ORIENTAL MOTOR

NEW PRODUCTS

Hollow Rotary Actuators

DG Series

Frame Size □130mm

Frame Size □60mm

DG Series

Hollow Rotary Actuators DG Series
2 install base sizes, compact □60m

DG Series Common Features

Large-Diameter, Hollow Rotary Stage
Easy routing of wires and tubes

Direct Drive
Simple but reliable design

Accurate Positioning
Repetitive positioning accuracy: ±0.004°
Lost motion: 0.033°
Angle transfer error: 0.067°

Easy Homing
An optional home-sensor set is simple to install, making home operation quick and easy.

Shorter Positioning Time
Inertial loads can be positioned quickly using an αSTEP motor.

High Torque, High Rigidity

Compact

Frame size □60mm

Permissible Torque	Bearing	Diameter of Hollow Section
0.9 N·m	Ball Bearing	ϕ28mm (Rotational)

Safety Standard		Actuator Weight
cULus CE	24-VDC Input Driver	0.5kg

High-Rigidity Type
Frame size □130mm

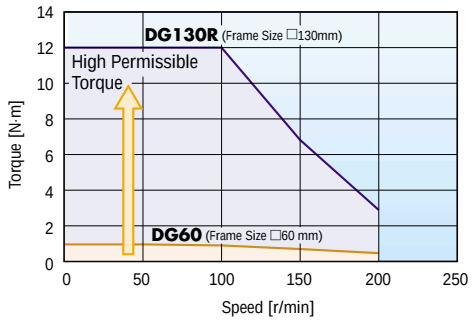
Permissible Torque	Bearing	Diameter of Hollow Section	High Permissible-Moment
12N·m	Cross-Roller Bearing	ϕ62mm (Not rotational)	

High Permissible-Thrust Load	Safety Standard		Actuator Weight
	cULus CE	AC Input Driver	2.6kg

make the machine design, wiring, and maintenance simple.
m and high-rigidity □130mm, are available.

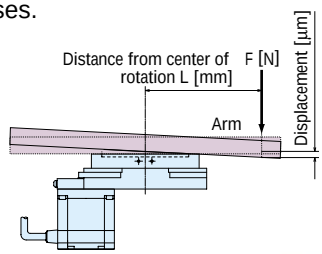
High Permissible Torque

The hollow rotary actuators with larger permissible torque deliver stable, high-speed positioning of larger inertial loads.

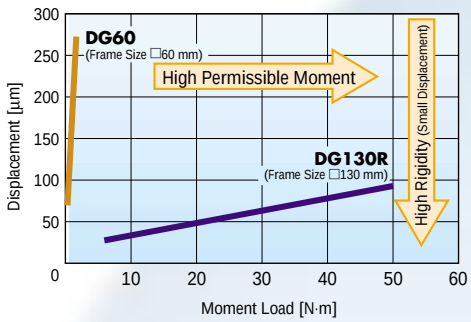


High Rigidity

The output table uses deep-groove ball bearings (two pieces) for the 60 mm frame-size type, and a cross-roller bearing for the 130 mm frame-size type. As the model number increases, the permissible moment load also increases but the displacement caused by the moment load decreases.



Displacement at distance L = 200 mm from center of rotation



Product Number Code

DG 130 R - AS A C

- **DG Series**
- **Frame Size**
  - **60** : 60 mm sq.
  - **130** : 130 mm sq.
- **Type of Output Table Bearing**
  - No Letter : Deep-Groove Ball Bearings (for standard type)
  - **R** : Cross-Roller Bearing (for high rigidity type)
- **Motor Type**
  - **AS** : αSTEP
- **Motor Shaft**
  - **A** : Single Shaft
- **Power Source**
  - **C** : Single-Phase 200 VAC — 230 VAC
  - **K** : 24 VDC

Product Lines

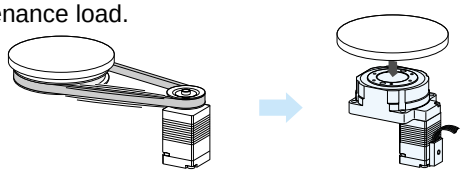
Type		Standard Type	High-Rigidity Type
Power Supply		24 VDC	Single-Phase 200 - 230 VAC
Frame Size	□60 mm	**DG60-ASAK**	—
	□130 mm	—	**DG130R-ASAC**

Double shaft type is available.
In the **DG130R** model, single-phase 100 V - 115 V input and three-phase 200 V - 230 V input products are also available.
Please ask us for further information on the product specification, delivery date, and so on.

Hollow Rotary Actuators **DG Series**

●Direct Drive ➧ Simple but Reliable Design

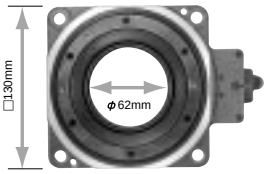
The output table of the hollow rotary actuator allows direct installation of the table or arm of your equipment. If your equipment performs indexing operation through use of a belt, pulley or other mechanical part, you can use the **DG Series** to reduce the number of parts and thereby ease the maintenance load.



●Large-Diameter, Hollow Rotary Stage ➧ Simple Wiring and Tubing

The diameter of the driven gear has been increased with the use of a single-stage reduction gear mechanism, resulting in a hollow shaft (through-hole) of sufficiently large diameter with respect to frame size. This helps reduce the complexity of wiring and tubing, thus simplifying your equipment design.

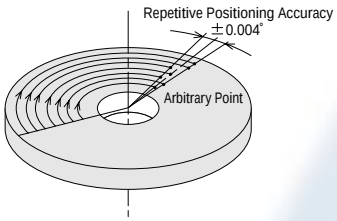
	Frame size [mm]	Diameter of Hollow Section [mm]
DG60	60	28
DG130R	130	62



Example: **DG130R**

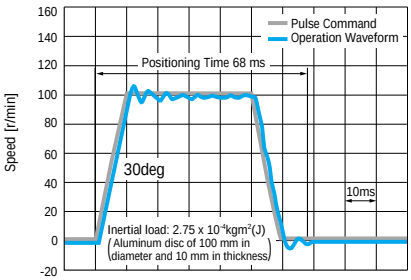
●Accurate Positioning ➧ Repetitive Positioning Accuracy of ±0.004˚ & Lost Motion of ±0.033˚

The gear-reduction mechanism employs precision gears along with a proprietary adjustment mechanism that eliminates backlash. The repetitive accuracy of positioning from a single direction is ±0.004˚, while lost motion in a positioning operation from two directions is 0.033˚. These characteristics make the **DG Series** an ideal choice for applications in which accurate positioning is a must.



●Shorter Positioning Time ➧ Quick Positioning of Inertial Loads

The drive motor of the **DG Series** is an αSTEP stepping motor with built-in rotor-position detection sensor. This combination results in a shorter positioning time. Moreover, the actuator uses a dedicated driver to monitor the motor speed and position information, and switches to closed-mode control the moment it detects the risk of a misstep. Therefore, acceleration and deceleration times can be shortened for quicker positioning.

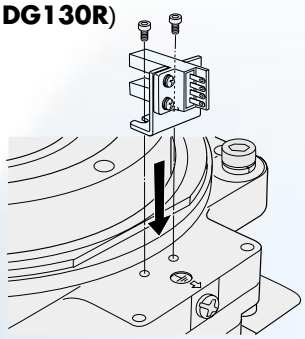


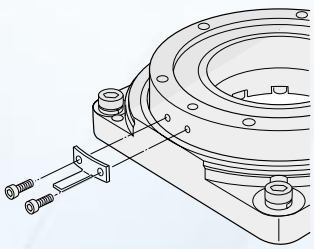
Example: Positioning time with **DG60-ASAK**

●Simple Homing ➧ Less Design/Parts Procurement Time

The **DG Series** provides an optional home-sensor set that simplifies the home hunting operation.
The sensor set comes with all the parts required for home hunting, meaning you will spend less time designing, fabricating and procuring parts in connection with sensor installation.

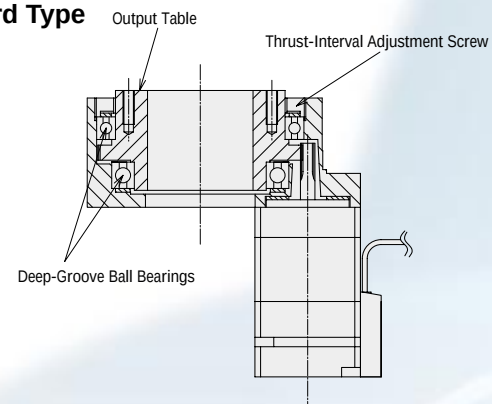
(Example of sensor/shielding plate installation on **DG130R**)


Sensor Installation

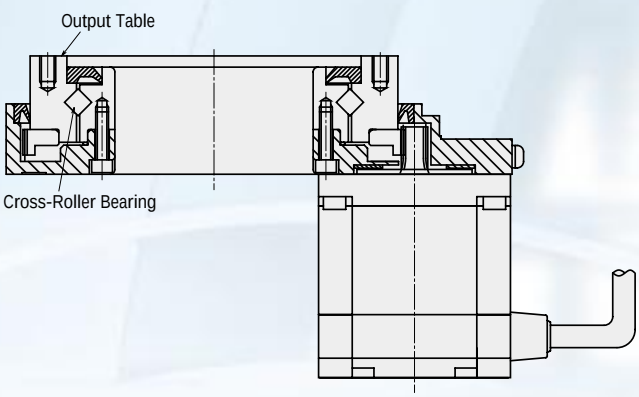

Installation of Shielding Plate

Structural Drawings

●Standard Type (**DG60**)



●High-Rigidity Type (**DG130R**)

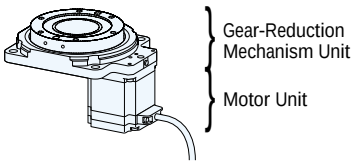


Safety Standards and CE Marking

Hollow rotary actuators **DG Series** employ an UL/CSA recognized α_{STEP} motor.
Motors and drivers are recognized for the following model name(s).

