CKD

New Products

Electric Actuator

2-Finger Gripper	FLSH Series
Table type	FLCR Series
Rotary	FGRC Series
Controller	ECR Series
Controller	ECG Series

Inheriting the dimensions and performance of pneumatic components

New **FLCR**
Brake option added

ROBODEX *Pulse*

CKD Corporation

CC-1444A 6

Ever-evolving components for ever-evolving facilities

Rotary

FGRC
Series

Table type

FLCR
Series

2-Finger Gripper

FLSH
Series

Controller

ECG
Series

Controller

ECR
Series

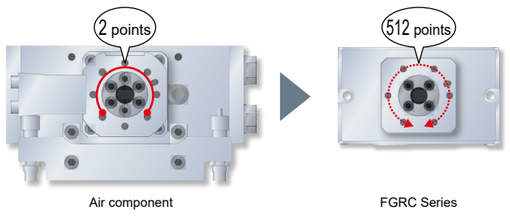
INDEX

CKD electric actuators bring "EXTRA" features to air components.

■ Extra! Multipoint stopping

Stopping is possible at multiple points.

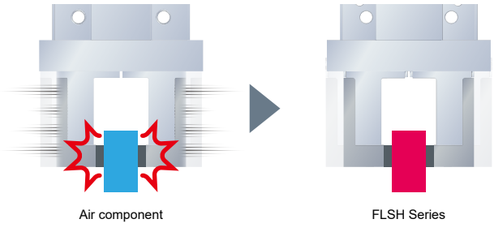
Flexible production



■ Added Shockless!

Speed and pressing current can be set to any value to gently grip workpieces.

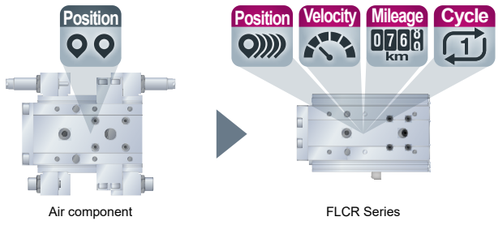
Improved tact, with no concerns about damage



■ Extra! Information output

Output the present position and speed, as well as the travel distance and number of operational cycles, etc.

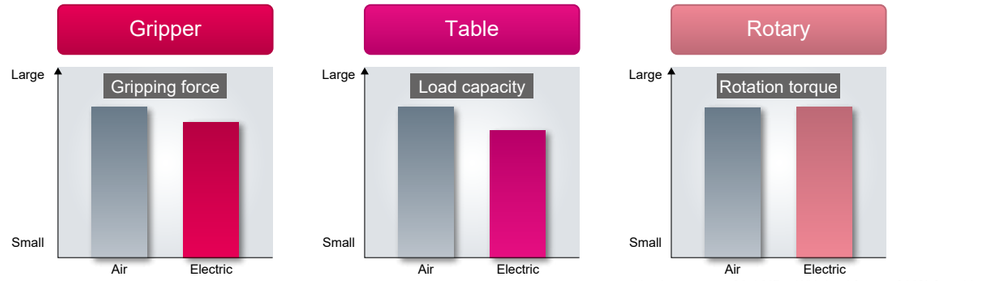
Avoid equipment stops with IoT



Inheriting the advantages of air components

■ Realizing capacity equal to that of air components

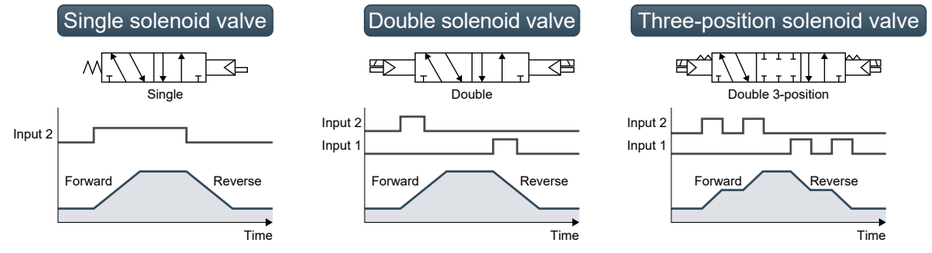
Each series is capable of outputting power equivalent to that of air components.



*At air pressure of 0.4 MPa. With load factor of 30% for table.

■ Realizing the ease of use of air components

Can also be operated using the same sequence as the solenoid valve that controls air components.



2-Finger Gripper

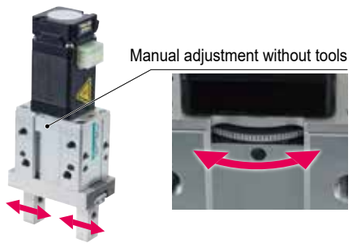
FLSH Series

For soft handling of multi-model workpieces

Reduces equipment adjustment time

Includes manual operation and self-lock mechanisms

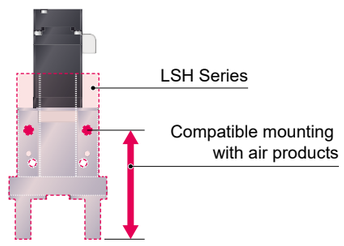
A manual operation mechanism enabling tool-free operation is equipped on the front of the body. The finger position can be easily adjusted at equipment startup, and the self-lock enables retained workpieces to be easily mounted and detached.



Expanded selection

Dimensions equivalent to air products

This series has compatible mounting with the Air Hand LSH Series, allowing a wider range of options during the design phase. When multi-model workpiece handling is required, we recommend the FLSH Series.



Four new options added

New

With case

Reduced risk of disconnection with movable cables

Rubber cover option

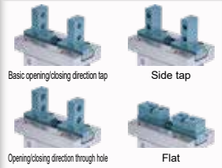
Improved environmental resistance (+ IP50 with case)

Long stroke

Size	Conventional Stroke	Long Stroke
FLSH-16G	6 mm	12 mm
FLSH-20G	10 mm	18 mm
FLSH-25G	14 mm	22 mm

Up to +8 mm compared to conventional

Finger shape option



Design fingers as desired.

* Refer to "Electric actuator 2-Finger Gripper FLSH Series (Catalog No.CC-1564A)" for details.

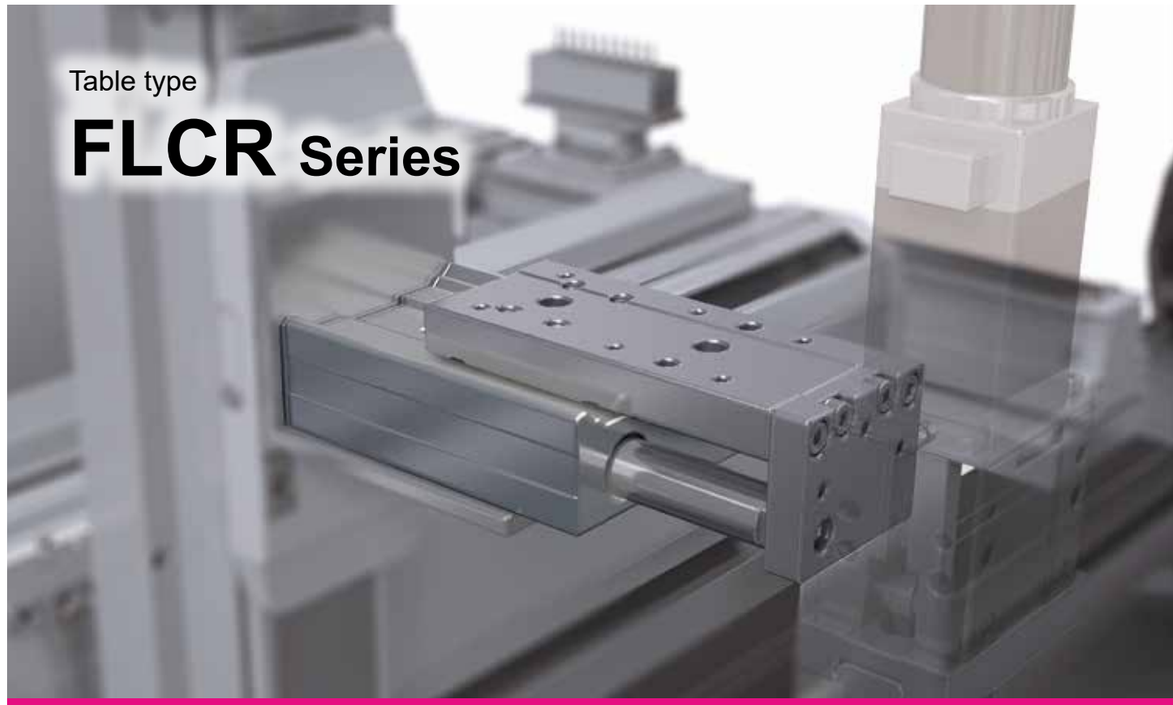


Table type

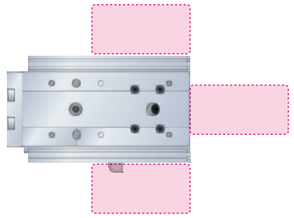
FLCR Series

For short-stroke workpiece transport and positioning

Smaller equipment footprint

Built-in motor

The actuator contains a built-in motor. No protrusions or wrapping in the motor assembly, allowing space-saving equipment design.

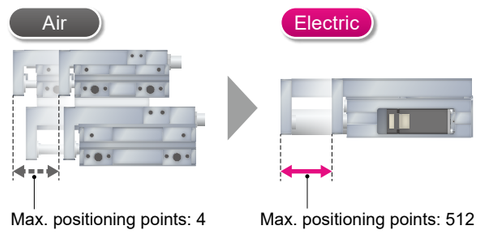


Dimensional compatibility with air products

The body has dimensional compatibility with the air LCR Series, allowing compact, air-style design. The FLCR Series also enables arbitrary adjustment of acceleration/deceleration, rendering shock absorbers unnecessary.

Multi-point positioning

The FLCR Series enables positioning at arbitrary positions. Because a single actuator handles multi-model production, it also contributes to saving space.



Brake option added

When the power supply is cut OFF, the brake section is locked to retain the position (non-excitation). It can be used as safety measures such as position locking on the Z-axis. Lock release unit (optional) is also available.

Rotary

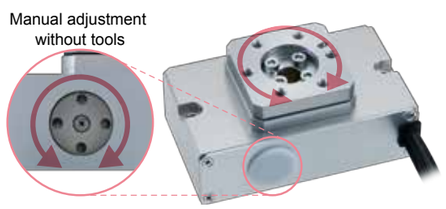
FGRC Series

For indexing operation and workpiece inversion

Reduces adjustment times

Includes manual operation and self-lock mechanisms

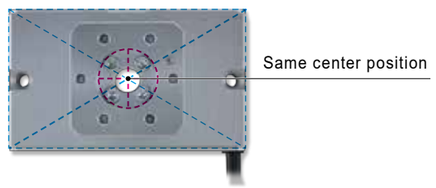
Equipped with a manual operation mechanism enabling tool-free operation. The rotating table position can be easily adjusted at equipment startup or when retained with the self-lock.



Easy layout planning

Coaxial design

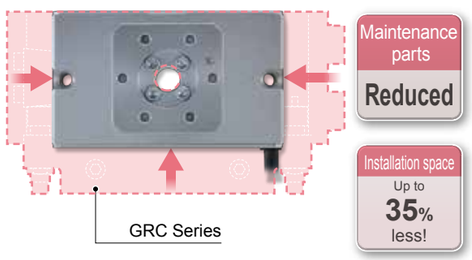
The center of rotation and the center of the actuator body are coaxial, making it easy to plan layouts.



Smaller equipment footprint

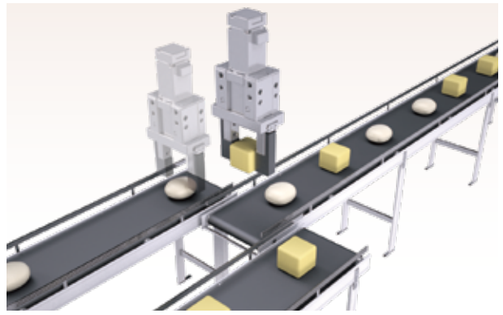
Compact body

The FGRC Series performs acceleration/deceleration, rendering shock absorbers unnecessary.



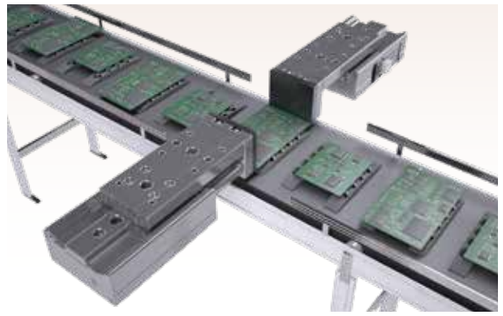
Application examples

2-Finger Gripper FLSH Series



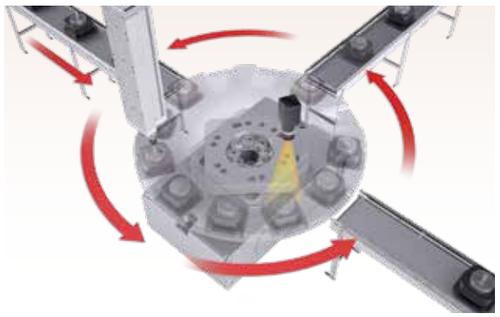
- Gently grasp various workpieces that are easy to deform, and with just one actuator.

Table type FLCR Series



- Centering of different sized circuit board materials

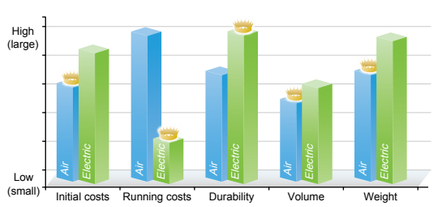
Rotary FGRC Series



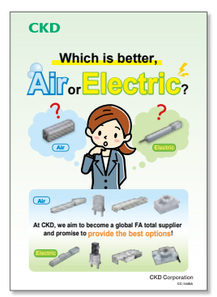
- Indexing to positions for assembly and simple inspection processes

CKD recommends using air as well to...

- Reduce initial costs as much as possible
- Use as light an actuator as possible



For more information



Refer to the catalog No.CC-1446A for details.

Controller

ECR Series

ECG Series

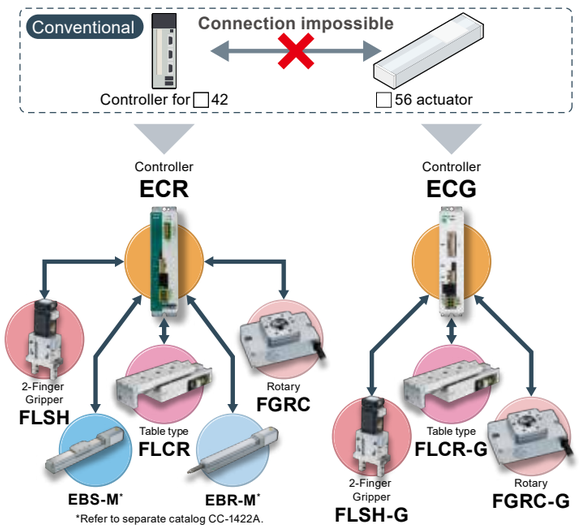
A new controller for every actuator model and size

Reduced initial work hours and stock

Original functions available for a variety of motor sizes

The same controller operates with actuators of different sizes and models. Equipped with an automatic recognition function that reads actuator information, for less work during initial setting. Further, with a common controller, work hours for selection and ordering can be reduced as well as inventory.

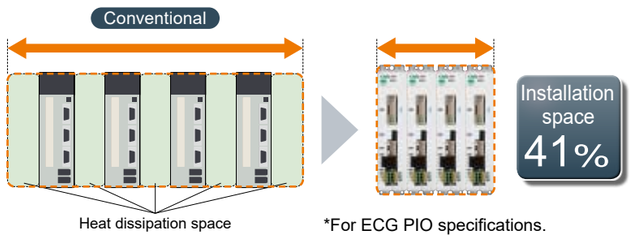
*ECR is compatible with 5 models, ECG is compatible with 3 models.
*Only ECR supports the automatic recognition function.



Reduced controller footprint

Compact, allowing adjacent installation

The optimized design eliminates the need for heat dissipation space at the sides. This allows controllers to be installed next to one another.

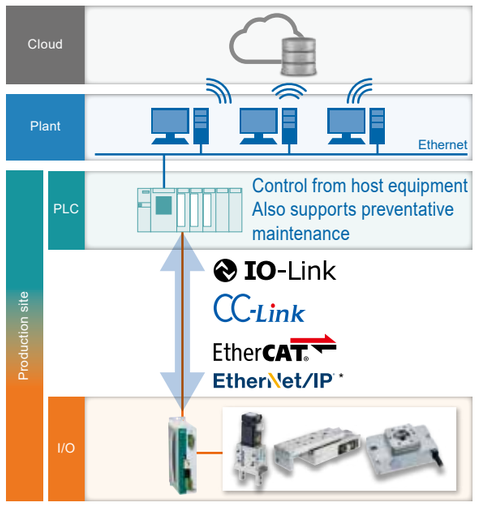


*For ECG PIO specifications.

Supports IoT

Compatible with all types of networks

Our product is compatible with all types of industrial networks. This allows control from host equipment over Ethernet, and also enables preventative maintenance.



*Only ECG supported.

Abundant wiring configurations

Supports a wide range of line, star and ring wiring for EtherNet/IP. Select an appropriate one for your application.

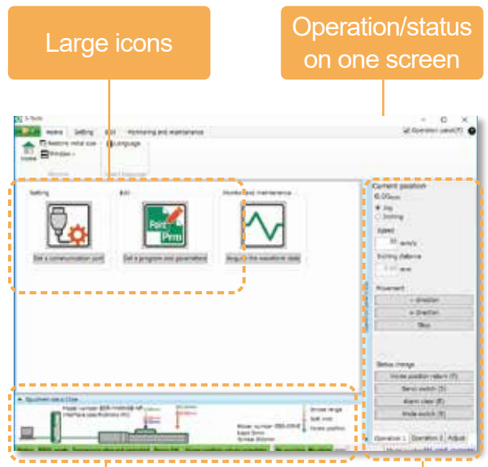
Reduces adjustment time

Easy setup with the "S-Tools" common software

CKD YouTube channel
Simple manual video for dedicated software "S-Tools" available. Please check via iPad or smartphone.

*Depending on your smartphone environment, it may not be displayed correctly.

Inherits the operational feel of the popular AX-Tools software for ABSODEX. S-Tools can be downloaded from our website.



FLSH

2-Finger Gripper

Electric actuator
Motor specification

CONTENTS

FLSH Series variation

Model No.	Motor size	Stroke and max. speed (mm/s)			Max. gripping force (N)
		6mm	10mm	14mm	
FLSH-16	□20	50mm/s			20
FLSH-20	□25		50		42
FLSH-25	□25L			50	65

Long stroke, rubber cover, with case and finger shape options are also available.
Refer to "Electric actuator 2-finger gripper FLSH Series (Catalog No.CC-1564A)" for details.

Electric actuator 2-finger gripper

FLSH-16

□20 stepper motor

For applicable controller ECR, 48 V and 24 V power supplies can be used.
For applicable controller ECG, 24 V power supplies can be used.

How to order

FLSH - 16 (A) G (B) H1 (C) 06 (D) N C (E) N - F (F) S03 (G)

A Size

16

B Applicable controller *1

G	ECG
Blank	ECR

C Screw lead

H1	1.5 mm

D Stroke length

06	6 mm (one side 3 mm)

E Encoder

C	Incremental encoder

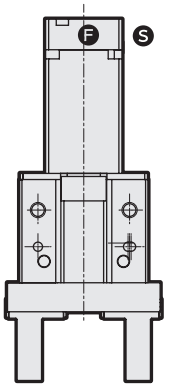
F Connector leadout direction *2

F	Front
S	Side

G Relay cable *3

N00	None
S01	Fixing cable 1m
S03	Fixing cable 3m
S05	Fixing cable 5m
S10	Fixing cable 10m
R01	Movable cable 1m
R03	Movable cable 3m
R05	Movable cable 5m
R10	Movable cable 10m

[Fig. 1]



*1 Select the controller from page 45 or page 59.
*2 Refer to Figure 1.
*3 Refer to page 55 or page 70 for relay cable dimensions.

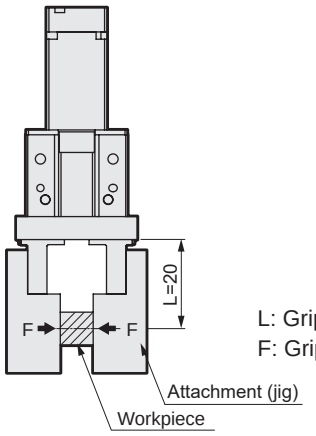
Specifications

Motor		□20 stepper motor
Encoder type		Incremental encoder
Drive method		Sliding screw
Stroke length	mm	6 (one side 3)
Screw lead	mm	1.5
Max. gripping force *1	N	20 (one side)
Open/close speed range	mm/s	5 to 50 (one side)
Gripping speed range *1	mm/s	5 to 15 (one side)
Repeatability *2	mm	±0.02
Positioning repeatability *3	mm	±0.05 (one side)
Lost motion	mm	0.3 or less (one side)
Static allowable moment	N·m	MP=0.68, MY=0.68, MR=1.36
Motor power supply voltage		24 VDC ±10% or 48 VDC ±10%
Motor section maximum instantaneous current	A	1.2
Insulation resistance		10 MΩ, 500 VDC
Withstand voltage		500 VAC for 1 minute
Operating ambient temperature, humidity		0 to 40°C (no freezing) 35 to 80% RH (no condensation)
Storage ambient temperature, humidity		-10 to 50°C (no freezing) 35 to 80% RH (no condensation)
Atmosphere		No corrosive gas, explosive gas, or dust
Degree of protection		IP40
Weight	g	250

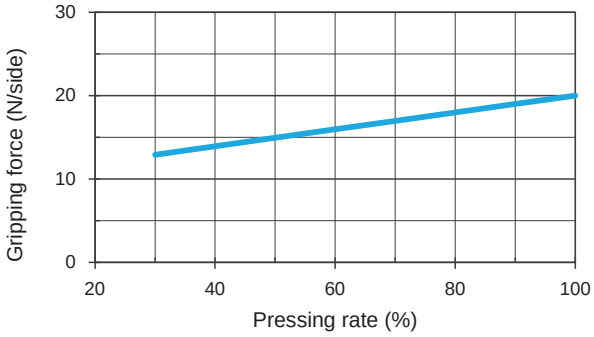
*1 Gripping is done with pressing operation.
*2 Repeatability indicates variation when the same workpiece is repeatedly gripped at the same power, under the same operation conditions.
*3 The stop position will vary if positioning is repeatedly performed to the same point.

Gripping force and pressing rate

[At 24/48 VDC]



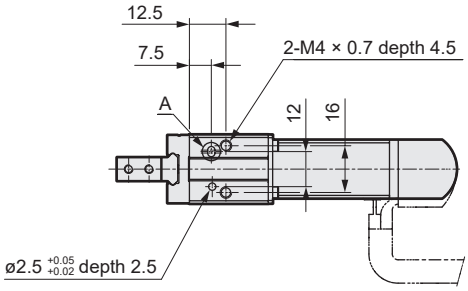
L: Gripping point
F: Gripping force



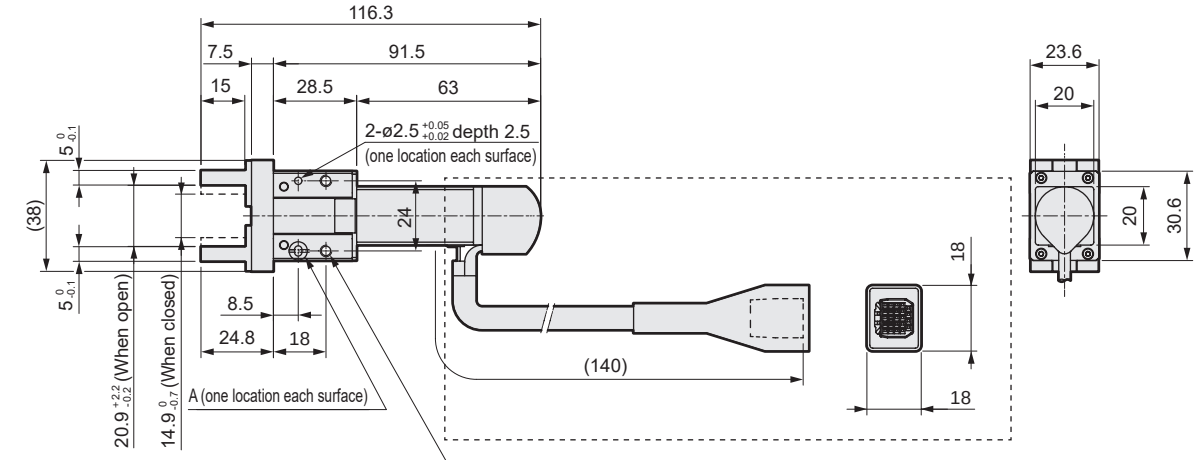
*1 The gripping force and pressing rate are merely guidelines. Power supply voltages, individual motor differences and variations in mechanical efficiency may result in differing actual values, even at the same pressing rate.
*2 At speed of 15 mm/s during pressing operation. (L=20)

Dimensions

● FLSH-16

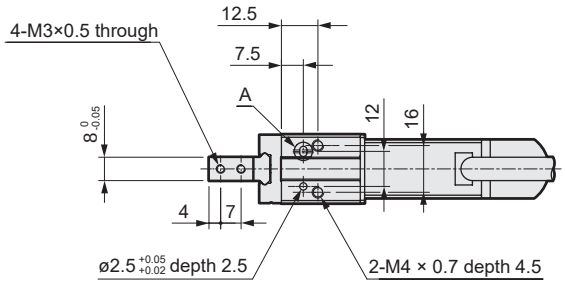


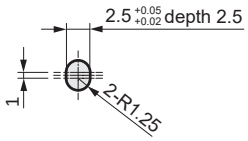
Connector leadout direction: Front (F)



*Cable is not removable.

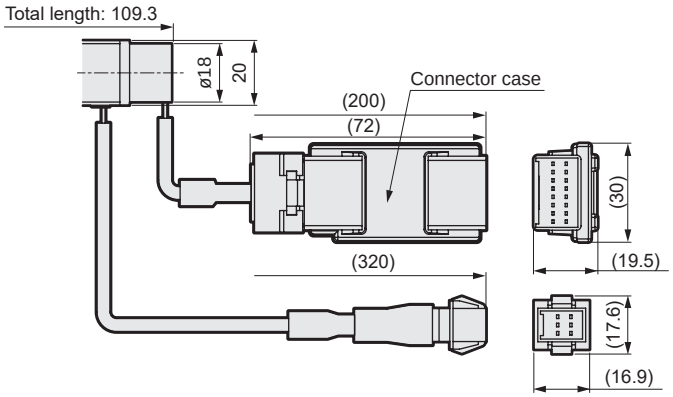
Connector leadout direction: Side (S)

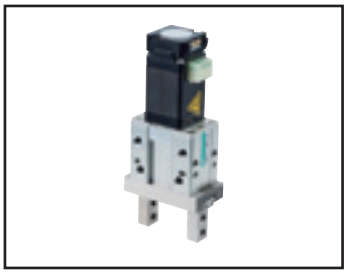




Dimensions of A slot

* When ECR is connected, the dotted line will be as shown below.





Electric actuator 2-finger gripper

FLSH-20

□25 stepper motor

For applicable controller ECR, 48 V and 24 V power supplies can be used.
For applicable controller ECG, 24 V power supplies can be used.

How to order

FLSH - 20 (A) G (B) H1 (C) 10 (D) N C (E) N - F (F) S03 (G)

A Size

20

B Applicable controller *1

G	ECG
Blank	ECR

C Screw lead

H1	1.5 mm

D Stroke length

10	10 mm (one side 5 mm)

E Encoder

C	Incremental encoder

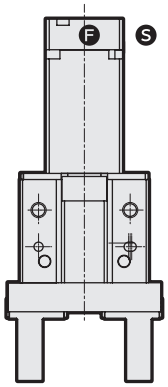
F Connector leadout direction *2

F	Front
S	Side

G Relay cable *3

N00	None
S01	Fixing cable 1 m
S03	Fixing cable 3 m
S05	Fixing cable 5 m
S10	Fixing cable 10 m
R01	movable cable 1 m
R03	movable cable 3 m
R05	movable cable 5 m
R10	movable cable 10 m

[Fig. 1]



*1 Select the controller from page 45 or page 59.
*2 Refer to Figure 1.
*3 Refer to page 55 or page 70 for relay cable dimensions.

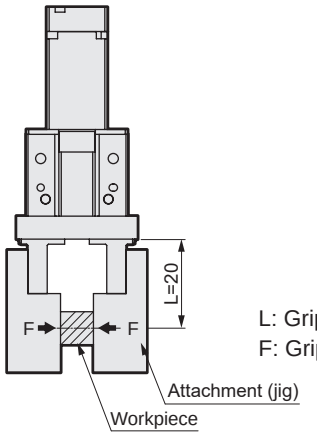
Specifications

Motor		□25 stepper motor
Encoder type		Incremental encoder
Drive method		Sliding screw
Stroke length	mm	10 (one side 5)
Screw lead	mm	1.5
Max. gripping force *1	N	42 (one side)
Open/close speed range	mm/s	5 to 50 (one side)
Gripping speed range *1	mm/s	5 to 15 (one side)
Repeatability *2	mm	±0.02
Positioning repeatability *3	mm	±0.05 (one side)
Lost motion	mm	0.3 or less (one side)
Static allowable moment	N·m	MP=1.32, MY=1.32, MR=2.65
Motor power supply voltage		24 VDC ±10% or 48 VDC ±10%
Motor section maximum instantaneous current	A	2.4
Insulation resistance		10 MΩ, 500 VDC
Withstand voltage		500 VAC for 1 minute
Operating ambient temperature, humidity		0 to 40°C (no freezing) 35 to 80% RH (no condensation)
Storage ambient temperature, humidity		-10 to 50°C (no freezing) 35 to 80% RH (no condensation)
Atmosphere		No corrosive gas, explosive gas, or dust
Degree of protection		IP40
Weight	g	380

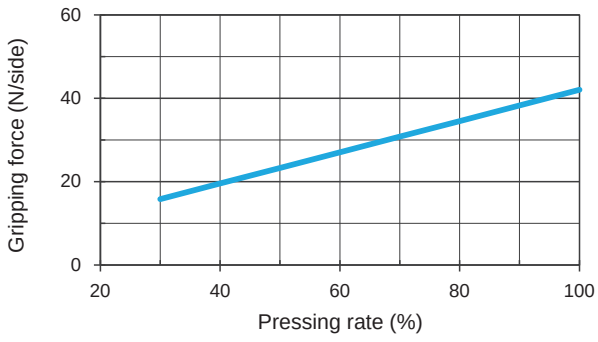
*1 Gripping is done with pressing operation.
*2 Repeatability indicates variation when the same workpiece is repeatedly gripped at the same power, under the same operation conditions.
*3 The stop position will vary if positioning is repeatedly performed to the same point.

Gripping force and pressing rate

[At 24/48 VDC]



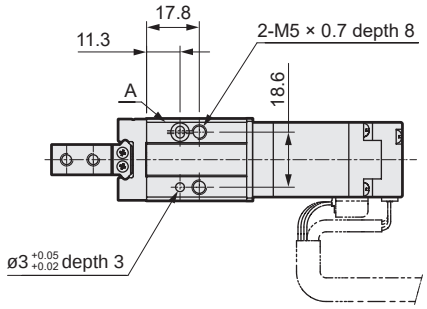
L: Gripping point
F: Gripping force



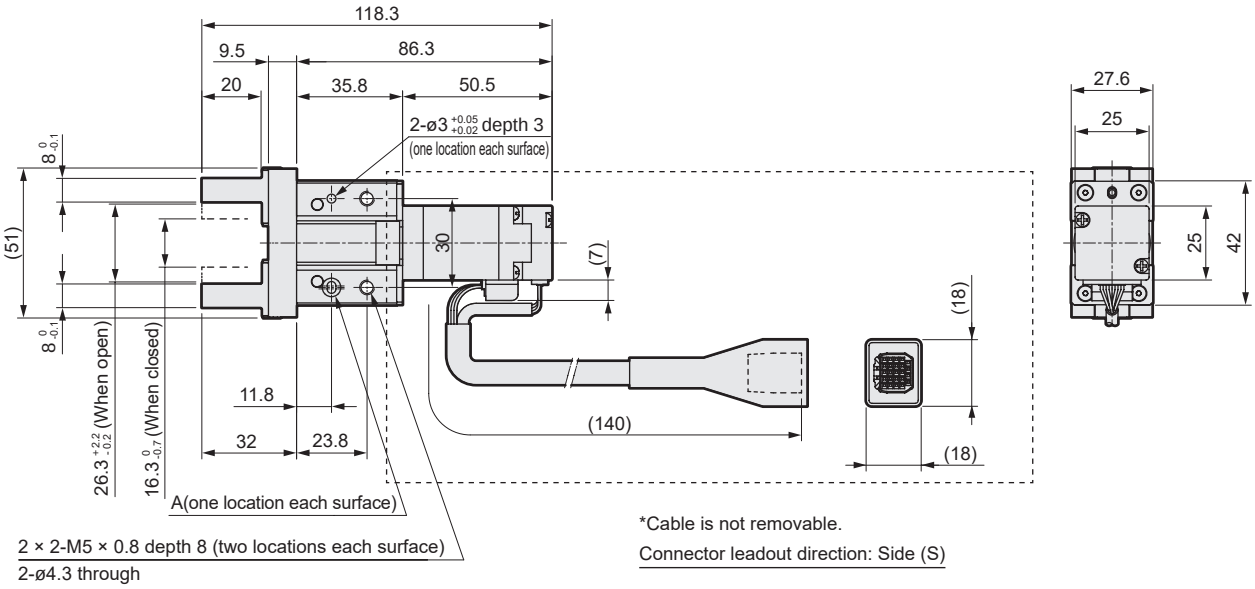
*1 The gripping force and pressing rate are merely guidelines. Power supply voltages, individual motor differences and variations in mechanical efficiency may result in differing actual values, even at the same pressing rate.
*2 At speed of 15 mm/s during pressing operation. (L=20)

Dimensions

● FLSH-20

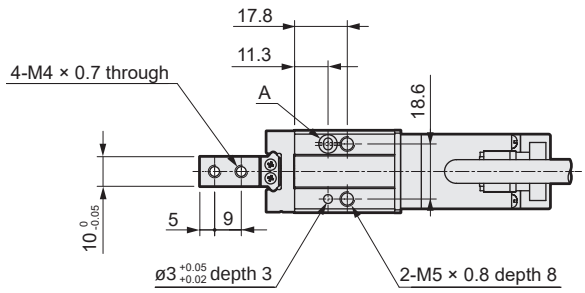


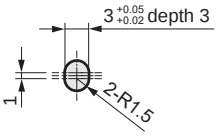
Connector leadout direction: Front (F)



2 × 2-M5 × 0.8 depth 8 (two locations each surface)
2-ø4.3 through

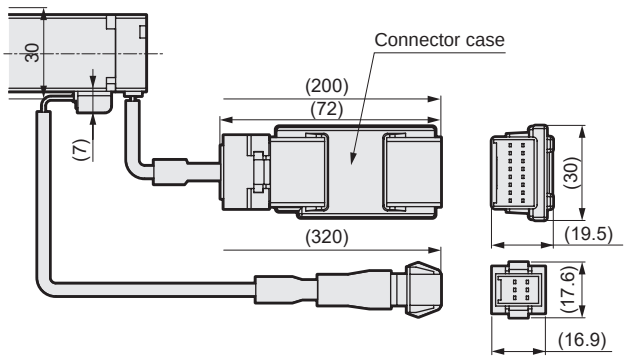
*Cable is not removable.
Connector leadout direction: Side (S)

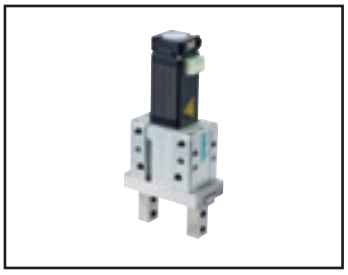




Dimensions of A slot

* When ECR is connected, the dotted line will be as shown below.





Electric actuator 2-finger gripper

FLSH-25

□ 25L stepper motor

For applicable controller ECR, 48 V and 24 V power supplies can be used.
For applicable controller ECG, 24 V power supplies can be used.

How to order

FLSH - 25 (A) G (B) H1 (C) 14 (D) N C (E) N F (F) S03 (G)

(A) Size

25

(B) Applicable controller *1

G	ECG
Blank	ECR

(C) Screw lead

H1	1.5 mm

(D) Stroke length

14	14 mm (one side 7 mm)

(E) Encoder

C	Incremental encoder

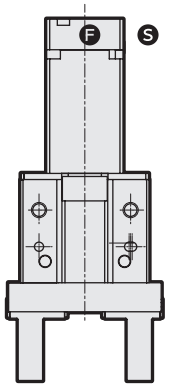
(F) Connector leadout direction *2

F	Front
S	Side

(G) Relay cable *3

N00	None
S01	Fixing cable 1m
S03	Fixing cable 3m
S05	Fixing cable 5m
S10	Fixing cable 10m
R01	Movable cable 1m
R03	Movable cable 3m
R05	Movable cable 5m
R10	Movable cable 10m

[Fig. 1]



*1 Select the controller from page 45 or page 59.
*2 Refer to Figure 1.
*3 Refer to page 55 or page 70 for relay cable dimensions.

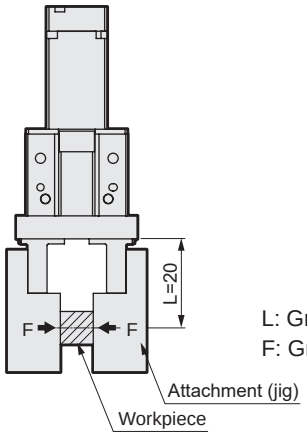
Specifications

Motor		□ 25L stepper motor
Encoder type		Incremental encoder
Drive method		Sliding screw
Stroke length	mm	14 (one side 7)
Screw lead	mm	1.5
Max. gripping force *1	N	65 (one side)
Open/close speed range	mm/s	5 to 50 (one side)
Gripping speed range *1	mm/s	5 to 15 (one side)
Repeatability *2	mm	±0.02
Positioning repeatability *3	mm	±0.05 (one side)
Lost motion	mm	0.3 or less (one side)
Static allowable moment	N·m	MP=1.94, MY=1.94, MR=3.88
Motor power supply voltage		24 VDC ±10% or 48 VDC ±10%
Motor section maximum instantaneous current	A	3.6
Insulation resistance		10 MΩ, 500 VDC
Withstand voltage		500 VAC for 1 minute
Operating ambient temperature, humidity		0 to 40 °C (no freezing) 35 to 80% RH (no condensation)
Storage ambient temperature, humidity		-10 to 50 °C (no freezing) 35 to 80% RH (no condensation)
Atmosphere		No corrosive gas, explosive gas, or dust
Degree of protection		IP40
Weight	g	580

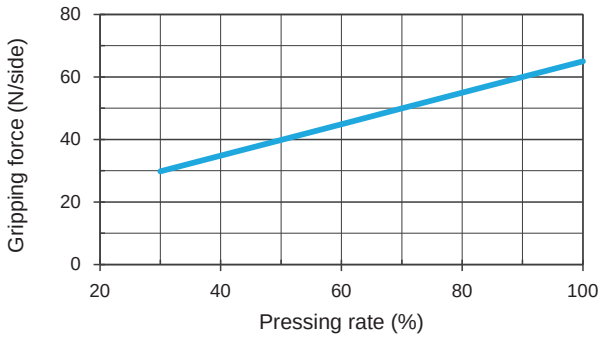
*1 Gripping is done with pressing operation.
*2 Repeatability indicates variation when the same workpiece is repeatedly gripped at the same power, under the same operation conditions.
*3 The stop position will vary if positioning is repeatedly performed to the same point.

