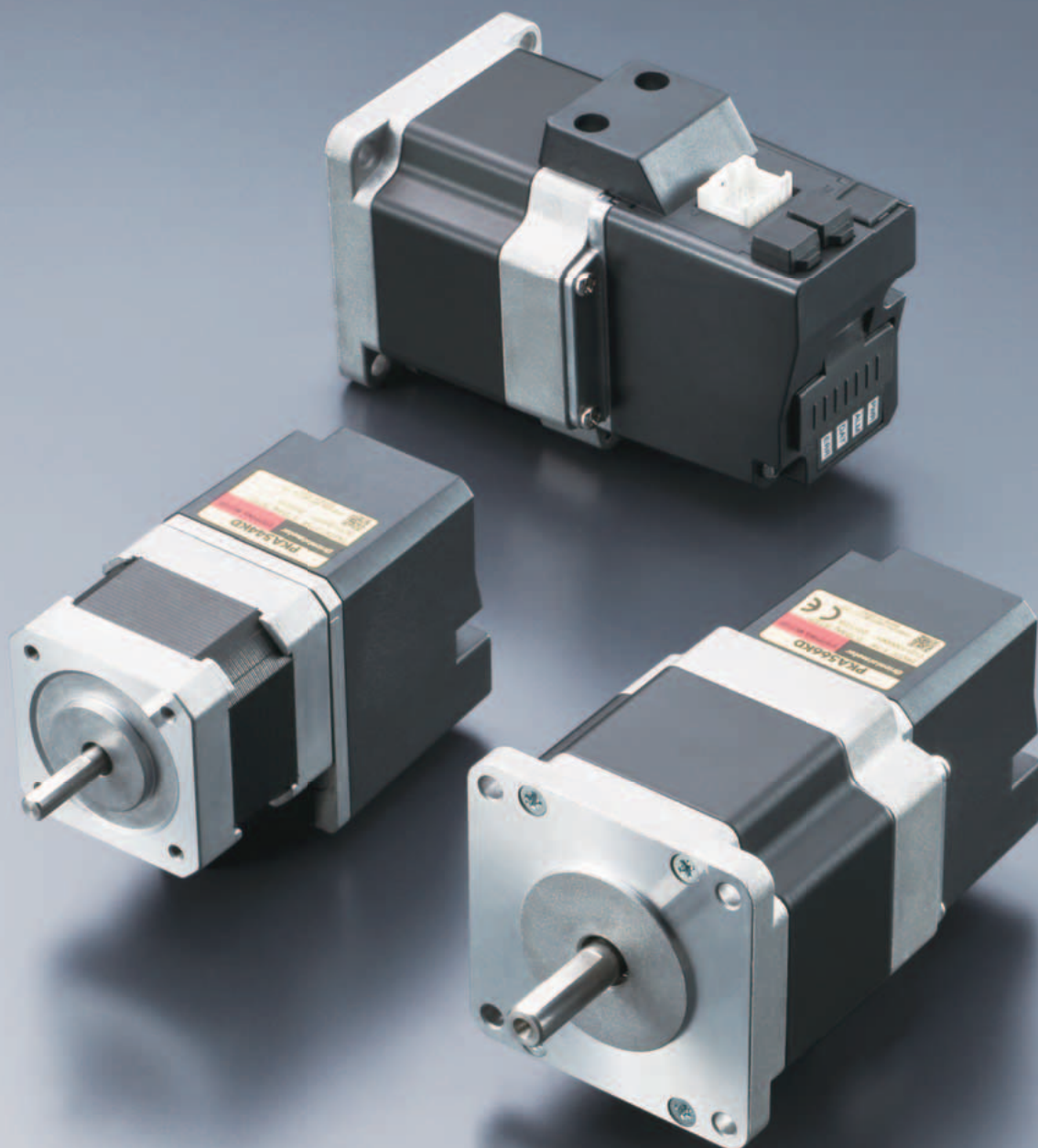# Oriental motor

Driver Integrated 5-Phase Stepping Motor

PKA Series

Built-in Controller Type

This is an all-in-one DC power supply input 5-phase stepping motor
in which the driver and motor are integrated.
This contributes to space saving and a reduction in the size of the customer's equipment.

This is a DC input 5-phase stepping motor in which the driver and motor are integrated.

No wiring is needed between the driver and motor, contributing to space saving and a reduction in the size of the customer's equipment. It also reduces man hours required for wiring.

There are two methods of control that can be selected, including Modbus control.

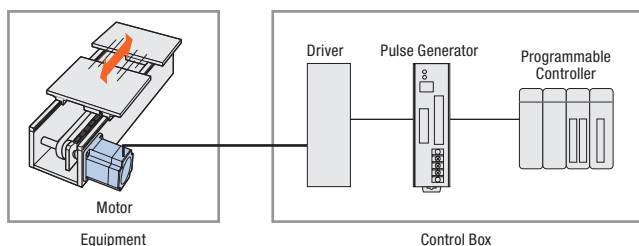## Contributes to Space Saving and Reduced Wiring in the Equipment

The driver and the motor are integrated. Also, since there is a built-in positioning function, there is no need for a pulse generator. The system is simplified, contributing to space saving and a reduction in the size of the customer's equipment. It also requires less wiring.
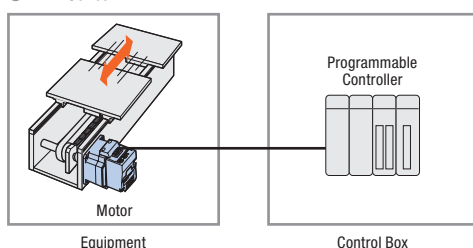
Motor

Driver

Contributes to a Shorter Equipment Startup Time

Since no wiring is needed between the motor and driver or driver and pulse generator, wiring time is reduced. This also decreases the number of problems caused by wiring.

