ORIENTAL MOTOR

NEW
PRODUCTS

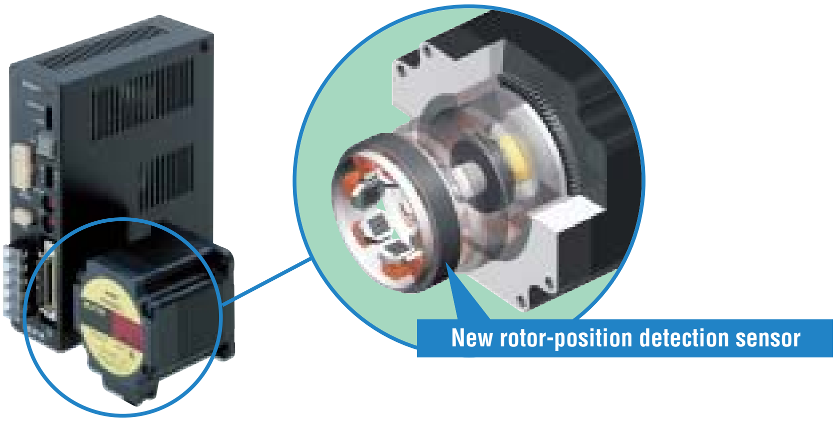
New Generation Stepping Motor and Driver Package

αSTEP IP65 rated motor

Features

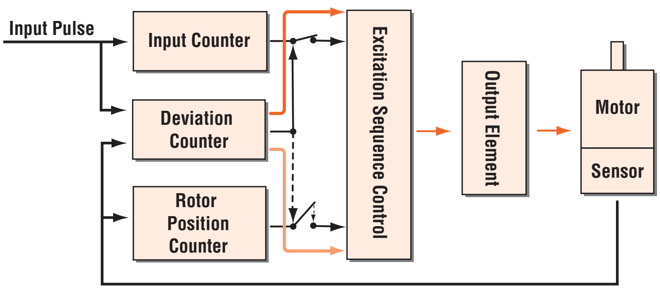
αSTEP adopts a new-concept in closed-loop control

Each αSTEP model is designed as a "package unit," consisting of a motor and a driver.



αSTEP does not lose synchronism even when subjected to abrupt load fluctuation or acceleration. A newly developed rotor position detection sensor constantly monitors the motor movement. If synchronism is about to be lost, closed loop control is used, so there is no need to worry about loss of steps.

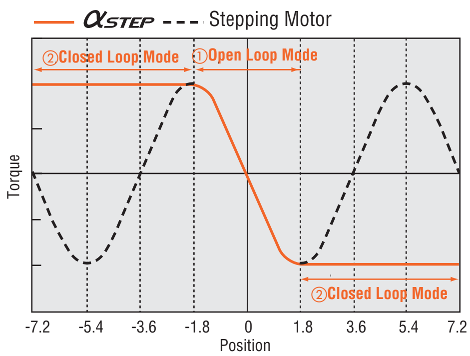
● αSTEP Control Diagram



Normal (Positioning Deviation is less than ±1.8°)
Motor runs in open loop mode like a stepping motor.

If Motor Missteps (Positioning Deviation is greater than ±1.8°)
Control switches to closed loop mode to prevent loss of synchronism.

● αSTEP Angle-Torque Characteristics

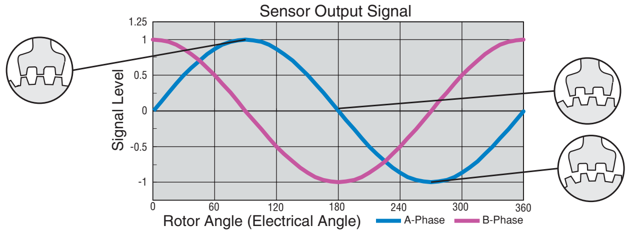


① If the positioning deviation is ±1.8° or smaller, the motor runs in open loop mode like a stepping motor.
② If the positioning deviation is ±1.8° or greater, the motor runs in closed loop mode and the position is corrected by exciting the motor windings to generate maximum torque based on the rotor position.

New rotor-position detection sensor

The new rotor-position detection sensor detects position information of the rotor, based on change in inductance, as determined by change in the spatial distance between rotor teeth and stator teeth.

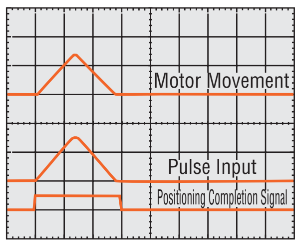
• Features
Allow for a compact, slim design, which in turn shortens the overall motor length.
Provide high resolution.
No electronic components are used, so the sensor is resistant to heat and vibration.



● High Response

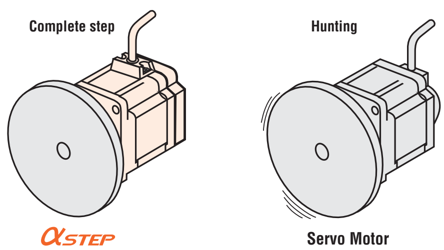
Like conventional stepping motors, αSTEP operates in synchronism with command pulses. This makes possible short stroke positioning in a short time.

Measurement condition : Feed 1/5 rotation
Load inertia 250×10^{-7} kg·m^2



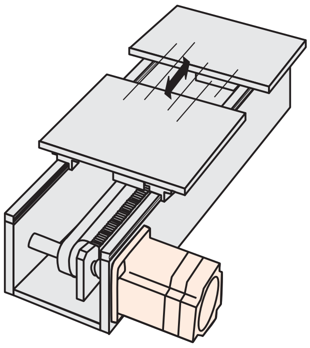
● No Hunting

Since αSTEP is a stepping motor, it has no hunting problem such as might be found in a traditional servo motor. Therefore, when it stops, its position is completely stable and does not fluctuate. αSTEP is ideal for applications in which vibration would be a problem.



