEMPERATURE	°C	0 to 55								

The "PERMISSIBLE OVERHUNG LOAD" unit column reads "N".

9. Torque Characteristics of Motor

Ezi-STEP-MI-20 series

Motor Voltage : 24V

Ezi-STEP-MI-28 series

Motor Voltage : 24V

Ezi-STEP-MI-42 series

Motor Voltage : 24V

10. Dimensions of Motor [mm]

20mm

Model name	Length(L)
BM-20M	28
BM-20L	38

28mm

Model name	Length(L)
BM-28S	32
BM-28M	45
BM-28L	50

42mm

Model name	Length(L)
BM-42S	34
BM-42M	40
BM-42L	48
BM-42XL	60

11. Notes on Installation

1) Ezi-STEP MINI is designed for indoor use only.

2) The ambient temperature of the room should be 0°C~50°C.

3) If the temperature of the product case is higher than 50°C, radiate heat of the outside to cool down.

4) Do not install Ezi-STEP MINI under direct rays, near magnetic or radioactive objects.

5) If you set more than 2 drives, you must set over 20mm horizontally and over 50mm vertically
   as shown below.

12. Settings and Operation

12.1 Drive Status LED

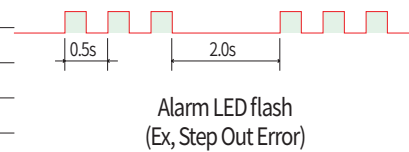| Indication	Color	Function	ON/OFF Condition
PWR	Green	Power Input Indication	Lights when power is ON Flashes when motor is Free status
ALM	Red	Alarm Indication	Flash when protection function is activated (Identifiable which protection mode is activated by counting the flash times)
CW	Yellow	Motor Rotation Direction	Lights when motor rotate CW direction
CCW	Orange	Motor Rotation Direction	Lights when motor rotate CCW direction

◆ Protection functions and LED flash times

Times	Protection	Conditions
1	Over Current Error	The current through power devices in drive exceeds the limit value[1]
2	Over Speed Error	Motor speed exceeded 3,000 [rpm]
3	Step Out Error	Abnormally motor do not followed pulsed input
5	Over Temperature Error	Internal temperature of a motor drive exceeded 85°C
6	Over Regenerative Voltage Error	Back EMF more than 50V
7	Motor Connect Error	Power is ON without connection of motor cable to drive
9	Motor Voltage Error	Motor voltage is below 20V
11	System Error	Error occurs in drive system
12	ROM Error	Error occurs in Parameter storage Device(ROM)

0.5s   2.0s

Alarm LED flash
(Ex, Step Out Error)

*1 : Limit value depends on motor model

12.2 Stop Current Setting Switch(SW1.1~1.4)

Stop Current means the motor current value automatically set in 0.1 sec after motor stops. This is to prevent the overheat of a motor when the motor is under long time idling. The unit of the selection value is a percentage.

Switch Position				STOP Current (%)	Switch Position				STOP Current (%)
4	3	2	1		4	3	2	1	
ON	ON	ON	ON	10	OFF	ON	ON	ON	90
ON	ON	ON	OFF	20	OFF	ON	ON	OFF	100
ON	ON	OFF	ON	30	OFF	ON	OFF	ON	10
ON	ON	OFF	OFF	40	OFF	ON	OFF	OFF	10
ON	OFF	ON	ON	50[1]	OFF	OFF	ON	ON	10
ON	OFF	ON	OFF	60	OFF	OFF	ON	OFF	10
ON	OFF	OFF	ON	70	OFF	OFF	OFF	ON	10
ON	OFF	OFF	OFF	80	OFF	OFF	OFF	OFF	10

*1 : Default : 50%

12.3 Resolution Setting Switch(SW1.5~1.8)

The Number of pulse per revolution.

Switch Position				Pulse/ Revolution	Switch Position				Pulse/ Revolution
8	7	6	5		8	7	6	5	
ON	ON	ON	ON	500	OFF	ON	ON	ON	6,400
ON	ON	ON	OFF	1,000	OFF	ON	ON	OFF	8,000
ON	ON	OFF	ON	1,600	OFF	ON	OFF	ON	10,000[1]
ON	ON	OFF	OFF	2,000	OFF	ON	OFF	OFF	20,000
ON	OFF	ON	ON	3,200	OFF	OFF	ON	ON	25,000
ON	OFF	ON	OFF	3,600	OFF	OFF	ON	OFF	36,000
ON	OFF	OFF	ON	4,000	OFF	OFF	OFF	ON	40,000
ON	OFF	OFF	OFF	5,000	OFF	OFF	OFF	OFF	50,000

*1 : Default: 10,000

12.4 Rotational Direction Setting Switch(SW2.5)

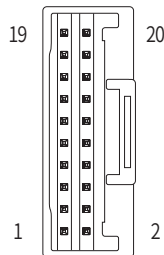| Indication	Switch Name	Functions
D	Rotational Direction Select Switch	Based on CW(+Dir signal) input to driver. ON: CCW(-Direction) OFF: CW(+Direction) ※ Default: CW mode

Direction setting switch: ON

CCW Dir.

