Oriental motor

Hollow Rotary Actuators **DH Series**

Designed for precision and space savings, tubing and wiring can pass through the hollow hole, contributing to simpler and smaller equipment.



Actuators with a hollow rotor.

Tubing and wiring can be simplified, and the number of installation mechanism parts can be reduced.

This contributes to smaller and lighter equipment, as well as reduced design time.

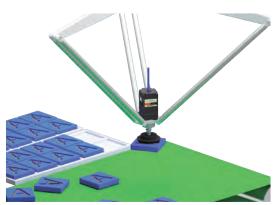
Hollow Rotary Actuators

DH Series

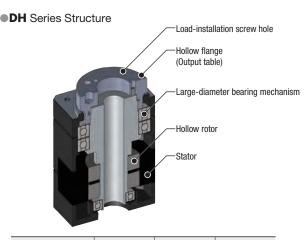


The hollow portion simplifies the tubing and wiring of cutting-edge equipment

This actuator is a 5-phase stepper motor with a hollow flange. Tubing, wiring and light beams can be passed through the hollow part, contributing to simpler cutting-edge design, as well as smaller and lighter equipment.



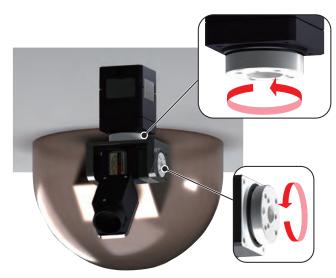
Parallel link robot θ axis of suction device



Product Name	Frame Size	Diameter of Hollow Section	Mass
DHM28PAK2	28 mm	ф5.2 mm	0.17 kg
DHM42PAK	42 mm	ф10 mm	0.47 kg

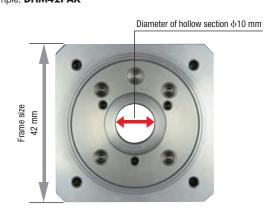
The flange installation reduces the number of parts around the moving parts

The hollow flange can be attached directly to the load. This reduces the number of parts around the moving parts.



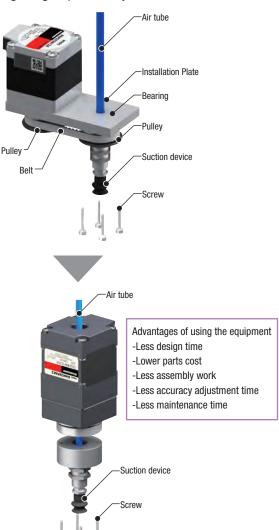
Axes of rotation of security camera

Diameter of Hollow Section (Actual size)Example: **DHM42PAK**



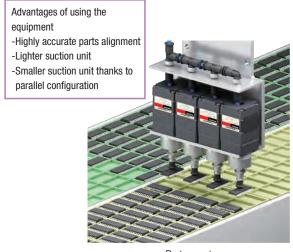
Some of the conventional parts have been eliminated, so the time required for equipment design and product selection is shortened.

Furthermore, the number of man-hours required for assembly and the adjustment of installation accuracy can be reduced, contributing to higher productivity.

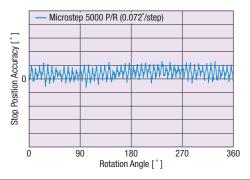


High Positioning Accuracy

The on-board 5-phase stepper motor allows for high positioning accuracy and fine operations to be stably repeated. Thanks to the microstep drive and smooth drive function in combination with the **CVD** driver, vibration is reduced at low speed and smooth operation is possible. Because the hollow flange does not use any transfer mechanisms like couplings or belts, there is no effect of error on accuracy caused by part rigidity or combination.



 $\begin{array}{c} \text{Part mounter} \\ \theta \text{ axis of parallel suction device} \end{array}$



Product Name	Stop Position Accuracy	Repetitive Positioning Accuracy
DHM28PAK2	±0.33°	±0.15°
DHM42PAK	±0.11°	±0.05°

Combined Drivers

CVD Series drivers are available.

Refer to "CVD Series 5-phase Stepper Motor Drivers (Combined Drivers)" on page 12 for details.

Low Vibration Achieved by Full-Time Microstep Drive

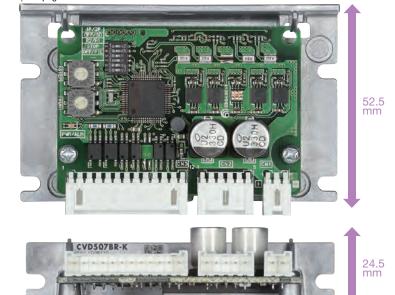
Utilizing a digitally-controlled full-time microstep driver improves the vibration levels and reduces both vibration and noise at all speeds.