Gripping force and pressing rate

[At 24/48 VDC]



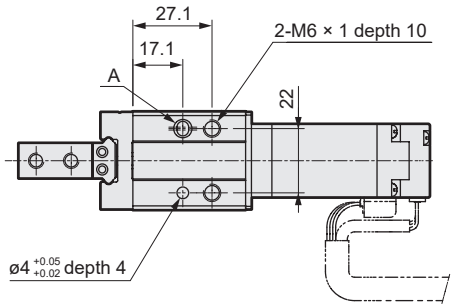
L: Gripping point
F: Gripping force



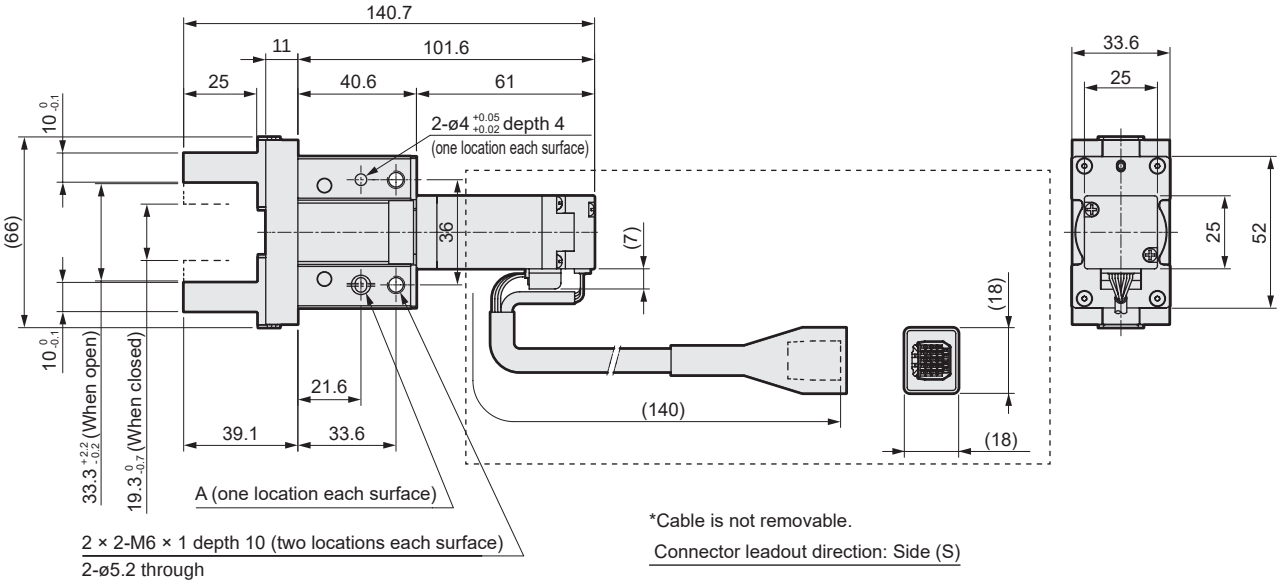
*1 The gripping force and pressing rate are merely guidelines. Power supply voltages, individual motor differences and variations in mechanical efficiency may result in differing actual values, even at the same pressing rate.
*2 At speed of 15 mm/s during pressing operation. (L=20)

Dimensions

● FLSH-25

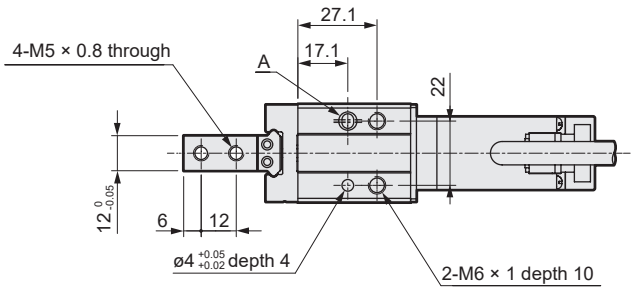


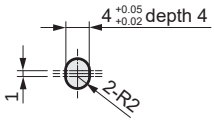
Connector leadout direction: Front (F)



*Cable is not removable.

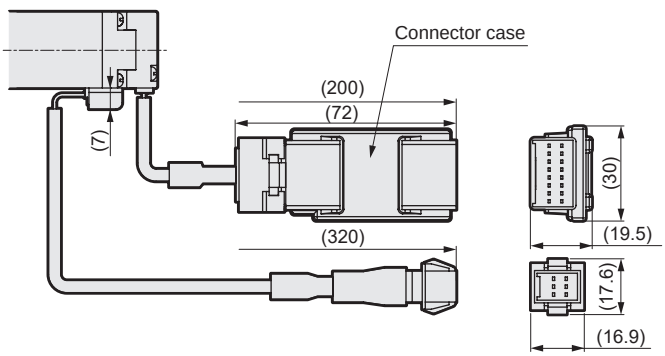
Connector leadout direction: Side (S)





Dimensions of A slot

* When ECR is connected, the dotted line will be as shown below.



Model selection

STEP 1 Calculating the required gripping force

Calculate the required gripping force when transporting a workpiece (weight W_L) with the following as the reference.

$$F_W > \frac{W_L \times g \times K}{n}$$

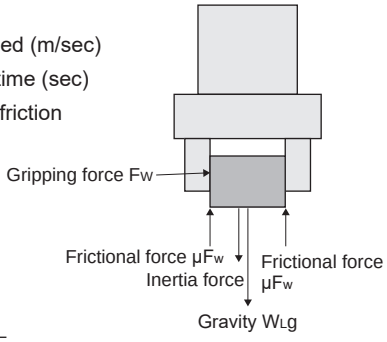
F_W : Required gripping force (N)
n : Number of Attachments = 2
W_L : Weight of workpiece (kg)
g : Gravity acceleration 9.8 (m/s^2)
K : Transport coefficient
5 [holding only]
10 [normal transport]
20 [suddenly accelerated transport]

Transport coefficient K

Calculation example: When decelerating and stopping in 0.1 second from transport speed of V = 0.75 m/s with friction coefficient μ of workpiece and attachment as 0.1, see below.

Obtain the transport coefficient K from the force applied to the workpiece

V: Transport speed (m/sec)
t: Deceleration time (sec)
μ: Coefficient of friction



- Inertial force = $W_L \times (V/t)$
- Gravity = $W_L g$
- Required gripping force $F_W > \frac{W_L \times (V/t) + W_L g}{n\mu} = \frac{W_L \times (V/t+g)}{n\mu} = \frac{17.3 W_L}{2 \times 0.1} = 86.5 W_L$

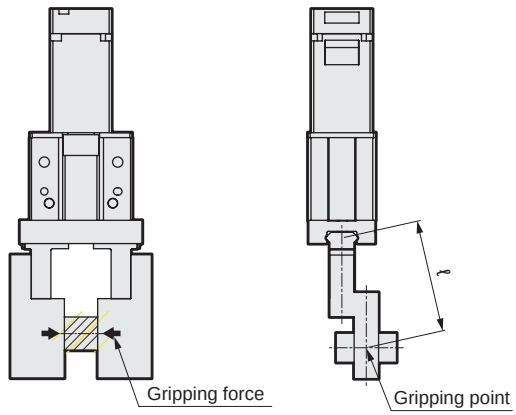
∴ The transport coefficient K is calculated from the above equation: $\frac{W_L \times g \times K}{n} = 86.5 W_L$

$$K = \frac{n \times 86.5}{g} = \frac{2 \times 86.5}{9.8} \approx 20$$

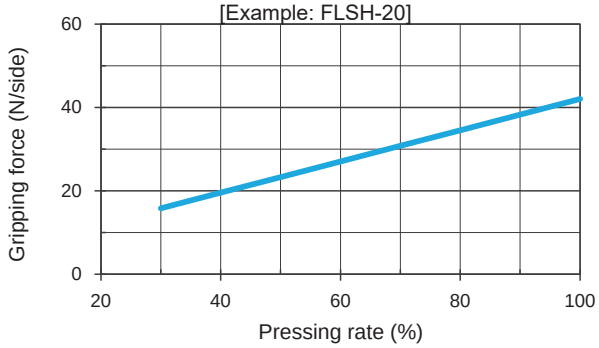
Note) Allowance is required for transport coefficient K due to impacts during transportation, etc. Even when the coefficient of friction μ is higher than μ = 0.1, set transport coefficient K from 10 to 20 or more for safety.

STEP 2 Temporarily select a model from the gripping force graph

Check the following conditions and temporarily select a model from the gripping force graph.
The gripping force varies according to length L of the attachment (gripping point distance ℓ) and the pressing rate.
Confirm on the graph that sufficient force can be obtained under the working conditions.

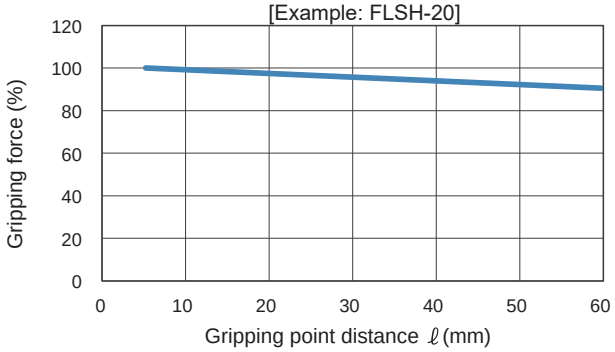


Gripping force and pressing rate
[Example: FLSH-20]



*Refer to pages 2, 4 and 6.

Gripping force and gripping point distance
[Example: FLSH-20]

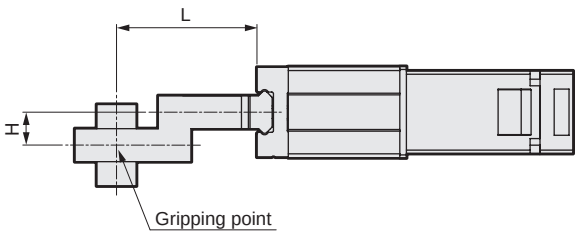


*Refer to page 10.

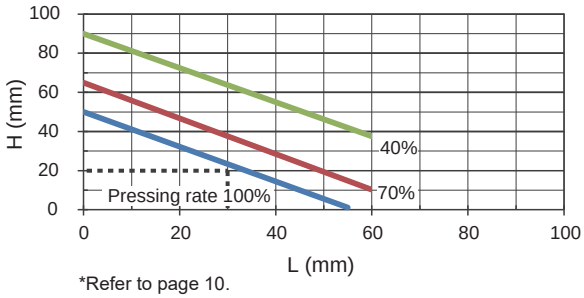
STEP 3 Confirmation of attachment shape

Use gripping point distance within the range of the graph at right.

Example) L: 30 mm, H: 20 mm



Gripping point distance and pressing rate
[Example: FLSH-20]



*Refer to page 10.

When FLSH-20 is selected, the intersection of L: 30 mm and H: 20 mm will be inside the 100% pressing line, so it can be used.

●Use attachments as short and lightweight as possible.

If the attachment is long and heavy, inertia increases when opening and closing.
This may cause play in the finger, and adversely affect durability.

●Minimizing the attachment shape as much as possible within the performance data enables the product to be used for a longer time.

●The weight of the attachment affects durability, so check that the weight is less than the following value.

W < 1/4h (1 pc.) W : Weight of attachment
h : Product weight of gripper

STEP 4 Confirmation of external forces applied to finger

When external force is applied to the finger, use it within the range in [Table 1].

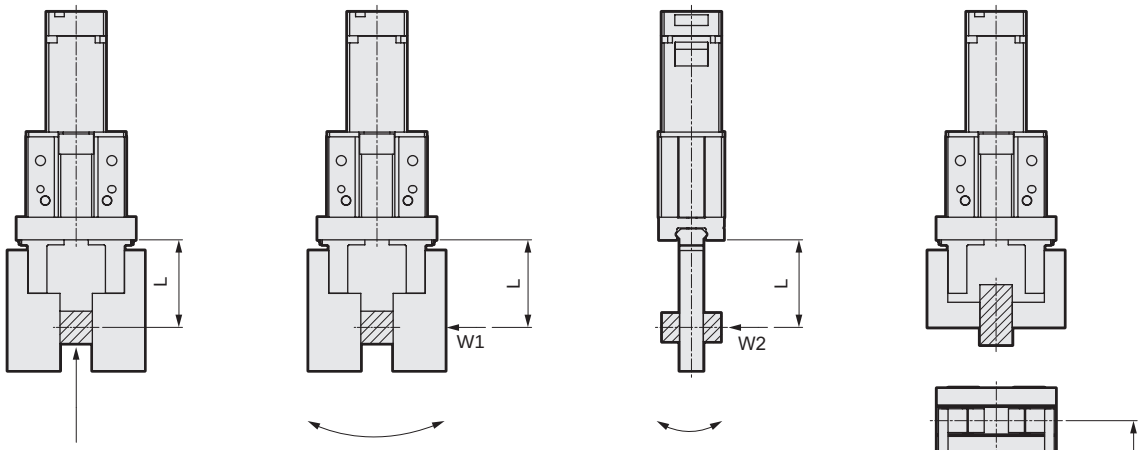


Table 1 Static allowable moment

Size	Vertical load Wmax (N)	Bending moment MPmax (N·m)	Radial moment MRmax (N·m)	Torsion moment MYmax (N·m)
FLSH-16	98	0.68	1.36	0.68
FLSH-20	147	1.32	2.65	1.32
FLSH-25	255	1.94	3.88	1.94

Example of calculation:

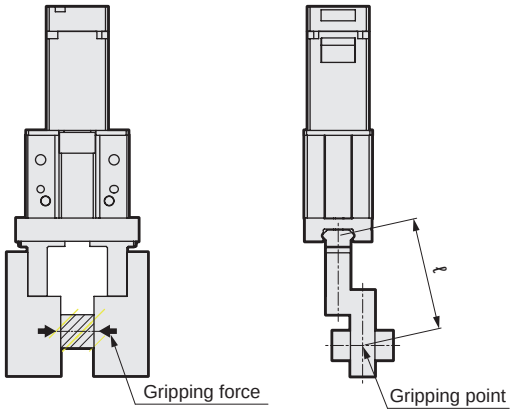
Model No.: FLSH-20, L: where load W1 of 30 N is applied to 40 mm

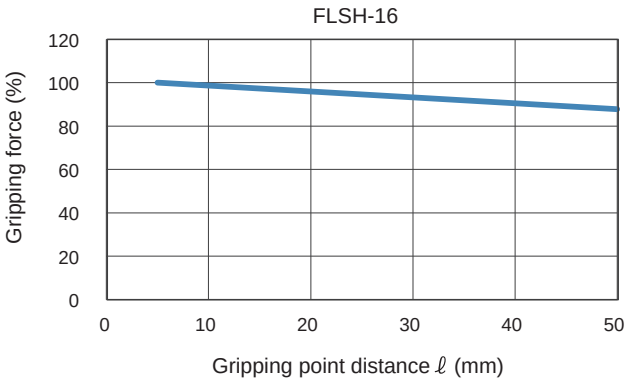
$MP = 30 \times 40 \times 10^{-3} = 1.2\ N \cdot m < MPmax = 1.32\ N \cdot m$

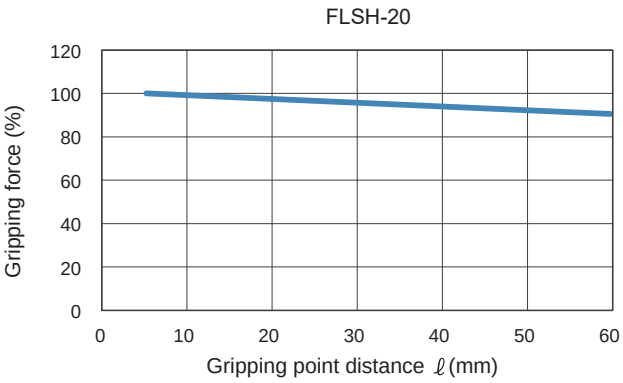
Gripping force and gripping point guidelines

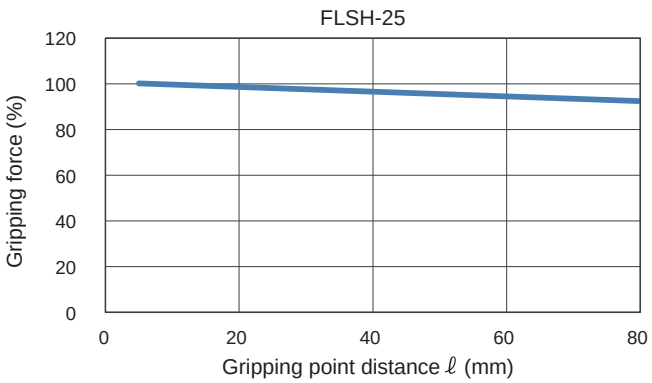
This indicates the gripping force at gripping point distance ℓ.

Calculated by $\ell = \sqrt{L^2+H^2}$.

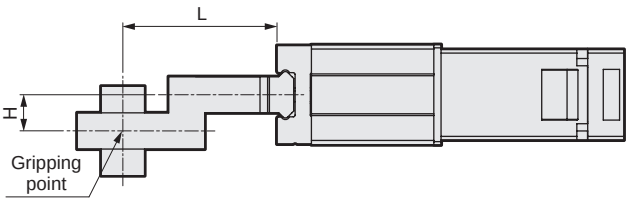


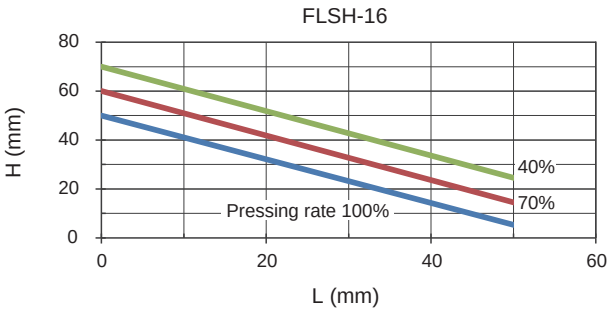


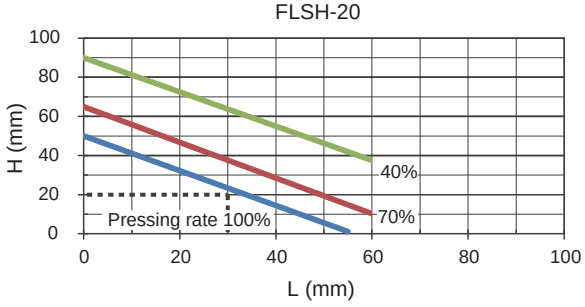


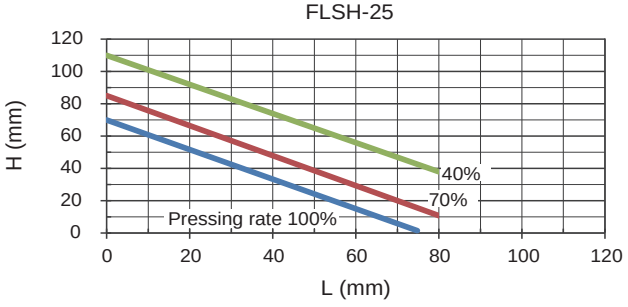


Gripping point distance and pressing rate







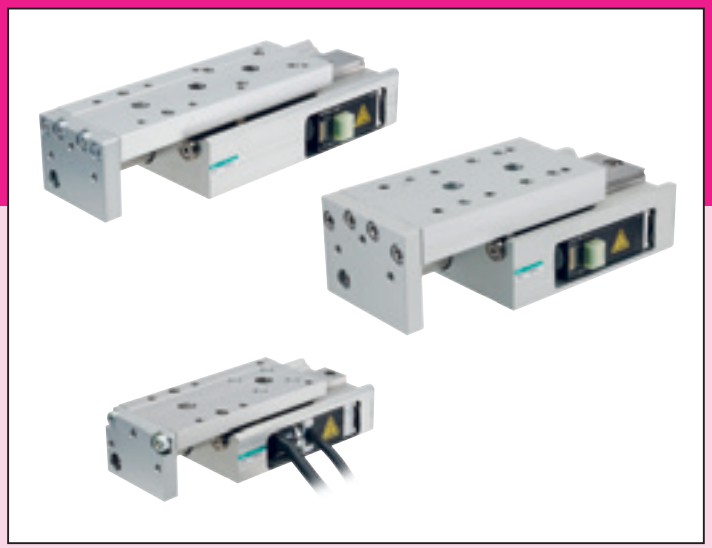


MEMO

FLCR

Table type

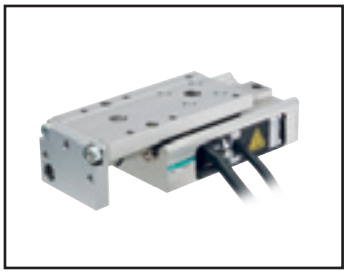
Electric actuator
Motor specification



CONTENTS

FLCR Series variation

Model No.	Motor size	Screw lead (mm)	Max. load capacity (kg)		Stroke and max. speed (mm/s)			Maximum pressing force (N)
			Horizontal	Vertical	50 mm	75 mm	100 mm	
FLCR-16	□20	2	4	4	100 mm/s			90
		8	3	0.5	300			20
FLCR-20	□25	2	5.5	6	100			150
		8	5	0.8	300			55
FLCR-25	□25L	2	11	8.5	100			210
		6	11	3	300			90



Electric actuator Table

FLCR-16

□ 20 stepper motor

For applicable controller ECR, 48 V and 24 V power supplies can be used.
For applicable controller ECG, 24 V power supplies can be used.

How to order

FLCR - 16 (A) G (B) 02 (C) 050 (D) N (E) C (F) N - L (G) S03 (H)

A Size

16

B Applicable controller *1

G	ECG
Blank	ECR

C Screw lead

02	2 mm
08	8 mm

D Stroke length

050	50 mm
075	75 mm
100	100 mm

E Brake

N	None
B	With brake (only with ECG)

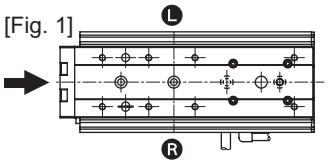
F Encoder

C	Incremental encoder

G Connector leadout direction *2

L	Left surface
R	Right surface

[Fig. 1]



H Relay cable *3

N00	None
S01	Fixing cable 1 m
S03	Fixing cable 3 m
S05	Fixing cable 5 m
S10	Fixing cable 10 m
R01	Movable cable 1 m
R03	Movable cable 3 m
R05	Movable cable 5 m
R10	Movable cable 10 m

*1 Select the controller from page 45 or page 59.
*2 Refer to Figure 1.
*3 Refer to page 55 or page 70 for relay cable dimensions.

Specifications

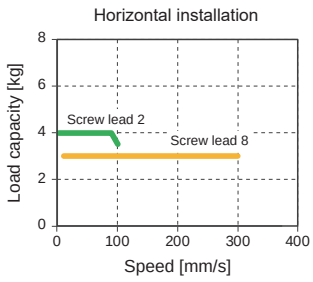
Motor		□ 20 stepper motor	
Encoder type		Incremental encoder	
Drive method		Ball screw (ø6) + belt	
Stroke	mm	50, 75, 100	
Screw lead	mm	2	8
Max. load capacity *1, *2	kg Horizontal	4 (4)	3 (3)
	Vertical	4 (4)	0.5 (0.5)
Operation speed range *3	mm/s	2 to 100 (100)	10 to 300 (250)
Maximum pressing force	N	90	20
Pressing operation speed range	mm/s	2 to 20	5 to 20
Repeatability	mm	±0.02	
Lost motion	mm	0.1 or less	
Static allowable moment	N·m	[50st] MP:17.8, MY:17.8, MR:19.2	
		[75 st or greater]: MP: 37.3, MY: 37.3, MR: 19.2	
Motor power supply voltage		24 VDC ±10% or 48 VDC ±10%	
Motor Max. instantaneous current	A	1.5	
Brake: Model, power supply voltage		Non-excitation actuated type, 24 VDC (+ 10% / -5%)	
Brake: Power consumption	W	1	
Brake: Holding force	N	51	9
Insulation resistance		10 MΩ, 500 VDC	
Withstand voltage		500 VAC for 1 minute	
Operating ambient temp, humidity		0 to 40°C (no freezing) 35 to 80% RH (no condensation)	
Storage ambient temp, humidity		-10 to 50°C (no freezing) 35 to 80% RH (no condensation)	
Atmosphere		No corrosive gas, explosive gas, or dust	
Degree of protection		IP40	

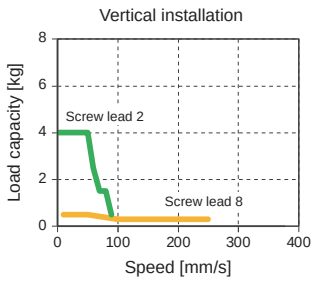
*1 The values in ( ) are at 24 VDC.
*2 Maximum value at acceleration/deceleration of 0.3 G. Load capacity varies according to acceleration/deceleration and speed. Refer to page 27 for details.
*3 The maximum speed values in ( ) are at 24 VDC.

Speed and load capacity

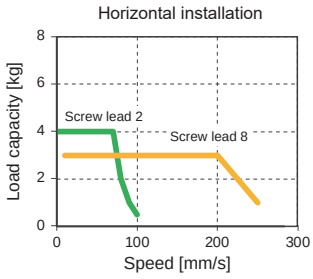
[At 48 VDC]

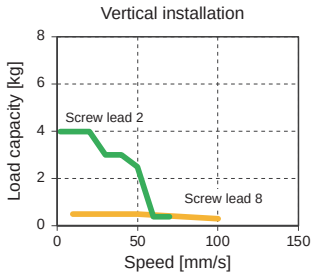
*Acceleration/deceleration 0.3 G





[At 24 VDC]





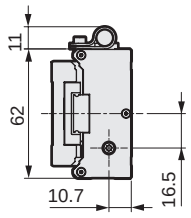
Stroke length and max. speed

(mm/s)

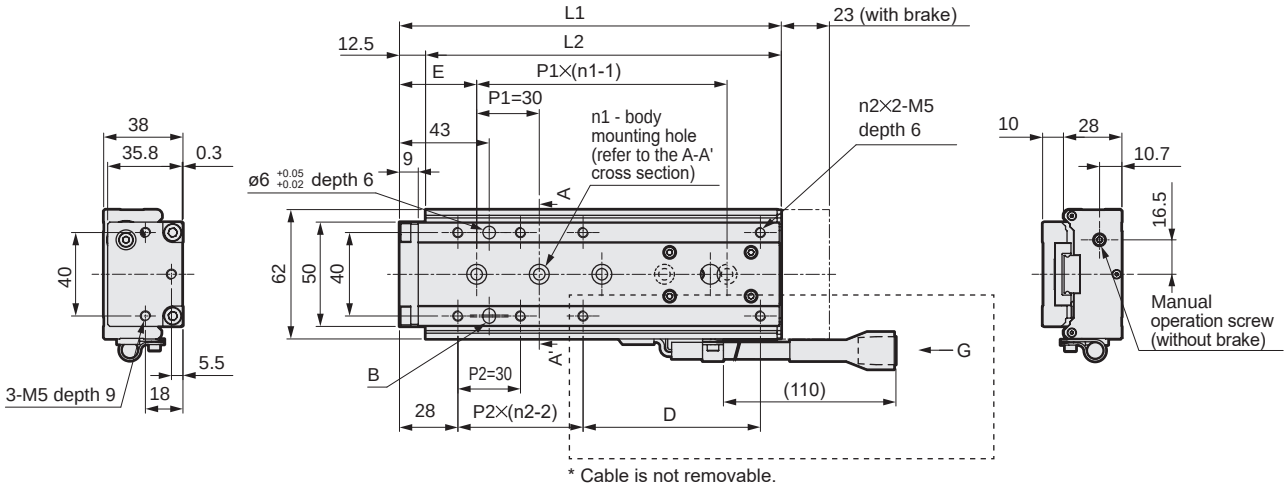
Screw lead	Power supply voltage	Stroke length
		50 to 100
2	48 VDC	100
	24 VDC	100
8	48 VDC	300
	24 VDC	250

Dimensions

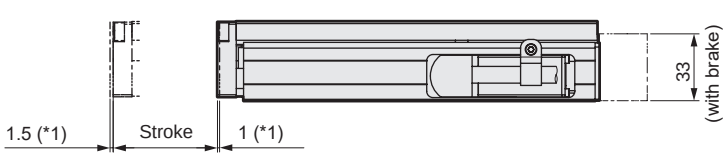
● FLCR-16



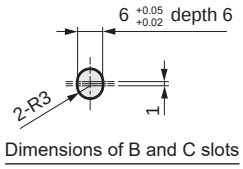
Connector leadout direction L (Left)



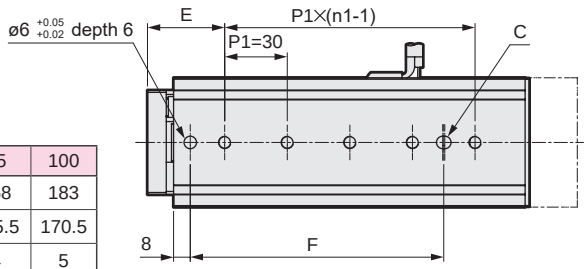
* Cable is not removable.

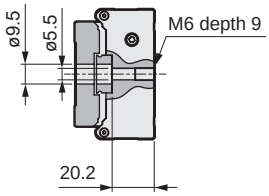


*1 Operating range to the mechanical stopper.

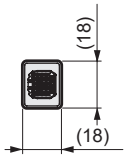


Dimensions of B and C slots





A-A' cross section



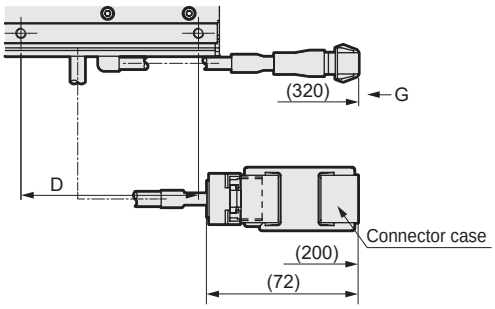
G arrow view

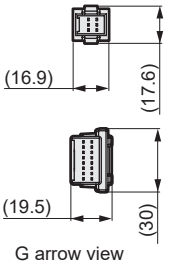
[Dimensions by stroke]

Stroke		50	75	100
L1		116	158	183
L2		103.5	145.5	170.5
n1		3	4	5
n2		3	4	4
D		48	60	85
E		35.5	39	37
F		60	93.5	121.5
Weight kg	without brake	0.8	1.1	1.3
	with brake	0.9	1.2	1.4

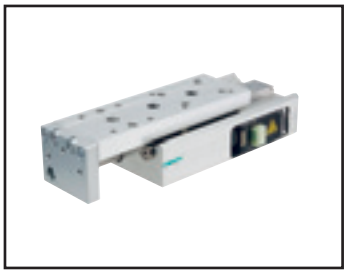
The figure shows connector leadout direction R (right side).

* When connecting ECR, the dotted lines should be as shown below.





G arrow view



Electric actuator Table

FLCR-20

□25 stepper motor

For applicable controller ECR, 48 V and 24 V power supplies can be used.
For applicable controller ECG, 24 V power supplies can be used.

How to order

FLCR - 20 (A) G (B) 02 (C) 050 (D) N (E) C (F) N - L (G) S03 (H)

A Size

20

B Applicable controller *1

G	ECG
Blank	ECR

C Screw lead

02	2 mm
08	8 mm

D Stroke length

050	50 mm
075	75 mm
100	100 mm

E Brake

N	None
B	With brake (only with ECG)

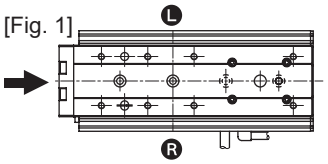
F Encoder

C	Incremental encoder

G Connector leadout direction *2

L	Left surface
R	Right surface

[Fig. 1]



H Relay cable *3

N00	None
S01	Fixing cable 1 m
S03	Fixing cable 3 m
S05	Fixing cable 5 m
S10	Fixing cable 10 m
R01	Movable cable 1 m
R03	Movable cable 3 m
R05	Movable cable 5 m
R10	Movable cable 10 m

*1 Select the controller from page 45 or page 59.
*2 Refer to Figure 1.
*3 Refer to page 55 or page 70 for relay cable dimensions.

Specifications

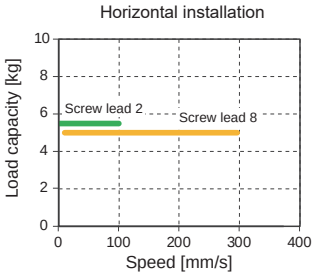
Motor		□25 stepper motor	
Encoder type		Incremental encoder	
Drive method		Ball screw (ø6) + belt	
Stroke	mm	50, 75, 100	
Screw lead	mm	2	8
Max. load capacity *1, *2	kg Horizontal	5.5 (5.5)	5 (5)
	Vertical	6 (6)	0.8 (0.8)
Operation speed range *3	mm/s	2 to 100 (100)	10 to 300 (300)
Maximum pressing force	N	150	55
Pressing operation speed range	mm/s	2 to 20	5 to 20
Repeatability	mm	±0.02	
Lost motion	mm	0.1 or less	
Static allowable moment	N·m	[50st] MP:31.1, MY:31.1, MR:37.6	
		[75 st or greater]: MP: 56.2, MY: 56.2, MR: 37.6	
Motor power supply voltage		24 VDC ±10% or 48 VDC ±10%	
Motor Max. instantaneous current	A	3	
Brake	Model, power supply voltage	Non-excitation actuated type, 24 VDC (+ 10% / -5%)	
	Power consumption W	1	
	Holding force N	77	15
Insulation resistance		10 MΩ, 500 VDC	
Withstand voltage		500 VAC for 1 minute	
Operating ambient temp, humidity		0 to 40°C (no freezing) 35 to 80% RH (no condensation)	
Storage ambient temp, humidity		-10 to 50°C (no freezing) 35 to 80% RH (no condensation)	
Atmosphere		No corrosive gas, explosive gas, or dust	
Degree of protection		IP40	

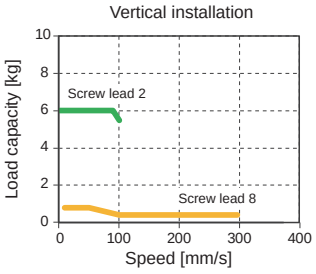
*1 The values in ( ) are at 24 VDC.
*2 Maximum value at acceleration/deceleration of 0.3 G. Load capacity varies according to acceleration/deceleration and speed. Refer to page 27 for details.
*3 The maximum speed values in ( ) are at 24 VDC.

Speed and load capacity

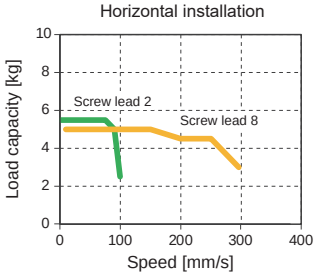
[At 48 VDC]

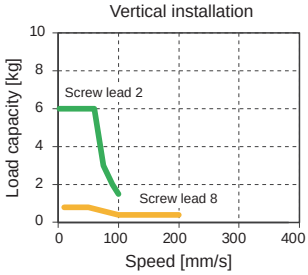
*Acceleration/deceleration 0.3 G





[At 24 VDC]





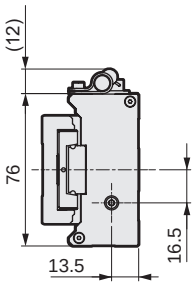
Stroke length and max. speed

(mm/s)

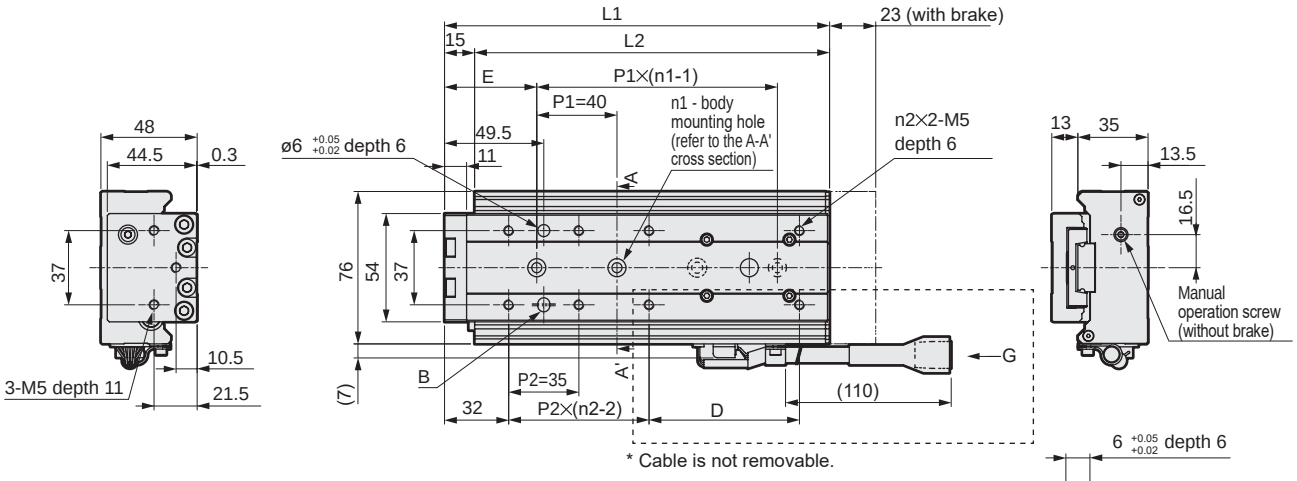
Screw lead	Power supply voltage	Stroke length
		50 to 100
2	48 VDC	100
	24 VDC	100
8	48 VDC	300
	24 VDC	300

Dimensions

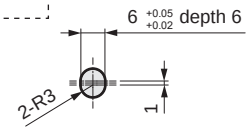
● FLCR-20



Connector leadout direction L (Left)

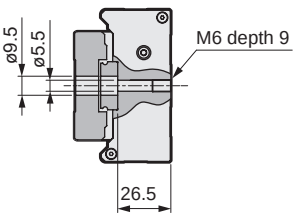


* Cable is not removable.



Dimensions of B and C slots

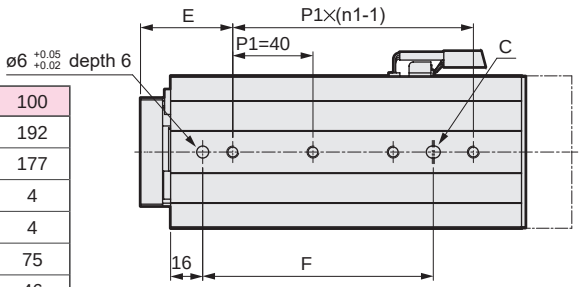
*1 Operating range to the mechanical stopper.

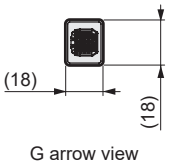


A-A' cross section

[Dimensions by stroke]

Stroke		50	75	100
L1		130.5	167	192
L2		115.5	152	177
n1		2	3	4
n2		3	4	4
D		48.5	50	75
E		49	46	46
F		38	75	115
Weight kg	without brake	1.3	1.7	1.9
	with brake	1.4	1.8	2.0

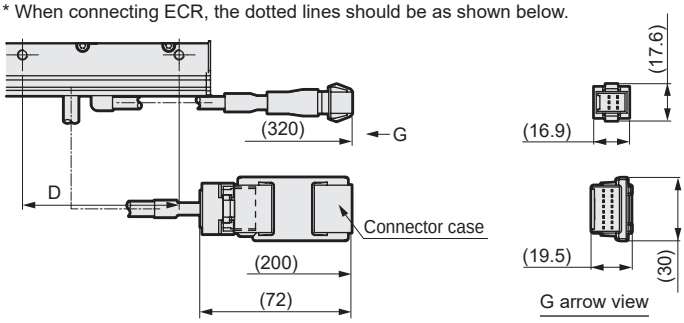




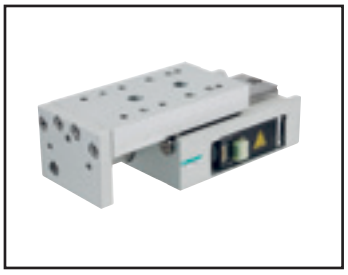
G arrow view

The figure shows connector leadout direction R (right side).

* When connecting ECR, the dotted lines should be as shown below.



G arrow view



Electric actuator Table

FLCR-25

☐ 25L stepper motor

For applicable controller ECR, 48 V and 24 V power supplies can be used.
For applicable controller ECG, 24 V power supplies can be used.

How to order

FLCR - 25 (A) G (B) 02 (C) 050 (D) N (E) C (F) N - L (G) S03 (H)

(A) Size

25

(B) Applicable controller *1

G	ECG
Blank	ECR

(C) Screw lead

02	2 mm
06	6 mm

(D) Stroke length

050	50 mm
075	75 mm
100	100 mm

(E) Brake

N	None
B	With brake (only with ECG)

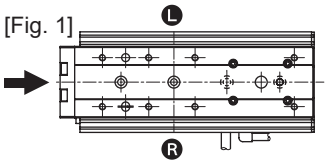
(F) Encoder

C	Incremental encoder

(G) Connector leadout direction *2

L	Left surface
R	Right surface

[Fig. 1]



(H) Relay cable *3

N00	None
S01	Fixing cable 1 m
S03	Fixing cable 3 m
S05	Fixing cable 5 m
S10	Fixing cable 10 m
R01	Movable cable 1 m
R03	Movable cable 3 m
R05	Movable cable 5 m
R10	Movable cable 10 m

*1 Select the controller from page 45 or page 59.
*2 Refer to Figure 1.
*3 Refer to page 55 or page 70 for relay cable dimensions.