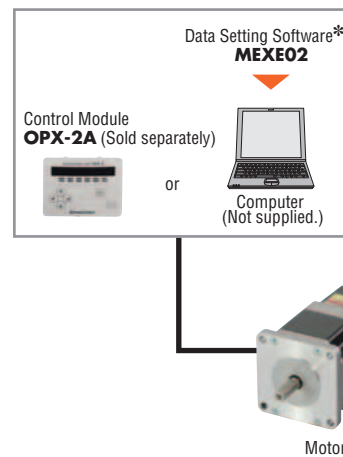All of this contributes to a shorter startup time for the customer's equipment.

● Motor + Driver + Pulse Generator

Driver

Pulse Generator

Programmable Controller

Motor

Equipment

Control Box

● PKA Series

Programmable Controller

Motor

Equipment

Control Box

Two Control Method Options

Data Setting Software*1
MEXE02

Control Module
OPX-2A (Sold separately)
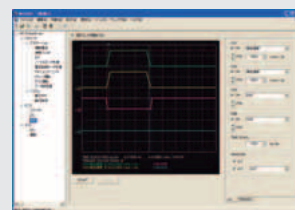
or

Computer
(Not supplied.)

RS-485 communication

Motor

*1 Data Setting Software
MEXE02

Operating data settings, parameter changes, and monitoring are done on a computer.

Compatible software can be downloaded from the Oriental Motor website.

http://www.orientalmotor.eu

● Operating Status Waveform Monitoring

2

I/O Control

The function of a pulse generator is built in, letting you build an operation system by connecting directly to a programmable controller. Since no pulse generator is required, space is saved and the system is simplified.

Programmable Controller

Modbus Control

Computer

or

Operating data, parameter settings or operation commands can be input via RS-485 communication. A maximum of 31 motors can be connected to one programmable controller. Multi-axis simultaneous starting is also possible. The protocol is compatible with Modbus (RTU) and can be easily connected via a programmable controller, etc.

Programmable Controller

Reduces the Load on High-Order Programmable Controllers

A positioning function is built in, ensuring that the traveling amount, speed, and other operating data is retained in the motor. It is also equipped with a variety of other operation functions in addition to the positioning operation, such as continuous operation and a return-to-home operation. This contributes to a reduced load on the programmable controller, and a simplified program.

●Positioning Operation

The motor's operating speed and traveling amount are set in the operating data, and operations are performed in accordance with the selected operating data.

◇Linked Operation

If the operating data is set to "linked", continuous positioning with the following data number is possible with one START signal.

[Linked operation]

Data No. 01 | Data No. 02 | Data No. 03

If data No. 01 is selected and START input, linked driving from data No. 01 to No. 03 is performed without the motor stopping.

[Linked operation 2]

CW rotation   Dwell time

Data No. 01

Data No. 02 | Data No. 03

CCW rotation

If data No. 01 is selected and START input, the data No. 01 operation is executed. After that, it is stopped for only the set dwell time✱ and then the operations from data No. 02 to No. 03 are executed. Operating data with a different rotation direction can also be linked.