● No Gain Tuning

Gain tuning for a servo motor is critical, troublesome and time-consuming. Since the αSTEP operates like a stepping motor, there are no gain tuning requirements. Low rigidity applications, such as a belt and pulley system, are ideal for αSTEP.



UL / CSA certified

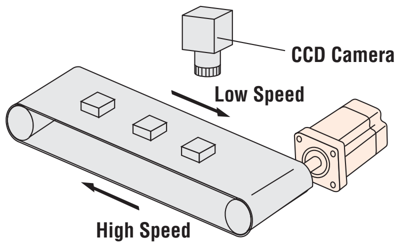
The αSTEP is certified under the UL/CSA and EN Standards. All units bear a CE Mark to indicate their conformance with the Low-Voltage Directive.

● One motor/driver connection cable

The motor and driver can be connected using only one cable. It makes αSTEP connection easier than regular servo motors that require two cables for connecting the motor and the encoder. The motor/driver cable is extendable to a maximum of 20 m (10 m in the case of a flexible cable), so you can install the motor and driver apart from each other.

● Low Vibration at Low Speed

The driver employs advanced technology that produces smoothness comparable to a microstepping driver.
Its vibration level is incredibly low, even when operating in the low speed range.
When frequent changes from low (high) to high (low) speed operation are required, the use of the Resolution Select Function solves the problem.
αSTEP provides resolution as low as 0.036° per step without any damping mechanism or other mechanical device.
Even smoother operation is possible with geared models.



αSTEP is well suited to applications where smooth movement or stability is required, such as where a camera is used to monitor the quality of a product.

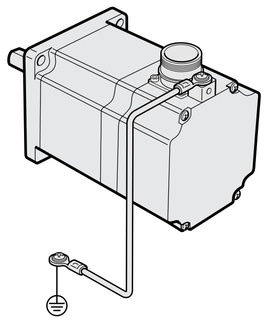
● IP65 rated motor

Adopting a reliable, strong metal motor connector

Ideal for applications that require IP65-level dust-proof/water-proof performance when the motor will be exposed to powder dust, water splashes, etc.

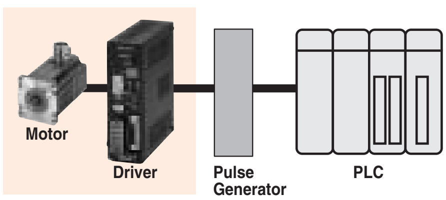
Protective earth terminal

In addition to providing the protection performance of IP65 class, the motor also comes with a protective earth terminal on its housing. This protective earth terminal can be wired either from the cable leading side or from the rear side.

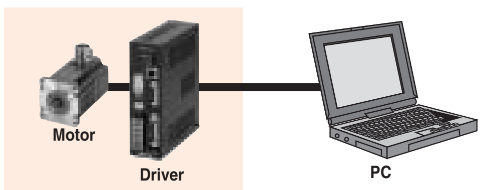


■ Driver Line-Up

αSTEP		αSTEP PLUS
Step & Direction Input Type	or	Integrated Controller & Driver



Motor and driver are controlled by an external pulse generator.

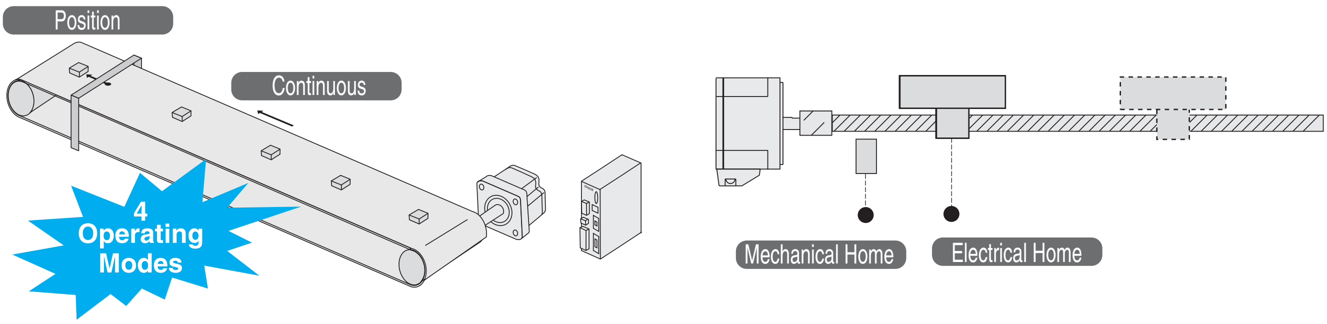


No external pulse generator required.

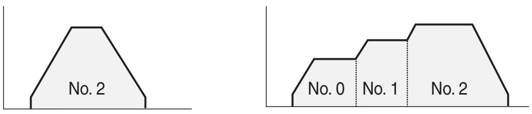
αSTEP PLUS Features

The αSTEP PLUS driver has an integrated controller which ensures a simple, efficient solution for stepping motor applications.
Intelligent, integrated, and ideal for technology's increasing demand on motion control, the αSTEP PLUS is computer-programmable via an RS-232C connection.

Operating Modes



Linked Motion Capability



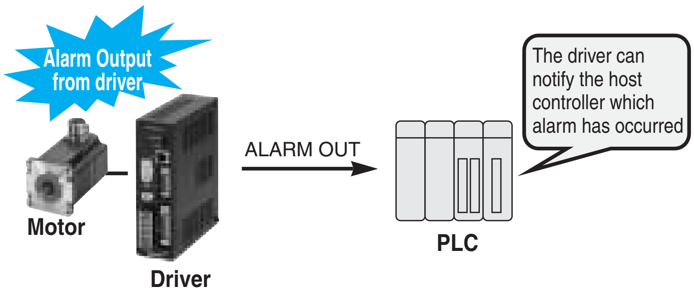
Single Motion

Linked Motion

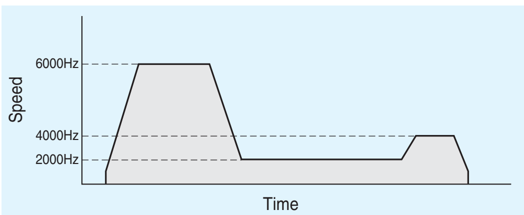
When a START signal is received motions 0, 1 and 2 are executed without stopping between each one.

