SMC

Low Profile Air Gripper

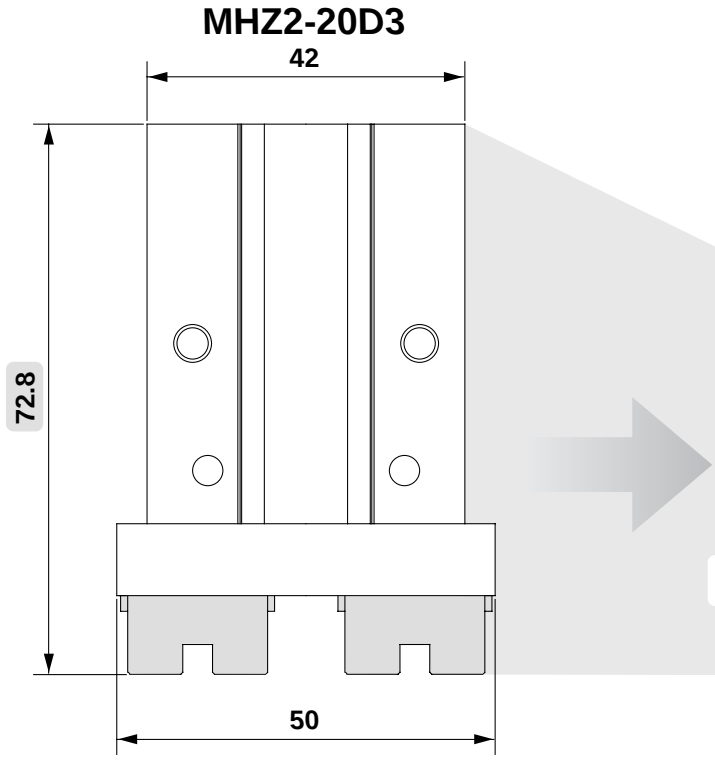
Series MHF2

Low profile air gripper with space-saving design is newly released.

Low Profile Air Gripper

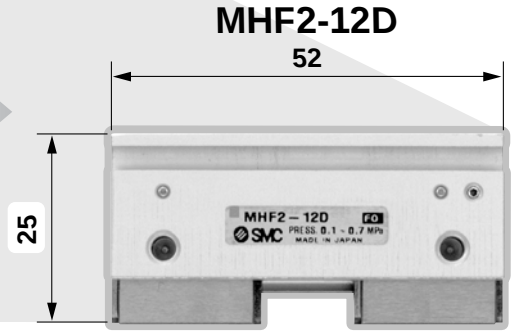
Series MHF2

Height is approximately 1/3 the size of an equivalent Series MHZ2.

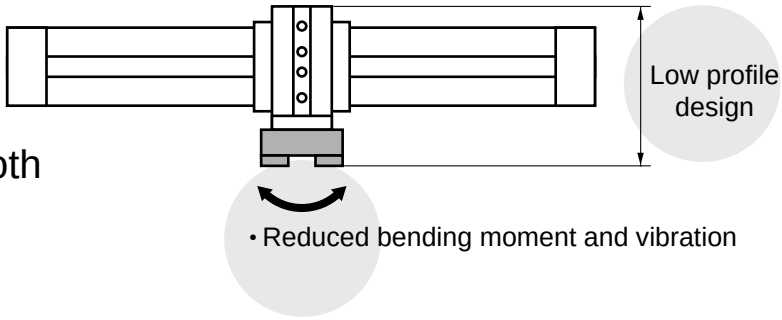


(mm)

Bore size	Height
8	19
12	25
16	33
20	41

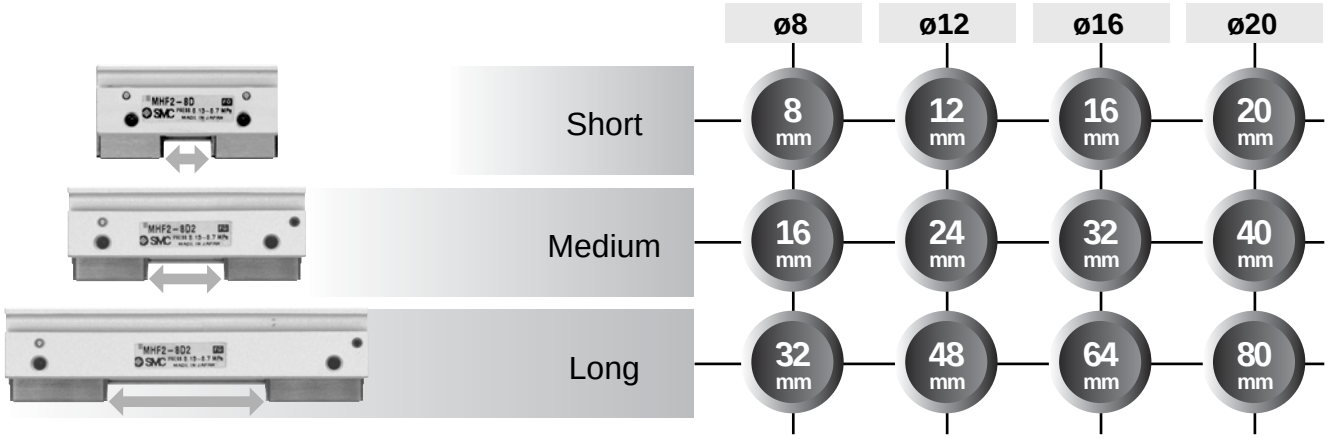


- The low profile design saves space and reduces bending moments.
- Improved accuracy with smooth operation



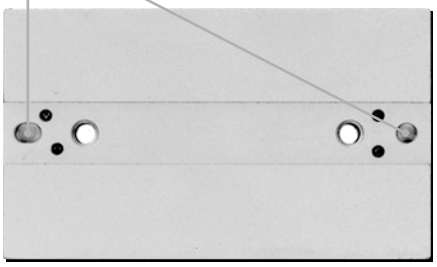
Stroke selection is available.

3 standard stroke lengths are available for each bore size.
Stroke can be selected to suit the work piece.

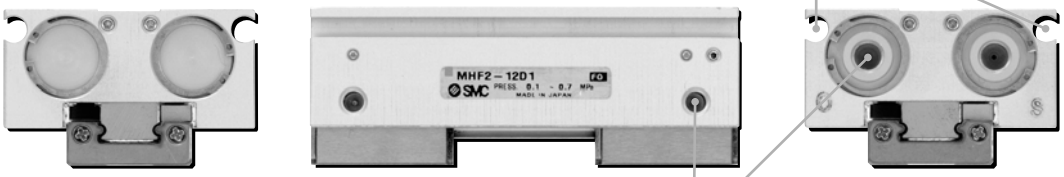


Improved mounting repeatability

With positioning pin holes



Auto switches can be mounted on both sides.

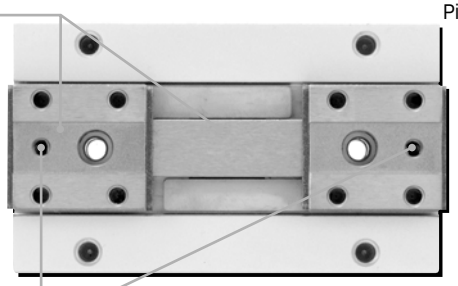


Piping is available from 2 directions

Piping port position can be specified using a part number.

Linear guide provides:

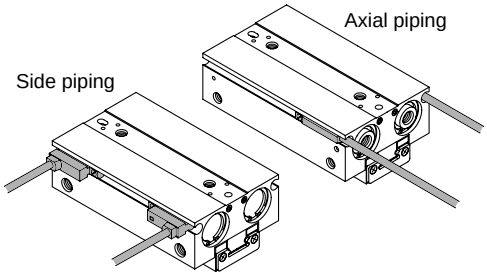
High precision and high rigidity with martensitic stainless steel



Easy positioning for mounting attachments

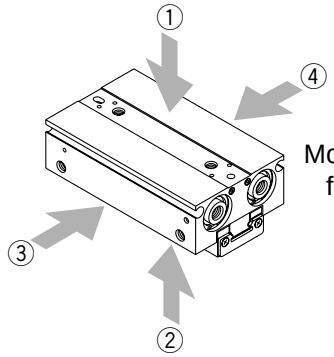
With positioning pin holes

Centralized wiring and piping are possible.

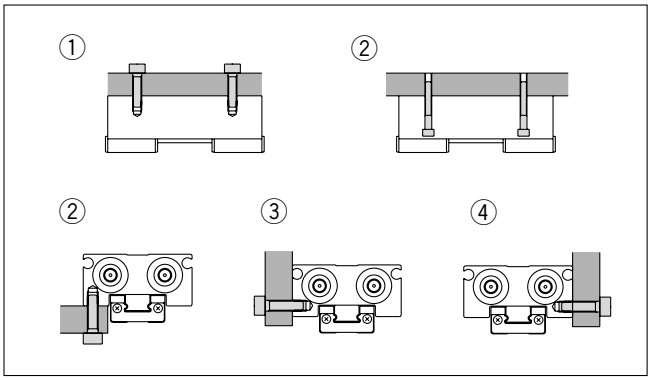


High degree of mounting flexibility

As no brackets are required, mounting height can be minimized.

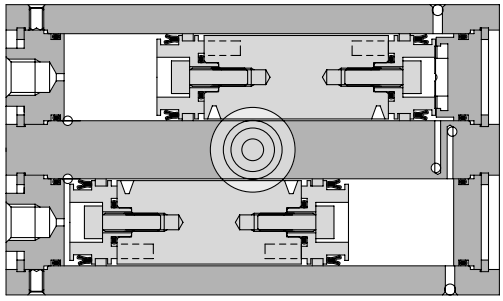


Mounting is possible from 4 directions.



Strong holding force

Double piston construction achieves compact design with strong holding force.



