Stepping motors with internal drivers

Features

1.Driver and motor are now integrated into a single unit.

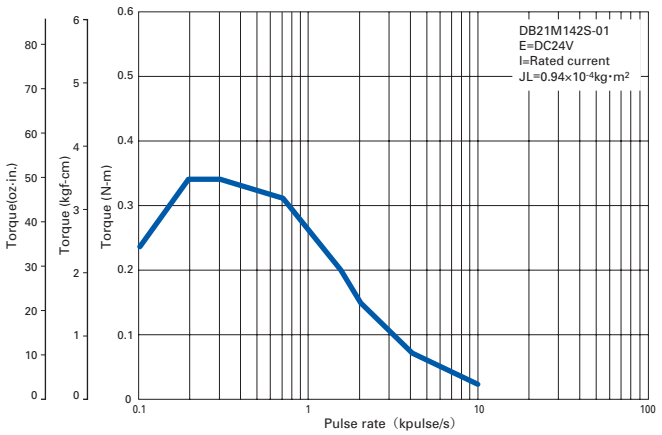
A driver incorporating a motion control function needed for driving a motor and a 2-phase stepping motor were integrated into a single unit for enabling a more compact installation space and less wiring.

2.Three types of operation modes can be selected to match the specific application.

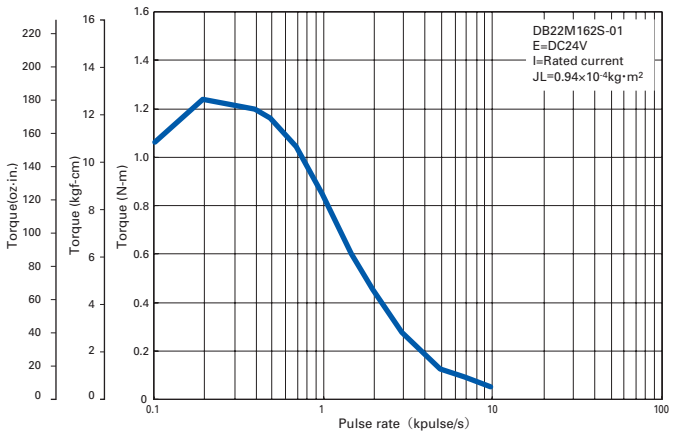
（1）Control by command pulses
（2）Program control by general-purpose I/O(Parallel)
（3）Compliant with RS-485, half-duplex asynchronous communication

Pulse rate-torque characteristics

□42mm(□1.65inch)