Direction setting switch: OFF

CW Dir.

12.5 Pulse Input Setting Switch(SW2.6)

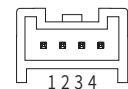| Indication	Switch Name	Functions
P	Pulse input mode Select Switch	Selectable 1-Pulse input mode or 2-Pulse input mode as Pulse input signal. ON: 1-Pulse mode OFF: 2-Pulse mode ※ Default: 2-Pulse mode

2-Pulse Mode   1-Pulse Mode

CW(Pulse) Pin
CCW(Dir) Pin
Rotational Direction   CW   CCW   CW   CCW

12.6 Signal Connector(CN1)

NO.	Function	I/O
1	CW+(Pulse+)	Input
2	CW-(Pulse-)	Input
3	CCW+(Dir+)	Input
4	CCW-(Dir-)	Input
11	Alarm	Output
12	Run/Stop	Output
13	Motor Free	Input
14	Alarm Reset	Input
19	EXT_GND	Input
20	EXT_DC24V	Input

12.7 Motor Connector(CN3)

NO.	Function	I/O
1	B Phase	Output
2	/B Phase	Output
3	/A Phase	Output
4	A Phase	Output

12.8 Power Connector(CN4)

NO.	Function	I/O
1	DC24V	Input
2	GND	Input

13. System Configuration

Type	Signal Cable	Motor Cable	Power Cable
Length supplied	-	30cm	-
Max. Length	20m	20m	2m

13.1 Options

① Signal Cable

Available to connect between Input/Output Control System and Ezi-STEP MINI.

Item	Length [m]	Remark
CSVI-S-☐☐☐F CSVI-S-☐☐☐M	☐☐☐ ☐☐☐	Normal Cable Robot Cable

☐ is for Cable Length. The unit is 1m and Max. 20m length.

② Motor Extension Cable

Available to extended connection between motor and Ezi-STEP MINI.

Item	Length [m]	Remark
CMNB-M-☐☐☐F CMNB-M-☐☐☐M	☐☐☐ ☐☐☐	Normal Cable Robot Cable

☐ is for Cable Length. The unit is 1m and Max. 20m length.

③ Power Cable

Available to connect between Power and Ezi-STEP MINI.

Item	Length [m]	Remark
CMNB-P-☐☐☐F CMNB-P-☐☐☐M	☐☐☐ ☐☐☐	Normal Cable Robot Cable

☐ is for Cable Length. The unit is 1m and Max. 2m length.

13.2 Connector Specifications

Connector specifications for cabling to drive.

Purpose		Item	Part Number	Manufacturer
Power (CN4)		Housing Terminal	PAP-02V-S SPHD-001T-P0.5	JST
Motor	Drive Side (CN3)	Housing Terminal	PAP-04V-S SPHD-001T-P0.5	JST
	Motor Side	Housing Terminal	5557-04R 5556T	MOLEX
Signal (CN1)		Housing Terminal	501646-2000 501648-1000(AWG 26~28)	MOLEX

※ Above connector is the most suitable product for the drive applied. Another equivalent connector can be used.

14. External Wiring Diagram

Ezi-STEP MINI

CN4

DC24V	1 DC24V
GND	2 GND

Controller

CN1

* Shielded Twisted Pair Cable

Controller	CN1
CW+(Pulse+)	1
CW−(Pulse−)	2
CCW+(Dir+)	3
CCW−(Dir−)	4

CN3

Motor

CN3	Motor
A	4
A̅	3
B	1
B̅	2

Controller	CN1
Alarm	11
Run/Stop	12
EXT_GND	19
EXT_DC24V	20
Motor Free	13
Alarm Reset	14
F.GND	

* Shielded Twisted Pair Cable

※ When connects I/O cable between controller and drive, please turn off the power of both controller and drive, in order to protect the drive from any damage.
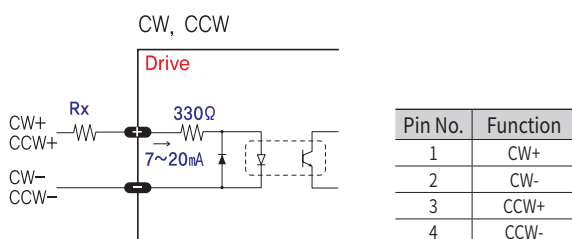

