

ALIGNMENT

(Alignment unit)

Uses a stepping motor to drive a cam and accurately positions the workpiece with smooth jaw operation

Buffer type

Developed for the purpose of positioning by holding a workpiece with light load.

With an original buffer structure added to the rigid type, the mechanism lightly pushes a workpiece in four directions for centering with a buffer function. This alignment unit features gentleness to workpieces with the concept of high speed and durability maintained.

Rigid type

Developed for the purpose of positioning with a clearance provided.

The mechanism centers a delicate workpiece by lightly pushing in four directions.

With the precise cam technology applied, this alignment unit features high accuracy and robust design.



In automated assembly, workpiece positioning is an indispensable element.

In particular, positioning of a minute workpiece essentially requires use of a mechanism precisely assembled with elaborate parts.

The trend of the times has grown faster and it is now impossible to take time and build a precise alignment unit from scratch. With the product cycles of workpieces also increasingly shorter, use of air actuators often fails to sufficiently accommodate model changeovers and a smaller footprint and higher speed are required of

equipment itself. This situation has made it difficult to realize long-term stable positioning at a high speed.

In the process of building automated assembly systems, we have worked on this problem and successfully made an alignment unit that achieves high-speed, high-accuracy positioning based on the cam manufacturing technology and precision parts machining technology developed over the years. Use MEG's alignment unit for automated assembly systems and other factory automation plans.



Small rigid X9103□



Small buffer X9113□



Rigid X9106□



Buffer X9116□

4 finger alignment unit

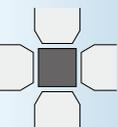
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ALIGNMENT (Alignment unit)

Model selection

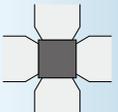
Model list

Positioning with clearance from workpiece maintained



Alignment
(stepping motor-driven)

Positioning by pushing workpiece with buffer applied



To prevent damage to workpieces

 **Variation in external dimensions**
Wrong type mixed in

 **Burr**
Foreign matter attached

 **Misoriented by 90°**

Type	Model No.	Mechanism/features	Page
Small rigid type X9103 		Functions required for rigid type condensed into main unit of □30 mm. Compact and pace-saving. Features high-speed operation. Two types available: model with motor and external-drive model.	F-6
Rigid type X9106 		Supports a wide range of applications with the long stroke. Two types available: model with motor and external-drive model.	F-12
Dustproof type X9107M		Advanced version of X9106 Side finger structure adopted to prevent entry of foreign matters. Supports positioning of workpieces of wide-ranging sizes.	On Web site
Small buffer type X9113 		Functions required for rigid type condensed into main unit of □30 mm. Compact and space-saving. Features high-speed operation. Two types available: model with motor and external-drive model.	F-6
Buffer type X9116 		Supports a wide range of applications with the long stroke. Two types available: model with motor and external-drive model.	F-16
Dustproof buffer type X9117M		Advanced version of X9106 Side finger structure adopted to prevent entry of foreign matters. Supports positioning of workpieces of wide-ranging sizes.	On Web site

- For restriction of applications and safety precautions, see F-24.
- For precautions, see F-20.

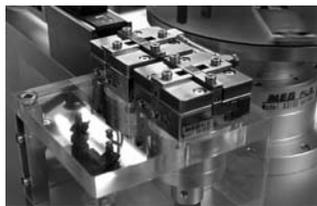
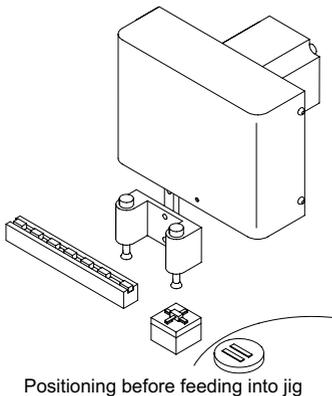
■ **Basic specifications**

Type	Model No.	Number of fingers	Stroke (mm)	Cycle time (sec)	Repeat accuracy (mm)	Page
Rigid	X9103□	4	0 to 3 (1.5 on one side)	At least 0.1	±0.01	F-6
	X9106□	4	0 to 6 (3 on one side)	At least 0.2	±0.01	F-12
	X9107M	4	0 to 6 (3 on one side)	At least 0.2	±0.01	Website
Buffer	X9113□	4	0 to 3 (1.5 on one side)	At least 0.1	±0.01	F-6
	X9116□	4	0 to 6 (3 on one side)	At least 0.2	±0.01	F-16
	X9117M	4	0 to 6 (3 on one side)	At least 0.2	±0.01	Website
Remarks	*1	*2	*3	*4		

■ **Remark description**

- *1 A model No. ends with "M" for a type with a motor and "C" for an external-drive connect type.
- *2 The number of fingers cannot be changed.
- *3 The stroke can be changed by the number of pulses.
- *4 The speed can be changed by the operation frequency and acceleration/deceleration time settings.

■ **How to utilize**



ALIGNMENT (Alignment unit)

Small type X9103, X9113

This small alignment unit has been developed to meet the demand for a positioning unit capable of high-accuracy positioning even in a small space. The design with the body width reduced is a product of elaboration. Realizes accurate positioning of a workpiece even in a small space only allowing short-stroke feeding.

	With motor	Connect
Stroke (mm)	3	3
Rigid	×	×
Buffer (closing side)	×	×



X9103-M
(rigid with motor)



X9113-M
(buffer with motor)



X9103-C
(rigid connect)



X9113-C
(buffer connect)

High-accuracy despite small size

Based on a cam with high repeat accuracy, the rigid type uses a backlashless mechanism. The buffer type uses the spring-driven centering buffer function for high-accuracy positioning.

Light and smooth operation

The use of endless track linear guides allows light and smooth operation. Features high-speed response.

High-speed positioning

The adoption of a stepping motor and cam mechanism with a small inertia allow positioning at a response speed of 0.1 sec/cycle (full stroke).

Externally driven

Connect types now available that are external-drive models without a motor.

Long life despite small size

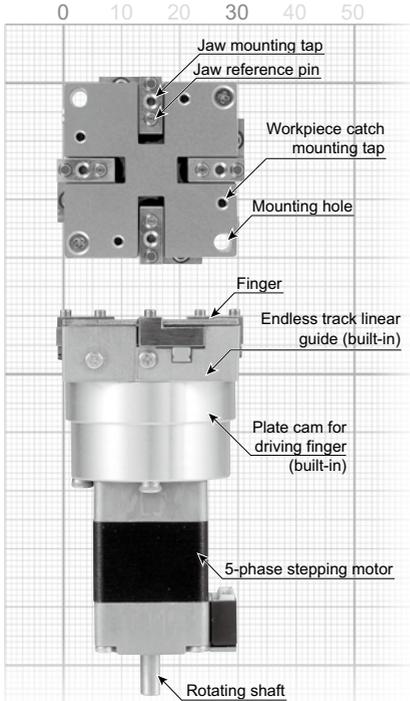
With the simple structure that does not overload the finger drive section, this alignment unit features high durability and is serviceable over a long time for improved economic efficiency.