Model	Bore size	Holding force (N)
MHF2-8D☐	8	19
MHZ2-10D☐	10	11
MHF2-12D☐	12	48
MHZ2-20D☐	20	42
MHF2-16D☐	16	90
MHZ2-25D☐	25	65
MHF2-20D☐	20	141
MHZ2-32D☐	32	158

Series MHF2
Model Selection

Model Selection

Selection procedure

Step 1 Confirm gripping force → **Step 2** Confirm gripping point → **Step 3** Confirm external force on fingers

Step 1 Confirmation of gripping force

Confirmation of conditions → Calculation of required gripping force → Model selection from gripping force graph

Example

Work piece weight: **0.15kg**

Gripping method: External gripping

Model selection criteria with respect to work piece weight

- Although differences will exist depending on factors such as shape and the coefficient of friction between attachments and work pieces, select a model which will provide a gripping force 10 to 20 times the weight of the work piece.
  (Note1) Refer to the model selection illustration for more information.
- Furthermore, in cases with high acceleration or impact, etc., it is necessary to allow an even greater margin of safety.

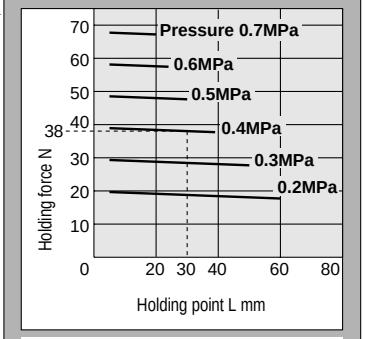
Example

When it is desired to set the gripping force at 20 times or more the work piece weight.
Required griping force = 0.15 kg x 20 x 9.8 m/s² = Approx. 29.4N or more

Length of gripping point : **30mm**

Operating pressure : **0.4MPa**

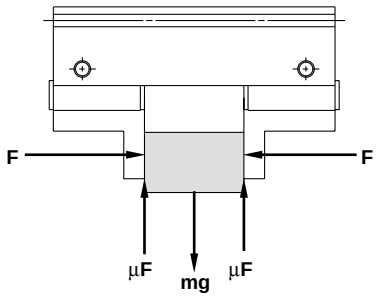
MHF2-12D□



Selecting the MHF2-12D

- The gripping force is obtained from the intersection point of the gripping point distance L=30mm and a pressure of 0.4MPa.
  Gripping force N=38N
- A gripping force of 38N satisfies the required gripping force of 29.4N. Therefore, the selection of MHF2-12D is appropriate.

Model selection illustration



Gripping force at least 10 to 20 times the work piece weight

The "10 to 20 times or more of the work piece weight" recommended by SMC is calculated with the safety margin of a = 4, which allows for impacts that occur during normal transportation, etc.

When μ = 0.2	When μ = 0.1
$F = \frac{mg}{2 \times 0.2} \times 4$	$F = \frac{mg}{2 \times 0.1} \times 4$
= 10 x mg	= 20 x mg
10 x work piece weight	20 x work piece weight

When gripping a work piece as in the figure to the left and with the following definitions,

F : Gripping force (N)

μ : Coefficient of friction between attachments and work piece

m : Work piece mass (kg)

g : Gravitational acceleration (= 9.8m/s²)

mg : Work piece weight (N)

the conditions under which the work piece will not drop are

$$\underline{2}\mu F > mg$$

(2 : Number of fingers)

and therefore,

$$F > \frac{mg}{2 \times \mu}$$

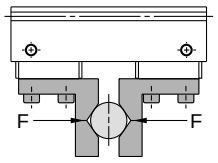
With "a" as the safety margin, F is determined as follows:

$$F = \frac{mg}{2 \times \mu} \times a$$

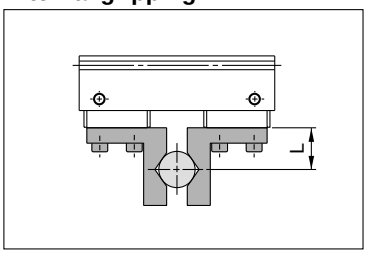
(Note) · Even in cases where the coefficient of friction is greater than μ = 0.2, for safety reasons, SMC recommends selecting a gripping force which is at least 10 to 20 times the work piece weight.
· If is necessary to allow a greater safety margin for high accelerations and strong impacts, etc.

Step 1 Effective gripping force: Series MHF2

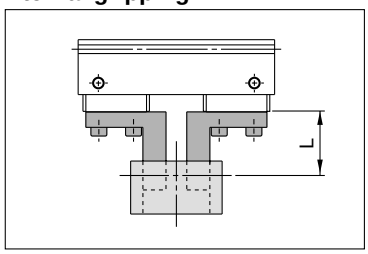
•Expressing the effective gripping force
The effective gripping force shown in the graphs to the right is expressed as F, which is the thrust of one finger when both fingers and attachments are in full contact with the work piece as shown in the figure below.