Industry's-Top-Class Compact High Performance Driver

- Compact and lightweight drivers that contribute to saving space
- Protective function that enables you to find driver errors early
- Smooth drive function that enables smoother operation
- Set the running current using a digital switch



Mass 20 g - 70 g (The value differs according to the driver type.)



85 mm

Wide Variety of Products According to System Configuration and Application

◇Pulse Input Type

Synchronous operation is easy with pulse input.



Right Angle Type with Installation Plate



With Installation Plate

Types without an installation plate are available.

Operation control and parameter settings are possible via RS-485 communication (Modbus RTU).

Since a pulse generator is not required, the operating data set in the driver can be selected and executed from the host control device.



Right Angle Type with Installation Plate

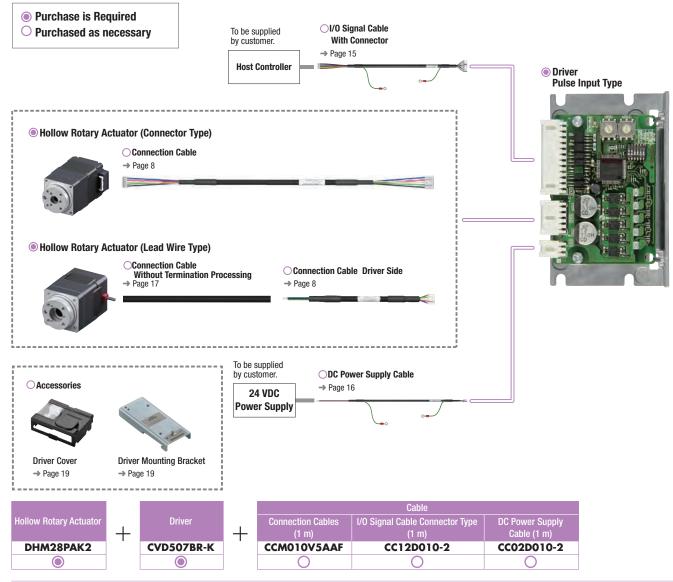


With Installation Plate

System Configuration

Combination of Hollow Rotary Actuator and CVD Series Pulse Input Type Driver

This is an example of system configuration using a programmable controller (with pulse oscillation function). Hollow rotary actuators, drivers, and connection cables need to be ordered separately.



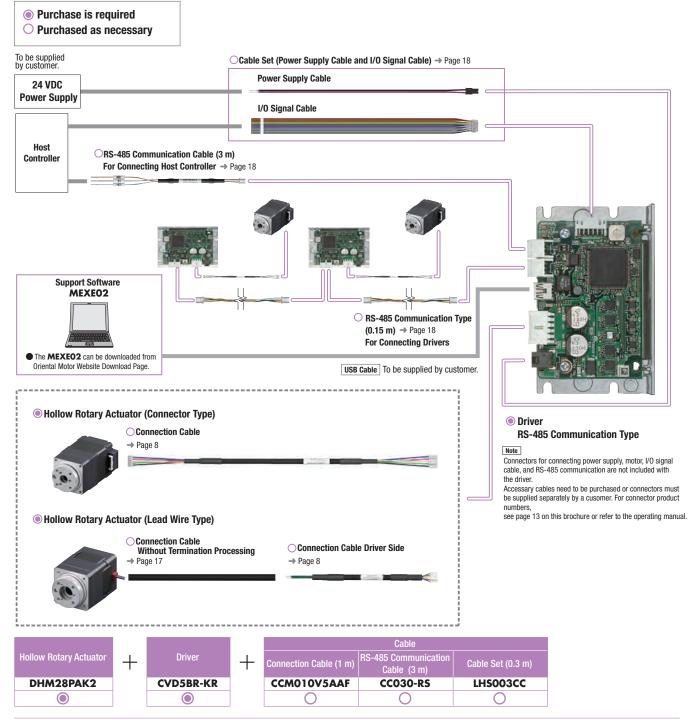
The system configuration shown above is an example. Other combinations are also available.
Note:

The driver cover can be used for a pulse input type driver right-angle type with installation plate.

Combination of Hollow Rotary Actuator and CVD Series RS-485 Communication Type Driver

An example of three-axis system configuration when controlled with RS-485 communication is shown below.