Alarm Functions

The driver can flash LEDs to indicate which alarm has occurred.



Speed Change On The Fly



The running speed of the motor can be changed while the motor is in motion.

Daisy Chain

Up to 36 units can be daisy chained via customer supplied cable.

Position Control
- Incremental mode (relative distance specification)/Absolute mode (absolute position specification)
- Linked operation (a maximum of four motion profiles may be linked)
- Data range (in pulses): −8,388,608 to +8,388,607
- Operating speed: 10 Hz to 500 kHz (set in 1Hz increments)

Four Operation Modes
1. Positioning
2. Mechanical home seeking (+LS, −LS, HOMELS)
3. Continuous
4. Electrical home seeking

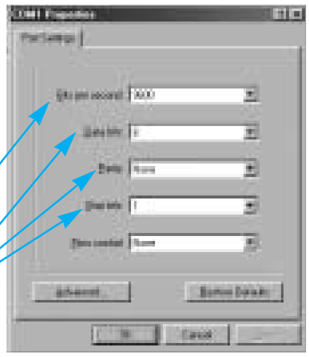
General Inputs/Outputs
- 8 Programmable Inputs
- 8 Programmable Outputs

Daisy Chain Capability
- Up to 36 units can be daisy chained with unique device ID's

Communication
- ASCII based commands
- Conforms to RS-232C communication specifications
- Start-stop asynchronous transmission method
- Transmission speed: 9,600 bps
- Data length: 8 bits, 1 stop bit, no parity
  Protocol: TTY (CR+LF)
- Modular 4-pin connector

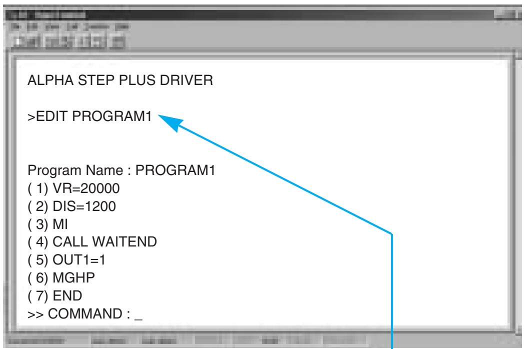
Program Memory
- Maximum number of programs: 14 (including STARTUP)
- Maximum lines per program: 64
- Commands per line: 1
- Program variables: 26 (A to Z)

Built-in Functions
- Selectable motor-resolution
- Run and stop current values
- Speed-filter set value
- Motor rotation direction
- Emergency stop
- Sensor logic
- Over-travel limits
- Software over-travel
- Alarm history
- Syntax checking
- Display values
- Incremental moves
- I/O status



Using Windows HyperTerminal®, programming the αSTEP PLUS driver is a simple task.

Example: "PROGRAM1"



PROGRAM1 Definition
- Operating Speed: 20,000 Hz
- Move Distance: 1,200 pulses
- Call a subroutine that waits for the motor to stop before moving on to the next command
- Turn On Output #1
- Seek the Mechanical Home Position in the Positive Direction
- End of Program

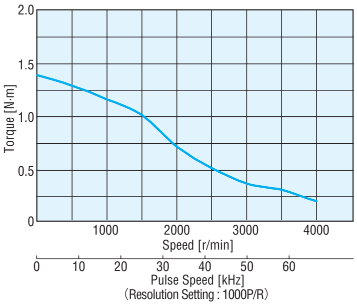
Specifications c UL us CE

Model		αSTEP	AS66ACT	AS69ACT	AS98ACT	AS911ACT
		αSTEP PLUS	AS66ACTP	AS69ACTP	AS98ACTP	AS911ACTP
Maximum Holding Torque		N·m	1.2	2	2	4
Rotor Inertia		J:kg·m²	405×10^{-7}	802×10^{-7}	1400×10^{-7}	2710×10^{-7}
Resolution*1			0.36°/Pulse (Resolution Setting : 1000 P/R)			
Power Source	Voltage-Frequency		Single-Phase 200-230 VAC −15%~+10% · 50/60 Hz			
	Maximum Input Current	Single-Phase 200-230 VAC	3	3.9	3.5	4.5
Degree of Protection			Motor : IP65*2 Driver : IP10			
Weight kg	Motor		1	1.5	2.2	3.3
	Driver		0.8			
Dimension No.	Moto		1		2	
	Driver	αSTEP	3			
		αSTEP PLUS	4			

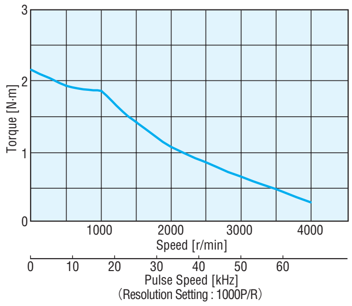
*1 αSTEP : The resolution can be set to any one of 500 P/R, 1000 P/R, 5000 P/R, 10000 P/R with the resolution select switch or resolution select switching signals.
αSTEP PLUS: The resolution can be set from 500 P/R to 10000 P/R by setting parameters.
*2 Excluding the gap between the shaft and the flange
● Always use the optional cable for IP65 rated motor (sold separately) for connection between the IP65 rated motor and the driver. ➜ Page 12