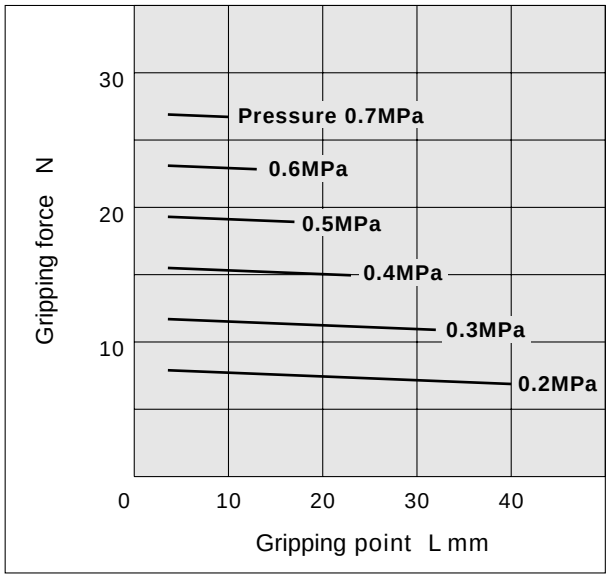
External gripping



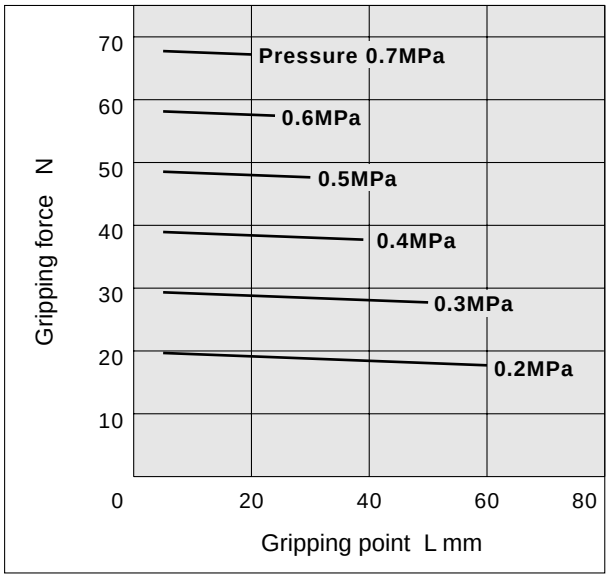
Internal gripping



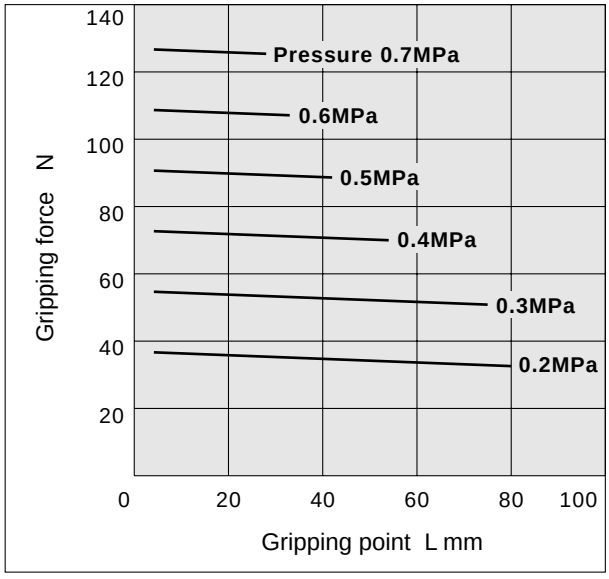
MHF2-8D□



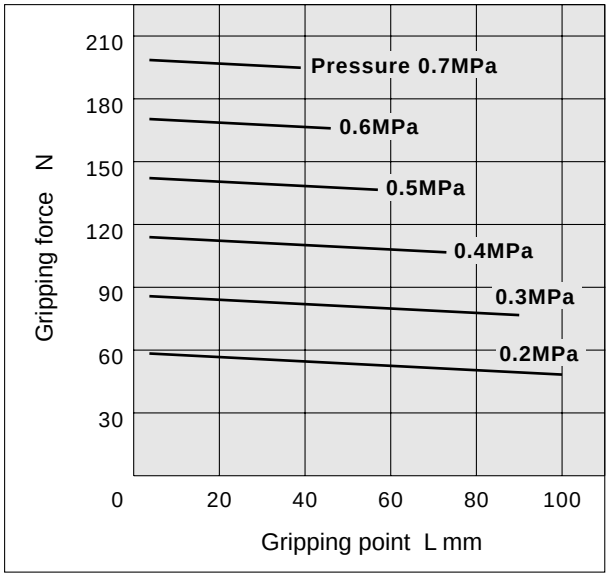
MHF2-12D□



MHF2-16D□



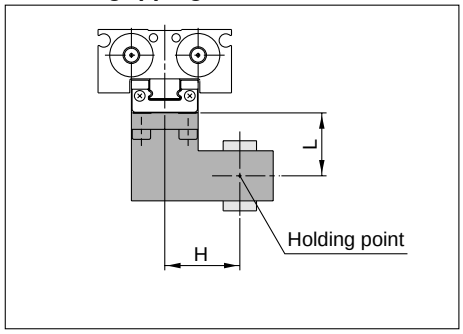
MHF2-20D□



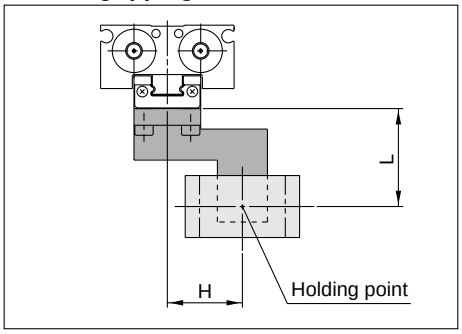
Model Selection

Step 2 Effective gripping force: Series MHF2

External gripping

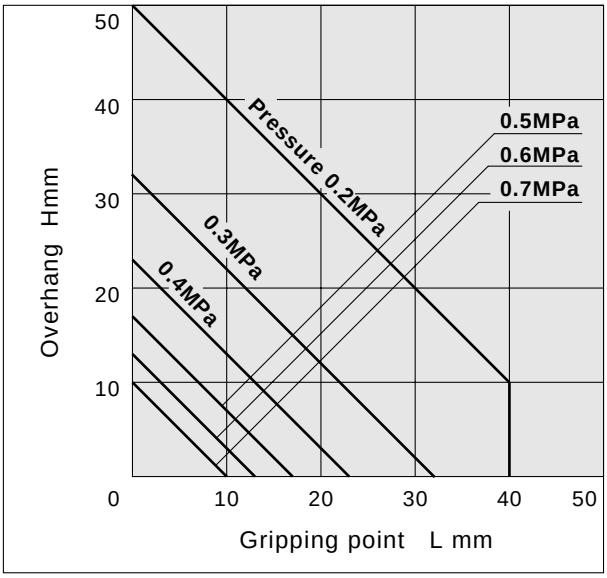


Internal gripping

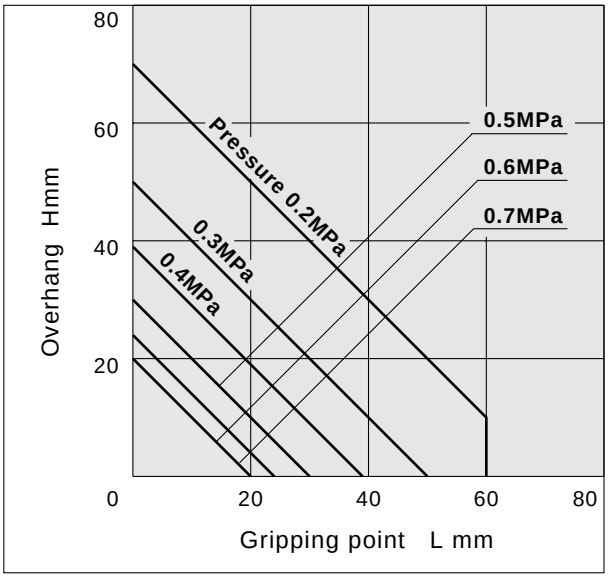


- The air gripper should be operated so that the amount of overhang "H" will stay within the range given in the graphs below.
- If the work piece gripping point goes beyond the range limits, this will have an adverse effect on the life of the air gripper.

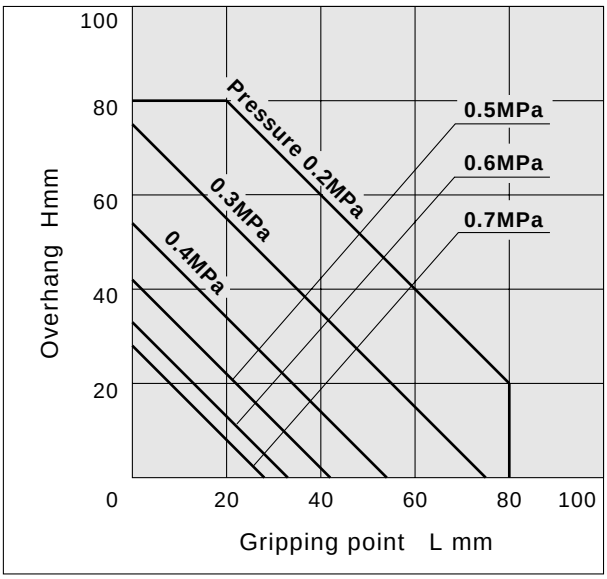
MHF2-8D□



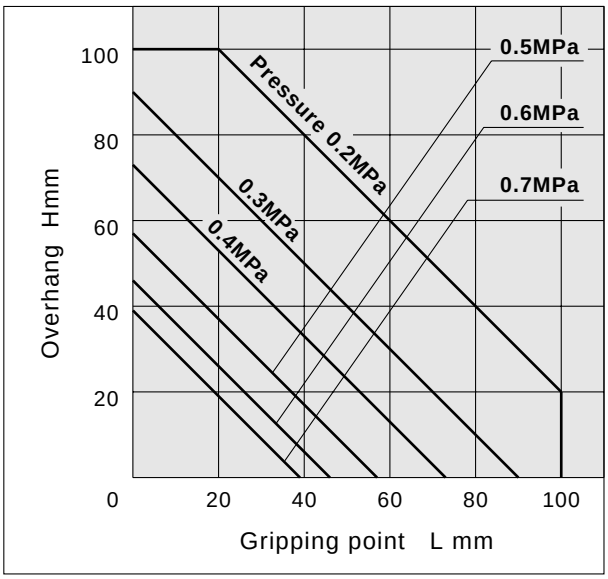
MHF2-12D□



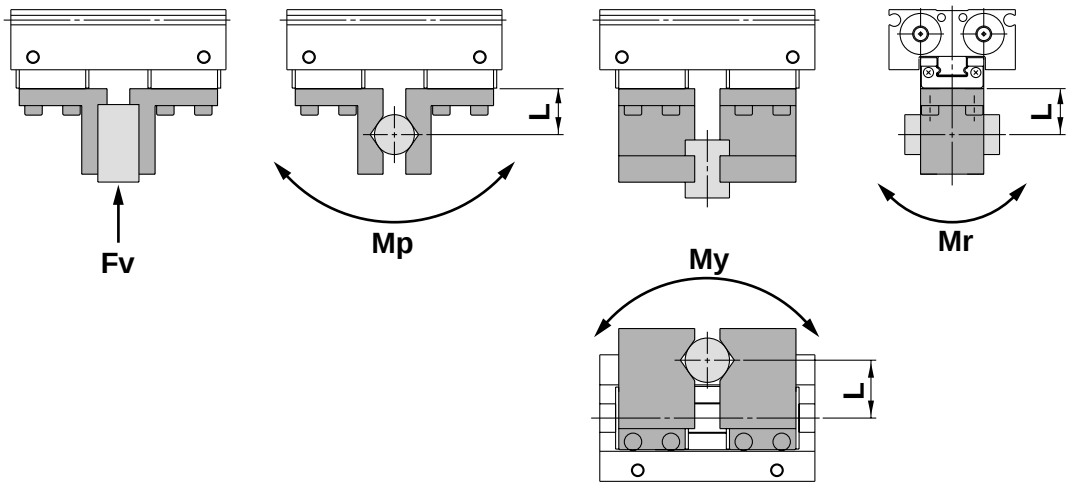
MHF2-16D□



MHF2-20D□



Step 3 Confirmation of external force on fingers: Series MHF2



L: Distance to the point at which the load is applied (mm)

Model	Allowable vertical load **Fv (N)**	Maximum allowable moment		
		Pitch moment **Mp (N·m)**	Yaw moment **My(N·m)**	Roll moment **Mr (N·m)**
MHF2-8D□	58	0.26	0.26	0.53
MHF2-12D□	98	0.68	0.68	1.4
MHF2-16D□	176	1.4	1.4	2.8
MHF2-20D□	294	2	2	4

Note) The load and moment values in the table indicate static values.

Calculation of allowable external force (when moment load is applied)	Calculation example
$\text{Allowable load } F(N) = \dfrac{M(\text{Maximum allowable moment})(N\cdot m)}{L \times \underset{*}{10^{-3}}}$ (*Unit converted invariable number)	When a load off = 10N is operating, which applies pitch moment to point L = 30 mm from the end of the MHF2-12D finger. $\textbf{Allowable load } F = \dfrac{0.68}{30 \times 10^{-3}}$ $= 22.7\ (N)$ **Load f = 10 (N) < 22.7 (N)** Therefore, it can be used.

Low Profile Air Gripper

Series MHF2

How to Order

MHF 2 — 12 D □ □ — M9B □

Number of fingers

2	2 finger

Bore size (mm)

8	8
12	12
16	16
20	20

Action

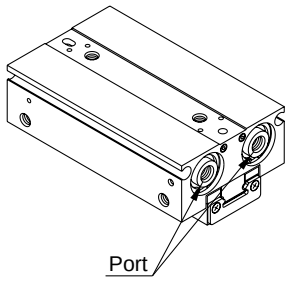
D	Double acting

Stroke

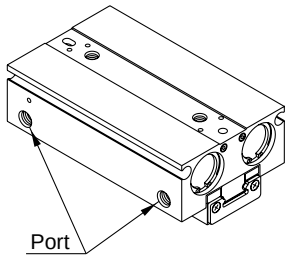
Nil	Short stroke
1	Middle stroke
2	Long stroke

Body option

Nil: Axial direction piping type



R: Side piping type



Number of auto switches

Nil	2 pcs.
S	1 pc.

Auto switch type

Nil	Without auto switch (built-in magnet)

Applicable auto switches

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage			Auto switch type		Lead wire length (m) *			Note2) Flexible lead wire (-61)	Applicable loads	Applicable model			
					DC		AC	Electrical entry direction		0.5 (Nil)	3 (L)	5 (Z)			Bore size (mm)			
								Perpendicular	In-line						8	12	16	20
Solid state switch	—	Grommet	Yes	3-wire (NPN)	24V	12V	–	M9NV	M9N	●	●	○	○	Relay PLC	●	●	●	●
				3-wire (PNP)				M9PV	M9P	●	●	○	○		●	●	●	●
				2-wire				M9BV	M9B	●	●	○	○		●	●	●	●
	Note 1) Diagnostic indication (2-colour display)			3-wire (NPN)				M9NWV	M9NW	●	●	○	○		●	●	●	●
				3-wire (PNP)				M9PWV	M9PW	●	●	○	○		●	●	●	●
				2-wire				M9BWV	M9BW	●	●	○	○		●	●	●	●

∗Lead wire length symbol: 0.5m·····Nil (Example) M9N
3m·····L (Example) M9NL
5m·····Z (Example) M9NWZ

∗Auto switches marked "O" are produced upon receipt of order.