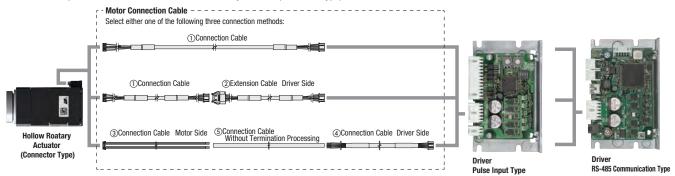
The hollow rotary actuators, drivers, and connection cables must be ordered separately.



The system configuration shown above is an example. Other combinations are also available.

■ Cable System Configuration Example

This is an example of connection between the hollow rotary actuator (connector type) and our driver.



Selectable from the following three connection methods:

Connect using a connection cable

Connect by adding a extension cable to the connection cable

Use the connection cable motor side to connect to the connection cable driver side by a customer.

Note

Up to 3 cables can be used to connect the motor and the driver.

■ The distance between the motor and the driver can be extended up to 10 m.

Product Number

DHM 28 PAK 2









1	Series Name	DHM: DH Series
2	Frame Size	28: 28 mm 42: 42 mm
3	Equipped Motor	P: 5-Phase Stepper Motor
4	Motor Type	A: Standard
(5)	Motor Specifications	K: DC Power Supply Input
6	Reference Number	

Product Line

Actuators, drivers, and cables need to be ordered separately. Please refer to page 12 for details of the drivers.

Actuators

Product Name
DHM28PAK2
DHM42PAK

Connection Cables / Flexible Connection Cables

Connection Cables

Product Name Length L [m] CCM005V5AAF 0.5 CCM010V5AAF 1.5 CCM020V5AAF 2 CCM025V5AAF 2.5 CCM030V5AAF 3 CCM040V5AAF 4 CCM050V5AAF 5 CCM070V5AAF 7 CCM100V5AAF 10		
CCM010V5AAF 1.5 CCM015V5AAF 2.5 CCM020V5AAF 2.5 CCM030V5AAF 3 CCM040V5AAF 4 CCM050V5AAF 5 CCM070V5AAF 7	Product Name	
CCM015V5AAF 1.5 CCM020V5AAF 2 CCM025V5AAF 2.5 CCM030V5AAF 3 CCM040V5AAF 4 CCM050V5AAF 5 CCM070V5AAF 7	CCM005V5AAF	0.5
CCM020V5AAF 2 CCM025V5AAF 2.5 CCM030V5AAF 3 CCM040V5AAF 4 CCM050V5AAF 5 CCM070V5AAF 7	CCM010V5AAF	1
CCM025V5AAF 2.5 CCM030V5AAF 3 CCM040V5AAF 4 CCM050V5AAF 5 CCM070V5AAF 7	CCM015V5AAF	1.5
CCM030V5AAF 3 CCM040V5AAF 4 CCM050V5AAF 5 CCM070V5AAF 7	CCM020V5AAF	2
CCM040V5AAF 4 CCM050V5AAF 5 CCM070V5AAF 7	CCM025V5AAF	2.5
CCM050V5AAF 5 CCM070V5AAF 7	CCM030V5AAF	3
CCM070V5AAF 7	CCM040V5AAF	4
	CCM050V5AAF	5
CCM100V5AAF 10	CCM070V5AAF	7
	CCM100V5AAF	10

• Flexible Connection Cables

Product Name	Length L [m]
CCM005V5AAR	0.5
CCM010V5AAR	1
CCM015V5AAR	1.5
CCM020V5AAR	2
CCM025V5AAR	2.5
CCM030V5AAR	3
CCM040V5AAR	4
CCM050V5AAR	5
CCM070V5AAR	7
CCM100V5AAR	10

Please refer to the PKP Series brochure for the "Extension cable driver side (CCM DSADFT)" to be added to the connection cable. The wiring distance between the motor and the driver should be 10 m or less.

♦ For Frame Size 42 mm

• Connection Cables Driver Side

Product Name	Length L [m]
CC005N1	0.5
CC010N1	1

[•] Flexible Connection Cables Driver Side

Product Name	Length L [m]
CC005N1R	0.5
CC010N1R	1

Connection cables without termination processing (CC PK5, CC PK5R) are for extending the connection between the motor and the driver. See page 17 for details. The wiring distance between the motor and the driver should be 10 m or less.

