Stepping Motors

Introduction

αSTEP AS
AC Input

αSTEP ASC
DC Input

5-Phase Microstep RK
AC Input

2-Phase Full/Half UMK

5-Phase Microstep CRK

2-Phase Microstep RBK
DC Input

2-Phase Microstep CMK

2-Phase PK/PV
Without Encoder

2-Phase PK
With Encoder

EMP400
Controllers

SG8030J

Accessories

Installation

■ Connection and Operation

● Names and Functions of Driver Parts

Motor Connector

Power Input Connector
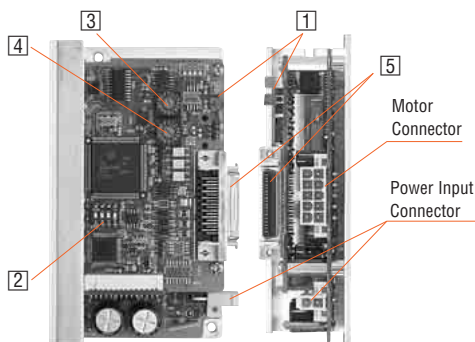
① Signal Monitor Display

◇ LED Indicators

Indication	Color	Function	When Activated
LED1	Green	Power Supply Indication	Lights when power is on.
LED2	Red	Alarm Indication	Blinks when protective functions are activated.

◇ Alarm

Blink Count	Function	When Activated
2	Overload	The motor has been operated continuously over 5 seconds under a load exceeding the maximum torque.
3	Overvoltage	The primary voltage of the driver's inverter has exceeded the allowable level.
4	Speed Error	The motor cannot accurately follow at the indicated pulse speed.
6	Overspeed	The motor shaft velocity exceeds 5000 r/min. (Except geared type)
7	EEPROM Data Error	A motor control parameter has been damaged.
8	Sensor Error	The power has been turned on without the motor cable connected to the driver.
Lights (No blinking)	System Error	The driver has fatal error.

② Function Switches

Indication	Switch Name	Function
1000/500 ×1/×10	Resolution Select Switch	This function is for selecting the motor resolution. For each geared type, the resolution of gear output shaft is 1/gear ratio. [1000] [×1] → 1000 P/R (0.36°/step) [1000] [×10] → 10000 P/R (0.036°/step) [500] [×1] → 500 P/R (0.72°/step) [500] [×10] → 5000 P/R (0.072°/step)
1P/2P	Pulse Input Mode Switch	The settings of this switch are compatible with the following two types of pulse input modes: "1P" for the 1-pulse input mode, "2P" for the 2-pulse input mode.

Notes:
● Always turn the power off before switching resolution or pulse input, and turn it ON again after you have made the change.
● If the resolution select switch is set to [×10], it cannot control the resolution selected by the input signal. It is always [×10].

③ Current Adjustment Switch

Indication	Switch Name	Function
CURRENT	Current Adjustment Switch	The motor running current can be lowered to suppress temperature rise in the motor and driver, or lower operating current in order to allow a margin for motor torque (a maximum of 16 settings).

④ Velocity Filter Adjustment Switch

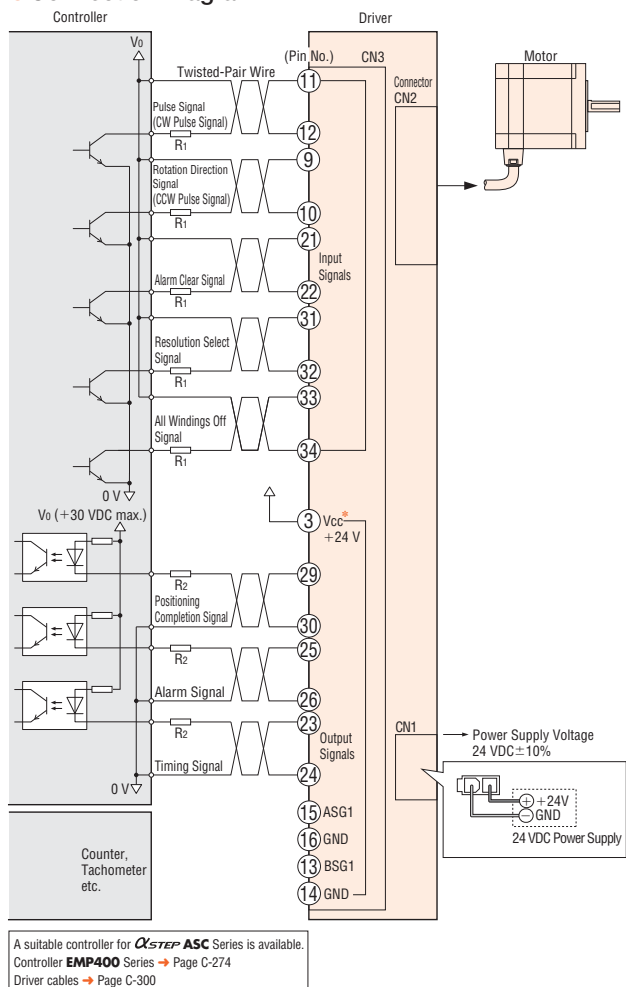| Indication	Switch Name	Function	
V.FIL	Velocity Filter Adjustment Switch	This switch is used to make adjustments when a smooth start-stop or smooth motion at low speed is required (a maximum of 16 settings).	