Shockless operation

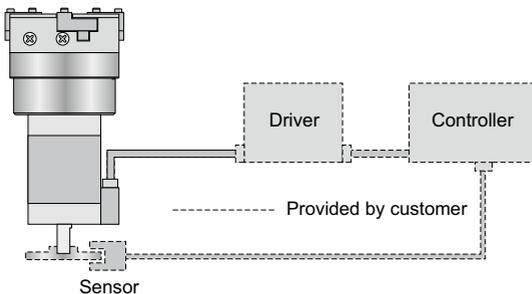
The stepping acceleration/deceleration control allows soft positioning even in high-speed operation.

Air blow port

The main body is provided with an M5 port, which allows blowing of dry air for preventing entry of foreign matters through the angle hole in the upper part of the main body.

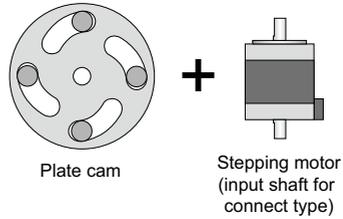


■ **System (with motor)**



■ **Structural principle**

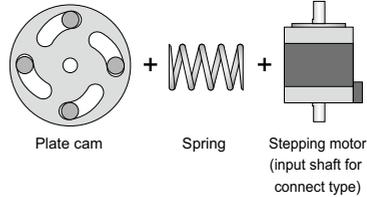
Rigid type (X9103)



■ The four fingers opens and closes at the same timing.

* For the time lag option with timing of the respective finger index angle of the plate cam changed, contact us.

Buffer type (X9113)



- Positioning of irregular-shaped objects is also possible by using a suitable attachment.
- The four fingers always move in synchronization.
- The opening/closing movement is motor-driven and the spring buffer is effective only for the closing side.

ALIGNMENT (Alignment unit)

Small type X9103, X9113



X9103-M
X9113-M



X9103-C
X9113-C

- Driven by a 5-phase stepping motor, which allows the jaw feed to be configured according to the workpiece.
- For the finger guides, precompressed linear guides are used, which realizes high repeat accuracy.
- The rotating shaft of the motor rear section can be used to mount an origin sensor or limit sensor or as a convenient manual handle for mechanical adjustment.
- A backlashless mechanism is adopted for the cam mechanism. Features high repeat accuracy.
- External-drive connect types are also available.

Product number configuration

X9103-M

Model No. 03: X9103
13: X9113 M: With motor
C: Connect

■ Specifications X9103 (rigid)

Operating method	Double action/parallel
Stroke	3 mm (1.5 mm \pm 0.1 mm on one side)
1 cycle time	From 0.1 sec (0.05 sec for each opening/closing)
Frequency of use	180 cpm (with full stroke)
Drive motor (Note 1)	Stepping motor (Oriental Motor)
Operational characteristics	Constant velocity
Drive mechanism	Grooved cam
Index angle	43.2° (no dwell)
Required torque	0.023N·m (connect type)
Finger looseness (close end)	None
Position repetition accuracy	\pm 0.01 mm (single jaw opening/closing with no load)
Ambient temperature	5 to 50°C
Lubrication	Grease filled Non-lubrication use Low particle emission
Product mass	With motor: 110 g Connect: 78 g

(Note 1) Only for the model with a motor.

■ Specifications X9113 (buffer)

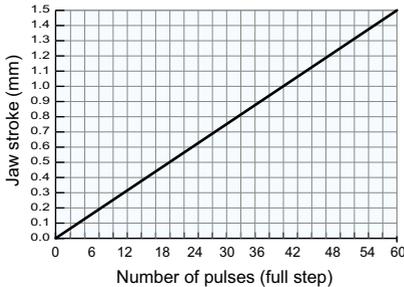
Operating method	Double action/parallel
Stroke	0 to 3 mm (1.5 \pm 0.1 mm on one side)
1 cycle time	From 0.1 sec (with full stroke)
Frequency of use	180 cpm
Drive motor (Note 1)	Stepping motor (Oriental Motor)
Operational characteristics	Constant velocity
Drive mechanism	Grooved cam
Index angle	43.2° (no dwell)
Finger looseness (in direction of stroke)	Approx. 0.02 mm
Position repetition accuracy	\pm 0.01 mm (with buffer)
Buffer load (grip force)	Approx. 0.1 to 1N (Note 2)
Buffer range	50°
Ambient temperature	5 to 50°C
Power supply voltage	24 VDC
Lubrication	Grease filled Non-lubrication use Low particle emission
Product mass	With motor: 110 g Connect: 78 g

(Note 1) Only for the model with a motor.

(Note 2) Depends on the amount of buffer (operation angle).



Operating stroke (rough guide)



Displacement (theoretical value)

Pulse-angle-displacement table

Number of pulses	Angle (°)	Displacement (mm)
0	0.00	0.000
1	0.72	0.025
2	1.44	0.050
3	2.16	0.075
4	2.88	0.100
5	3.60	0.125
6	4.32	0.150
7	5.04	0.175
8	5.76	0.200
9	6.48	0.255
10	7.20	0.250

30	21.60	0.750
31	22.32	0.775
32	23.04	0.800
33	23.76	0.825
34	24.48	0.850
35	25.20	0.875
36	25.92	0.900
37	26.64	0.925
38	27.36	0.950
39	28.08	0.975
40	28.80	1.000
41	29.52	1.025
42	30.24	1.050
43	30.96	1.075
44	31.68	1.100
45	32.40	1.125
46	33.12	1.150
47	33.84	1.175
48	34.56	1.200
49	35.28	1.225
50	36.00	1.250
51	36.72	1.275
52	37.44	1.300
53	38.16	1.325
54	38.88	1.350
55	39.60	1.375
56	40.32	1.400
57	41.04	1.425
58	41.76	1.450
59	42.48	1.475
60	43.20	1.500

Note) No dwell process at the open/close end is provided.

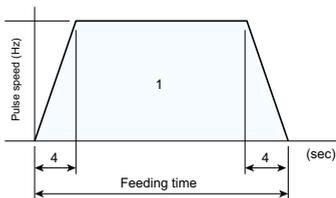
Motor specifications (model with motor)

Name	5-phase stepping motor
Manufacturer	Oriental Motor
Model	PK513PB (double shaft)
Basic step	0.72°
Max. holding torque	0.023N·m
Rated current (A/phase)	0.35
Accessory	LC5N06A (Cable between motor and driver UL style 3265 AWG 24: 0.6 m)

- The stepping motor driver is to be provided by the customer.
- * CRD5103P (Oriental Motor)

Controller setting (reference) (with motor)

Feeding time (sec)	Feed (pulses)	Jaw stroke (mm)	Pulse speed (Hz)		Acceleration/deceleration time (sec)
			Max.	Min.	
0.05	56	1.4	1867	0	0.02
0.10	56	1.4	800	0	0.03
0.15	56	1.4	560	0	0.05
Remarks	1		2	3	4



- The controller is to be provided by the customer.
- These values are for trapezoidal acceleration/ deceleration setting.
- The values in the table are for reference only. Configure the setting according to the specification.