Included

Operating Manual: 1 Copy

How to Read Specifications

Specifications

		28 mm	42 mm
		DHM28PAK2	DHM42PAK
Pulse Input		CVD50	7BR-K
RS-485 Communication		CVD5I	BR-KR
	Nm	0.029	0.175
Power ON	Nm	0.014	0.087
	J: kg⋅m ²	3.5×10 ⁻⁶	25.5×10 ⁻⁶
	A/Phase	0.7	75
		0.7	'2°
		±0.33°	±0.11°
		±0.15°	±0.05°
	N	40	150
Permissible Moment Load Nm		0.1	0.4
Runout of Output Table (Hollow Flange) Surface mm		0.0	05
ge) Inner/Outer [Diameter mm	0.0	05
	RS-485 Comm Power ON	RS-485 Communication Nm Power ON Nm J: kg·m² A/Phase N N Nm	DHM28PAK2

Note

- The accuracy is measured at a constant temperature (normal temperature) under a constant load.
- Be sure to set the driver setting current to be less than the rated current of the actuator. Exceeding the rated current of the actuator may damage the product.

(1)Maximum Holding Torque

This is the maximum holding torque the actuator has when power is supplied but the output table (hollow flange) is not rotating.

②Holding Torque at Motor Standstill

This is the holding torque when the automatic current cutback function is active.

(3) Repetitive Positioning Accuracy

A value indicating the degree of error that generates when positioning is performed repeatedly to the same position in the same direction.

Permissible Axial Load

The permissible value of axial load applied to the output table (hollow flange) in the axial direction.

⑤Permissible Moment Load

When a load is applied to a position away from the center of the output table (hollow flange), the output table (hollow flange) receives a tilting force. The permissible moment load refers to the permissible value of moment load calculated by multiplying the offset distance from the center by the applied load.

⑥Runout of Output Table (Hollow Flange) Surface

The maximum value of runout of the mounting surface of the output table (hollow flange) when the output table (hollow flange) is rotated under no load.

7) Runout of Output Table (Hollow Flange) Inner/Outer Diameter

The maximum value of runout of the inner diameter or outer diameter of the table when the output table (hollow flange) is rotated under no load.

Specifications

Frame Size			28 mm	42 mm
Actuator Product Name			DHM28PAK2	DHM42PAK
Driver Product Name	Pulse Input		CVD5	07BR-K
Driver Product Name	RS-485 Comm	unication	CVD5	BR-KR
Maximum Holding Torque		Nm	0.029	0.175
Holding Torque at Motor Standstill	Power ON	Nm	0.014	0.087
Rotor Inertia		J: kgm ²	3.5×10 ⁻⁶	25.5×10 ⁻⁶
Rated Current A/Phase		0.75		
Basic Step Angle			0.	72°
Stop Position Accuracy		±0.33°	±0.11°	
Repetitive Positioning Accuracy			±0.15°	±0.05°
Permissible Axial Load		N	40	150
Permissible Moment Load		Nm	0.1	0.4
Runout of Output Table (Hollow Flange) Surface mm		0	.05	
Runout of Output Table (Hollow Flange) Inner/Outer Diameter mm		meter mm	0	.05

Note

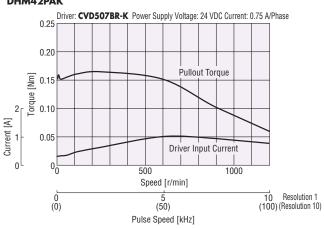
- The accuracy is measured at a constant temperature (normal temperature) under a constant load.
- Be sure to set the driver setting current to be less than the rated current of the actuator.
- Exceeding the rated current of the actuator may damage the product.

Speed - Torque Characteristics (Reference Value)

DHM28PAK2

Driver: CVD507BR-K Power Supply Voltage: 24 VDC Current: 0.75 A/Phase 0.035 0.030 0.025 Pullout Torque O.020 0.015 Current [A] 0.010 0.005 Driver Input Current 1000 Speed [r/min] ō 5 10 Resolution: 1 (0) (50)(100)(Resolution: 10) Pulse Speed [kHz]

ПНМ42РАК

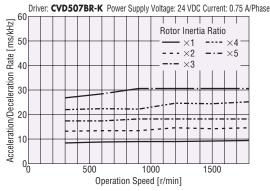


Note

- Data for the speed torque characteristics is based on Oriental Motor's internal measurement conditions. If the conditions are changed, the characteristics may also change as a result.
- Depending on the driving conditions, a considerable amount of heat may be generated by the actuator. Be sure to keep the motor case temperature at 100°C max.
- $\begin{tabular}{ll} \blacksquare \begin{tabular}{ll} The characteristics are the same when RS-485 communication type driver is used in combination. \end{tabular}$

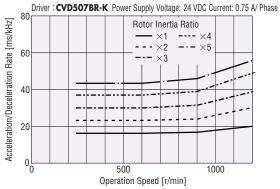
■ Operation Speed - Acceleration/Deceleration Rate (Reference Value)

DHM28PAK2



These diagrams show the inertia ratio of the load inertia to the rotor inertia.