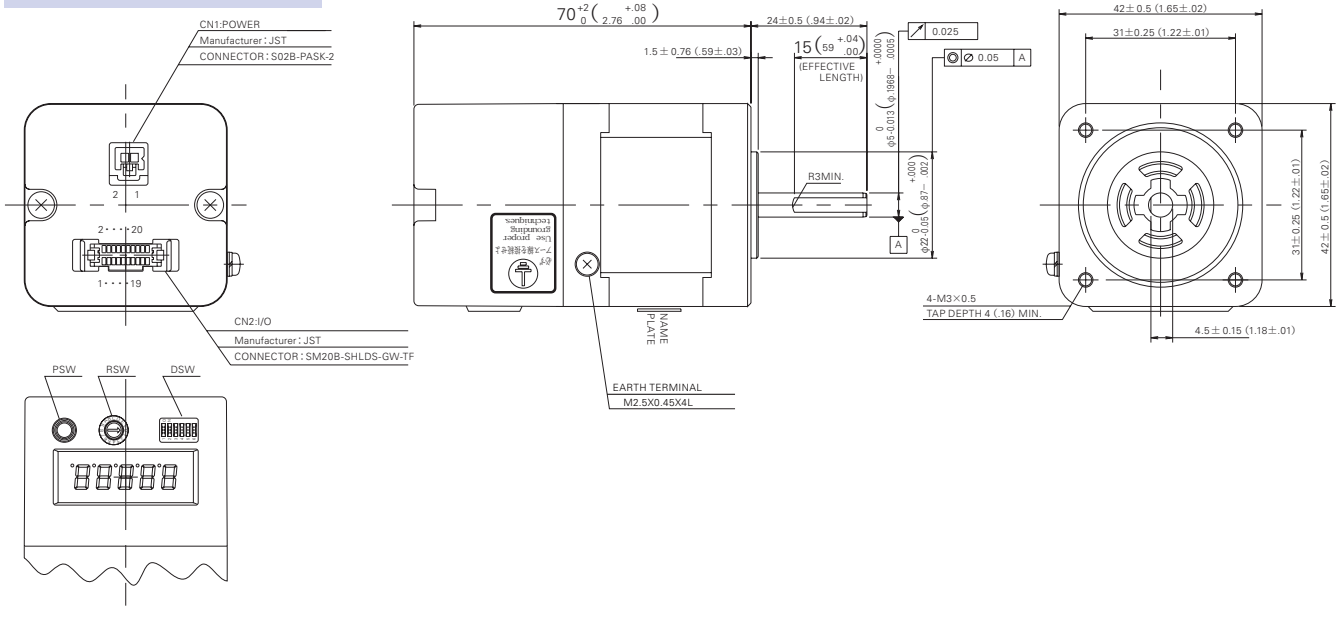


□60mm(□2.36inch)



Dimensions [Unit : mm (inch)]

□42mm(□1.65inch)