Speed — Torque Characteristics

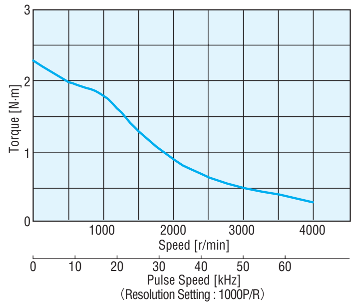
AS66ACT,AS66ACTP



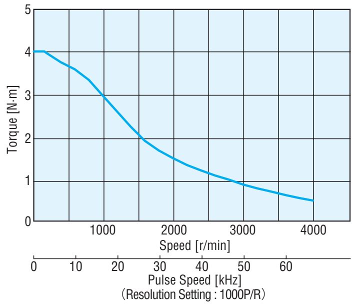
AS69ACT,AS69ACTP



AS98ACT,AS98ACTP



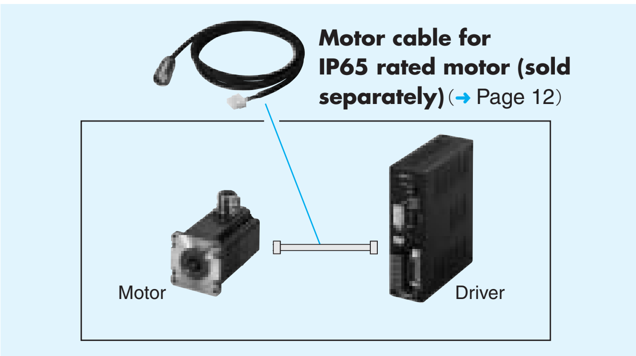
AS911ACT,AS911ACTP



Notes:
- Pay attention to heat dissipation from motor and driver. In particular, remember that the motor will produce a considerable amount of heat under certain conditions. Be sure to keep the temperature of the motor case under 100˚C. [Under 75˚C is required to comply with UL or CSA standards.]
- When using the motor with the dedicated driver, the driver's automatic current cutback at motor standstill function reduces maximum holding torque by approximately 50%.

Requirement for motor cable for IP65 rated motor (sold separately)

Always use the motor cable for IP65 rated motor (sold separately) for connection between the IP65 rated motor and the driver,
The IP65 rated motor cannot be driven unless the dedicated motor cable is used.



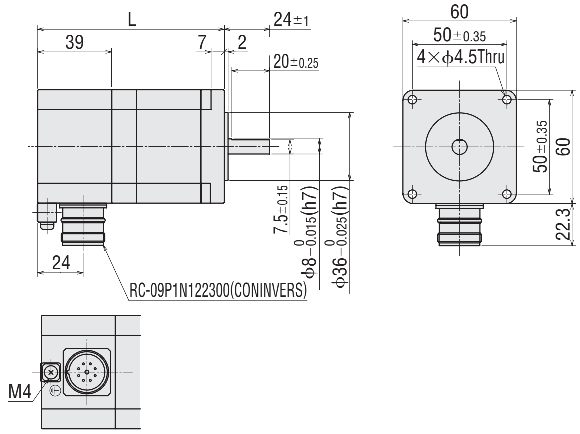
Dimensions

Motor

1 □ 60mm

Model	Motor Model	L(mm)	Weight(kg)	Driver Model
AS66ACT	ASM66ACT	98.7	1	ASD12A-C
AS66ACTP	ASM66ACT			ASD12A-CP
AS69ACT	ASM69ACT	129.7	1.5	ASD16D-C
AS69ACTP	ASM69ACT			ASD16D-CP

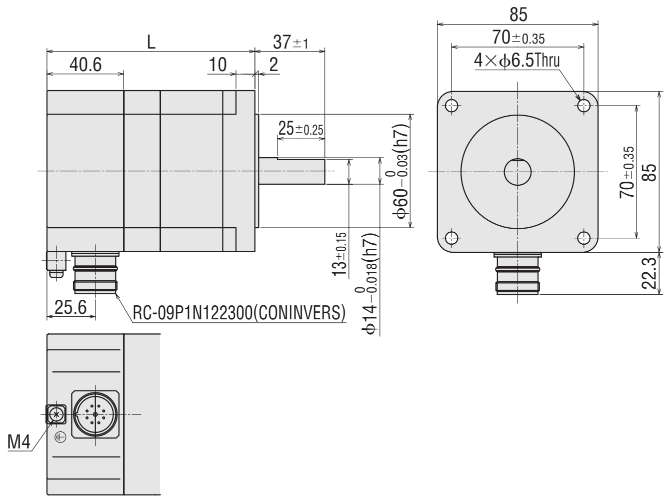
● Always use the optional cable for IP65 rated motor (sold separately) for connection between the IP65 rated motor and the driver. ➜ Page 12



2 □ 85mm

Model	Motor Model	L(mm)	Weight(kg)	Driver Model
AS98ACT	ASM98ACT	110	2.2	ASD16A-C
AS98ACTP	ASM98ACT			ASD16A-CP
AS911ACT	ASM911ACT	140	3.3	ASD20A-C
AS911ACTP	ASM911ACT			ASD20A-CP

● Always use the optional cable for IP65 rated motor (sold separately) for connection between the IP65 rated motor and the driver. ➜ Page 12



Motor Cable for IP65 rated motor

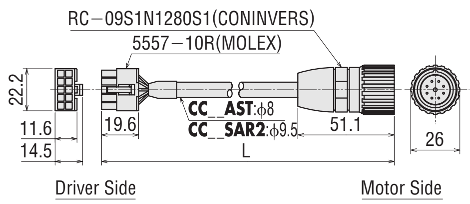
Extension Cable

Model	Length L(m)
CC01AST	1
CC02AST	2
CC03AST	3
CC05AST	5
CC07AST	7
CC10AST	10
CC15AST	15
CC20AST	20

Flexible Cable

Model	Length L(m)
CC01SAR2	1
CC02SAR2	2
CC03SAR2	3
CC05SAR2	5
CC07SAR2	7
CC10SAR2	10

