

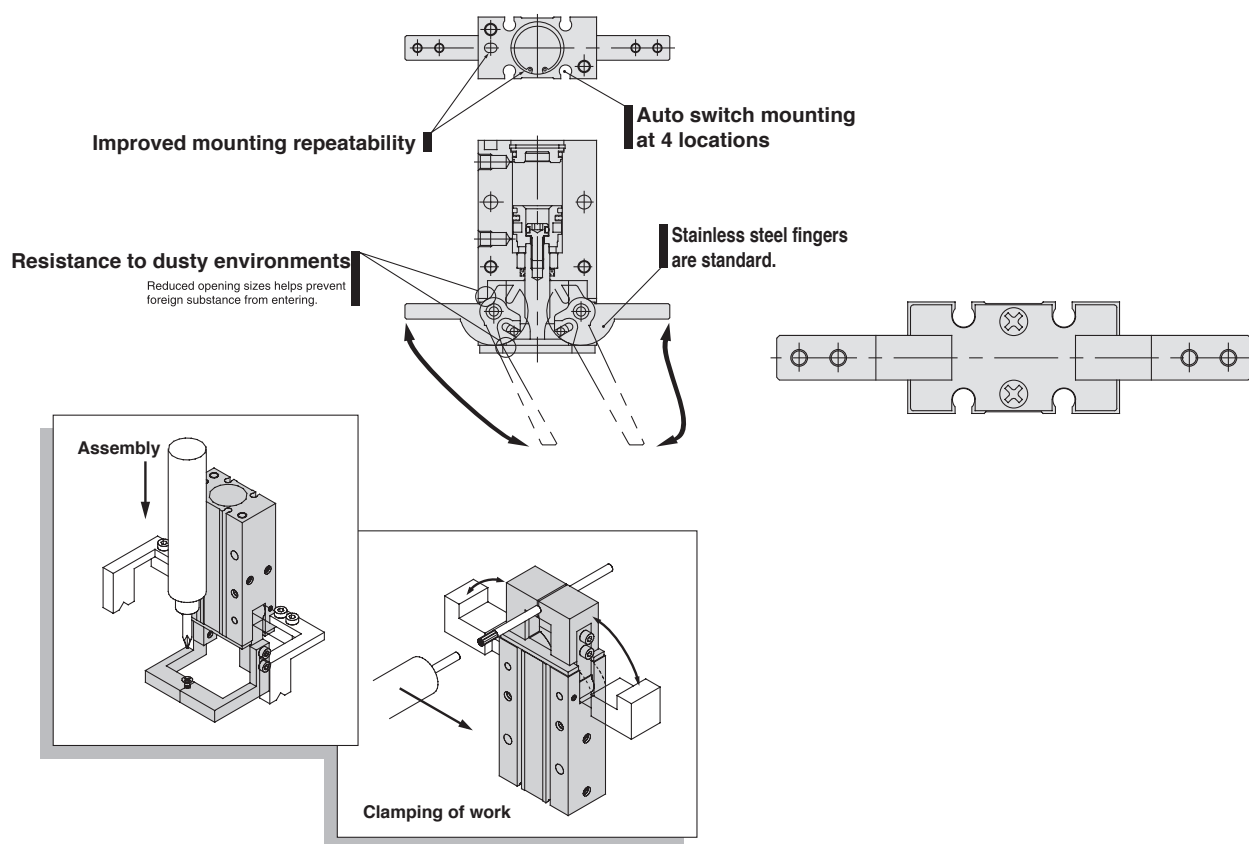
180° Angular Gripper Series WHFR

WHFR Series / Cam Style



Light and compact size in small bore sizes

Symbol



Model

Model	Bore size mm	Effective holding moment* Nm	Overall length Lmm 	Weight g
WHFR-10D	10	0.16	71	70
WHFR-16D	16	0.54	84	150
WHFR-20D	20	1.10	106	320
WHFR-25D	25	2.28	131	560

*At pressure of 0.5MPa

Variation

Bore size (mm)	
	10162025324050
Cam style Series WHFR	●●●●
Rack & Pinion style Series WHFR	●●●●●

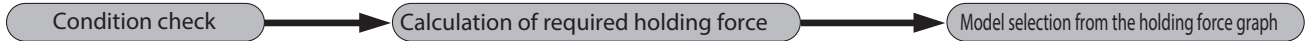
How to Select the Applicable Model

How to Select

Procedure



Step 1 Confirm holding force



Example Work weight: 0.05kg

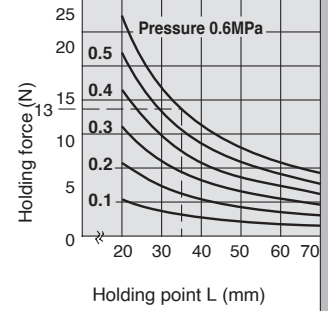
Guidelines on model selection according to work weight

- Although the condition differs according to the coefficient of friction between the attachment and work, select a model that can produce a holding force of 10 to 20 times the work weight.
- Further allowance should be provided when great acceleration or impact is expected during work transfer.

Ex.) For setting the holding force to be at least 20 times the work weight;

$$\text{Required holding force} = 0.05\text{kg} \times 20 \times 9.8\text{m/s}^2 = 10\text{N min.}$$

WHFR-16D



- When MHY2-16D is selected, the holding force is determined to be 13N according to the holding point distance (L = 35mm) and the pressure (0.6MPa).
- The holding force is 26 times the work weight meeting the guideline that holding force should be more than 20 times the set holding force value.

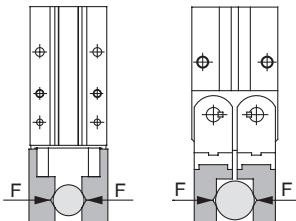
Holding point L = 35mm

Operating pressure: 0.6MPa

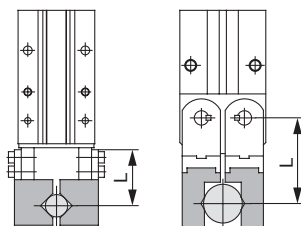
Effective Holding Force

Series WHFR Double acting

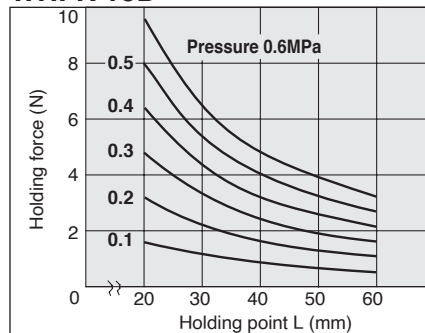
- Indication of effective holding force
The holding force shown in the tables represents the holding force of one finger when all fingers and attachments are in contact with the work.
(F: Thrust of one finger)