DHM42PAK



■ General Specifications

Actuators		Actuators	
Thermal Class		130(B)	
Insulation Resistance		The measured value is 100 ${\rm M}\Omega$ or more when a 500 VDC megger is applied between the following locations: Between case and motor windings	
Dielectric Strength		Sufficient to withstand the following for 1 minute: DHM28 -Between case and motor windings: 0.5 kVAC, 50 Hz or 60 Hz DHM42 -Between case and motor windings: 1.0 kVAC, 50 Hz or 60 Hz	
Operating Environment	Ambient Temperature	0 to +40°C (Non-freezing)	
Operating Environment (In operation) Ambient Humidity Atmosphere		85% or less (Non-condensing)	
		No corrosive gas or dust. No water or oil.	
Degree of Protection		IP20	

Note

Rotating Direction

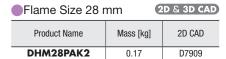
The rotation directions shown below represent the directions as viewed from the hollow flange (output table) side.

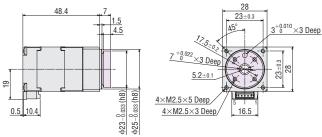
Rotation direction when inputting the CCW signal



Rotation direction when inputting the CW signal

Dimensions (Unit: mm)



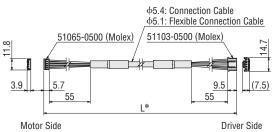


The shaded areas are rotating parts.

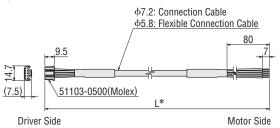
Flame Size 42 mm 2D & 3D CAD **Product Name** Mass [kg] 2D CAD DHM42PAK 0.47 D2852 58.6 4^{+0.012}×4 Deep 16 +0.027 ×6 Deer 0.039 (h8) ф34-0.039 (h8) Ф36-($4 \times M3 \times 5$ Deep 4×M4×4 Deep 5 Motor Leads 600 mm UL Style 3265, AWG 26 The _____ shaded areas are rotating parts.

Connection Cables / Flexible Connection Cables

♦ For Frame Size 28 mm



*"L" in the dimensions represents the Length L (m) described in "■Product Line" on page 8.



 $\pmb{\ast}$ "L" in the dimensions represents the Length L (m) described in " \blacksquare Product Line" on page 8.

Disconnect the actuator and driver when taking an insulation resistance measurement or performing a dielectric voltage withstand test.

Drivers for 5-Phase Stepper Motors CVD Series (Combination Driver)

The microstep function is equipped in the low-vibration design driver to enable even low-vibration and low-noise drive.





Product Number

Pulse Input Type

CVD 5 07 B R - K

① ② ③ ④ ⑤

RS-485 Communication Type

CVD 5 B R - K R

① ② ③ ④ ⑤ ⑥

1	Series Name	CVD: CVD Series
2	5 : 5-Phase	
3	Rated Current	
4	Driver Shape	B : With Installation Plate Blank: Without Installation Plate
5	Connector Shape	R: Right-Angle
6	Power Supply Input	K: DC Power Supply

1	Series Name	CVD: CVD Series
2	5 : 5-Phase	
3	Driver Shape	B: With Installation Plate
4	Connector Shape	R: Right-Angle
(5)	Power Supply Input	K: DC Power Supply
6	Туре	R: RS-485 Communication Type

Product Line

Pulse Input Type

♦ Right-Angle Type with Installation Plate ♦ With Installation Plate

 Product Name
 Product Name

 CVD507BR-K
 CVD507B-K

RS-485 Communication Type

 \Diamond Right-Angle Type with Installation Plate $\ \Diamond$ With Installation Plate

Product Name Product Name
CVD5BR-KR CVD5B-KR

Product Name	
CVD507-K	

Included

Туре	Connector for Driver Connection
Pulse Input Type	CN1 Connector (1 pc.) CN2 Connector (1 pc.) CN3 Connector (1 pc.)
RS-485 Communication Type	_