✱Dwell time is the wait time until the next positioning operation starts.
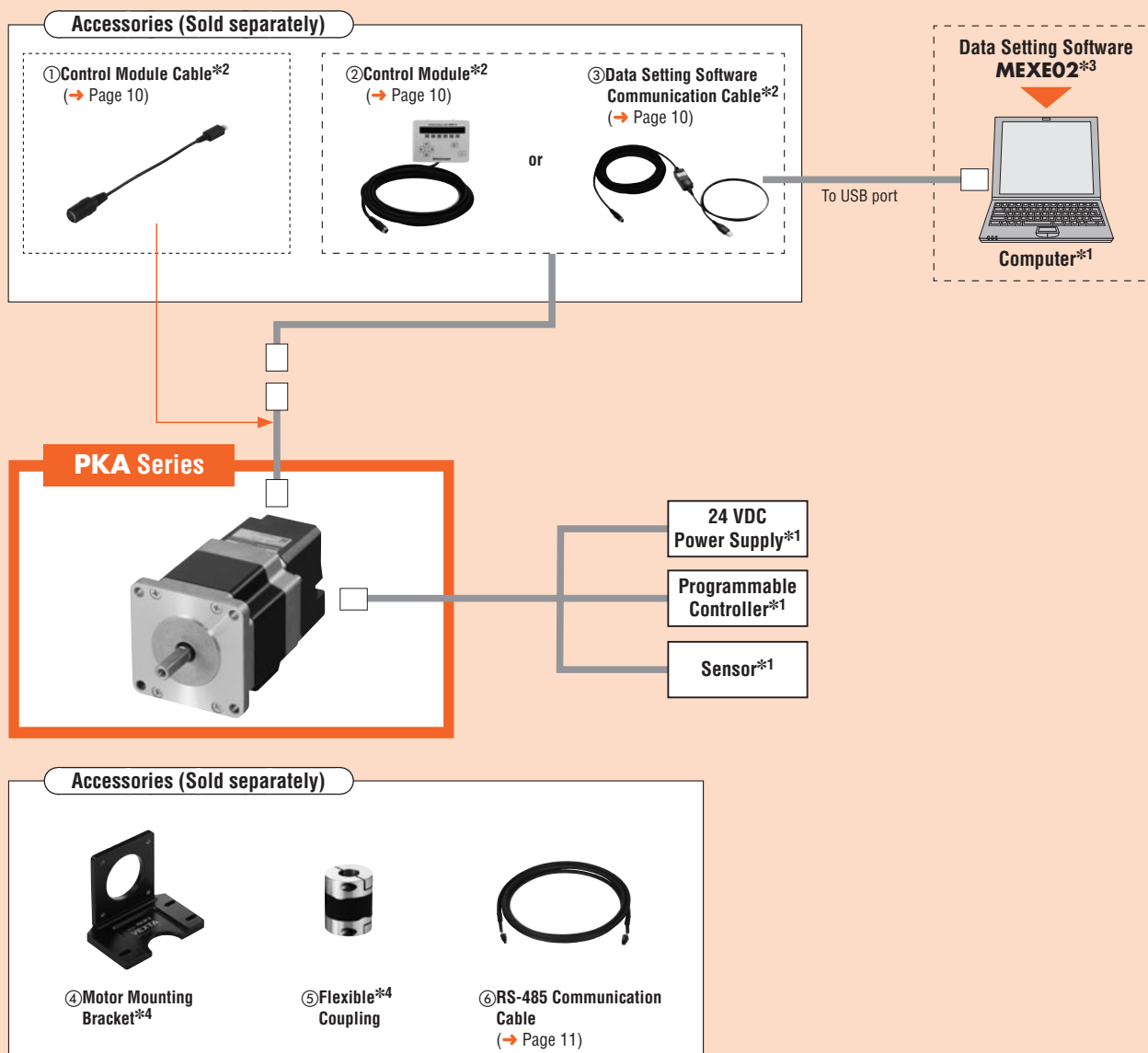
◇Sequential Operation

If the operating data is set to "sequential positioning", positioning of the next data number is performed in sequence every time a START signal is input.

●Speed Control Operation

The motor operates continuously while a FWD signal or RVS signal is input. Because it operates at the speed of the operating data set beforehand, multistep speed-change operation is possible by changing the data number.

Motor operation — + Direction / − Direction

FWD Input — ON / OFF

RVS Input — ON / OFF

M0~M5 Input — ON / OFF — 01 02 01 03

●Return-To-Home Operation

It is equipped with a return-to-home operation, so return-to-home can be done easily by wiring a sensor.

■System Configuration

Accessories (Sold separately)

①**Control Module Cable**∗2
(→ Page 10)

②**Control Module**∗2
(→ Page 10)

or

③**Data Setting Software Communication Cable**∗2
(→ Page 10)

To USB port

Data Setting Software MEXE02∗3

Computer∗1

PKA Series

24 VDC Power Supply∗1

Programmable Controller∗1

Sensor∗1

Accessories (Sold separately)

④**Motor Mounting Bracket**∗4

⑤**Flexible**∗4 **Coupling**

⑥**RS-485 Communication Cable**
(→ Page 11)

Number	Name	Overview	Page
①	Control Module Cable	This is a cable that connects a control module or data setting software communication cable to the **PKA** series. (0.1 m)	10
②	Control Module	Various data can be edited, monitored and operated. Communication cable (5 m) included.	10
③	Data Setting Software Communication Cable	This communication cable is used for connecting a computer and motor.	10
④	Motor Mounting Bracket	This is a dedicated mounting bracket for the motor.	∗4
⑤	Flexible Coupling	This is a coupling that connects the motor shaft to the driven shaft.	∗4
⑥	RS-485 Communication Cable	This cable is used for daisy-chain connection of **PKA** series equipment. There are also cables for connecting **PKA** series equipment and a network converter, or **PKA** series equipment and other RS-485 compatible products.	11

● A User's Manual that explains how to operate this product is available. For details, please contact the nearest Oriental Motor sales office or download the manual from the Oriental Motor website. http://www.orientalmotor.eu

●System Configuration Example

PKA Series		Sold Separately	
	+	Motor Installation Bracket	Flexible Coupling
PKA566KD		**PAL2P-5**	**MCV190808**

∗1 Not supplied.
∗2 This is required for driving I/O control.
∗3 Compatible software can be downloaded from the Oriental Motor website. A CD-ROM is also distributed.
∗4 For details, please contact the nearest Oriental Motor sales office.