⑤ Input/Output Signals (36 pins)

Indication	Input/Output	Pin. No	Signal	Signal Name
CN3	External power input	2	GND	Power Supply for Signal Control
		3	Vcc+24V	
	Input	9	DIR. (CCW)	Rotation Direction (CCW Pulse)✽
		10	$\overline{\text{DIR.}}$ (CCW)	
		11	PLS (CW)	Pulse (CW Pulse)✽
		12	$\overline{\text{PLS}}$ (CW)	
	Output	13	BSG1	Quadrature BSG Output (Open-collector)
		14	GND	
		15	ASG1	Quadrature ASG Output (Open-collector)
		16	GND	
	Input	21	ACL	Alarm Clear
		22	$\overline{\text{ACL}}$	
	Output	23	TIM.1	Timing (Open-collector)
		24	$\overline{\text{TIM.1}}$	
		25	ALARM	Alarm
		26	$\overline{\text{ALARM}}$	
		29	END	Positioning Completion
		30	$\overline{\text{END}}$	
	Input	31	×10	Resolution Select
		32	$\overline{\times 10}$	
		33	C.OFF	All Windings Off
		34	$\overline{\text{C.OFF}}$	

Description of input/output signals ➜ Page C-85
✽ Signal name in parentheses represents the setting in 2-pulse input mode.

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● Connection Diagram

Controller
Driver

A suitable controller for **αstep ASC** Series is available.
Controller **EMP400** Series ➡ Page C-274
Driver cables ➡ Page C-300

◇ **Input Signal Connection**

Signals can be connected directly when 5 VDC is supplied. If the signals are used at a voltage exceeding 5 VDC, be sure to provide an external resistor to prevent the current exceeding 20 mA from flowing. Internal components will be damaged if a voltage exceeding 5 VDC is supplied directly without using an external resistor.
Example: If the voltage is 24 VDC, connect a resistor (R_1) of 1.5 to 2.2 kΩ and 0.5 W or more.

◇ **Output Signal Connection**

Use output signals at 30 VDC or less and 15 mA or less.
If these specifications are exceeded, the internal components may be damaged.
Check the specification of the connected equipment.
✽ Check the connection on page C-85 when using a 24 VDC power supply for control signals.

◇ **Notes on Wiring**

● Use multi-core, twisted-pair shielded wires of AWG28 or thicker for the control I/O signal lines (CN3), and keep wiring as short as possible [within 2 m (6.6 ft.)].
● Note that as the length of the pulse signal line increases, the maximum transmission frequency decreases. Technical reference ➡ Page F-54
● When it is necessary to extend the wiring distance between the motor and driver more than 0.4 m (1.31 ft.) [0.15 m (0.5 ft.) or more: **ASC34** and **ASC36** types], the accessory extension cable or flexible extension cable must be used. Electromagnetic brake motor models [except motor frame size 42 mm (1.65 in.)] must use an electromagnetic brake extension cable or flexible extension cable (sold separately). The frame size 42 mm (1.65 in.) models can use a standard extension cable even for electromagnetic brake motor models. Extension cables for electromagnetic brake motor ➡ Page C-297
● The range of wire for the power connector (CN1) is AWG24 to 18. Use wire of AWG20 or thicker for the power line.
● Provide a minimum distance of 300 mm (1 ft.) between the control I/O signal lines and power lines (AC lines, motor lines and other large-current circuits).
Do not run the control I/O signal lines in the same duct as power lines or bundle them with power lines.
● The customer must furnish the cables for power supply lines and control I/O signal lines.
● Use included connector for connection of power supply.
● To install the pins, be sure to use the specified crimping tool made by MOLEX 57026-5000 (for UL 1007) or 57027-5000 (for UL 1015).