Extension cable, Flexible cable



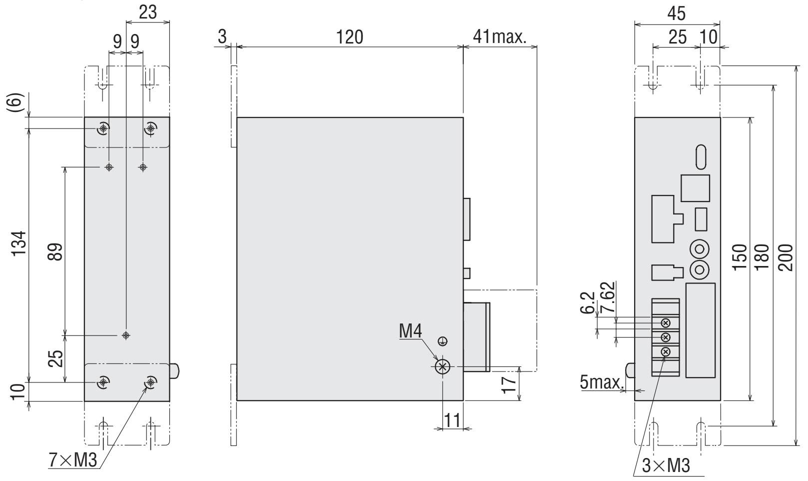
Note:
● The driver-side connector does not conform to IP65. Do not immerse the connector in oil or water.

Dimensions

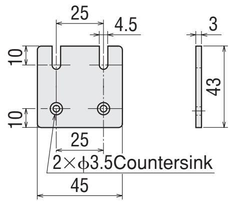
Driver

3 αSTEP

Weight: 0.8 kg



Mounting Bracket
(2 pieces, included)

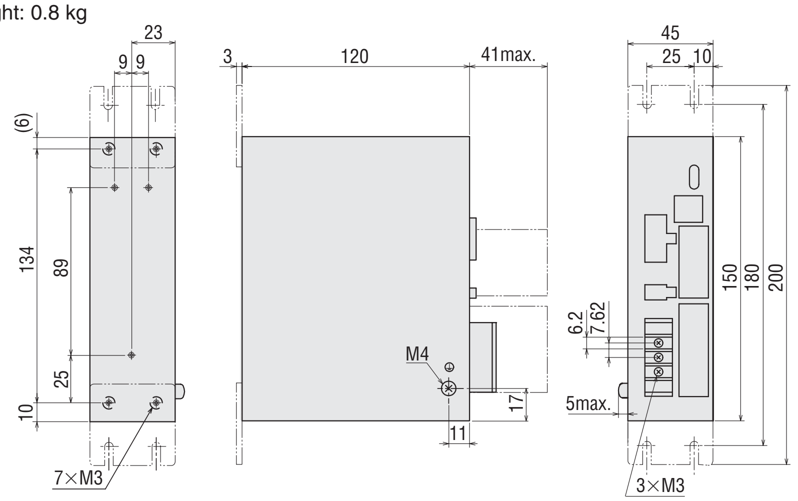


I/O Connector (included)

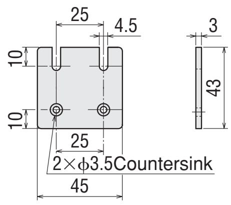
Cover Assembly: 54331-0361 (MOLEX)
Connector: 54306-3619 (MOLEX)

4 αSTEP PLUS

Weight: 0.8 kg



Mounting Bracket
(2 pieces, included)



I/O Connector (included)

Cover Assembly : 54331-0361 (MOLEX) for CN4
Connector : 54306-3619 (MOLEX) for CN4
Cover Assembly : 54331-0201 (MOLEX) for CN5
Connector : 54306-2019 (MOLEX) for CN5

Safety Standards and CE Marking

Model	Standards	Certification Body	File No.	CE Marking
Motor	UL1004 UL2111 CSA C22.2 No.100 CSA C22.2 No.77	UL	E64199	Low Voltage Directives EMC Directives
	EN60950 EN60034-1 EN60034-5	Conform to EN Standards		
Driver	UL508C *1 CSA C22.2 No.14	UL	E171462	
	EN60950 *2 EN50178	Conform to EN Standards		

• When the system is approved under various safety standards, the model names on the motor and driver nameplates are the approved model names.
List of Motor and Driver Combinations ➜ Page 7
• The EMC value changes according to the wiring and layout. Therefore, the final EMC level must be checked with the motor/driver incorporated in the user's equipment.
*1 Maximum Ambient Temperature for UL
αSTEP: +50°C, αSTEP PLUS: +40°C
*2 EN60950 (Certified αSTEP only)

Common Specifications

● αSTEP

Speed and Position Control Command	Pulse Train Input
Maximum Input Pulse Frequency	250 kHz (When the pulse duty is 50%)
Protective Functions	Overheat, Overload, Overvoltage, Speed Error, Overcurrent, OverSpeed, EEPROM Data Error, Sensor Error, System Error
Input Signals	Photocoupler Input (optically isolated), Equivalent Input Impedance : 220 Ω, Input Current 7~20 mA [Pulse Signal, Rotation Direction Signal (Negative logic pulse input), CW Pulse Signal, CCW Pulse Signal (Negative logic pulse input), All Windings Off Signal, Alarm Clear Signal, Resolution Select Signal]
Output Signals	Photocoupler, Open-Collector Output, External use condition: 30 VDC maximum, 15 mA Maximum (Positioning Completion Signal, Alarm Signal, Excitation Timing Signal, ASG•BSG Signal) Line Driver Output: Equivalent of 26C31 (Timing Signal, ASG•BSG Signal)