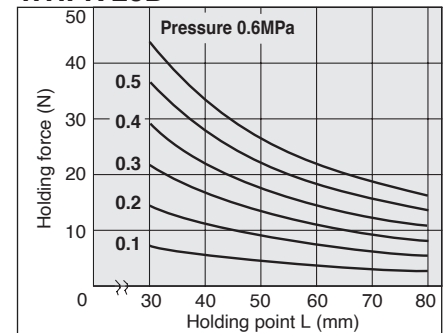
External hold



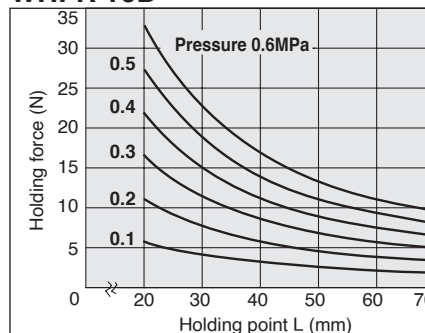
WHFR-10D



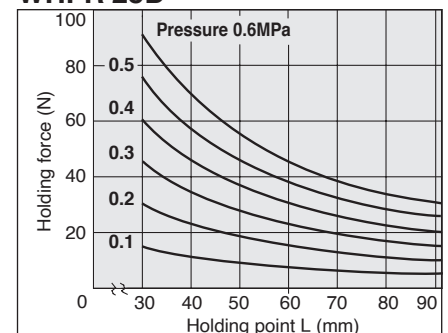
WHFR-20D



WHFR-16D

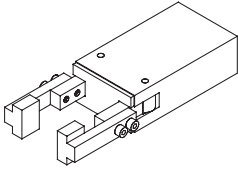


WHFR-25D

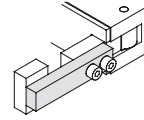


How to Select the Applicable Model

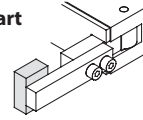
Step 3 Confirm moment of inertia of attachments



Confirm the moment of inertia for the attachment at one side.
Calculate the moment of inertia for A and B separately as shown in the figures on the right.



A part



B part

Procedure	Formula	Calculation example
1 Check the operating conditions, dimensions of attachment, etc.	A part B part	Operating model: MHY2-16D Opening time: 0.15s a = 40 (mm) b = 7 (mm) c = 8 (mm) d = 5 (mm) e = 10 (mm) f = 12 (mm)
2 Calculate the moment of inertia of attachment.	A part Calculation of weight $m_1 = a \times b \times c \times \text{Specific gravity}$ Moment of inertia around Z1 axis $I_{z1} = \{m_1(a^2 + b^2)/12\} \times 10^{-6}$ Moment of inertia around Z axis $I_A = I_{z1} + m_1 r_1^2 \times 10^{-6}$ B part Calculation of weight $m_2 = d \times e \times f \times \text{Specific gravity}$ Moment of inertia around Z2 axis $I_{z2} = \{m_2(d^2 + e^2)/12\} \times 10^{-6}$ Moment of inertia around Z axis $I_B = I_{z2} + m_2 r_2^2 \times 10^{-6}$ Total moment of inertia (*: constant for unit conversion) $I = I_A + I_B$	Material of attachment: Aluminum alloy (Specific gravity = 2.7) $r_1 = 37$ (mm) $m_1 = 40 \times 7 \times 8 \times 2.7 \times 10^{-6}$ $= 0.006$(kg) $I_{z1} = \{0.006 \times (40^2 + 7^2)/12\} \times 10^{-6}$ $= 0.8 \times 10^{-6}$ (kgm²) $I_A = 0.8 \times 10^{-6} + 0.006 \times 37^2 \times 10^{-6}$ $= 9.0 \times 10^{-6}$ (kgm²) $r_2 = 47$(mm) $m_2 = 5 \times 10 \times 12 \times 2.7 \times 10^{-6}$ $= 0.002$(kg) $I_{z2} = \{0.002 \times (5^2 + 10^2)/12\} \times 10^{-6}$ $= 0.02 \times 10^{-6}$ (kgm²) $I_B = 0.02 \times 10^{-6} + 0.002 \times 47^2 \times 10^{-6}$ $= 4.4 \times 10^{-6}$ (kgm²) $I = 9.0 \times 10^{-6} + 4.4 \times 10^{-6}$ $= 13.4 \times 10^{-6} = 0.13 \times 10^{-4}$ (kgm²)
3 Determine the allowable moment of inertia from the graph.	WHFR-16D	The moment of inertia is determined to be 0.9×10^{-4} (kgm²) according to the operating time (0.15s) from the graph on the left.
4 Confirm the moment of inertia of one attachment is within the allowable range.	Moment of inertia of attachment < Allowable moment of inertia	0.13×10^{-4} (kgm²) < 0.9×10^{-4} (kgm²) Possible to use this model MHY2-16D completely.

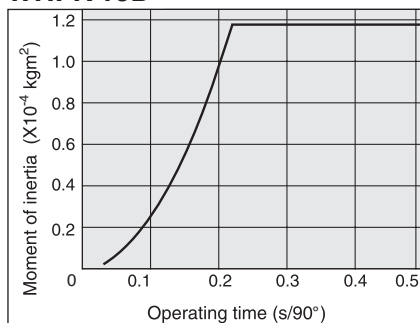
Symbol

Symbol	Definition	Unit
Z	Finger rotation axis	—
Z1	Axis on the centre gravity of A part of attachment and parallel to Z	—
Z2	Axis on the centre gravity of B part of attachment and parallel to Z	—
I	Total moment of inertia for attachment	kgm ²
Iz1	Inertia moment around the Z1 axis of A part of attachment	kgm ²
Iz2	Inertia moment around the Z2 axis of B part of attachment	kgm ²

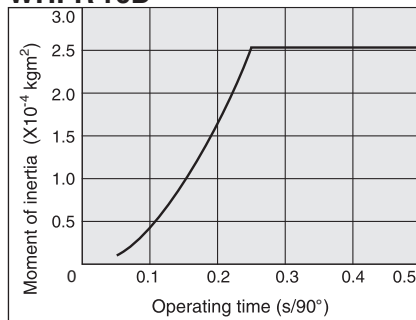
Symbol	Definition	Unit
IA	Moment of inertia around the Z axis of A part of attachment	kgm ²
IB	Moment of inertia around the Z axis of B part of attachment	kgm ²
m1	Weight of A part of attachment	kg
m2	Weight of B part of attachment	kg
r1	Distance between Z and Z1 axis	mm
r2	Distance between Z and Z2 axis	mm