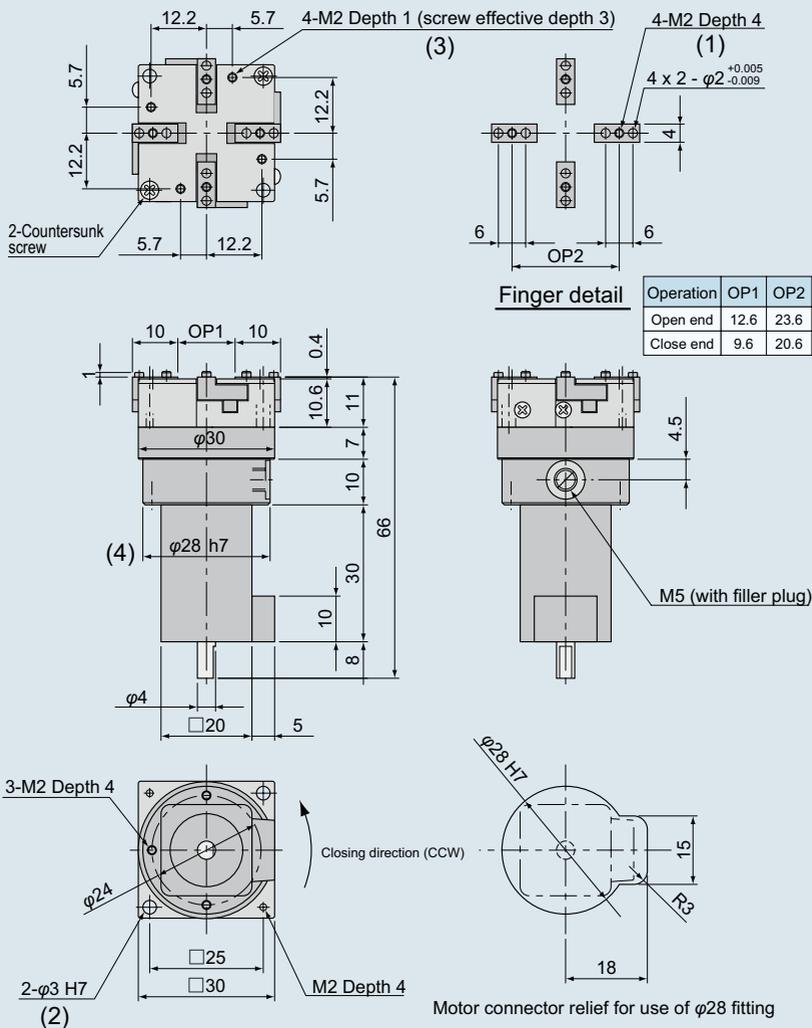
ALIGNMENT (Alignment unit)

X9103□, X9113□

■ Dimensional drawing

(mm)

X9103-M, X9113-M

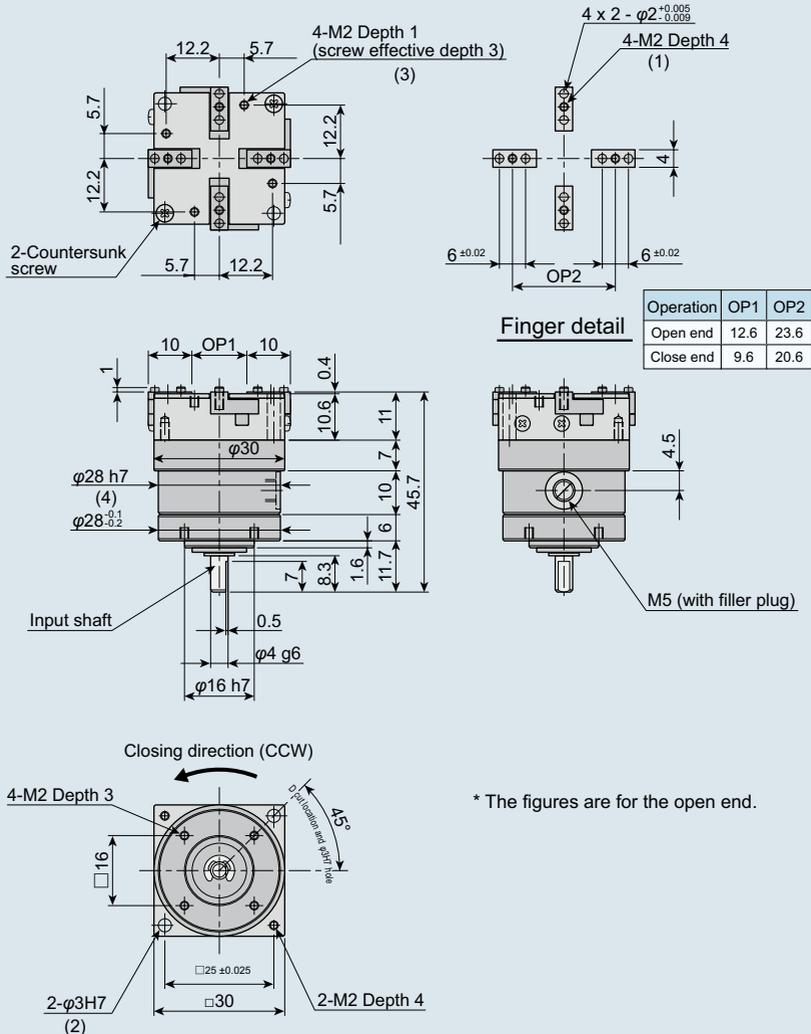




■ Dimensional drawing

(mm)

X9103-C, X9113-C



* The figures are for the open end.

ALIGNMENT (Alignment unit)

Rigid type X9106

This alignment unit has realized a long stroke flexibly accommodating various types of workpieces and long life required for high-speed positioning. The product has been adopted for workpiece positioning in the semiconductor and electronic component industries and produced a number of successful results.

	With motor	Connect
Stroke (mm)	6	6
Rigid	×	×
Buffer	×	×

Model with motor revised with 2-phase motor.

Stable positioning performance

Based on a cam with high repeat accuracy, the rigid type uses a backlashless mechanism. The buffer type uses the spring-driven centering buffer function for stable positioning.

Shockless operation

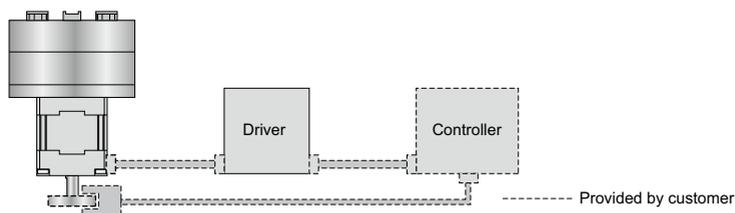
The cam that uses modified constant velocity of cam curve combined with stepping motor acceleration/deceleration control allows soft positioning even in high-speed operation.

2-phase stepping motor

Instead of the existing PMC33B2 (5-phase), a 2-phase CMK motor equipped with the latest technology is used. Provides high-resolution feed.