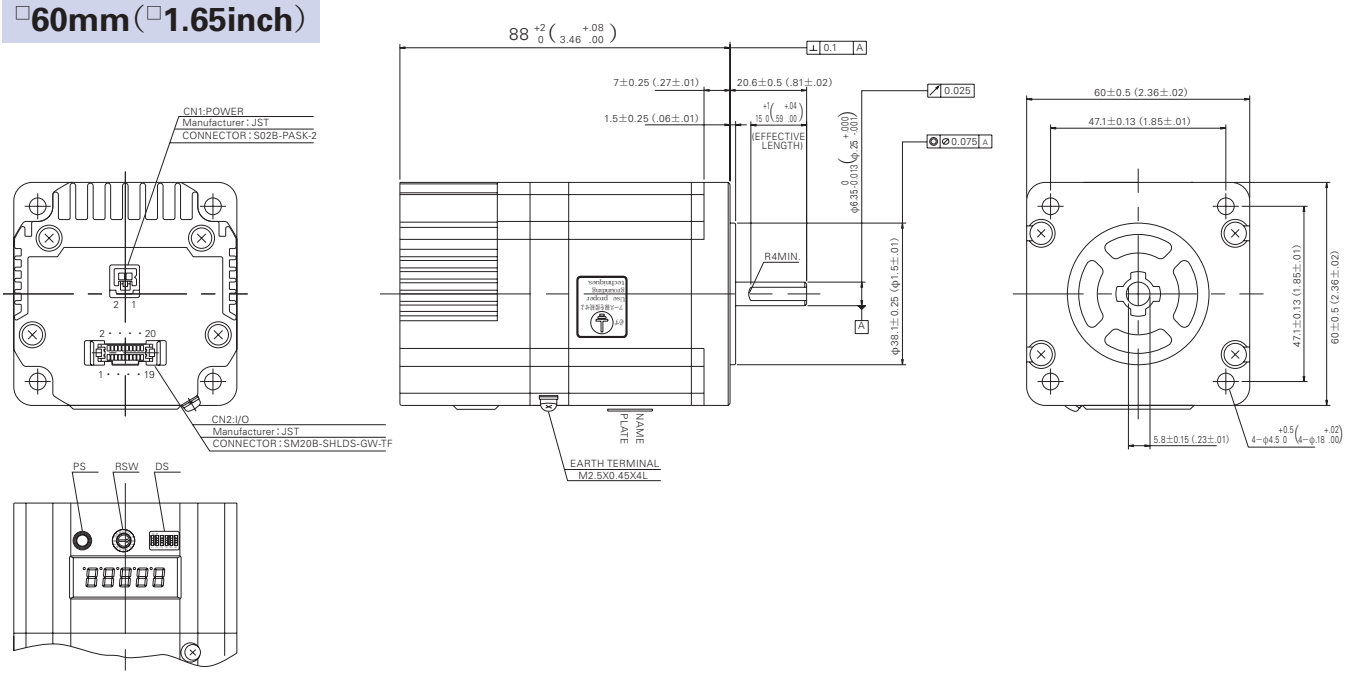


Specifications

Basic specifications	Part number (Flange size)		**DB21M142S-01 (□42)**	**DB22M162S-01 (□60)**
	Input source (Note1)		DC24 V ±10 %	
	Getaway torque (A)		2 MAX.	3 MAX.
	Environment	Protection class	Class I	
		Operation environment	Installation category (over-voltage category) : II, pollution degree : 2	
		Applied standards	EN61010-1	
		Operating ambient temperature (Note2)	0 to +40℃	
		Conservation temperature	-20 to +60℃	
		Operating ambient humidity	35 to 85%RH (no condensation)	
		Conservation humidity	10 to 90%RH (no condensation)	
		Operation altitude	1000 m (3280 feet) MAX. above sea level	
		Vibration resistance	Tested under the following conditions ; 4.9m/s2, frequency range 10 to 55Hz, direction along X, Y and Z axes, for 2 hours each	
		Impact resistance	Not influenced at NDS-C-0110 standard section 3.2.2 division "C" .	
		Withstand voltage	Not influenced when 1500V AC is applied between power input terminal and cabinet for one minute.	
		Insulation resistance	10M ohm MIN. when measured with 500V DC megohmmeter between input terminal and cabinet.	
	Mass (Weight)		0.5kg (1.10lbs)	0.87kg (1.92lbs)
Function	Protection function		Against driver overheat	
	LED indicator		Alarm monitor	
I/O signals	Command pulse input signal (Note3)		Photo coupler input method, input resistance 220 Ω Input signal voltage : "H" = 4.0 to 5.5V, "L" = 0 to 0.5V	
	Power down input signal (PD)		Photo coupler input method, input resistance 470 Ω Input signal voltage : "H" = 4.0 to 5.5V, "L" = 0 to 0.5V	
	Step angle setting selection input (EXT)		Photo coupler input method, input resistance 470 Ω Input signal voltage : "H" = 4.0 to 5.5V, "L" = 0 to 0.5V	
	FULL/HALF setting selection input (F/H)		Photo coupler input method, input resistance 470 Ω Input signal voltage : "H" = 4.0 to 5.5V, "L" = 0 to 0.5V	
	EMG input signal		Photo coupler input method, input resistance 470 Ω Input signal voltage : "H" = 4.0 to 5.5V, "L" = 0 to 0.5V	
	BUSY output signal		Photo coupler input method, input resistance 220 Ω Input signal voltage : "H" = 4.0 to 5.5V, "L" = 0 to 0.5V	
	Phase origin monitor output signal (MON)		Open collector output by photo coupler Output signal standard : Vceo = 30V MAX., Ic = 20mA MAX.	
	Alarm output signal (AL)		Open collector output by photo coupler Output signal standard : Vceo = 30V MAX., Ic = 20mA MAX.	

※1Note that the power voltage must not exceed 24VDC + 10% (26.4VDC).
※2If the driver is placed in a box, the temperature inside the box must not exceed this specified range.
※3The maximum input frequency is 250k pulse/s.

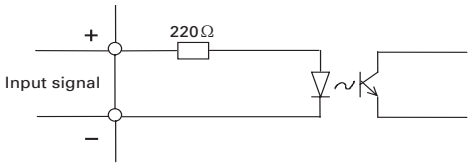
□60mm(□1.65inch)



Input circuit configuration

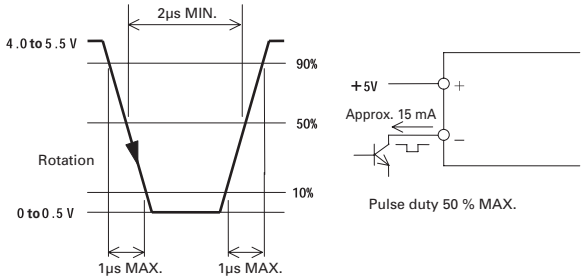
■ Input interface

◎ **Input circuit configuration**

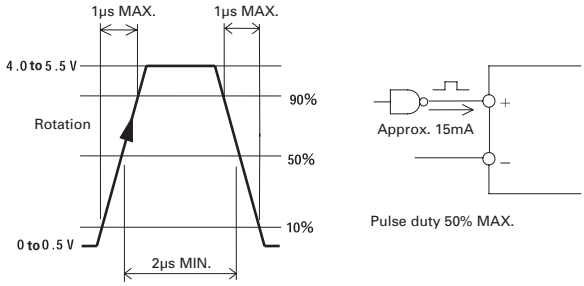


■ Input signal specifications

◎ **Negative logic**

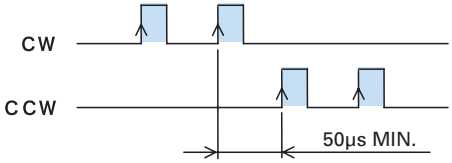


◎ **Positive logic**



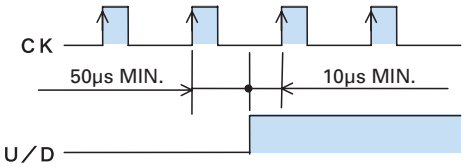
■ Timing of the command pulse

◎ **2-input mode（CW, CCW）**



- The internal photo coupler turns ON within the ■ and, at its falling edge to OFF, the internal circuit (motor) is activated.
- When applying the pulse to CW, turn OFF the CCW side internal photo coupler.
- When applying the pulse to CCW, turn OFF the CW side internal photo coupler.