Specifications

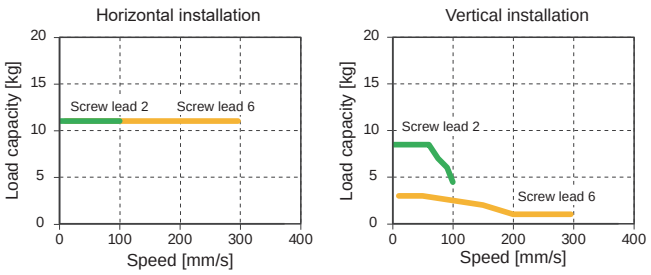
Motor		☐ 25L stepper motor	
Encoder type		Incremental encoder	
Drive method		Ball screw (ø10) + belt	
Stroke	mm	50, 75, 100	
Screw lead	mm	2	6
Max. load capacity *1, *2	kg Horizontal	11 (11)	11 (11)
	Vertical	8.5 (8.5)	3 (3)
Operation speed range *3	mm/s	2 to 100 (75)	7 to 300 (200)
Maximum pressing force	N	210	90
Pressing operation speed range	mm/s	2 to 20	5 to 20
Repeatability	mm	±0.02	
Lost motion	mm	0.1 or less	
Static allowable moment	N·m	[50st] MP:65.1, MY:65.1, MR:116.3	
		[75 st or greater]: MP: 127.5, MY: 127.5, MR: 116.3	
Motor power supply voltage		24 VDC ±10% or 48 VDC ±10%	
Motor Max. instantaneous current	A	4.5	
Brake	Model, power supply voltage	Non-excitation actuated type, 24 VDC (+ 10% / -5%)	
	Power consumption W	1	
	Holding force N	109	38
Insulation resistance		10 MΩ, 500 VDC	
Withstand voltage		500 VAC for 1 minute	
Operating ambient temp, humidity		0 to 40°C (no freezing) 35 to 80% RH (no condensation)	
Storage ambient temp, humidity		-10 to 50°C (no freezing) 35 to 80% RH (no condensation)	
Atmosphere		No corrosive gas, explosive gas, or dust	
Degree of protection		IP40	

*1 The values in ( ) are at 24 VDC.
*2 Maximum value at acceleration/deceleration of 0.3 G. Load capacity varies according to acceleration/deceleration and speed. Refer to page 27 for details.
*3 The maximum speed values in ( ) are at 24 VDC.

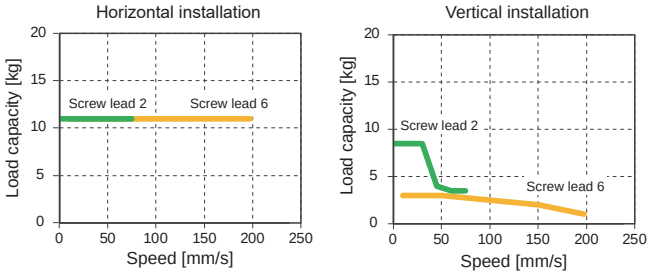
Speed and load capacity

[At 48 VDC]

*Acceleration/deceleration 0.3 G



[At 24 VDC]



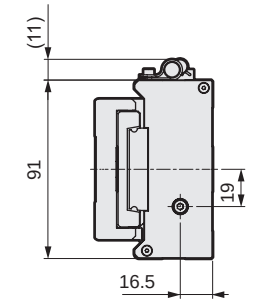
Stroke length and max. speed

(mm/s)

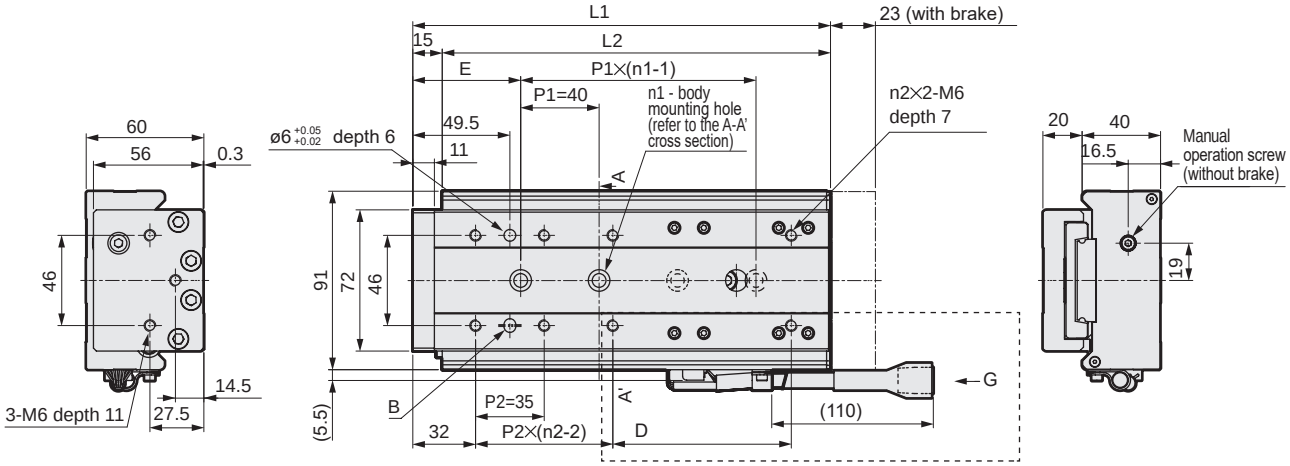
Screw lead	Power supply voltage	Stroke length 50 to 100
2	48 VDC	100
	24 VDC	75
6	48 VDC	300
	24 VDC	200

Dimensions

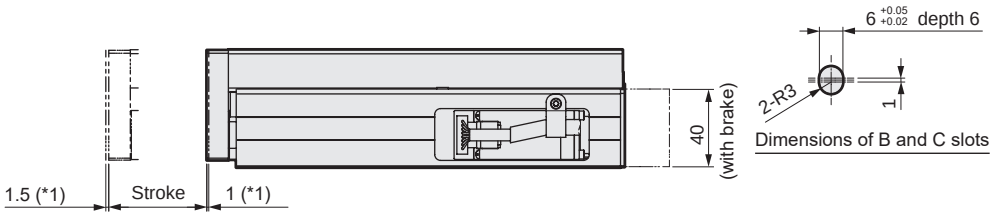
● FLCR-25



Connector leadout direction L (Left)



* Cable is not removable.



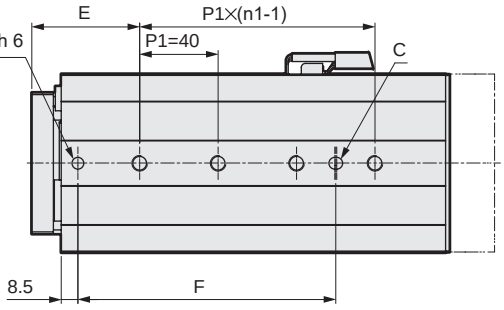
Dimensions of B and C slots

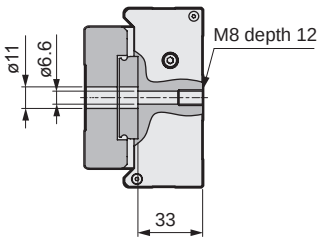
*1 Operating range to the mechanical stopper.

[Dimensions by stroke]

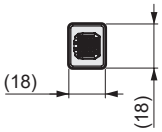
Stroke		50	75	100
L1		142.5	188	213
L2		127.5	173	198
n1		2	3	4
n2		3	4	4
D		55.5	66	91
E		60.5	60	55
F		57	96.5	131.5
Weight kg	without brake	2.3	3.0	3.3
	with brake	2.5	3.2	3.5

The figure shows connector leadout direction R (right side).



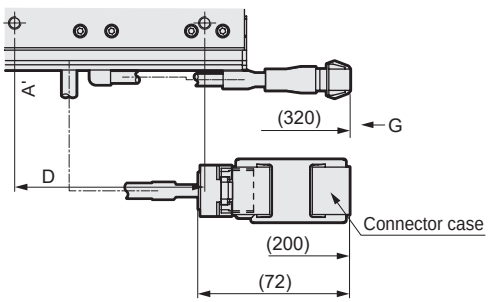


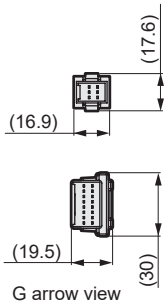
A-A' cross section



G arrow view

* When connecting ECR, the dotted lines should be as shown below.





G arrow view

Model selection

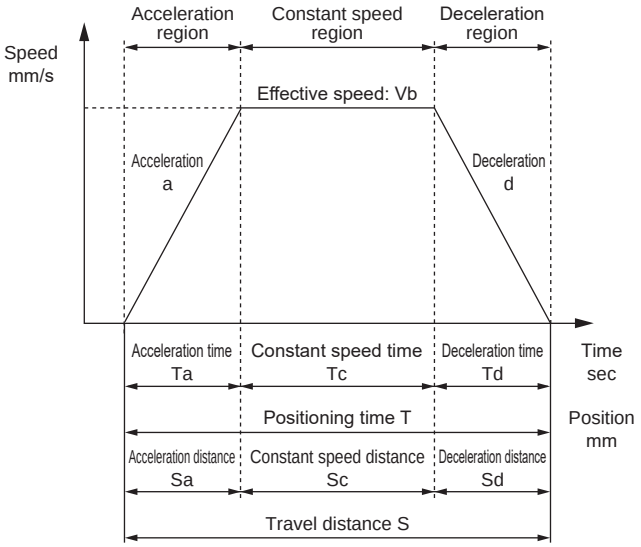
STEP 1 Confirming load capacity

Load capacity varies with mounting orientation, screw lead, transport speed, acceleration/deceleration and power supply voltage.
Refer to the Series Variation (page 13), the specification table for each model and the Table of Load Capacity by Speed and Acceleration/Deceleration to select the size and screw lead.

STEP 2 Confirming positioning time

Calculate the positioning time with the selected product according to the following example and confirm that the required tact is attainable.

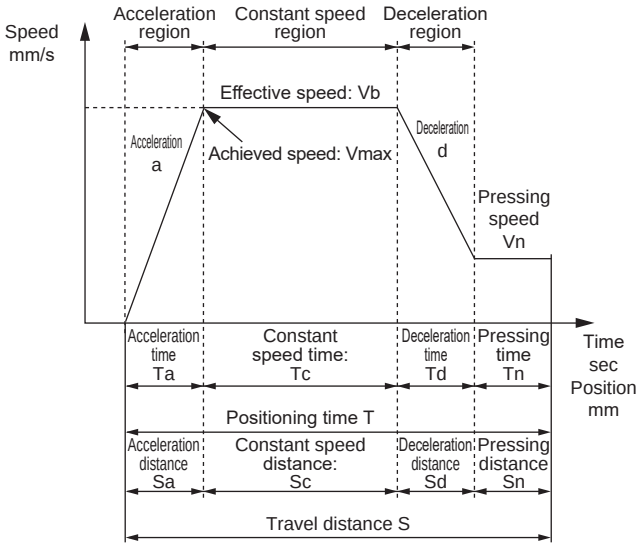
Positioning time for general transport operation



	Description	Code	Unit	Remarks
Set value	Set speed	V	mm/s	
	Set acceleration	a	mm/s^2	
	Set deceleration	d	mm/s^2	
	Travel distance	S	mm	
Calculated value	Achieved speed	Vmax	mm/s	$= \{2 \times a \times d \times S/(a + d)\}^{1/2}$
	Effective speed	Vb	mm/s	Smaller of V and Vmax
	Acceleration time	Ta	s	= Vb/a
	Deceleration time	Td	s	= Vb/d
	Constant speed time	Tc	s	= Sc/Vb
	Acceleration distance	Sa	mm	$= (a \times Ta^2)/2$
	Deceleration distance	Sd	mm	$= (d \times Td^2)/2$
	Constant speed distance	Sc	mm	= S - (Sa + Sd)
	Positioning time	T	s	= Ta + Tc + Td

* Do not use at speeds that exceed the specifications.
* Depending on acceleration/deceleration and stroke length, the trapezoid speed waveform may not be formed (the set speed may not be achieved). In this case, select the effective speed (Vb) from the set speed (V) and the achieved speed (Vmax), whichever is smaller.
* Use at the acceleration and deceleration of 0.3 G or less. Refer to page 27 for details.
* While settling time depends on working conditions, it may take 0.2 seconds or so.
* 1 G ≈ 9.8 m/s^2.

Positioning time for pressing operation



	Description	Code	Unit	Remarks
Set value	Set speed	V	mm/s	
	Set acceleration	a	mm/s^2	
	Set deceleration	d	mm/s^2	
	Travel distance	S	mm	
	Pressing speed	Vn	mm/s	
	Pressing distance	Sn	mm	
Calculated value	Achieved speed	Vmax	mm/s	$=\{2 \times a \times d \times (S - Sn + Vn^2/2/d)/(a + d)\}^{1/2}$
	Effective speed	Vb	mm/s	The lesser value of V and Vmax
	Acceleration time	Ta	s	= Vb/a
	Deceleration time	Td	s	= (Vb - Vn)/d
	Constant speed time	Tc	s	= Sc/Vb
	Pressing time	Tn	s	= Sn/Vn
	Acceleration distance	Sa	mm	$= (a \times Ta^2)/2$
	Deceleration distance	Sd	mm	= ((Vb + Vn) × Td)/2
	Constant speed distance	Sc	mm	= S - (Sa + Sd + Sn)
	Positioning time	T	s	= Ta + Tc + Td + Tn

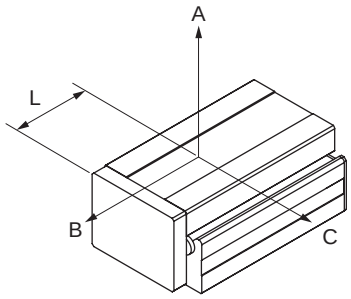
* Do not use at speeds that exceed the specifications.
* Pressing speed differs depending on the product.
* Depending on acceleration/deceleration and stroke length, the trapezoid speed waveform may not be formed (the set speed may not be achieved). In this case, select the effective speed (Vb) from the set speed (V) and the achieved speed (Vmax), whichever is smaller.
* Use at the acceleration and deceleration of 0.3 G or less. Refer to page 27 for details.
* While settling time depends on working conditions, it may take 0.2 seconds or so.
* 1 G ≈ 9.8 m/s^2.

STEP 3 Checking allowable overhang length

Make sure that the load overhang length during operation is within the allowable range (pages 21 to 23).

Allowable overhang length

[When installed horizontally]



[Allowable overhang length]

■ FLCR-16

Stroke length mm	Acceleration/ deceleration Speed G	Screw lead	Load weight kg	Overhang mm A	B	C
50	0.1	2	1	630	155	195
			2	630	75	95
			4	630	35	45
		8	1	630	135	155
			2	630	65	75
			4	340	30	35
	0.3	2	1	630	160	195
			2	630	80	95
			4	340	35	45
		8	1	475	120	120
			2	225	60	55
			3	145	40	35
75/100	0.1	2	1	630	380	195
			2	630	185	95
			4	630	85	45
		8	1	630	325	165
			2	630	155	80
			4	630	75	35
	0.3	2	1	630	385	200
			2	630	185	95
			4	630	90	45
		8	1	630	295	145
			2	630	140	70
			3	460	90	45

■ FLCR-20

Stroke length mm	Acceleration/ deceleration Speed G	Screw lead	Load weight kg	Overhang mm A	B	C
50	0.1	2	1	645	285	380
			3	645	90	125
			5.5	645	50	65
		8	1	645	225	265
			3	645	75	85
			5.5	350	35	45
	0.3	2	1	645	285	380
			3	645	90	120
			5.5	405	50	65
		8	1	645	220	235
			3	270	70	75
			5	155	40	40
75/100	0.1	2	1	645	580	385
			3	645	185	125
			5.5	645	95	65
		8	1	645	460	295
			3	645	145	95
			5.5	645	75	45
	0.3	2	1	645	580	385
			3	645	185	125
			5.5	645	95	65
		8	1	645	450	280
			3	645	145	90
			5	410	80	50

■ FLCR-25

Stroke length mm	Acceleration/ deceleration Speed G	Screw lead	Load weight kg	Overhang mm A	B	C
50	0.1	2	3	940	210	410
			5	940	125	245
			11	940	55	105
		6	3	940	165	245
			5	780	95	145
			11	330	40	60
	0.3	2	3	940	210	405
			5	940	125	240
			11	450	55	105
		6	3	630	165	225
			5	365	95	130
			11	150	40	55
75/100	0.1	2	3	940	465	420
			5	940	275	245
			11	940	115	105
		6	3	940	360	300
			5	940	210	175
			11	920	90	75
	0.3	2	3	940	465	420
			5	940	275	245
			11	940	115	105
		6	3	940	360	295
			5	940	210	175
			11	445	90	70

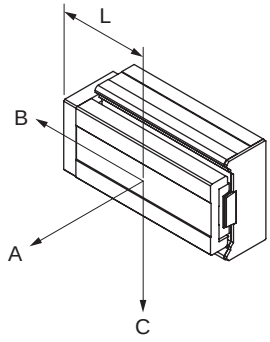
* Values for which the actuator operation cycles are limited to 5 million cycles or if the travel life is shorter than 1000km.
* The overhang direction is for a single-direction load.
* Dimensions A, B, and C are measured from the top surface of the table.
* Values are at maximum speed and maximum load capacity.
* Values may vary according to power supply voltage. Contact CKD for details.
* For acceleration/deceleration and load capacity, refer to the Load Capacity by Speed and Acceleration/ Deceleration table (page 27).

L value (guide block center distance) [mm]

Size	Stroke 50	75	100
FLCR-16	91	124	149
FLCR-20	101	127	152
FLCR-25	104	143	168

Allowable overhang length

[When wall-mounted]



[Allowable overhang length]

■ FLCR-16

Stroke length mm	Acceleration/ deceleration G	Screw lead	Weight kg	Overhang mm A	B	C
50	0.1	2	1	180	145	630
			2	80	65	630
			4	30	25	540
		8	1	140	125	630
			2	60	55	600
			4	20	20	230
	0.3	2	1	185	150	630
			2	85	65	630
			4	30	25	300
		8	1	110	110	440
			2	45	45	190
			3	25	25	110
75/100	0.1	2	1	180	350	630
			2	80	160	630
			4	30	60	630
		8	1	150	295	630
			2	65	130	630
			4	20	45	630
	0.3	2	1	185	360	630
			2	80	160	630
			4	30	60	630
		8	1	130	265	630
			2	55	115	620
			3	30	65	370

■ FLCR-20

Stroke length mm	Acceleration/ deceleration G	Screw lead	Weight kg	Overhang mm A	B	C
50	0.1	2	1	365	275	645
			3	110	80	645
			5.5	50	35	645
		8	1	255	215	645
			3	70	60	565
			5.5	30	25	245
	0.3	2	1	365	275	645
			3	110	80	645
			5.5	50	35	365
		8	1	225	210	645
			3	60	55	235
			5	30	25	115
75/100	0.1	2	1	370	560	645
			3	110	165	645
			5.5	50	75	645
		8	1	280	440	645
			3	80	125	645
			5.5	30	50	645
	0.3	2	1	370	560	645
			3	110	165	645
			5.5	50	75	645
		8	1	270	430	645
			3	75	120	640
			5	35	60	335

■ FLCR-25

Stroke length mm	Acceleration/ deceleration G	Screw lead	Weight kg	Overhang mm A	B	C
50	0.1	2	3	390	200	940
			5	225	115	940
			11	85	45	850
		6	3	230	150	940
			5	130	85	680
			11	45	30	230
	0.3	2	3	385	200	940
			5	220	115	940
			11	85	45	415
		6	3	215	150	600
			5	120	85	335
			11	40	25	115
75/100	0.1	2	3	400	445	940
			5	225	250	940
			11	85	95	940
		6	3	285	335	940
			5	155	190	940
			11	55	65	700
	0.3	2	3	400	445	940
			5	225	250	940
			11	85	95	940
		6	3	280	335	940
			5	155	190	940
			11	55	65	370

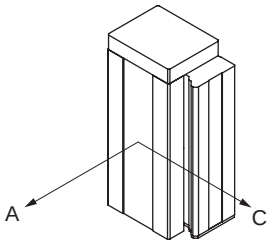
* Values for which the actuator operation cycles are limited to 5 million cycles or if the travel life is shorter than 1000km.
* The overhang direction is for a single-direction load.
* Dimensions A, B, and C are measured from the top surface of the table.
* Values are at maximum speed and maximum load capacity.
* Values may vary according to power supply voltage. Contact CKD for details.
* For acceleration/deceleration and load capacity, refer to the Load Capacity by Speed and Acceleration/ Deceleration table (page 27).

L value (guide block center distance) [mm]

Size	Stroke		
	50	75	100
FLCR-16	91	124	149
FLCR-20	101	127	152
FLCR-25	104	143	168

Allowable overhang length

[When installed vertically]



[Allowable overhang length]

■ FLCR-16

Stroke length mm	Acceleration/ deceleration G	Screw lead	Weight kg	Overhang mm A	Overhang mm C
50	0.1	2	1	160	160
			2	70	70
			4	30	30
		8	0.3	570	570
			0.4	425	420
			0.5	335	335
	0.3	2	1	160	160
			2	70	70
			4	30	30
		8	0.3	570	570
			0.4	425	420
			0.5	335	335
75/100	0.1	2	1	410	405
			2	195	195
			4	90	90
		8	0.3	630	630
			0.4	630	630
			0.5	630	630
	0.3	2	1	410	405
			2	195	195
			4	90	90
		8	0.3	630	630
			0.4	630	630
			0.5	630	630

■ FLCR-20

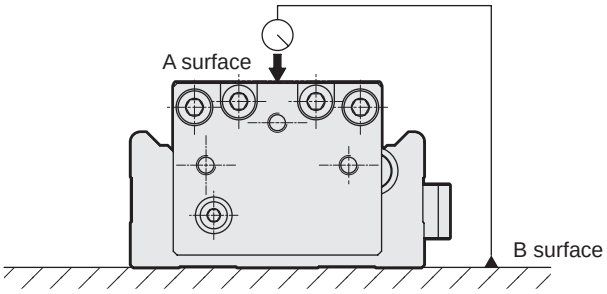
Stroke length mm	Acceleration/ deceleration G	Screw lead	Weight kg	Overhang mm A	Overhang mm C
50	0.1	2	1	300	295
			2	140	140
			4	60	60
		8	0.3	645	645
			0.5	615	610
			0.8	375	375
	0.3	2	1	295	295
			2	140	140
			4	60	60
		8	0.3	645	645
			0.5	610	610
			0.8	375	375
75/100	0.1	2	1	625	625
			2	305	305
			4	145	145
		8	0.3	645	645
			0.4	645	645
			0.5	645	645
	0.3	2	1	625	625
			2	305	305
			4	145	145
		8	0.3	645	645
			0.4	645	645
			0.5	645	645

■ FLCR-25

Stroke length mm	Acceleration/ deceleration G	Screw lead	Weight kg	Overhang mm A	Overhang mm C
50	0.1	2	2	325	320
			4	150	150
			8.5	60	60
		6	1	680	680
			2	330	330
			3	210	210
	0.3	2	2	325	320
			4	150	150
			8.5	60	60
		6	1	680	680
			2	330	330
			3	210	210
75/100	0.1	2	2	745	745
			4	360	360
			8.5	160	160
		6	1	940	940
			2	760	760
			3	500	500
	0.3	2	2	745	745
			4	360	360
			8.5	160	160
		6	1	940	940
			2	760	760
			3	500	500

* Values for which the actuator operation cycles are limited to 5 million cycles or when the operating life is shorter than 1000km.
* The overhang direction is for a single-direction load.
* Dimensions A and C are measured from the top surface of the table.
* Values are at maximum speed and maximum load capacity.
* Values may vary according to power supply voltage. Contact CKD for details.
* For acceleration/deceleration and load capacity, refer to the Load Capacity by Speed and Acceleration/Deceleration table (page 27).

Slider parallelism *Reference value

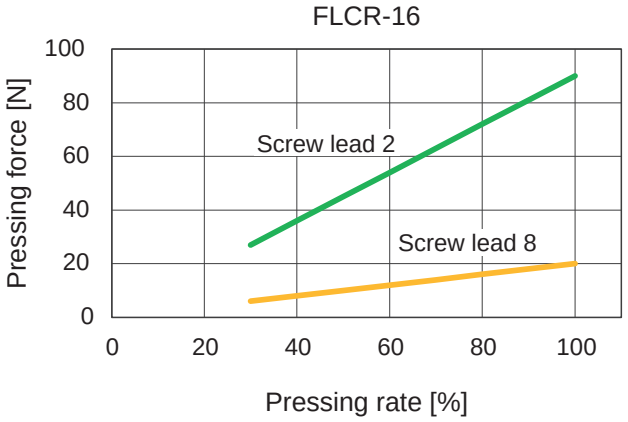


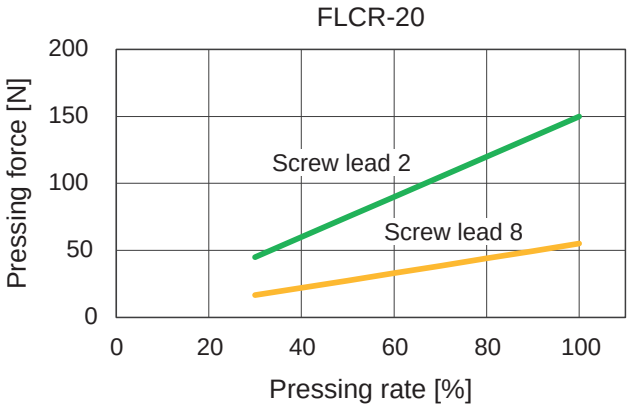
Parallelism of A surface against B surface (mm)

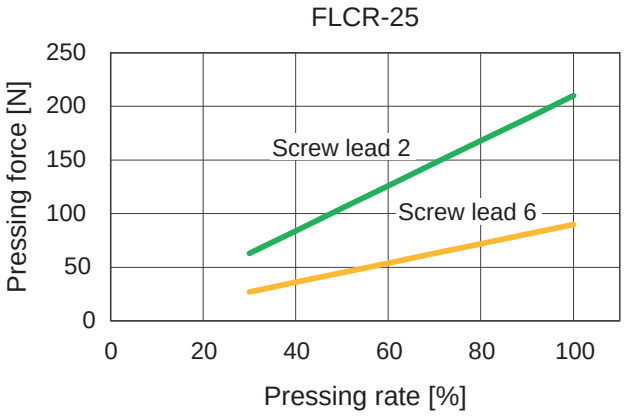
Size	Stroke		
	50	75	100
FLCR-16	0.070	0.105	0.135
FLCR-20	0.075	0.115	0.140
FLCR-25	0.080	0.110	0.140

*Parallelism with the product fixed to a surface plate.

Pressing force and pressing rate correlation diagram





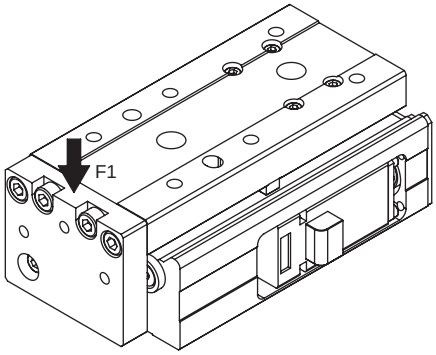


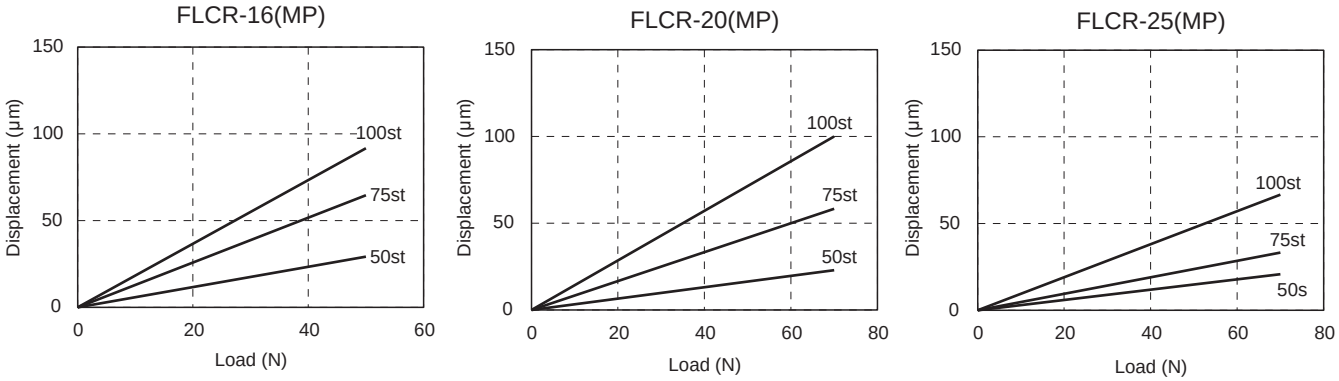
*1 The pressing force/pressing rate correlation diagram is merely a guideline. Individual motor differences and variations in mechanical efficiency may result in differences, even at the same pressing rate.

Table deflection *Reference value

[Table deflection due to pitching moment MP]

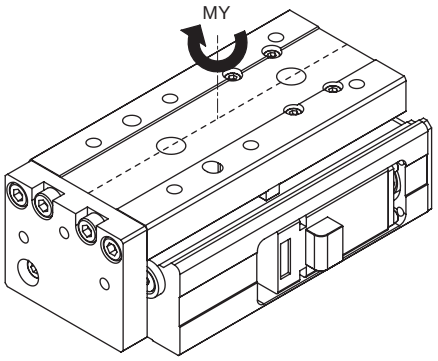
Displacement at the table end when load (F1) is applied to the table end





[Table displacement angle due to yawing moment MY]

Displacement angle of the table when rotation moment (MY) is applied to the table



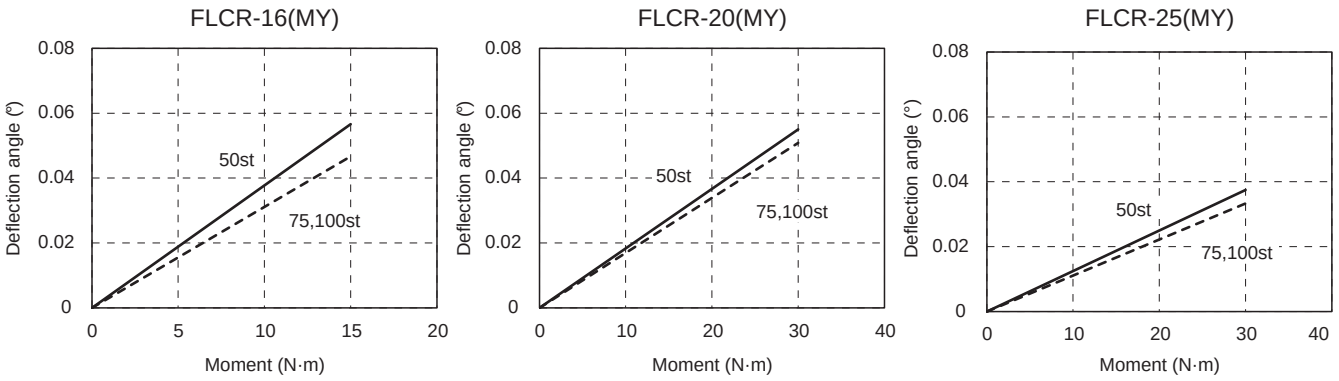
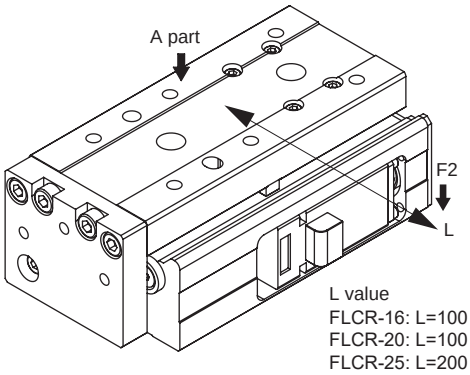


Table deflection *Reference value

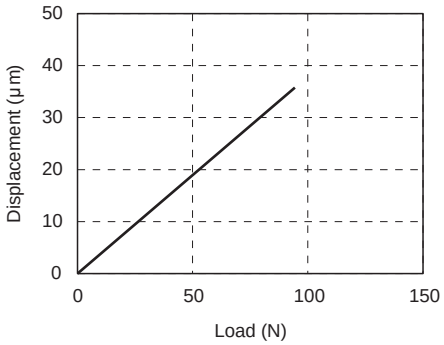
[Table deflection due to rolling moment MR]

Displacement at the table end (part A) when load (F2) is applied to a position L mm away from the center of the actuator

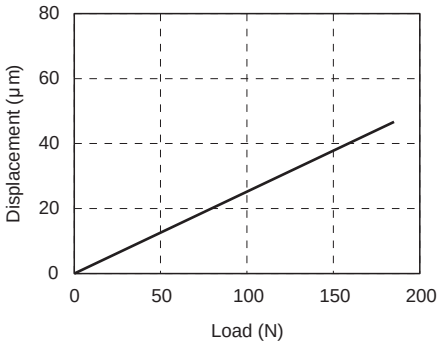


L value
FLCR-16: L=100
FLCR-20: L=100
FLCR-25: L=200

FLCR-16(MR)



FLCR-20(MR)



FLCR-25(MR)

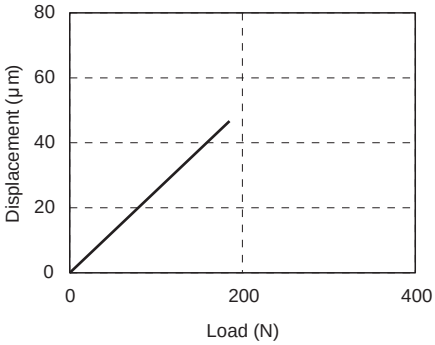


Table of Load Capacity by Speed and Acceleration/Deceleration

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The table below lists the maximum load capacity during acceleration/deceleration and the maximum speed at which operation is possible. Refer to the model that satisfies the required operation conditions.

● FLCR-16

■ Screw lead 2 (kg)

Speed (mm/s)	Horizontal		Vertical	
	Acceleration/deceleration (G)			
	0.1	0.3	0.1	0.3
2	4	4	4	4
10	4	4	4	4
20	4	4	4	4
30	4	4	4	4
40	4	4	4	4
50	4	4	4	4
60	4	4	2.5	2.5
70	4	4	2	1.5
80	4	4	1.5	1.5
90	4	4	1	0.5
100	4	3.5	0.4	

■ Screw lead 8

Speed (mm/s)	Horizontal		Vertical	
	Acceleration/deceleration (G)			
	0.1	0.3	0.1	0.3
10	4	3	0.5	0.5
50	4	3	0.5	0.5
100	4	3	0.3	0.3
150	4	3	0.3	0.3
200	4	3	0.3	0.3
250	3	3	0.3	0.3
300	3	3		

● FLCR-20

■ Screw lead 2

Speed (mm/s)	Horizontal		Vertical	
	Acceleration/deceleration (G)			
	0.1	0.3	0.1	0.3
2	5.5	5.5	6	6
15	5.5	5.5	6	6
30	5.5	5.5	6	6
45	5.5	5.5	6	6
60	5.5	5.5	6	6
75	5.5	5.5	6	6
90	5.5	5.5	6	6
100	5.5	5.5	5.5	5.5

■ Screw lead 8

Speed (mm/s)	Horizontal		Vertical	
	Acceleration/deceleration (G)			
	0.1	0.3	0.1	0.3
10	5.5	5	0.8	0.8
50	5.5	5	0.8	0.8
100	5.5	5	0.4	0.4
150	5.5	5	0.4	0.4
200	5.5	5	0.4	0.4
250	5.5	5	0.4	0.4
300	5	5	0.4	0.4

● FLCR-25

■ Screw lead 2

Speed (mm/s)	Horizontal		Vertical	
	Acceleration/deceleration (G)			
	0.1	0.3	0.1	0.3
2	11	11	8.5	8.5
15	11	11	8.5	8.5
30	11	11	8.5	8.5
45	11	11	8.5	8.5
60	11	11	8.5	8.5
75	11	11	7.5	7
90	11	11	7.5	6
100	11	11	7.5	4.5

■ Screw lead 6

Speed (mm/s)	Horizontal		Vertical	
	Acceleration/deceleration (G)			
	0.1	0.3	0.1	0.3
10	11	11	3	3
50	11	11	3	3
100	11	11	2.5	2.5
150	11	11	2	2
200	11	11	1	1
250	11	11	1	1
300	11	11	1	1

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● FLCR-16

■ Screw lead 2 (kg)

Speed (mm/s)	Horizontal		Vertical	
	Acceleration/deceleration (G)			
	0.1	0.3	0.1	0.3
2	4	4	4	4
10	4	4	4	4
20	4	4	4	4
30	4	4	4	3
40	4	4	4	3
50	4	4	3	2.5
60	4	4	0.5	0.4
70	4	4	0.5	0.4
80	4	2	0.4	
90	2.5	1		
100	2.5	0.5		

■ Screw lead 8

Speed (mm/s)	Horizontal		Vertical	
	Acceleration/deceleration (G)			
	0.1	0.3	0.1	0.3
10	4	3	0.5	0.5
50	4	3	0.5	0.5
100	4	3	0.3	0.3
150	4	3		
200	4	3		
250	1	1		

● FLCR-20

■ Screw lead 2

Speed (mm/s)	Horizontal		Vertical	
	Acceleration/deceleration (G)			
	0.1	0.3	0.1	0.3
2	5.5	5.5	6	6
15	5.5	5.5	6	6
30	5.5	5.5	6	6
45	5.5	5.5	6	6
60	5.5	5.5	6	6
75	5.5	5.5	4	3
90	5.5	5	2	2
100	5.5	2.5	1.5	1.5

■ Screw lead 8

Speed (mm/s)	Horizontal		Vertical	
	Acceleration/deceleration (G)			
	0.1	0.3	0.1	0.3
10	5.5	5	0.8	0.8
50	5.5	5	0.8	0.8
100	5.5	5	0.4	0.4
150	5.5	5	0.4	0.4
200	5.5	4.5	0.4	0.4
250	5.5	4.5		
300	3	3		

● FLCR-25

■ Screw lead 2

Speed (mm/s)	Horizontal		Vertical	
	Acceleration/deceleration (G)			
	0.1	0.3	0.1	0.3
2	11	11	8.5	8.5
15	11	11	8.5	8.5
30	11	11	8.5	8.5
45	11	11	4	4
60	11	11	3.5	3.5
75	11	11	3.5	3.5

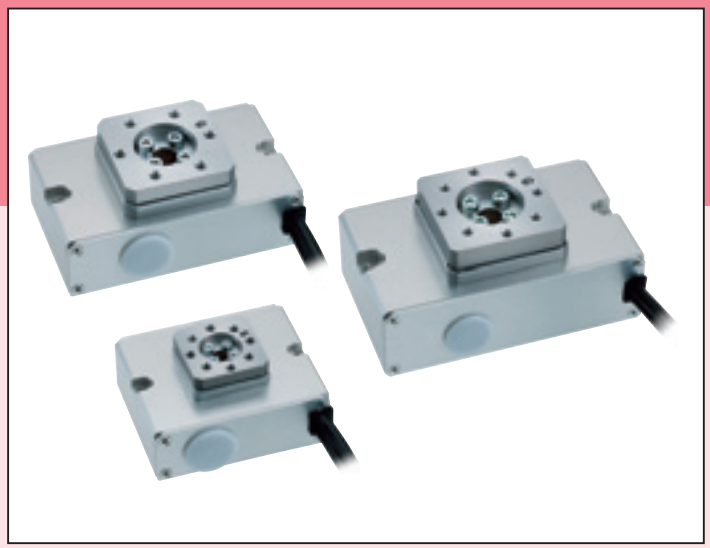
■ Screw lead 6

Speed (mm/s)	Horizontal		Vertical	
	Acceleration/deceleration (G)			
	0.1	0.3	0.1	0.3
10	11	11	3	3
50	11	11	3	3
100	11	11	2.5	2.5
150	11	11	2	2
200	11	11	1	1

FGRC

Rotary

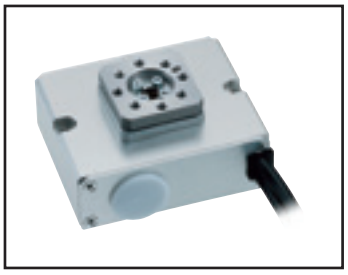
Electric actuator
Motor specification



CONTENTS

FGRC Series variation

Model No.	Motor size	Max. torque (N·m)	Max. angular speed (deg/s)
FGRC-10	□20	0.89	200
FGRC-30	□25	2.71	
FGRC-50	□35	4.66	



Electric actuator Rotary

FGRC-10

□20 stepper motor

For applicable controller ECR, 48 V and 24 V power supplies can be used.
For applicable controller ECG, 24 V power supplies can be used.

How to order

FGRC - 10 G 360 N C N - F S03

Ⓐ Size

10

Ⓑ Applicable controller *1

G	ECG
Blank	ECR

Ⓒ Encoder

C	Incremental encoder

Ⓓ Relay cable *2

N00	None
S01	Fixing cable 1 m
S03	Fixing cable 3 m
S05	Fixing cable 5 m
S10	Fixing cable 10 m
R01	Movable cable 1 m
R03	Movable cable 3 m
R05	Movable cable 5 m
R10	Movable cable 10 m

*1 Select the controller from page 45 or page 59.
*2 Refer to page 55 or page 70 for relay cable dimensions.