Allowable range of inertia moment of attachment

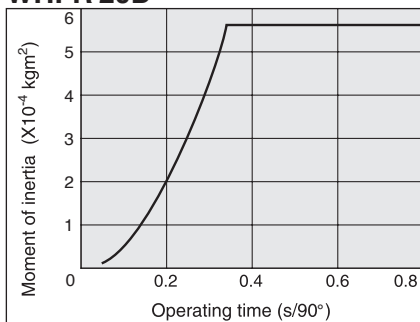
WHFR-10D



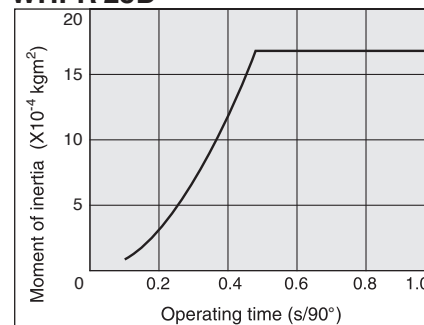
WHFR-16D



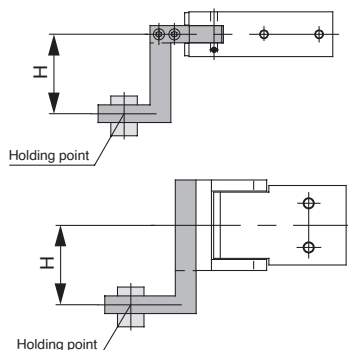
WHFR-20D



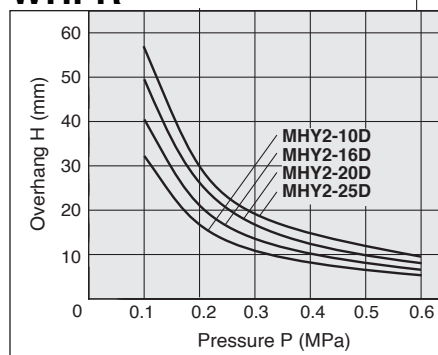
WHFR-25D



Step 2 Confirmation of holding point



WHFR



- Work should be held at a point within the range of overhanging distance (H) for a given pressure indicated in the tables on the right.
- When the work is held at a point outside of the recommended range for a given pressure, it may causes adverse effect on the product life.

ø10, ø16, ø20, ø25

How to Order

WHFR 2-16 D 2

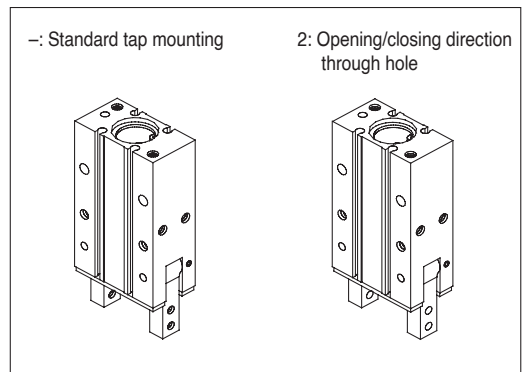
Number of fingers
2 | 2 fingers

Bore size

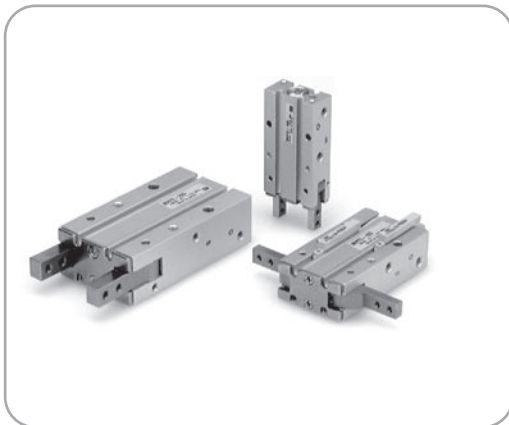
10	10mm
16	16mm
20	20mm
25	25mm

Action
D | Double acting

Finger option



Specifications



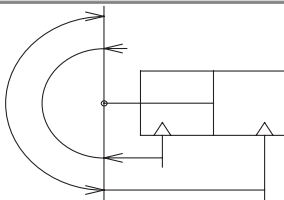
Fluid	Air
Operating pressure	0.1 to 0.6MPa
Ambient and fluid temperature	-10 to 60°C
Repeatability	±0.2mm
Max. operating frequency	60c.p.m
Lubrication	Not required
Action	Double acting
Auto switch (Optional) ^{Note)}	Solid state switch (3 wire, 2 wire)



Note) Refer to p. 6-15 for details of auto switch specifications.

Symbol

Double acting



Model

Model	Bore size (mm)	Effective holding force (Nm) ⁽¹⁾	Opening angle (Both sides)		Weight (g) ⁽²⁾
			Opening side	Closing side	
WHFR-10D	10	0.16	180°	-3°	70
WHFR-16D	16	0.54			150
WHFR-20D	20	1.10			320
WHFR-25D	25	2.28			560

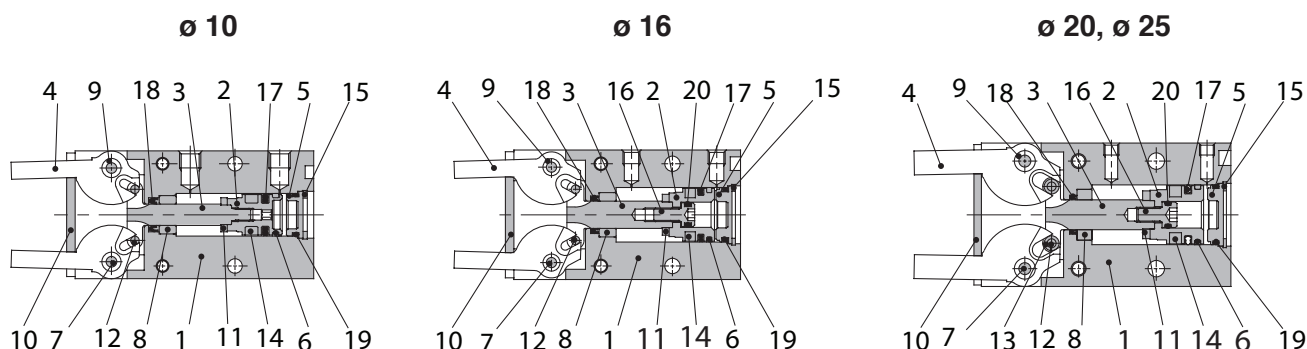
Note 1) At the pressure of 0.5MPa
Note 2) Not including auto switch



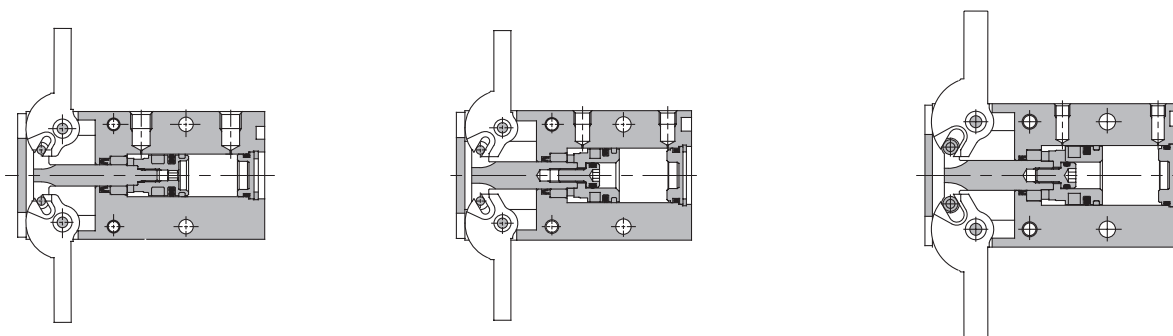
- Refer to the "How to Select the Applicable Model" on p.5-244
- Refer to p.5-244 and 5-245 for the details of effective holding force and allowable overhanging distance.