● αSTEP PLUS

Positioning Control	Incremental (relative distance) mode/Absolute (absolute positioning) mode. One-shot operation/Linked operation (A maximum of 4 profiles can be linked) Maximum Operating Ranges • Steps: −8388608~8388607 (1 each)	• Operating speed: 10 Hz~500,000 Hz (500 kHz)	• Acceleration/deceleration rate*: 10~50,000 msec
Operating Modes	• Indexing (Positioning operation) • Return (Return to electrical home position)	• Scan (Continuous operation) • Home Operation (Return to mechanical home position)	• Linked Profile
Mechanical Home Hunting Function	Home hunting operation is performed from the entire range using mechanical position detection signals (+LS, −LS, HOMELS).		
Other Functions	• Setting function for speed-filter value • Setting function for direction of motor rotation • Software over-travel function	• Current setting function • Emergency stop function • Alarm trace-back function	• Electronic gear function • Over-travel function • Daisy-chain connections
Input Signals	AC Photocoupler input Control inputs: 24 VDC, input resistance 4.7 kΩ (X0~X7, START, E-STOP, HOMELS, +LS, −LS, SENSOR)		
Output Signals	Photocoupler/Open Collector Output	External operating conditions; 30 VDC or below, 4~8 mA (Y0~Y7, ALM)	
Terminal Emulation	Communication Standard: RS-232C conformity Data length: 8 bits, 1 stop bit, No parity Connector specification: Modular (4 wires, 4 pins) Pin arrangement: RS232 Compatible	Transmit system: Asynchronous communication, NRZ (Non Return to Zero), Full duplex Transmit speed: 9600 bps Protocol: TTY (CR+LF)	
User Program	Maximum number of programs: 14 programs (including STARTUP program) Maximum commands per 1 line: 1 command (Single state)	Maximum lines per program: 64 lines Maximum program variables: 26 variables (A~Z)	

* The rates of acceleration and deceleration can be set separately.

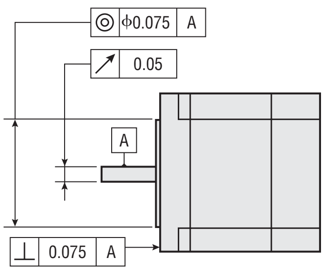
General Specifications

This is the value after rated operation at normal temperature and normal humidity.

		Motor	Driver
Insulation Class		Class B (130˚C) [UL/CSA: Recognized as class A (105˚C)]	—
Insulation Resistance		100 MΩ minimum when measured by a 500 VDC megger between the following places: • Frame-Windings	100 MΩ minimum when measured by a 500 VDC megger between the following places: • Frame-Power supply input terminal • I/O-Power supply input terminal
Dielectric Strength		Sufficient to withstand the following for one minute: • Frame-Windings 1.5 kV 50 Hz	Sufficient to withstand the following for one minute: • Frame-Power supply input terminal 1.5 kV 50 Hz • I/O-Power supply input terminal 3.0 kV 50 Hz: αSTEP 1.8 kV 50 Hz: αSTEP PLUS
Operating Environment (In Operation)	Ambient Temperature	0°C~+50˚C , nonfreezing	αSTEP PLUS: 0°C~+40˚C αSTEP : 0°C~+50˚C, nonfreezing
	Ambient Humidity	85% or less (noncondensing)	
	Atmosphere	No corrosive gases.	
Static Angle Error		±5 minutes (0.084˚)	—
Shaft Runout		0.05 mm T.I.R.*	—
Concentricity		0.075 mm T.I.R.*	—
Perpendicularity		0.075 mm T.I.R.*	—

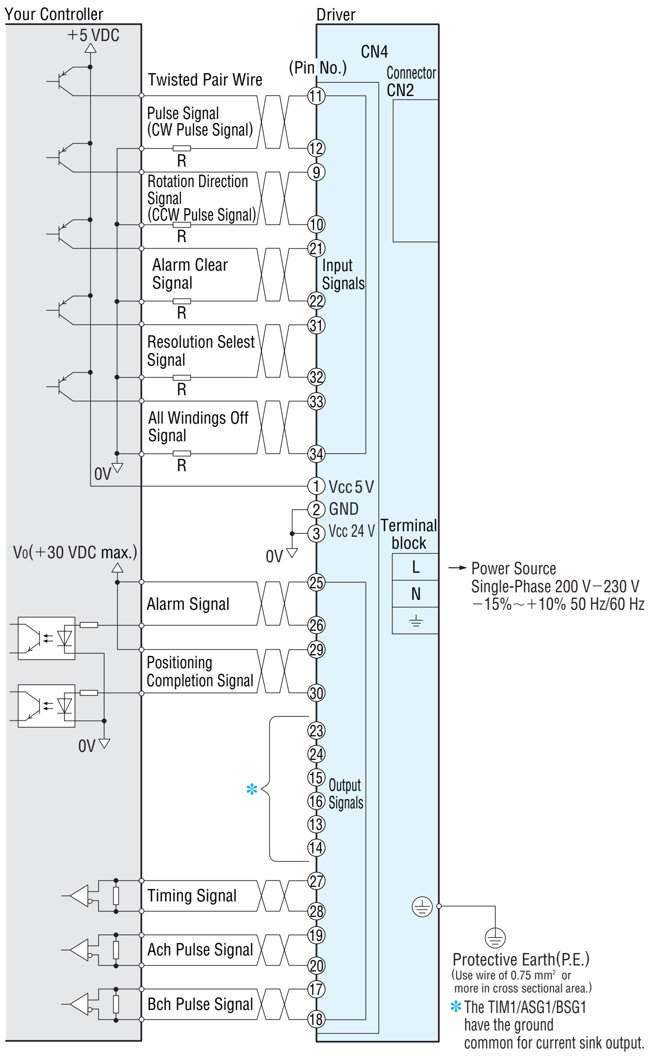
* T.I.R.(Total Indicator Reading) : Refers to the total dial gauge reading when the measurement section is rotated 1 revolution centered on the reference axis center.