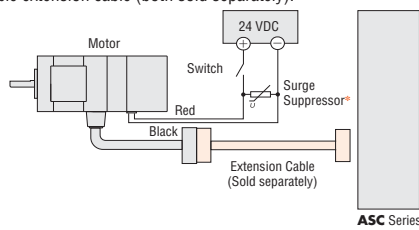## ■ Connecting the Electromagnetic Brake to a Power Supply

Connect the electromagnetic brake to the power supply using a cable of at least AWG24. The power supply input to the electromagnetic brake is 24 VDC ±5% 0.3 A minimum (**ASC46**: 0.1 A minimum) and therefore must be independent of the driver's power supply for signal control.

Notes:
● Applying a voltage that exceeds the specifications will cause the electromagnetic brake to generate a great deal of heat, resulting in motor temperature rises and possible damage to the motor. Conversely, if voltage is too low, the electromagnetic brake may not release.
● To protect the switch contacts and prevent noise, always connect the surge suppressor.✽ (✽The surge suppressor is included with electromagnetic brake motors.)
● To prevent noise, use a dedicated power supply for electromagnetic brake.
● Correct polarity (+ and −) must be ensured when connecting the electromagnetic brake leads of **ASC** Series to the DC power supply. If polarity is incorrect, the electromagnetic brake will not operate properly.
● When using as a CE certified part, use a dedicated DC power supply for electromagnetic brake.

(1) **ASC46**

The electromagnetic brake leads are linked to the connector on the motor [600 mm (23.6 in.)]. When connecting with the DC power supply, connect the red spiral lead wire to +24 V, and the black lead wire to the ground (GND). Use the extension cable or the flexible extension cable (both sold separately).
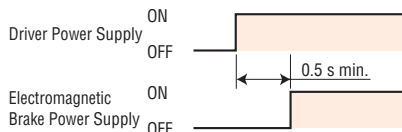

(2) **ASC66**

The electromagnetic brake leads are linked to the connector on the driver connection side of extension cable for electromagnetic brake motor (sold separately). Be sure to use the accessory (sold separately) extension cable or flexible extension cable. Connect the orange/black spiral lead wire (orange for flexible extension cable) [60 mm (2.36 in.)] to +24 V, and the gray lead wire [60 mm (2.36 in.)] to the ground (GND).
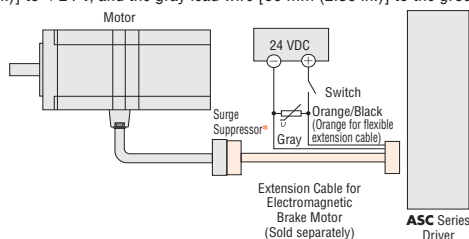
Timing Chart for Electromagnetic Brake Operation

To release the electromagnetic brake, wait at least 0.5 second after turning on the driver power supply.
The load may fall down.

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● Description of Input/Output Signals

Indication of Input/Output Signal "ON""OFF"

Input (Output) "ON" indicates that the current is sent into the photocoupler (transistor) inside the driver. Input (Output) "OFF" indicates that the current is not sent into the photocoupler (transistor) inside the driver.
The input/output remains "OFF" if nothing is connected.

Photocoupler | OFF | ON |

PLS (CW) and DIR. (CCW) Input Signal

◇ Input Circuit and Sample Connection
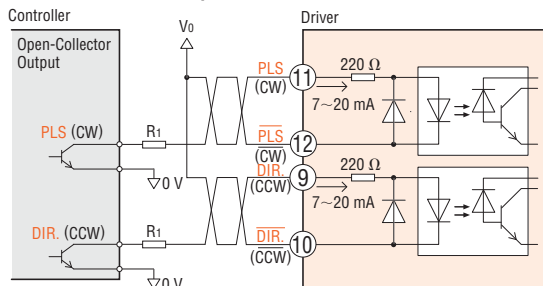
● The colored characters indicate signals under the 1-pulse input mode, while the black characters indicate signals under the 2-pulse input mode.

Note:
● The external resistor is not needed when Vo is 5 VDC. When the voltage exceeds 5 VDC, connect the external resistor R_1 to keep input current at 20 mA or less. When 5 VDC or more is applied without the external resistor, the internal components may get damaged.