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

■Product Line

| Product Name |
|---|
| **PKA544KD** |
| **PKA566KD** |

■ Specifications (RoHS)   CE

Product Name		PKA544KD	PKA566KD
Max. Holding Torque	N·m	0.18	0.83
Holding Torque at Motor Standstill	N·m	0.09	0.41
Rotor Inertia	J:kg·m²	$54×10^{-7}$	$280×10^{-7}$
Rated Current	A/Phase	0.75	1.4
Basic Step Angle		0.72°	
Power Supply Input		24 VDC±10% 1.4 A	24 VDC±10% 2.5 A
Excitation Mode		Microstep	

■ Speed – Torque Characteristics fs: Max. starting frequency

PKA544KD
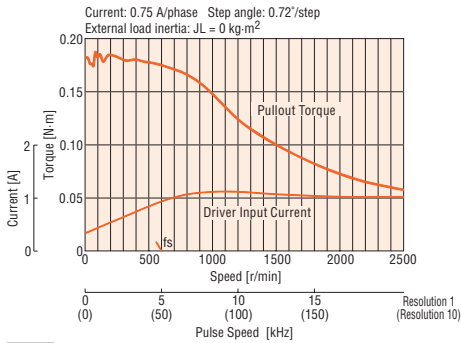
PKA566KD
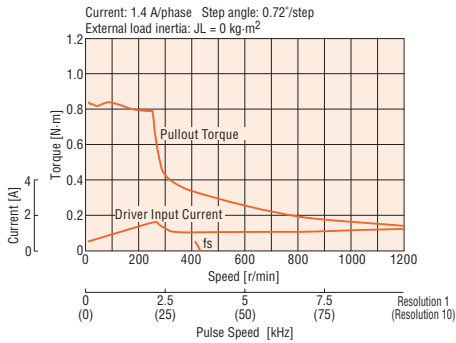
Note
● Depending on the driving conditions, a considerable amount of heat may be generated by the motor. Be sure to keep the motor case temperature at 75℃ max.

■ Control Circuit Specifications

No. of Positioning Data Sets	64
Operation functions	Positioning Operation, Return-To-Home Operation, Continuous Operation, JOG Operation, Test Operation

■ Control Circuit RS-485 Communication Specification

| Protocol	Modbus protocol (Modbus RTU mode)
Electrical Characteristics	EIA-485 compliance Twisted-pair wire (TIA/EIA-568B CAT5e or greater recommended) is used up to a total extension length of 50 m.
Transmission/Reception Mode	Half-duplex communication
Baud Rate	9600 bps/19200 bps/38400 bps/57600 bps/115200 bps
Physical Layer	Asynchronous mode (data: 8-bit, stop bit: 1-bit/2-bit, parity: none/odd/even)
Connection Type	Up to 31 units can be connected to one programmable controller (master equipment).

■ General Specifications

Specifications		Motor
Heat-Resistant Class		130 (B)
Insulation Resistance		The measured value is 100 MΩ min. when a 500 VDC megger is applied as follows under normal ambient temperature and humidity: · FG terminal and motor case — Between power input terminals
Dielectric Strength		No abnormality is judged with the following application for 1 minute under normal ambient temperature and humidity: · FG terminal and motor case — Between power input terminals 500 VAC 50 Hz or 60 Hz
Operating environment (In operation)	Ambient Temperature	0～+50℃ (non-freezing)
	Ambient Humidity	85% max. (non-condensing)
	Atmosphere	Use in an area without corrosive gases and dust. The product should not be exposed to water, oil or other liquids.
Degree of Protection		IP20
Temperature Rise		Winding temperature rise is 80℃ max. (measured by the resistance change method) at the rated current, at standstill, and 5-phases energized.
Stop Position Accuracy[1]		±3 arc minutes (±0.05°)
Shaft Runout		0.05 T. I. R. (mm)[4]
Radial Play[2]		0.025 mm max. of 5 N
Axial Play[3]		0.075 mm max. of 10 N
Concentricity of Installing Pilot to the Shaft		0.075 T. I. R. (mm)[4]
Perpendicularity of Installation Surface to the Shaft		0.075 T. I. R. (mm)[4]

[1] This value is for full step under no load. (The value changes with the size of the load.)

[2] Radial Play: Displacement in shaft position in the radial direction when a 5 N load is applied in the vertical direction to the tip of the motor shaft.

[3] Axial Play: Displacement in shaft position in the axial direction when a 10 N load is applied to the motor shaft in the axial direction.

[4] T. I. R. (Total Indicator Reading): The total dial gauge reading when the measurement section is rotated one revolution centered on the reference axis center.
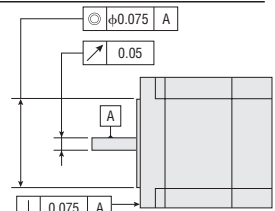
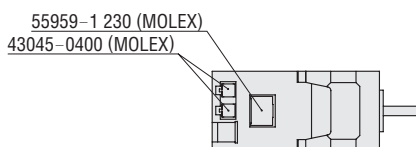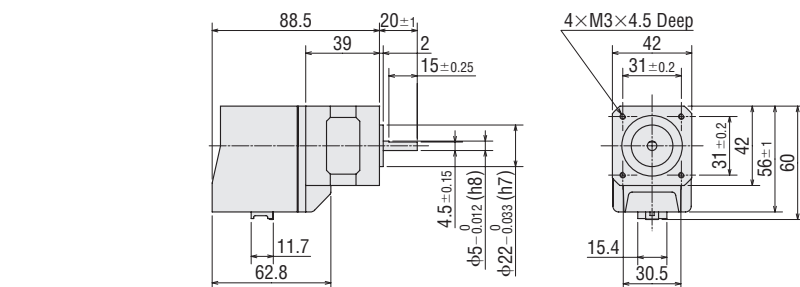## ■ Permissible Overhung Load and Permissible Thrust Load