Note:
- Do not measure insulation resistance or perform the dielectric strength test while the motor and driver are connected.



Connection Diagrams

αSTEP



◆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 break if a voltage exceeding 5 VDC is supplied directly without using an external resistor.
  Example)If the voltage is 24 VDC, connect a resistance (R) 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 elements may break.
  Check the specification of the connected equipment.

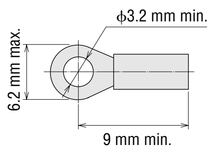
◆Notes on wiring

- Wire the control I/O signal line (CN4) over the shortest possible distance (within 2 m) by using a shielded, multi-core twisted pair cable of AWG28 or larger (0.08 mm² or more).
- Take note that the maximum transmission frequency will drop as the pulse line becomes longer.

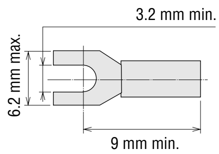
- Always use the optional cable for IP65 rated motor (sold separately) for connection between the IP65 rated motor and the driver.
- Use the following cable for the power line:
  Single-phase 200 to 230 V: 3-core cable (Conductor cross-section area: 0.75 mm² or more)
  Provide a minimum distance of 300 mm between the control I/O signal line and power lines (AC lines, motor lines and other large-current circuits).
- Do not guide the control I/O signal line in the same duct as power lines or bundle it with power lines.
- The power cable and control I/O signal cable are not supplied with the package and must be provided separately by the user.
- To ground the driver, lead the ground conductor from the protective ground terminal (M4) and connect the ground conductor to a cable of AWG18 (0.75 mm²) or larger to provide single-point grounding.
- If the timing signal output or pulse signal output is used, a 5-VDC or 24-VDC power supply is required. Connect the power supply for timing signal output or pulse signal output to either 5 VDC or 24 VDC. Do not input 5 VDC and 24 VDC at the same time.

◆Recommended Crimp Terminals

- Round shape terminals with insulator



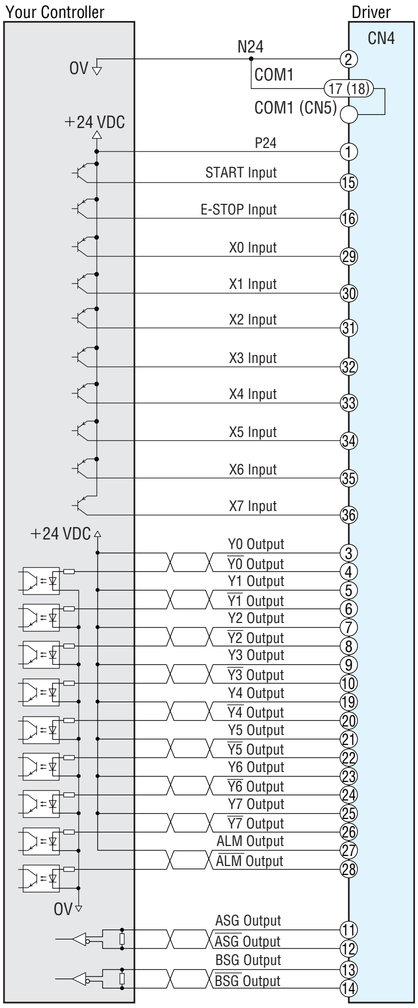
- U shape terminals with insulator



✻ Crimp terminals are not provided with the package. They must be furnished separately.

αSTEP PLUS

I/O Signals(CN4)

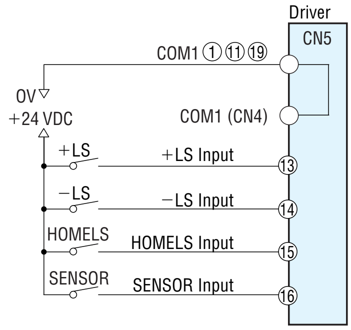


X0 to X7: General Input ✻1
Y0 to Y7: General Output ✻2

✻1 The following signals can be assigned arbitrarily via program settings. Additionally, the output logic of each signal can be switched. END output, RUN output, MOVE output, HOME-P output, TIM output, MBC output

✻2 The following signals can be assigned arbitrarily via program settings. Additionally, the input logic of each signal can be switched. ACL input, PAUSE input, MSTOP input, RESTART input

Limit Sensors(CN5)



Wiring the signal cable

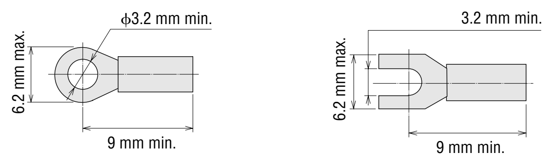
- Use input signals at 24 VDC±10%.
- Use output signals at 30 VDC or below and at 4 to 8 mA.
- Use a shielded cable with a wire of a size ranging between AWG 24 and AWG 22 for the driver signal cable (I/O signals, limit sensors signals), and keep it as short as possible.
- Keep the control input/output signal line at least 300 mm away from power lines (e.g. lines carrying large current, such as AC lines and motor lines). Also, do not run these lines through the same ducts or pipes as power lines.

Other wiring

- Always use the optional cable for IP65 rated motor (sold separately) for connection between the IP65 rated motor and the driver.
- Use the following cable for the power line:
  Single-phase 200 to 230 V: 3-core cable (Conductor cross-section area: 0.75 mm² or more)
  Provide a minimum distance of 300 mm between the control I/O signal line and power lines (AC lines, motor lines and other large-current circuits).
- Do not guide the control I/O signal line in the same duct as power lines or bundle it with power lines.
- The power cable and control I/O signal cable are not supplied with the package and must be provided separately by the user.
  To ground the driver, lead the ground conductor from the protective ground terminal (M4) and connect the ground conductor to a cable of AWG18 (0.75 mm²) or larger to provide single-point grounding.