◇ Pulse Waveform Characteristics
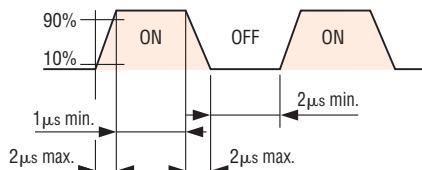
● For pulse signals, use input pulse waveforms like those shown in the figure above.

◇ Pulse Input Modes
#### ● 1-Pulse Input Mode

The 1-pulse input mode uses "Pulse" (PLS) and "Rotation Direction" (DIR.) signals. CW is selected by inputting DIR. signal at low level (with the input photocoupler ON), CCW by inputting at high level (with input photocoupler OFF).

Rotation Direction Signals Photocoupler "ON": Clockwise
Photocoupler "OFF": Counterclockwise
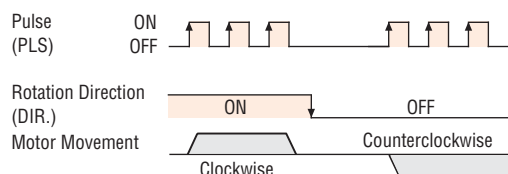
● 2-Pulse Input Mode

The 2-pulse input mode uses "CW" and "CCW" pulses.
When "CW" pulses are input, the motor's output shaft rotates clockwise when the motor is viewed facing the shaft; when "CCW" pulses are input, the shaft rotates counterclockwise.
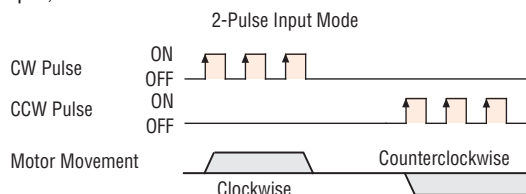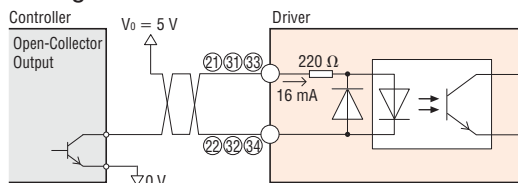

All Windings Off (C.OFF) Input Signal
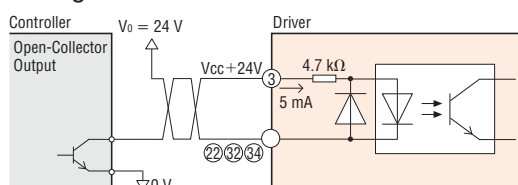### Resolution Select (×10) Input Signal
Alarm Clear (ACL) Input Signal
◇ Input Circuit and Sample Connection
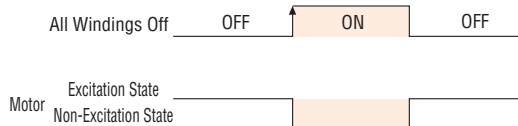#### ● When Using 5 VDC

● When Using 24 VDC

◇ All Windings Off (C.OFF) Input Signal
Pin No. ㉝, ㉞

This controller power supply offers a choice of either 5 VDC or 24 VDC. Inputting the "All Windings Off" (C.OFF) signal puts the motor in a non-excitation (free) state. It is used when turning the motor shaft externally or when positioning manually. This signal clears the deviation counter.

◇ Resolution Select (×10) Input Signal
Pin No. ㉛, ㉜

This controller power supply offers a choice of either 5 VDC or 24 VDC. Inputting this signal when 1000 P/R or 500 P/R is selected as resolution via the function switch will increase the resolution ten times to 10000 P/R or 5000 P/R.

Note:
● While the resolution select switch is set to 10000 P/R or 5000 P/R, input of this signal will not change the resolution.

◇ Alarm Clear (ACL) Input Signal
Pin No. ㉑, ㉒

This controller power supply offers a choice of either 5 VDC or 24 VDC. This signal is used for canceling the alarm without turning off power to the driver when a protective function has been activated.

Note:
● The following alarm cannot be cleared. To cancel the alarm, first resolve the cause and check for safety, and then turn power on again.
· EEPROM data error · System error

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Positioning Completion (END) Output Signal
Alarm (ALARM) Output Signal
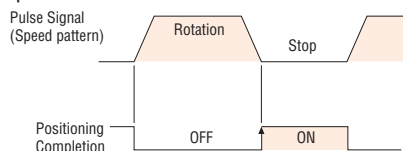### ◇Output Circuit and Sample Connection
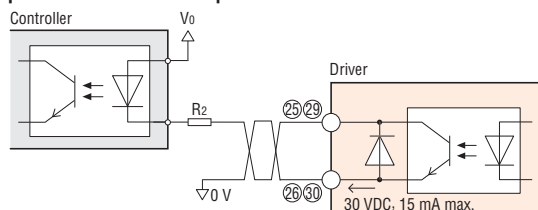
◇Positioning Completion (END) Output Signal
Pin No. ㉙, ㉚