Construction

Closed



Open



Component Parts

No.	Description	Material	Note
1	Body	Aluminum alloy	Hard anodized
2	Piston	ø10: Stainless steel ø16 to 25: Aluminum alloy	ø16 to 25: Chromated
3	Joint	Stainless steel	Heat treatment
4	Finger	Stainless steel	Heat treatment
5	Cap	Resin	
6	Ware ring	Resin	
7	Shaft	Stainless steel	Nitriding
8	Bushing A	Sintered alloy steel	

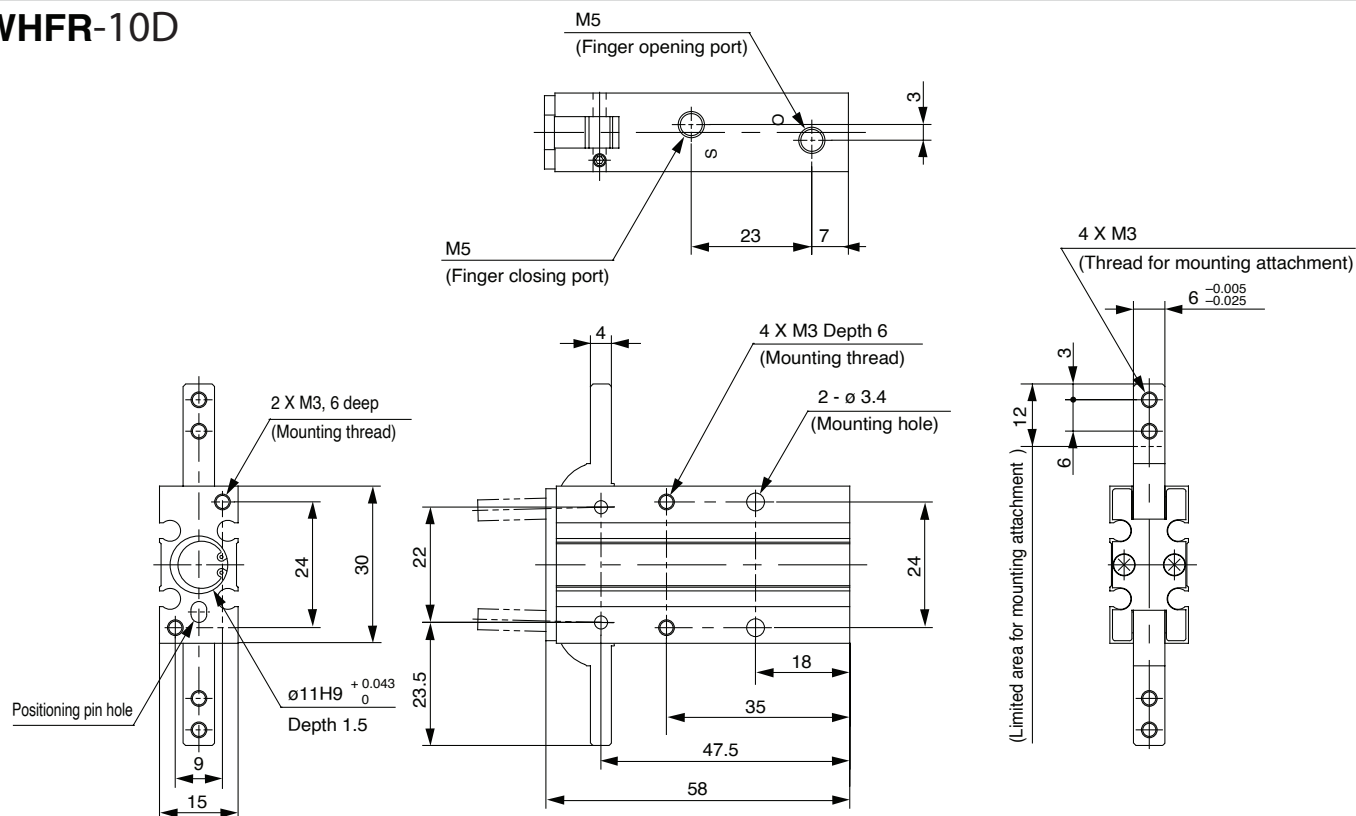
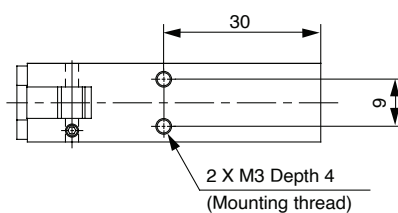
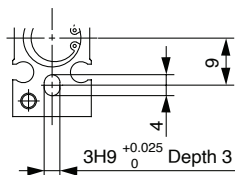
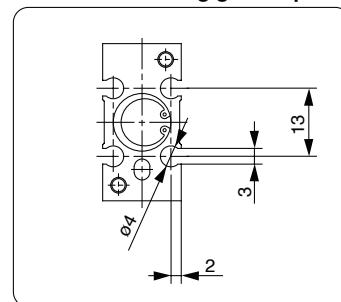
Component Parts

No.	Description	Material	Note
9	Bushing B	Sintered alloy steel	
10	End plate	Stainless steel	
11	Bumper	Urethane rubber	
12	Cylindrical roller	High carbon chrome bearing steel	
13	Joint roller	Carbon steel	Nitriding
14	Rubber magnet	Synthetic rubber	
15	C-shape snap ring	Carbon steel	Nickel plated
16	Piston bolt	Stainless steel	

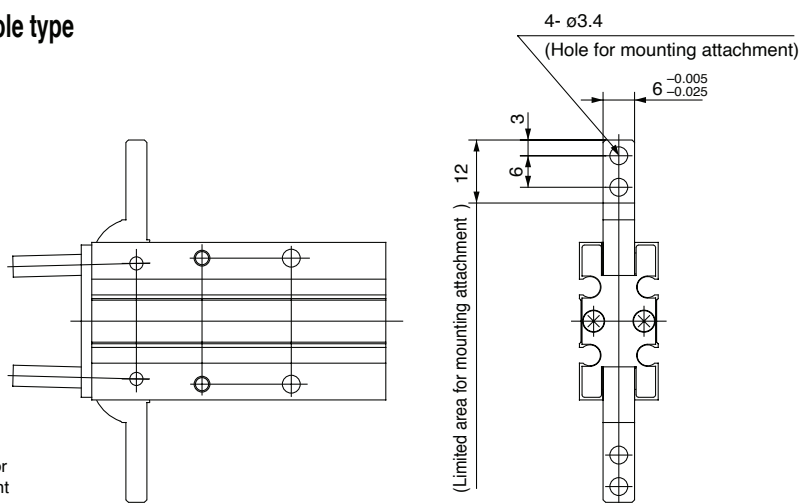
Replacement Parts: Seal Kits

No.	Description	Material	Kit No.			
			WHFR10-PS	WHFR16-PS	WHFR20-PS	WHFR25-PS
17	Seal kit	NBR	WHFR10-PS	WHFR16-PS	WHFR20-PS	WHFR25-PS
18						
19						
20						