Revised

System (with motor)



Buffer type X9116



X9106-MO23B
(rigid with motor)



X9116-MO23B
(buffer with motor)



X9106-C
(rigid connect)



X9116-C
(buffer connect)

Long stroke despite the compact size

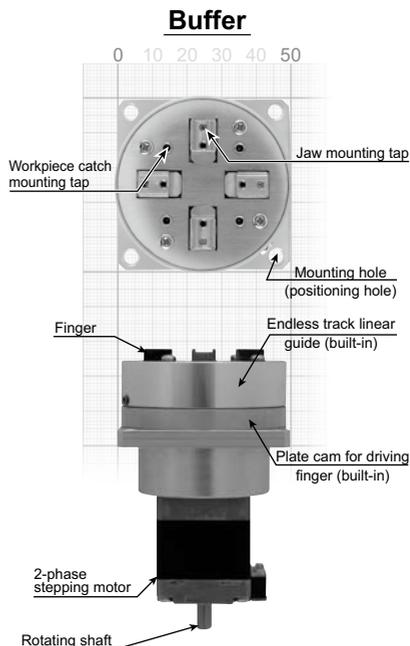
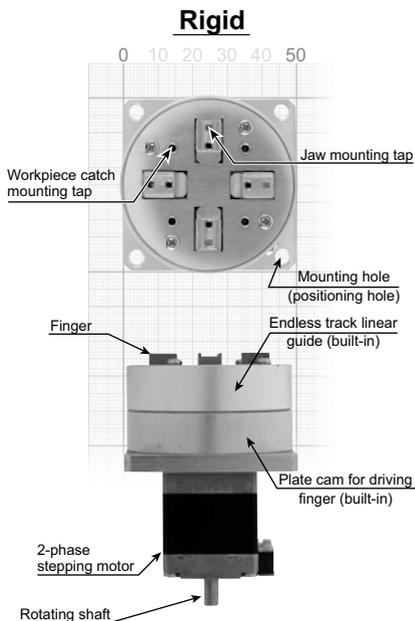
Contains four endless track linear guides in the $\phi 50$ mm body. In addition, waste has been eliminated to the maximum to realize a long stroke of 6 mm. This supports a variety of applications ranging from minute chips to chips with terminals.

Long life

The light operation by the endless track linear guides and simple cam-based mechanism ensure the initial position accuracy over a long time.

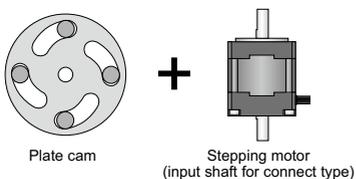
Externally driven

Connect types are now available that are external-drive models without a motor.



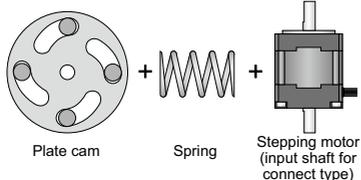
■ Structural principle

Rigid type



- The four fingers opens and closes at the same timing.

Buffer type



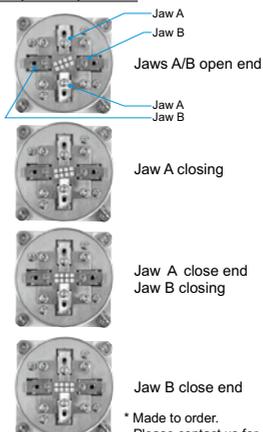
- Positioning of irregular-shaped objects is also possible by using a suitable attachment.
- The four fingers always move in synchronization.
- The opening/closing movement is motor-driven and the spring buffer is effective only for the closing side.

■ Time lag option (rigid)

Rectangular workpieces smoothly positioned

Changes the timing of the respective finger index angle of the plate cam to realize time lag.

Example of operation



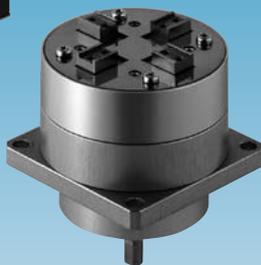
* Made to order.
Please contact us for detailed information.

ALIGNMENT (Alignment unit)

Rigid type X9106



X9106-M



X9106-C

- Driven by a stepping motor, which allows the jaw feed to be configured according to the workpiece.
- For the finger guides, precompressed linear guides are used, which realizes high repeat accuracy.
- The rotating shaft of the motor rear section can be used to mount an origin sensor or limit sensor or as a convenient manual handle for mechanical adjustment.
- The fingers operate according to cam curve and feature long life with shockless operation.
- External-drive connect types are also available.
- The model with a motor has been revised. It is now equipped with a 2-phase motor. Provides high-resolution feed.

Product number configuration

X9106- M O23B

Model No. M: With motor
C: Connect Motor symbol
O23B: PK223PB (2-phase)
(only for model with motor)

Specifications

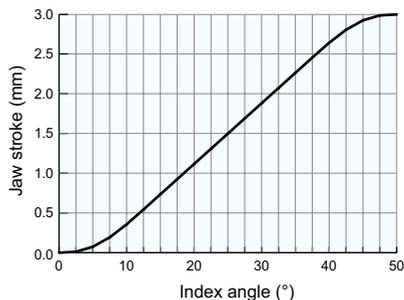
Operating method	Double action/parallel
Stroke	6 mm (3 mm on one side)
1 cycle time	From 0.2 sec (0.1 sec for each opening/closing)
Frequency of use	120 cpm (with full stroke)
Drive motor (Note 1)	Stepping motor (Oriental Motor)
Operational characteristics	Modified constant velocity (MCV50)
Drive mechanism	Grooved cam
Index angle	50° (dwell 3° respectively for open/close)
Required torque	0.033N·m (connect type)
Finger looseness	Approx. 0.02 mm (Note 2)
Finger looseness (close end)	None (Note 3)
Position repetition accuracy	±0.01 mm (single jaw opening/closing with no load) (Note 3)
Ambient temperature	5 to 50°C
Power supply input (Note 1)	24 VDC ±10% 1.5 A
Lubrication	Grease filled Non-lubrication use Low particle emission
Product mass	With motor: 300 g Connect: 230 g

(Note 1) Only for the model with a motor.

(Note 2) Looseness in the direction of stroke in the range of approximately 2.2 mm stroke from the open end for each finger.

(Note 3) Looseness in the direction of stroke in the range of approximately 0.8 mm stroke from the close end for each finger.