Unit = N

Motor Frame Size	Product Name	Max. Permissible Overhung Load Distance from Shaft End mm					Permissible Thrust Load
		0	5	10	15	20	
42 mm	**PKA544KD**	20	25	34	52	−	Motor Self-Weight max.
60 mm	**PKA566KD**	63	75	95	130	190	

■ Dimensions (Unit = mm)

● Motor

Frame Size 42 mm

Product Name	Mass kg
PKA544KD	0.37

Frame Size 60 mm

Product Name	Mass kg
PKA566KD	0.89
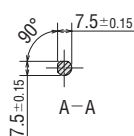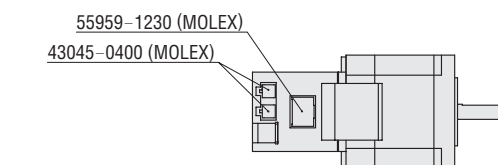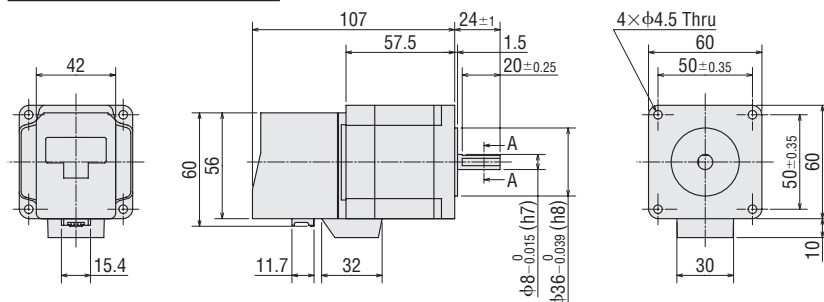
● Connection Cable (Included)
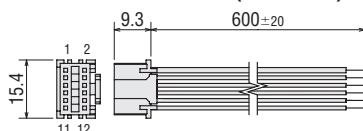
■ Connection and Operation

● Names and Function of Parts

5 Power Source & I/O Signal Connector (CN1)

RS-485 Communication Connector (CN2,3)

Control Module Connector (CN4)

4 Baud Rate Setting Switch (SW3)

3 Model Setting Switch (SW2)

1 Signal Monitor Display

2 Function Switch (SW1)
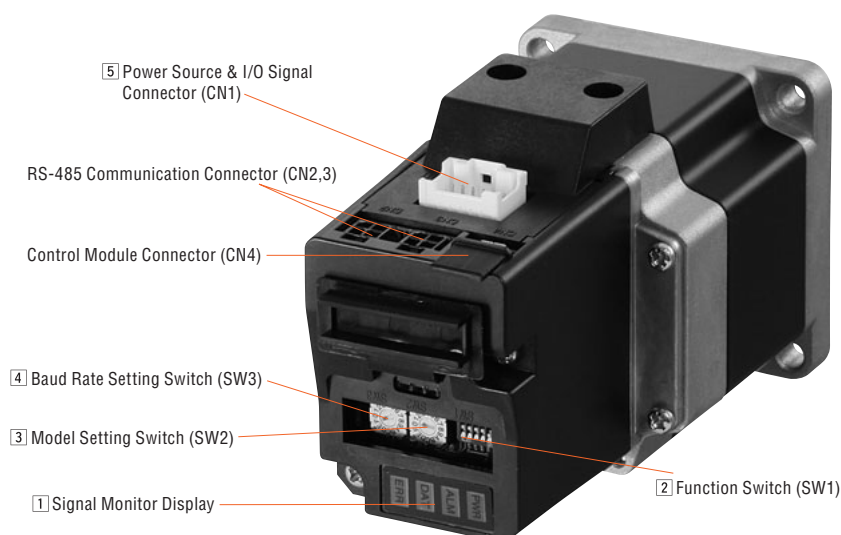
1 Signal Monitor Display

◇ LED Indicator

Indication	Color	Function	Lighting Condition
PWR	Green	Power Supply Indication	When the power supply is input
ALM	Red	Alarm Indication	When protective function is activated (blinking)
DAT	Green	Communication Indicator	When data is being received and sent
ERR	Red	Communication Error Indicator	When communication data is abnormal

2 Function Switch (SW1)

Indication	No.	Function
SW1	1,2	This sets the terminating resistance for RS-485 communication (120 Ω) (factory setting: OFF). OFF: No terminating resistance ON: Terminating resistance
	3	This sets the model number in combination with the model setting switch (SW2) (factory setting: OFF).
	4	This sets the protocol for RS-485 communication (factory setting: OFF).

◇ RS-485 Communication Protocol Setting

Destination No.	Network Converter Connection	Modbus RTU Mode
4	OFF	ON

3 Model Setting Switch (SW2)

Indication	Function
SW2	This is set during use with RS-485 communication. It sets the model number (factory setting: 0).

4 Baud Rate Setting Switch (SW3)

Indication	Function
SW3	This is set during use with RS-485 communication. It sets the baud rate (factory setting: 7).