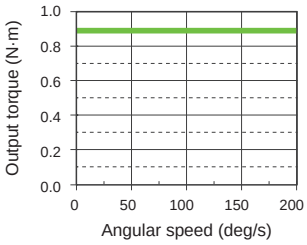
Specifications

Motor		□20 stepper motor
Encoder type		Incremental encoder
Drive method		Worm gear + belt
Travel angle *1		360
Max. output torque *2	N·m	0.89
Repeatability	deg	±0.05
Backlash *3	deg	±0.3
Lost motion	deg	0.3 or less
Operation angular speed range	deg/s	20 to 200
Pressing operation angular speed range	deg/s	20 to 30
Allowable moment of inertia *2	kg·m²	0.0057
Allowable thrust load	N	80
Allowable radial load	N	80
Allowable moment	N·m	2.5
Motor power supply voltage		24 VDC ±10% or 48 VDC ±10%
Motor section maximum instantaneous current	A	1.4
Insulation resistance		10 MΩ, 500 VDC
Withstand voltage		500 VAC for 1 minute
Operating ambient temperature, humidity		0 to 40°C (no freezing) 35 to 80% RH (no condensation)
Storage ambient temperature, humidity		-10 to 50°C (no freezing) 35 to 80% RH (no condensation)
Atmosphere		No corrosive gas, explosive gas, or dust
Degree of protection		IP40
Weight	kg	0.65

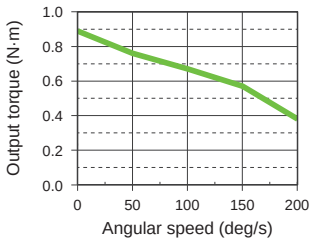
*1 Movable angle is up to 359.9° via travel instructions.
*2 Rotation torque and allowable moment of inertia change in accordance with angular speed and angular acceleration/deceleration. Refer to the table at right for details.
*3 When stopping precision is required, stop with an external stopper, etc., and complete positioning with pressing operation.

Angular speed and output torque

[At 48 VDC]

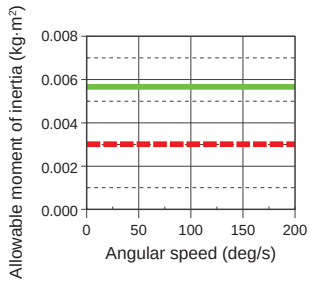


[At 24 VDC]

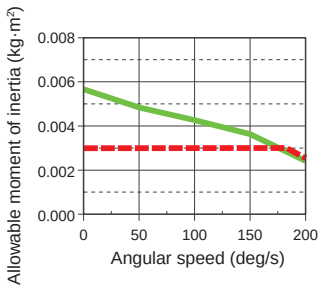


Angular speed and allowable moment of inertia

[At 48 VDC]

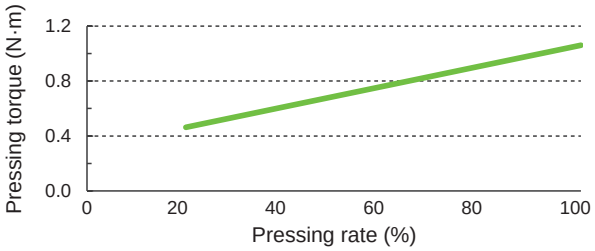


[At 24 VDC]



* When angular acceleration/deceleration is greater than 1700deg/s², operate below the dashed line.

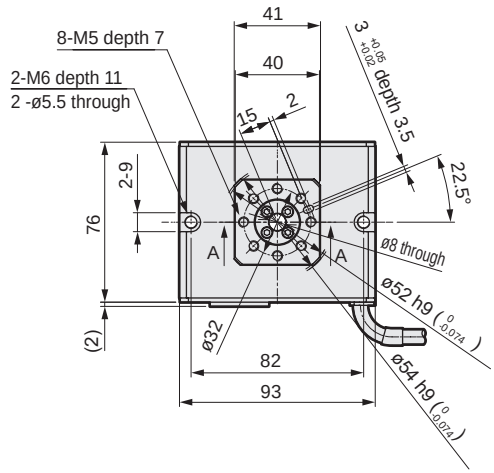
Pressing torque

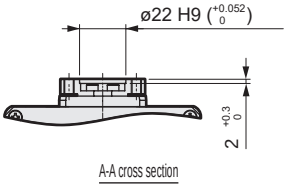


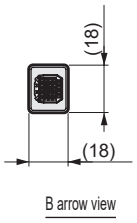
* The pressing torque and pressing rate are merely guidelines. Individual motor differences and variations in mechanical efficiency may result in differing actual values, even at the same pressing rate.

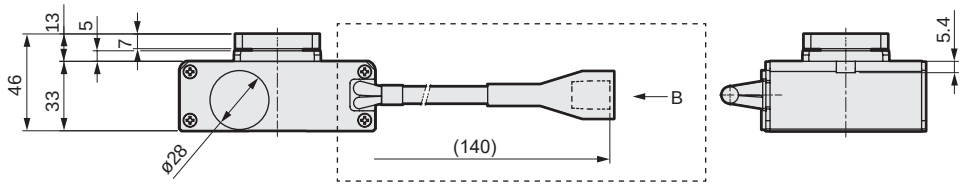
Dimensions

● FGRC-10

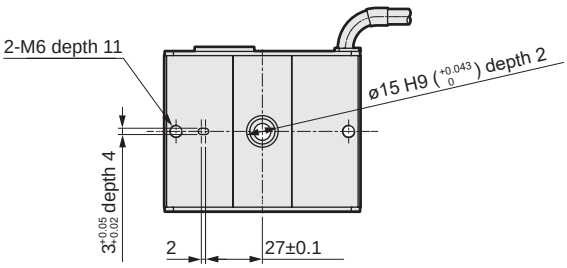




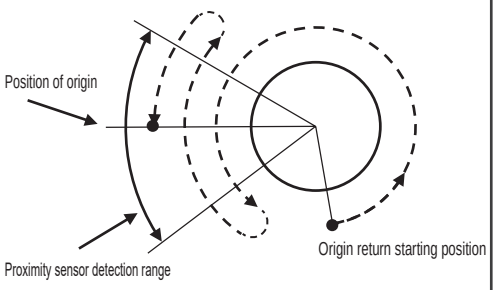




* The cable cannot be removed.

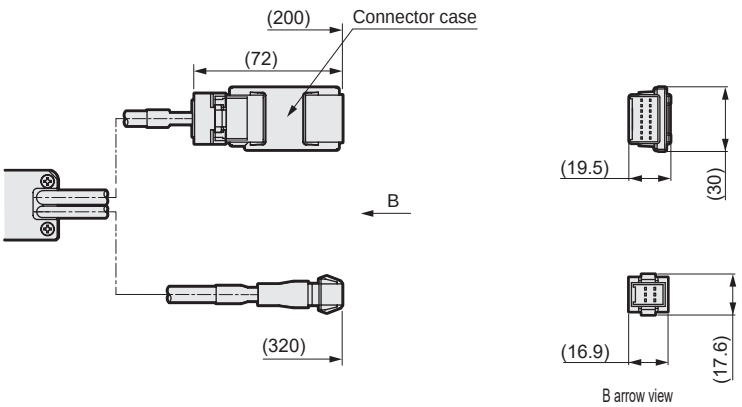


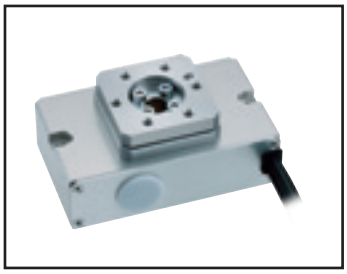
The FGRC Series detects the origin position by detecting a proximity sensor located in the actuator. Therefore, depending on the zero point return start position, the actuator may move by more than one rotation during zero point return. With FGRC-10, after detecting a proximity sensor, the actuator operates within the range of ±45deg with the sensor as its center. After that, the zero point return operation is completed.



*The angle at which the unit operates around the sensor varies somewhat for each product due to factors such as how the sensor is fixed.

* The dotted line is as shown below when connecting ECR.





Electric actuator Rotary

FGRC-30

□25 stepper motor

For applicable controller ECR, 48 V and 24 V power supplies can be used.
For applicable controller ECG, 24 V power supplies can be used.

How to order

FGRC - 30 G 360 N C N - F S03

Ⓐ Size

30

Ⓑ Applicable controller *1

G	ECG
Blank	ECR

Ⓒ Encoder

C	Incremental encoder

Ⓓ Relay cable *2

N00	None
S01	Fixing cable 1 m
S03	Fixing cable 3 m
S05	Fixing cable 5 m
S10	Fixing cable 10 m
R01	Movable cable 1 m
R03	Movable cable 3 m
R05	Movable cable 5 m
R10	Movable cable 10 m

*1 Select the controller from page 45 or page 59.
*2 Refer to page 55 or page 70 for relay cable dimensions.

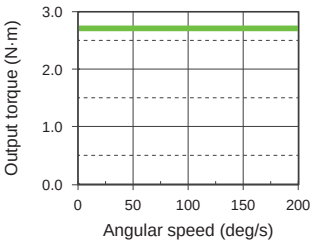
Specifications

Motor		□25 stepper motor
Encoder type		Incremental encoder
Drive method		Worm gear + belt
Travel angle *1		360
Max. output torque *2	N·m	2.71
Repeatability	deg	±0.05
Backlash *3	deg	±0.2
Lost motion	deg	0.3 or less
Operation angular speed range	deg/s	20 to 200
Pressing operation angular speed range	deg/s	20 to 30
Allowable moment of inertia *2	kg·m²	0.0173
Allowable thrust load	N	200
Allowable radial load	N	200
Allowable moment	N·m	5.5
Motor power supply voltage		24 VDC ±10% or 48 VDC ±10%
Motor section maximum instantaneous current	A	3
Insulation resistance		10 MΩ, 500 VDC
Withstand voltage		500 VAC for 1 minute
Operating ambient temperature, humidity		0 to 40°C (no freezing) 35 to 80% RH (no condensation)
Storage ambient temperature, humidity		-10 to 50°C (no freezing) 35 to 80% RH (no condensation)
Atmosphere		No corrosive gas, explosive gas, or dust
Degree of protection		IP40
Weight	kg	1.05

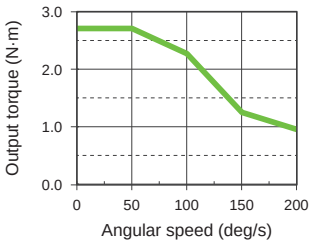
*1 Movable angle is up to 359.9° via travel instructions.
*2 Rotation torque and allowable moment of inertia change in accordance with angular speed and angular acceleration/deceleration. Refer to the table at right for details.
*3 When stopping precision is required, stop with an external stopper, etc., and complete positioning with pressing operation.

Angular speed and output torque

[At 48 VDC]

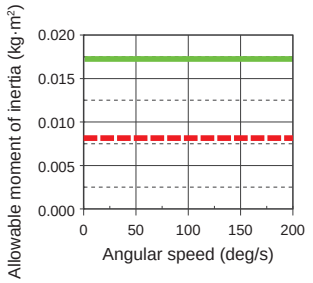


[At 24 VDC]

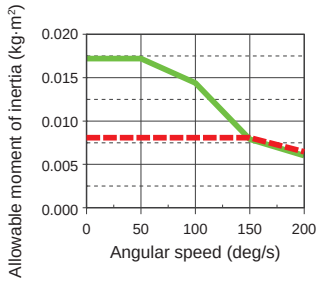


Angular speed and allowable moment of inertia

[At 48 VDC]

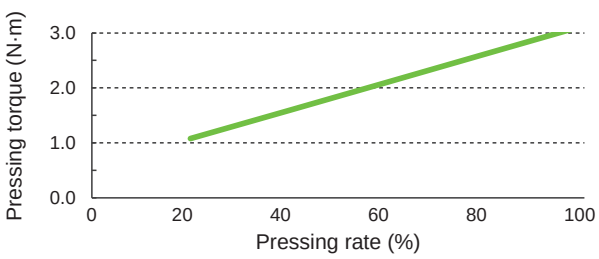


[At 24 VDC]



* When angular acceleration/deceleration is greater than 1700deg/s², operate below the dashed line.

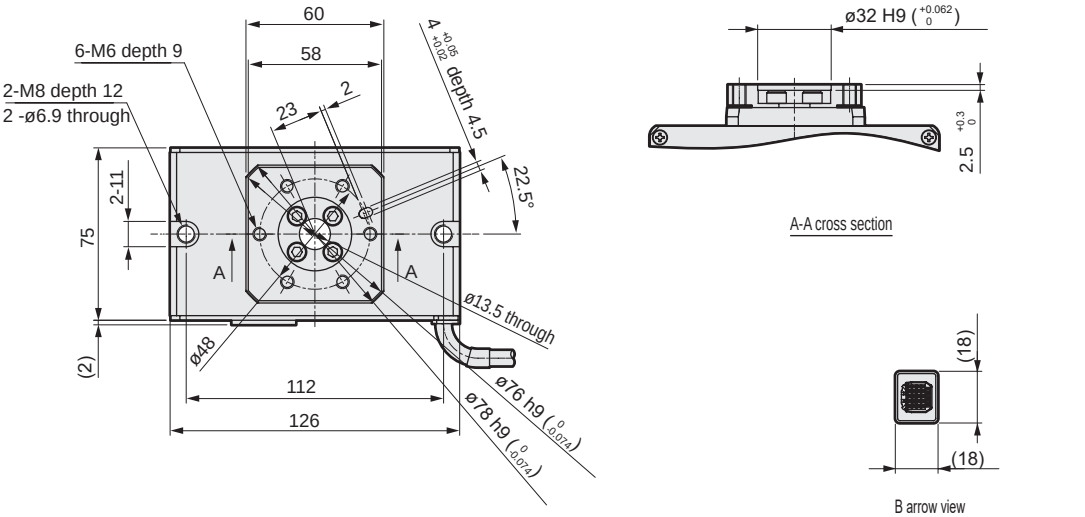
Pressing torque



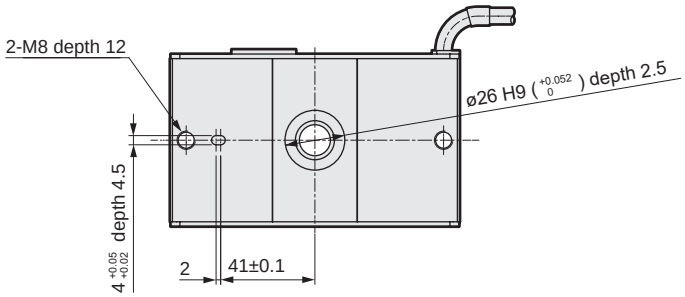
* The pressing torque and pressing rate are merely guidelines.
Individual motor differences and variations in mechanical efficiency may result in differing actual values, even at the same pressing rate.

Dimensions

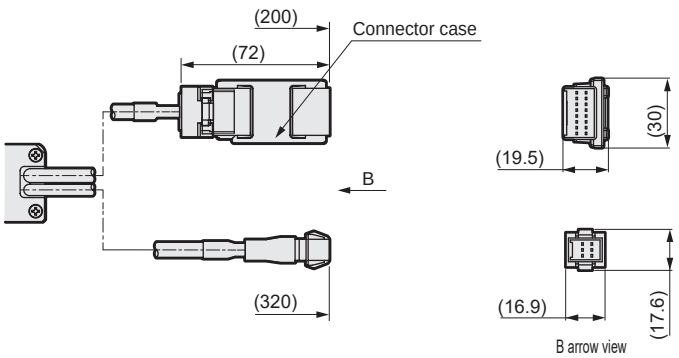
● FGRC-30



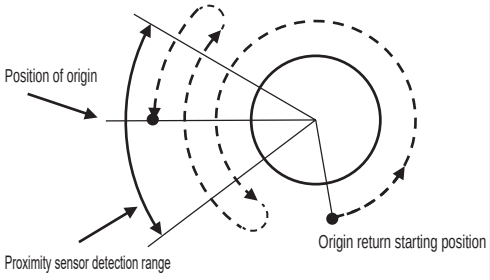
* The cable cannot be removed.



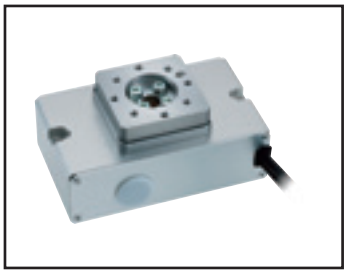
* The dotted line is as shown below when connecting ECR.



The FGRC Series detects the origin position by detecting a proximity sensor located in the actuator. Therefore, depending on the zero point return start position, the actuator may move by more than one rotation during zero point return. With FGRC-30, after detecting a proximity sensor, the actuator operates within the range of ±35deg with the sensor as its center. After that, the zero point return operation is completed.



*The angle at which the unit operates around the sensor varies somewhat for each product due to factors such as how the sensor is fixed.



Electric actuator Rotary

FGRC-50

□35 stepper motor

For applicable controller ECR, 48 V and 24 V power supplies can be used.
For applicable controller ECG, 24 V power supplies can be used.

How to order

FGRC - 50 G 360 N C N - F S03

Ⓐ Size

50

Ⓑ Applicable controller *1

G	ECG
Blank	ECR

Ⓒ Encoder

C	Incremental encoder

Ⓓ Relay cable *1*2

N00	None
S01	Fixing cable 1 m
S03	Fixing cable 3 m
S05	Fixing cable 5 m
S10	Fixing cable 10 m
R01	Movable cable 1 m
R03	Movable cable 3 m
R05	Movable cable 5 m
R10	Movable cable 10 m

*1 Select the controller from page 45 or page 59.
*2 Refer to page 55 or page 70 for relay cable dimensions.

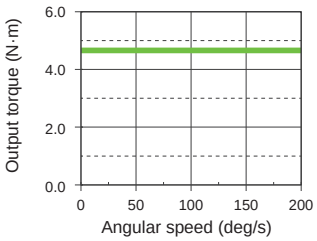
Specifications

Motor		□35 stepper motor
Encoder type		Incremental encoder
Drive method		Worm gear + belt
Travel angle *1		360
Max. output torque *2	N·m	4.66
Repeatability	deg	±0.05
Backlash *3	deg	±0.2
Lost motion	deg	0.3 or less
Operation angular speed range	deg/s	20 to 200
Pressing operation angular speed range	deg/s	20 to 30
Allowable moment of inertia *2	kg·m²	0.0297
Allowable thrust load	N	450
Allowable radial load	N	320
Allowable moment	N·m	10
Motor power supply voltage		24 VDC ±10% or 48 VDC ±10%
Motor section maximum instantaneous current	A	4.2
Insulation resistance		10 MΩ, 500 VDC
Withstand voltage		500 VAC for 1 minute
Operating ambient temperature, humidity		0 to 40°C (no freezing) 35 to 80% RH (no condensation)
Storage ambient temperature, humidity		-10 to 50°C (no freezing) 35 to 80% RH (no condensation)
Atmosphere		No corrosive gas, explosive gas, or dust
Degree of protection		IP40
Weight	kg	1.85

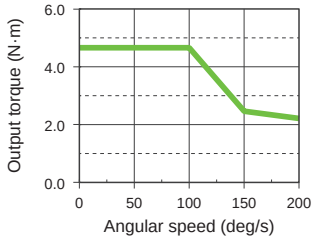
*1 Movable angle is up to 359.9° via travel instructions.
*2 Rotation torque and allowable moment of inertia change in accordance with angular speed and angular acceleration/deceleration. Refer to the table at right for details.
*3 When stopping precision is required, stop with an external stopper, etc., and complete positioning with pressing operation.

Angular speed and output torque

[At 48 VDC]

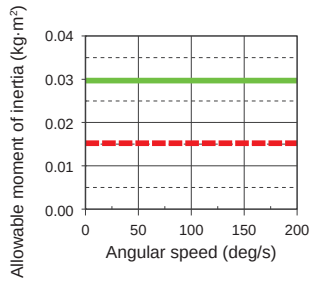


[At 24 VDC]

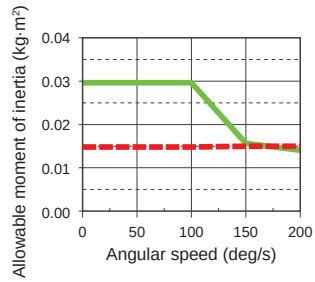


Angular speed and allowable moment of inertia

[At 48 VDC]

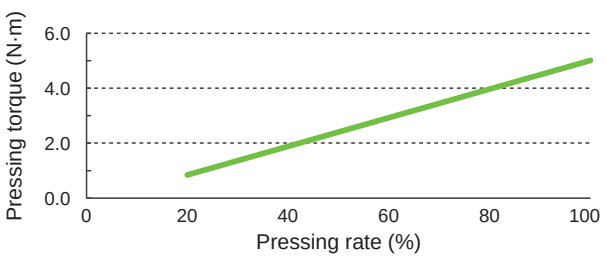


[At 24 VDC]



* When angular acceleration/deceleration is greater than 1700deg/s², operate below the dashed line.

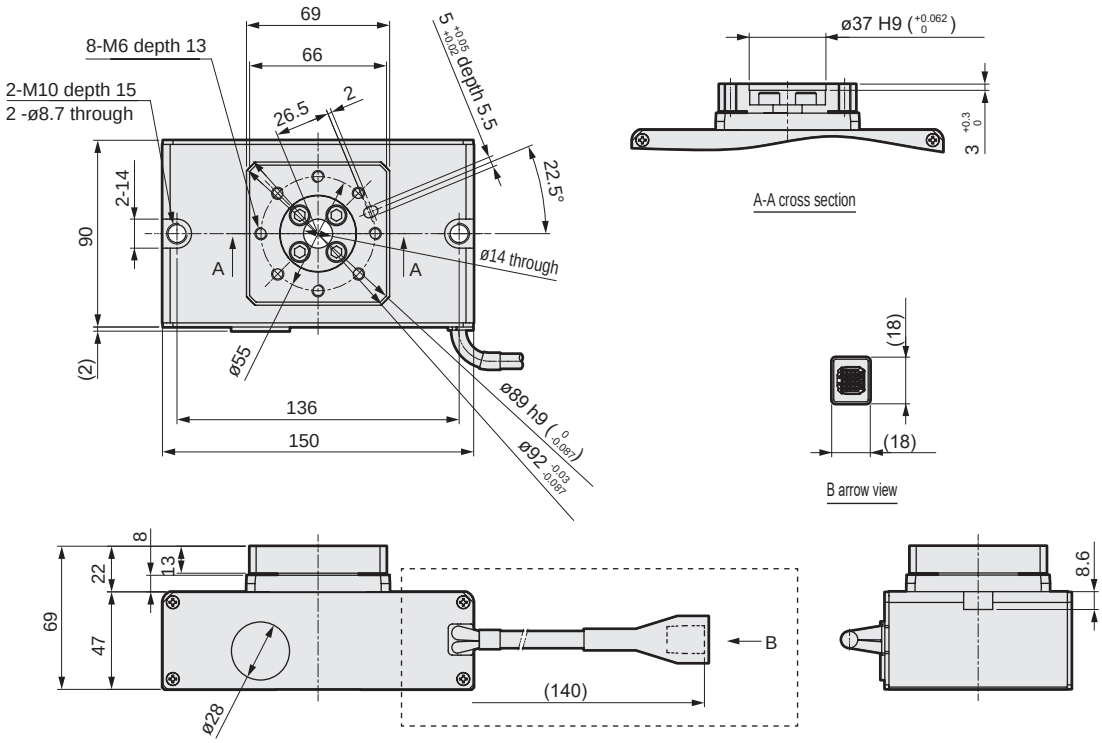
Pressing torque



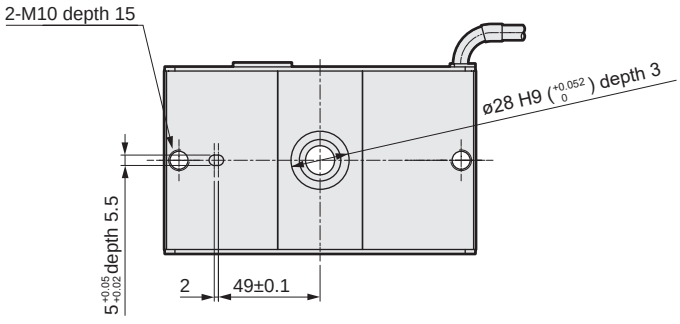
* The pressing torque and pressing rate are merely guidelines. Individual motor differences and variations in mechanical efficiency may result in differing actual values, even at the same pressing rate.

Dimensions

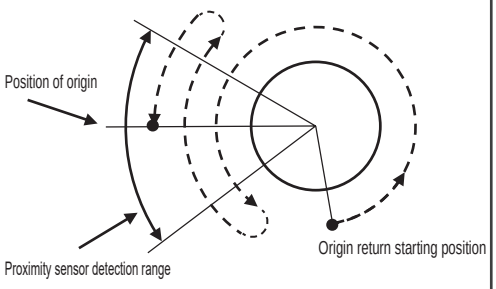
● FGRC-50



* The cable cannot be removed.

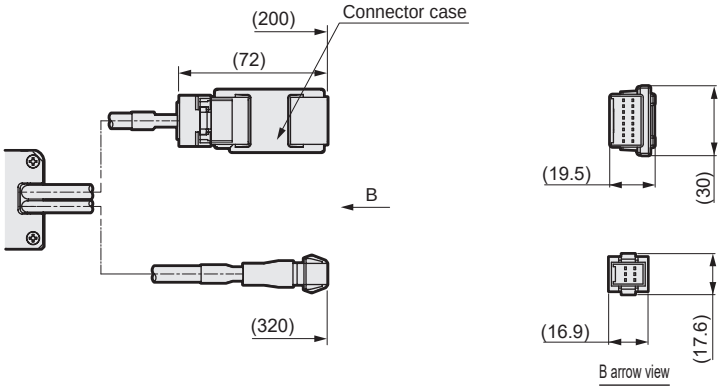


The FGRC Series detects the origin position by detecting a proximity sensor located in the actuator. Therefore, depending on the zero point return start position, the actuator may move by more than one rotation during zero point return. With FGRC-50, after detecting a proximity sensor, the actuator operates within the range of ±25deg with the sensor as its center. After that, the zero point return operation is completed.



*The angle at which the unit operates around the sensor varies somewhat for each product due to factors such as how the sensor is fixed.

* The dotted line is as shown below when connecting ECR.

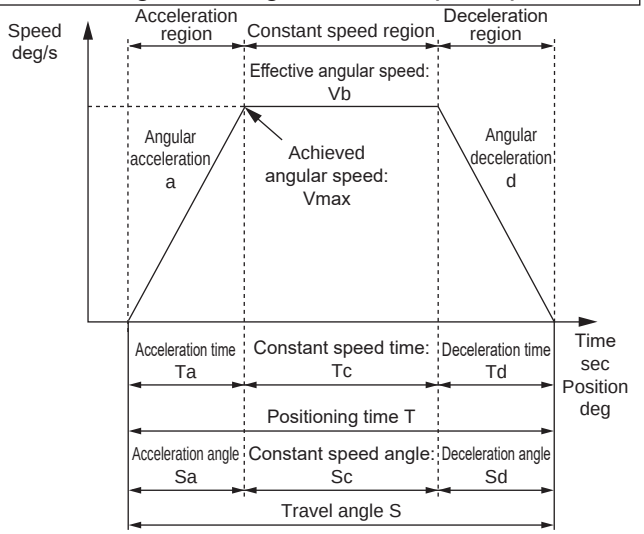


Model selection

STEP 1 Confirming positioning time

Calculate the positioning time with the selected product according to the following example and confirm that the required tact is attainable.

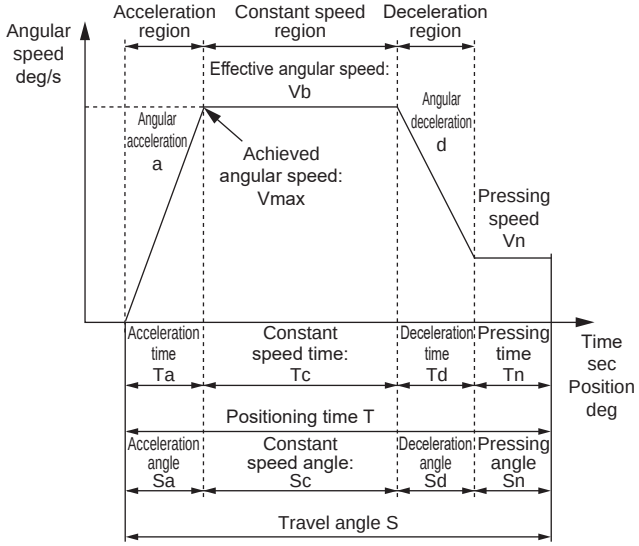
Positioning time for general transport operation



	Item	Code	Unit	Remarks
Set value	Set angular speed	V	deg/s	
	Set angular acceleration	a	deg/s^2	
	Set angular deceleration	d	deg/s^2	
	Travel angle	S	deg	
Calculated value	Achieved angular speed	Vmax	deg/s	$= \{2 \times a \times d \times S/(a + d)\}^{1/2}$
	Effective angular speed	Vb	deg/s	The lesser value of V and Vmax
	Acceleration time	Ta	s	= Vb/a
	Deceleration time	Td	s	= Vb/d
	Constant speed time	Tc	s	= Sc/Vb
	Acceleration angle	Sa	deg	$= (a \times Ta^2)/2$
	Deceleration angle	Sd	deg	$= (d \times Td^2)/2$
	Constant speed angle	Sc	deg	= S - (Sa + Sd)
	Positioning time	T	s	= Ta + Tc + Td

* Do not use at angular speeds that exceed the specifications.
* Depending on angular acceleration/deceleration and travel angle, the trapezoid speed waveform may not be formed (the set angular speed may not be achieved).
  In this case, select the effective angular speed (Vb) from the set angular speed (V) and the achieved angular speed (Vmax), whichever is smaller.
* Use at the angular acceleration/angular deceleration of 3000 deg/s^2 or less.
* While settling time depends on working conditions, it may take 0.2 seconds or so.
* 1G≒9800deg/s^2

Positioning time for pressing operation

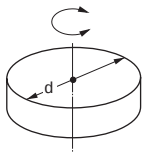
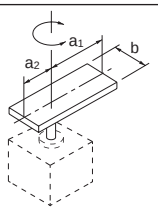


	Item	Code	Unit	Remarks
Set value	Set angular speed	V	deg/s	
	Set angular acceleration	a	deg/s^2	
	Set angular deceleration	d	deg/s^2	
	Travel angle	S	deg	
	Pressing speed	Vn	deg/s	
	Pressing angle	Sn	deg	
Calculated value	Achieved angular speed	Vmax	deg/s	$=\{2 \times a \times d \times (S - Sn + Vn^2/2/d)/(a + d)\}^{1/2}$
	Effective angular speed	Vb	deg/s	The lesser value of V and Vmax
	Acceleration time	Ta	s	= Vb/a
	Deceleration time	Td	s	= (Vb - Vn)/d
	Constant speed time	Tc	s	= Sc/Vb
	Pressing time	Tn	s	= Sn/Vn
	Acceleration angle	Sa	deg	$= (a \times Ta^2)/2$
	Deceleration angle	Sd	deg	= ((Vb + Vn) × Td)/2
	Constant speed angle	Sc	deg	= S - (Sa + Sd + Sn)
	Positioning time	T	s	= Ta + Tc + Td + Tn

* Do not use at angular speeds that exceed the specifications.
* Depending on angular acceleration/deceleration and travel angle, the trapezoid speed waveform may not be formed (the set angular speed may not be achieved).
  In this case, select the effective angular speed (Vb) from the set angular speed (V) and the achieved angular speed (Vmax), whichever is smaller.
* Use at the angular acceleration/angular deceleration of 3000 deg/s^2 or less.
* While settling time depends on working conditions, it may take 0.2 seconds or so.
* 1G≒9800deg/s^2

STEP 2 Confirming load moment of inertia

Calculate the load moment of inertia, and then select a model from the angular speed and allowable moment of inertia graph.

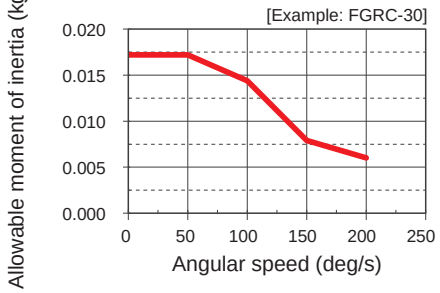
Shape	Sketch	Requirements	Moment of inertia I kg·m^2	Radius of rotation
Dial plate		● Diameter d (m) ● Weight M (kg)	$I = \frac{Md^2}{8}$	$\frac{d^2}{8}$
Thin rectangle plate (rectangular parallelepiped)		●Plate length a_1, a_2 ●Side length b ●Weight M_1, M_2	$I = \frac{M_1}{12}(4a_1^2 + b^2) + \frac{M_2}{12}(4a_2^2 + b^2)$	$\frac{(4a_1^2 + b^2)+(4a_2^2 + b^2)}{12}$

*Refer to page 43.

[At 24 VDC]

Angular speed and allowable moment of inertia

[Example: FGRC-30]



*Refer to pages 30, 32 and 34.

STEP 3 Confirming required torque

Use the following equations to determine the maximum load torque, and then refer to the angular speed and output torque graph to select the applicable model.

Selection method is roughly categorized into three load types.
In each case, the required torque must be calculated. If the load is a compound load, add each torque to calculate the required torque.

(1) Static load (T_S)
When static pushing force is required for clamp, etc.

$T_S = F_S \times L$

T_S: Required torque (N·m)
F_S: Required force (N)
L: Length from center of rotation to pressure cone apex (m)

(2) Resistance load (T_R)
When force including frictional force, gravity or other external force is applied

$T_R = 3 \times F_R \times L$

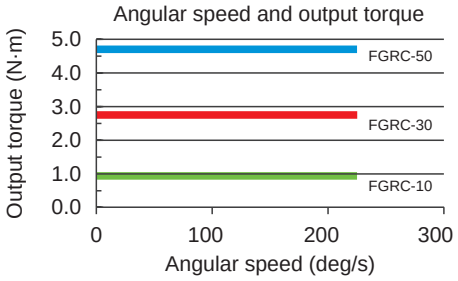
T_R: Required torque (N·m)
F_R: Required force (N)
L: Length from center of rotation to pressure cone apex (m)

(3) Inertia load (T_A)
When the object is rotated

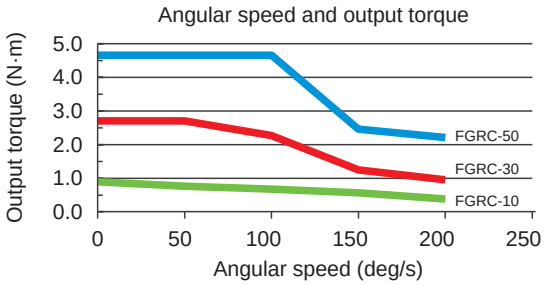
$T_A = 3 \times I \times \dot{\omega}$

T_A: Required torque (N·m)
I: Moment of inertia (kg·m^2)
$\dot{\omega}$: Set angular acceleration/deceleration (rad/s^2)
θ: Travel angle (rad)
t: Travel time (s)

[At 48 VDC]



[At 24 VDC]



* Calculate $\dot{\omega}$ from angular acceleration or angular deceleration, whichever is higher.
The formula below can be used to determine the radian (rad) from the degree (deg).
rad = deg x (π/180)

Use the moment of inertia and travel time (pages 30, 32, and 34) or the figure for moment of inertia calculation (page 43) to calculate the moment of inertia.

STEP 4 Confirming allowable load

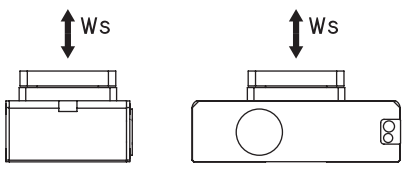
If load applies to table, load is to be within allowable value on Table 1.
For combined multiple load, ensure that the total is 1.0 or less.

Table 1

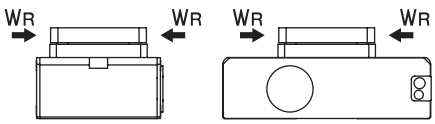
Model No.	W_S max	W_R max	M max
FGRC-10	80	80	2.5
FGRC-30	200	200	5.5
FGRC-50	450	320	10

W_S : Thrust load (N)
W_R : Radial load (N)
M : Moment load (N·m)
W_{Smax} : Allowable thrust load (N)
W_{Rmax} : Allowable radial load (N)
M_{max} : Allowable moment load (N·m)

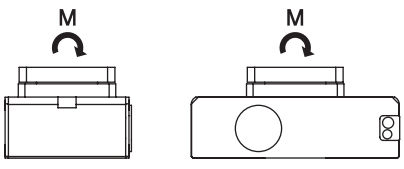
(1) Thrust load (axial load)



(2) Radial load (lateral load)



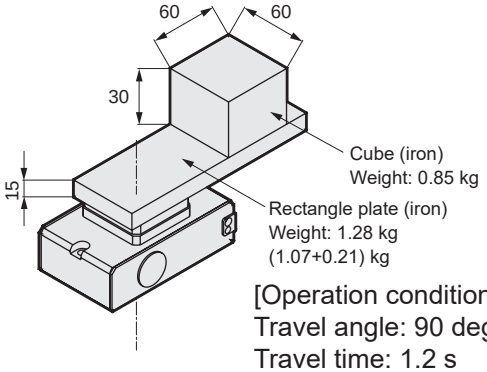
(3) Moment load

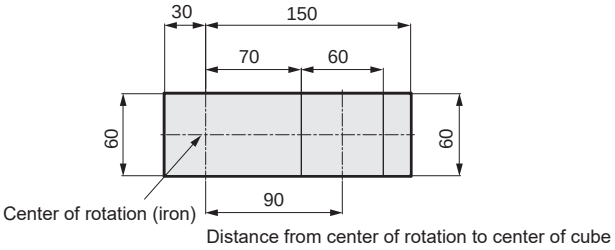


Combined load
Substitute the result to the following formula, and check after each load is calculated.

$$\frac{W_S}{W_S max} + \frac{W_R}{W_R max} + \frac{M}{M max} \leq 1.0$$

Selection example [Horizontal]





[Operation conditions]
Travel angle: 90 deg
Travel time: 1.2 s
Angular acceleration/deceleration: 1000 deg/s^2 (0.1 G)

STEP 1 Confirming positioning time

Positioning time is 1.09 s according to operation conditions.
This is lower than the required travel time of 1.2 s, so proceed to the next step.

Set value

Angular speed	V	90 deg/s
Angular acceleration	a	1000 deg/s^2
Angular deceleration	d	1000 deg/s^2
Travel angle	S	90 deg

Calculated value

Achieved angular speed	Vmax	300 deg/s
Effective angular speed	Vb	90 deg/s
Acceleration time	Ta	0.09 s
Deceleration time	Td	0.09 s
Constant speed time	Tc	0.91 s
Positioning time	T	1.09 s

STEP 2 Confirming load moment of inertia

Calculate the moment of inertia I, and then temporarily select a model from the angular speed and allowable moment of inertia graph.

[Rectangle plate]

$$I1 = 1.07 \times \frac{4 \times 0.15^2 + 0.06^2}{12} + 0.21 \times \frac{4 \times 0.03^2 + 0.06^2}{12} = 0.00847$$

[Cube]

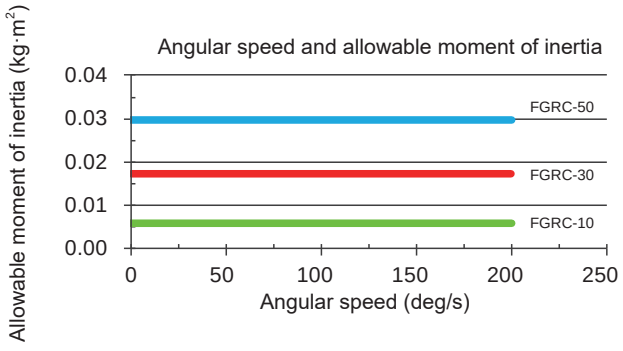
$$I2 = 0.85 \times \left[\frac{0.06^2 + 0.06^2}{12} + 0.09^2\right] = 0.00740$$

The overall moment of inertia I is as follows.

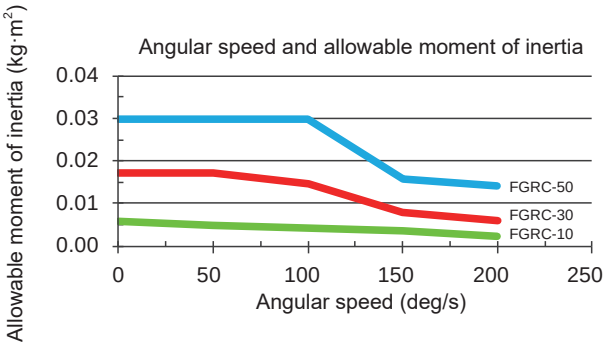
$$I = I1 + I2 = 0.01587 \text{ (kg·m}^2\text{)} \ldots\ldots (1)$$

From the graph of angular speed and allowable moment of inertia, select FGRC-30 [48 VDC], which satisfies the allowable moment of inertia at angular speed 90 deg/s.