Operating stroke (rough guide)





Displacement

With micro step 1/4 (0.45°) setting

Number of pulses	Angle (°)	Displacement (mm)	Number of pulses	Angle (°)	Displacement (mm)
0	0.00	0.000	84	37.80	2.456
1	0.45	0.000	85	38.25	2.491
2	0.90	0.001	86	38.70	2.525
3	1.35	0.002	87	39.15	2.558
4	1.80	0.004	88	39.60	2.592
5	2.25	0.008	89	40.05	2.624
6	2.70	0.014	90	40.50	2.656
7	3.15	0.022	91	40.95	2.687
8	3.60	0.031	92	41.40	2.718
9	4.05	0.043	93	41.85	2.747
10	4.50	0.056	94	42.30	2.775
11	4.95	0.071	95	42.75	2.801
12	5.40	0.088	96	43.20	2.827
13	5.85	0.107	97	43.65	2.850
14	6.30	0.127	98	44.10	2.873
15	6.75	0.150	99	44.55	2.893
16	7.20	0.173	100	45.00	2.912
17	7.65	0.199	101	45.45	2.929
18	8.10	0.225	102	45.90	2.944
19	8.55	0.253	103	46.35	2.957
20	9.00	0.282	104	46.80	2.969
21	9.45	0.313	105	47.25	2.978
22	9.90	0.344	106	47.70	2.986
23	10.35	0.376	107	48.15	2.992
24	10.80	0.408	108	48.60	2.996
25	11.25	0.442	109	49.05	2.998
26	11.70	0.475	110	49.50	2.999
27	12.15	0.509	111	49.95	3.000
28	12.60	0.544	112	50.40	3.000
29	13.05	0.578			

- *1) The section from 29 to 84 pulses is a constant speed feed section. Use the following formulas to find the angle and displacement.

$$\begin{aligned} \text{Angle} &= \text{Number of pulses} \times 0.45^\circ \\ \text{Displacement} &= (\text{Number of pulses} - 29) \\ &\quad \times 0.03416 + 0.578 \end{aligned}$$

- *2) The dwell angle is 3° respectively for open/close end. It is not included in the table above.

Motor (for model with motor)

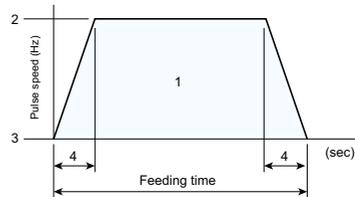
Name	2-phase stepping motor
Manufacturer	Oriental Motor
Model	PK223PB (double shaft)
Basic step	1.8°
Max. holding torque	0.05 N·m (0.5 kgf·cm)
Rated current (A/phase)	0.95
Accessory	Connection cable (0.6 m) LC2U06A

- The motor cable is supplied with the product.
- The stepping motor driver is not supplied with the product. It must be provided by the customer.
Driver: CMD2109P
Connection cable: LCS01CMK2
- For details of the motor, see the catalog for the CMK Series available from Oriental Motor Co., Ltd.

Controller setting (reference) (with motor)

Number of divisions 4: 0.45°/step

Feeding time (sec)	Feed (pulses)	Jaw stroke (mm)	Pulse speed (Hz)		Acceleration/deceleration time (sec)
			Max.	Min.	
0.1	112	3	1588	0	0.03
0.15	112	3	1111	0	0.05
0.2	112	3	741	0	0.05
Remarks	1		2	3	4



- The controller is to be provided by the customer.
- These values are for trapezoidal acceleration/deceleration setting.
- The values in the table are for reference only. Configure the setting according to the specification.

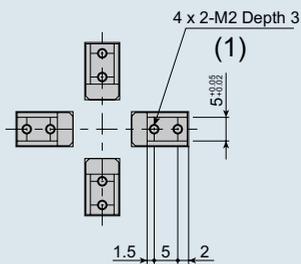
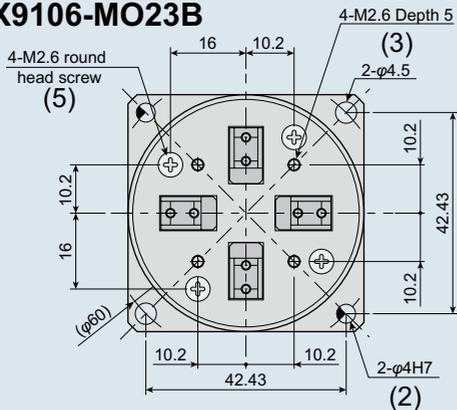
ALIGNMENT (Alignment unit)

X9106

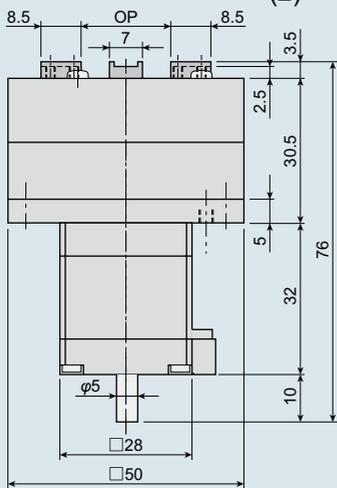
Dimensional drawing

(mm)

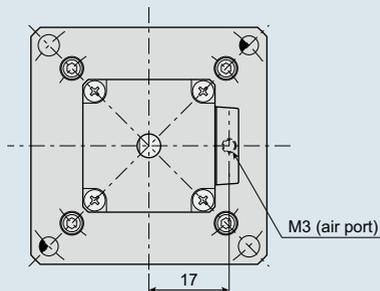
X9106-MO23B



Finger detail



Operation	OP
Open end	19
Close end	13

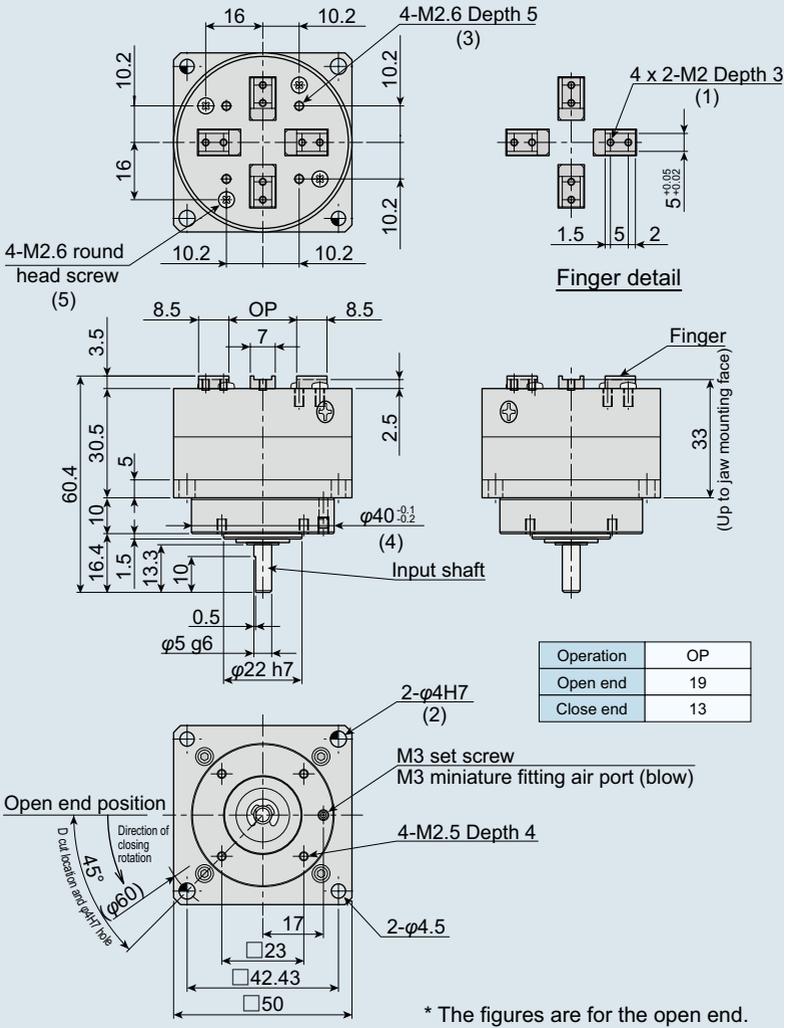




■ Dimensional drawing

(mm)