◇ RS-485 Baud Rate Setting

No.	Baud Rate (bps)
0	9600
1	19200
2	38400
3	57600
4	115200
5~6	Not used
7	625000 (Network Converter Connection)
8~F	Not used

5 **Power Source & I/O Signal Connector (CN1)**

Indication	Pin No.	Signal Name	Content
CN1	1	FG	Frame Ground
	2	GND	Power Supply GND
	3	IN-COM	Input Common
	4	+24 VDC	+24 VDC Power Supply Input
	5	IN0	Control Input 0 (initial value: +LS)✱
	6	IN1	Control Input 1 (initial value: −LS)✱
	7	IN2	Control Input 2 (initial value: HOMES)✱
	8	IN3	Control Input 3 (initial value: STOP)✱
	9	OUT0+	Control Output 0 (initial value: ALM)✱
	10	OUT0−	
	11	OUT1+	Control Output 1 (initial value: READY)✱
	12	OUT1−	

✱Assigned functions are set by means of the parameter settings. The above is the initial value. For details, refer to the User's Manual.

The following input signals can be assigned to input terminals IN0~3.

Input Signal					
0: Not used	8: MS0	18: STOP	36: R4	44: R12	52: M4
1: FWD	9: MS1	24: ALM-RST	37: R5	45: R13	53: M5
2: RVS	10: MS2	25: P-PRESET	38: R6	46: R14	60: +LS
3: HOME	11: MS3	27: HMI	39: R7	47: R15	61: −LS
4: START	12: MS4	32: R0	40: R8	48: M0	62: HOMES
5: SSTART	13: MS5	33: R1	41: R9	49: M1	63: SLIT
6: +JOG	16: FREE	34: R2	42: R10	50: M2	
7: −JOG	17: AW0	35: R3	43: R11	51: M3	

The following output signals can be assigned to output terminal OUT0~1.

Output Signal					
0: Not used	9: MS1_R	33: R1	42: R10	51: M3_R	67: READY
1: FWD_R	10: MS2_R	34: R2	43: R11	52: M4_R	68: MOVE
2: RVS_R	11: MS3_R	35: R3	44: R12	53: M5_R	70: HOME-P
3: HOME_R	12: MS4_R	36: R4	45: R13	60: +LS_R	72: TIM
4: START_R	13: MS5_R	37: R5	46: R14	61: −LS_R	73: AREA1
5: SSTART_R	16: FREE_R	38: R6	47: R15	62: HOMES_R	74: AREA2
6: +JOG_R	17: AW0_R	39: R7	48: M0_R	63: SLIT_R	75: AREA3
7: −JOG_R	18: STOP_R	40: R8	49: M1_R	65: ALM	80: S-BSY
8: MS0_R	32: R0	41: R9	50: M2_R	66: WNG	

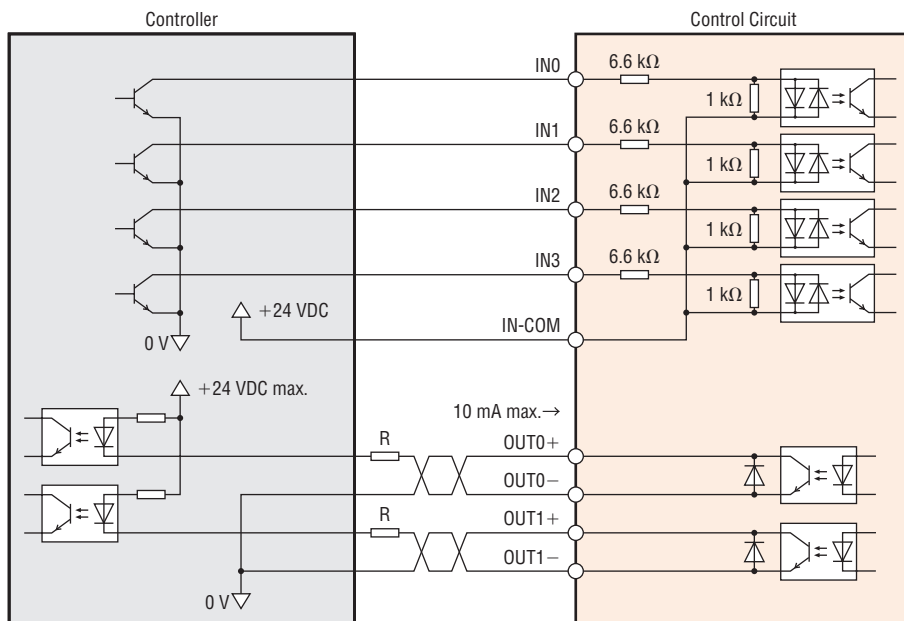## ● Connection Diagram

◇ Connection to Programmable Controller

● Example of Connection with Current Sink Output Circuit (PNP specification)