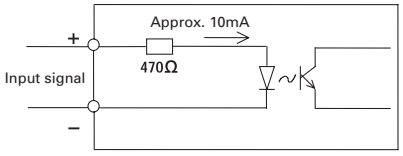
◎ **Pulse and direction mode（CK, U/D）**



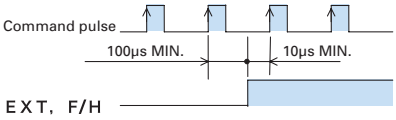
- The “H” level is input for ■ and, at its rising edge to “H” level, the internal circuit (stepping motor) is activated.
- Switching the input signal U/D should be performed while the input level on the CK side is “L”.

■ Input circuit configuration

◎ **Input circuit configuration（PD、EXT、F/H、EMG）**



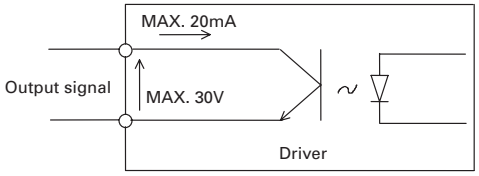
◎ **Timing of command pulse, step angle selection, and FULL/HALF selection input signal**



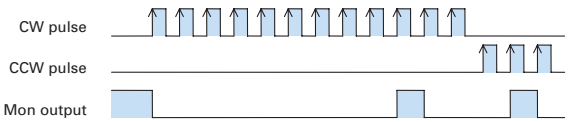
- Shaded area indicates internal photo coupler "ON".
- EXT input signal
  EXT photo coupler "ON" enables a function by external F/H input signal.
  EXT photo coupler "OFF" enables the setting of a number of micro steps by main unit's rotary switch S.S.
- F/H input signal
  F/H photo coupler "ON" sets HALF step (2-division) operation.
  F/H photo coupler "OFF" sets FULL step (1-division) operation.
- Refer to switching EXT and F/H input signal in the [FULL/HALF input signal, command pulse, and step angle select].
- When switching the step angle by EXT and F/H input signal, the phase origin LCD may not turn ON and the phase origin monitor output may not output when stop. Refer to the MON output in the [Output Interface].

Output interface

■ Output circuit configuration（BUSY、MON、AL）

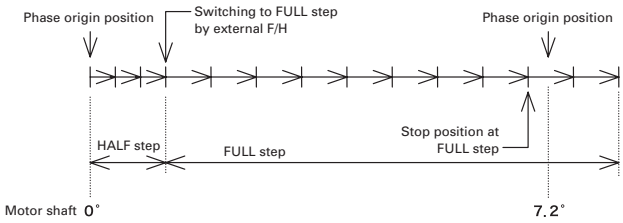


■ Mon output



- When the motor excitation phase is at the phase origin (power ON status), the photo coupler is turned "ON", and the upper D.P of status LED turns on synchronously.
- Output from MON is set to on at every 7.2 degrees of motor output shaft from phase origin.

◎ **When changing the division setting by F/H input signal.**



- When changing the motor division setting by the external input signal and the rotary switch as shown in the example below, the motor cannot stop where MON output signal can be output. Take this into consideration when using the MON output signal.

WIRING

■ Specification Summary of Input/Output Signals (Serial I/F mode)