X9106-C

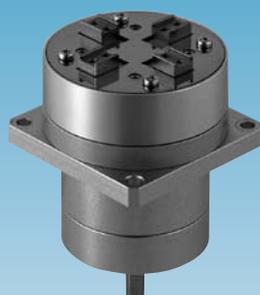


ALIGNMENT (Alignment unit)

Buffer type X9116



X9116-M



X9116-C

- Driven by a stepping motor and capable of speed and stop position control.
- Motor thrust is not directly transmitted to the fingers, which prevents damage to the workpiece.
- Four fingers move in synchronization, realizing centering with buffer function.
- For the finger guides, precompressed linear guides are used, which realizes high repeat accuracy.
- The rotating shaft of the motor rear section can be used to mount an origin sensor or limit sensor or as a convenient manual handle for mechanical adjustment.
- External-drive connect types are also available.
- The model with a motor has been revised. It is now equipped with a 2-phase motor. Provides high-resolution feed.

Product number configuration

X9116-M O23B

Model No. M: With motor C: Connect Motor symbol O23B: PK223PB (2-phase) (only for model with motor)

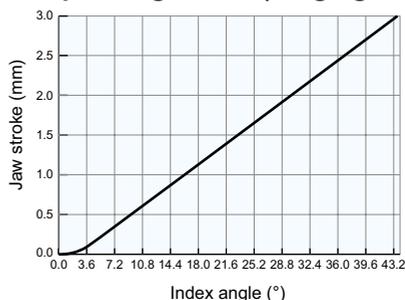
Specifications

Operating method	Double action/parallel
Stroke	0 to 6mm (3 mm on one side)
1 cycle time	From 0.2 sec (with full stroke)
Frequency of use	120 cpm
Drive motor (Note 1)	Stepping motor (Oriental Motor)
Operational characteristics	Modified constant velocity/constant velocity
Drive mechanism	Grooved cam
Index angle	43.2° (dwell 3° for open)
Finger looseness (in direction of stroke)	Approx. 0.02 mm
Position repetition accuracy	±0.01 mm (with buffer)
Buffer load (grip force)	Approx. 0.8 to 1.2N (Note 2)
Buffer range	50°
Ambient temperature	5 to 50°C
Power supply input (Note 1)	24 VDC ±10% 1.5 A
Lubrication	Grease filled Non-lubrication use Low particle emission
Product mass	With motor: 317 g Connect: 250 g

(Note 1) Only for the model with a motor.

(Note 2) Depends on the amount of buffer (operation angle).

Operating stroke (rough guide)





■ Displacement

With micro step 1/4 (0.45°) setting

Number of pulses	Angle (°)	Displacement (mm)
0	0.00	0.000
1	0.45	0.000
2	0.90	0.002
3	1.35	0.007
4	1.80	0.015
5	2.25	0.026
6	2.70	0.041
7	3.15	0.060
8	3.60	0.082
9	4.05	0.107
10	4.50	0.134
11	4.95	0.163
12	5.40	0.194
13	5.85	0.227
14	6.30	0.260
15	6.75	0.294
16	7.20	0.327

91	40.95	2.833
92	41.40	2.866
93	41.85	2.900
94	42.30	2.933
95	42.75	2.967
96	43.20	3.000

- *1) The section from 16 to 96 pulses is a constant speed feed section. Use the following formulas to find the angle and displacement.

$$\begin{aligned} \text{Angle} &= \text{Number of pulses} \times 0.45^\circ \\ \text{Displacement} &= (\text{Number of pulses} - 16) \\ &\quad \times 0.03341 + 0.327 \end{aligned}$$

- *2) The dwell angle is 3° for open end. It is not included in the table above.

■ Motor (for model with motor)

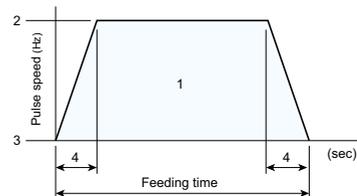
Name	2-phase stepping motor
Manufacturer	Oriental Motor
Model	PK223PB (double shaft)
Basic step	1.8°
Max. holding torque	0.05 N·m (0.5 kgf·cm)
Rated current (A/phase)	0.95
Accessory	Connection cable (0.6 m) LC2U06A

- The motor cable is supplied with the product.
- The stepping motor driver is not supplied with the product. It must be provided by the customer.
Driver: CMD2109P
Connection cable: LCS01CMK2
- For details of the motor, see the catalog for the CMK Series available from Oriental Motor Co., Ltd.

■ Controller setting (reference) (with motor)

Number of divisions 4: 0.45°/step

Feeding time (sec)	Feed (pulses)	Jaw stroke (mm)	Pulse speed (Hz)		Acceleration/ deceleration time (sec)
			Max.	Min.	
0.1	96	3	1372	0	0.03
0.15	96	3	960	0	0.05
0.2	96	3	640	0	0.05
Remarks	1		2	3	4



- The controller is to be provided by the customer.
- These values are for trapezoidal acceleration/ deceleration setting.
- The values in the table are for reference only. Configure the setting according to the specification.

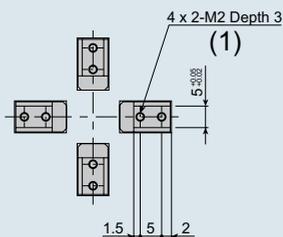
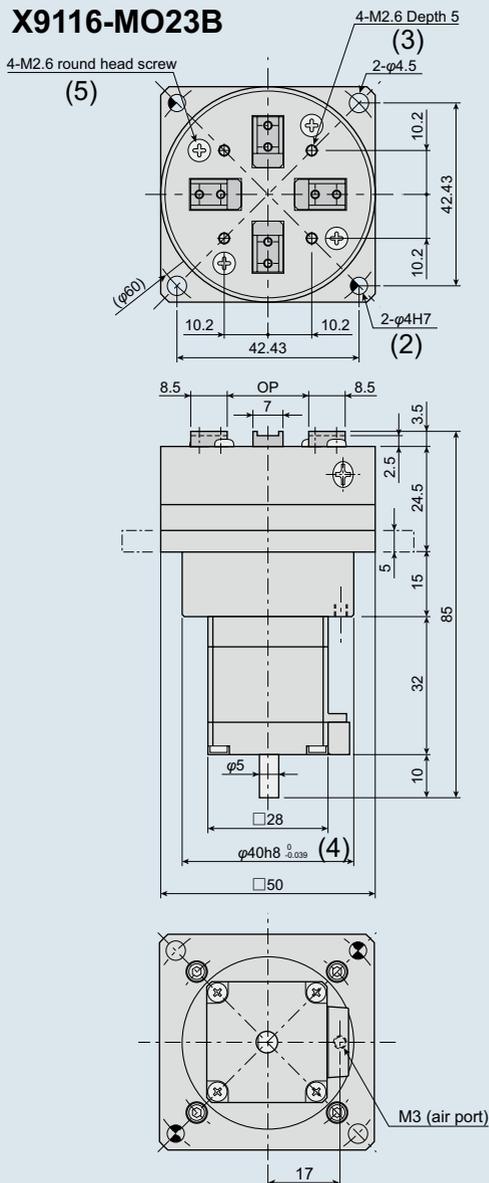
ALIGNMENT (Alignment unit)