Note 1) Be careful for the differential of 2-color display type.
Refer to "Auto Switch Hysteresis" on page 5-101

Note2) For the flexible wire specification, enter-61 after the part number.
Example: When ordering with an air chuck

MHF2-12D-M9NVS -61
Flexible wire

When ordering only an auto switch

D-M9PL -61
Flexible wire

Specifications

Fluid		Air
Operating pressure		ø8: 0.15 to 0.7MPa
		ø12 to 20: 0.1 to 0.7MPa
Ambient and fluid temperature		−10 to 60°C (with no condensation)
Repeatability		±0.05mm Note1)
Maximum operating frequency	Short stroke	120c.p.m.
	Middle stroke	120c.p.m.
	Long stroke	60c.p.m.
Lubrication		Not required
Action		Double acting
Auto switch (Optional) Note2)		Solid state switch (3-wire, 2-wire)

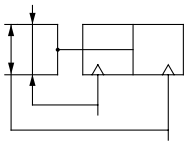
Note 1) This is the value when no offset load is applied to the finger.
When an offset load is applied to the finger, the maximum value is ±0.15 mm due to the influence of backlash of the rack and pinion.
Note 2) Refer to page 6-15 for further information on auto switch specifications.

Model

Action	Model	Cylinder bore (mm)	Gripping force Note1) / Effective holding force per finger N	Opening /closing stroke (Both sides) mm	Weight Note2) g	Unobstructed capacity (cm^3)	
						Finger open side	Finger close side
Double acting	**MHF2-8D**	8	19	8	65	0.7	0.6
	MHF2-8D1			16	85	1.1	1.0
	MHF2-8D2			32	120	2.0	1.9
	MHF2-12D	12	48	12	155	1.9	1.6
	MHF2-12D1			24	190	3.3	3.0
	MHF2-12D2			48	275	6.1	5.8
	MHF2-16D	16	90	16	350	4.9	4.1
	MHF2-16D1			32	445	8.2	7.4
	MHF2-16D2			64	650	14.9	14.0
	MHF2-20D	20	141	20	645	8.7	7.3
	MHF2-20D1			40	850	15.1	13.7
	MHF2-20D2			80	1,225	28.0	26.6

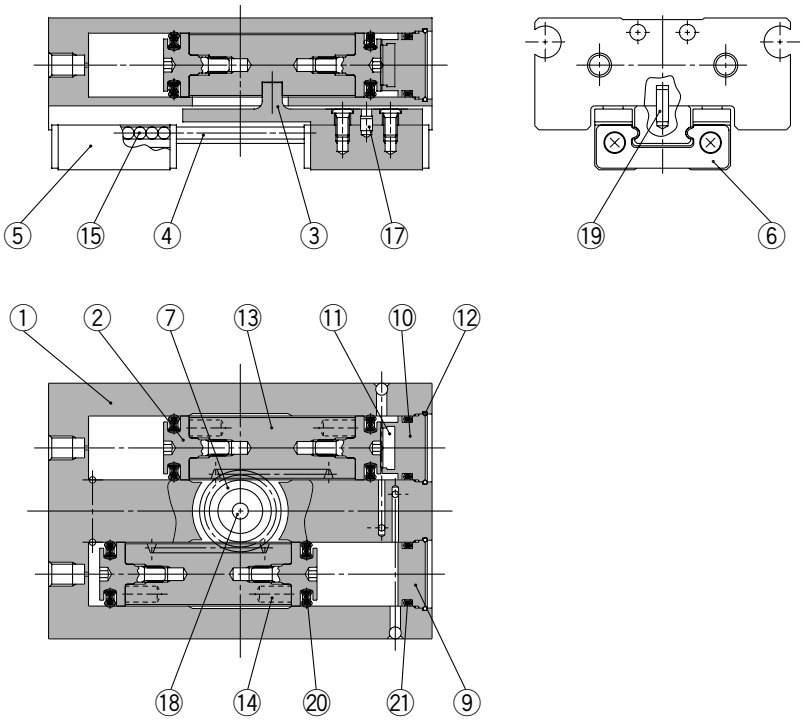
Note 1) At the pressure of 0.5MPa, when holding point L is 20mm.
Note 2) Excluding the auto switch weight

Symbol
Double acting

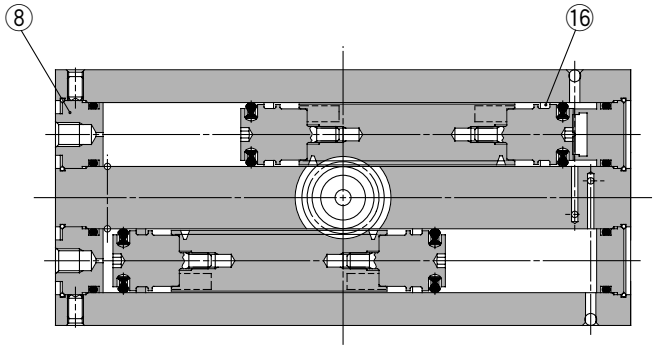


Construction

MHF2-8D, MHF2-8D1



MHF2-8D2



Parts list

No.	Description	Material	Note
1	**Body**	Aluminium alloy	Hard anodized
2	**Piston**	Stainless steel	
3	**Joint**	Stainless steel	Heat treatment
4	**Guide rail**	Stainless steel	Heat treatment
5	**Finger**	Stainless steel	Heat treatment
6	**Roller stopper**	Stainless steel	
7	**Pinion**	Carbon steel	Nit riding
8	**Cap A**	Aluminium alloy	Clear anodized
9	**Cap B**	Aluminium alloy	Clear anodized
10	**Cap C**	Aluminium alloy	Clear anodized

Parts list

No.	Description	Material	Note
11	**Head damper**	Urethane rubber	
12	**Clip**	Stainless steel wire	
13	**Rack**	Stainless steel	Nit riding
14	**Magnet**	Rare earth magnet	Nickel plated
15	**Steel balls**	High carbon chromium bearing steel	
16	**Wear ring**	Synthetic resin	
17	**Roller**	High carbon chromium bearing steel	
18	**Needle roller**	High carbon chromium bearing steel	
19	**Parallel pin**	Stainless steel	
20	**Piston seal**	NBR	
21	**Gasket**	NBR	

Replaceable parts list

Description	Kit No.			Contents
	MHF2-8D	MHF2-8D1	MHF2-8D2	
Seal kit	MHF8-PS	MHF8-PS	MHF8-PS-2	12, 20, 21
Finger assembly	MHF-A0802	MHF-A0802-1	MHF-A0802-2	3, 4, 5, 6, 15, 17, 19 Mounting screw

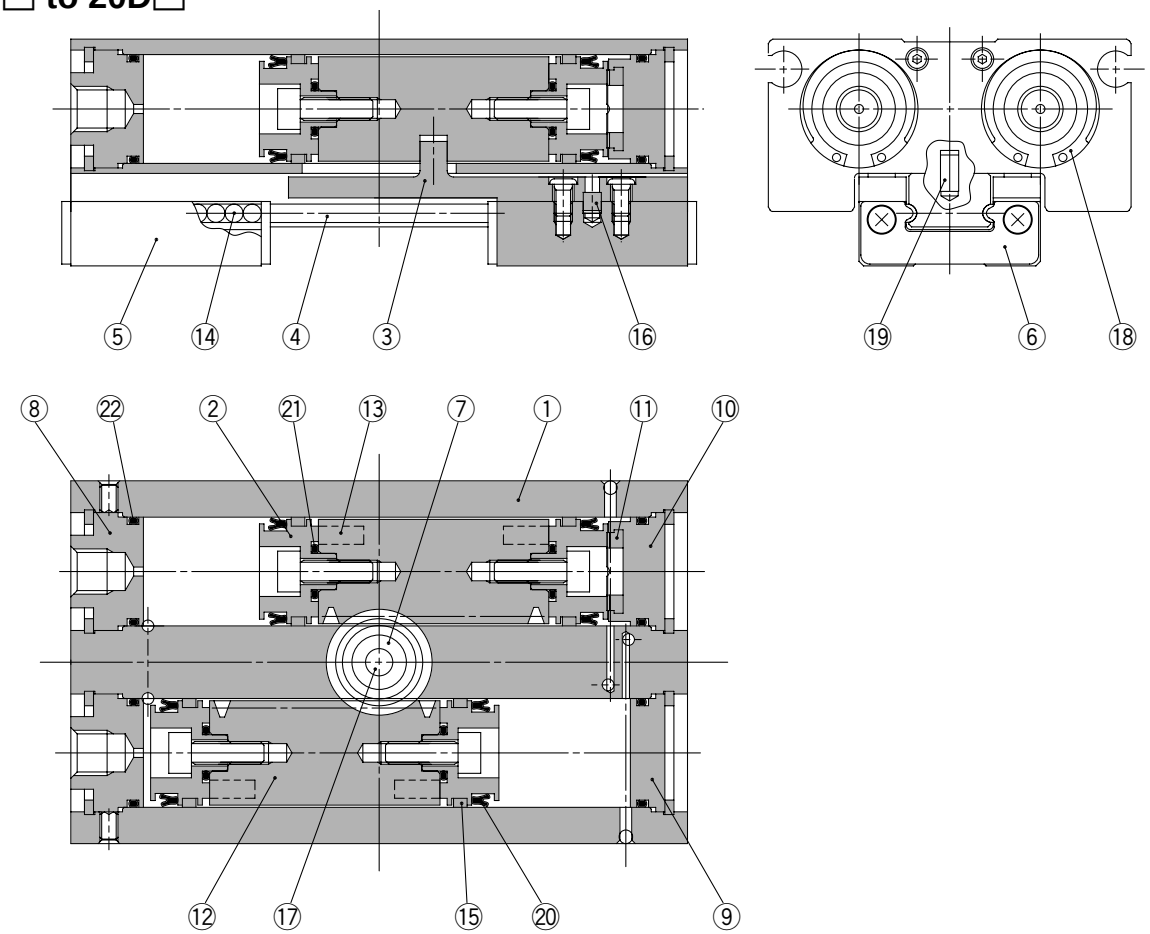
Bolts for body through hole mounting

Part No.	Number of pieces	
MHF-B08	MHF2-8D	2 pieces/unit
	MHF2-8D1	2 pieces/unit
	MHF2-8D2	4 pieces/unit

∗The bolts for body through hole mounting are attached to the product. They are also provided at an order of 1 piece or more with the above part numbers.