Specifications

Pulse Input Type

Product Name		CVD507BR-K	CVD507B-K	CVD507-K	
Driving Method		Microstep Drive, Bipolar, Constant Current Drive Method			
Power Supply Voltage		24 VDC ±10%			
Input Current A		1.4			
Max. Input Pulse Frequency		Line driver output by programmable controller: 1 MHz (When the pulse duty is 50%) Open-collector output by programmable controller: 250 kHz (When the pulse duty is 50%) Negative Logic Pulse Input			

RS-485 Communication Type

Pro	oduct Name	CVD5BR-KR	CVD5B-KR	
Driving Method		Microstep Drive, Bipolar, Co	Microstep Drive, Bipolar, Constant Current Drive Method	
Power Supply Voltage		24 VD0	24 VDC ±10%	
Input Current	A	1.4		
Control Input		7 points, Photocoupler		
Interface	Control Output	2 points, Photocoupler and Open Collector Output		
	Field Network	Modbus RTU (RS-4	85 Communication)	

RS-485 Communication Specifications

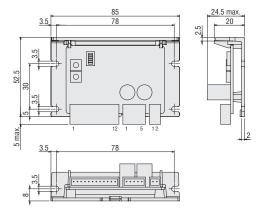
Electrical Characteristics	In compliance with EIA-485 Shielded twisted-pair wire is used up to a total extension length of 10 m.
Communication Mode	Half-duplex communication Synchronous mode (data: 8-bits, stop bit: 1-bit/2-bits, parity: none/odd/even)
Transmission Rate	Selected either from 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps, or 230400 bps
Protocol	Modbus RTU Mode
Connection Type	Up to 31 units can be connected to one programmable controller (master equipment).

Dimensions (Unit: mm)

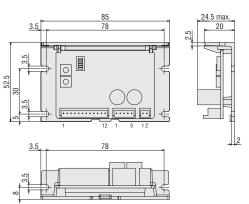
Pulse Input Type

♦ Right-Angle Type with Installation Plate 2D & 3D CAD

Product Name		Mass [kg]		2D CAD
CVD507BR-K	0.06		B1210	
Included				
Connector Housing:	5	1103-0200	(Molex)	
	5	1103-0500	(Molex)	
	5	1103-1200	(Molex)	
Contact:	5	0351-8100	(Molex)	



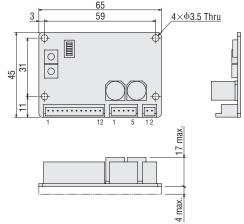
♦ With Installation	2D & 3D CAD			
Product Name	Mass [kg]		2D CAD	
CVD507B-K	0.0	6	B1255	
Included				
Connector Housing:	5	1103-0200	(Molex)	
	5	51103-0500 (Mole)		
5		1103-1200	(Molex)	
Contact: 50351-8100			(Molex)	
Contact:	50351-8100		(Molex)	



Cables for motors (actuators), I/O signals, and DC power supply are available (sold separately).
Since the connector has already been crimped, no crimping tool is required and wiring can be done easily. Please see pages 8 and 15 to 17.

♦ Without Installation Plate 2D & 3D CAD Product Name Mass [kg] 2D CAD CVD507-K 0.02 B1228 Included

Connector Housing:	51103-0200	(Molex)	
	51103-0500	(Molex)	
	51103-1200	(Molex)	
Contact:	50351-8100	(Molex)	



Cables for motors (actuators), I/O signals, and DC power supply are available (sold separately). Since the connector has already been crimped, no crimping tool is required and wiring can be done easily. Please see pages 8 and 15 to 17.

RS-485 Communication Type

Product Name	Mass [kg]	2D CAD
CVD5BR-KR	0.065	B1512

Applicable Connector Power Connector (CN1)

Connector Housing: 43645- 0200(Molex) Contact: 43030-0001(Molex)

Motor Connector (CN2)

Connector Housing: 51103- 0500(Molex) 50351-8100(Molex) Contact: RS-485 Communication Connector (CN4, CN5) Connector Housing: PAP-03V-S (J.S.T. Mfg. Co., Ltd.)

SPHD-001T-P0.5 or SPHD-002T-P0.5 (J.S.T. Mfg. Co., Ltd.)