Signal	Reference Designation	Pin Number	Function Summary
General-purpose input common	+COM	6	Input signal common of the 6 to 9 pins DC 5V is input.
Alarm clear signal (standard)	ALMC	6	Recoverable alarms are cleared. Internal photo coupler off → on···Alarm clear
General-purpose input 1	IN1	6	This is a general-purpose input signal that can be used by program driving. Internal photo coupler on···General purpose input 1 on Internal photo coupler off ··· General purpose input 1 off
Emergency stop input	EMG	6	The emergency stop signal is input. Internal photo coupler on···No emergency stop Internal photo coupler of···Emergency stop
Origin signal	ORG	6	The origin signal used for the return to origin operation is input. Internal photo coupler on···Origin signal on Internal photo coupler off···Origin signal off
+ direction overtravel signal	+OT	7	An overtravel signal in the + direction is input. Internal photo coupler on ···+ direction overtravel not arrived Internal photo coupler off ···+ direction overtravel arrived
General-purpose input 2	IN2	7	This is a general-purpose input signal that can be used by program driving. Internal photo coupler on···General purpose input 2 on Internal photo coupler off ···General purpose input 2 off
Emergency stop input	EMG	7	The emergency stop signal is input. Internal photo coupler on···No emergency stop Internal photo coupler off···Emergency stop
Origin signal	ORG	7	The origin signal used for the return to origin operation is input. Internal photo coupler on···Origin signal on Internal photo coupler off ··· Origin signal off
Alarm clear signal	ALMC	7	Recoverable alarms are cleared. Internal photo coupler off → on···Alarm clear
- direction overtravel signal	— OT	8	An overtravel signal in the - direction is input. Internal photo coupler on ···- direction overtravel not arrived Internal photo coupler off···- direction overtravel arrived
General-purpose input 3	IN3	8	This is a general-purpose input signal that can be used by program driving. Internal photo coupler on···General purpose input 3 on Internal photo coupler off ··· General purpose input 3 off
Emergency stop input	EMG	8	emergency stop signal is input. Internal photo coupler on···No emergency stop Internal photo coupler off···Emergency stop
Origin signal	ORG	8	The origin signal used for the return to origin operation is input. Internal photo coupler on···Origin signal on Internal photo coupler off ··· Origin signal off
Alarm clear signal	ALMC	8	Recoverable alarms are cleared. Internal photo coupler off → on···Alarm clear

Signal	Reference Designation	Pin Number	Function Summary
Emergency stop signal	EMG	9	The emergency stop signal is input. Internal photo coupler on···No emergency stop Internal photo coupler off···Emergency stop
General-purpose input 4c	IN4	9	This is a general-purpose input signal that can be used by program driving. Internal photo coupler on···General purpose input 4 on Internal photo coupler off ··· General purpose input 4 off
Origin signal	ORG	9	The origin signal used for the return to origin operation is input. Internal photo coupler on···Origin signal on Internal photo coupler off ··· Origin signal off
Alarm clear signal	ALMC	9	alarms are cleared. Internal photo coupler off → on···Alarm clear
During motor operation	BUSY	10	The operation status of the motor is output. Internal photo coupler on···During motor operation Internal photo coupler off···During motor stop
During program execution	PEND	10	The execution status of the program is output. Internal photo coupler on···During program execution Internal photo coupler off···Program execution complete
Zone signal	ZONE	10	on when the current position is inside the coordinates that were set beforehand.
During program execution	PEND	11	The execution status of the program is output. Internal photo coupler on···During program execution Internal photo coupler off···Program execution complete
During motor operation	BUSY	11	The operation status of the motor is output. Internal photo coupler on···During motor operation Internal photo coupler off···During motor stop
Zone signal	ZONE	11	Turns on when the current position is inside the coordinates that were set beforehand.
Alarm output	ALM	12	When various alarm circuits operate in the driver, an external signal is output. At this time, the stepping motor becomes non excited status.
Output signal common	OUT_COM	13	It is for the output signal common.
DATA+	DATA+	14	It is for the serial signal.
DATA —	DATA —	15	It is for the serial signal.

■ Specification Summary of Input/Output Signals (Pulse train I/F mode)

Signal	Reference Designation	Pin Number	Function Summary
CW pulse input (Standard)	CW+ CW —	1 2	When "2 input mode", Input drive pulse rotating CW direction.
Pulse train input	CK+ CK —	1 2	When "1 input mode", Input drive pulse train for motor rotation.
CCW pulse input (Standard)	CCW+ CCW —	3 4	When "2 input mode", Input drive pulse rotating CCW direction.
Rotational direction input	U/D+ U/D —	3 4	When "1 input mode", Input motor rotational direction signal. Internal photo coupler ON ··· CW direction Internal photo coupler OFF ··· CCW direction
General-purpose input common	+COM	6	Input signal common of the 6 to 9 pins DC5V is input.
Power down input	PD	6	Inputting PD signal will cut off (power off) the current flowing to the Motor (With dip switch select, change to the Power low function is possible). PD input signal on (internal photo coupler on) ··· PD function is valid. PD input signal off (internal photo coupler off) ··· PD function is invalid.
Step angle select input	EXT	7	FULL/HALF select input will become valid by inputting EXT signal. EXT input signal on (internal photo coupler on) ··· External input signal F/H is valid EXT input signal off (internal photo coupler off) ··· Main body rotary switch S.S is valid