Controller | Control Circuit

+24 VDC

IN0 6.6 kΩ
1 kΩ
IN1 6.6 kΩ
1 kΩ
IN2 6.6 kΩ
1 kΩ
IN3 6.6 kΩ
1 kΩ
IN-COM

0 V

10 mA max. →

+24 VDC max.
OUT0＋
R OUT0－
OUT1＋
R OUT1－

0 V
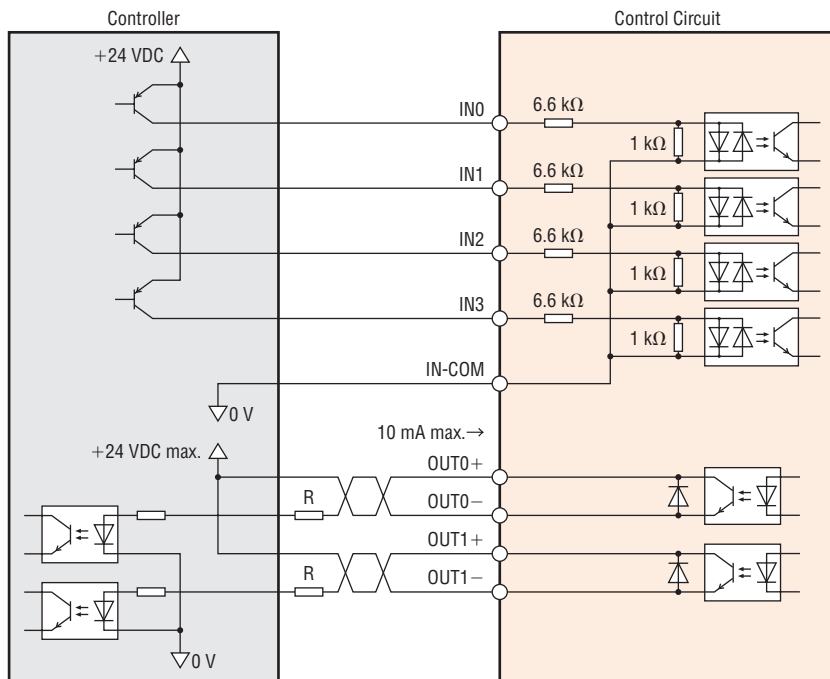
● Example of Connection with Current Sink Output Circuit (NPN specification)

Controller | Control Circuit

IN0 6.6 kΩ
1 kΩ
IN1 6.6 kΩ
1 kΩ
IN2 6.6 kΩ
1 kΩ
IN3 6.6 kΩ
1 kΩ
+24 VDC
IN-COM
0 V

+24 VDC max.

10 mA max. →
R OUT0＋
OUT0－
R OUT1＋
OUT1－

0 V

Note

● Please use 24 VDC for the input signal.

● Please use 24 VDC 10 mA max. for the input signal. When the current value exceeds 10 mA, connect the external resistor R to keep the current 10 mA max.

● If noise generated by the power supply cable causes a problem with the specific wiring or layout, shield the cable or use ferrite cores.

9

Accessories (Sold separately)

These accessories are needed to change parameter settings, data settings, etc. in the **PKA** Series.

② Control Module
OPX-2A

① Control Module Cable
CC001IF-CA

CN4

or

Data Setting Software
MEXE02

USB Cable 0.5 m

③ Communication Cable for Data
Setting Software
CC05IF-USB

Computer
(Not supplied.)

Connected to control module cable

PC Interface Cable 5 m

Note
● A dedicated driver must be installed to connect to a computer.
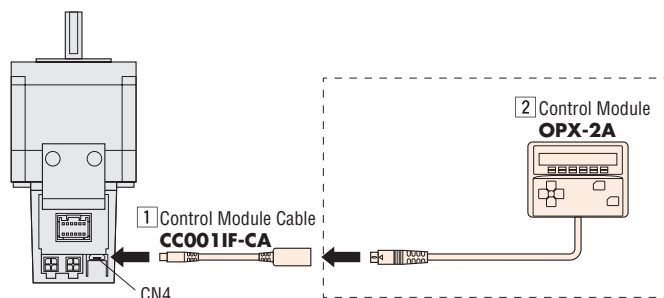
① Control Module Cable (RoHS)

This is a cable that connects an **OPX-2A** or data setting software communication cable to the **PKA** Series.

■ Product Line

Product Name
CC001IF-CA

■ Dimensions

6.8

φ9.9
φ13

10.4
6.85

5.5   28.6   φ2.8   100±10   36   2

② Control Module (RoHS)

Changes can be made to parameter settings, data settings, etc. It can also be used for speed and I/O monitoring, teaching, etc.
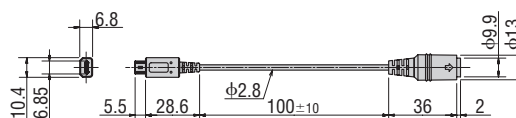
■ Product Line

Product Name
OPX-2A

■ Specifications

Indication	LED
Cable Length	5 m
Operating Ambient Temperature	0～+40℃ (non-freezing)

<Enlarged view>
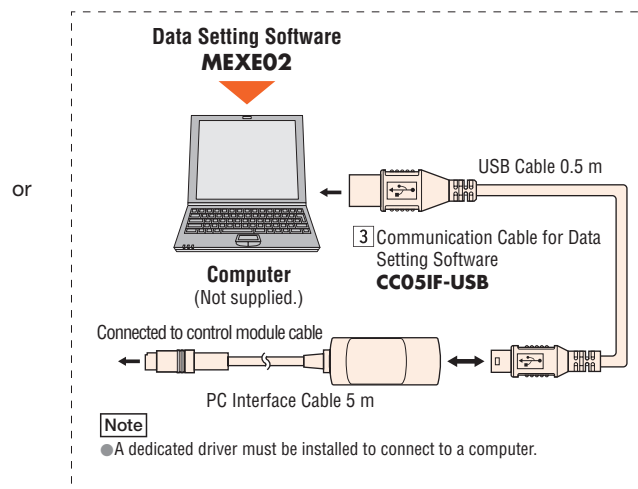
■ Dimensions (Unit = mm)