[At 48 VDC]



[At 24 VDC]



STEP 3 Confirming required torque

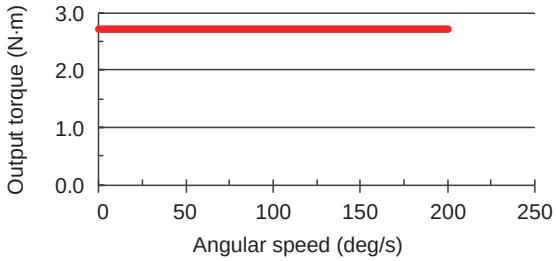
Calculate the load torque and confirm that it is within the range in the graph of angular speed and output torque.
Set acceleration/deceleration from a=d=1000 deg/s^2

$$\dot{\omega} = 1000 \times \frac{\pi}{180}$$

$$= 17.45 \text{ rad/s}^2 \quad \ldots\ldots(2)$$

From (1) and (2), inertia load (T_A) is
$T_A = 3 \times 0.01587 \times 17.45$
$= 0.831$ (N·m)

[48 VDC] <FGRC-30>



The intersection of angular speed V = 90 (deg/s) and T_A = 0.598 (N·m) is toward the interior of the graph, meaning use is possible.

STEP 4 Confirming allowable load

Finally, check if value is within allowable load range after load value that applies to table is calculated.

[Thrust load]
The total weight is
1.07 + 0.21 + 0.85 = 2.13 (kg)
Therefore, the thrust load (W_S) is
$W_S = 2.13 \times 9.8 = 20.9$ (N)

[Radial load]
Since no radial load is applied,
$W_R = 0$ (N)

[Moment load]
The moment load from the rectangle plate (M_1) is
1.07 × 9.8 = 10.5 (N)
0.21 × 9.8 = 2.06 (N)
Therefore,
$M_1 = 10.5 \times 0.075 - 2.06 \times 0.015 = 0.76$ (N·m)

The moment load from the rectangular parallelepiped (M_2) is
0.85 × 9.8 = 8.3 (N)
Therefore,
$M_2 = 8.3 \times 0.09 = 0.75$ (N·m)

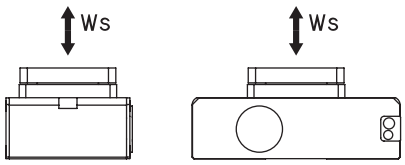
When M_1 and M_2 are totaled,
M= 0.76 + 0.75 = 1.51 (N·m)

$$\frac{W_S}{W_{Smax}} + \frac{W_R}{W_{Rmax}} + \frac{M}{M_{max}}$$

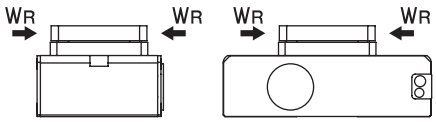
$$\frac{20.9}{200} + \frac{0}{200} + \frac{1.51}{5.5} = 0.4 \leq 1.0$$

The total load value is within the allowable load value, so FGRC-30 can be selected.

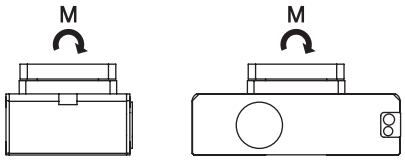
(1) Thrust load (axial load)



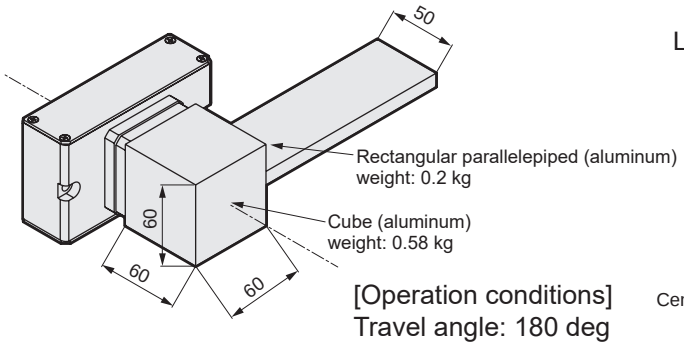
(2) Radial load (axial load)



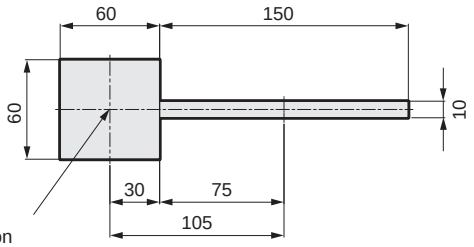
(3) Moment load (axial load)



Selection example [Wall-mounted]



Load details



(Distance from center of rotation to rectangle plate load center)

[Operation conditions]
Travel angle: 180 deg
Travel time: 1.8 s
Angular acceleration/deceleration: 1000 deg/s^2 (0.1 G)

STEP 1 Confirming positioning time

Positioning time is 1.57 s according to operation conditions.
This is lower than the required travel time of 1.8 s, so proceed to the next step.

Set value

Angular speed	V	125 deg/s
Angular acceleration	a	1000 deg/s^2
Angular deceleration	d	1000 deg/s^2
Travel angle	S	180 deg

Calculated value

Achieved angular speed	Vmax	424.3 deg/s
Effective angular speed	Vb	125 deg/s
Acceleration time	Ta	0.125 s
Deceleration time	Td	0.125 s
Constant speed time	Tc	1.315 s
Positioning time	T	1.57 s

STEP 2 Confirming load moment of inertia

Calculate the moment of inertia I, and then temporarily select a model from the angular speed and allowable moment of inertia graph.

[Rectangular parallelepiped]

$$I_1 = 0.2 \times \frac{(0.01^2 + 0.15^2)}{12} + 0.2 \times 0.105^2 = 0.00258\ (kg \cdot m^2)$$

[Cube]

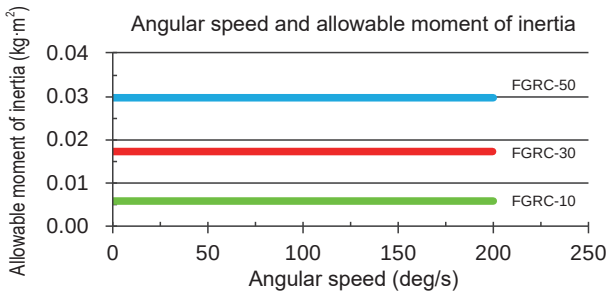
$$I_2 = 0.58 \times \frac{(0.06^2 + 0.06^2)}{12} = 0.00035\ (kg \cdot m^2)$$

Therefore, the overall moment of inertia is as follows.

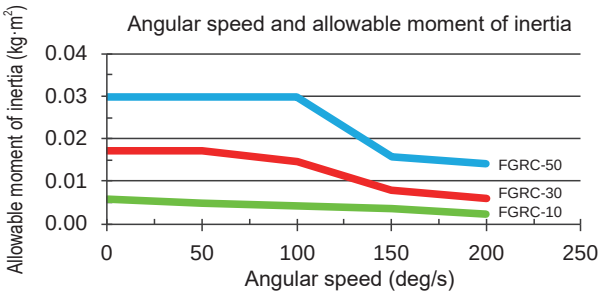
$$I = I_1 + I_2 = 0.00293\ (kg \cdot m^2) \ldots\ldots (1)$$

From the graph of angular speed and allowable moment of inertia, select FGRC-10 [48 VDC], which satisfies the allowable moment of inertia at angular speed 125 deg/s.

[At 48 VDC]



[At 24 VDC]



STEP 3 Confirming required torque

Calculate the load torque and confirm that it is within the range in the graph of angular speed and output torque.
Calculate the load torque using the gravitational resistance load (T_R) and inertia load (T_A).

[Resistance load]

$T_R = 3 \times 0.2 \times 9.8 \times 0.105$

$= 0.617$ (N·m) ……(2)

[Inertia load]

Set acceleration/deceleration from a = d = 1000 deg/s^2

$$\dot{\omega} = 1000 \times \frac{\pi}{180}$$

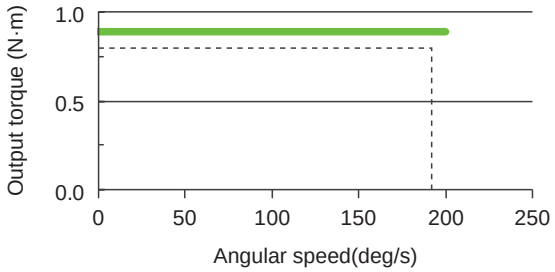
$= 17.45$ rad/s^2 ……(3)

From (1) and (3), inertia load (T_A) is

$T_A = 3 \times 0.00293 \times 17.45$

$= 0.153$ (N·m) ……(4)

[48 VDC] <FGRC-10>



From (2) and (4), total load torque (T) is

$T = T_R + T_A = 0.617 + 0.153 = 0.77$ (N·m)

The intersection of angular speed V=180(deg/s) and T=0.77(N·m) is toward the interior of the graph, meaning use is possible.

STEP 4 Confirming allowable load

Finally, check if value is within allowable load range after load value that applies to table is calculated.

[Thrust load]
Since no thrust load is applied,
$W_S = 0$ (N)

[Radial load]
The total weight is
0.2 + 0.58 = 0.78(kg)
Therefore, the radial load (W_R) is
$W_R = 0.78 \times 9.8 = 7.64$(N)

[Moment load]
Based on the figure to the lower right, the moment load (M) is
$M = 0.03 \times (0.2 + 0.58) \times 9.8 = 0.23$ (N·m)

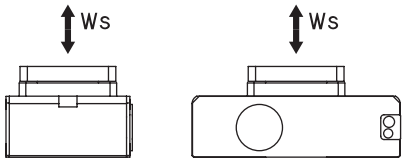
Therefore,

$$\frac{W_S}{W_{Smax}} + \frac{W_R}{W_{Rmax}} + \frac{M}{M_{max}}$$

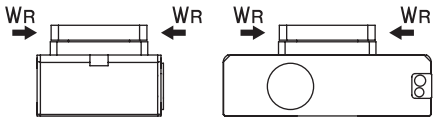
$$\frac{0}{80} + \frac{7.64}{80} + \frac{0.23}{2.5} = 0.19 \leq 1.0$$

Therefore, the total load value is within the total allowable load, so FGRC-10 can be selected.

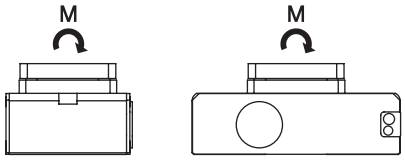
(1) Thrust load (axial load)



(2) Radial load (axial load)



(3) Moment load (axial load)



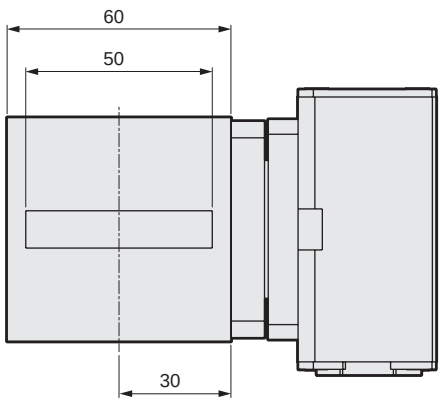
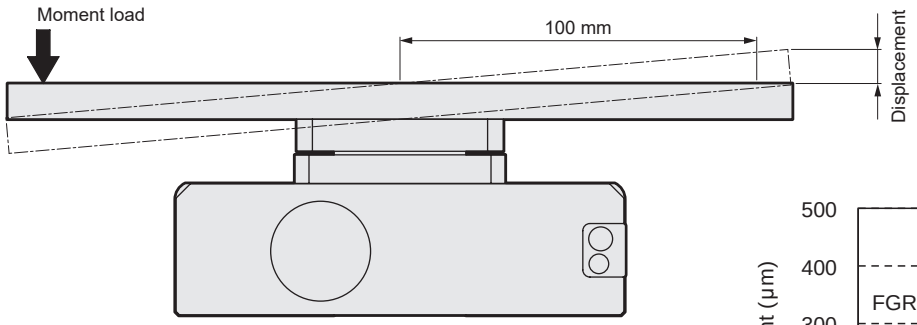
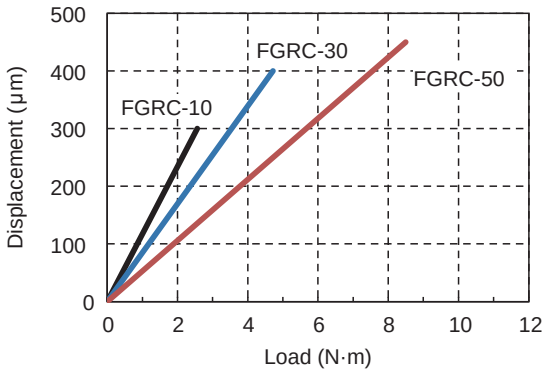


Table deflection *Reference value

Table deflection at 100 mm away from center of rotation when moment load is applied to FGRC.
(It is assumed that the table is in a non-rotating stationary state.)
Table deflection





Deflection: Displacement during 180° travel *Reference value

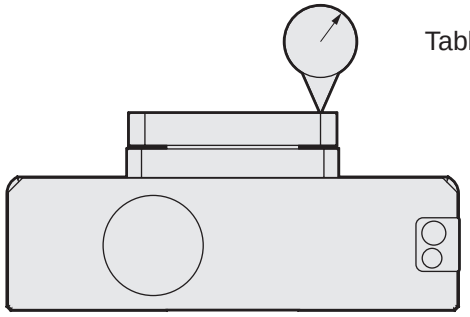


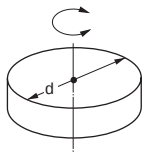
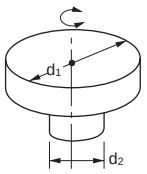
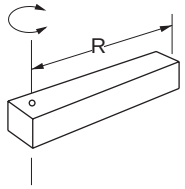
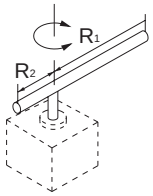
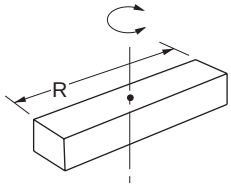
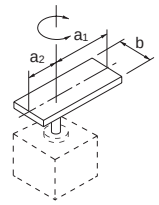
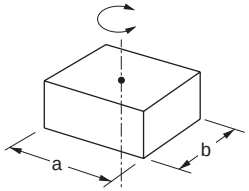
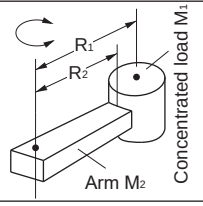
Table top runout

(mm)

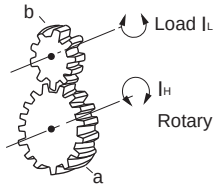
Measurement location	FGRC
Table top runout	0.1

Figure for moment of inertia calculation

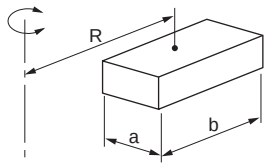
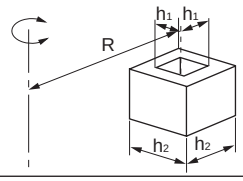
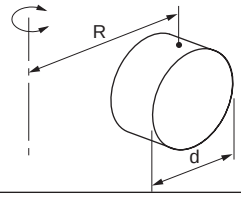
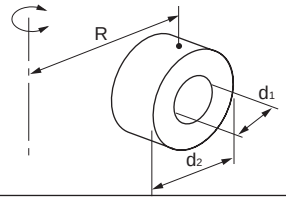
When rotary shaft passes through the workpiece

Shape	Sketch	Requirements	Moment of inertia I kg·m²	Radius of rotation K_1^2	Remarks
Dial plate		● Diameter d(m) ● Weight M(kg)	$I = \frac{Md^2}{8}$	$\frac{d^2}{8}$	● No mounting direction ● For sliding use, contact CKD.
Stepped dial plate		● Diameter d_1(m) d_2(m) ● Weight d_1 section M_1(kg) d_2 section M_2(kg)	$I = \frac{1}{8}(M_1d_1^2 + M_2d_2^2)$	$\frac{d_1^2 + d_2^2}{8}$	● Ignore when the d_2 section is extremely small compared to the d_1 section
Bar (center of rotation at end)		● Bar length R(m) ● Weight M(kg)	$I = \frac{MR^2}{3}$	$\frac{R^2}{3}$	● Mounting direction is horizontal ● Oscillating time changes when the mounting direction is vertical
Thin rod		● Bar length R_1 R_2 ● Weight M_1 M_2	$I = \frac{M_1/R_1^2}{3} + \frac{M_2/R_2^2}{3}$	$\frac{R_1^2 + R_2^2}{3}$	● Mounting direction is horizontal ● Oscillating time changes when the mounting direction is vertical
Bar (center of rotation at center of gravity)		● Bar length R (m) ● Weight M(kg)	$I = \frac{MR^2}{12}$	$\frac{R^2}{12}$	● No mounting direction
Thin rectangle plate (rectangular parallelepiped)		● Plate length a_1 a_2 ● Side length b ● Weight M_1 M_2	$I = \frac{M_1}{12}(4a_1^2 + b^2) + \frac{M_2}{12}(4a_2^2 + b^2)$	$\frac{(4a_1^2 + b^2) + (4a_2^2 + b^2)}{12}$	● Mounting direction is horizontal ● Oscillating time changes when the mounting direction is vertical
Rectangular parallelepiped		● Side length a(m) b(m) ● Weight M(kg)	$I = \frac{M}{12}(a^2 + b^2)$	$\frac{a^2 + b^2}{12}$	● No mounting direction ● For sliding use, contact CKD.
Concentrated load		● Shape of concentrated load ● Length to center of gravity of concentrated load R_1 ● Arm length R_2(m) ● Concentrated load weight M_1(kg) ● Arm weight M_2(kg)	$I = M_1(R_1^2 + k_1^2) + \frac{M_2R_2^2}{3}$	Calculate k_1^2 according to shape of concentrated load	● Mounting direction is horizontal ● When M2 is extremely small compared to M1, it may be calculated as M2 = 0

How to convert load J_L to rotary actuator shaft rotation when using with gear

Gear		● Gear Rotary side (No. of teeth) a Load side (No. of teeth) b ● Load moment of inertia N·m	Load moment of inertia for the rotary actuator's shaft rotation $I_H = \left(\frac{a}{b}\right)^2 I_L$		● When gear shape is larger, gear moment of inertia should be considered.

● Rotary shaft offsets from workpiece

Shape	Sketch	Requirements	Moment of inertia I kg·m²	Remarks
Rectangular parallelepiped		● Side length a(m) ● Distance from rotary shaft to load center b(m) R(m) ● Weight M(kg)	$I = \frac{M}{12}(a^2 + b^2) + MR^2$	● Same for cube
Hollow rectangular parallelepiped		● Side length h1(m) h2(m) ● Distance from rotary shaft to load center R(m) ● Weight M(kg)	$I = \frac{M}{12}(h_1^2 + h_2^2) + MR^2$	● Cross section is for cube only
Cylinder		● Diameter d(m) ● Distance from rotary shaft to load center R(m) ● Weight M(kg)	$I = \frac{Md^2}{16} + MR^2$	
Hollow cylinder		● Diameter d1(m) d2(m) ● Distance from rotary shaft to load center R(m) ● Weight M(kg)	$I = \frac{M}{16}(d_1^2 + d_2^2) + MR^2$	

* To find moment of inertia, first convert load, jig, etc., to simple shapes with modeling, then calculate values. For the combined load, calculate each inertial moment and their total.

ECR

Controller

CONTENTS

Controller

ECR Series

All sizes of EBS, EBR, FLSH, FLCR, and FGRC can be operated with the same controller

How to order

ECR-MNNN3B - NP A 02

(A) (B) (C)

(A) Interface specifications	
NP	Parallel I/O (NPN and PNP common)
LK	IO-Link
CL	CC-Link
EC	EtherCAT

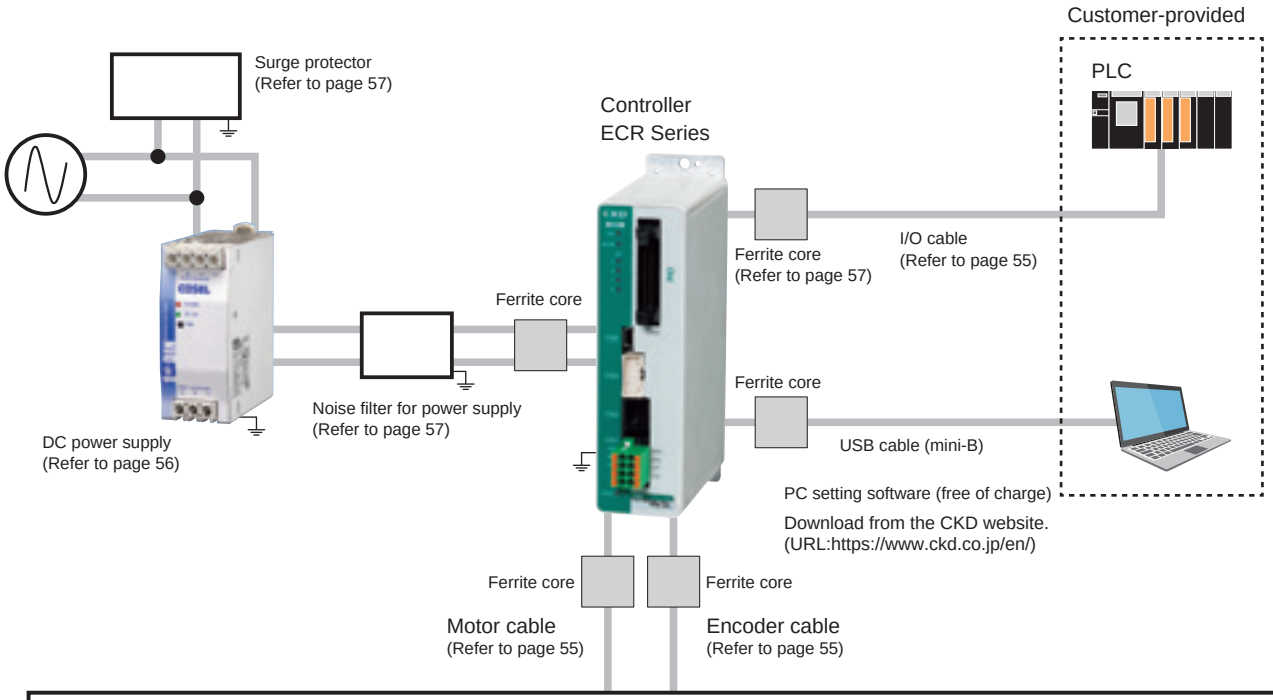
(B) Mounting method	
A	Standard mount
D	DIN rail mount

(C) IO cable length *1	
00	None
02	2m
03	3m
05	5m
10	10m

*1 Select "None" when selecting interface specifications other than "Parallel I/O".

EAR-compliant product (EAR99-embedded product)

System configuration



Connectable actuators

EBS-M Series
(Catalog No. CC-1422A)

EBR-M Series
(Catalog No. CC-1422A)

FLSH Series
(Page 1)

FLCR Series
(Page 13)

FGRC Series
(Page 29)

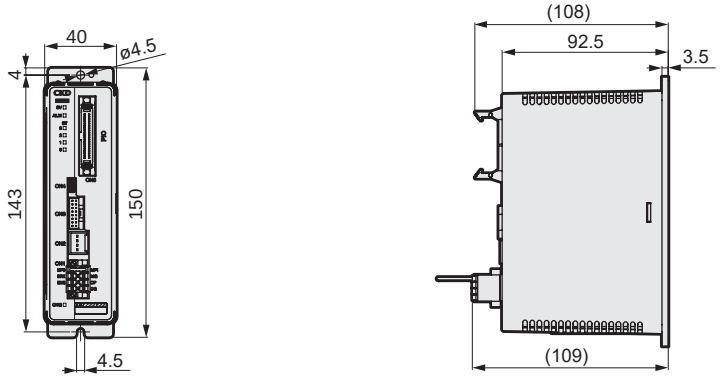
* Refer to the Instruction Manual for details about installing and wiring the noise filter, surge protector, and ferrite core.

General specifications

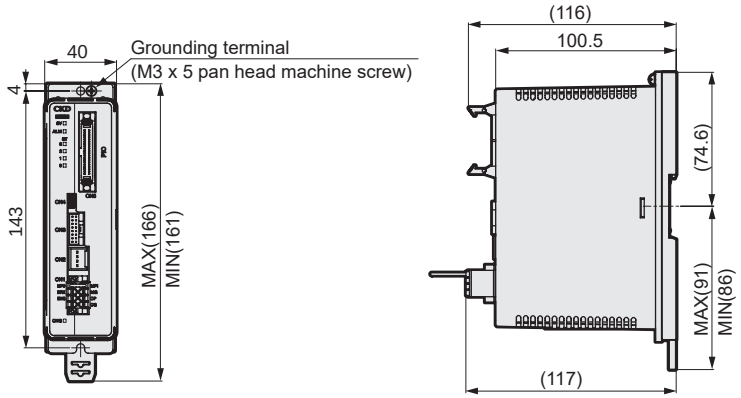
Item		Description						
Applicable actuators		EBS/EBR			FLSH/FLCR/FGRC			
Applicable motor sizes		□35	□42	□56	□20	□25	□25L	□35
Setting tools		PC setting software (S-Tools) Connection cable: USB cable (mini-B)						
External interface	Parallel I/O specification	24 VDC ±10%, input/output max. 16 points, cable length max. 10 m						
	Field network specification	IO-Link, CC-Link, EtherCAT						
Display lamp		Servo ON/OFF LED, alarm status LED Status LED, communication status LED (according to each interface specification)						
Power supply voltage	Control power	24 VDC ±10% or 48 VDC ±10%						
	Power supply	24 VDC ±10% or 48 VDC ±10%						
Current consumption	Control power	0.6 A or less						
	Power supply	2.8 A or less	3.7 A or less	6.1 A or less	1.1 A or less	2.1 A or less	3.2 A or less	3.0 A or less
Motor section maximum instantaneous current		4.0 A or less	5.2 A or less	8.6 A or less	1.5 A or less	3.0 A or less	4.5 A or less	4.2 A or less
Brake current consumption		0.4 A or less						
Insulation resistance		10 MΩ and over at 500 VDC						
Withstand voltage		500 VAC for 1 minute						
Operating ambient temperature		0 to 40°C (no freezing)						
Operating ambient humidity		35 to 80% RH (no condensation)						
Storage ambient temperature		-10 to 50°C (no freezing)						
Storage ambient humidity		35 to 80% RH (no condensation)						
Working atmosphere		No corrosive gas, explosive gas, or dust						
Degree of protection		IP20						
Weight		Approx. 400 g (standard mount) Approx. 430 g (DIN rail mount)						

Dimensions

● Standard mount (ECR-MNNN3B-*A*)



● DIN rail mount (ECR-MNNN3B-*D*)

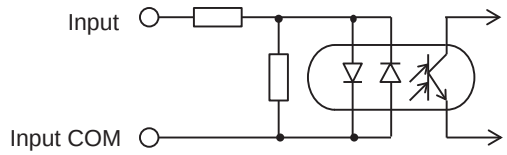


Parallel I/O (PIO) input/output circuit

Input specification

Item	ECR-MNNN3B-NP□□
No. of inputs	16 points
Input voltage	24 VDC ±10%
Input current	3.7 mA/1 point
ON voltage	19 V or higher
OFF current	0.2 mA or less

Input circuit

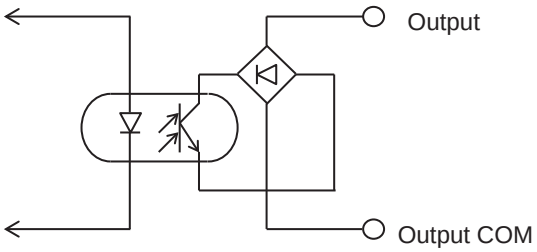


The input is not polarized.
(The input COM can be used with either + or -)

Output specifications

Item	ECR-MNNN3B-NP□□
Output points	16 points
Load voltage	24 VDC ±10%
Load current	20 mA or less/1 point
Internal voltage drop	3 V or less
Leakage current	0.1 mA or less
Output short-circuit protection circuit	Yes
Connecting load	PLC, etc.

Output circuit



The output is not polarized.
(The output COM can be used with either + or -)

Parallel I/O (PIO) Operation mode

Controllers offer nine operation modes.

Use the PC setting software to set the appropriate operation mode. The initial setting is 64-point mode.

Operation mode	Positioning point count	Overview
64-point mode	64 points	· Travel output · Zone output: 2 points · Point zone output: 1 point
128-point mode	128 points	· Travel output · Selectable output: 2 points (point zone, zone 1, zone 2, travel)
256-point mode	256 points	· Selectable output: 2 points (point zone, zone 1, zone 2, travel)
512-point mode	512 points	· Selectable output: 1 point (point zone, zone 1, zone 2, travel)
Teaching 64-point mode	64 points	· JOG (INCH) travel start input · Selectable output: 2 points (point zone, zone 1, zone 2, travel) · Travel output
Simple 7-point mode	7 points	· Travel output · Zone output: 2 points
Solenoid valve mode double 2-position	2 points	· SW output: 2 points · Travel output · Point zone output: 1 point · Zone output: 2 points
Solenoid valve mode double 3-position	2 points	· SW output: 2 points · Travel output · Point zone output: 1 point · Zone output: 2 points
Solenoid valve mode single	2 points	· SW output: 2 points · Travel output · Point zone output: 1 point · Zone output: 2 points

Parallel I/O (PIO) Signal abbreviation list

Input signal

Abbreviation	Name	Abbreviation	Name
PST	Point travel start	JIM	JOG/INCH (-) travel start
PSB*	Point selection bit*	JIP	JOG/INCH (+) travel start
OST	Home position return start	INCH	INCH selection
SVON	Servo ON	P*ST	Point number * travel start
ALMRST	Alarm reset	V1ST	Solenoid valve travel command 1
STOP	Stop	V2ST	Solenoid valve travel command 2
PAUSE	Pause	VST	Solenoid valve travel command
WRST	Write start		
TEACH	Teaching selection		

Output signal

Abbreviation	Name	Abbreviation	Name
PEND	Point travel complete	ALM	Alarm
PCB*	Point number confirmation bit *	WARN	Warning
ACB*	Alarm confirmation bit *	READY	Operation preparation complete
PZONE	Point zone	WREND	Write complete
MOVE	Traveling	TEACHS	Teaching state
ZONE1	Zone 1	P*END	Point number * travel complete
ZONE2	Zone 2	SW1	Switch 1
OEND	Home position return complete	SW2	Switch 2
SONS	Servo ON state		

Parallel I/O (PIO) Operation modes and signal assignment

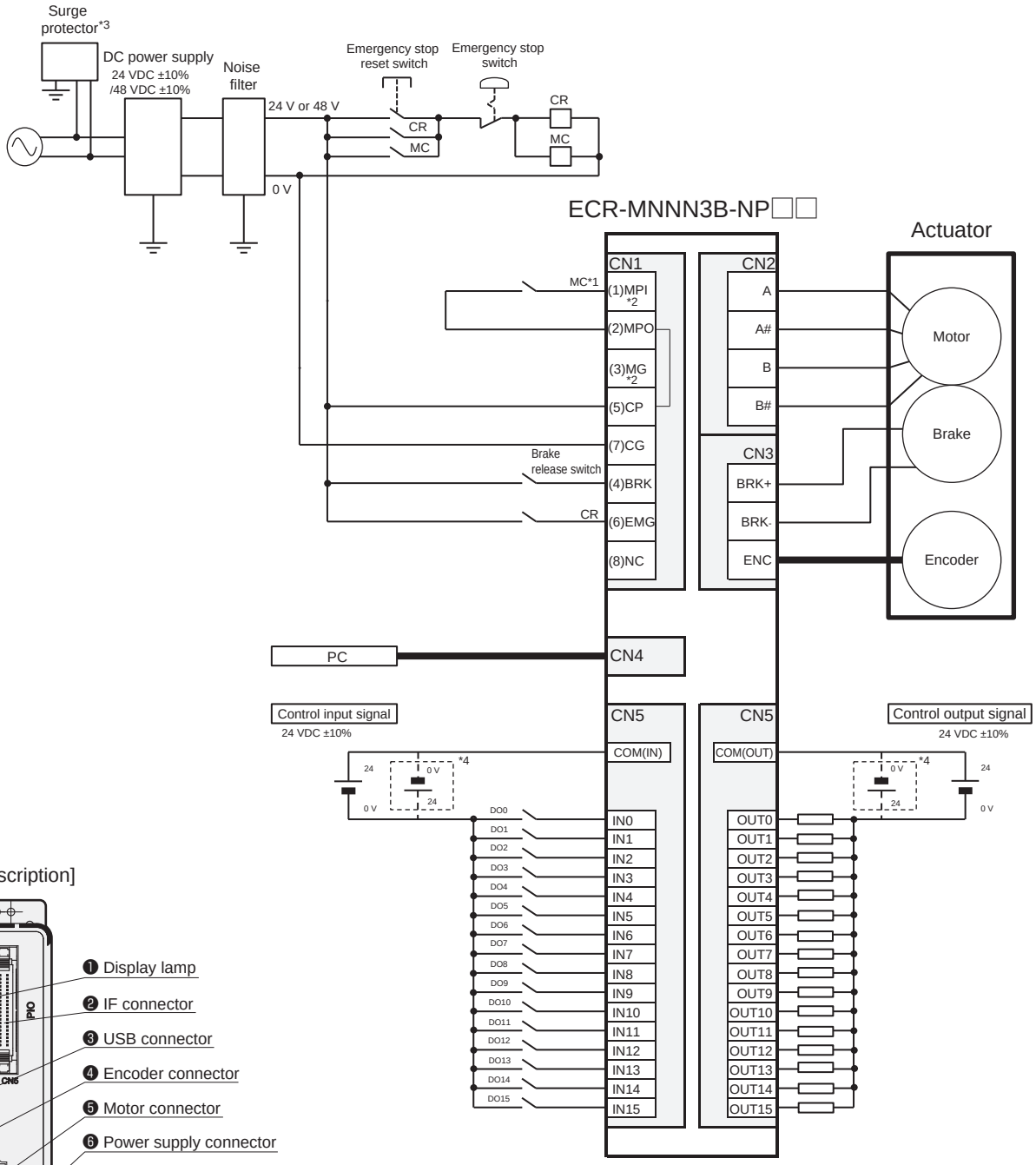
The following figure shows signal assignments in each operation mode.

Operation mode		64-point mode	128-point mode	256-point mode	512-point mode	Teaching 64-point mode	Simple 7-point mode	Solenoid valve mode double 2-position	Solenoid valve mode double 3-position	Solenoid valve mode single
Positioning point count		64	128	256	512	64	7	2	2	2
Input	IN0	PSB0	PSB0	PSB0	PSB0	PSB0	P1ST	V1ST	V1ST	-
	IN1	PSB1	PSB1	PSB1	PSB1	PSB1	P2ST	V2ST	V2ST	VST
	IN2	PSB2	PSB2	PSB2	PSB2	PSB2	P3ST	-	-	-
	IN3	PSB3	PSB3	PSB3	PSB3	PSB3	P4ST	-	-	-
	IN4	PSB4	PSB4	PSB4	PSB4	PSB4	P5ST	-	-	-
	IN5	PSB5	PSB5	PSB5	PSB5	PSB5	P6ST	-	-	-
	IN6	-	PSB6	PSB6	PSB6	TEACH	P7ST	-	-	-
	IN7	-	-	PSB7	PSB7	JIM	-	-	-	-
	IN8	-	-	-	PSB8	JIP	-	-	-	-
	IN9	-	-	-	-	INCH	-	-	-	-
	IN10	PST	PST	PST	PST	PST/ WRST	-	-	-	-
	IN11	OST	OST	OST	OST	OST	OST	OST	OST	OST
	IN12	SVON	SVON	SVON	SVON	SVON	SVON	SVON	SVON	SVON
	IN13	ALMRST	ALMRST	ALMRST	ALMRST	ALMRST	ALMRST	ALMRST	ALMRST	ALMRST
	IN14	STOP#	STOP#	STOP#	STOP#	STOP#	STOP#	-	-	-
	IN15	PAUSE#	PAUSE#	PAUSE#	PAUSE#	PAUSE#	PAUSE#	-	-	-
Output	OUT0	PCB0/ ACB0	PCB0/ ACB0	PCB0/ ACB0	PCB0/ ACB0	PCB0/ ACB0	P1END	P1END	P1END	P1END
	OUT1	PCB1/ ACB1	PCB1/ ACB1	PCB1/ ACB1	PCB1/ ACB1	PCB1/ ACB1	P2END	P2END	P2END	P2END
	OUT2	PCB2/ ACB2	PCB2/ ACB2	PCB2/ ACB2	PCB2/ ACB2	PCB2/ ACB2	P3END	-	-	-
	OUT3	PCB3/ ACB3	PCB3/ ACB3	PCB3/ ACB3	PCB3/ ACB3	PCB3/ ACB3	P4END	-	-	-
	OUT4	PCB4	PCB4	PCB4	PCB4	PCB4	P5END	SW1	SW1	SW1
	OUT5	PCB5	PCB5	PCB5	PCB5	PCB5	P6END	SW2	SW2	SW2
	OUT6	PZONE	PCB6	PCB6	PCB6	TEACHS	P7END	-	-	-
	OUT7	MOVE	MOVE	PCB7	PCB7	MOVE	MOVE	MOVE	MOVE	MOVE
	OUT8	ZONE1	PZONE/ ZONE1/ ZONE2/ MOVE	PZONE/ ZONE1/ ZONE2/ MOVE	PCB8	PZONE/ ZONE1/ ZONE2/ MOVE	ZONE1	ZONE1	ZONE1	ZONE1
	OUT9	ZONE2	PZONE/ ZONE1/ ZONE2/ MOVE	PZONE/ ZONE1/ ZONE2/ MOVE	PZONE/ ZONE1/ ZONE2/ MOVE	PZONE/ ZONE1/ ZONE2/ MOVE	ZONE2	ZONE2	ZONE2	ZONE2
	OUT10	PEND	PEND	PEND	PEND	PEND/ WREND	PZONE	PZONE	PZONE	PZONE
	OUT11	OEND	OEND	OEND	OEND	OEND	OEND	OEND	OEND	OEND
	OUT12	SONS	SONS	SONS	SONS	SONS	SONS	SONS	SONS	SONS
	OUT13	ALM#	ALM#	ALM#	ALM#	ALM#	ALM#	ALM#	ALM#	ALM#
	OUT14	WARN#	WARN#	WARN#	WARN#	WARN#	WARN#	WARN#	WARN#	WARN#
	OUT15	READY	READY	READY	READY	READY	READY	READY	READY	READY

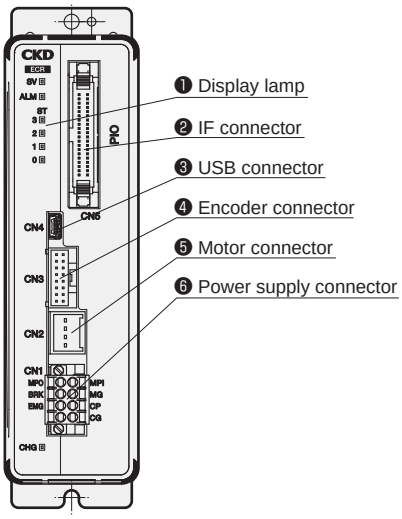
*The pound sign (#) indicates a negative logic signal.

Parallel I/O connection diagram (ECR-MNNN3B-NP**)

[PIO]



[Panel description]



*1 For safety category support, connect the contact of an electromagnetic switch or other device between the MPI and MPO terminals when motor drive power must be shut OFF. (Connected with jumper wires at shipment.)
*2 The MPI and MG terminals can be used to isolate the motor power supply and control power supply.
*3 A surge protector is required to comply with the CE marking.
*4 This can be used even if the polarity is reversed.

● Accessories

Part name	Manufacturer model	Manufacturer
Power supply connector	DFMC1,5/4-STF-3,5	PHOENIX CONTACT

Description of field network operation modes

Mode	Overview
PIO mode (PIO)	The same operation modes as the parallel I/O specification can be selected. Assigned signals are as listed in the parallel I/O signal assignment table. Monitor data cannot be confirmed.
Simple direct value mode (SDP)	An arbitrary target position can be set from the PLC. In this mode, the target position is directly set prior to operation. Operation conditions other than the target position (such as speed and acceleration) will use the values set in the point data during operation. Monitor data can be confirmed.
Full direct value mode (FDP)	All operation conditions (including target position, speed, acceleration, etc.) can be arbitrarily set from the PLC. Monitor data can be confirmed.