Construction

MHF2-12D□ to 20D□



Parts list

No.	Description	Material	Note
1	**Body**	Aluminium alloy	Hard anodized
2	**Piston**	Aluminium alloy	Clear anodized
3	**Joint**	Stainless steel	Heat treatment
4	**Guide rail**	Stainless steel	Heat treatment
5	**Finger**	Stainless steel	Heat treatment
6	**Roller stopper**	Stainless steel	
7	**Pinion**	Carbon steel	Nit riding
8	**Cap A**	Aluminium alloy	Clear anodized
9	**Cap B**	Aluminium alloy	Clear anodized
10	**Cap C**	Aluminium alloy	Clear anodized
11	**Head damper**	Urethane rubber	
12	**Rack**	Stainless steel	Nit riding

Parts list

No.	Description	Material	Note
13	**Magnet**	Tare earth magnet	Nickel plated
14	**Steel balls**	High carbon chromium bearing steel	
15	**Wear ring**	Synthetic resin	
16	**ø12: Roller**	High carbon chromium bearing steel	
	ø16 to 20: Parallel pin	Stainless steel	
17	**Needle roller**	High carbon chromium bearing steel	
18	**ø12: R shape snap ring**	Carbon steel	Nickel plated
	ø16 to 20: C type snap ring		
19	**Parallel pin**	Stainless steel	
20	**Piston seal**	NBR	
21	**Gasket**	NBR	
22	**Gasket**	NBR	

Replaceable parts list

Description	Kit No.			Contents
	MHF2-12D	MHF2-12D1	MHF2-12D2	
Seal kit	MHF12-PS	MHF12-PS	MHF12-PS	20, 21, 22
Finger assembly	MHF-A1202	MHF-A1202-1	MHF-A1202-2	3, 4, 5, 6, 14, 16,19 Mounting screw

Description	Kit No.			Contents
	MHF2-16D	MHF2-16D1	MHF2-16D2	
Seal kit	MHF16-PS	MHF16-PS	MHF16-PS	20, 21, 22
Finger assembly	MHF-A1602	MHF-A1602-1	MHF-A1602-2	3, 4, 5, 6, 14, 16,19 Mounting screw

Description	Kit No.			Contents
	MHF2-20D	MHF2-20D1	MHF2-20D2	
Seal kit	MHF20-PS	MHF20-PS	MHF20-PS	20, 21, 22
Finger assembly	MHF-A2002	MHF-A2002-1	MHF-A2002-2	3, 4, 5, 6, 14, 16,19 Mounting screw

Bolts for body through hole mounting

Part No.	Number of pieces	
MHF-B12	MHF2-12D	2 pieces/unit
	MHF2-12D1	2 pieces/unit
	MHF2-12D2	4 pieces/unit

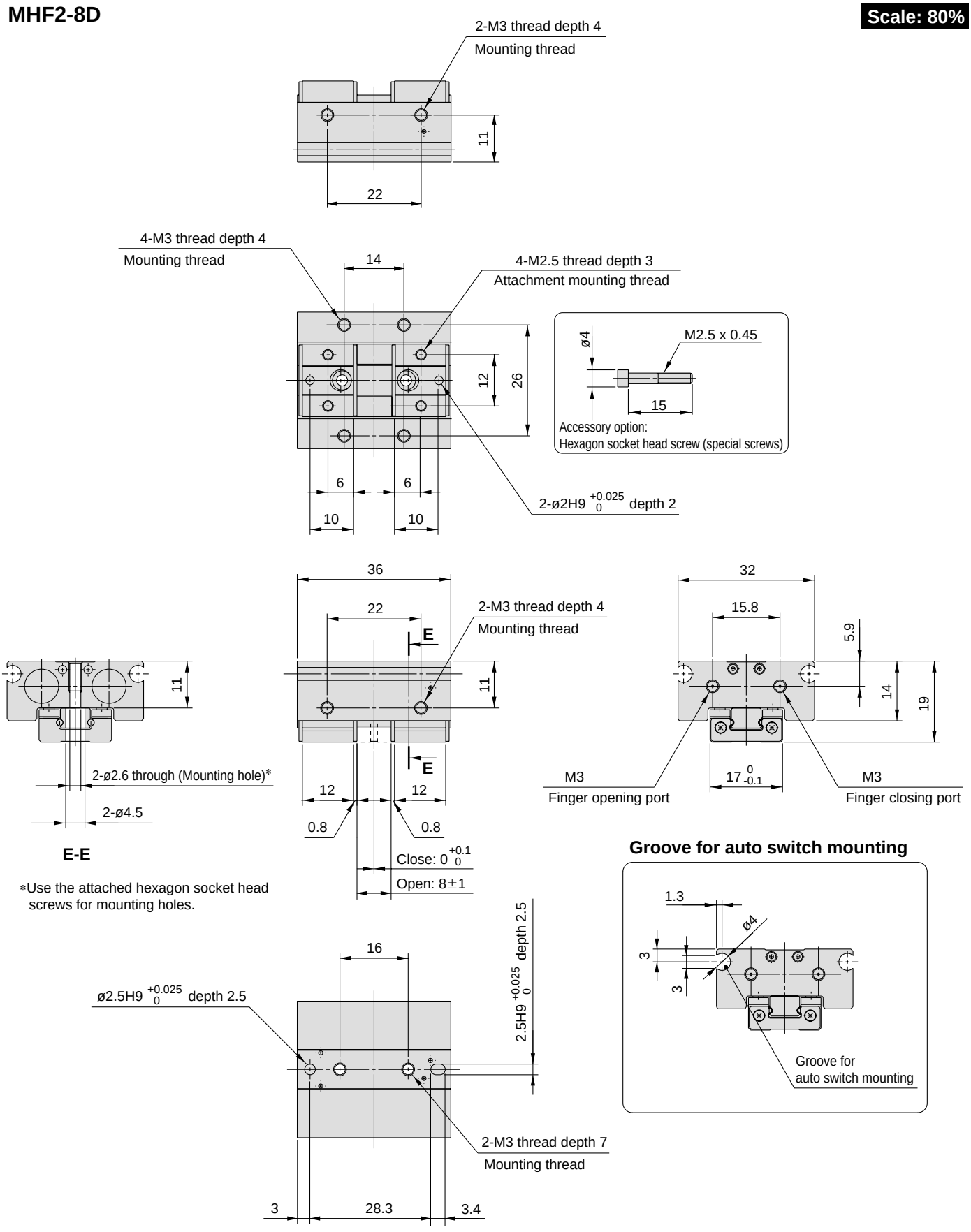
∗The bolts for body through hole mounting are attached to the product. They are also provided at an order of 1 piece or more with the above part numbers.

∗When mounting MHF2-16D□ or MHF2-20D□ with the body through holes, use hexagon socket head screws available on the market.