X9116 □

■ Dimensional drawing

(mm)

X9116-MO23B



Finger detail

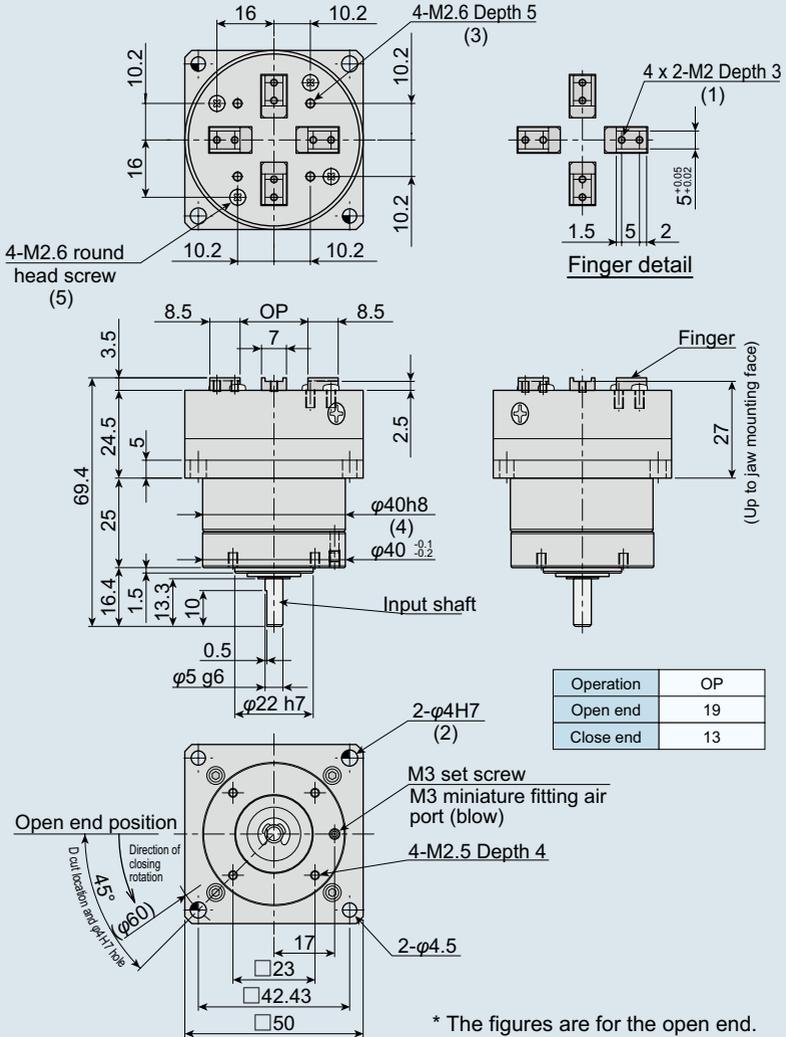
Operation	OP
Open end	19
Close end	13



■ Dimensional drawing

(mm)

X9116-C



Precautions

Precautions for selection

■ All models

- The strokes of the fingers (operating shafts) can be changed by changing the number of pulses. For the relationship between the number of pulses and stroke, see the graph* for the respective model.

* F-7 for small types X9103 and X9113

* F-13 for rigid type X9106

* F-17 for buffer type X9116

- This product cannot be used as it is laid sideways.
- The thrust depends on the cycle time. A shorter cycle time causes the thrust to be decreased due to the effect of the accelerating torque.
- The thrust (force that pushes the workpiece) changes depending on the point of contact with the workpiece. As compared with a case of contact with the workpiece from the beginning, the thrust slightly decreases in a case of contact with the workpiece in the process.
- The thrust should be roughly 20 g max. A large suction force of the transfer head (PPU) may cause an insufficient thrust. See the formula below as the reference.

*Calculation of suction force: $W = P \times C / 760$

W: Theoretical suction force (kgf)

P: Degree of vacuum (mmHg)

C: Pad area (cm²)

* Calculation of required force: $F = W \times \mu$

F: Finger thrust (kgf)

W: Theoretical suction force (kgf)

μ : Friction coefficient between workpiece and suction face

- Positioning by using the full stroke may cause insufficient stroke or step-out. Use at an intermediate position of the stroke.
- Ensure that the drive torque of the connect type is the same as the maximum holding torque of the standard motor of the model with a motor.

■ Rigid

- This product is incapable of holding a workpiece.
- This product is not provided with the finger buffer function. If there is any possibility that a jaw interferes with the workpiece because of variation in the workpiece size, provide the jaw with a buffer function.
- The movements of the four fingers are synchronized. X/Y time lag is not provided. The stroke cannot be changed separately for the respective fingers.

* For X9106, X/Y time lag option is available.

- The fingers of this product are forced to move by the cam mechanism. A large thrust may be generated in theory depending on the cam pressure angle even if the motor torque is small.

■ Buffer

- This product is of an "outside grip type," in which four fingers move in synchronization by the cam mechanism and the buffer functions in movement to the closing side. Movement in the opening direction is forced and a large thrust may be generated in theory depending on the cam pressure angle even if the motor torque is small.
- This product positions a workpiece as it is held. The position repeat accuracy may not be achieved with use without holding a workpiece due to looseness in the direction of finger stroke.
- The four fingers move in synchronization. X/Y time lag is not provided. The stroke cannot be changed separately for the respective fingers.
- The buffer force cannot be changed (spring cannot be replaced) by the customer.

Mounting precautions

■ All models

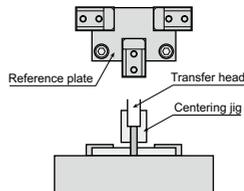
- The workpiece catches and jaws are to be designed and made by the customer.
- Ensure that the mount is provided with rigidity. Failure to follow this instruction may affect the position repeat accuracy or performance.
- For easy position adjustment of the product, providing the mount with an Y X (Z) fine adjustment mechanism is recommended.
- The top face of the product of a type other than the small type is provided with round head screws (5) for securing the top cover. Remove them if workpiece catches interfere with them. Ensure that a workpiece catch covers the tapped hole (5).
- * Do not remove the top cover. For mounting a workpiece catch, read the precautions for the respective type.
- * Provide a clearance between the top cover and fingers. Failure to observe this instruction may result in a malfunction of the product.