Signal	Reference Designation	Pin Number	Function Summary
FULL/HALF select input	F/H	8	When EXT input signal on (internal photo coupler on), F/H input signal on (internal photo coupler on) ··· HALF step F/H input signal off (internal photo coupler off) ··· FULL step
Emergency stop	EMG	9	The emergency stop signal is input. Internal photo coupler on···No emergency stop Internal photo coupler off···Emergency stop
During motor operation	BUSY	10	The operation status of the motor is output. Internal photo coupler on ···During motor operation Internal photo coupler off ···During motor stop
Phase origin monitor output	MON	11	When the excitation phase is at the origin (in power on) it turns on. When FULL step, ON once for 4 pulses, when HALF step, ON once for 8 pulses.
Alarm output	ALM	12	When alarm circuits actuated inside the Driver, outputs signals to outside. Then the Stepping motor becomes unexcited status.
Output signal common	OUT_COM	13	It is for the output signal common.

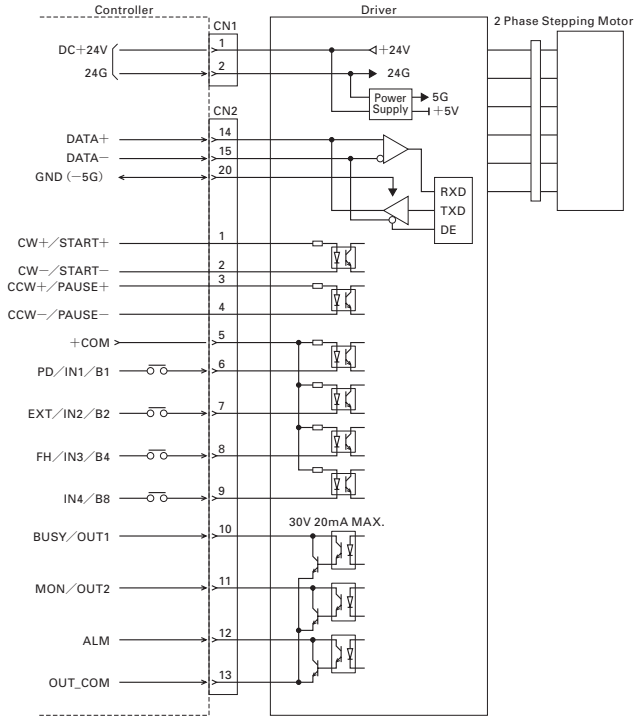
※As for the Motor rotational direction, CW direction is regard as the clockwise revolution by viewing the Motor from output shaft side.

■ Specification Summary of Input/Output Signals (Parallel I/F mode)

Signal	Reference Designation	Pin Number	Function Summary
Program drive Start/Stop	START+ START-	1 2	Commands the start and stop of program driving. Internal photo coupler on···Program driving start Internal photo coupler off···Program driving stop
Program pause	PAUSE+ PAUSE-	3 4	When START signal on, a pause in program driving is commanded. Internal photo coupler on···Program driving pause Internal photo coupler off···Program driving pause release
General-purpose input common	+COM	6	Input signal common of the 6 to 9 pins DC5V is input.
Alarm clear signal (standard)	ALMC	6	Recoverable alarms are cleared. Internal photo coupler off → on···Alarm clear
General-purpose input 1	IN1	6	This is a general-purpose input signal that can be used by program driving. Internal photo coupler on···General purpose input 1 on Internal photo coupler off ··· General purpose input 1 off
Program number selection bit 1	B1	6	The program number is selected along with other bits. (Subordinate bit) Internal photo coupler on···Corresponding bit 1 Internal photo coupler off··· Corresponding bit 0
Emergency stop input	EMG	6	The emergency stop signal is input. Internal photo coupler on···No emergency stop Internal photo coupler off···Emergency stop
Origin signal	ORG	6	The origin signal used for the return to origin operation is input. Internal photo coupler on···Origin signal on Internal photo coupler off ··· Origin signal off
+ direction overtravel signal	+OT	7	An overtravel signal in the + direction is input. Internal photo coupler on ···+ direction overtravel not arrived Internal photo coupler off ···+ direction overtravel arrived
General-purpose input 2	IN2	7	This is a general-purpose input signal that can be used by program driving. Internal photo coupler on···General purpose input 2 on Internal photo coupler off ··· General purpose input 2 off
Program number selection bit 2	B2	7	The program number is selected along with other bits. (The second bit from the subordinate) Internal photo coupler on···Corresponding bit 1 Internal photo coupler off··· Corresponding bit 0
Emergency stop input	EMG	7	The emergency stop signal is input. Internal photo coupler on···No emergency stop Internal photo coupler off···Emergency stop
Origin signal	ORG	7	The origin signal used for the return to origin operation is input. Internal photo coupler on···Origin signal on Internal photo coupler off ··· Origin signal off
Alarm clear signal	ALMC	7	Recoverable alarms are cleared. Internal photo coupler off → on···Alarm clear
- direction overtravel signal	-OT	8	An overtravel signal in the - direction is input. Internal photo coupler on ····- direction overtravel not arrived Internal photo coupler off ····- direction overtravel arrived
General-purpose input 3	IN3	8	This is a general-purpose input signal that can be used by program driving. Internal photo coupler on···General purpose input 3 on Internal photo coupler off ··· General purpose input 3 off
Program number selection bit 4	B4	8	The program number is selected along with other bits. (The third bit from the subordinate) Internal photo coupler on···Corresponding bit 1 Internal photo coupler off··· Corresponding bit 0
Emergency stop input	EMG	8	The emergency stop signal is input. Internal photo coupler on···No emergency stop Internal photo coupler off···Emergency stop
Origin signal	ORG	8	The origin signal used for the return to origin operation is input. Internal photo coupler on···Origin signal on Internal photo coupler off ··· Origin signal off
Alarm clear signal	ALMC	8	Recoverable alarms are cleared. Internal photo coupler off → on···Alarm clear