Dimension

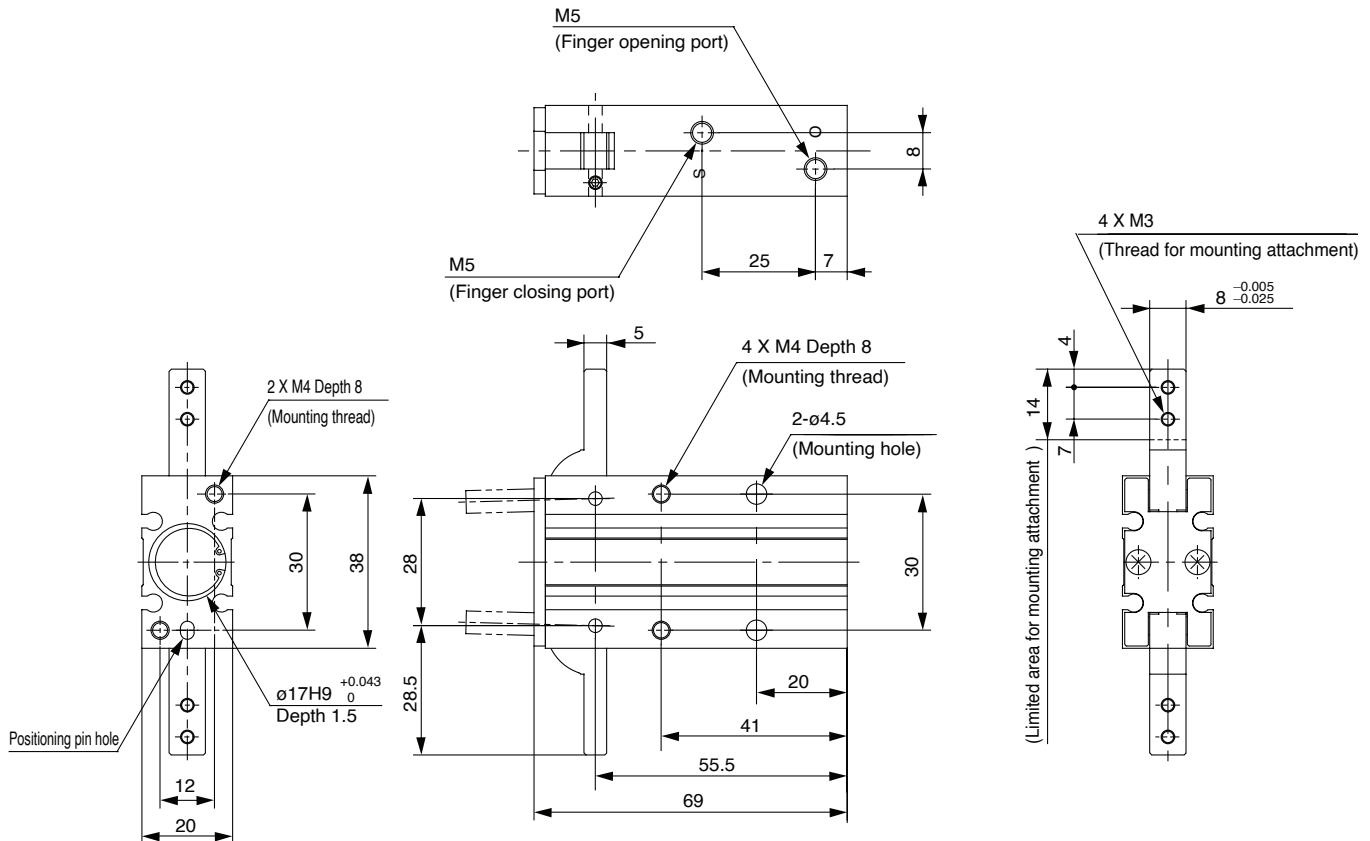
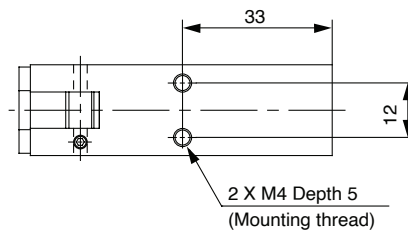
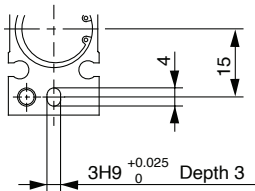
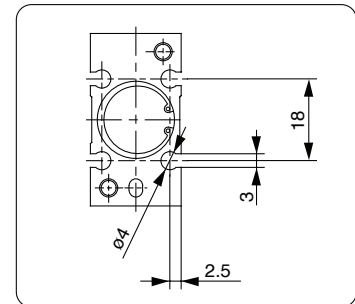
WHFR-10D

Pin hole positioning

Auto switch mounting groove position

WHFR-10D2

Opening/closing direction through hole type

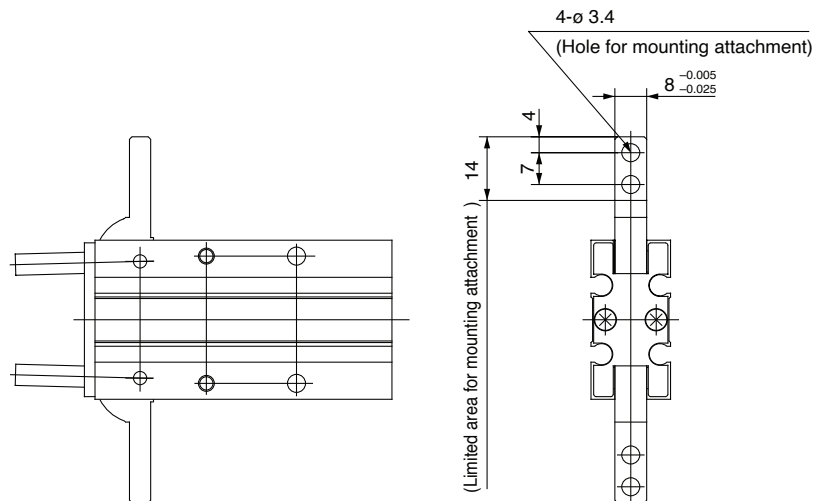


*Do not extend the attachment from limited area for mounting to avoid interference with the attachment or main body.