Dimensions

MHF2-8D

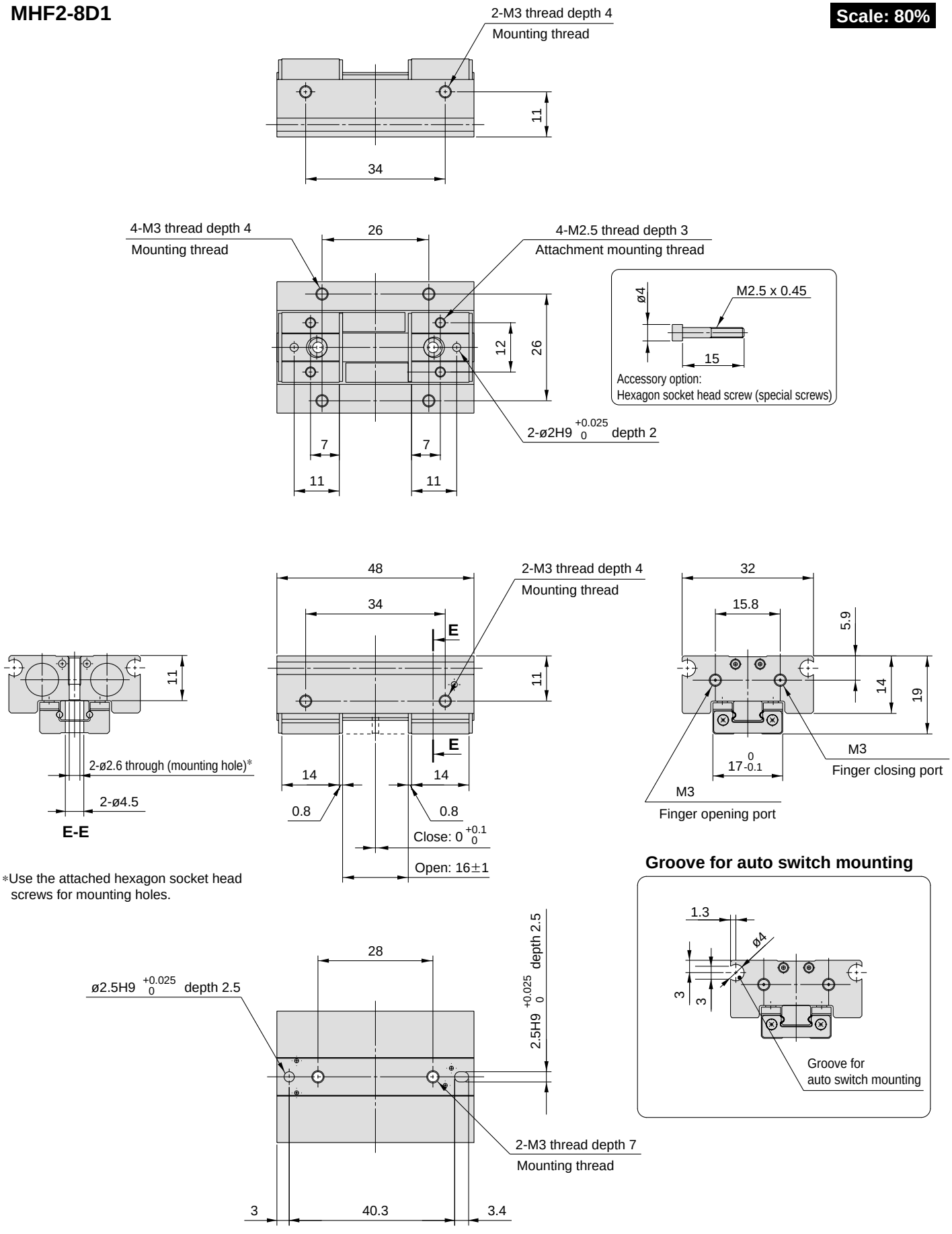
Scale: 80%



Dimensions

MHF2-8D1

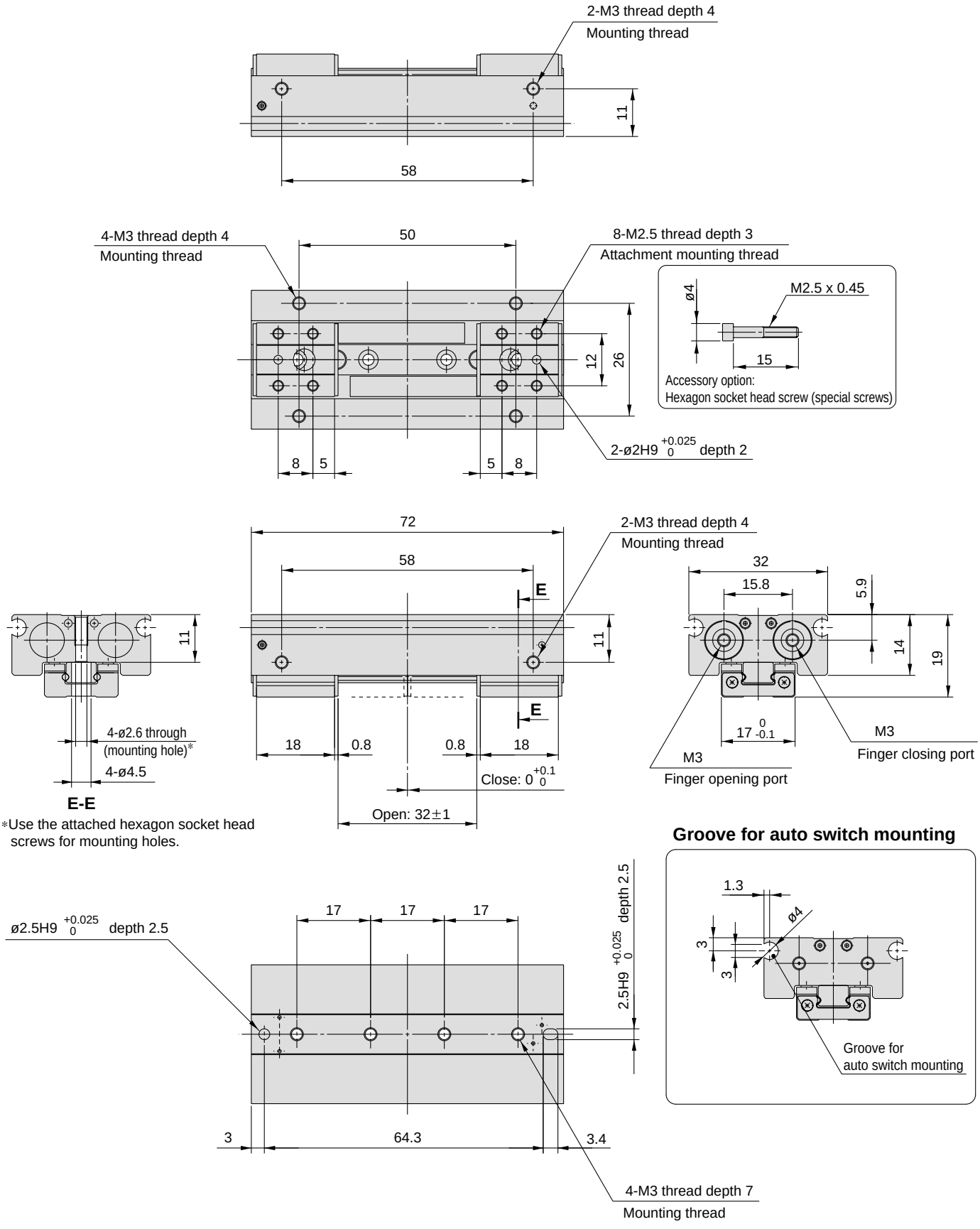
Scale: 80%



Dimensions

MHF2-8D2

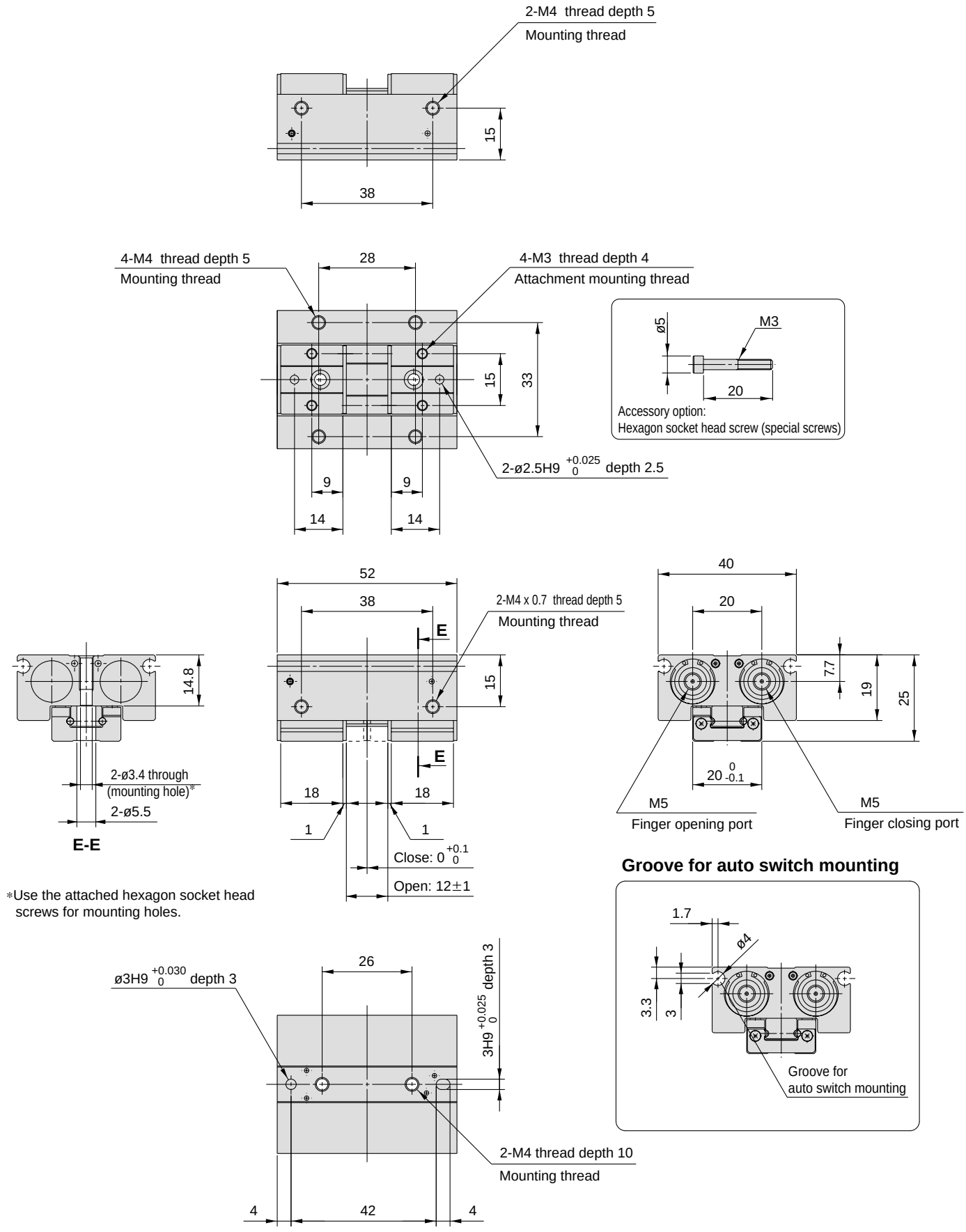
Scale: 80%