■ X9103, X9113

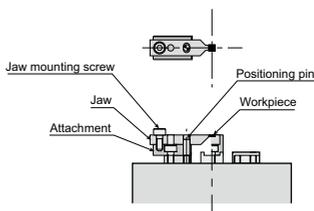
- For positioning the product main body, use the $\phi 3H7$ hole (2).
- For mounting from the top, use the $\phi 3H7$ hole.
- For mounting from the bottom of the main body □30, use the M2 tap for securing.
- The positioning boss (4) can be secured for adjustment of height or in the direction of rotation, if necessary. For securing, use a slot clamp and ensure that the boss face is not crushed.
- For locating the jaws, use the $\phi 2$ pins. A dimension error of up to 0.2 mm may be present between the X- and Y-axis pins. Provide an adjusting element such as a slotted hole of $\phi 2$ for one of the four jaws.
- For mounting a workpiece catch on the top of the product, use a tap (3) in the main body.
- The overhang of a jaw must be within 10 mm from the mounting face. In the lateral direction, it must be within the finger width (4 mm).

■ X9106, X9116

- For locating the product main body, use the $\phi 4H7$ hole (2).
- To mount the jaws, use tapped holes (1) of the fingers for securing.
- The end faces in the direction of finger strokes do not provide the reference for the position adjustment of the four jaws.
- For mounting a workpiece catch on the top of the product, use a tap (3) in the main body.
- The overhang of a jaw must be within 10 mm from the mounting face and within the finger width (5 mm) in the lateral direction.
- For centering the product main body and transfer head, refer to the method as shown below.



- When repeatability of the jaws is required, refer to the method as shown below.



- For X9116, the positioning boss (4) can be secured for adjustment of height or in the direction of rotation, if necessary. For securing, use a slot clamp and ensure that the boss face is not crushed.

Precautions

Precautions for use

■ All models

- Ensure that the motor heat generation does not exceed 60°C. A higher temperature may cause premature deterioration of the internal parts, leading to reduced life or damage.
- Ensure that the acceleration/deceleration time is at least 20 ms. Otherwise, excessive load may be applied to the product, causing step-out or shorter life.
- Make the dog of the sensor for origin detection as light as possible. A heavy dog may cause unexpected inertial load, leading to capacity shortage.
- If there is any possibility of interference with any peripheral device that operates at the same time, be sure to provide interlock.
- Be sure to detect the origin with the sensor after the completion of each cycle. Failure to observe this instruction may cause damage to the product or equipment.
- For handling of the motor, read the catalog or instruction manual of the motor for proper operation.
- This product is comprised of precision parts. Handle with care to prevent any dent or deformation of the body.
- Do not disassemble. If this product is disassembled, the functions and performance of the product cannot be reproduced.
- Before use, read and understand the instruction manual for correct use.

■ X9103, X9113

- The driver for the model with a motor is to be provided by the customer.
Recommended: CRK Series CRD513P (Oriental Motor)
- When using the M5 air port in the main body to blow air out of the fingers, use dry air.

■ X9106, X9116

- When using the M3 air port in the main body to blow air out of the fingers (operating shafts), use dry air.

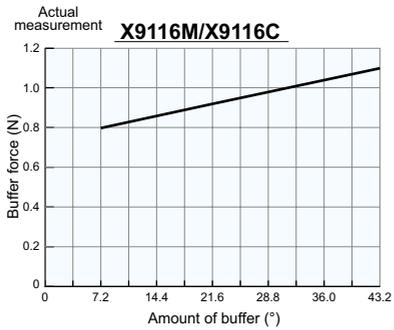
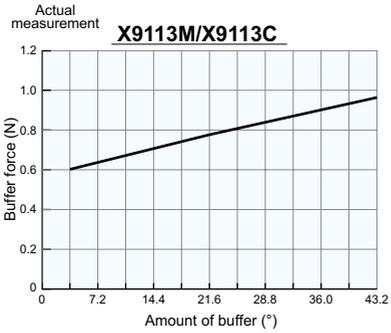
■ Rigid (X9106)

- There is no looseness in the direction of stroke near the close end (approximately 0.8 mm) of fingers. The looseness increases toward the open end. When high position repeat accuracy is required, use near the close end.

■ Buffer

- A higher speed of fingers causes the inertial force of the fingers and cam to be larger and the load on the workpiece may exceed the buffer force. Stopping once or decelerating the fingers before the workpiece is recommended.
- In movement in the closing direction, rotation of the motor beyond the buffer range forces finger feed, which may lead to damage to the workpiece or product.
- This product positions a workpiece as it is held. The position repeat accuracy may not be achieved with use without holding a workpiece due to looseness in the direction of finger stroke.

- The buffer force depends on the amount of buffer (operation angle). Refer to the figures below.



Applications

1. Restriction of applications

4F alignment unit is an X-(Y-) axis control positioning unit driven by a translation grooved cam and automatically corrects the attitude of the workpiece.

2. Safety precautions

DANGER

- Do not use the product for the following applications.
 1. Medical devices related to the support and maintenance of human life and body
 2. Mechanisms and machinery used for the purpose of moving and transporting people
 3. Important security components of machinery
This product is not developed or designed for applications that require a high degree of safety. Use of this product for such applications may cause death.
- Do not use the product in a place where hazardous substances such as combustible or flammable substances exist.
There is a possibility of the product catching fire.
- Never modify the product. Doing so may cause injury due to abnormal operation, electric shock, fire, etc.
- Do not perform improper disassembly/assembly that affects the product's basic structure, performance, or functions.
- Do not pour water on the product. Pouring water on the product, washing it or using it immersed in water may cause injury due to abnormal operation, electric shock, fire, etc.

WARNING

- Be sure to confirm the safety of the operating range of devices before supplying power to and operating the product. If the power is supplied improperly, there is a risk of electric shock and injury caused by contact with a movable part.
- Keep away from the operating range of machinery when a product is in operation or ready to operate. Failure to do so may result in injury due to unexpected operation of the product.
- Do not touch the terminal blocks or switches while the power is turned on. There is a risk of abnormal operation and electric shock.
- Do not damage any of the cables.
Damaging, forcibly bending, pulling, winding, putting under heavy objects or pinching cords may lead to electric shock or abnormal operation due to leakage or defective continuity.
- Do not throw the product into the fire. The product may explode or poisonous gases may be discharged.
- Be sure to completely remove the supply of electricity before performing various tasks such as maintenance, inspection, service, or replacement.

⚠ CAUTION

- Do not apply sudden shocks from outside. Doing so may cause unexpected force to be applied and result in failure of the product or personal injury.
- Do not use this product in places subjected to direct sunlight (ultraviolet light) or dust, iron, iron powder, or in an atmosphere containing organic solvent, phosphate-ester hydraulic oil, sulphurous acid gas, chlorine gas, acids, etc. The product may stop functioning in a short period of time, or the performance may be deteriorated and the lifetime of the product may be significantly reduced.

- Entry of any foreign matter through the gap between the main body and fingers to the inside may cause shorter life or malfunction of the product.

If there is any possibility of entry, provide the finger section with a cover that suits the specifications.

An M3 air port is provided in the main body. This allows dry air to be blown from the product main body to the outside of the fingers.

- Use protective covers to prevent the moving parts of machinery from coming in direct contact with human body.
- As you incorporate the products into your system, add all safety information to the instruction manual of your system and make sure the operators of the system follow the instructions.
Be sure to add to the instruction manual all new safety information that needs to be provided as a result of the incorporation.