Dimension

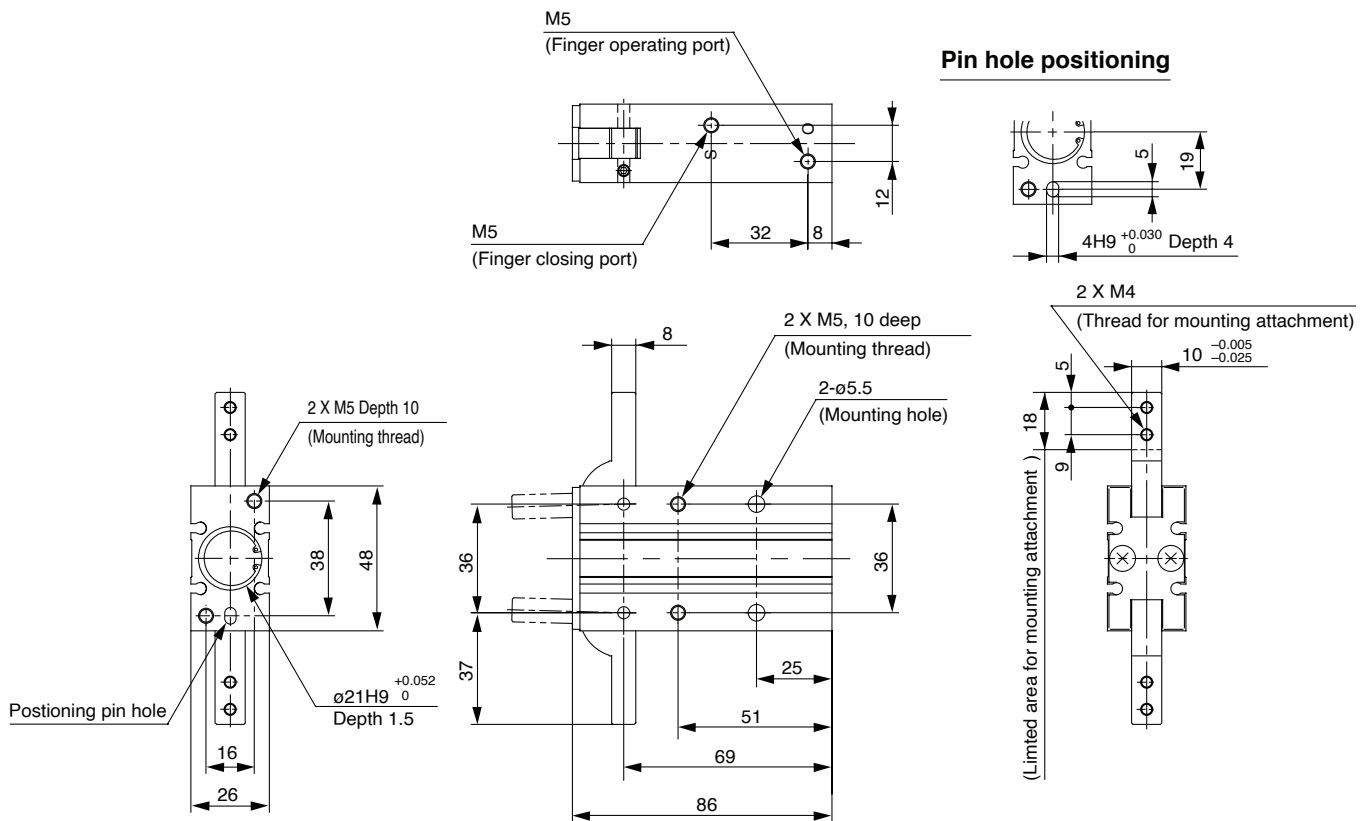
WHFR-16D

Pin hole positioning

Auto switch mounting groove position

WHFR-16D2

Opening/closing direction through hole type

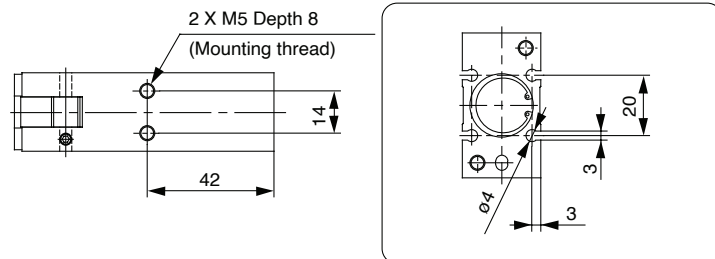


*Do not extend the attachment from limited area for mounting to avoid interference with the attachment or main body.