Dimensions

MHF2-12D

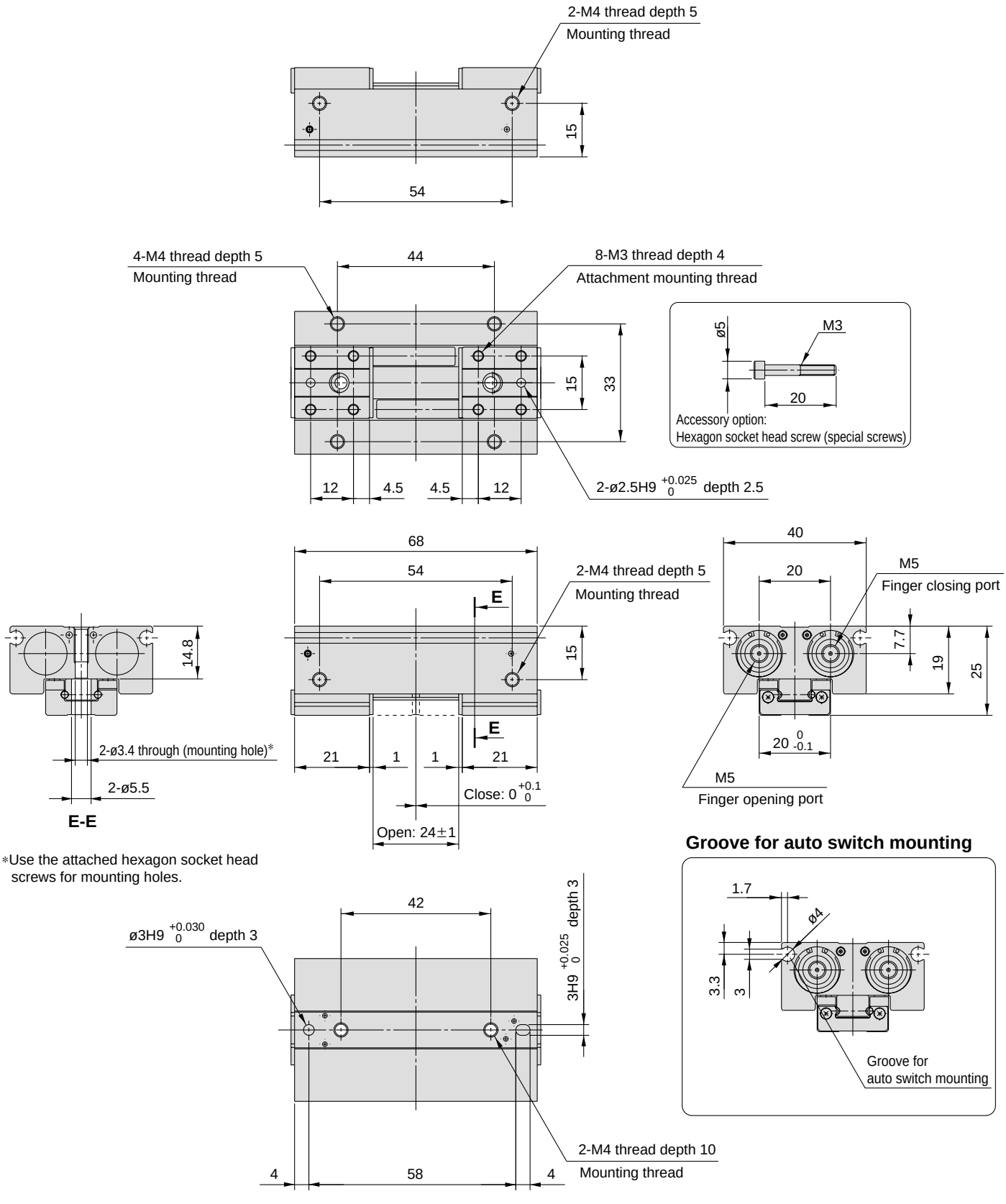
Scale: 65%



Dimensions

MHF2-12D1

Scale: 65%

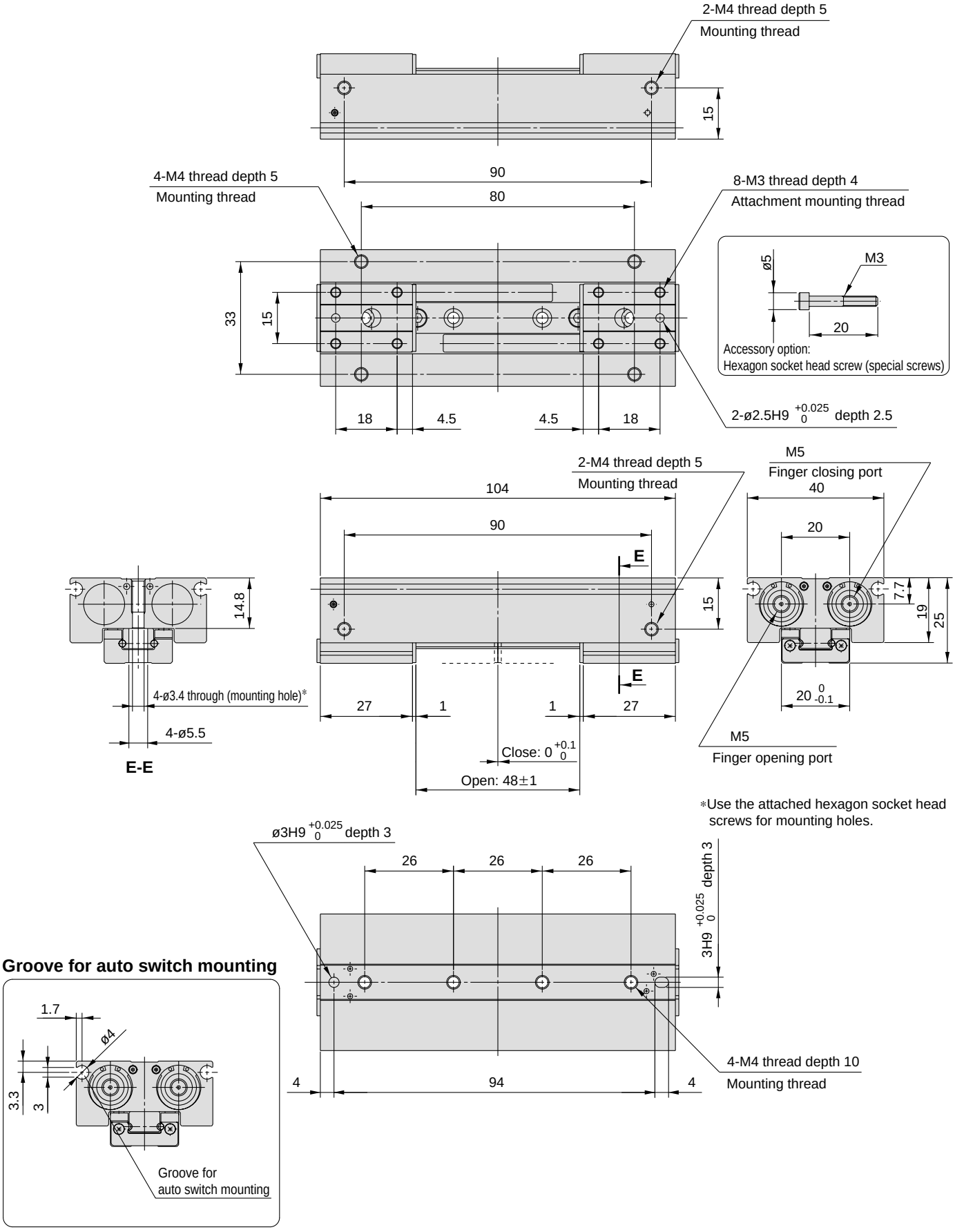


*Use the attached hexagon socket head screws for mounting holes.