●DG60-ASAK

Model		Standard	Certification Body	File No.	CE Marking
Motor	ASM34AK-D	UL60950 CSA C22.2 No.60950	UL	E208200	EMC Directives
Driver	ASD10A-K	UL508C CSA C22.2 No.14	UL	E171462	
		UL60950 CSA C22.2 No.60950		E208200	



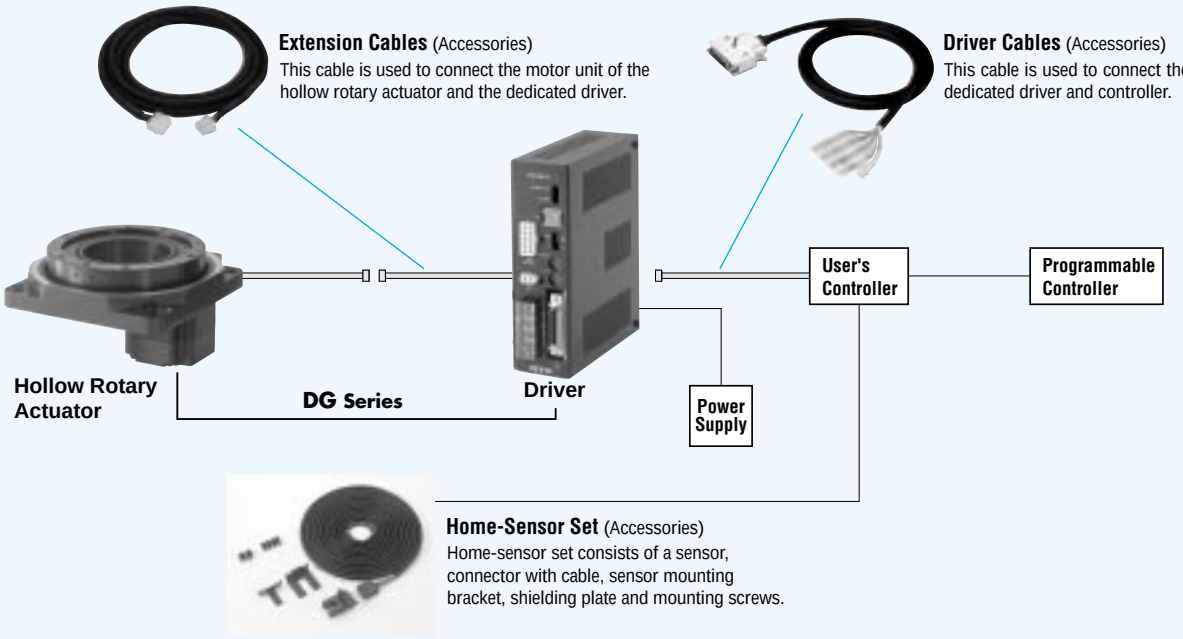
●DG130R-ASAC

Model		Standard	Certification Body	File No.	CE Marking
Motor	ASM66AC-D	UL1004、UL2111 CSA C22.2 No.100 CSA C22.2 No.77	UL	E64199	Low Voltage Directive EMC Directives*
		EN60950 EN60034-1 EN60034-5	—	—	
Driver	ASD12A-C	UL508C CSA C22.2 No.14	UL	E171462	
		EN60950 EN50178	—	—	


Driver Unit

* The EMC value changes according to the wiring and layout. Therefore, the final EMC level must be checked with the actuator/driver incorporated in the user's equipment.

System Configuration



●Example of System Configuration

Actuator Product

DG Series
DG130R-ASAC

+

Sold Separately

Extension Cables Flexible Cable (3m)	Home-Sensor Set
CC03AIP	PADG-SBY
○	○

○: Optional part

●This system configuration shown above is an example. Other combinations are available.

Specifications

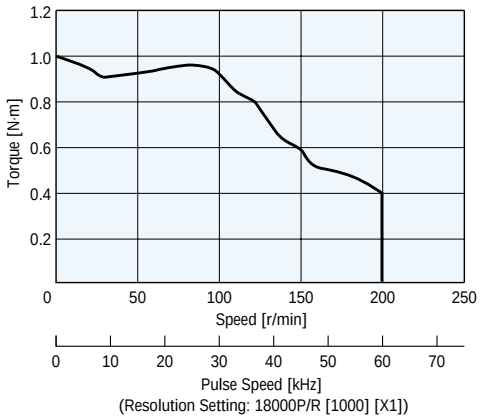
●Specifications of Hollow Rotary Actuator Unit

			Standard Type	High-Rigidity Type
Model	Frame Size		60mm	130mm
	24VDC		**DG60-ASAK**	—
	Single-Phase 200V-230V		—	**DG130R-ASAC**
Motor Type			α_{STEP}	
Type of Output Table Bearing			Deep-Groove Ball Bearings	Cross-Roller Bearings
Permissible Torque *1		N·m	0.9	12
Maximum Holding Torque *2		N·m	0.45	12
Inertial Moment *3		J: kgm^2	4324 $\times 10^{-7}$	15874 $\times 10^{-6}$
Permissible Speed		r/min	200	
Resolution *4			9000 P/R (Resolution Setting: 0.04°/pulse [500] [×1]) 18000 P/R (Resolution Setting: 0.02°/pulse [1000] [×1]) 90000 P/R (Resolution Setting: 0.004°/pulse [500] [×10]) 180000 P/R (Resolution Setting: 0.002°/pulse [10000] [×10])	
Repetitive Positioning Accuracy		degree	±0.004°	
Lost Motion		degree	0.033°	
Angle Transfer Error		degree	0.067°	
Permissible Thrust Load		N	100	2000
Permissible Moment Load		N·m	2	50
Runout of Output Table Surface		mm	0.030	0.015
Runout of Output Table Inner (Outer) Diamenter		mm	0.030	0.015
Parallelism of Output Table		mm	0.050	0.030
Degree of Protection			IP40 (IP20 for motor connector) (IEC60529)	
Mass of Actuator Unit		kg	0.5	2.6

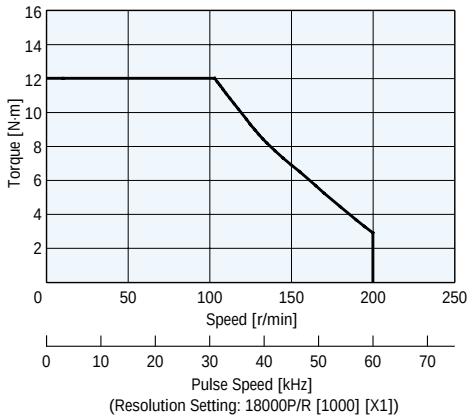
*1 Permissible torque refers to the mechanical-strength limit of the gear-reduction mechanism. Be sure to keep the torque, including acceleration torque, within the permissible limit.
*2 Maximum holding torque at excitation represents the holding torque of the output table when the motor is at a standstill.
*3 Inertial moment is calculated through conversion at the output table of the motor rotor's inertial moment and the inertial moment in the gear-reduction mechanism.
*4 You can set one of four resolutions using the driver-resolution select switch or driver-resolution select signal. The factory driver settings are [1000] [×1] and 18000 P/R (0.02°/pulse).

●Speed — Torque Characteristics

DG60-ASAK



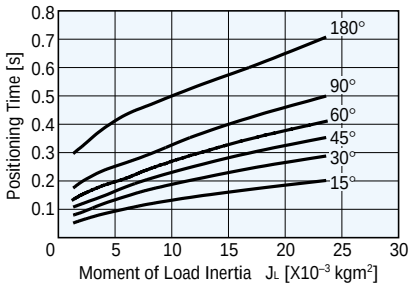
DG130R-ASAC



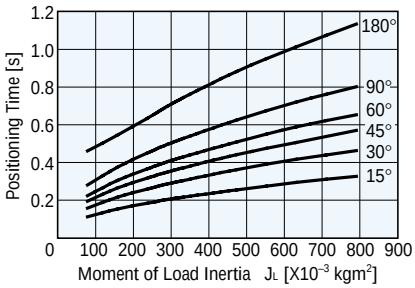
Double shaft type is available.
In the **DG130R** model, single-phase 100 V - 115 V input and three-phase 200 V - 230 V input products are also available.
Please ask us for further information on the product specification, delivery date, and so on.

●Minimum Positioning Time (Tact Time) *Reference Values

DG60-ASAK

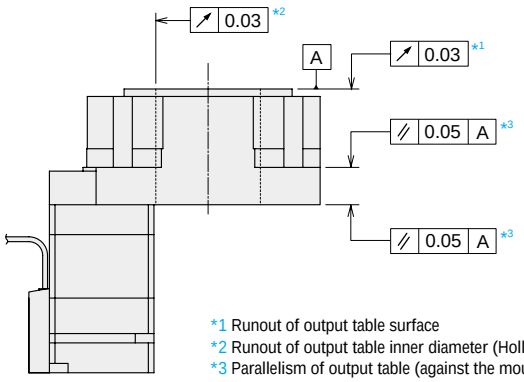


DG130R-ASAC



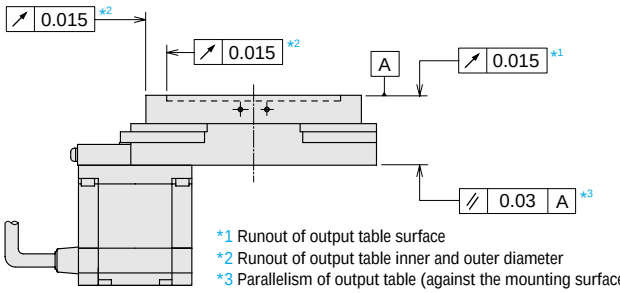
●Table Precision (at no load)

DG60-ASAK



*1 Runout of output table surface
*2 Runout of output table inner diameter (Hollow diameter)
*3 Parallelism of output table (against the mounting surface)

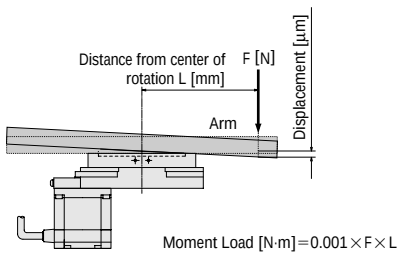
DG130R-ASAC



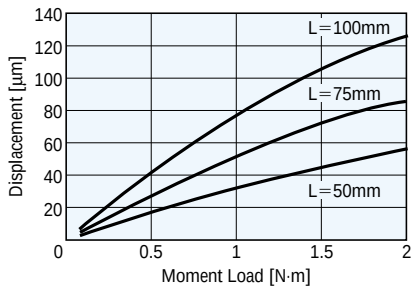
*1 Runout of output table surface
*2 Runout of output table inner and outer diameter
*3 Parallelism of output table (against the mounting surface)

●Displacement by Moment Load (Reference value)

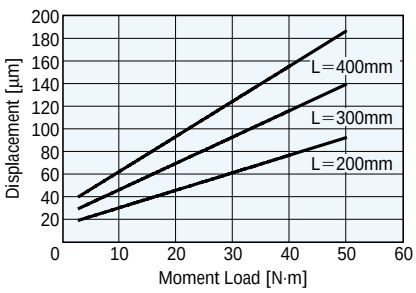
The output table will be displaced when it receives the moment load.
The graph plots the table displacement that occurs at distance L from the rotation center of the output table when a given moment load is applied in the negative direction.
The displacement becomes approximately twofold when the moment load is applied in both the positive and negative directions.