I/O Signals Connector (CN6)

Connector Housing: PHDR-12VS (J.S.T. Mfg. Co., Ltd.) SPHD-001T-P0. 5(J.S.T. Mfg. Co., Ltd.)

⇔With Installation	2D & 3D CAD	
Product Name	2D CAD	
CVD5B-KR	0.065	B1511

Applicable Connector Power Connector (CN1)

Connector Housing: 43645- 0200(Molex) Contact: 43030- 0001(Molex)

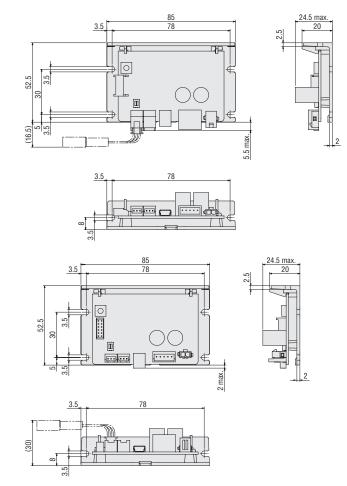
Motor Connector (CN2)

Connector Housing: 51103-0500(Molex) 50351- 8100(Molex) Contact: RS-485 Communication Connector (CN4, CN5) Connector Housing: PAP-03V-S (J.S.T. Mfg. Co., Ltd.) SPHD-001T-P0.5 or SPHD-002T-P0.5

(J.S.T. Mfg. Co., Ltd.)

I/O Signals Connector (CN6)

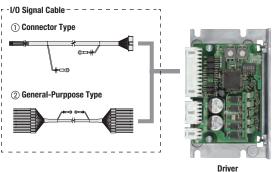
Connector Housing: PHDR-12VS (J.S.T. Mfg. Co., Ltd.) Contact: SPHD-001T-P0. 5(J.S.T. Mfg. Co., Ltd.)



Cables for motors (actuators), power supply and I/O signals, and RS-485 communication are available (sold separately). Since the connector has already been crimped, no crimping tool is required and wiring can be done easily. Please see pages 8 and 18.

Cables and Accessories

I/O Signal Cables (For Pulse Input Type)



Driver Pulse Input Type

①Connector Type



These are connection cables between the host controller and the driver

A shielded cable with protruding ground wires on both ends for easy grounding.

◇Product Line

*		
Product Name	Length L [m]	Conductor AWG
CC12D005-2	0.5	
CC12D010-2	1	24
CC12D015-2	1.5	(0.2mm ²)
CC12D020-2	2	

For dimensions please visit our website.

②General-Purpose Type



These are connection cables between the host controller and the driver. Both ends are flying lead wires.

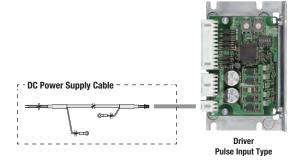
A shielded cable with protruding ground wires on both ends for easy grounding.

◇Product Line

Product Name	Length L [m]	Number of Lead Wire Cores	Outer Diameter D [mm]	AWG
CC06D005B-1	0.5			
CC06D010B-1	1	6	φ5.4	
CC06D015B-1	1.5	0	θ φ5.4	
CC06D020B-1	2			
CC10D005B-1	0.5			
CC10D010B-1	1	10	ф6.7	24 (0.2mm ²)
CC10D015B-1	1.5			
CC10D020B-1	2			
CC12D005B-1	0.5			
CC12D010B-1	1	12		
CC12D015B-1	1.5		φ7.5	
CC12D020B-1	2			

For dimensions please visit our website.

■DC Power Supply Cables (For Pulse Input Type)





These cables are used to connect the driver and the DC power supply.

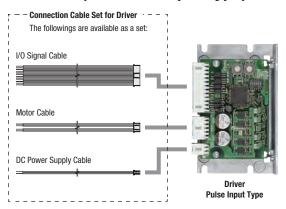
A shielded cable with protruding ground wires on both ends for easy grounding.

◇Product Line

Product Name	Length L [m]	Conductor AWG
CC02D005-2	0.5	
CC02D010-2	1	22
CC02D015-2	1.5	(0.3mm ²)
CC02D020-2	2	

For dimensions please visit our website.

■ Connection Cable Sets for Driver (For Pulse Input Type)



Connecting Cables for motor (actuator), I/O signals, and DC power supply that can be connected to the driver are available as a set. A connector is coupled on the driver side of each cable.