Operation mode		PIO	SDP	FDP
Parameter read/write		Not available	Available	Available
Direct value travel selection*1		Selection not possible	1	1
Positioning point count		512	Unlimited	Unlimited
Direct values of motion items *2	Target position	-	○	○
	Positioning width	-	-	○
	Speed	-	-	○
	Acceleration	-	-	○
	Deceleration	-	-	○
	Pressing rate	-	-	○
	Pressing distance	-	-	○
	Pressing speed	-	-	○
	Position specification method	-	-	○
	Operation mode	-	-	○
	Stop method	-	-	○
	Acceleration/deceleration method	-	-	○
Monitor item *3	Position	-	○	○
	Speed	-	△	▲
	Current	-	△	▲
	Alarm	-	△	▲

*1: When the direct value travel selection is 0, it operates with the values set by the point data. This enables up to 512 positioning points.
*2: ○ indicates items operated with the values set by the PLC. - indicates operation with the values set by the point data.
*3: ○ indicates items that can be monitored on all networks at all times. - indicates items that cannot be monitored.
△ indicates items that can be selected from △ for monitoring one at a time with IO-Link and CC-Link or simultaneously monitored with EtherCAT.
▲ indicates items that can be selected from ▲ for monitoring one at a time with IO-Link or simultaneously monitored with CC-Link and EtherCAT.

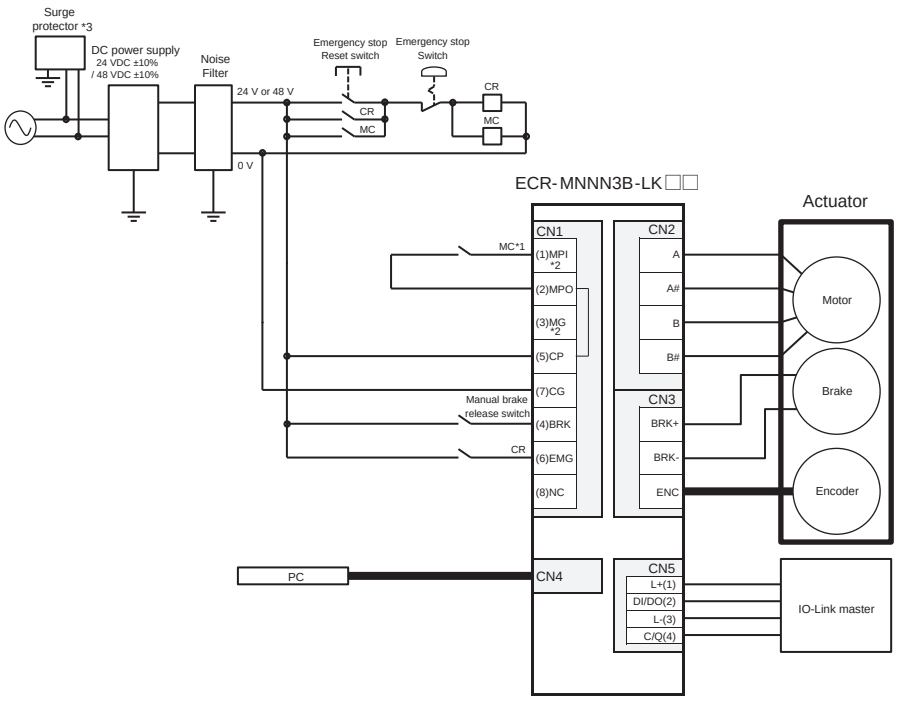
IO-Link specifications and connection diagram (ECR-MNNN3B-LK**)

[Communication specifications]

Item	Specifications
Communication protocol version	V1.1
Transmission bit rate	COM3 (230.4kbps)
Port	Class A
Process data length (input) PD (in) data length	PIO mode: 2 bytes
	Simple direct value mode: 9 bytes
	Full direct value mode: 9 bytes
Process data length (output) PD (out) data length	PIO mode: 2 bytes
	Simple direct value mode: 7 bytes
	Full direct value mode: 22 bytes
Minimum cycle time	PIO mode: 1 ms
	Simple direct value mode: 2 ms
	Full direct value mode: 2.5 ms
Monitor function	Position, speed, current, alarm

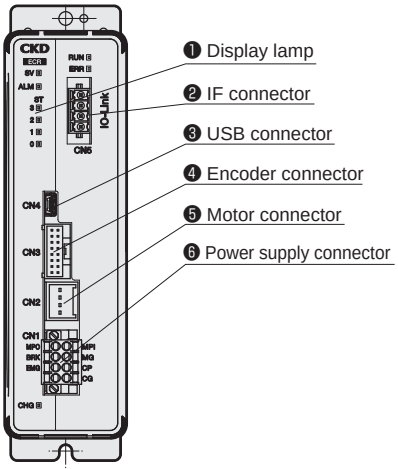
* Items that can be monitored change depending on the mode. Refer to page 51 for details.

[IO-Link]



*1 For safety category support, connect the contact of an electromagnetic switch or other device between the MPI and MPO terminals when motor drive power must be shut OFF. (Connected with jumper wires at shipment.)
*2 The MPI and MG terminals can be used to isolate the motor power supply and control power supply.
*3 A surge protector is required to comply with the CE marking.

[Panel description]



Cyclic data from master

PD (out)	bit	Full direct value mode Signal name
0	7	Pause#
	6	Stop#
	5	Alarm reset
	4	Servo ON
	3	Home position return start
	2	Point travel start
	1	—
	0	Point number selection bit 8
1	7 to 0	Point number selection bit 7 to 0
2	7	—
	6	—
	5 to 4	Rotation direction
	3 to 1	Monitor number
	0	Direct value travel selection
3 to 6	7 to 0	Position
7 to 8	7 to 0	Positioning width
9 to 10	7 to 0	Speed
11	7 to 0	Acceleration
12	7 to 0	Deceleration
13	7 to 0	Pressing rate
14	7 to 0	Pressing speed
15 to 18	7 to 0	Pressing distance
19 to 20	7 to 0	Gain magnification
21	7	Position specification method
	6 to 5	Operation mode
	4 to 3	Acceleration/deceleration method
	2 to 0	Stop method

Cyclic data from controller

PD (in)	bit	Full direct value mode Signal name
0	7	Operation preparation complete
	6	Warning#
	5	Alarm#
	4	Servo ON state
	3	Home position return complete
	2	Point travel complete
	1	—
	0	Point number confirmation bit 8
1	7 to 0	Point number confirmation bit 7 to 0
2	7 to 5	—
	4	Zone 2
	3	Zone 1
	2	Traveling
	1	Point zone
	0	Direct travel state
3 to 6	7 to 0	Position (monitor value)
7 to 8	7 to 0	Monitor value

*Refer to the Instruction Manual for details of other operation modes.
*The pound sign (#) indicates a negative logic signal.

● Accessories

Part name	Manufacturer model	Manufacturer
Power supply connector	DFMC1,5/4-STF-3,5	PHOENIX CONTACT
IO-Link connector	FMC1,5/4-ST-3,5-RF	PHOENIX CONTACT

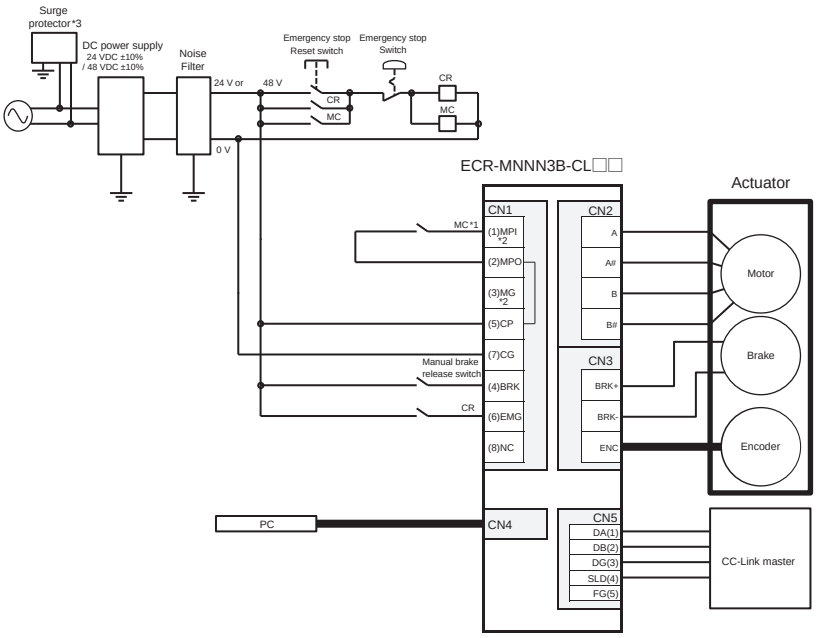
CC-Link specifications and connection diagram (ECR-MNNN3B-CL**)

[Communication specifications]

Item	Specifications
CC-Link version	Ver. 1.10
Station	Remote device station
Remote station No.	1 to 64 (set by parameter setting)
Operation modes and occupied stations	PIO mode (1 station occupied)
	Simple direct value mode (2 stations occupied)
	Full direct value mode (4 stations occupied)
Remote input/output points	PIO mode: 32 points each
	Simple direct value mode: 64 points each
	Full direct value mode: 128 points each
Remote register input/output	PIO mode: 4 words each
	Simple direct value mode: 8 words each
	Full direct value mode: 16 words each
Communication speed	10 M/5 M/2.5 M/625 k/156 kbps (Selected by parameter setting)
Connection cable	CC-Link Ver. 1.10 compliant cable (shielded 3-conductor twisted pair cable)
Number of connected units	42 max. when only remote device stations are connected
Monitor function	Position, speed, current, alarm

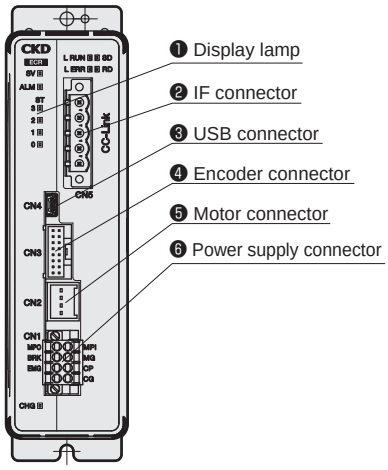
* Items that can be monitored change depending on the mode.
Refer to page 51 for details.

[CC-Link]



*1 For safety category support, connect the contact of an electromagnetic switch or other device between the MPI and MPO terminals when motor drive power must be shut OFF. (Connected with jumper wires at shipment.)
*2 The MPI and MG terminals can be used to isolate the motor power supply and control power supply.
*3 A surge protector is required to comply with the CE marking.

[Panel description]



Cyclic data from master

Device No.	Full direct value mode
	Signal name
RYn0 to RYnF	PIO input signal (conforms to parallel I/O signal assignment)
RY(n+1)0 to RY(n+1)3	–
RY(n+1)4	Data request
RY(n+1)5	Data R/W selection
RY(n+1)6 to RY(n+1)B	–
RY(n+1)C	Monitor request
RY(n+1)D	–
RY(n+1)E	
RY(n+1)F	Direct value travel selection
RY(n+2)0 to RY(n+7)9	–
RY(n+7)A	Error reset request flag
RY(n+7)B to RY(n+7)F	–

* Refer to the Instruction Manual for details of other operation modes.

Cyclic data from controller

Device No.	Full direct value mode
	Signal name
RXn0 to RXnF	PIO output signal (conforms to parallel I/O signal assignment)
RX(n+1)0 to RX(n+1)3	Data response
RX(n+1)4	Data complete
RX(n+1)5	Data write status
RX(n+1)6	–
RX(n+1)7	
RX(n+1)8 to RX(n+1)B	Monitor response
RX(n+1)C	Monitor complete
RX(n+1)D	–
RX(n+1)E	
RX(n+1)F	Direct travel state
RX(n+2)0	Point zone
RX(n+2)1	Traveling
RX(n+2)2	Zone 1
RX(n+2)3	Zone 2
RX(n+2)4 to RX(n+7)9	–
RX(n+7)A	Error status flag
RX(n+7)B	Remote ready flag
RX(n+7)C to RX(n+7)F	–

● Accessories

Part name	Manufacturer model	Manufacturer
Power supply connector	DFMC1,5/4-STF-3,5	PHOENIX CONTACT
CC-Link connector	MSTB2,5/5-STF-5,08ABGYAU	PHOENIX CONTACT

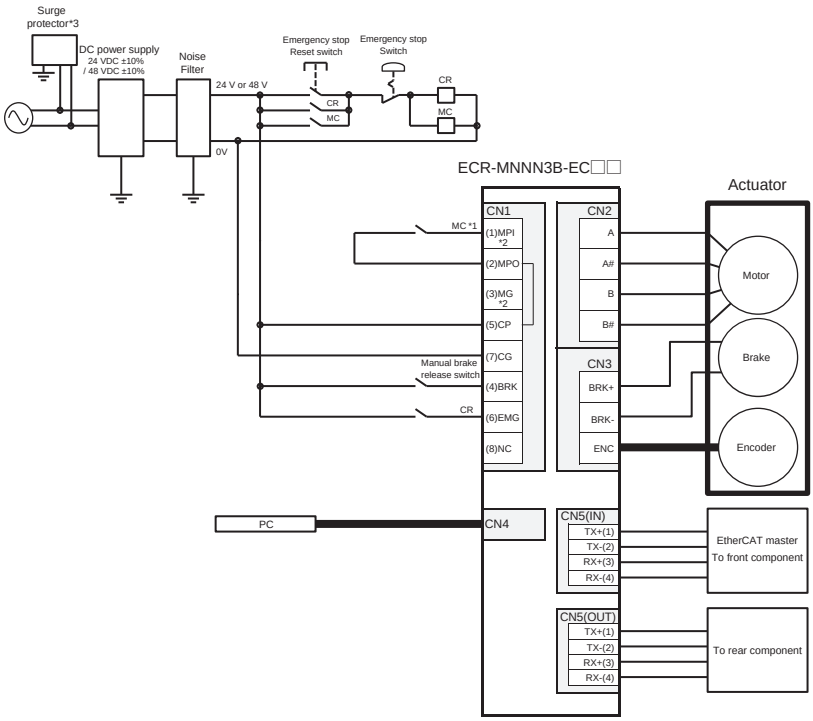
EtherCAT specifications and connection diagram (ECR-MNNN3B-EC**)

[Communication specifications]

Item	Specifications
Communication speed	100 Mbps (fast Ethernet, full duplex)
Process data	Variable PDO mapping
Max. PDO data length	RxPDO: 64 bytes/TxPDO: 64 bytes
Station alias	0 to 65535 (set by parameters)
Connection cable	EtherCAT-compliant cable (CAT5e or higher twisted-pair cable [aluminum tape and braided double-shield] recommended)
Node address	Automatic indexing the master
Monitor function	Position, speed, current, alarm

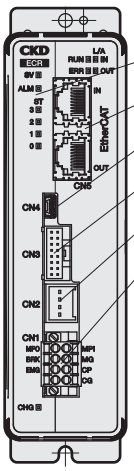
* Items that can be monitored change depending on the mode. Refer to page 51 for details.

[EtherCAT]



*1 For safety category support, connect the contact of an electromagnetic switch or other device between the MPI and MPO terminals when motor drive power must be shut OFF. (Connected with jumper wires at shipment.)
*2 The MPI and MG terminals can be used to isolate the motor power supply and control power supply.
*3 A surge protector is required to comply with the CE marking.

[Panel description]



Process data from master

Index	Sub Index	bit	Full direct value mode
			Signal name
0x2001	0x01	0 to 15	PIO input signal (conforms to parallel I/O signal assignment)
		16 to 31	–
	0x02	0 to 3	–
		4	Data request
		5	Data R/W selection
		6 to 11	–
		12	Monitor request
		13	–
		14	–
		15	Direct value travel selection
		16 to 31	–

*Refer to the Instruction Manual for details of other operation modes.

Process data from controller

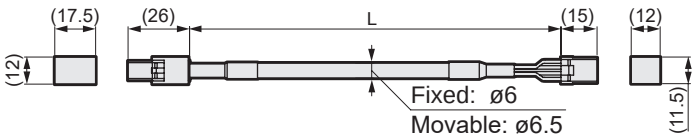
Index	Sub Index	bit	Full direct value mode
			Signal name
0x2005	0x01	0 to 15	PIO output signal (conforms to parallel I/O signal assignment)
		16 to 31	–
	0x02	0 to 3	Data response
		4	Data complete
		5	Data write status
		6	–
		7	–
		8 to 11	Monitor response
		12	Monitor complete
		13	–
		14	–
		15	Direct travel state
		16	Point zone
		17	Traveling
		18	Zone 1
		19	Zone 2
		20 to 31	–

● Accessories

Part name	Manufacturer model	Manufacturer
Power supply connector	DFMC1,5/4-STF-3,5	PHOENIX CONTACT

Relay cable (included with actuator)

● Motor cable (fixed/movable)

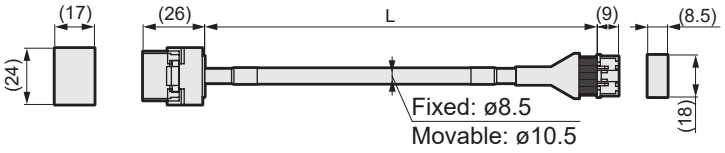


EA-CBLM1 - S 01

Ⓐ Cable type	
S	Fixed cable
R	Movable cable

Ⓑ Cable length	
01	1 m
03	3 m
05	5 m
10	10 m

● Encoder cable (fixed/movable)



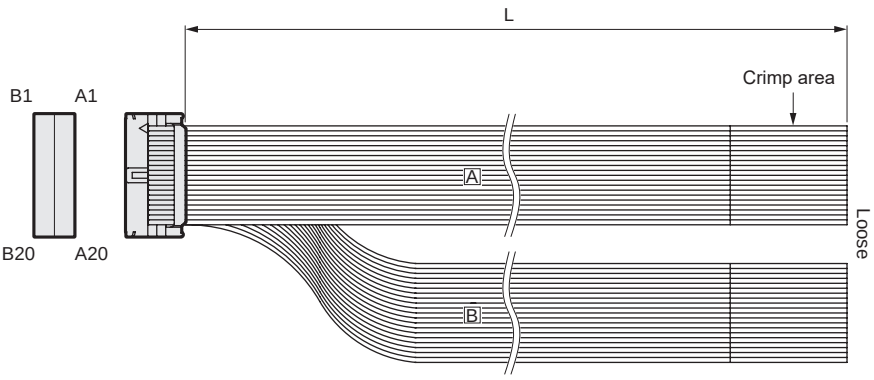
EA-CBLE1 - S 01

Ⓐ Cable type	
S	Fixed cable
R	Movable cable

Ⓑ Cable length	
01	1 m
03	3 m
05	5 m
10	10 m

I/O cable (included with parallel I/O specification controller)

● I/O cable



EA-CBLNP1 - 02

Ⓐ Cable length	
02	2 m
03	3 m
05	5 m
10	10 m

Related parts model No. table

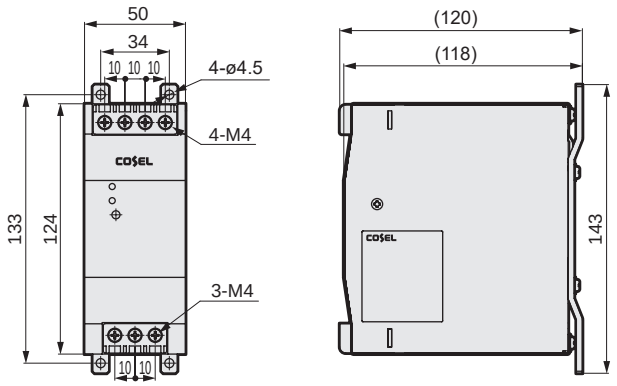
ECR DC power supply

Item \ Model No.		EA-PWR-KHNA240F-24-N2 (Screw mount) EA-PWR-KHNA240F-24 (DIN rail mount)	EA-PWR-KHNA480F-48-N2 (Screw mount) EA-PWR-KHNA480F-48 (DIN rail mount)
Manufacturer		COSEL Co., Ltd.	
Manufacturer model No.	Mounting screw	KHNA240F-24-N2	KHNA480F-48-N2
	DIN rail mount	KHNA240F-24	KHNA480F-48
Input voltage		85 to 264 VAC 1ø or 88 to 370 VDC	85 to 264 VAC 1ø or 88 to 350 VDC
Output	Power	240 W	480 W
	Voltage/current	24 V 10 A	48 V 10 A
	Variable voltage range	22.5 to 28.5 V	45.0 to 55.2 V
Included functions	Overcurrent protection	Operating at 101% min of peak current	
	Overvoltage protection	30.0 to 36.0 V	57.6 to 67.2 V
	Remote control	Available	
	Remote sensing	-	
	Others	DC_OK display, ALARM display	
Operating temperature/humidity		-25 to +70°C, 20 to 90% RH (no condensation), startup possible at -40°C*	
Applicable standards	Safety standards AC input	AC input: Certified UL60950-1, C-UL (CSA60950-1), EN60950-1, UL508, ANSI / ISA12.12.01, and ATEX; Electrical Appliances and Material Safety Act compliant*	
	Safety standards DC input	UL60950-1, C-UL(CSA60950-1), EN60950-1	
	Noise terminal voltage	Compliant with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B	
	Harmonic current	Compliant with IEC61000-3-2 (class A)*	
Structure	Dimensions (W x H x D)	50 × 124 × 117 mm	70 × 124 × 117 mm
	Weight	900 g max	1,200 g max
	Cooling method	Natural air cooling	

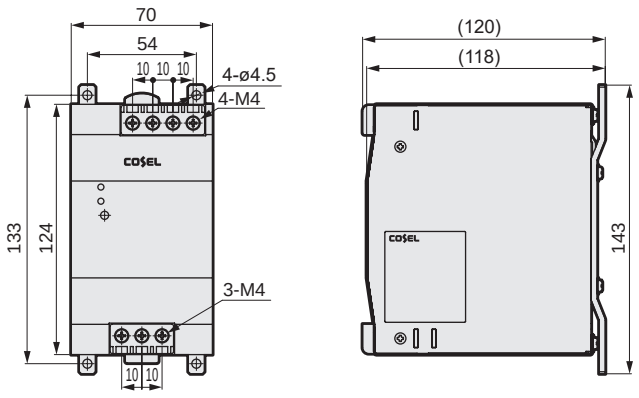
*Refer to the manufacturer's website for details.
*CE and RoHS certification has been obtained under the manufacturer's model number.

Part names and dimensions

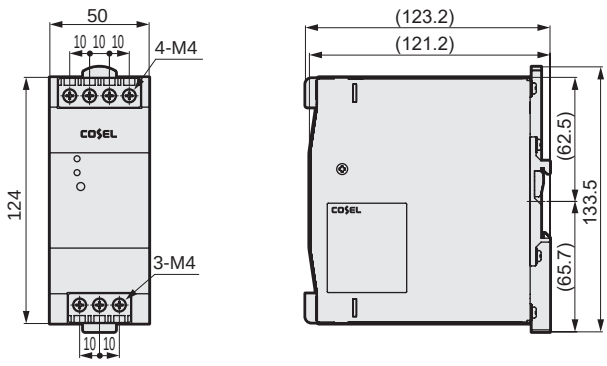
● 24 V screw mounting
EA-PWR-KHNA240F-24-N2



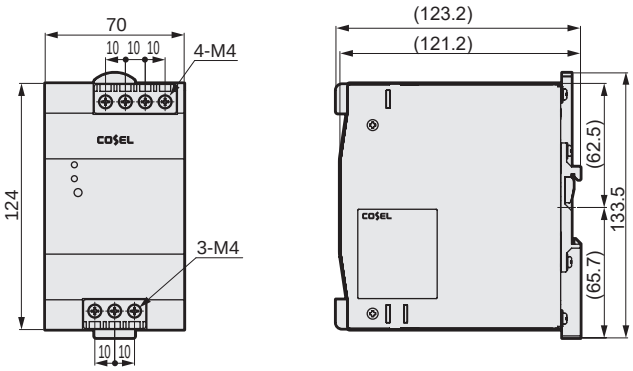
● 48 V screw mounting
EA-PWR-KHNA480F-48-N2



● 24 V DIN rail mounting
EA-PWR-KHNA240F-24



● 48 V DIN rail mounting
EA-PWR-KHNA480F-48



Related parts model No. table

● Other parts

Part name	Model No.
Noise filter for power supply (single phase, 15 A)	AX-NSF-NF2015A-OD
Ferrite core set (7 pieces/set)	EA-NSF-FC01-SET

* Refer to the instruction manual for the ferrite core to be used.

ECG-B

Controller

CONTENTS

Controller

ECG-B Series

All sizes of FLSH-G, FLCR-G and FGRC-G can be operated with the same controller

How to order

ECG-BNNN30 - NP A 02

(A) (B) (C)

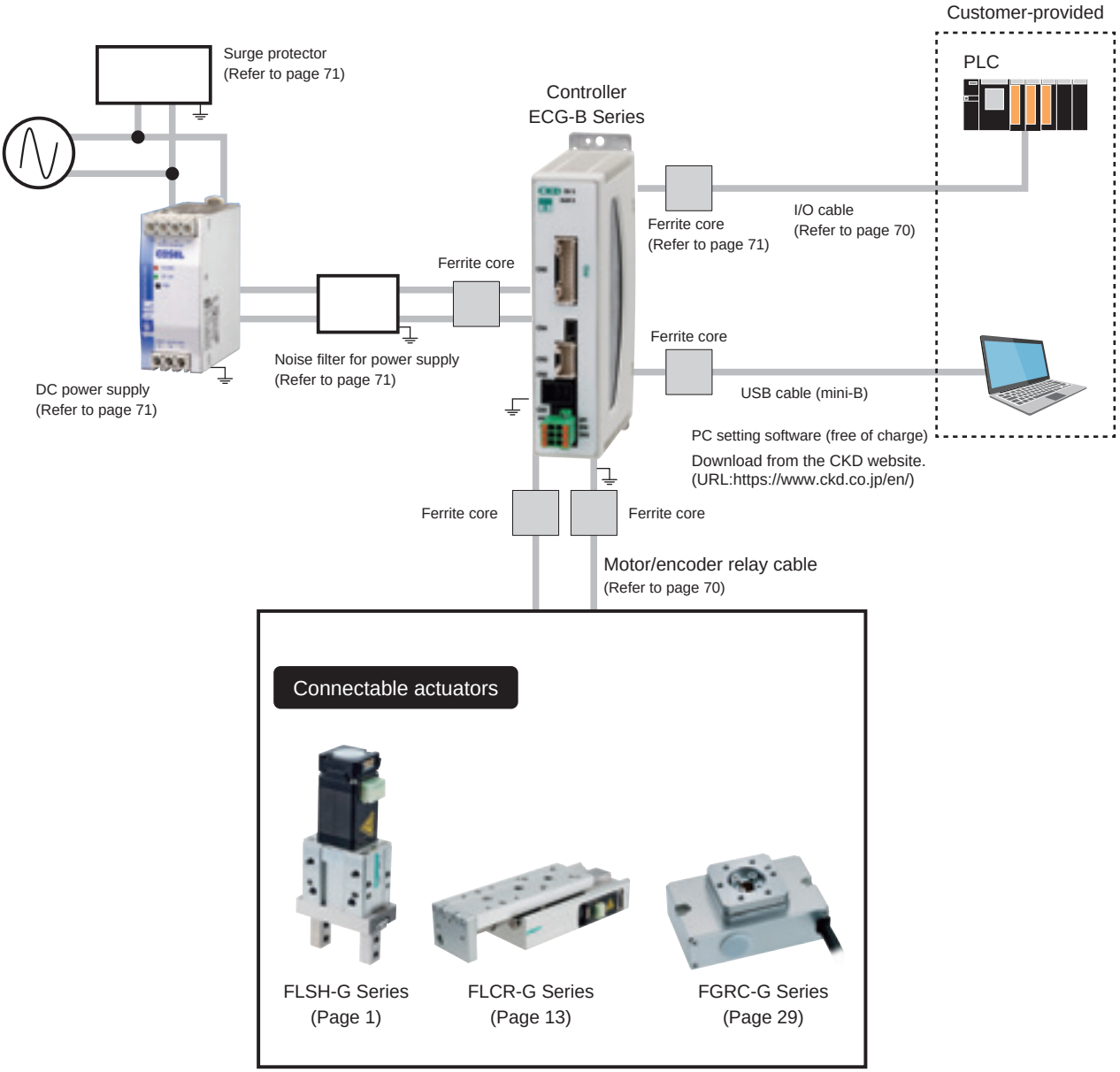
(A) Interface specifications	
NP	Parallel I/O (NPN and PNP common)
LK	IO-Link
CL	CC-Link
EC	EtherCAT
EN	EtherNet/IP

(B) Mounting method	
A	Standard mount
D	DIN rail mount

(C) IO cable length *1	
00	None
02	2 m
03	3 m
05	5 m
10	10 m

*1 Select "None" when selecting interface specifications other than "Parallel I/O".

System configuration



* Refer to the Instruction Manual for details on installing and wiring noise filters, surge protectors, and ferrite cores.

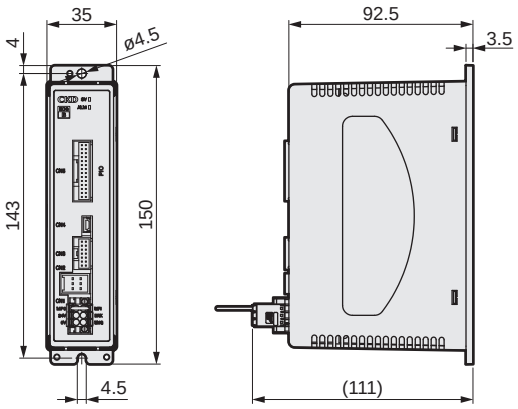
General specifications

Item		Description			
Applicable actuators		FLSH-G/FLCR-G/FGRC-G			
Applicable motor sizes		□20	□25	□25L	□35
Settings tool		PC setting software (S-Tools) Connection cable: USB cable (mini-B)			
External interface	Parallel I/O specification	24 VDC ±10%, input/output max. 13 points, cable length max. 10 m			
	Field network specification	IO-Link, CC-Link, EtherCAT, EtherNet/IP			
Display lamp		SV lamp, alarm lamp Communication status lamp (according to each interface specification)			
Power supply voltage	Control power	24 VDC ±10%			
	Power supply	24 VDC ±10%			
Current consumption	Control power	0.4 A or less			
	Power supply	1.1 A or less	2.1 A or less	3.2 A or less	3.0 A or less
Motor section max. instantaneous current		1.5 A or less	3.0 A or less	4.5 A or less	4.2 A or less
Insulation resistance		10 MΩ and over at 500 VDC			
Withstand voltage		500 VAC for 1 minute			
Operating ambient temperature		0 to 40°C (no freezing)			
Operating ambient humidity		35 to 80% RH (no condensation)			
Storage ambient temperature		-10 to 50°C (no freezing)			
Storage ambient humidity		35 to 80% RH (no condensation)			
Working atmosphere		No corrosive gas, explosive gas, or dust			
Degree of protection		IP20			
Weight		Approx. 310 g (standard mount) Approx. 340 g (DIN rail mount)			

Dimensions

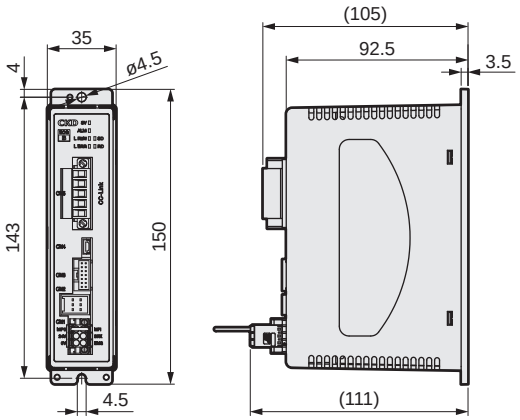
● Standard mount

ECG-BNNN30-NPA□□ (Parallel I/O specification)



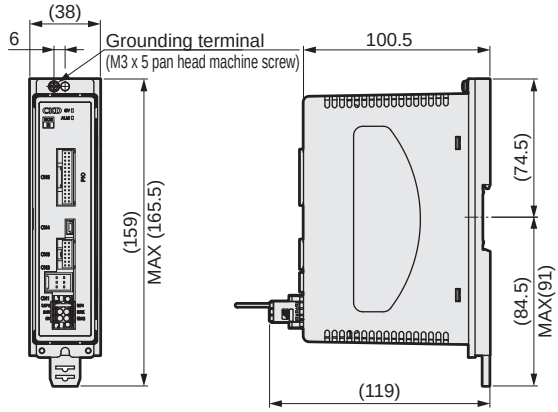
ECG-BNNN30-□□A□□ (Others)

*This figure shows the dimensions for CC-Link specifications. The dimensions are the same for other interface specifications, except the connector part.



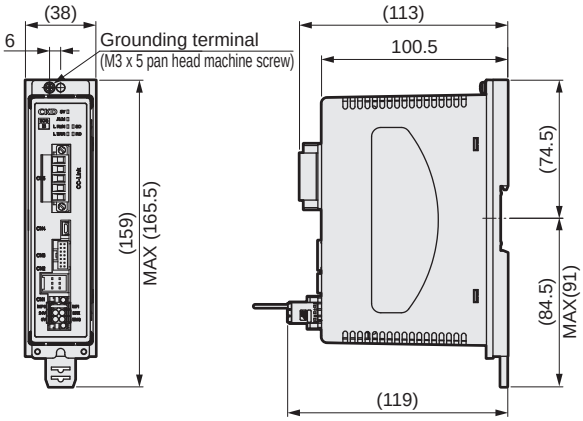
● DIN rail mount

ECG-BNNN30-NPD□□ (Parallel I/O specification)



ECG-BNNN30-□□D□□ (Others)

*This figure shows the dimensions for CC-Link specifications. The dimensions are the same for other interface specifications, except the connector part.

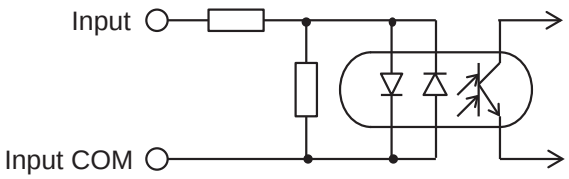


Parallel I/O (PIO) input/output circuit

Input specification

Item	ECG-ANNN30-NP□□
No. of inputs	13 points
Input voltage	24 VDC ±10%
Input current	4 mA/point
Input voltage when ON	19 V or higher
Input current when OFF	0.2 mA or less

Input circuit

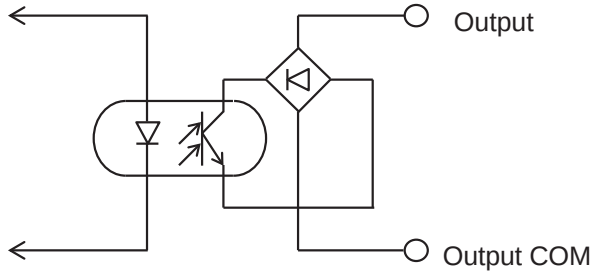


The input is not polarized.
(The input COM can be used with either + or -)

Output specifications

Item	ECG-ANNN30-NP□□
No. of I/O points	13 points
Load voltage	24 VDC ±10%
Load current	20 mA or less/point
Internal voltage drop when ON	3 V or less
Leakage current when OFF	0.1 mA or less
Output short-circuit protection circuit	Yes
Connecting load	PLC, etc.

Output circuit



The output is not polarized.
(The output COM can be used with either + or -)

Parallel I/O (PIO) operation mode

Controllers offer five operation modes.
Use the PC setting software to set the appropriate operation mode. The initial setting is 64-point mode.

Operation mode	Positioning point count	Overview
64-point mode	64 points	· JOG travel start input · Selectable output: 2 points (point zone, zone 1, zone 2, travel, warning)
Simple 7-point mode	7 points	· JOG travel start input · Selectable output: 2 points (point zone, zone 1, zone 2, travel, warning)
Solenoid mode Double 2-position type	2 points	· SW output: 2 points · Selectable output: 2 points (point zone, zone 1, zone 2, travel, warning)
Solenoid mode Double 3-position type	2 points	· SW output: 2 points · Selectable output: 2 points (point zone, zone 1, zone 2, travel, warning)
Solenoid mode Single type	2 points	· SW output: 2 points · Selectable output: 2 points (point zone, zone 1, zone 2, travel, warning)

Parallel I/O (PIO) signal name list

Input signal

Abbreviation	Name	Abbreviation	Name
PST	Point travel start	JOGM	JOG(-) travel start
PSB*	Point selection bit*	JOGP	JOG(+) travel start
OST	Origin return start	P*ST	Point number * travel start
SVON	Servo ON	V1ST	Solenoid valve travel instruction 1
ALMRST	Alarm reset	V2ST	Solenoid valve travel instruction 2
STOP	Stop	VST	Solenoid valve travel instruction

Output signal

Abbreviation	Name	Abbreviation	Name
PEND	Point travel complete	SONS	Servo ON state
PCB*	Point number confirmation bit *	ALM	Alarm
ACB*	Alarm confirmation bit *	WARN	Warning
PZONE	Point zone	READY	Operation preparation complete
MOVE	Moving	P*END	Point number * travel complete
ZONE1	Zone 1	SW1	Switch 1
ZONE2	Zone 2	SW2	Switch 2
OEND	Origin return complete		

Parallel I/O (PIO) operation mode and signal assignment

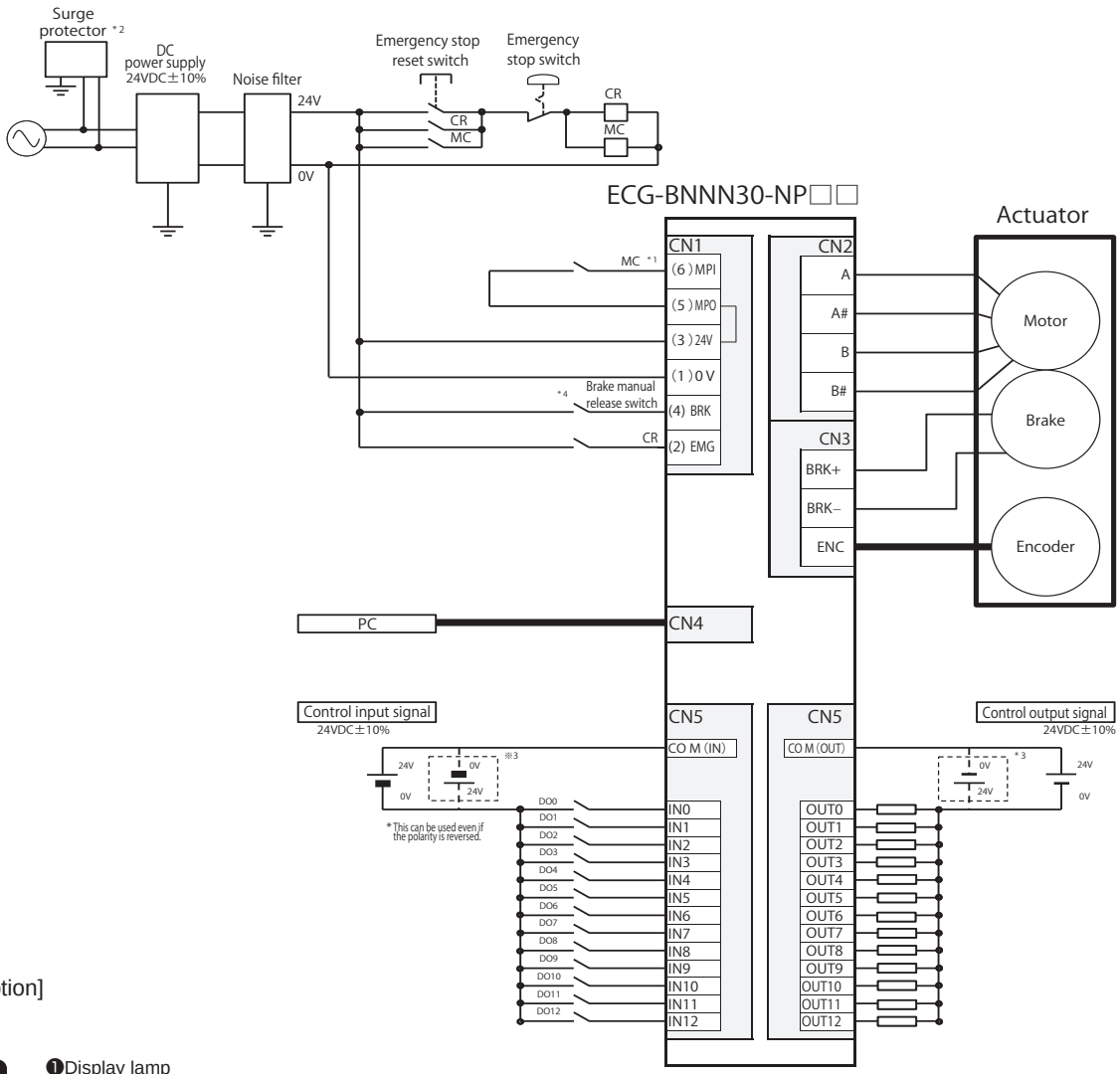
The following figure shows signal assignments in each operation mode.