Recommended Crimp Terminals

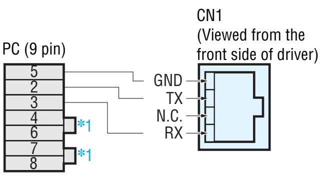
- Round shape terminals with insulator
- U shape terminals with insulator



✻ Crimp terminals are not provided with the package. They must be furnished separately.

Connecting the Driver with a Personal Computer (CN1)

• Pin Assignments and Connecting



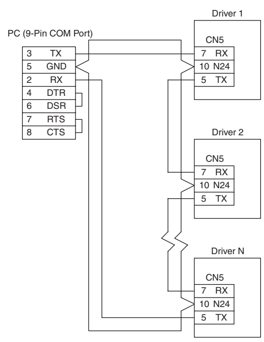
✻1 Short pins 4 and 6 together, as well as pins 7 and 8 together.

Description of Daisy-chain Connections

Use the RS-232C communication pins (TX, RX and N24) of the sensor connector (CN5) when connecting two or more drivers via a daisy chain (up to 36 drivers).

• TX, RX

These communication terminals are used when implementing daisy-chain connections.



Notes:

- Confirm that each driver is supplied 24 VDC±10% (P24 and N24) of CN4 from outside for communication.
- Wire the RS-232C signal lines over the shortest possible distance. It is recommended that the signal lines be shielded to protect them from noise interference.
- The maximum distance between drivers when using a daisy chain connection should be 49.2 feet (15 m).
- Do not use the RS-232C communication port (CN1) for daisy chain connections.

Accessories (Sold Separately)

Motor Cable for IP65 rated motor

This motor cable must be used for connection between the IP65 rated motor and the driver.
One end of the cable connects to the metal connector on the motor, while the other end connects to the driver.
Use a flexible cable if the motor is installed on a moving part and its cable will be flexed repeatedly.

Extension Cable

Model	Length L(m)
CC01AST	1
CC02AST	2
CC03AST	3
CC05AST	5
CC07AST	7
CC10AST	10
CC15AST	15
CC20AST	20

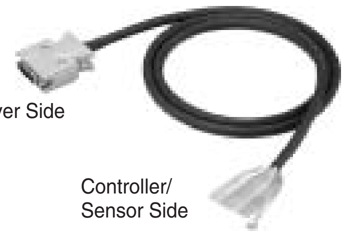
Flexible Cable

Model	Length L(m)
CC01SAR2	1
CC02SAR2	2
CC03SAR2	3
CC05SAR2	5
CC07SAR2	7
CC10SAR2	10

Note:
- The driver-side connector does not conform to IP65. Do not immerse the connector in oil or water.

Driver Cables

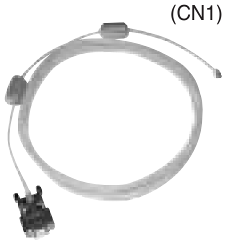
Model	Length m	Connector
CC20D1-1	1	20-pins Sensor CN5
CC20D2-1	2	
CC36D1-1	1	36-pins I/O CN4
CC36D2-1	2	



Communications Cable

Used to connect computer and αSTEP **PLUS** Driver through an RS232C connection.

Model	Length m
FC04W5	5



Mounting Brackets

Useful for maintaining proper alignment between the motor shaft and the load.

Material: Die cast aluminum

Mounting Bracket Models	αSTEP PLUS Models
PAL2P-5	**AS66ACT** **AS66ACTP** **AS69ACT** **AS69ACTP**
PAL4P-5	**AS98ACT** **AS98ACTP** **AS911ACT** **AS911ACTP**

The mounting bracket base is built with holes large enough to allow for horizontal alignment adjustments.

This product is manufactured at a plant certified with the international standards **ISO 9001** (for quality assurance) and **ISO 14001** (for systems of environmental management).

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ORIENTAL MOTOR (EUROPA) GmbH
www.orientalmotor.de

European Headquarters and Düsseldorf Office
Schiessstraße 74
40549 Düsseldorf, Germany
Tel: 0211-5206700 Fax: 0211-52067099

Munich Office
Liebigstraße 14
85757 Karlsfeld, Germany
Tel: 08131-59880 Fax: 08131-598888

Hamburg Office
Meckelfelder Weg 2
21079 Hamburg, Germany
Tel: 040-76910443 Fax: 040-76910445

Stuttgart Office
Tel: 073-35-924853 Fax: 073-35-924854

ORIENTAL MOTOR (UK) LTD.
www.oriental-motor.co.uk

Unit 5, Faraday Office Park,
Rankine Road, Basingstoke,
Hampshire RG24 8AG U.K.
Tel: 01256-347090 Fax: 01256-347099

ORIENTAL MOTOR (FRANCE) SARL
www.orientalmotor.fr

France Headquarters
32, Avenue de l'ile Saint Martin
92737 Nanterre Cedex, France
Tel: 01 47 86 97 50 Fax: 01 47 82 45 16

Lyon Office
10, Allée des Sorbiers
69673 Bron Cedex, France
Tel: 04 78 41 15 02 Fax: 04 78 41 15 90

ORIENTAL MOTOR ITALIA s.r.l.
www.orientalmotor.it

Italy Headquarters
Via A. De Gasperi, 85
20017 Mazzo di Rho (MI), Italy
Tel: 02-93906346 Fax: 02-93906348

Bologna Office
Via mori, 6
40054 Prunaro di Budrio (BO), Italy
Tel: 051-6931249 Fax: 051-6929266

ORIENTAL MOTOR CO., LTD.
www.orientalmotor.co.jp

Headquarters
16-17, Ueno 6-chome
Taito-ku, Tokyo 110-8536, Japan
Tel: (03)3835-0684 Fax: (03)3835-1890

For more information please contact:

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