Product Line



Product Name	Connector	Connector Name	Length L1	Length L2	Conductor AWG	
	For Motor	51103-0500			00	
LCS04SD5	For Power Supply	51103-0200	0.6 m	10 mm	22 (0.3 mm ²)	
	For I/O Signal	51103-1200	1		(0.3 11111)	

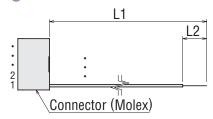
Connector Pin Assignments

Pin No.	Wire Color
1	Blue
2	Red
3	Orange
4	Green
5	Black

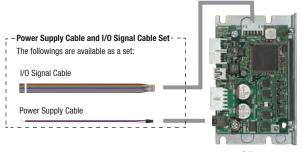
Pin No.	Wire Color
1	Red
2	Black

Pin No.	Wire Color
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White
10	Black
11	Brown
12	Red

Dimensions



Power Supply Cable and I/O Signal Cable Sets (For RS-485 Communication Type)



RS-485 Communication Type

Power supply cable connects the driver and the DC power supply.

I/O signal cable connects the drivers and the host controller.

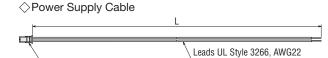
Power supply cable and I/O signal cable are available as a set.

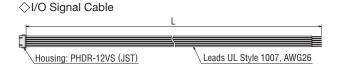
Product Line

Product Name	Length L [m]
LHS003CC	0.3
LHS010CC	1

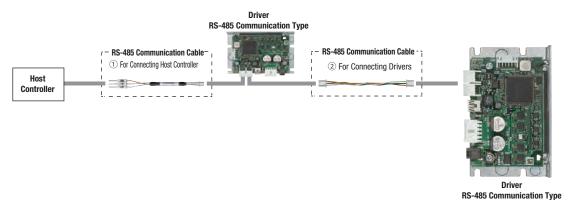
Dimensions (Unit: mm)

Housing: 43645-0200 (Molex)





RS-485 Communication Cables (For RS-485 Communication Type)



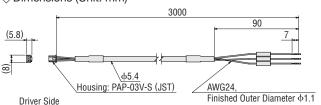
(1)For connecting host controller

This cable is used to connect the driver and the host controller

◇Product Line

Product Name	Length L [m]
CC030-RS	3

◇Dimensions (Unit: mm)

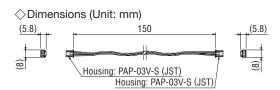


②For connecting drivers

This cable is used to connect two drivers together.

◇Product Line

Product Name	Length L [m]
LH0015-RWN	0.15



■Driver Mounting Bracket

This is bracket for installation on a DIN rail.



Product Line

Product Name	Applicable Drivers	Surface Treatment
MADP07	CVD5□□BR-K CVD5□□ B-K CVD5BR-KR CVD5B-KR	Electroless nickel plating

Driver Cover

This is a protection cover to prevent contact with the circuit board. Available for the right angle type driver with an installation plate.



Product Line

Material: Resin

Product Name	Applicable Drivers
PADC-CVD2	CVD5□□BR-K CVD5BR-KR

Oriental motor

These products are manufactured at plants certified with the international standards ISO 9001 (for quality assurance) and ISO 14001 for systems of environmental management).

Specifications are subject to change without notice. This catalogue was published in June 2024.

ORIENTAL MOTOR (EUROPA) GmbH

European Headquarters

Schiessstraße 44 40549 Düsseldorf, Germany Tel: 0211 5206700 Fax: 0211 52067099

Spanish Office

Ronda de Poniente 2, Ed. 12, 2ª planta 28109 Tres Cantos (Madrid), Spain Tel: +34 919 61 06 76

ORIENTAL MOTOR (UK) LTD.

UK Headquarters

Unit 5, Faraday Office Park, Rankine Road, Basingstoke, Hampshire RG24 8AH, U.K. Tel: +44 1256 347090 Fax: +44 1256 347099

ORIENTAL MOTOR ITALIA s.r.l.

Italy Headquarters

Via XXV Aprile 5 20016 Pero (MI), Italy Tel: +39 2 93906346 Fax: +39 2 93906348

ORIENTAL MOTOR (FRANCE) SARL

France Headquarters

56, Rue des Hautes Pâtures 92000 Nanterre, France Tel: +33 1 47 86 97 50 Fax: +33 1 47 82 45 16

Customer Service Center

(Support in German & English)

0080022556622*

Mon-Thu: 08:00 - 16:30 CET Friday: 08:00 - 15:00 CET *Free Call Europe

info@orientalmotor.de



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