DG60-ASAK

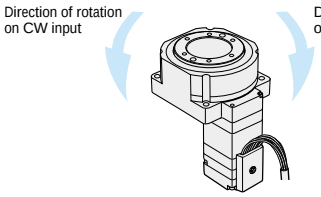


DG130R-ASAC



●Specifications of Driver Unit

Driver Model		ASD10A-K	ASD12A-C
Power Source	Voltage	24 VDC ±10%	Single-Phase 200-230V $^{+10\%}_{-15\%}$
	Frequency	—	50/60 Hz
	Current	1.0 A	3 A
Maximum Input Pulse Frequency		250 kHz (at duty 50%)	
Input Signals	Input Mode	Photocoupler input, Input resistance 220Ω, Input Current 7~20 mA	
	· Pulse (CW Pulse)	Step command signal (CW direction operation command signal at 2-pulse input mode) Pulse width: 2μs minimum, Pulse rise/fall time: 2μs maximum (negative logic pulse input)	
	· Rotation Direction (CCW Pulse)	Rotation direction command signal (CCW direction operation command signal at 2-pulse input mode), Photocoupler OFF: CW, ON: CCW Pulse width: 2μs minimum, Pulse rise/fall time: 2μs maximum (negative logic pulse input)	
	· Alarm Clear	This signal is used when a protection circuit has been activated, for canceling the alarm without turning off the power to the driver.	
	· All Windings Off	When in the "photocoupler ON" state, the current to the actuator is cut off and the actuator table can be rotated manually. When in the "photocoupler OFF" state, the current is supplied to the actuator.	
	· Resolution Select	When in the "photocoupler ON" state, the resolution is 10 times of the initial resolution setting. When in the "photocoupler OFF" state, the initial resolution setting is selected. This function is effective when the resolution select switch is set to 9000R/P or 18000R/P.	
Output Signals	Output Mode	Photocoupler, Open-collector output, External use condition: 30 VDC maximum, 15 mA maximum [Position completion, Alarm, Excitation timing] (only for ASD10A-K) Transistor, Open-collector output, External use condition: 30 VDC maximum, 15 mA maximum [Excitation timing, Feedback A·B pulse] (only for ASD12A-C) Line driver output, equivalent to 26C31 [Excitation timing, Feedback pulse A·B phase] (only for ASD12A-C)	
	· Excitation Timing	The signal is output every time the table rotates 0.4°. (Photocoupler: ON) A precise timing signal cannot be obtained when the speed of the pulse input frequency is over 500 Hz.	
	· Alarm	The signal is output when one of the driver's protection function has been activated. (Photocoupler: OFF) The alarm signal is output, the alarm indicator (red LED) blinks, and the actuator stops (non-excitation state).	
	· Positioning Completion	The signal is output when positioning is completed. (Photocoupler: ON) This signal is output when the table position is less than ±0.1° from the commanded position during operation with a pulse input frequency of 500 Hz or less.	
	· Feedback Pulse A·B Phase	The pulse resolution is the same as the motor resolution at the power is on. The phase difference between A and B is 90° electrical. There is a 1 ms (max.) time lag between real actuator motion and the output signals. These signals are only for position verification when the actuator stopped.	
Protection Function		Overheat protection, Overload protection, Overvoltage protection, Speed error protection, Overvoltage protection, Overspeed protection, EEPROM data error, Sensor error, System error (ASD10A-K does not have overvoltage and overcurrent protections)	
Degree of Protection		IP00 (IEC60529)	IP10 (IEC60529)
Indicators (LED)		Operation idicator: Green LED, Alarm indicator: Red LED	
Cooling Method		Natural Ventilation	
Mass		0.25 kg	0.8 kg



Note:

●The rotating directions of the driver input signals (CW and CCW) are opposite the actual rotating directions of the output table. When the CW signal is input, the output table will rotate in the counterclockwise direction. When the CCW signal is input, the output table will rotate in the clockwise direction.

General Specifications

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

	Motor	Driver
Insulation Class	Class B (130°C) [Recognized as Class A (105°C) by UL and CSA standards]	—
Insulation Resistance	100Ω minumum when measured bu a 500 VDC megger between the following places. ・Frame - Motor and Sensor Windings	100MΩ minumum when measured bu a 500 VDC megger between the following places. [ASD10A-K] ・Heat Sink - Power Supply Terminal [ASD12A-C] ・Frame - Power Supply Terminal ・I/O - Power Suply Terminal
Dielectric Strength	Sufficient to withstand the following for one minute [DGM60-ASAK] ・Frame - Motor and Sensor Windings 0.5 kV 50Hz [DGM130R-ASAC] ・Frame - Motor and Sensor Windings 1.5 kV 50Hz	Sufficient to withstand the following for one minute [ASD10A-K] ・Heat Sink - Power Supply Terminal 0.5 kV 50Hz [ASD12A-C] ・Frame - Power Supply Terminal 1.5 kV 50Hz ・I/O - Power Suply Terminal 3.0 kV 50Hz
Ambient Temperature	0°C〜+50°C (nonfreezing) 0°C 〜+40°C (nonfreezing) when home-sensor set is attached	[ASD10A-K] 0°C〜+40°C (nonfreezing) [ASD12A-C] 0°C〜+50°C (nonfreezing)
Ambient Humidity	85 % or less (noncondensing)	

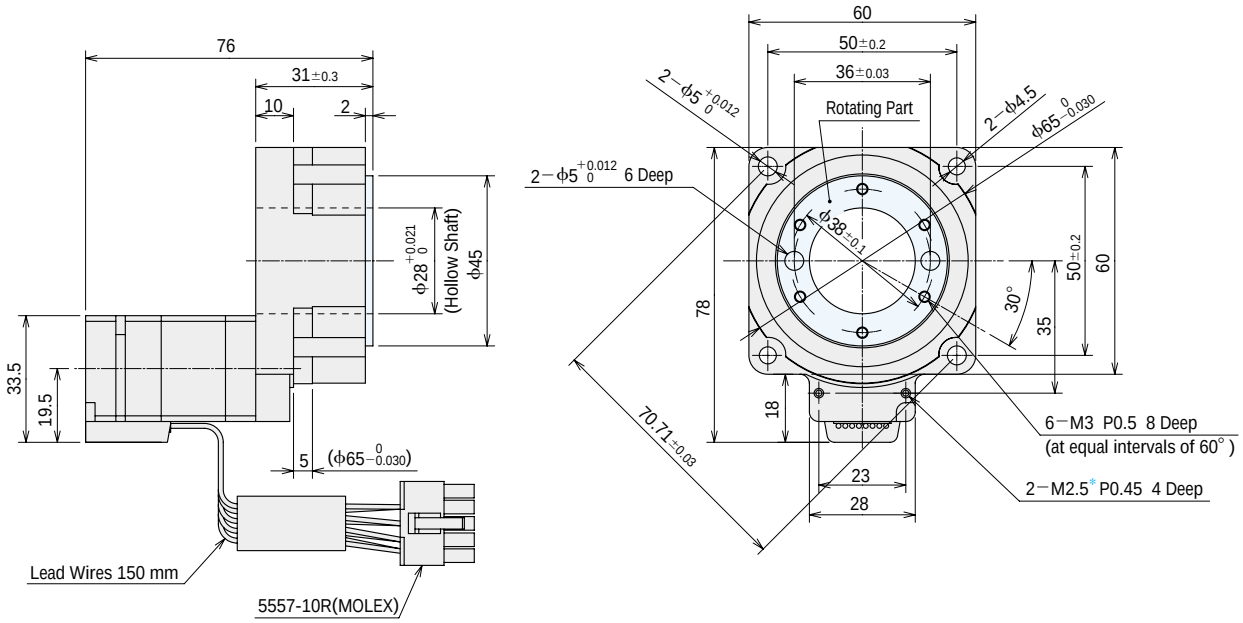
Note:

●Do not measure insulation resistance or perform the dielectric strength test while the actuator and driver are connected.