CAUTION

Please refer to the Appendix when connects motor extension cable. Careful connection will be required to protect the drive from any damages.
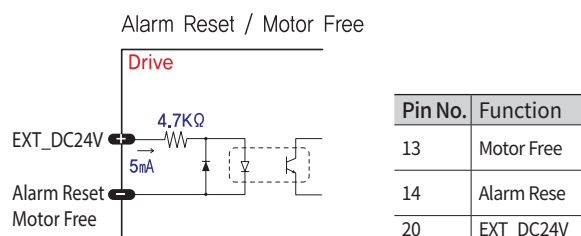
15. Control Signal Input/Output Description

1 Input Signal

Input signals of the drive are all photocoupler protected. The signal shows the status of internal photocouplers [ON：conduction], [OFF：Non-conduction], not displaying the voltage levels of the signal.

CW, CCW

Pin No.	Function
1	CW+
2	CW-
3	CCW+
4	CCW-

◆ CW, CCW Input

This signal can be used to receive a positioning pulse command from a user host motion controller. The user can select 1-pulse input mode or 2-pulse input mode. The input schematic of CW, CCW is designed for 5V TTL level. When using 5V level as an input signal, the resistor Rx is not used and connect to the driver directly. When the level of input signal is more than 5V, Rx resistor is required. If the resistor is absent, the drive will be damaged. If the input signal level is 12V, Rx value is 680ohm and 24V, Rx value is 1.8Kohm.

Alarm Reset / Motor Free

Pin No.	Function
13	Motor Free
14	Alarm Rese
20	EXT_DC24V

◆ Motor Free Input

This input can be used only to adjust the position by manually moving the motor shaft from the load-side. By setting the signal [ON], the drive cuts off the power supply to the motor. Then, one can manually adjust output position. When setting the signal back to [OFF], the drive resumes the power supply to the motor and recovers the holding torque. When driving a motor, one needs to set the signal [OFF]. In normal operations set the signal [OFF] or disconnect a wire to the signal.
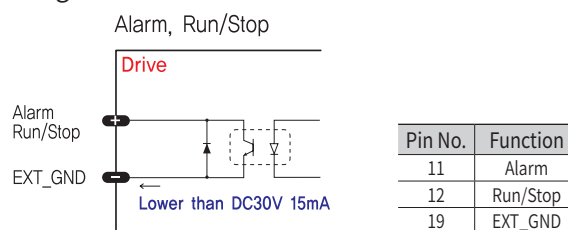
◆ Alarm Reset Input

When a protection mode has been activated, a signal to this Alarm Reset input cancels the Alarm output. By setting the alarm reset input signal [ON], cancel Alarm output. Before cancel the Alarm output, have to remove the source of alarm.

[Caution] If Alarm Reset input signal still remains [ON], motor will be Free state. Keep in mind to change [ON]→[OFF] state.

2 Output Signal

As the output signal from the drive, there are the photocoupler outputs (Alarm, Run/Stop). The signal status operate as [ON：conduction], [OFF：Non-conduction] of photocoupler not as the voltage level of signal.

Alarm, Run/Stop

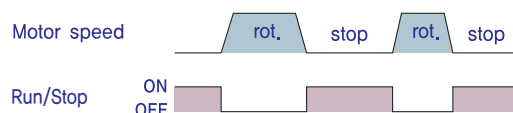| Pin No.	Function
11	Alarm
12	Run/Stop
19	EXT_GND

◆ Alarm Output

The Alarm output indicates [OFF] when the drive is in a normal operation. If a protection mode has been activated, it goes [ON]. A host controller meeds to detect this signal and stop sending a motor driving command.
When the drive detects an abnormal operation such as overload of overcurrent of a motor, it sets the Alarm output to [ON], flash the Alarm LED, disconnects the power to a motor and stops the motor, simultaneously.

◆ Run/Stop Output

Run/Stop Output state is [ON] when motor positioning is completed. It operates reversely compare to Normal mode, when you set inverse mode.
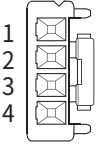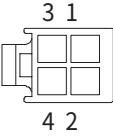
Appendix

■ Extension Cable for Motor

For cable extension between Motor and Drive.

WIRING DIAGRAM

Connector of Drive		wiring	Connector of Motor	
Pin layout	Pin number		Pin number	Pin layout
 1 2 3 4	1 2 3 4		1 3 4 2	3 1 4 2

MEMO

Fast, Accurate, Smooth Motion

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