WHFR-20D

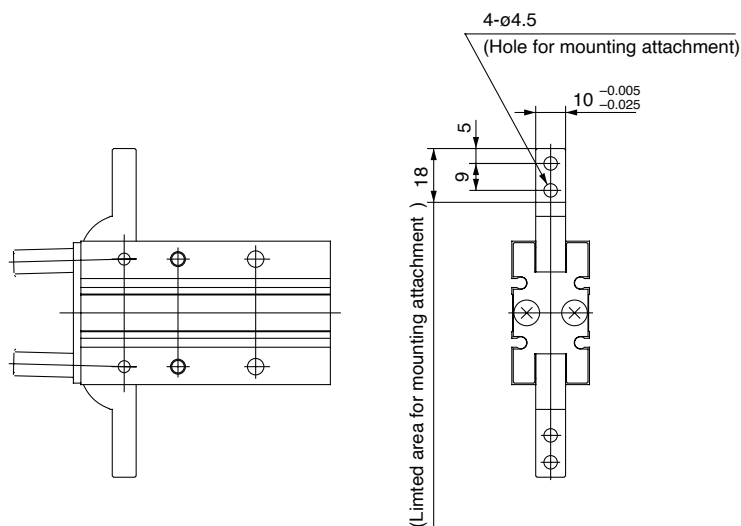


Auto switch mounting groove position



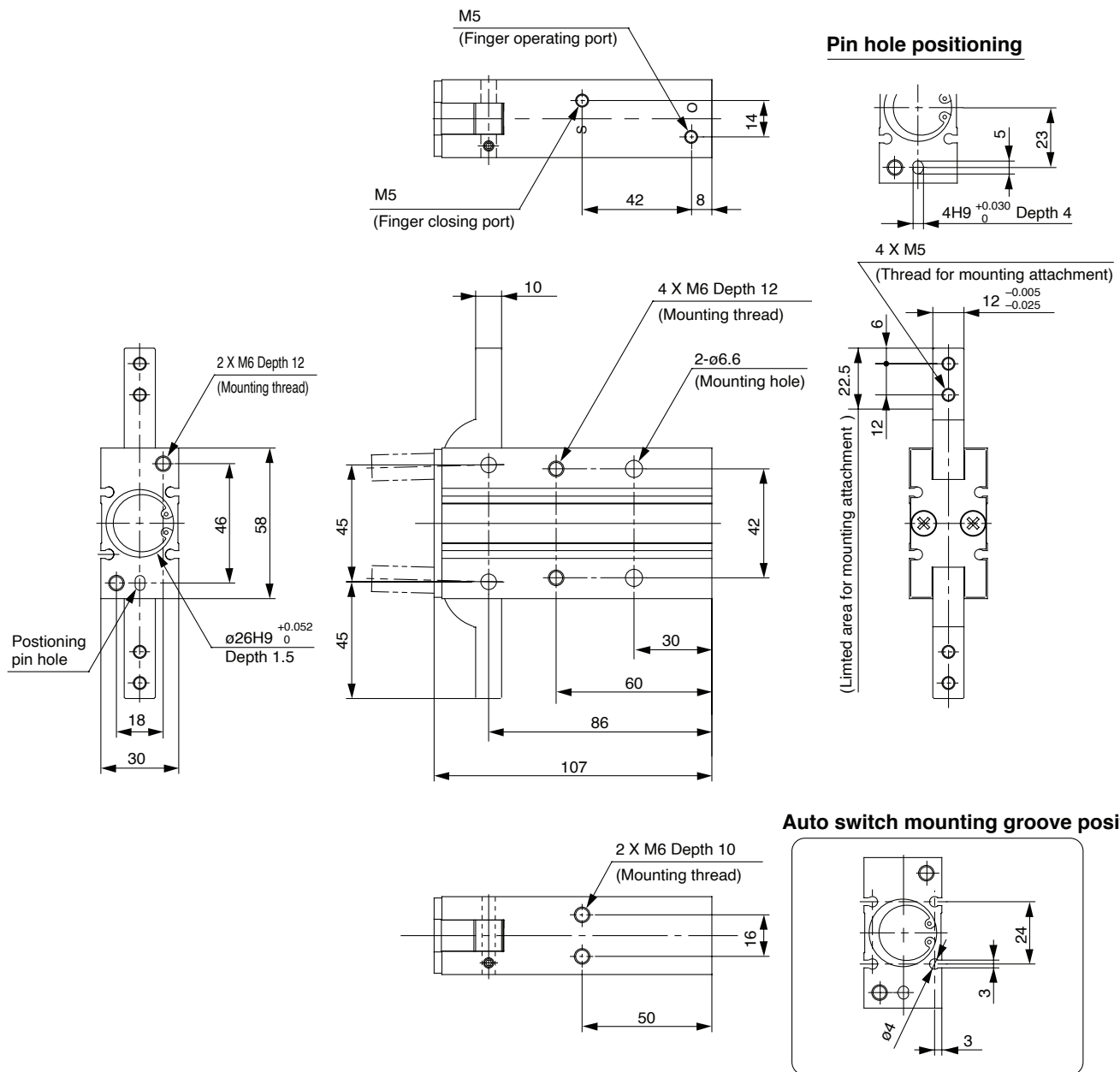
WHFR-20D2

Opening/closing direction through hole type



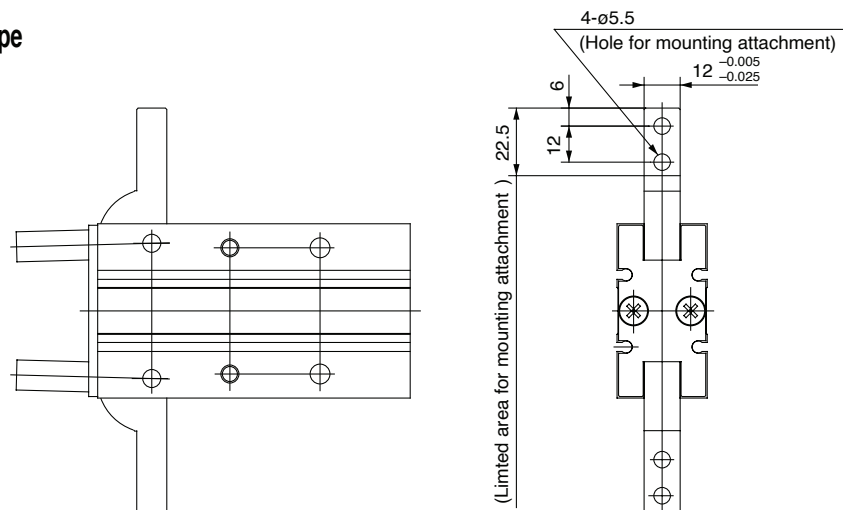
* Do not extend the attachment from limited area for mounting to avoid interference with the attachment or main body.

WHFR-25D



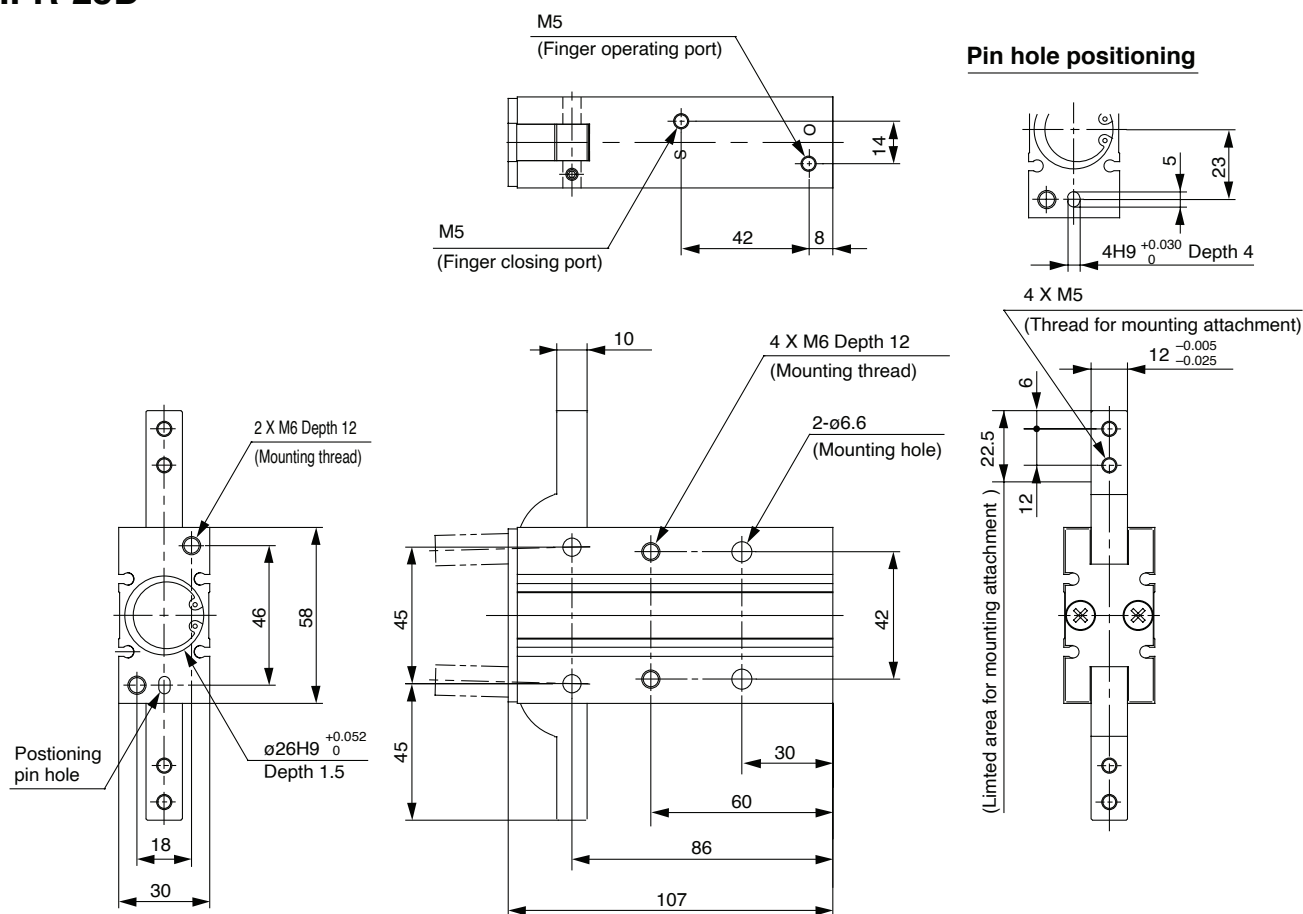
WHFR-25D2

Opening/closing direction through hole type

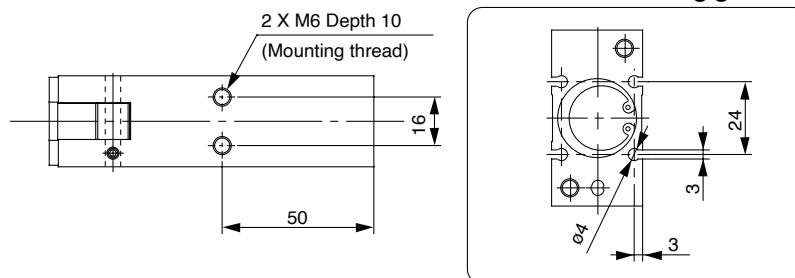


* Do not extend the attachment from limited area for mounting to avoid interference with the attachment or main body.