Signal	Reference Designation	Pin Number	Function Summary
Emergency stop signal	EMG	9	The emergency stop signal is input. Internal photo coupler on···No emergency stop Internal photo coupler off···Emergency stop
General-purpose input 4	IN4	9	This is a general-purpose input signal that can be used by program driving. Internal photo coupler on···General purpose input 4 on Internal photo coupler off ··· General purpose input 4 off
Program number selection bit 8	B8	9	The program number is selected along with other bits. (The fourth bit from the subordinate) Internal photo coupler on ··· Corresponding bit 1 Internal photo coupler off ··· Corresponding bit 0
Origin signal	ORG	9	The origin signal used for the return to origin operation is input. Internal photo coupler on···Origin signal on Internal photo coupler off ··· Origin signal off
Alarm clear signal	ALMC	9	Recoverable alarms are cleared. Internal photo coupler off → on···Alarm clear
During motor operation	BUSY	10	The operation status of the motor is output. Internal photo coupler on···During motor operation Internal photo coupler off···During motor stop
During program execution	PEND	10	The execution status of the program is output. Internal photo coupler on···During program execution Internal photo coupler off···Program execution complete
Zone signal	ZONE	10	Turns on when the current position is inside the coordinates that were set beforehand.
During program execution	PEND	11	The execution status of the program is output. Internal photo coupler on···During program execution Internal photo coupler off···Program execution complete
During motor operation	BUSY	11	The operation status of the motor is output. Internal photo coupler on···During motor operation Internal photo coupler off···During motor stop
Zone signal	ZONE	11	Turns on when the current position is inside the coordinates that were set beforehand.
Alarm output	ALM	12	When various alarm circuits operate in the driver, an external signal is output. At this time, the stepping motor becomes non excited status.
Output signal common	OUT_COM	13	It is for the output signal common.
DATA+	DATA+	14	It is for the serial signal.
DATA −	DATA −	15	It is for the serial signal.

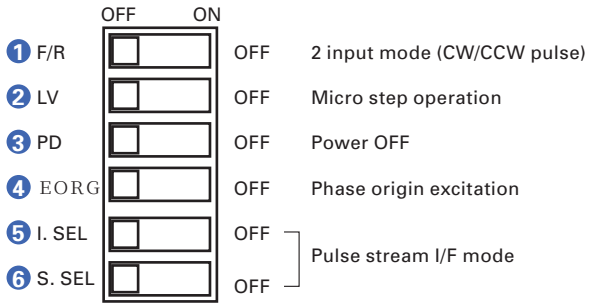
■ External Wiring Diagrams



SET UP

■ Function Select Dip Switch

The functions according to the specification can be selected with this Dip switch.
Confirm the ex-factory setting as follows.



◎ **For pulse stream I/F mode**

❶Input mode select (F/R)

Input pulse mode selection
This switch setting is only effective in pulse stream I/F mode.