● Control Module
Mass: 0.25 kg

91.8

96   6.1   21.5

72   67.8

Cable φ4.7 5000 mm   38   φ11.2
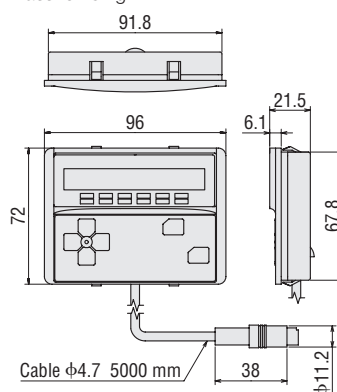
● Installation Hole Dimensions
(Installation Plate Thickness 1～3 mm)

$68^{+0.7}_{0}$

$92^{+0.8}_{0}$

Panel Cut-Out Dimensions
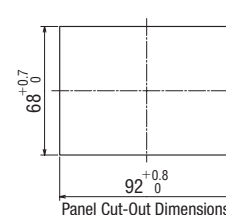
③ Communication Cable for Data Setting Software (RoHS)

This communication cable is used for connecting a computer and motor.

■ Product Line

Product Name
CC05IF-USB

■Data Setting Software   MEXE02

Data setting software can be downloaded from the Oriental Motor website.
http://www.orientalmotor.eu
A CD-ROM is also distributed.
For details, please go to the Oriental Motor website or contact the nearest Oriental Motor sales office.

■Operating Environment

●Operating System (OS)
- Microsoft Windows 2000 Professional Service Pack 4
  Be sure to use the Rollup1 provided by Microsoft Corporation. Check "Program Additions and Deletions" to see if Rollup1 is used.

The following OS are only compatible with 32-bit (x86) and 64-bit (x64) versions.
- Microsoft Windows XP Home Edition Service Pack 3
- Microsoft Windows XP Professional Service Pack 2
- Microsoft Windows XP Professional Service Pack 3[*1]
- Microsoft Windows Vista Home Basic Service Pack 2
- Microsoft Windows Vista Home Premium Service Pack 2
- Microsoft Windows Vista Business Service Pack 2
- Microsoft Windows Vista Ultimate Service Pack 2
- Microsoft Windows Vista Enterprise Service Pack 2
- Microsoft Windows 7 Starter Service Pack 1
- Microsoft Windows 7 Home Premium Service Pack 1
- Microsoft Windows 7 Professional Service Pack 1
- Microsoft Windows 7 Ultimate Service Pack 1
- Microsoft Windows 7 Enterprise Service Pack 1

*1 32-bit (x86) version only

●PC

Recommended CPU[*2]	Intel Core processor 2 GHz min. (Compatible with OS)
Display	Video Adapter and Monitor with Resolution of XGA (1024 × 768) min.
Recommended Memory[*2]	32-bit version (x86): 1 GB min. 64-bit version (x64): 2 GB min.
Hard Disk[*3]	Free disk space of 30 MB min.
USB Port	USB 1.1 1 Port
Disk Device	CD-ROM Drive (Used for installation)

*2 The operating conditions of the OS must be met.
*3 **MEXE02** requires Microsoft .NET Framework 2.0 Service Pack 2. It will be automatically installed if it is not already installed, so 500 MB max. of free space may be required.

Note
●Depending on the system environment used by the customer, the required memory and hard disk space may vary.
●Windows and Windows Vista are registered trademarks of Microsoft Corporation in the United States and other countries.

RS-485 Communication Cable
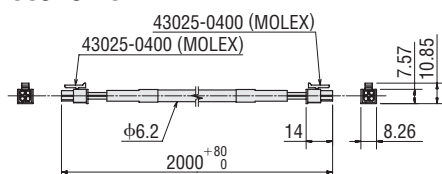
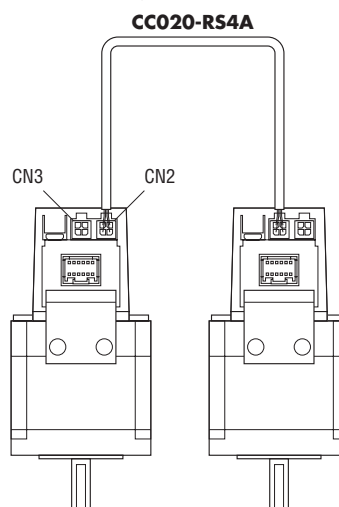This is an RS-485 communication cable.

CC020-RS4A

■Product Line

Product Name	Overview	Length m
CC020-RS4A	This cable is used for daisy-chain connection of **PKA** Series equipment.	2

■Dimensions

CC020-RS4A

43025-0400 (MOLEX)
43025-0400 (MOLEX)
7.57
10.85
φ6.2
14
8.26
2000 $^{+80}_{0}$

●Connection Example

CC020-RS4A

CN3   CN2

Oriental motor

ORIENTAL MOTOR (EUROPA) GmbH

www.orientalmotor.de

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Schiessstraße 74
40549 Düsseldorf, Germany
Tel: 0211-5206700   Fax: 0211-52067099

Munich Office

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85716 Unterschleißheim, Germany
Tel: 089-318122500 Fax: 089-318122525

Hamburg Office

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

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