Operation mode		64-point mode	Simple 7-point mode	Solenoid mode Double 2-position type	Solenoid mode Double 3-position type	Solenoid mode Single type
Positioning point count		64	7	2	2	2
Input	IN0	PSB0	P1ST	V1ST	V1ST	-
	IN1	PSB1	P2ST	V2ST	V2ST	VST
	IN2	PSB2	P3ST	-	-	-
	IN3	PSB3	P4ST	-	-	-
	IN4	PSB4	P5ST	-	-	-
	IN5	PSB5	P6ST	-	-	-
	IN6	PST	P7ST	-	-	-
	IN7	JOGM	JOGM	-	-	-
	IN8	JOGP	JOGP	-	-	-
	IN9	OST	OST	OST	OST	OST
	IN10	SVON	SVON	SVON	SVON	SVON
	IN11	ALMRST	ALMRST	ALMRST	ALMRST	ALMRST
	IN12	STOP#	STOP#	-	-	-
Output	OUT0	PCB0/ ACB0	P1END	P1END	P1END	P1END
	OUT1	PCB1/ ACB1	P2END	P2END	P2END	P2END
	OUT2	PCB2/ ACB2	P3END	-	-	-
	OUT3	PCB3/ ACB3	P4END	-	-	-
	OUT4	PCB4	P5END	SW1	SW1	SW1
	OUT5	PCB5	P6END	SW2	SW2	SW2
	OUT6	PEND	P7END	-	-	-
	OUT7	PZONE/ ZONE1/ ZONE2/ MOVE/ WARN#	PZONE/ ZONE1/ ZONE2/ MOVE/ WARN#	PZONE/ ZONE1/ ZONE2/ MOVE/ WARN#	PZONE/ ZONE1/ ZONE2/ MOVE/ WARN#	PZONE/ ZONE1/ ZONE2/ MOVE/ WARN#
	OUT8	PZONE/ ZONE1/ ZONE2/ MOVE/ WARN#	PZONE/ ZONE1/ ZONE2/ MOVE/ WARN#	PZONE/ ZONE1/ ZONE2/ MOVE/ WARN#	PZONE/ ZONE1/ ZONE2/ MOVE/ WARN#	PZONE/ ZONE1/ ZONE2/ MOVE/ WARN#
	OUT9	OEND	OEND	OEND	OEND	OEND
	OUT10	SONS	SONS	SONS	SONS	SONS
	OUT11	ALM#	ALM#	ALM#	ALM#	ALM#
	OUT12	READY	READY	READY	READY	READY

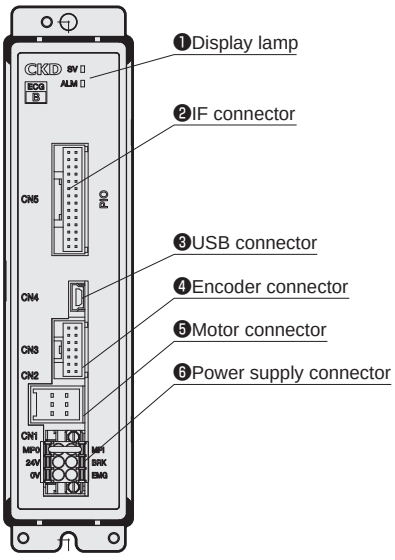
* The pound sign (#) indicates a negative logic signal.

Parallel I/O connection diagram (ECG-BNNN30-NP**)

[PIO]



[Panel description]



*1 For safety category support, connect the contact of an electromagnetic switch or other device between the MPI and MPO terminals when motor drive power must be shut OFF. (Connected with jumper wires at shipment.)
*2 A surge protector is required to comply with the CE marking.
*3 This can be used even if the polarity is reversed
*4 Wire only when brake is mounted.

● Accessories

Part name	Manufacturer model	Manufacturer
Power supply connector	DFMC1, 5/3-STF-3, 5	PHOENIX CONTACT

Description of field network operation modes

Operation mode	Overview
PIO mode (PIO)	Point operation can be used and signal assignment of inputs and outputs can be changed in the operation mode (PIO) in the same manner as with the parallel I/O specification. However, you cannot select a direct-value operation that sets the operating conditions for operation directly from the PLC. Reading and writing of parameters do work, but the monitoring function cannot be used. Refer to the table below for details.
Half simple direct value mode (HSDP)	This mode is selectable only with the CC-Link specification controller. Switching the direct travel selection signal enables a target position to be arbitrarily be set by the PLC or 64 point operation. The selected direct travel operation method can then be used. The monitoring function can be used with restrictions. Reading and writing of parameters does not work. Refer to the table below for details.
Simple direct value mode (SDP)	Switching the direct travel selection signal enables a target position to be arbitrarily be set by the PLC or 64 point operation. The selected direct travel operation method can then be used. Reading and writing of parameters do work and the monitoring function can be used. Refer to the table below for details.
Half direct value mode (HDP)	This mode is selectable only with the CC-Link specification controller. Switching the direct travel selection signal enables operating conditions to be arbitrarily be set by a PLC (with restrictions) or 64 point operation. The selected direct travel operation method can then be used. The monitoring function can be used. Reading and writing of parameters does not work. Refer to the table below for details.
Full direct value mode (FDP)	Switching the direct travel selection signal enables operating conditions to be arbitrarily be set by the PLC or 64 point operation. The selected direct travel operation method can then be used. Reading and writing of parameters do work and the monitoring function can be used. Refer to the table below for details.

Operation mode		PIO	HSDP	SDP	HDP	FDP
Parameter read/write		Available	Not available	Available	Not available	Available
Direct value travel selection *1		Selection not possible	1	1	1	1
Positioning point count		64	Unlimited	Unlimited	Unlimited	Unlimited
Direct value travel item *2	Target position	-	○	○	○	○
	Positioning width	-	-	-	○	○
	Speed	-	-	-	○	○
	Acceleration	-	-	-	●	○
	Deceleration	-	-	-	●	○
	Pressing rate	-	-	-	○	○
	Pressing distance	-	-	-	○	○
	Pressing speed	-	-	-	-	○
	Position specification method	-	-	-	○	○
	Operation mode	-	-	-	○	○
	Stop method	-	-	-	○	○
	Acceleration/ deceleration method	-	-	-	○	○
	Rotation direction	-	-	-	○	○
Monitor item *3	Position	-	○	○	○	○
	Speed	-	○	▲	○	○
	Current	-	○	▲	○	○
	Alarm	-	-	▲	○	○

*1: When the direct value travel selection is 0, it operates with the value set by the point data. This enables up to 64 positioning points.
*2: ○ indicates items operated with the value set by the PLC.
- indicates operation with the value set by the point data.
● indicates items operated with the value set by the PLC, but only the same values can be set.
*3: ○ indicates items that can be monitored.
- indicates items that cannot be monitored.
Use ▲ to select only 1 item to be monitored.
▲ indicates items which can be monitored when selected as monitor values (one at a time for CC-Link and IO-Link, three values at a time for others).

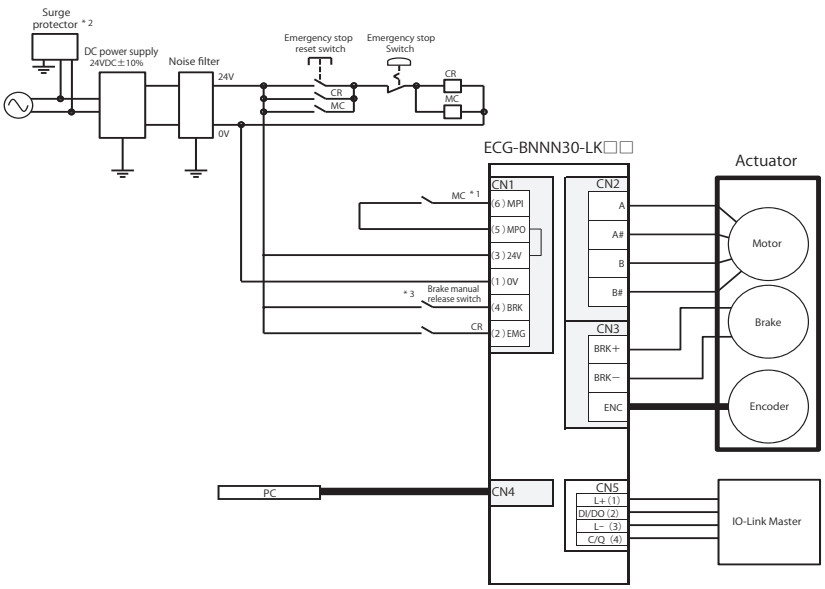
IO-Link specifications and connection diagram (ECG-BNNN30-LK**)

[Communication specifications]

Item	Specifications
Communication protocol Version	V1.1
Transmission bit rate	COM3 (230.4kbps)
Port	Class A
Process data length (Input) PD (in) data length	PIO mode: 2 bytes
	Simple direct value mode: 9 bytes
	Full direct value mode: 12 bytes
Process data length (Output) PD (out) data length	PIO mode: 2 bytes
	Simple direct value mode: 7 bytes
	Full direct value mode: 22 bytes
Minimum cycle Time	PIO mode: 1 ms
	Simple direct value mode: 1.5 ms
	Full direct value mode: 2.5 ms
Monitor function	Position, speed, current, alarm

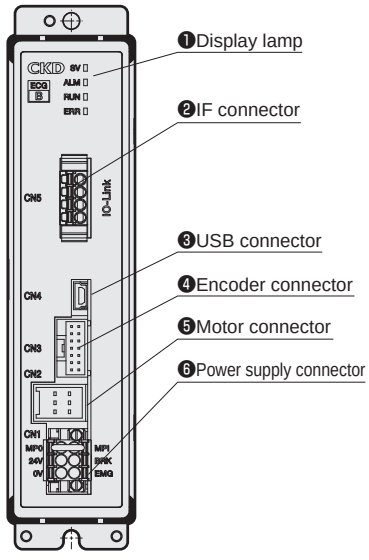
* Items that can be monitored change depending on the operation mode. Refer to page 65 for details.

[IO-Link]



*1 For safety category support, connect the contact of an electromagnetic switch or other device between the MPI and MPO terminals when motor drive power must be shut OFF. (Connected with jumper wires at shipment.)
*2 A surge protector is required to comply with the CE marking.
*3 Wire only when brake is mounted.

[Panel description]



Cyclic data from master

PD (out)	bit	Full direct value mode Signal name
0	7	Pause#
	6	Stop#
	5	Alarm reset
	4	Servo ON
	3	Origin return start
	2	Point travel start
	1	JOG/INCH (+) travel start
	0	JOG/INCH (-) travel start
1	7	INCH selection
	6	-
	5 to 0	Point number selection bit 5 to 0
2	7 to 4	-
	3 to 1	Rotation direction (direct value travel)
	0	Direct value travel selection
3 to 6	7 to 0	Position (direct value travel)
7 to 8	7 to 0	Positioning width (direct value travel)
9 to 10	7 to 0	Speed (direct value travel)
11	7 to 0	Acceleration (direct value travel)
12	7 to 0	Deceleration (direct value travel)
13	7 to 0	Pressing rate (direct value travel)
14	7 to 0	Pressing speed (direct value travel)
15 to 18	7 to 0	Pressing distance (direct value travel)
19 to 20	7 to 0	Gain magnification (direct value travel)
21	7	Position specification method (direct value travel)
	6 to 5	Operation mode (direct value travel)
	4 to 3	Acceleration/deceleration method (direct value travel)
	2 to 0	Stop method (direct value travel)

Cyclic data from controller

PD (in)	bit	Full direct value mode Signal name
0	7	Operation preparation complete
	6	Warning#
	5	Alarm#
	4	Servo ON state
	3	Origin return complete
	2	Point travel complete
	1 to 0	-
1	7 to 6	-
	5 to 0	Point travel confirmation bit 5 to 0
2	7 to 5	-
	4	Zone 2
	3	Zone 1
	2	Moving
	1	Point zone
	0	Direct travel status
3 to 6	7 to 0	Position (monitor value)
7 to 8	7 to 0	Speed (monitor value)
9	7 to 0	Current (monitor value)
10 to 11	7 to 0	Alarm (monitor value)

* Refer to the Instruction Manual for details of other operation modes.
* The pound sign (#) indicates a negative logic signal.

● Accessories

Part name	Manufacturer model	Manufacturer
Power supply connector	DFMC 1,5/3-STF-3,5	PHOENIX CONTACT
IO-Link connector	FMC1,5/4-ST-3,5-RF	PHOENIX CONTACT

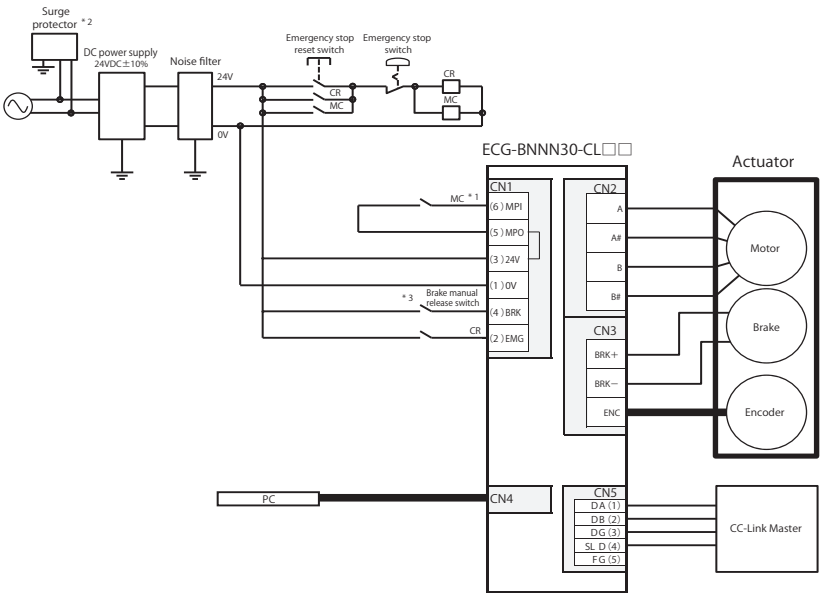
CC-Link specifications and connection diagram (ECG-ANNN30-CL**)

[Communication specifications]

Item	Specifications
CC-Link Version	Ver. 1.10
Station	Remote device station
Remote station No.	1 to 64 (set by parameter setting)
Operation mode Number of occupied stations	PIO mode (1 station occupied)
	Half simple direct value mode (1 stations occupied)
	Simple direct value mode (2 stations occupied)
	Half direct value mode (2 stations occupied)
	Full direct value mode (4 stations occupied)
Remote I/O points	32 points x number of occupied stations
Remote Register input/output	4 words x number of occupied stations
Communication speed	10M/5M/2.5M/625k/156kbps (Selected by parameter setting)
Connection cable	CC-Link Ver. 1.10. compliant cable (3 core twisted pair cable with shield)
Number of connected units	42 max. when only remote device stations are connected
Monitor function	Position, speed, current, alarm

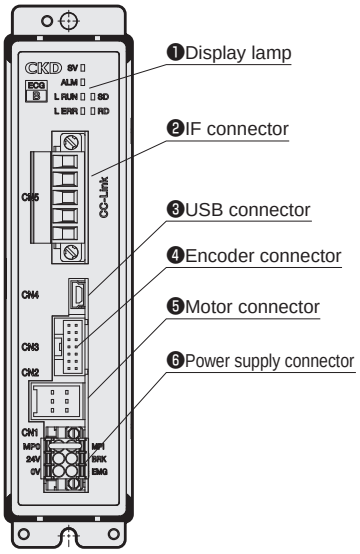
* Items that can be monitored change depending on the operating mode. Refer to page 65 for details.

[CC-Link]



*1 For safety category support, connect the contact of an electromagnetic switch or other device between the MPI and MPO terminals when motor drive power must be shut OFF. (Connected with jumper wires at shipment.)
*2 A surge protector is required to comply with the CE marking.
*3 Wire only when brake is mounted.

[Panel description]



Cyclic data from master

Device No.	Half simple direct value mode Signal name
RYn0	Point number selection bit 0
RYn1	Point number selection bit 1
RYn2	Point number selection bit 2
RYn3	Point number selection bit 3
RYn4	Point number selection bit 4
RYn5	Point number selection bit 5
RYn6	Direct value travel selection
RYn7	JOG/INCH (-) travel start
RYn8	JOG/INCH (+) travel start
RYn9	INCH selection
RYnA	Point travel start
RYnB	Origin return start
RYnC	Servo ON
RYnD	Alarm reset
RYnE	Stop#
RYnF	Pause#
RY (n+1) 0 to RY (n+1) F	Vacant

Cyclic data from controller

Device No.	Half simple direct value mode Signal name
RXn0	Point number confirmation bit 0
RXn1	Point number confirmation bit 1
RXn2	Point number confirmation bit 2
RXn3	Point number confirmation bit 3
RXn4	Point number confirmation bit 4
RXn5	Point number confirmation bit 5
RXn6	Direct value travel status
RXn7	Selectable output 1
RXn8	Selectable output 2
RXn9	-
RXnA	Point travel complete
RXnB	Origin return complete
RXnC	Servo ON state
RXnD	Alarm#
RXnE	Warning#
RXnF	Operation preparation complete
RX (n+1) 0 to RX (n+1) F	Vacant

Device No.	Half simple direct value mode Signal name
RWw0	Position (direct value travel)
RWw1	
RWw2	-
RWw3	-

Device No.	Half simple direct value mode Signal name
RWr0	Position (monitor value)
RWr1	
RWr2	Speed (monitor value)
RWr3	Current (monitor value)

* Refer to the Instruction Manual for details of other operation modes.
* The pound sign (#) indicates a negative logic signal.

● Accessories

Part name	Manufacturer model	Manufacturer
Power supply connector	DFMC1, 5/3-STF-3, 5	PHOENIX CONTACT
CC-Link connector	MSTB2, 5/5-STF-5, 08ABGYAU	PHOENIX CONTACT

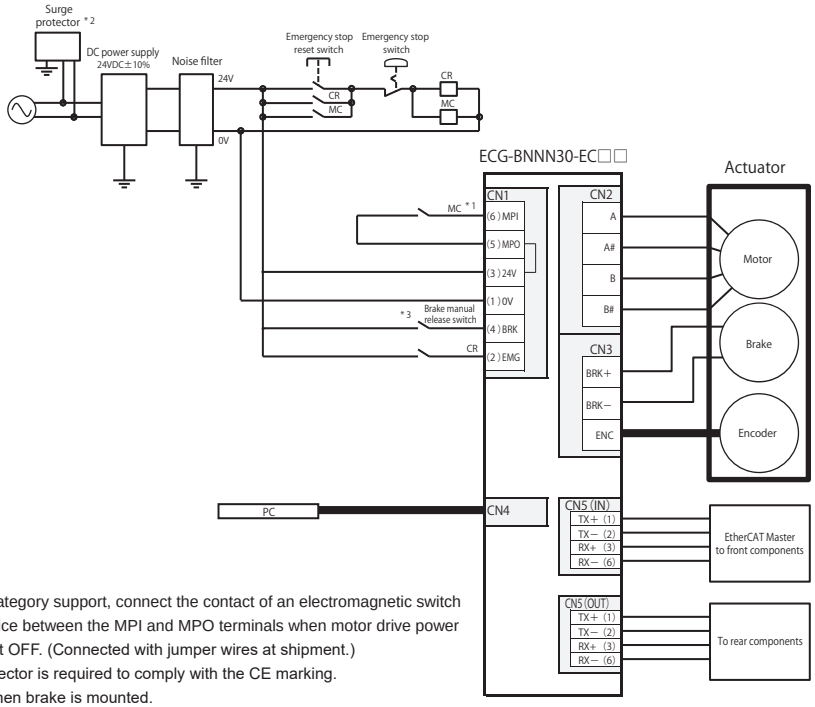
EtherCAT specifications and connection diagram (ECG-ANNN30-EC**)

[Communication specifications]

Item	Specifications
Communication speed	100 Mbps (fast Ethernet, full duplex)
Process data	Variable PDO mapping
Max. PDO data length	RxPDO: 64 bytes/ TxPDO: 64 bytes
Station alias	0 to 65535 (set by parameters)
Connection cable	EtherCAT compliant cable (CAT5e or higher twisted pair cable (double shield with aluminum tape and braid) is recommended.)
Node address	Automatic indexing the master
Monitor function	Position, speed, current, alarm

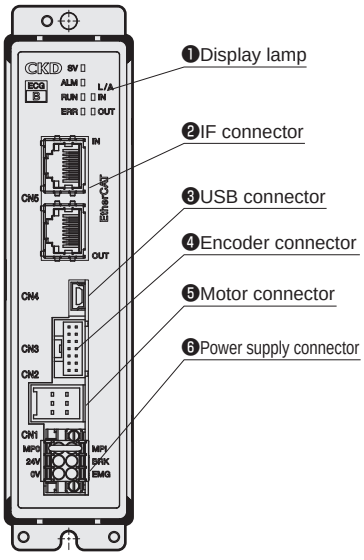
* Items that can be monitored change depending on the operation mode. Refer to page 65 for details.

[EtherCAT]



*1 For safety category support, connect the contact of an electromagnetic switch or other device between the MPI and MPO terminals when motor drive power must be shut OFF. (Connected with jumper wires at shipment.)
*2 A surge protector is required to comply with the CE marking.
*3 Wire only when brake is mounted.

[Panel description]



Cyclic data from master

Index	Sub Index	bit	Full direct value mode Signal name
0x2001	0x01	0 to 5	Point number selection bit 0 to 5
		6	-
		7	JOG/INCH (-) travel start
		8	JOG/INCH (+) travel start
		9	INCH selection
		10	Point travel start
		11	Origin return start
		12	Servo ON
		13	Alarm reset
		14	Stop#
		15	Pause#
		16 to 31	-
	0x02	0 to 3	-
		4	Data request
		5	Data R/W selection
		6 to 11	-
		12	Monitor request
		13 to 14	-
		15	Direct value travel selection
		16 to 31	-
0x2003	0x01	0 to 31	Position (direct value travel)
	0x02	0 to 31	Positioning width (direct value travel)
	0x03	0 to 31	Speed (direct value travel)
	0x04	0 to 31	Acceleration (direct value travel)
	0x05	0 to 31	Deceleration (direct value travel)
	0x06	0 to 31	Pressing rate (direct value travel)
	0x07	0 to 31	Pressing speed (direct value travel)
	0x08	0 to 31	Pressing distance (direct value travel)
	0x09	0 to 31	Mode (direct value travel)
	0x0A	0 to 31	Gain magnification (direct value travel)
	0x0B	0 to 31	Write data
	0x0C	0 to 31	Data number
	0x0D	0 to 31	Monitor number 1
	0x0E	0 to 31	Monitor number 2

Cyclic data from controller

Index	Sub Index	bit	Full direct value mode Signal name
0x2005	0x01	0 to 5	Point number selection bit 0 to 5
		6 to 9	-
		10	Point travel complete
		11	Origin return complete
		12	Servo ON state
		13	Alarm#
		14	Warning#
		15	Operation preparation complete
		16 to 31	-
	0x02	0 to 3	Data response
		4	Data complete
		5	Data write status
		6 to 7	-
		8 to 11	Monitor response
		12	Monitor complete
		13 to 14	-
		15	Direct travel status
		16	Point zone
		17	Moving
		18	Zone 1
		19	Zone 2
		20 to 31	-
0x2007	0x01	0 to 31	Position (monitor value)
	0x02	0 to 31	Speed (monitor value)
	0x03	0 to 31	Current (monitor value)
	0x04	0 to 31	-
	0x05	0 to 31	Alarm (monitor value)
	0x06 to 0x0A	0 to 31	-
	0x0B	0 to 31	Read data
	0x0C	0 to 31	Data (alarm)
	0x0D	0 to 31	Monitor value 1
	0x0E	0 to 31	Monitor value 2

* Refer to the Instruction Manual for details of other operation modes.
* The pound sign (#) indicates a negative logic signal.

● Accessories

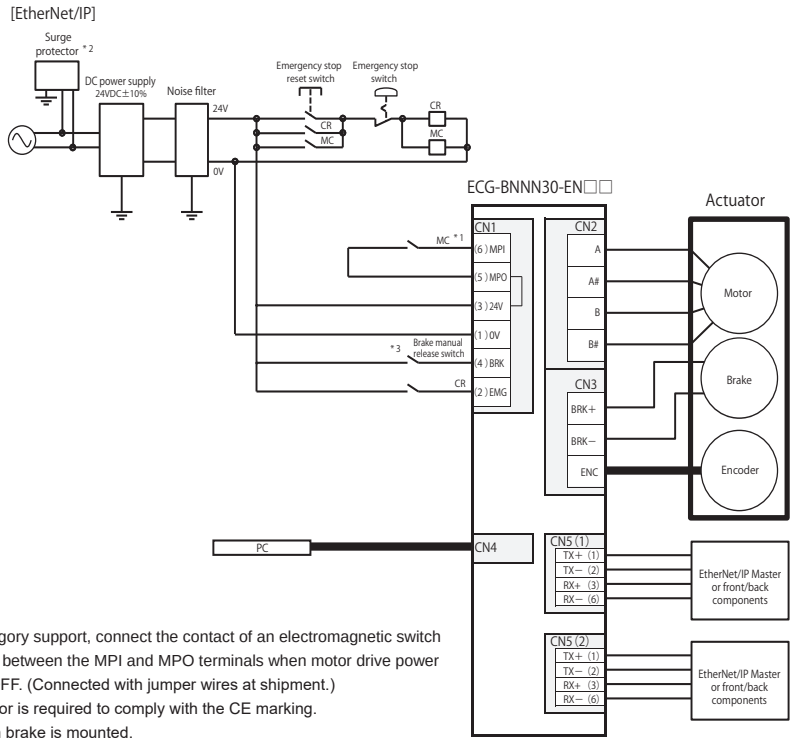
Part name	Manufacturer model	Manufacturer
Power supply connector	DFMC 1,5/3-STF-3,5	PHOENIX CONTACT

EtherNet/IP specifications and connection diagram (ECG-ANNN30-EN**)

[Communication specifications]

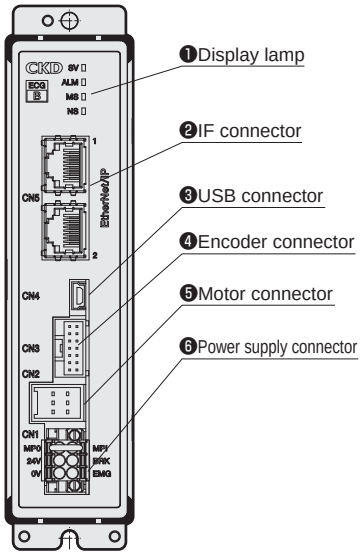
Item	Specifications
Communication protocol	EtherNet/IP
Communication speed	Automatic setting (100 Mbps/10 Mbps, full duplex/half duplex)
Occupied bytes	Input: 64 bytes / Output: 64 bytes
IP address	Setting by parameter (0.0.0.0 to 255.255.255.255) Via DHCP Server (arbitrary address)
RPI (Packet interval)	4 ms to 10000 ms
Connection cable	EtherNet/IP compliant cable (CAT5e or higher twisted pair cable (double shield with aluminum tape and braid) is recommended.)
Monitor function	Position, speed, current, alarm

* Items that can be monitored change depending on the operation mode. Refer to page 65 for details.



*1 For safety category support, connect the contact of an electromagnetic switch or other device between the MPI and MPO terminals when motor drive power must be shut OFF. (Connected with jumper wires at shipment.)
*2 A surge protector is required to comply with the CE marking.
*3 Wire only when brake is mounted.

[Panel description]



Cyclic data from master

Byte	bit	Full direct value mode Signal name
0	0 to 5	Point number selection bit 0 to 5
	6	-
	7	JOG/INCH (-) travel start
1	0	JOG/INCH (+) travel start
	1	INCH selection
	2	Point travel start
	3	Origin return start
	4	Servo ON
	5	Alarm reset
	6	Stop#
	7	Pause#
2 to 3	0 to 7	-
4	0 to 3	-
	4	Data request
	5	Data R/W selection
	6 to 7	-
5	0 to 3	-
	4	Monitor request
	5 to 6	-
	7	Direct value travel selection
6 to 7	0 to 7	-
8 to 11	0 to 7	Position (direct value travel)
12 to 15	0 to 7	Positioning width (direct value travel)
16 to 19	0 to 7	Speed (direct value travel)
20 to 23	0 to 7	Acceleration (direct value travel)
24 to 27	0 to 7	Deceleration (direct value travel)
28 to 31	0 to 7	Pressing rate (direct value travel)
32 to 35	0 to 7	Pressing speed (direct value travel)
36 to 39	0 to 7	Pressing distance (direct value travel)
40 to 43	0 to 7	Mode (direct value travel)
44 to 47	0 to 7	Gain magnification (direct value travel)
48 to 51	0 to 7	Write data
52 to 55	0 to 7	Data number
56 to 59	0 to 7	Monitor number 1
60 to 63	0 to 7	Monitor number 2

Cyclic data from controller

Byte	bit	Full direct value mode Signal name
0	0 to 5	Point number selection bit 0 to 5
	6 to 7	-
1	0 to 1	-
	2	Point travel complete
	3	Origin return complete
	4	Servo ON state
	5	Alarm#
	6	Warning#
	7	Operation preparation complete
2 to 3	0 to 7	-
4	0 to 3	Data response
	4	Data complete
	5	Data write status
	6 to 7	-
5	0 to 3	Monitor response
	4	Monitor complete
	5 to 6	-
	7	Direct travel status
6	0	Point zone
	1	Moving
	2	Zone 1
	3	Zone 2
	4 to 7	-
7	0 to 7	-
8 to 11	0 to 7	Position (monitor value)
12 to 15	0 to 7	Speed (monitor value)
16 to 19	0 to 7	Current (monitor value)
20 to 23	0 to 7	-
24 to 27	0 to 7	Alarm (monitor value)
28 to 47	0 to 7	-
48 to 51	0 to 7	Read data
52 to 55	0 to 7	Data (alarm)
56 to 59	0 to 7	Monitor value 1
60 to 63	0 to 7	Monitor value 2

* Refer to the Instruction Manual for details of other operation modes.
* The pound sign (#) indicates a negative logic signal.

Accessories

Part name	Manufacturer model	Manufacturer
Power supply connector	DFMC 1,5/3-STF-3,5	PHOENIX CONTACT

Relay cable

● Motor/encoder cable (movable)

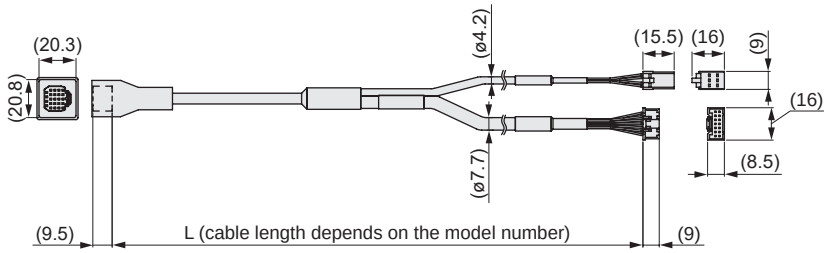
* Can be selected with actuator model

EA-CBLME2 - S 01

(A) (B)

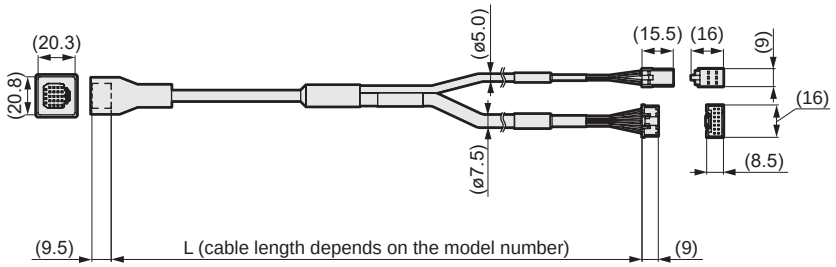
(A) Cable type	
S	Fixed cable
R	Movable cable

(B) Cable length	
01	1 m
03	3 m
05	5 m
10	10 m



● Motor/encoder cable (fixed)

* Can be selected with actuator model



I/O cable

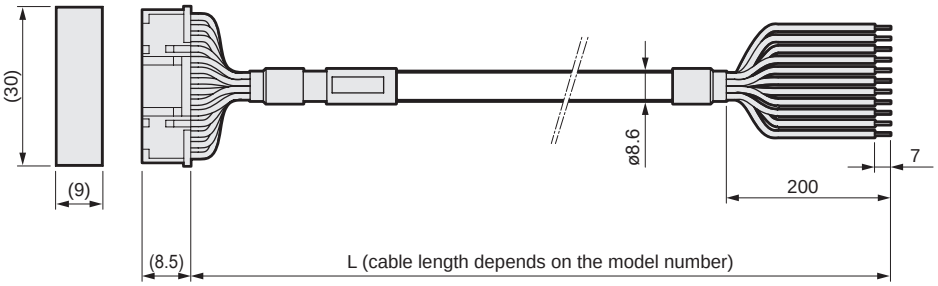
● I/O cable

* Parallel I/O specification controller model can be selected

EA-CBLNP2 - 02

(A)

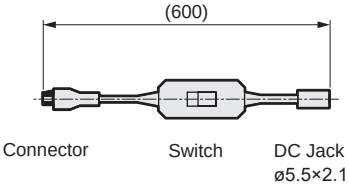
(A) Cable length	
02	2 m
03	3 m
05	5 m
10	10 m



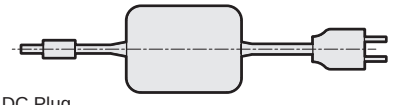
Brake release unit

● FLCR Brake release unit

EA-BRK-UNIT



Customer-provided: AC-DC adapter



DC Plug
ø5.5×2.1
Polarity: Center plus

AC-DC Adapter specifications
Rated output voltage: 18 to 24 VDC
Rated output current: 0.35A or more

Related parts model No. table

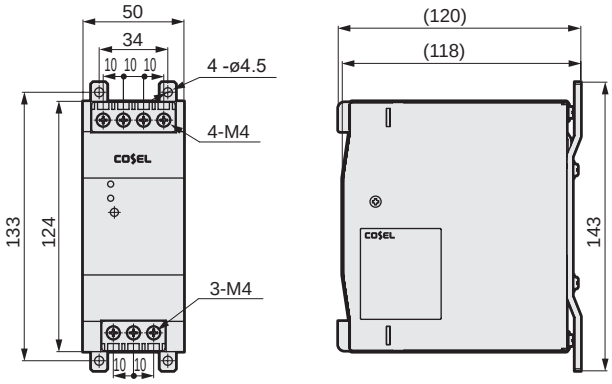
● DC power supply

Item \ Model No.			EA-PWR-KHNA240F-24-N2 (screw mounted) EA-PWR-KHNA240F-24 (DIN rail mount)
Manufacturer			COSEL Co., Ltd.
Manufacturer model No.	Mounting screw		KHNA240F-24-N2
	DIN rail mount		KHNA240F-24
Input voltage			85 to 264 VAC 1ø or 88 to 370 VDC
Output	Power		240 W
	Voltage/current		24V10A
	Variable voltage range		22.5 to 28.5V
Included functions	Overcurrent protection		Operating at 101% min of peak current
	Overvoltage protection		30.0 to 36.0V
	Remote control		Available
	Remote sensing		-
	Other		DC_OK display, ALARM display
Operating temperature/humidity			25 to +70°C, 20 to 90% RH (no condensation), startup possible at 40°C*
Applicable standards	Safety standards	AC input	AC input: Certified UL60950-1, C-UL (CSA60950-1), EN60950-1
			UL508, ANSI / ISA12.12.01, and ATEX; Electrical Appliances and Material Safety Act compliant*
		DC input	UL60950-1, C-UL(CSA60950-1), EN60950-1
	Noise terminal voltage		Compliant with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B
	Harmonic current		Compliant with IEC61000-3-2 (class A)*
Structure	Dimensions (W x H x D)		50×124×117mm
	Weight		900g max
	Cooling method		Natural air cooling

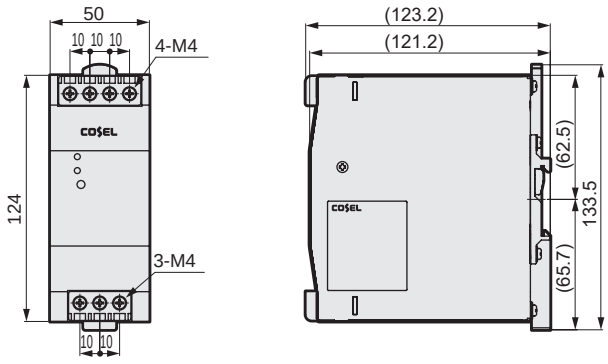
* Refer to the manufacturer's website for details.
* The CE marking and ROHS are obtained with the manufacturer model No.

Part names and dimensions

● EA-PWR-KHNA240F-24-N2 (24 V screw mounted)



● EA-PWR-KHNA240F-24 (24 V DIN rail mounted)



● Other parts

Part name	Model No.
Noise filter for power supply (single phase, 15 A)	AX-NSF-NF2015A-OD

* Refer to the instruction manual for the ferrite core to be used.

Safety Precautions

Always read this section before use.

When designing equipment using electric actuators, the manufacturer is obligated to ensure that the safety of the mechanism and the electrically controlled system are secured.
It is important to select, use, handle and maintain CKD products appropriately to ensure their safe usage.
Observe warnings and precautions to ensure device safety.
Check that device safety is ensured and a safe device is manufactured.

WARNING

1 This product is designed and manufactured as a general industrial machine part.
It must be handled by an operator having sufficient knowledge and experience in handling.

2 Use the product within specifications range.

This product must be used within its stated specifications. It must not be modified or machined additionally.
This product is intended for use as a device or part for general-purpose industrial machinery. It is not intended for use outdoors (except for outdoor type) or for use under the following conditions or environment.
(Note that this product can be used under the following conditions only when CKD is consulted prior to use and the customer consents to CKD product specifications. The customer must provide safety measures to avoid risks in the event of problems.)

❶ Use for special applications which require the safety, including nuclear energy, railways, aircrafts, marine vessels, vehicles, medicinal devices, devices or applications coming into contact with beverages or foodstuffs, amusement devices, emergency operations (cutoff circuits, opening etc.) circuits, press machines, brake circuits, or safety devices or applications.

❷ Use for applications where life or assets could be adversely affected and special safety measures are required.

3 Observe organization standards and regulations, etc. related to the safety of device design.

4 Never remove devices before confirming safety.

❶ Inspect and service on the machine and devices after confirming safety of the entire system related to this product.

❷ Note that there may be hot or charged sections even after operation is stopped.

❸ When inspecting or maintaining device, be sure to shut down the power supply of the equipment and the relevant power supply, using caution to avoid electric shock.

5 Observe instruction manual and precautions attached the product surely to prevent accidents.

❶ The product could operate unexpectedly during teaching operation or trial operation. Be especially careful not to touch the actuator. If operating the product from a position where the shaft body cannot be seen, be sure to first confirm that the safety is secured even if the actuator moves.

6 Observe precautions to prevent electric shock.

❶ Do not touch the heat sink, cement friction, or motor inside the controller.
These will heat up, and could cause burns. Wait an appropriate amount of time prior to performing inspections or other tasks.
A high voltage is applied until the electrical load stored in the internal capacitors is discharged after the power is turned OFF.
Do not touch for around three minutes after the power OFF.

❷ Make sure to turn the switch on the controller power supply source OFF, before maintenances and inspections.
There is a danger of high voltage electric shocks.

❸ Do not attach or remove connector, while the power is on. Otherwise, this may cause malfunction, failure, or electric shock.

7 Install an overcurrent protector.

The wiring to the driver should be in accordance with JIS B 9960-1:2019 (IEC 60204-1:2016) Safety of Machinery - Electrical Equipment of Machines - Part 1: General Requirements. Install an overcurrent protector (a circuit breaker or circuit protector for wiring) on the main power, control power, and I/O power.

(Reference: JIS B 9960-1 7.2.1 General description)
If there is a possibility the circuit current may exceed the rated value of the component or the allowable current of the conductor, an overcurrent protection must be provided. The details of the ratings or set values to be selected shall be provided in 7.2.10.

8 Observe precautions below to prevent accidents.

■ The precautions are ranked as "DANGER", "WARNING" and "CAUTION" in this section.

DANGER: When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries, and when there is a high degree of emergency to a warning.

WARNING: When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries.

CAUTION: When a dangerous situation may occur if handling is mistaken leading to minor injuries or physical damage.

Note that some items described as "CAUTION" may lead to serious results depending on the situation.
Every item provides important information and must be observed.

Warranty

1 Warranty period

The product specified herein is warranted for one (1) year from the date of delivery to the location specified by the customer.

2 Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified above, CKD will promptly provide a replacement for the faulty product or a part thereof or repair the faulty product at one of CKD's facilities free of charge.

However, following failures are excluded from this warranty:

1) Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or the Instruction Manual.
2) Failure caused by use of the product exceeding its durability (cycles, distance, time, etc.) or caused by consumable parts.
3) Failure not caused by the product.
4) Failure caused by use not intended for the product.
5) Failure caused by modifications/alterations or repairs not carried out by CKD.
6) Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
7) Failure caused by acts of nature and disasters beyond control of CKD.

The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.

Note: For details on the durability and consumable parts, contact your nearest CKD sales office.