Dimensions (unit: mm)

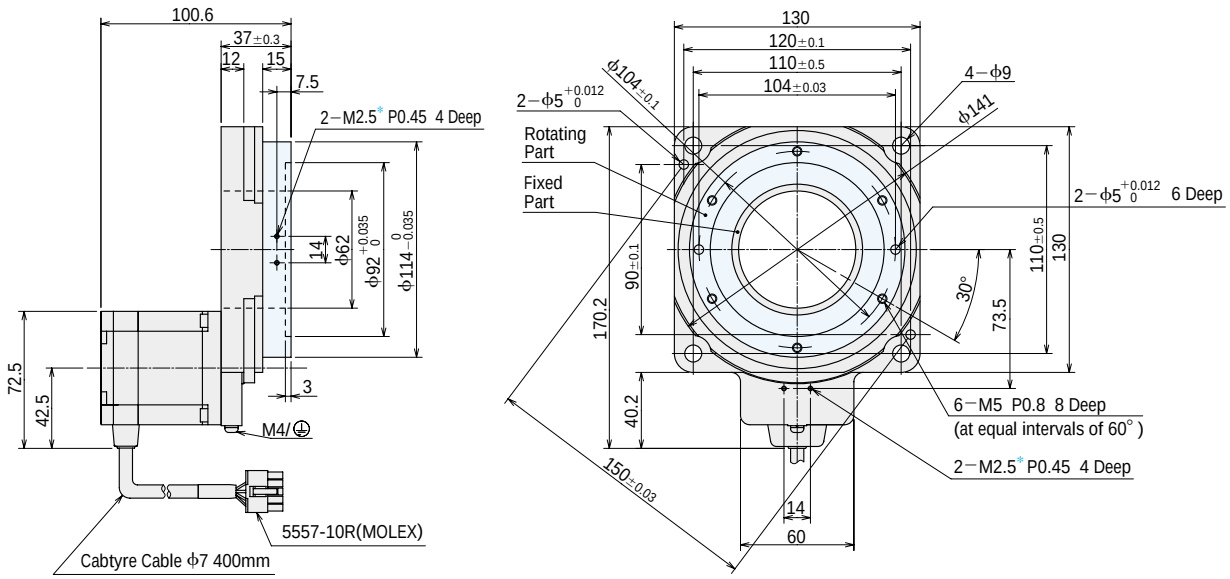
●Actuator Unit

Model	Actuator Model	Mass: 0.5 kg
DG60-ASAK	DGM60-ASAK	Scale: 1/2



* Use M2.5 screw holes when installing the home-sensor set (sold separately).
Do not use these holes for any purpose other than to install the home sensor.

Model	Actuator Model	Mass: 2.6 kg
DG130R-ASAC	DGM130R-ASAC	Scale: 1/4



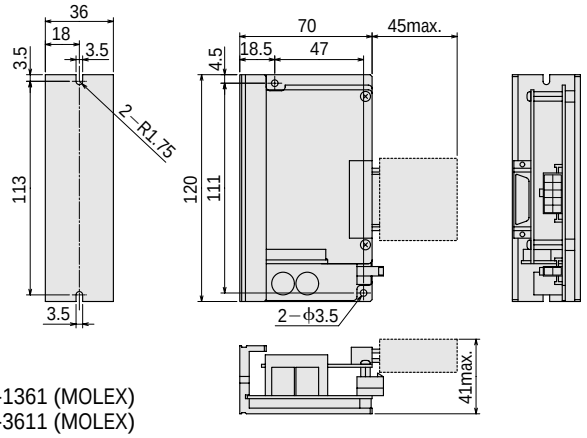
* Use M2.5 screw holes when installing the home-sensor set (sold separately).
Do not use these holes for any purpose other than to install the home sensor.

Dimensions (unit: mm)

Driver Unit (Scale: 1:4)

Driver Model: ASD10A-K

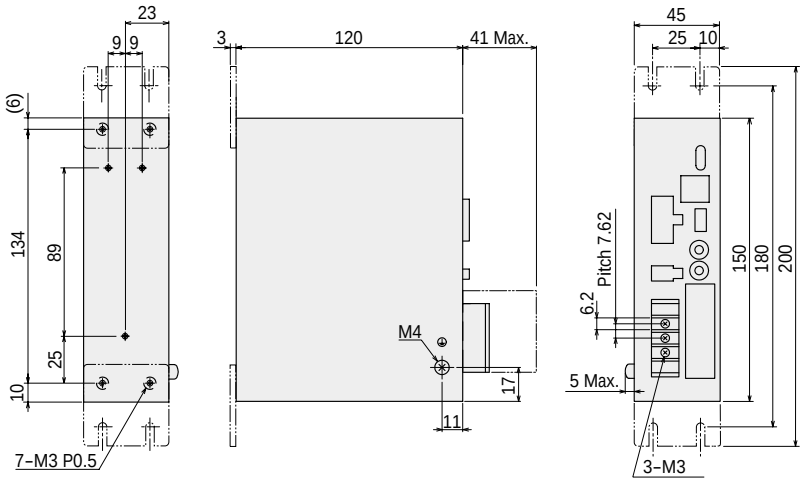
Mass: 0.25 kg



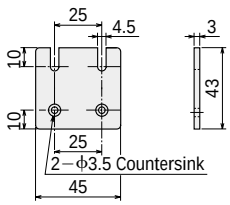
- I/O Connector (included)
  - Cover Assembly : 54331-1361 (MOLEX)
  - Connector : 54306-3611 (MOLEX)
- Power Supply Connector (included)
  - Connector : 5557-02R (MOLEX)
  - Connector Crimp Terminal : 5556TL (MOLEX)

Driver Model: ASD12A-C

Mass: 0.8 kg



- Mounting Bracket (2 pieces, included)

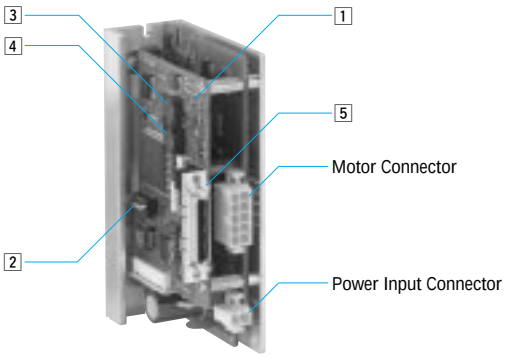


- I/O Connector (included)
  - Cover Assembly : 54331-1361 (MOLEX)
  - Connector : 54306-3611 (MOLEX)

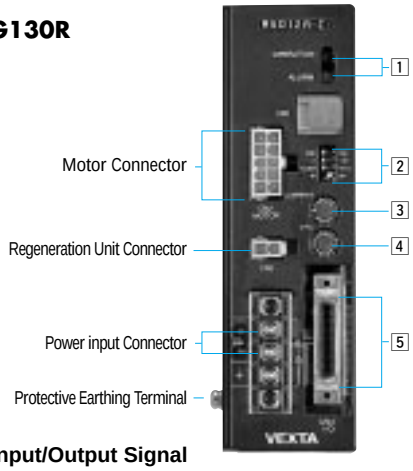
Connection and Operation

Names and Functions of Driver Parts

DG60



DG130R



1 Signal Monitor Display

LED Indications

Indications	Color	Functions	When activated
OPERATION	Green	Power Supply Indication	Lights when power is on.
ALARM	Red	Alarm Indication	Blinks when protection functions are activated.

Alarm

Blink Count	Protection Function	When activated
1	Overheat*	The temperature of the driver's internal heat sink rises to approximately 85°C.
2	Overload	The motor is operated continuously over 5 seconds under a load exceeding the maximum torque.
3	Overvoltage	The primary voltage of the driver's inverter exceeds the permissible value.
4	Speed Error	The motor cannot accurately follow at the indicated pulse velocity.
5	Overcurrent*	An excessive current has flowed to the driver's inverter.
6	Overspeed	The output table velocity exceeds 270r/min.
7	EEPROM Data Error	The EEPROM has a fault.
8	Sensor Error	The power source turns it on when the motor cable is not connected to the driver.
No Blink	System Error	The driver has fatal error.

*DG60 does not have "Overheat protection" and "Overcurrent protection" functions.

2 Function Switches

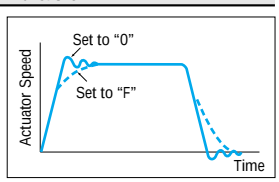
Indications	Name	Functions
1000/500 X1/ X10	Resolution Select Switch	This function is for selecting the actuator resolution. The resolution of output table is 18 times of indications. "500" "×1" →9000 Pulses (0.04°/step) "1000" "×1" →18000 Pulses (0.02°/step) [Initial Setting] "500" "×10" →90000 Pulses (0.004°/step) "1000" "×10" →180000 Pulses (0.002°/step)
1P/2P	Pulse Input Mode Switch	The settings of this switch are compatible with the following two 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 turns it ON again after you have made the change.
- If the "Resolution Select" switch is set to "×10", it cannot control the resolution select by input terminal. It is always "×10".

3 Current Adjustment Switch

Indications	Name	Functions
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.

4 Velocity Filter Adjustment Switch

Indications	Name	Functions
V.FIL	Velocity Filter Adjustment Switch	This switch is used to make adjustments when a smooth start-stop or smooth motion as low speed is required. 

5 Input/Output Signal

DG60

Indications	Input/Output	Pin Number	Signal	Name of Signal
CN3	External Power Input	2	GND	Power Supply for signal control
		3	Vcc+24V	
	Input Signal	9	DRE (CCW)	Rotation Direction (CCW Pulse)*
		10	$\overline{\text{DRE (CCW)}}$	
		11	PLS (CW)	Pulse (CW Pulse)*
		12	$\overline{\text{PLS (CW)}}$	
	Output Signal	13	BSG	B-Phase Pulse Output (Open Collector)
		14	GND	
		15	ASG	A-Phase Pulse Output (Open Collector)
		16	GND	
	Input Signal	21	ACL	Alarm Clear
		22	$\overline{\text{ACL}}$	
	Output Signal	23	TIM.	Timing (Open Collector)
		24	$\overline{\text{TIM.}}$	
		25	ALARM	Alarm
		26	$\overline{\text{ALARM}}$	
		29	END	Positioning Completion
		30	$\overline{\text{END}}$	
	Input Signal	31	10	Resolution Select
		32	$\overline{\times 10}$	
		33	C.OFF	All Windings Off
		34	$\overline{\text{C.OFF}}$	