F/R	Input pulse mode
ON	1 input mode (CK,U/D)
OFF	2 input mode (CW,CCW)

❷Low vibration mode select (LV)

Low vibration and smooth operation is enabled even by the rough resolution setting
(e.g. 1 division, 2 division).
This switch setting is only effective in pulse stream I/F mode.
For parallel I/F mode and serial I/F mode, this is usually a low vibration operation.

LV	Operation
ON	Low vibration operation
OFF	Micro step operation

※ When LV select is ON (low vibration mode), operational process of driving pulse will be carried out inside the Driver. Therefore, the Motor movement delays for the time of 3.2ms pulse per input pulse. Note that depending upon the combined Motor, load,driving profile and etc, it may take a while until the shaft is adjusted when the Motor stops. (In parallel I/F mode and serial I/F mode there is no delay)

❸Power down select (PD)

Select the Motor winding current value when inputting the power down signal.This switch setting is only effective in pulse stream I/F mode.

PD	Motor winding current
ON	Current value by rotary switch STP (Power Low)
OFF	0A (Power OFF)

※ PD function (the setting selected by PD of the function select dip switch) is enabled by PD input signal ON (built-in photo coupler ON) of Input/Output signal connector (CN2). Power down signal input is prior to all the other current settings except for alarms. The operational status may not be maintained such as power swing due to output torque drop or lower operation due to Motor current OFF (unexcited Motor). Pay extra attention to the input timing of the power down signal in addition that the security device should be installed to the machine.

❹Excitation select (EORG)

※ By turning on the EORG, excitation phase when power OFF is saved.

❺, ❻Operation mode selection (I.SEL, S.SEL)

The operation mode is selected.

I.SEL	S.SEL	Operation mode
OFF	–	Pulse stream I/F mode
ON	OFF	Parallel I/F mode
	ON	Serial I/F mode

※ Change the operation mode selection switch after cutting off the driver's power supply.

◎ **For parallel I/F mode or serial I/F mode**

The communication speed of serial communication is set.

Switch	Set value	Communication speed(bps)			
		9,600	19,200	38,400	115,200
F/R	OFF	○	○	○	○
	ON				
LV	OFF	○	○		
	ON			○	○
PD	OFF	○		○	
	ON		○		○

※ The setting change after the power supply is turned on is invalid.
It does not function as a F/R, LV, and PD.

※ The communication speed of pulse stream I/F mode is fixed at 9600bps.

■ Rotary switch(RSW) and the mode change switch(PSW)

◎ **For pulse stream I/F mode**

When it selects the step angle, the driving current is selected, and stops the current is selected, set by combining rotary switch (RSW) and mode change switch (PSW).

1. Step angle select(S.S)

The divisions of the basic step angle (0.9 °/step) when micro step driving can be set with this rotary switch.

Gradation	0	1	2	3	4	5	6	7
Partition	1	2	2.5	4	5	8	10	20
Gradation	8	9	A	B	C	D	E	F
Partition	25	40	50	80	100	125	200	250

Ex-factory setting is at 1 (division 2)

※ The step angle select switch (S.S) and the number of partitions become invalid by EXT input signal ON (built-in photo coupler ON) of Input/Output signal connector (CN2).

2. Driving current select(RUN)

The Motor operation current value can be selected with this rotary switch.

Gradation	0	1	2	3	4	5	6	7
Motor current (%)	100 (rated)	95	90	85	80	75	70	65
Gradation	8	9	A	B	C	D	E	F
Motor current (%))	60	55	50	45	40	35	30	25

Ex-factory setting is at 0 (rated value).

※ When there is a sufficient extra motor torque, lowering the operation current value will be effective in the lower vibration. The Motor output torque is almost proportional to the current value. When adjusting the operational torque, confirm the sufficient operation margin and determine the Motor current value.

3. Current Select when Stop (STP)

The motor current value when stop and when power down input signal ON (power low function is selected by dip switch) can be selected with this rotary switch.

Gradation	0	1	2	3	4	5	6	7
Motor current (%)	100 (rated)	95	90	85	80	75	70	65
Gradation	8	9	A	B	C	D	E	F
Motor current (%)	60	55	50	45	40	35	30	25

Ex-factory setting is set at A (50%).

※ The current setting when stop by STP becomes valid when the Motor stops (approximately 200ms after the last pulse input) and when power down input signal

◎ **For parallel I/F mode and serial I/F mode**

The slave bureau address of serial communications is set with this rotary switch.

RSW	Slave station address (HEX)
0	0
1	1
:	:
E	E
F	F

Ex-factory setting is set at 0

※ The slave station address of the pulse stream I/F mode is fixed at 0.