3 Compatibility confirmation

The customer is responsible for confirming the compatibility of CKD products with the customer's systems, machines and equipment.

4 Range of service

The delivered product price does not include engineer dispatch service fees. Separate fees will be charged in the following cases.

(1) Instruction of installation and adjustment, and presence on test operation
(2) Maintenance and inspection, adjustment, and repair
(3) Technical instructions and technical education (operation, program, wiring method, safety education, etc.)

Precautions for export

Products and related technologies in this catalog
Those of the products and related technologies in this catalog which are subject to US Export Administration Regulations
(EAR) are marked on the product page as "Product subject to the EAR (EAR99) or (EAR99 and 3A991)".
For export or provision of products or related technologies subject to EAR regulations, we request that the US Export Administration Regulations (EAR) be observed appropriately.

Safety Precautions

Be sure to read this section before use.

Common precautions: Electric actuator FLSH/FLCR/FGRC Series and Controller ECR/ECG

Design/selection

1. Common

⚠ DANGER

- Do not use in places where dangerous goods such as ignitable substances, inflammable substances or explosives are present.
  There is a possibility of ignition, combustion or explosion.
- Ensure that the product is free of water droplets and oil droplets.
  Failure to do so may lead to fire or malfunction.
- When mounting the product, be sure to hold and fix it (including workpieces) securely.
  Falling, dropping, abnormal operation, etc., of the product may cause injury. As a rule, fix the product using all mounting holes.
- Be sure to use a DC stabilized power supply (48 VDC ±10% or 24 VDC ±10%) for the ECR Series motor and control power supplies.
  Connecting directly to the AC power supply may cause fire, explosion, damage, etc.
- Be sure to use a DC stabilized power supply (24 VDC ±10%) for the I/O circuit power supply and ECG Series motor and control power supplies.
  Connecting directly to the AC power supply may cause fire, explosion, damage, etc.
- Only 24 VDC power supplies can be used for the ECG Series.
  Using a 48 VDC power supply may cause controller failure.

⚠ WARNING

- Use the product in the range of conditions specified for the product.
- Provide a safety fence to prevent entry to the movable range of the electric actuator. In addition, install the emergency stop button switch as a device in a location which is easy to operate in an emergency situation. For the emergency stop button, use a structure and wiring that will prevent automatic restoration or inadvertent restoration by personnel.
- If the moving workpiece poses a possible risk to personnel or if fingers could be caught, take safety measures.
- An emergency stop may take several seconds, depending on the travel speed and load.
- Design a safety circuit or equipment so that damage to equipment, injury to persons, etc., does not occur when the machine stops in the event of a system failure such as emergency stop or power outage.
- Install indoors with low humidity.
  There is a risk of electric leakage or fire accidents in places exposed to rainwater or where there is high humidity (humidity of 85% or more, condensation). Oil drops and oil mist are also strictly prohibited.
  Use in such an environment could lead to damage or operation failure.
- Make sure that the product is D type grounded (ground resistance of 100 Ω or less).
  Electric shock or malfunction may occur if there is electric leakage.
- Use and store in accordance with the working/storage temperatures and where there is no condensation.
  (Storage temperature: -10°C to 50°C, storage humidity: 35% to 80%, operating ambient temperature: 0°C to 40°C, operating ambient humidity: 35% to 80%) Otherwise, abnormal stopping or decreased product service life may result. Ventilate in locations where heat may build up.
- Do not use this product in a location where the ambient temperature could suddenly change and cause dew to condense.
- Install in a location free from direct sunlight, dust, and corrosive gas/explosive gas/inflammable gas/combustibles, and away from heat sources. Chemical resistance of this product has not been taken into account.
  Otherwise, damage, explosions, or fire may result.
- Use and store in locations free from strong electromagnetic waves, ultraviolet rays, or radiation.
  Otherwise, malfunction or damage may result.
- Consider the possibility of power source failure.
  Take measures to prevent bodily injury or machine damage even in the event of a power failure.
- Consider the operation status when restarting after emergency or abnormal stops.
  Design the system so that bodily injury or equipment damage will not occur when restarting. If there is a need to reset the electric actuator to the starting position, design a safe control device. Consider the possibility of power failure of the mounted motor. Take measures to prevent bodily injury or machine damage even in the event of a power failure.
- Avoid using this product where vibration or impact are present.
- Do not apply a load to the product that is greater than or equal to the allowable load listed in the materials for selection.

⚠ CAUTION

- Never disassemble or modify the product.
- The customer is responsible for confirming the compatibility of CKD products with the customer's systems, machines and equipment.
- For U L compatibility, use a Class2 power supply unit conforming to UL1310 for the combination DC power supply.

- Set up the wiring so as not to apply inductive noise.
  Avoid locations where large currents or strong magnetic fields are generated. Do not use the same wiring as any large motor power lines other than that of this product. Do not use the same wiring as inverter power supplies used for robots, etc. Apply a frame ground for the power supply and insert the filter to the output part.
- Be sure to separate the power supply of the output of this product and the power supply of inductive loads that generate surges, such as solenoid valves and relays.
  If the power supply is shared, surge current may flow into the output and cause damage. If a separate power supply cannot be used, connect the surge absorption element directly to all inductive loads in parallel.
- Select a power supply which provides ample capacity based on the number of installed products. Malfunction may occur if there is no margin for the capacity.
- A fixed cable cannot be used in applications where it is repeatedly bent. Use a movable cable in places where it is repeatedly bent.
- Fix the fixed cable so that it does not easily move. Cable used with bending radius 63mm or more.
- Because the bending radius does not apply to bending of the connector part, we recommend fixing near the connector.
- The origin position is recognized when the power supply is turned ON. If an external stopper or holding mechanism (brake, etc.) is attached, an unintended position may be recognized as the origin position. Be careful with the layout of the external stopper, etc., so that the origin can be properly detected after the power supply is turned ON.
- Use a cable within 10 m to connect the IF connector.

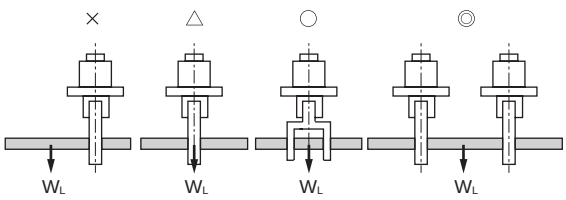
2. FLSH Series

⚠WARNING

- The gripping force may decrease during a power outage or similar. Use a safe design that takes this into consideration. The gripping force may decrease during a power outage or similar, dislodging the workpiece, so be sure to install a safety mechanism to prevent injury or mechanical damage.

⚠CAUTION

- When gripping long or large workpieces, stable gripping requires a grip on the center of gravity. Stability is a must when using larger or multiple workpieces as well.



×: Unsuitable, △: Conditional, ○: Acceptable, ◎: Excellent

- Select a model that has sufficient power to grip the workpiece weight.
- Select a model that has sufficient opening/closing width for the workpiece size. The gripping position may become unstable due to variation in the open/close width or the workpiece.
  When opening after gripping operation, increase the stroke by an amount corresponding to the backlash amount.

3. FLCR Series

⚠WARNING

- When installing the actuator in a direction other than horizontal, select the type with brake. If the motor is not equipped with a brake, the movable parts may fall off at servo OFF (including emergency stops and alarms) or power OFF, which may result in injury or damage to the workpiece.
- The brakes are not sufficient to completely retain the actuator in all situations. Be sure to achieve a balanced state or install a mechanical lock mechanism where safety must be guaranteed, such as when performing maintenance in an application where the table moves with an unbalanced load or when stopping the machine for a long period of time.

⚠CAUTION

- Use with a load that does not exceed the specified range. If used outside of the specified range, an excessive eccentric load will be applied to the guide. This can cause chattering in the guide, reduce accuracy, and/or reduce the operating life.

4. FGRC Series

⚠WARNING

- Use a safe design that takes load fluctuation, rising/lowering operation (wall-mounted), and changes in frictional resistance into consideration. Operation speed may increase, causing injury or mechanical damage.
- The pressing torque may decrease during a power outage or similar. Use a safe design that takes this into consideration. When using a clamp mechanism, the clamping force may decrease during a power outage or similar, dislodging the workpiece, so be sure to install a safety mechanism to prevent injury or mechanical damage.
- Sudden stops during table rotation may generate load torque larger than the theoretical value. Design with attention to safety.
- Backlash may cause vibration when stopping or increased positioning time. When stopping precision is required, use an external stopper, etc., and complete positioning with pressing operation.

1. Common

DANGER

- Do not enter the operating range of the product while the product is operable.
  The product may suddenly move and may result in injuries.
- The wiring should be in accordance with JIS B 9960-1: 2019 Safety of Machinery - Electrical Equipment of Machines - Part 1: General Requirements. Install an overcurrent protector (a circuit protector or a shutoff mechanism for wiring) for the primary side of the power supply.
- Do not operate the unit with wet hands.
  This may cause electric shock.
- When connecting a computer, do not ground its frame ground (FG).
  When using a controller with positive grounding, connecting the controller and peripheral components to the computer with a USB cable risks short-circuiting the DC power supply.

WARNING

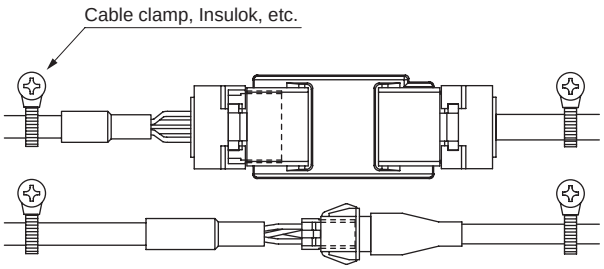
- Precision parts are built in, so laying the product on its side or applying vibration or impact during transportation are strictly prohibited.
  This may cause damage to the parts.
- For preliminary installation, place horizontally.
- Do not step onto the packaging or place objects on it.
- Avoid condensation, freezing, etc., and maintain ambient temperatures of -10 to 50°C and ambient humidity of 35 to 80% when transporting and carrying.
  Otherwise, the product may be damaged.
- Mount the product on incombustible materials. Direct mounting on combustibles or mounting near combustibles may cause fire.
  There is a risk of burns.
- Do not step onto the product or place objects on it.
  This may result in falling, knocking the product over, injury due to falling, product damage and/or malfunctions due therein, etc.
- Take measures to prevent bodily injury or machine damage even in the event of a power failure.
  There is a risk of unexpected accidents.
- If the product generates abnormal heat, smoke or odor, turn OFF the power immediately.
  Otherwise, product damage or fire may result.
- Stop operation immediately when abnormal noise or major vibration occurs. Otherwise, product damage or abnormal operation may result.
- Wire the product securely while confirming with this catalog and the instruction manual and ensuring that there is no miswiring or loose connectors. Check wiring insulation.
  Due to contact with other circuits, ground faults and insulation failure between terminals, overcurrent may flow into the product and damage it. This may cause abnormal operation or fire.
- Be sure to insulate unused wires.
  Failure to do so may cause malfunction, failure, or electric shock.
- Do not damage the cable, snag it, apply excessive stress to it, or place heavy objects on it.
  Otherwise, poor conduction or electric shock may occur.
- Be sure to perform a safety check of the device's operating range before supplying power to the product. If the product LEDs do not light up when the power supply is turned ON, immediately turn the power OFF.
  Inadvertently supplying power can cause electric shock or injury.
- When restarting the machine/equipment, confirm that measures are taken to prevent parts from coming loose.
- Check that the servo is turned OFF before manually moving the movable parts of the product.
- The movable parts may fall or otherwise move unexpectedly when the actuator servo is turned OFF. When turning the servo OFF, take steps to prevent danger and operate the equipment with full attention to safety.
- Before operating the actuator, check that it will operate safely.

CAUTION

- Regarding installing, setting up, and/or adjusting the actuator, read through the instruction manual and operate correctly.
- When installing the product, be sure to secure space for maintenance work.
  Otherwise, it may not be possible to conduct inspection and maintenance, leading to stoppage or damage of the device or injury during operation.
- Do not hold the product's movable parts or cables during transportation and installation.
  This may lead to injury or disconnection.

- When carrying the product, support it from the bottom.

- When transporting and mounting the product, ensure operator safety by supporting the product with a lift or other supporting tools, or working in pairs or more.
- Do not install in places where large vibration or impact is transmitted.
  This may cause malfunction.
- Do not operate the movable parts of the product with external force or sudden deceleration.
  This may lead to malfunction or damage due to regenerative current.
- When returning to origin, excluding pressing operation, do not hit the mechanical stopper, etc.
  This may cause malfunction.
- Do not apply external force to the actuator during origin return. There is a possibility of misrecognition of the origin.
- Durability varies with transported load and environment. The transport load, etc., should be at a setting well within the margin.
- Make sure that no vibration/impact is applied to the movable parts.
- Install such that no torsion or bending force is applied to the product.
- When performing electric welding on the equipment to which the product is mounted, remove all F.G. (frame ground) wire connections to the product.
  If electric welding is performed with the F.G. connection attached, the product may be damaged by welding current, excessively high voltage during welding, or surge voltage.
- Do not disassemble or modify the product.
  This may cause injury, accident, malfunction or failure.
- Do not bend the fixing cable repeatedly.
  If the cable needs to be repeatedly bent, use a movable cable.
- Do not move the cable leading out of the actuator.
  Fix the cable part.
  Furthermore, use cables with a bending radius of 40 mm or more.

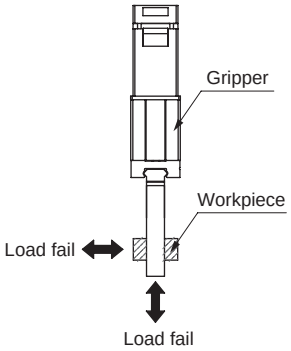


- Avoid use in locations exposed to ultraviolet rays or with atmospheres of corrosive gas or salt.
  Otherwise, degradation of performance, abnormal operation or deterioration in strength due to rust may result.
- Be sure to use the dedicated cable to connect the actuator and controller.
  Mistakenly connecting another component may cause malfunction or failure.
- Before adjusting the gain, secure the actuator body to a nearby machine and securely mount jigs and other components as well.
- When wiring, do not apply excessive force to the connectors.
- Do not push hard on the controller case.

2. FLSH Series

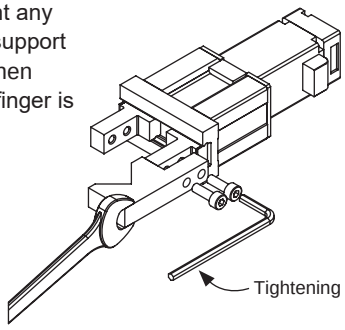
⚠CAUTION

- Do not apply excessive load to the finger or attachment when attaching/removing or transporting the workpiece. Scratches and dents may occur on the rolling surface of the finger linear guide, possibly causing malfunction.



- Do not cause dents or scratches that may damage flatness or perpendicularity on the body mounting surface or finger.
- Do not retighten or disassemble, other than the screws used for fixing the body and attachment.
  This could lead to malfunction.
- Installing the attachment

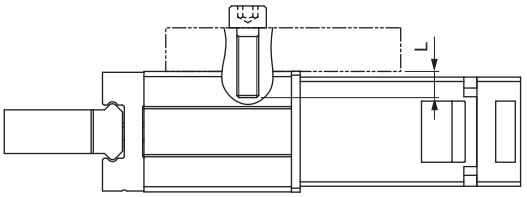
When mounting the attachment to the finger, to prevent any effect on the gripper, support with a wrench, etc., when tightening so that the finger is not twisted.



Item	Bolt used	Tightening torque (N·m)
FLSH-16	M3×0.5	0.59
FLSH-20	M4×0.7	1.4
FLSH-25	M5×0.8	2.8

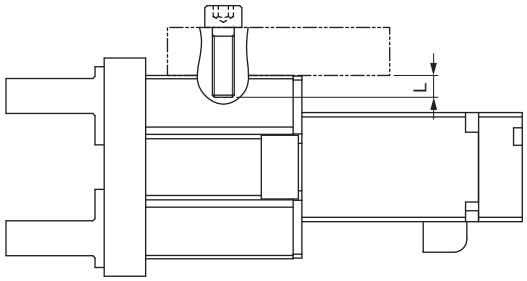
■ Refer to the following section for body mounting.

● Front mounting



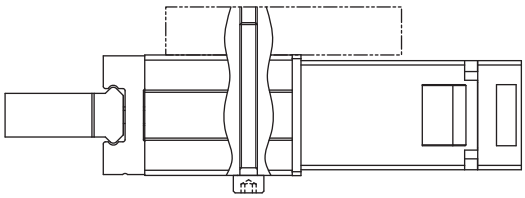
Item	Bolt used	Tightening torque (N·m)	Max. screw insertion depth L (mm)
FLSH-16	M4 × 0.7	2.1	8
FLSH-20	M5 × 0.8	4.3	8
FLSH-25	M6 × 1.0	5.2	10

● Side mounting



Item	Bolt used	Tightening torque (N·m)	Max. screw insertion depth L (mm)
FLSH-16	M4 × 0.7	1.6	4.5
FLSH-20	M5 × 0.8	3.3	8
FLSH-25	M6 × 1.0	5.2	10

● Use of through hole



Item	Bolt used	Tightening torque (N·m)
FLSH-16	M3 × 0.5	0.88
FLSH-20	M4 × 0.7	2.1
FLSH-25	M5 × 0.8	4.3

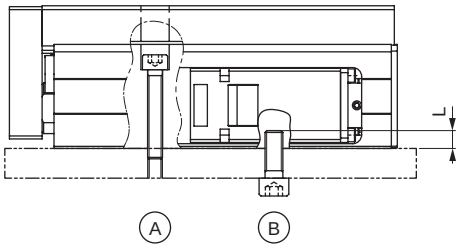
■ To remove the workpiece when not energized, use the manual operation plate to open/close the finger, or remove the attachment and then remove the workpiece. Do not apply excessive force to the manual operation plate. Otherwise it could be damaged or malfunction. (refer to P.81)

3. FLCR Series

⚠CAUTION

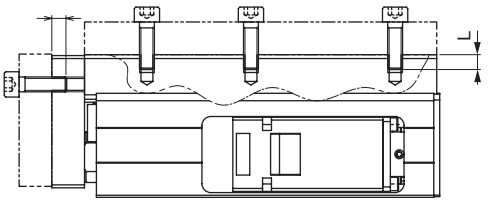
■ Do not damage the surface flatness by denting or scratching the body mounting surface or the table surface.
In addition, make sure that the flatness of the mating surface for body and table mounting is 0.02 mm or less.

■ Observe the following bolt insertion lengths and tightening torque when mounting the body.



Item	A		B		
	Bolt used	Tightening torque (N·m)	Bolt used	Tightening torque (N·m)	Max. screw insertion depth L (mm)
FLCR-16	M5 × 0.8	2.9 to 5.1	M6 × 1.0	4.8 to 8.6	9
FLCR-20	M5 × 0.8	2.9 to 5.1	M6 × 1.0	4.8 to 8.6	9
FLCR-25	M6 × 1.0	4.8 to 8.6	M8 × 1.25	12.0 to 21.6	12

■ Observe the following bolt insertion lengths and tightening torque when installing the jig on the slide table or end plate.



Item	Table		
	Bolt used	Tightening torque (N·m)	Max. screw insertion depth L (mm)
FLCR-16	M5 × 0.8	2.9	5 to 6
FLCR-20	M5 × 0.8	2.9	5 to 6
FLCR-25	M6 × 1.0	4.8	6 to 7

Item	End plate		
	Bolt used	Tightening torque (N·m)	Max. screw insertion depth L (mm)
FLCR-16	M5 × 0.8	2.9	7.5 to 9
FLCR-20	M5 × 0.8	2.9	7.5 to 11
FLCR-25	M6 × 1.0	4.8	9 to 11

■ When using a positioning hole, use a pin of dimensions that do not require press fitting. If a pin is press fitted, the load of press fitting may damage or distort the linear guide, lowering the accuracy. The recommended tolerance of a pin is JIS tolerance m6 or less.

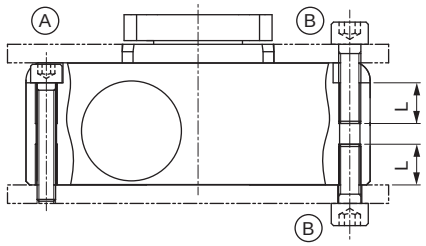
■ To operate when not energized, use the manual operation screw (refer to page 81).

4.FGRC Series

⚠CAUTION

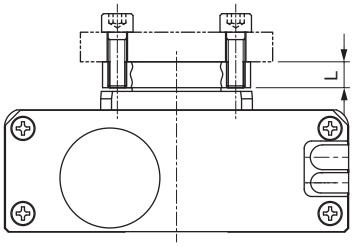
■ Do not damage the surface flatness by denting or scratching the body mounting surface or the table surface. In addition, make sure that the flatness of the mating surface for body and table mounting is 0.02mm or less.

■ Observe the following bolt insertion lengths and tightening torque when mounting the body.



Item	A (through hole)		B (main body mounting)		
	Bolt used	Tightening torque (N·m)	Bolt used	Tightening torque (N·m)	Max. screw insertion depth L (mm)
FGRC-10	M5 x 0.8	3	M6 x 1.0	5	11
FGRC-30	M6 x 1.0	5	M8 x 1.25	12	12
FGRC-50	M8 x 1.25	12	M10 x 1.5	24	15

■ Observe the following bolt insertion lengths and tightening torque when installing the jig on the table. If the bolt is long and interferes with the body, it could cause malfunction.



Item	Bolt used	Tightening torque (N·m)	Max. screw insertion depth L (mm)
FGRC-10	M5 x 0.8	2	7
FGRC-30	M6 x 1.0	4	9
FGRC-50	M6 x 1.0	4	13

■ When using a positioning hole, use a pin of dimensions that do not require press fitting. If a pin is press fitted, the press fitting load may damage the bearing or damage the distortion, lowering the accuracy. The recommended tolerance of a pin is JIS tolerance m6 or less.

■ To operate when not energized, use the manual operation plate. If operation with the manual operation plate is required, check the manual operation position of the electric rotary to ensure that there is enough space. Do not apply excessive torque to the manual operation plate. Otherwise it could be damaged or malfunction (refer to page 81).

1. Common

⚠DANGER

- Do not operate the unit with wet hands.
  It may lead to electric shock.
- When connecting a computer, do not ground its frame ground (FG).
  When using the controller with positive grounding, connecting the controller and peripheral equipment to the PC with a USB cable risks short-circuiting the DC power supply.

⚠WARNING

- Wiring work and inspection should be done by a specialized technician.
- When performing maintenance, inspection and repair, stop the power supply to this product.
  Caution people in the vicinity that a third party should not turn ON the power inadvertently.
- Do not attach or detach wiring or connectors with the power supply ON.
  Failure to do so may cause malfunction, failure, or electric shock.
- For wiring work and inspection, check the voltage with a tester after more than 5 minutes have elapsed since turning OFF the power.
  It may lead to electric shock.
- Mount the product before wiring.
  It may lead to electric shock.
- Make sure that the diameter of the lead wire used for the power cable can tolerate up to 8.6A of current.
  Otherwise, heat generation or damage during operation may be caused.
- Do not connect the product's communication connector to other components.
  Doing so may cause failure or damage.
- Turn OFF the power supply in the event of a power failure. When the power is restored, the product may move unexpectedly and cause accidents.
- Perform a safety check of the component's operating range before supplying power to the product.
  Inadvertently supplying power can cause electric shock or injury.
- Do not enter the operating range while the product is operable.
  The product may move unexpectedly and cause injury.
- Do not touch the product with hands or body during operation or immediately after stopping.
  This may cause burns.
- Do not step onto the product or place objects on it.
  This may result in falling, knocking the product over, injury due to falling, product damage, malfunctions due thereto, etc.
- Take measures to prevent bodily injury or machine damage even in the event of a power breakdown.
  There is a risk of unexpected accidents.
- Before operating from a position where the actuator cannot be seen, confirm that it can be safely operated.
- Check that the servo is turned OFF when manually moving the movable parts of the product.
- If there is a problem with the timing belt, stop operation immediately and replace the timing belt. Breakage of the timing belt in vertical use is particularly dangerous, so be sure to replace it in a timely manner.
  Check for wear and tear on the teeth or sides, vertically split teeth, cracked or softened reverse, partial disconnection or the like of the timing belt.
- If the product generates abnormal heat, smoke or odor, turn OFF the power immediately.
  Otherwise, product may result in damage or fire.
- Stop operation immediately when abnormal noise or major vibration occurs.
  Otherwise, product damage or abnormal operation may result.

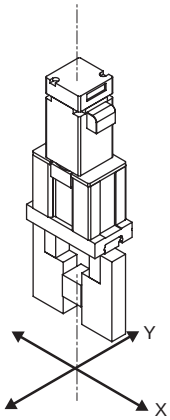
⚠CAUTION

- Do not put fingers or objects into the opening of the product.
  This may cause product damage or injury.
- Do not dent or damage the movable parts.
  This may cause malfunction.
- Do not turn OFF the servo with gravity or inertia applied.
  The product may continue to operate or fall at servo OFF. Be sure to turn OFF the servo in a balanced state without gravity or inertia applied, or confirm safety before proceeding.
- Do not issue a stop command while the product is accelerating or decelerating.
  Doing so may result in a dangerous change in speed (acceleration).
- When operation involves vibration, change the set speed so that vibration does not occur.
- Vibration may occur even within the operation speed range depending on the working conditions.
- Do not disassemble or modify the product.
  This may cause injury, accident, malfunction or failure.
- Ensure proper operation through periodic inspections (2 to 3 times per year).
- Be sure to wear protective eyewear when lubricating.
  If grease scatters and enters the eye, it may cause inflammation.
- When disposing of the product, comply with laws pertaining to waste treatment and cleaning. Consign it to a specialized waste disposal company for processing.
- The circuit board inside the product has capacitors connected between the circuits and the metal body to prevent damage due to static electricity. Avoid withstand voltage and insulation resistance tests on equipment with this product installed. If tests are done, the product will be damaged. If it is necessary for the equipment, remove the product before doing the test.
- If the actuator and controller combination is changed, be sure to confirm the programs and parameters prior to operation.
  Otherwise, there is a risk of unexpected accidents.
- Frequently turning the power ON/OFF can cause damage to the elements inside the controller.
- Use the product in the range of conditions specified for the product.
  The elements inside the controller may overheat and be damaged.
- The relationships between pressing force (gripping force) and pressing rate described in this catalog are merely guidelines. Fluctuation in motor torque, etc., may cause errors even at the same set values.

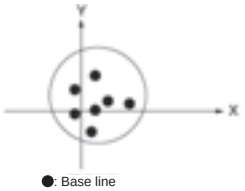
2. FLSH Series

⚠CAUTION

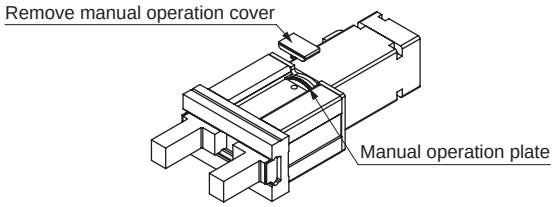
- Repeatability
  The repeatability here indicates the displacement of the finger stopping position when clamping and unclamping are repeated under the same conditions (gripper fixed, same attachment used: see below). Shock during opening and closing may lead to position misalignment of the workpiece and deterioration of repeatability. Note that wear to the attachment or insufficient rigidity may also decrease accuracy.



Conditions
·Attachment dimensions, shape, weight
·Attachment workpiece gripping position
·Clamp method, length
·Attachment and workpiece contact area resistance
·Fluctuation of gripping force, etc.



- The amount of backlash has no effect during pressing operation.
  Backlash may cause misalignment in the position of the finger during positioning operation, so be sure to take the amount of backlash into consideration when setting the position.
- When gripping during pressing operation, set the target position with some margin from the stop position. (Include the amount of backlash.)
- When gripping a workpiece, always use pressing operation.
  Do not allow the finger or attachment to strike the workpiece during positioning operation or within the positioning range.
  The feed screw may seize, leading to malfunction.
- Set the operating torque when releasing the grip to a value larger than the pressing operating torque. If the release torque is low, galling may prevent releasing.
- If the finger suffers galling due to operation setting abnormalities, use the manual operation plate to open/close the finger. However, do not apply excessive torque to the manual operation plate. Otherwise it could be damaged or malfunction.

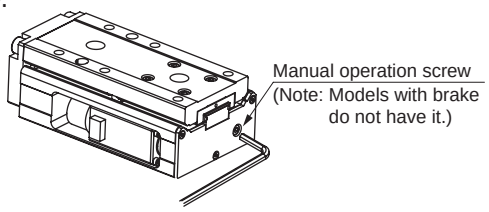


- This finger uses a finite orbit guide. Therefore, when inertia is applied due to travel or rotation, the steel ball moves closer, possibly increasing the sliding resistance or decreasing the accuracy. In this case, perform full stroke length operation.
- Apply AFF grease (THK) to the guide rail surface after six months or when the number of operational cycles reaches one million, whichever comes first.

3. FLCR Series

⚠CAUTION

- To perform pushing operation, always use "pressing operation." Do not make contact at the stroke end unless returning to origin.
  If the table collides at the stroke end, parts such as the guide, belt, or stopper could be damaged, preventing normal operation. Note that the workpiece may fall under its own weight when vertical.
- Do not apply load other than the transport load when returning to origin, or apply any vibration or resistance.
- Do not fix the table and operate the body.
- During pressing operation, set the target position with some margin from the stop position. (Include the amount of backlash.)
- Use an Allen wrench to turn the manual operation screw.

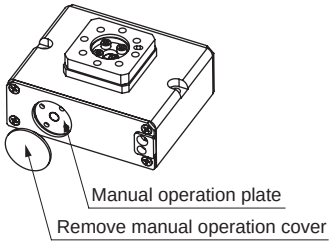


- Apply AFF grease (THK) to the guide rail surface after six months or when the number of operational cycles reaches one million, whichever comes first.

4. FGRC Series

⚠CAUTION

- To perform pushing operation, always use "pressing operation."
  If exterior contact is made during positioning operation or within the positioning range, a significant amount of energy will be generated and may cause damage.
- For pressing operation, set the position at least 1° to the front of the exterior contact position. (Include the amount of backlash.)
- Backlash has no effect during an exterior stop caused by pressing operation.
  Backlash may cause misalignment in the position of the table during positioning operation, so be sure to take the amount of backlash into consideration when setting the position.
- Self-lock mechanism
  A gear-based self-lock mechanism is included to prevent movement even if an external force is applied to the table.
  To move the table when the power supply is OFF, turn the manual operation plate to move the table.



- If repeatedly operating within a 45° range, perform operation with an angle of rotation of at least 90° roughly once a day. Otherwise, the bearings may become degreased.

MEMO

MEMO

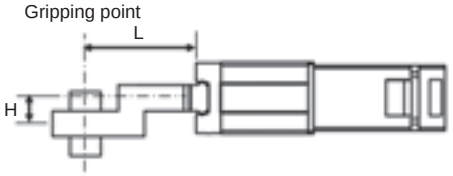
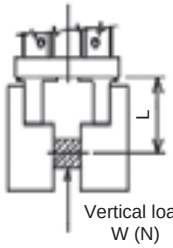
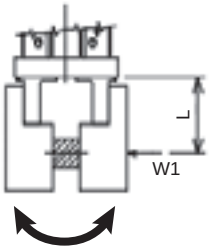
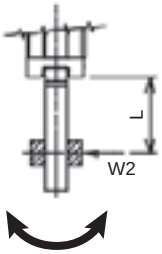
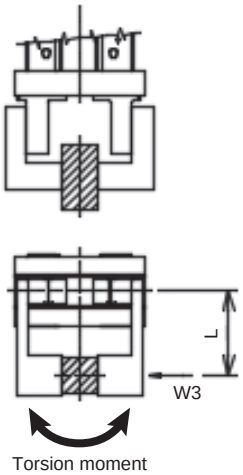
FLSH Series Model Selection Check Sheet → **CKD** (Contact:)

Fill in the form and send to the nearest CKD Sales Office.
We will respond with the model selection results.

Customer:

Company		Department	
Name		E-mail	
TEL		FAX	

Selecting conditions:

Desired model		
Basic specifications	Max. stroke length (one side):	mm
Operating conditions	Travel stroke (one side):	mm, travel time: s
	Gripping force (one side):	N
	Open/close speed (one side):	mm/s, gripping speed mm/s
	Repeatability: ±	mm, Positioning repeatability: ± mm
Load conditions	Mounting orientation: Horizontal / Wall mounted / vertical/other	
	Weight of workpiece:	kg, workpiece material:
	Number of attachments:	, Attachment material
	Attachment length: H: mm L: mm	
	External force on finger: No / Yes  (Load: N)  (Load: N Distance: mm)  (Load: N Distance: mm)  (Load: N Distance: mm)	
Working environment	Ambient temperature:	°C, Ambient humidity: %
	Atmosphere:	
Interface specifications	Parallel I/O / IO-Link / CC-Link / EtherCAT / EtherNet/IP	
Remarks		

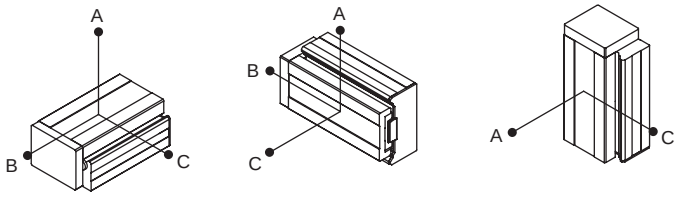
FLCR Series Model Selection Check Sheet → **CKD** (Contact:)

Fill in the form and send to the nearest CKD Sales Office.
We will respond with the model selection results.

Customer:

Company		Department	
Name		E-mail	
TEL		FAX	

Selecting conditions:

Desired model		
Basic specifications	Max. stroke length:	mm, Ball screw lead: mm
Operating conditions	Travel stroke:	mm, travel time: s
	Set speed:	mm/s
	Interface specifications:	mm/s^2 (set acceleration/deceleration time: s)
	Repeatability: ±	mm
Load conditions	Load weight:	kg
	Mounting orientation: Horizontal / wall mounted / vertical / ceiling mounted / other	
	Center of gravity of load from center of table: A direction: mm B direction: mm C direction: mm *The B dimension is the distance from the guide lock center (see pages 21 and 22).	
	Pressing load: No / Yes (N) Operating / Stopped Direction of the force applied to table center ( )	
Working environment	Ambient temperature:	°C, Ambient humidity: %
	Atmosphere:	
Interface specifications	Parallel I/O / IO-Link / CC-Link / EtherCAT / EtherNet/IP	
Remarks		

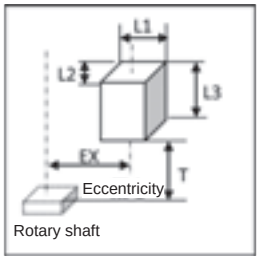
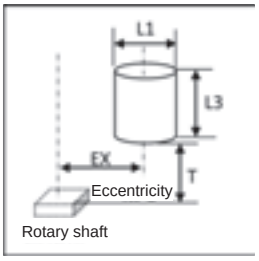
FGRC Series Model Selection Check Sheet → **CKD** (Contact:)

Fill in the form and send to the nearest CKD Sales Office.
We will respond with the model selection results.

Customer:

Company		Department	
Name		E-mail	
TEL		FAX	

Selecting conditions:

Desired model			
Operating conditions	Travel angle:	deg, travel time:	s
	Set angular speed:	deg/s	
	Set angular acceleration/deceleration:	deg/s^2 (Set angular acceleration/deceleration time:	s)
	Repeatability: ±	deg	
	Mounting orientation: Horizontal / wall mounted / other		
Load conditions	[Static load] Pressing force:	N, Distance from center of rotation to point of application:	mm
	[Resistance load] Load fluctuation: No / Yes Weight, external force, frictional force:	kg, Distance from center of rotation to point of application:	mm
	[Inertia load] L1: mm, L2: mm L3: mm, EX: mm T: mm Quantity: pieces, material:	  *For load shapes other than above, contact CKD.	
Working environment	Ambient temperature:	°C, Ambient humidity:	%
	Atmosphere:		
Interface specifications	Parallel I/O / IO-Link / CC-Link / EtherCAT / EtherNet/IP		
Remarks			

Electric actuator EBS-M/EBR-M Series

Catalog No. CC-1422A

■ Slider EBS-M Series
High speed transport

■ Rod with built-in guide EBR-M Series
For press fitting and hoisting

■ Controller ECR Series
"One controller" that connects to any actuator

■ Controller ECG Series
New controller enabling EZ inventory management, EZ design, EZ setting

Electric actuator Motorless general

Catalog No. CB-055A

Wide-ranging lineup of motorless electric actuators

■ Slider

For high speed transport	EBS-L Series
For high load transport	ETS/ECS Series
For long stroke transport	ETV/ECV Series
For fast tact transport	EKS-L Series

■ Rod

For press fitting and hoisting	EBR-L Series

■ ABSODEX
AX1000/2000/4000TS, TH
AX6000MU Series

● The Direct Drive Actuator, which strives for ease of use

From palm-sized to large torques. Conveyance, positioning, and simple construction of various devices

■ τ DISC Series

● The Direct Drive Servo Motor, which boasts high performance

A diverse lineup to meet various requirements such as high precision, high speed and speed stability. Achieves one level higher performance.

NIKKI DENSO

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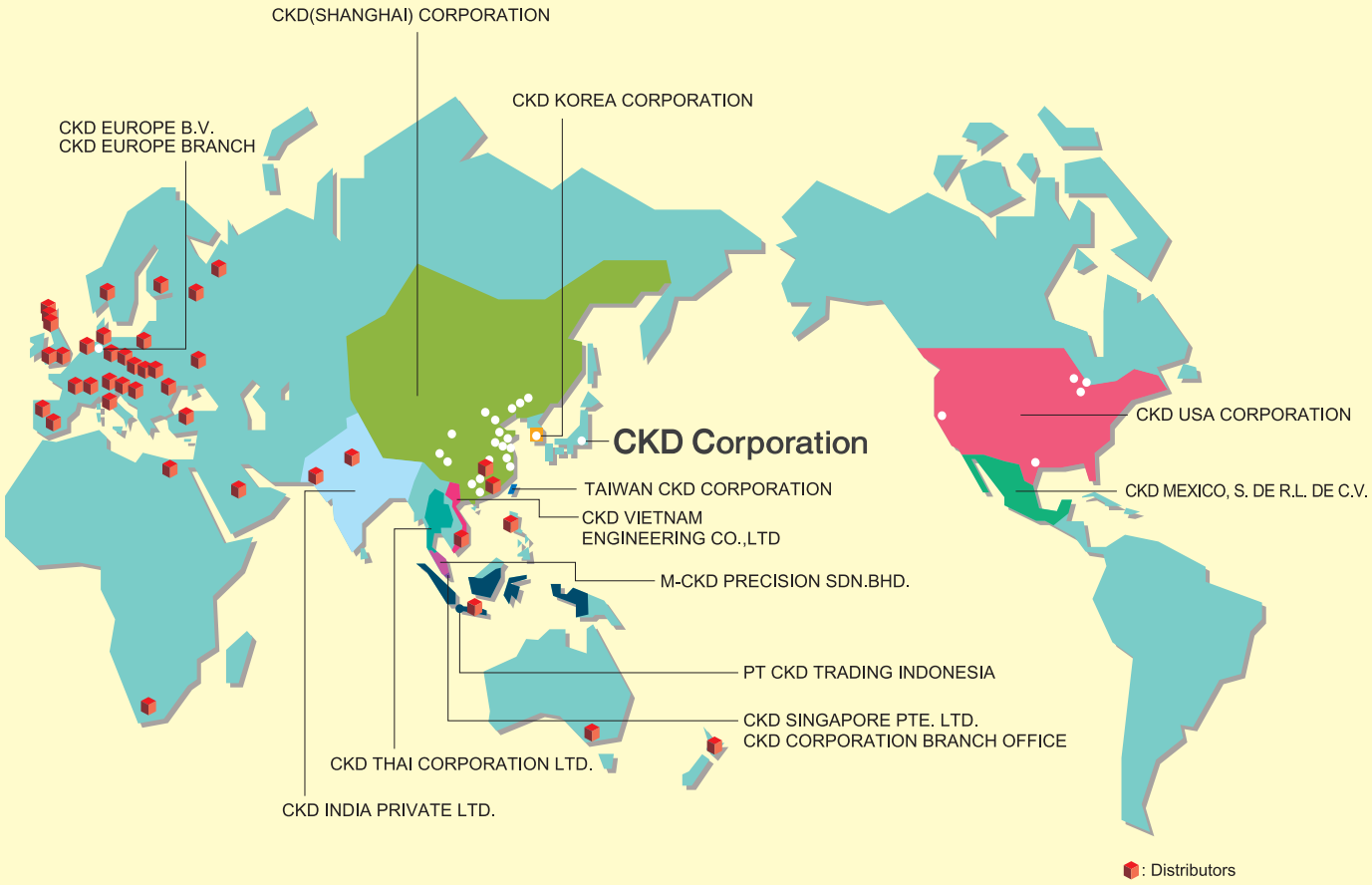

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2022.10