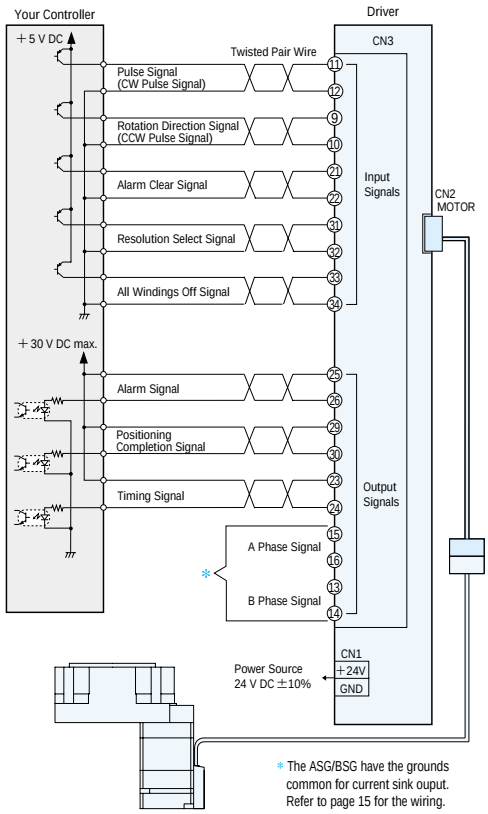
DG130R

Indications	Input/Output	Pin Number	Signal	Name of Signal
CN4	External Power Input	1	Vcc+5V	Power Supply for Control Signal
		2	GND	
	Input Signal	9	DRE (CCW)	Rotation Direction (CCW Pulse)*
		10	$\overline{\text{DRE (CCW)}}$	
		11	PLS (CW)	Pulse (CW Pulse)*
		12	$\overline{\text{PLS (CW)}}$	
	Output Signal	13	BSG1	B-Phase Pulse Output (Open Collector)
		14	GND	
		15	ASG1	A-Phase Pulse Output (Open Collector)
		16	GND	
		17	BSG2	B-Phase Pulse Output (Line Driver)
		18	$\overline{\text{BSG2}}$	
		19	ASG2	A-Phase Pulse Output (Line Driver)
		20	$\overline{\text{ASG2}}$	
	Input Signal	21	ACL	Alarm Clear
		22	$\overline{\text{ACL}}$	
	Output Signal	23	TIM.1	Timing (Open Collector)
		24	GND	
		25	ALARM	Alarm
		26	$\overline{\text{ALARM}}$	
		27	TIM.2	Timing (Line Driver)
		28	$\overline{\text{TIM.2}}$	
		29	END	Positioning Completion
		30	$\overline{\text{END}}$	
	Input Signal	31	$\times 10$	Resolution Select
		32	$\overline{\times 10}$	
		33	C.OFF	All Windings Off
		34	$\overline{\text{C.OFF}}$	

- For more details, refer to the description of input/output signal.
- *Refer to ( ) when set to 2-pulse input mode. The setting at shipment is the 1-pulse input mode.

●Connection Diagrams

DG60



♦Power Supply

Can be used with 24 VDC power supply.

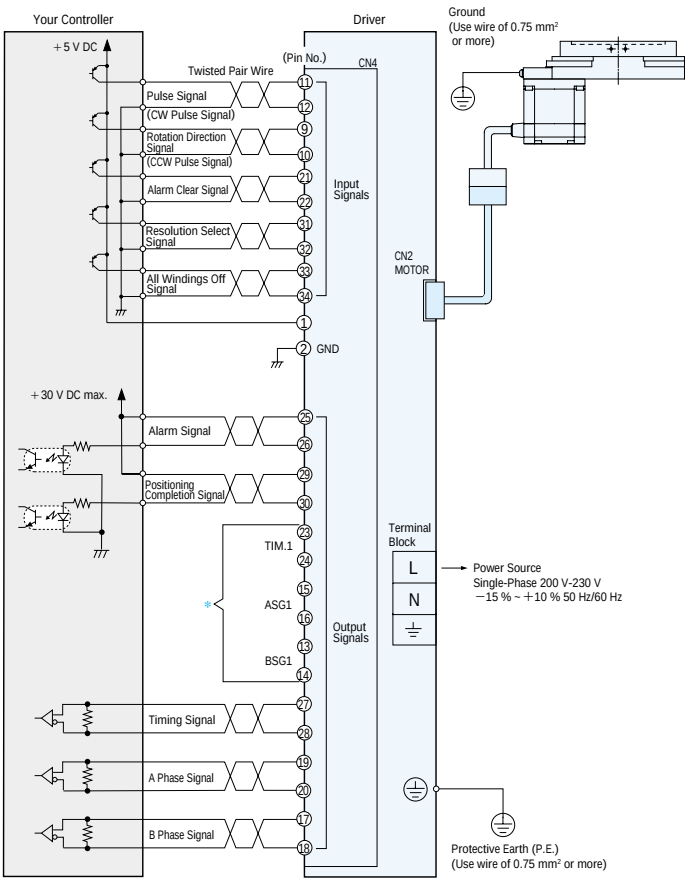
Use a power supply that can supply sufficient input current. When power supply capacity is insufficient, a decrease in motor output can cause the following malfunctions:

- Actuator does not operate properly (insufficient torque).

♦Notes on Connection

- Use a multi-core, twisted-pair shielded wire AWG 28 (0.08mm^2) for the control input/output signal line (CN3), and keep wiring as short as possible (within 2 m).
- Note that as the length of the pulse signal line increases, the maximum transmission frequency decreases.
- If the wiring between the actuator and driver needs to be extended, use an extension cable or a flexible cable (sold separately).
- The range of wire for the power connector (CN1) is AWG 18 ~ 24 (0.75 mm^2 ~ 0.23 mm^2). Use wire AWG 20 (0.5 mm^2) or thicker for the power line.
- 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.
- Always use the accessory connector to connect the power connector.
- To install the pins, be sure to use the specified crimping tool made by MOLEX 57026-5000 (for UL1007) or 57027-5000 (for UL1015).

DG130R

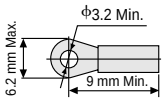


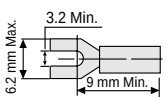
♦Notes on Connection

- Use a multi-core, twisted-pair shielded wire AWG 28 (0.08 mm^2) for the control input/output signal line (CN4), and keep wiring as short as possible (within 2 m).
- Note that as the length of the pulse signal line increases, the maximum transmission frequency decreases.
- If the wiring between the actuator and driver needs to be extended, use the extension cable or movable cable.
- Use a three-core cable for the power supply line with a conductor cross-sectional area of at least AWG 18 (0.75 mm^2).
- 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.
- The customer must furnish the cables for power supply lines and control input/output signal lines.
- The driver must be properly grounded. The driver's protective earthing terminal should be grounded to a common ground point, using a cable of AWG 18 (0.75 mm^2).
- When the "Timing Signal" or "Pulse Signal" is used, 5 VDC power supply is necessary. Use a 5 VDC power supply. Connect the power supply to the appropriate terminal.

♦Recommended Crimp Terminals

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





- Crimp terminals are not provided with the products. They must be furnished separately.

●Description of Input/Output Signal

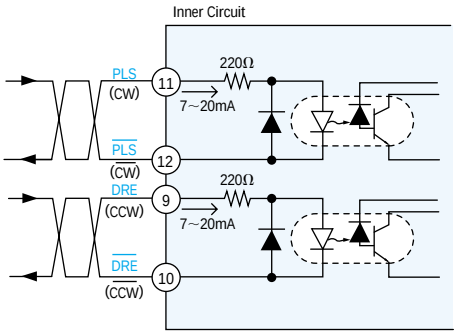
Indication of Input/Output Signal "ON" "OFF"

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.

Photocoupler OFF ON

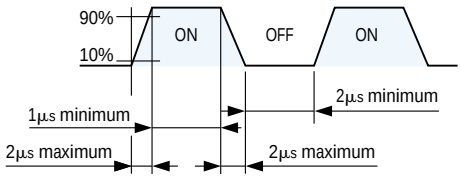
[PLS(CW), CCW(DRE) Pulse Input Signal]

♦Input Circuit and Sample Connection



The colored characters indicate signals under the 1-pulse input mode, while the black characters in parenthesis indicate signal when in the 2-pulse input mode.

♦Pulse Wave Characteristics



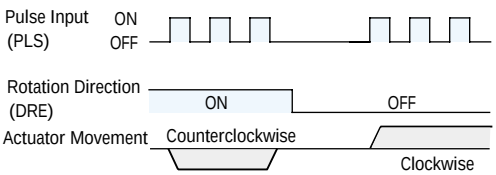
●For pulse signals, input pulse waveforms like those in the figure above.

♦Pulse Input Mode

《1-Pulse Input Mode》

The 1-pulse input mode uses "PULSE" (PLS) and "Rotation Direction" (DRE) signals. Clockwise rotation is selected by inputting DRE signals with the input photocoupler off, counterclockwise rotation by inputting with the input photocoupler on.

[Rotation Direction Signals] OFF: Clockwise ON: Counterclockwise

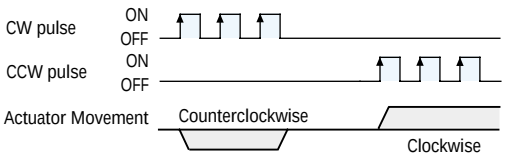


〈2-Pulse Input Mode〉

The 2-pulse input mode is used for CW and CCW pulses. When CW pulses are input, the actuator`s output table rotates counterclockwise direction; when CCW pulses are input, the table rotates clockwise direction.

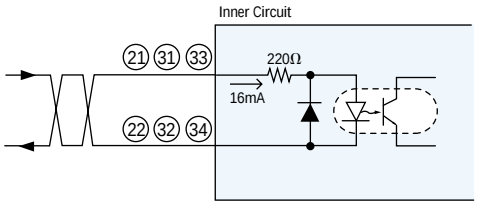
Note:

●The setting at shipment is 2-pulse input.



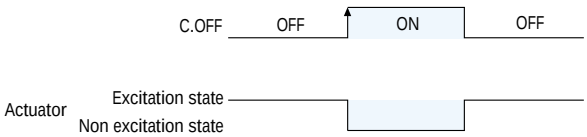
[All Windings Off (C.OFF), Resolution Select (×10), Alarm Clear (ACL) Input Signals]

♦Input Circuit and Sample Connection



♦All Windings OFF (C.OFF) Input Signal Pin No.㉝ and ㉞

Inputting the "All Windings off" (C.OFF) signal puts the actuator in a non-excitation (free) state. It is used when turning the output table externally or when positioning manually. This signal clears the deviation counter.