Circuits for use with 30 VDC, 15 mA maximum.
This signal is output at the photocoupler ON state when positioning is completed. This signal is output when the rotor position is less than ±1.8˚ from the command position, approximately 2 msec after the pulse input stops.
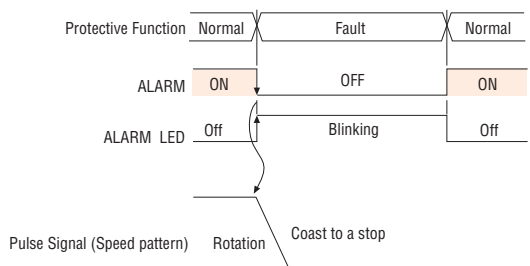

Note:
● The "Positioning Completion" signal blinks during operation with a pulse input frequency of 500 Hz or less.

◇Alarm (ALARM) Output Signal
Pin No. ㉕, ㉖

Circuits for use with 30 VDC, 15 mA maximum. The photocoupler turns OFF when one of the driver's protective functions has been activated. When an abnormality such as an overload or overvoltage is detected, the "Alarm" signal will be output, the driver's LED indicator (ALARM) blinks, and the motor stops (non-excitation state).
To cancel the alarm, first resolve the cause and check for safety, and then input an "Alarm Clear" (ACL) signal or reset power. Once power has been turned off, wait at least five seconds before turning it on again.
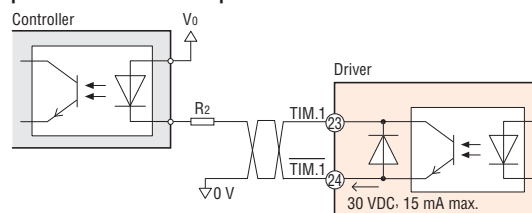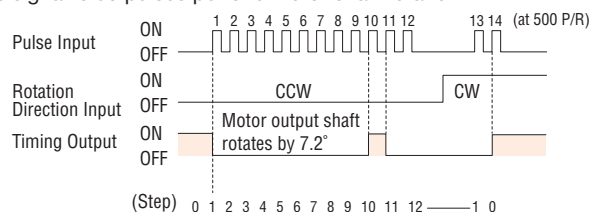

Note:
● The "Alarm" output uses positive logic (normally closed), all other outputs use negative logic (normally open).

Timing (TIM.1) Output Signal
◇Output Circuit and Sample Connection

Circuits for use with 30 VDC, 15 mA maximum. When the "Timing" signal is output, the transistor turns ON. This signal is used to detect the home position with greater precision. The number of pulses of this signal is 50 pulses per one motor shaft rotation.
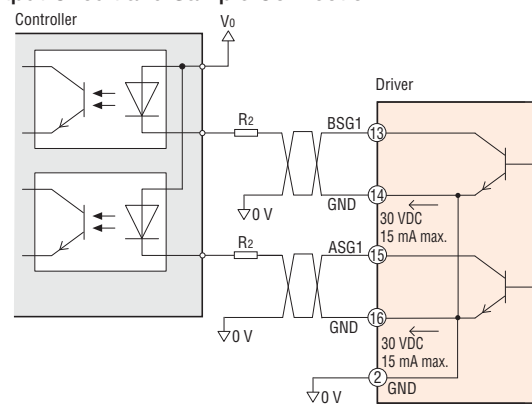

Note:
● A precise "Timing" signal cannot be obtained when the speed of the pulse input frequency is over 500 Hz.

Quadrature (ASG1/BSG1) Output Signal
◇Output Circuit and Sample Connection

Circuits for use with 30 VDC, 15 mA maximum.
A counter or similar device can be connected to monitor the position of the motor. The pulse resolution is the same as the motor resolution at the time of power-on.
[Example: Resolution select switch (1000 P/R) → Output pulse number for each motor rotation (1000).]
The phase difference between A and B is 90˚ in electrical angle.

Notes:
● The pulse output accuracy is, regardless of resolution, within ±0.36˚ (repetition accuracy: within ±0.09˚).
● This signal is only for position verification when the motor has stopped. There is a 1 msec (maximum) time lag between real rotor motion and the output signals.

◇Pulse Waveform Characteristics

(Clockwise rotation of motor)