WHFR-25D

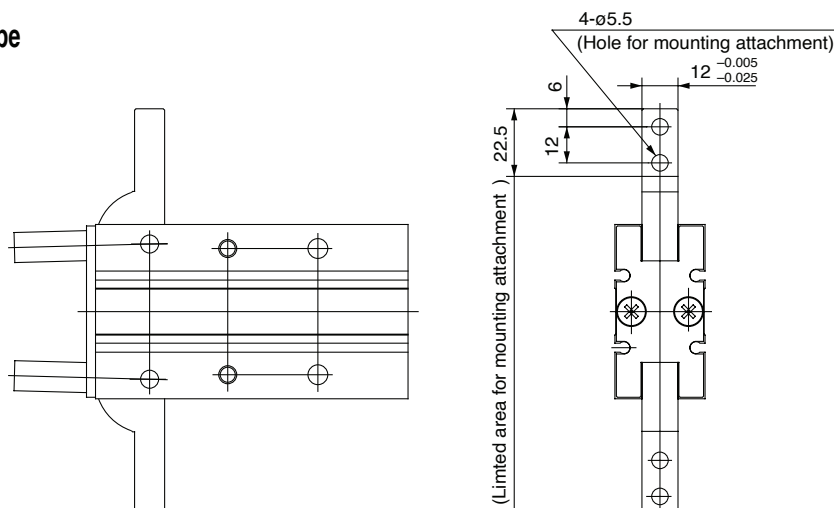


Auto switch mounting groove position



WHFR-25D2

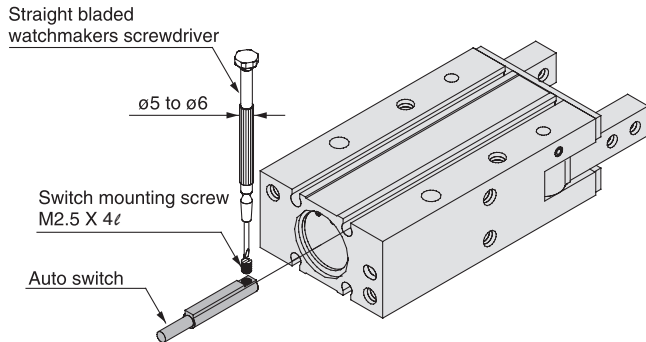
Opening/closing direction through hole type



Do not extend the attachment from limited area for mounting to avoid interference with the attachment or main body.

Setting Method of Auto Switch

To set auto switch, insert the auto switch into the installation groove of the gripper from the direction indicated in the following drawing. After establishing the installation position, tighten the attached switch mounting screw with a straight bladed watchmakers screwdriver.

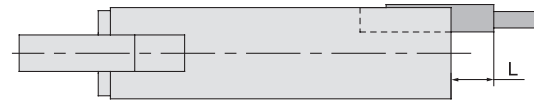


Note) Use a watchmaker screwdrivers with a grip diameter of 5 to 6 mm to tighten the auto switch mounting screw. Use a tightening torque of 0.05 to 0.1 Nm. As a rough guide, tighten the screw an additional 90° after feeling a tighten resistance.

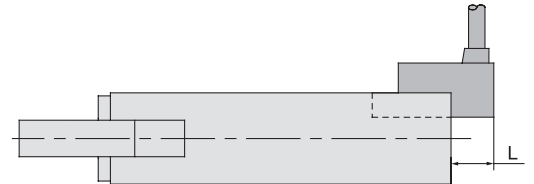
Projection of Auto Switch From Body Edge

The projection of an auto switch from the edge of the body is shown in the table below. Use the table as a guideline for mounting.

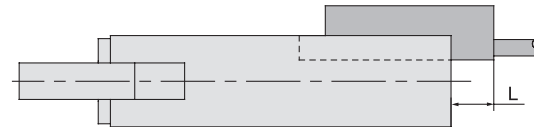
Note) 2 color indicator type and perpendicular entry type protrude in the direction of the lead wire entry.



When auto switch D-M9N is used



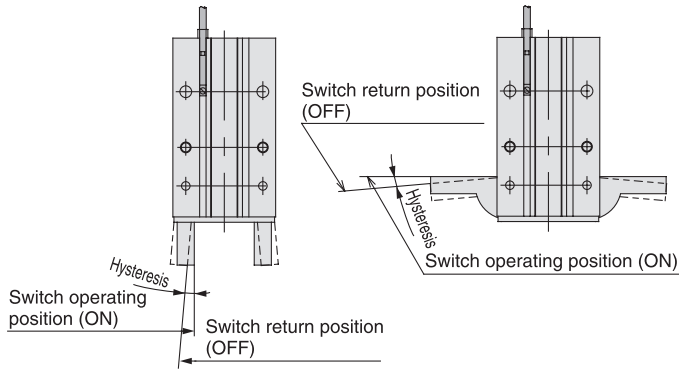
When auto switch D-M9□ V is used



When auto switch D-M9BA is used

Auto Switch Hysteresis

Auto switch have a differential like a micro switch. Please refer to the following table as a guide when setting auto switch positions.



Max. protrusion of auto switch from edge of body(L) Unit: mm

Auto switch model No.	Gripper Model No.	Protrusion						
		In-line				Perpendicular		
		D-M9N	D-M9BD	D-M9BA	D-M9NW	D-M9NV	D-M9BVD	D-M9NWV
WHFR-10D	O	—	—	—	—	—	—	—
	S	3	8	13	6	1	1	8
WHFR-16D	O	—	—	—	—	—	—	—
	S	3	8	13	7	1	1	8
WHFR-20D	O	—	—	—	—	—	—	—
	S	—	5	10	4	—	—	5
WHFR-25D	O	—	—	—	—	—	—	—
	S	—	3	9	3	—	—	3

		D-M9N(V) D-M9B(V)	D-M9NW(V)		D-M9BA	
			Red light at ON	Green light at ON	Red light at ON	Green light at ON
WHFR-10D	Finger fully closed	2°	2°	4°	2°	3°
	Finger fully open	4°	4°	7°	4°	5°
WHFR-16D	Finger fully closed	2°	2°	4°	2°	2°
	Finger fully open	3°	3°	6°	3°	4°
WHFR-20D	Finger fully closed	2°	2°	3°	2°	2°
	Finger fully open	3°	3°	5°	3°	3°
WHFR-25D	Finger fully closed	1°	1°	3°	1°	2°
	Finger fully open	2°	2°	5°	2°	3°