[Resolution Select (×10) Input Signal] Pin No.㉛ and ㉜

During input of this signal, the magnification of the resolution is ×10. It is only valid when the resolution select switch is set to ×1.

Note:

●When the resolution select switch is set to ×10, the "Resolution Select" input is ignored. In this case, the "Resolution Select" input is always equal to ON.

[Alarm Clear (ACL) Input Signal] Pin No.㉑ and ㉒

This signal is used when a protection circuit has been activated, for cancelling the alarm without turning off power to the driver.

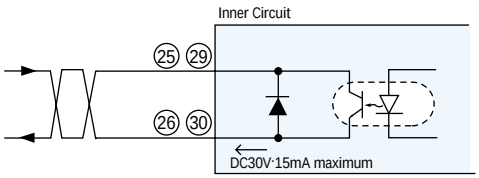
Note:

●The following alarm cannot be released. To cancel the alarm, first resolve the cause and check for safety , and then turn power on again.

• Overcurrent • EEPROM Data Error • System Error

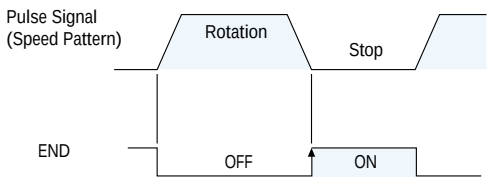
[Position Completion (END), Alarm (ALARM) Output Signal]

♦Output Circuit and Sample Connection



♦Position Completion (END) Output Signal Pin No.㉙ and ㉚

Circuits for use with 30V, 15mA maximum. This signal outputs at the photocoupler ON when positioning is completed. This signal is output when the table position is less than ±0.1˚ from the command position approximately 2 ms after the pulse input stops.



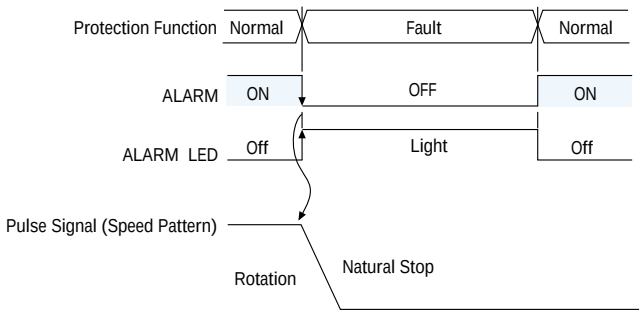
Note:

- The END signal flashes during operation with a pulse input frequency of 500 Hz or less.

[Alarm (ALARM) Output Signal]

Pin No.㉕ and ㉖

Circuits for use with 30V, 15mA maximum. This signal indicates that one of the driver's protection circuits has been activated. When an abnormality such as an overload or over-current is detected, the alarm signal is output, the ALARM indicator lights, and the actuator stops (non-excitation state). To cancel the alarm, first resolve the cause and check for safety, and then input a Alarm-clear (ACL) or turn power on again. Once power has been turned off, wait at least 3 seconds before turning it on again.



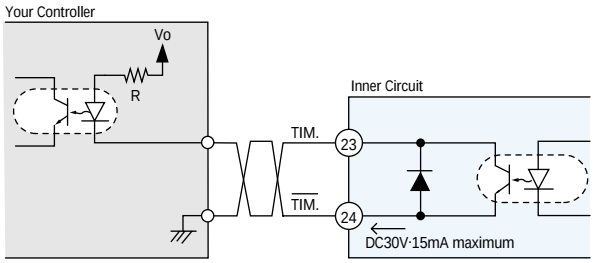
Note:

- Since alarm output uses positive logic, other outputs use negative logic.

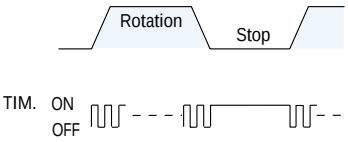
[DG60]

[Timing Signal (TIM.) Output Signal]

♦Output Circuit and Sample Connection



Circuits for use with 30V, 15mA maximum.
When the "TIMING" signal is output, the photocoupler turns ON. This signal is used to detect the home position with greater precision. The number of pulse of this signal is 900 pulses per 1 table revolution.

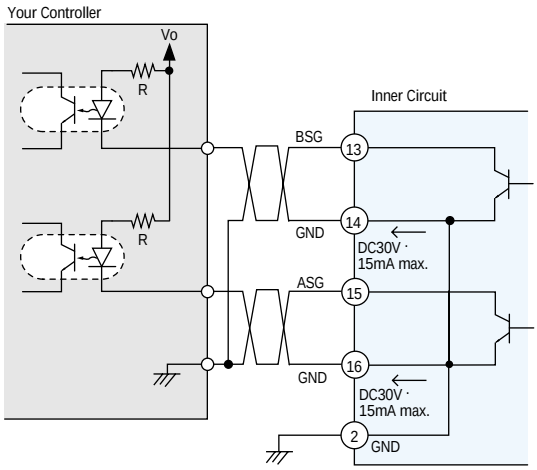


Note:

- A precise timing signal cannot be obtained when the speed of the pulse input frequency is over 500Hz.

[A-Phase, B-Phase Signal (ASG/BSG) Output Signal]

♦Output Circuit and Sample Connection

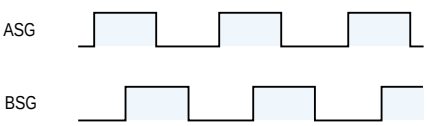


Circuits for use with 30V, 15mA maximum. These signals are used when monitoring the table motion. The same pulse numbers as the setting resolution are output for each motor revolution.
[Example: Resolution select switch (1000P/R) ⇒ output pulse number for each table revolution (18000).] The phase difference between A and B is 90° in electrical angle.

Note:

- The pulse output accuracy is, regardless of resolution, within ±0.36° (repetition accuracy: within ±0.09°).
- These signals are only for position verification when the motor is stopping. There is 1ms (MAX) time lag between real rotor motion and the output signals.

♦Pulse Waveform Characteristics



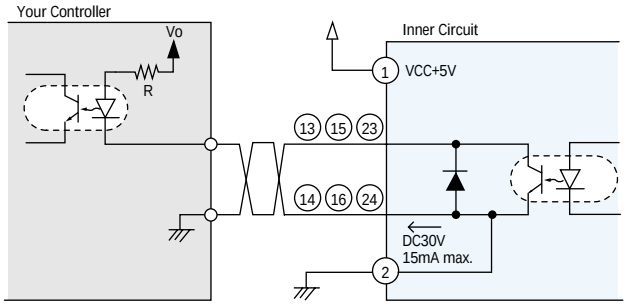
(In Forward Rotation)

[DG130R]

[Timing (TIM.1, TIM.2), A-Phase, B-Phase (ASG1/BSG1, ASG2/BSG2) Signal Output Signal]

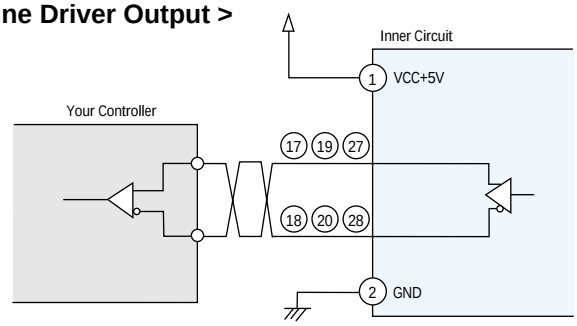
♦Output Circuit and Sample Connection

< Open Collector Output >



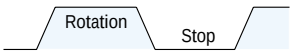
Circuits for use with 30V, 15mA maximum.

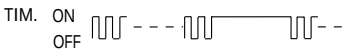
< Line Driver Output >



♦Timing Signal (TIM.1, TIM.2) Output Signal Pin No.㉓, ㉔, ㉗, and ㉘

When the Timing signal is output, the transistor turns ON (For the line driver out which is TIM.2, the output signal is High). This signal is used to detect the home position with greater precision. The number of pulses of this signal are 900 pulses per 1 table revolution.





Note:

- A precise Timing signal cannot be obtained when the speed of the pulse input frequency is over 500Hz.
- When the Timing Signal Output is used, DC5V or DC24V power supply is necessary.

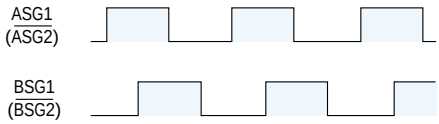
♦A-Phase, B-Phase Signal (ASG1/BSG1, ASG2/BSG2) Output Signal Pin No.⑬ ～ ⑳

These signals are used when monitoring the motor motion. The same pulse numbers as the setting resolution are output for each motor revolution.
[Example: Resolution select switch (1000P/R) ⇒ Output pulse number for each table revolution (18000).] The phase difference between A and B is 90° in electrical angle.

Note:

- The pulse output accuracy is, regardless of resolution, within ±0.36° (repetition accuracy: within ±0.09°).
- When the pulse output is used, DC5V or DC24V power supply is necessary. These signals are only for position verification when the actuator stopping. There is 1ms (MAX) time lag between real actuatorl motion and the output signals.

♦Pulse Waveform Characteristics



(In Forward Rotation)

Actuator/Driver Combinations

●Standard Type

Model	Actuator Model	Driver Model
DG60-ASAK	DGM60-ASAK	ASD10A-K

●High-Rigidity Type

Model	Actuator Model	Driver Model
DG130R-ASAC	DGM130R-ASAC	ASD12A-C

Selection Calculations

Calculations are needed to select an appropriate product that meets the specifications required for your equipment.
This section explains the calculations used for selecting an applicable **DG Series** actuator.

<Calculation of Required Torque>

①Calculate the work`s inertial moment.

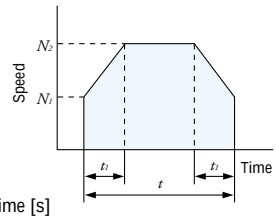
②Determine the positioning angle.

③If there is no friction torque, check the positioning time from the tact-time graph of the **DG Series**. Refer to page 8 for the minimum positioning time graph.

④Determine the positioning time and acceleration/deceleration time.
Note that the positioning time must be equal to or greater than the minimum positioning time obtained via the tact-time graph, and that it must be equal to or less than the acceleration/deceleration time (t_1) x 2.

⑤Determine the starting speed N_1 and calculate the operation speed N_2 using the formula below. Set N_1 to a low speed (0 to several r/min.), but be careful not increase it more than necessary.

$$N_2\ [\text{r/min}] = \frac{\theta - 6N_1t_1}{6(t - t_1)}$$



N_2 : Operation Speed [r/min]
θ : Positioning Angle [°]
N_1 : Starting Speed [r/min]
t : Positioning Time [s]
t_1 : Acceleration (Deceleration) Time [s]

If $N1 \leq N2 \leq 200$ [r/min] is not satisfied as a result of the above calculation, return to ④ and review the conditions.

⑥Calculate the acceleration torque using the formula below.

$$\text{Acceleration TorqueTa [N·m]} = (J_1 + J_L) \times \frac{\pi}{30} \times \frac{(N_2 - N_1)}{t_1}$$

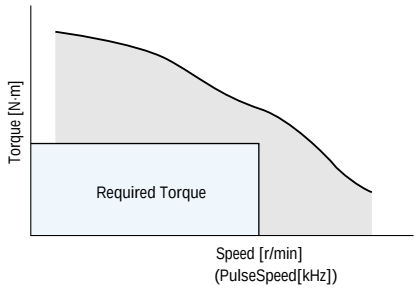
J_1 : Actuator's Inertia [kg·m²]
J_L : Total Inertia [kg·m²]
N_2 : Operation Speed [r/min]
N_1 : Starting Speed [r/min]
t_1 : Acceleration (Deceleration) Time [s]

⑦Calculate the required torque. The required torque is calculated by multiplying the sum of the load torque due to friction resistance and the acceleration torque due to inertial load, by an appropriate safety factor.

Required Torque T = (Load Torque [N·m] + Acceleration Torque [N·m]) x Safety Factor
= (T_L + Ta) x S

Use 1.5 or a greater value for the safety factor S.

⑧Confirm whether the required torque T is within the "speed vs. torque characteristics." If not, return to ④ and review the conditions, and then perform the calculation again.



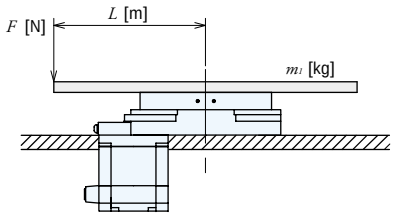
Use the formula below to convert speed to pulse speed.

$$f\ [\text{Hz}] = \frac{6N}{\theta_s}$$

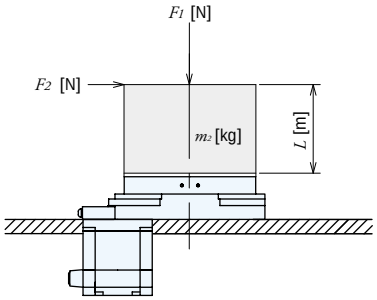
f : Pulse Speed [Hz]
N : Speed [r/min]
θ_s : Output-Table Step Angle [°/step]

<Calculation of Thrust Load and Moment Load>

If the load illustrated below applies to the output table, calculate the thrust load and moment load using the formulas below to confirm whether they are within the specified values.



Thrust Load [N] $F_S = F + m_1 \times g$
Moment Load [N·m] $M = F \times L$

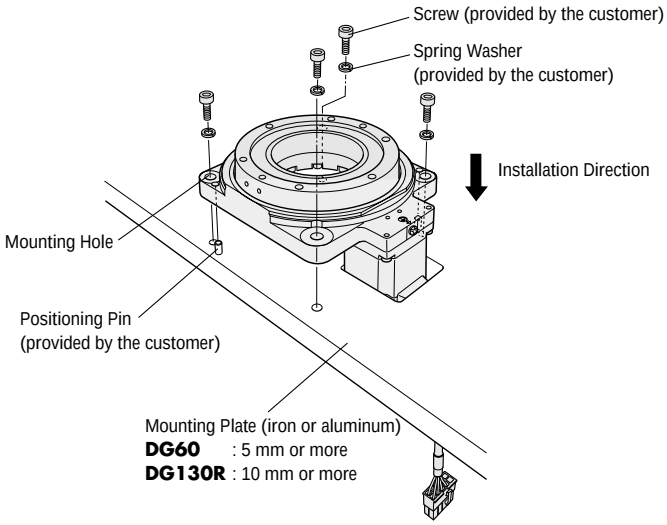


Thrust Load [N] $F_S = F_1 + m_2 \times g$
Moment Load [N·m] $M = F_2 \times (L + \alpha)$

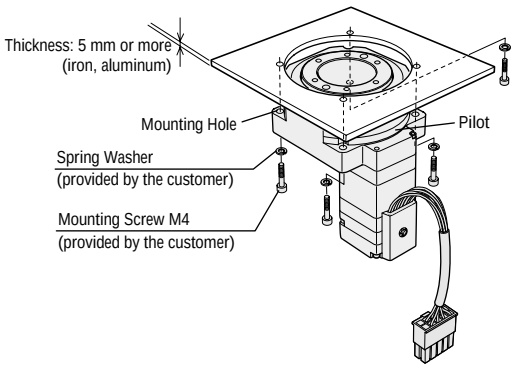
Model	a
DG60	0.01
DG130R	0.03

●Installing the Hollow Rotary Actuator

Install the hollow rotary actuator onto the mounting plate from the direction shown in the figure. Two positioning pinholes of $\phi 5\,^{+0.012}_{0}$ are provided in the mounting surface of the hollow rotary actuator. (With the 60 mm frame-size type, the mounting holes and positioning pinholes are the same.) Use these holes to determine the position of the hollow rotary actuator on your equipment. Be sure to firmly affix the positioning pins in the mounting plate.
Provide relief holes in the mounting plate to prevent contact with the motor.

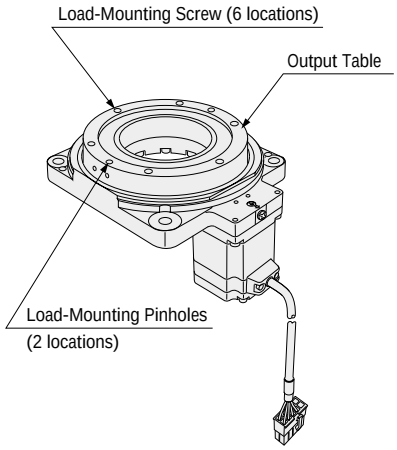


The hollow rotary actuator with a frame size of 60 mm can be installed from the direction shown in the figure using a pilot ($\phi 65\,^{0}_{-0.030}$). However, installation from this direction is not possible when the optional home-sensor set is used.



●Affixing the Load on the Output Table

Affix the load using the load-mounting screw holes (six locations) provided in the output table.
Two load-mounting pinholes of $\phi 5\,^{+0.012}_{0}$ and 6 mm in depth are provided in the output table. Use these holes and positioning pins to determine the position of the load. Be sure to firmly affix the positioning pins in the load.



Accessories (Sold Separately)

Home-Sensor Set

A home-sensor set, which consists of a sensor, connector with cable, sensor mounting bracket, shielding plate and mounting screws, is provided to facilitate easy home hunting. All parts needed for home hunting are included in the set, so you will spend less time designing, fabricating or procuring parts in connection with sensor installation. Installation is very easy, so you can start using the sensor right away.

Model	Applicable Products
PADG-SAY	**DG60-ASAK**
PADG-SBY	**DG130R-ASAC**

Model: **PADG-SBY**

Sensor Specifications

Model	EE-SX672R、EE-SX673R (OMRON)
Power Supply	5 ～ 24 VDC ±10%, ripple (P-P) 10% or less
Current Consumption	30 mA or less
Control Output	PNP open-collector output, 5 ～ 24 VDC 50 mA or less Residual voltage 1.3 V or less (at load current of 50 mA)
Indicator Lamp	Detection display (red)
Sensor Logic	Normal open/Normal close (switchable, depending on connection)

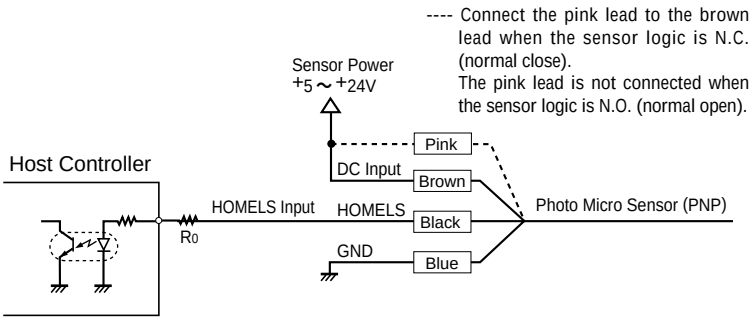
Installing the Home-Sensor Set

Be aware of the following points when installing the optional home-sensor set:

- Set the operating conditions so that the operating temperature stays at 40°C or below and the surface temperature of the hollow rotary actuator motor stays at 90°C or below.
- When performing home hunting using the counter-output shaft of the motor, the user must provide a separate sensor, mounting bracket and other necessary parts.

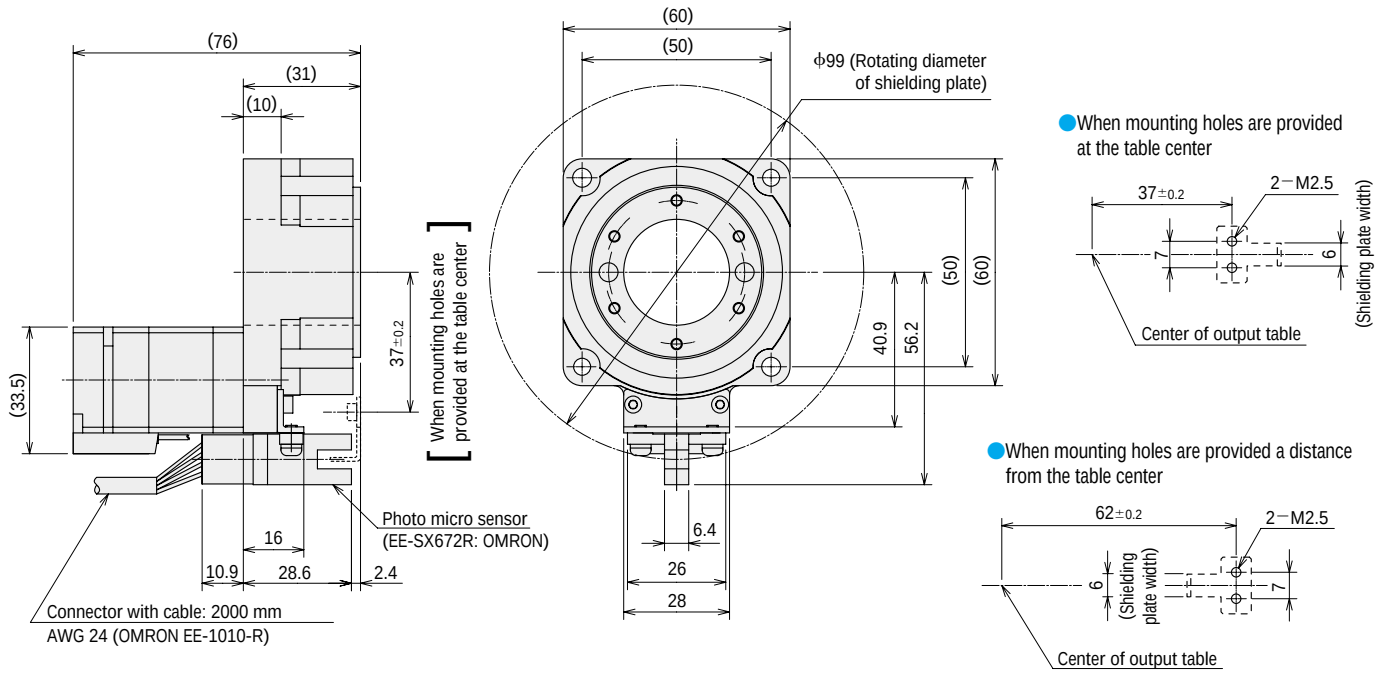
Wiring the Sensor

Power supply voltage must be 5 VDC – 24 VDC, 50 mA or less respectively.
If the current exceeds 50 mA, connect an external resistance R_0.
GND for sensor power supply and customer's controller power supply should be common.



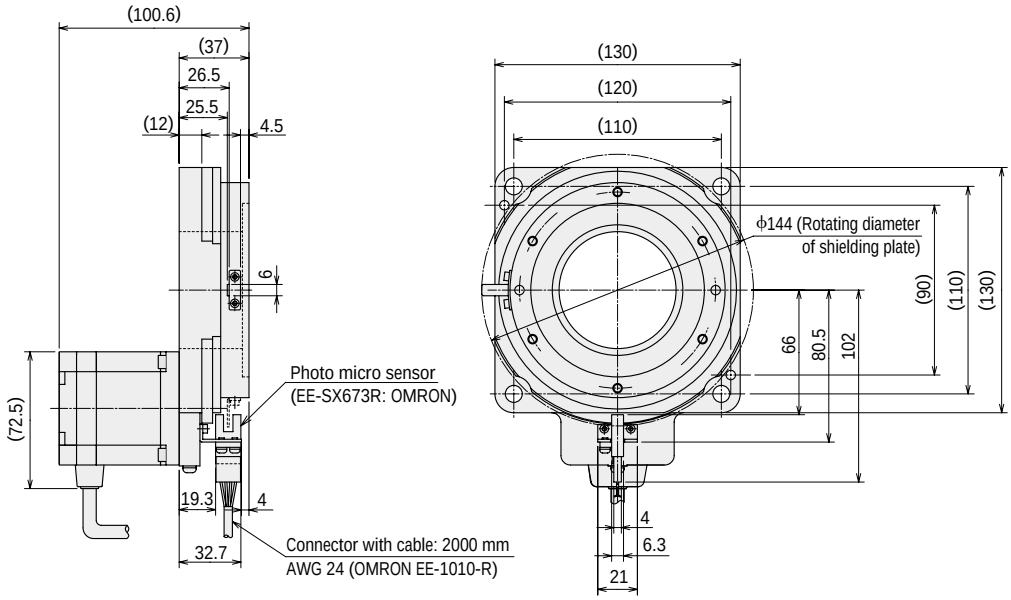
Dimensions of Sensor Installation (Unit: mm)

♦**DG60-ASAK**



Machining Dimension Drawing for Installation of Shielding Plate

♦DG130R-ASAC



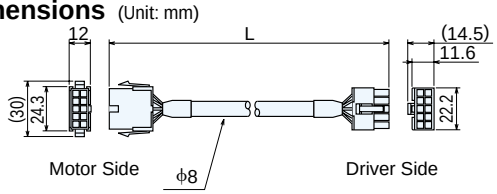
Extension Cable

These extension cables are convenient when using the actuator and the driver more than 0.4 m (0.15 m for **DG60**) apart from each other.

Model	Length (L)
CC01AIP	1 m
CC02AIP	2 m
CC03AIP	3 m
CC05AIP	5 m
CC07AIP	7 m
CC10AIP	10 m
CC15AIP	15 m
CC20AIP	20 m

* The maximum extension length of **DG60** is 10.15 m.

●Dimensions (Unit: mm)

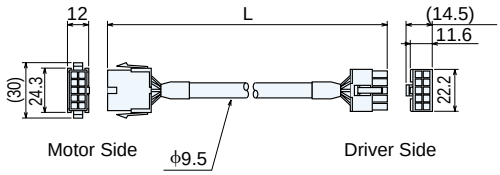


Flexible Cable

We recommend these flexible cables when the actuator is installed on a moving section and the cable is repeatedly bent and extended.

Model	Length (L)
CC01SAR	1 m
CC02SAR	2 m
CC03SAR	3 m
CC05SAR	5 m
CC07SAR	7 m
CC10SAR	10 m

●Dimensions (Unit: mm)



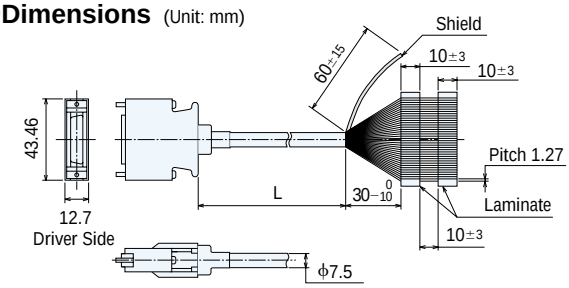
Driver Cable

This is a ribbon cable equipped with, at one end of the cable, the half-pitch connector that snaps into the driver for **DG** series.

Model	Length (L)
CC36D1-1	1m
CC36D2-1	2m

Control I/O Pin: 36 pins

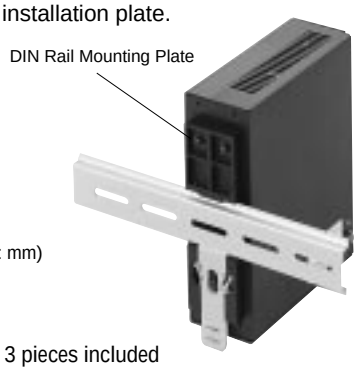
●Dimensions (Unit: mm)



Accessories (Sold Separately)

DIN Rail mounting Plate: PADP01

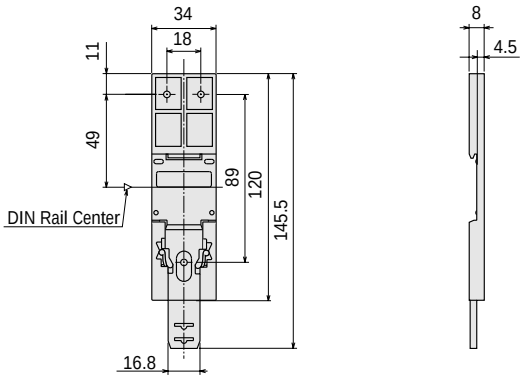
This installation plate is convenient for installing the driver for **DG130R** on DIN rails with ease. The required installation screws come with this installation plate.



Dimensions (Unit: mm)

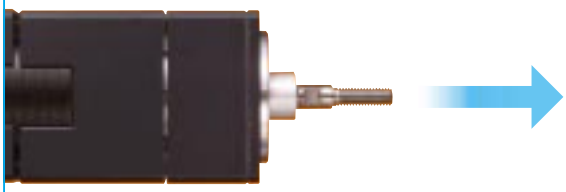
Mass: 20 g

- Screws:
  M3 P0.5, 8 mm long, 3 pieces included



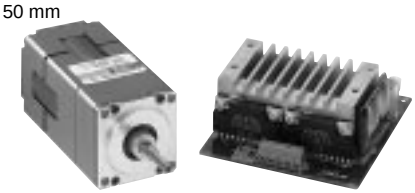
Motorized Actuators

Space-Saving Compact Actuator



- Three frame sizes, □28mm, □42mm and □60mm, are available.
- A stepping motor with a new, hollow-shaft structure and built-in ball screw.
- Thanks to a large-bore thrust-bearing mechanism, the load can be held directly.
- 30-mm stroke from a compact body of 58 mm in overall length (**DRL28** type)

Maximum Speed: 32 mm/s
Maximum Thrust Force: 300 N
Maximum Transportable Mass: 30 kg
Repetitive Positioning Accuracy: ±0.02 mm
Stroke: 30 to 50 mm



LIMO Compact Actuators
DRL Series

ORIENTAL MOTOR

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).

Specifications subject to change without notice.
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