Dimensions

MHF2-12D2

Scale: 65%

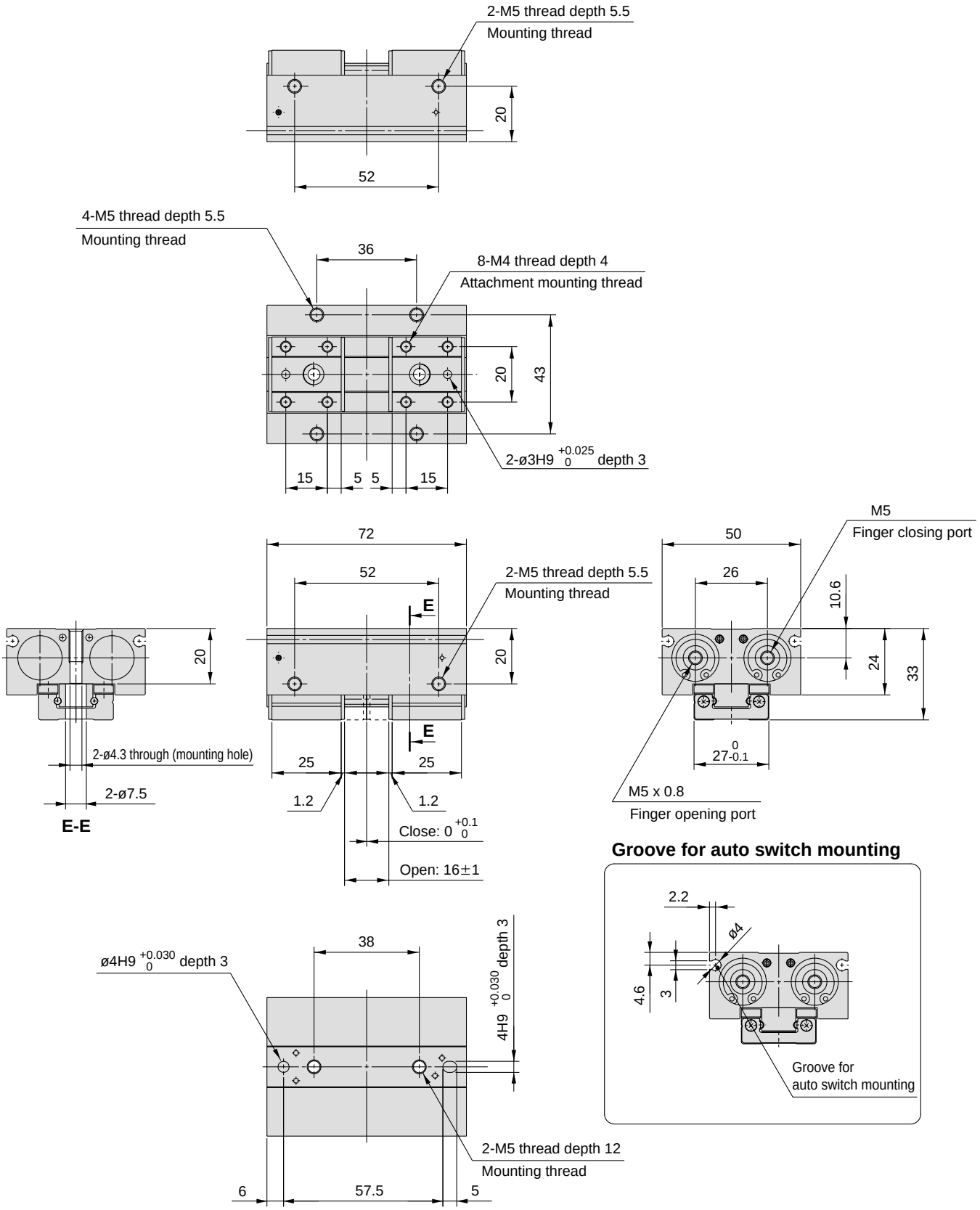


Groove for auto switch mounting

Dimensions

MHF2-16D

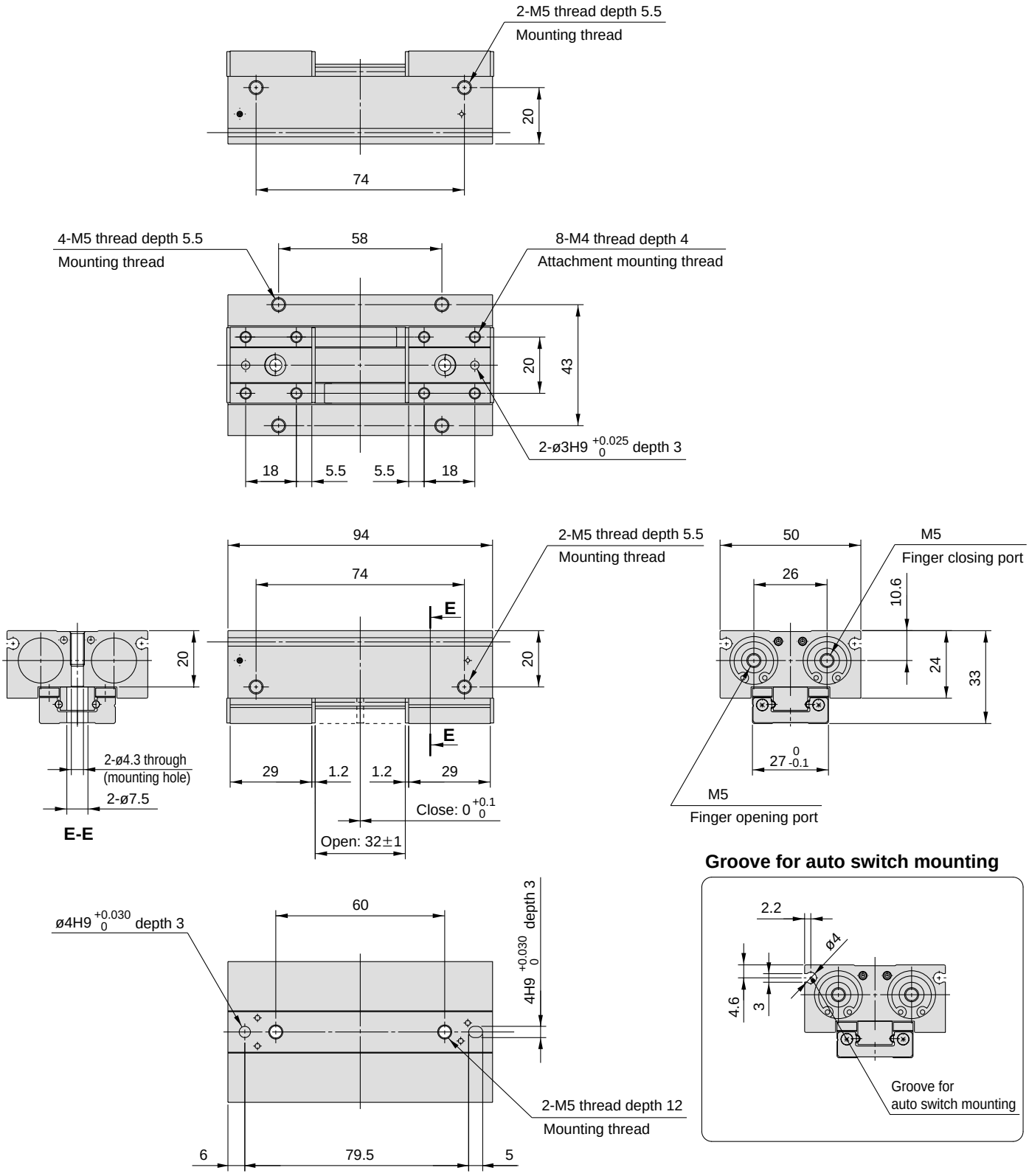
Scale: 50%



Dimensions

MHF2-16D1

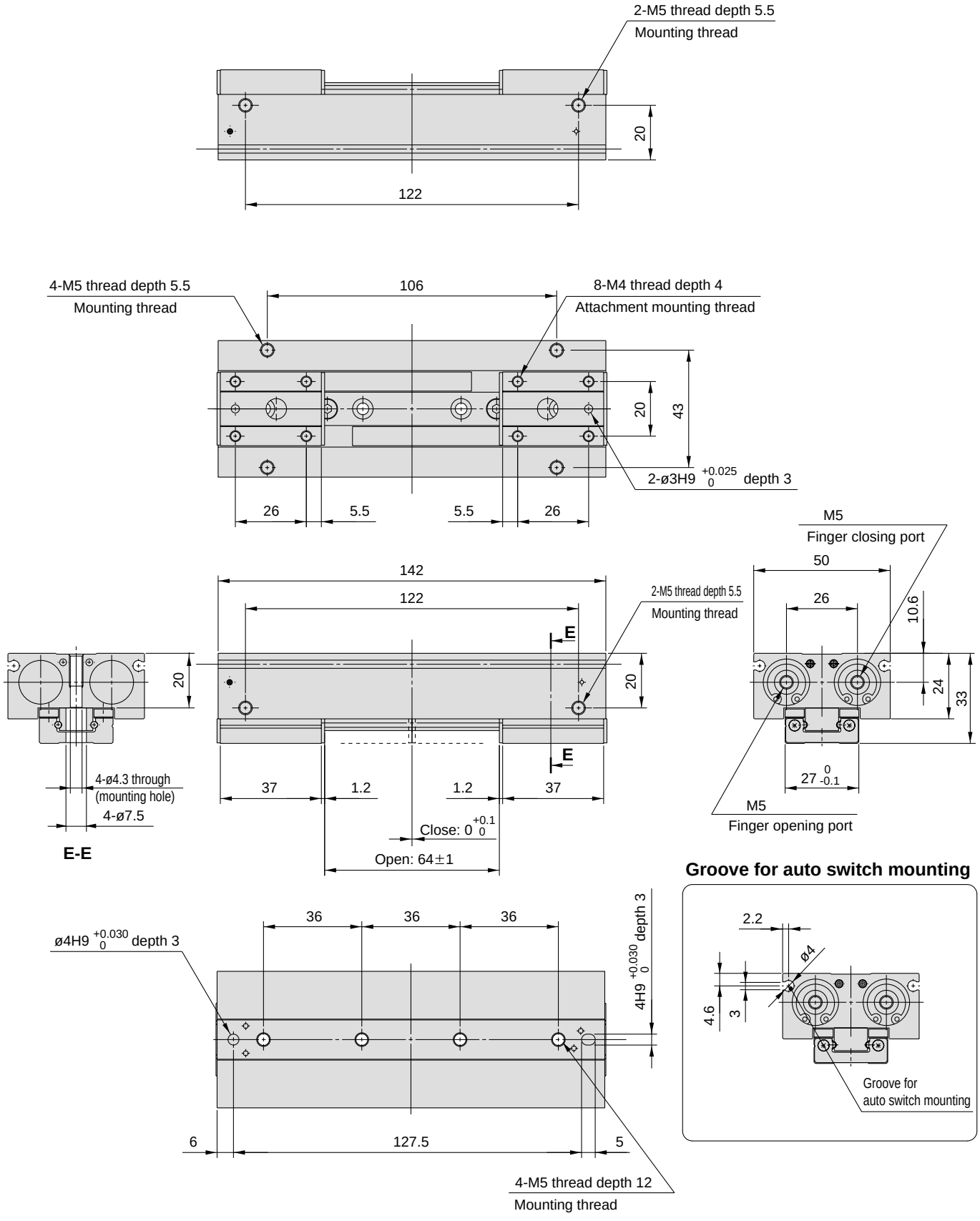
Scale: 50%



Dimensions

MHF2-16D2

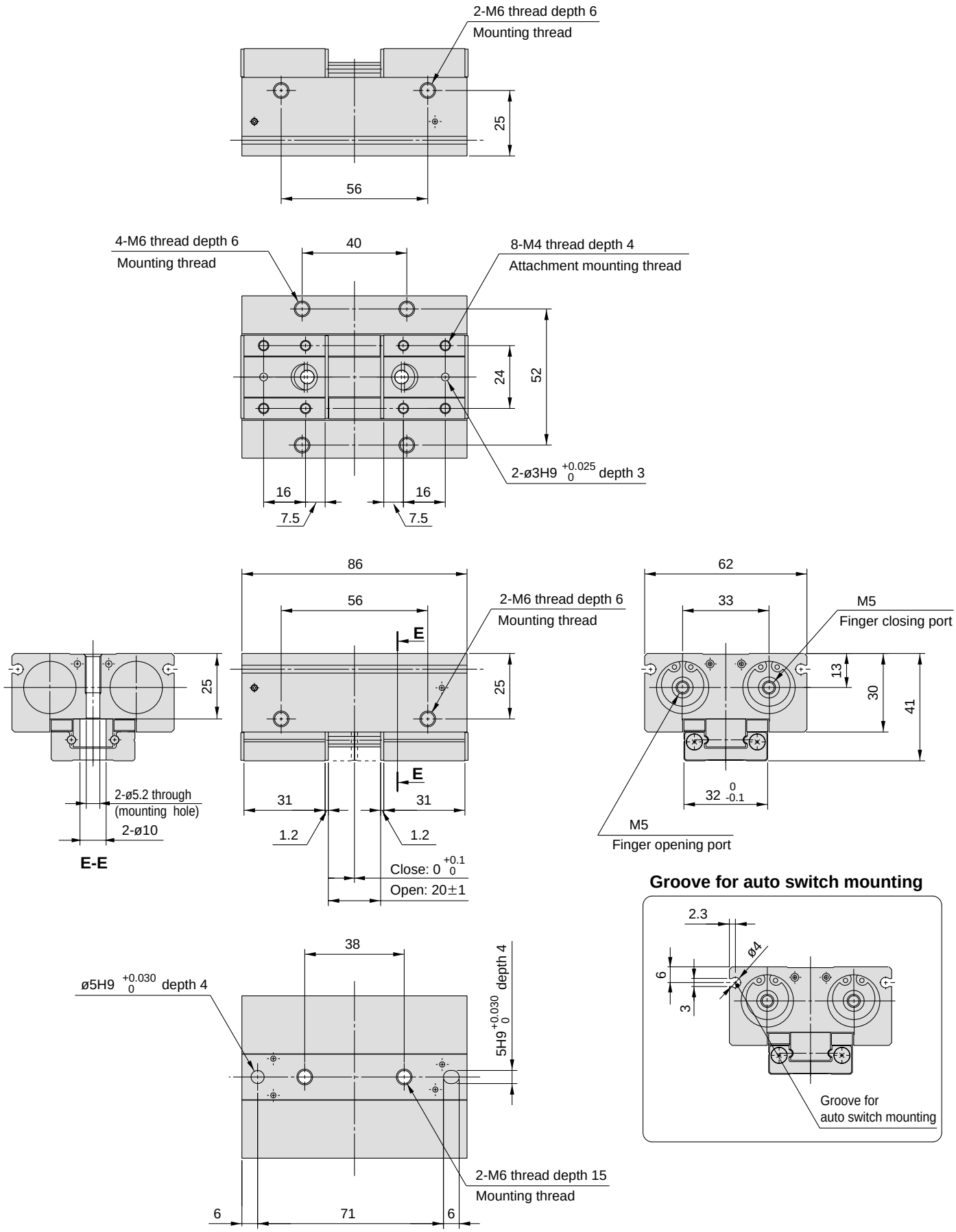
Scale: 50%



Dimensions

MHF2-20D

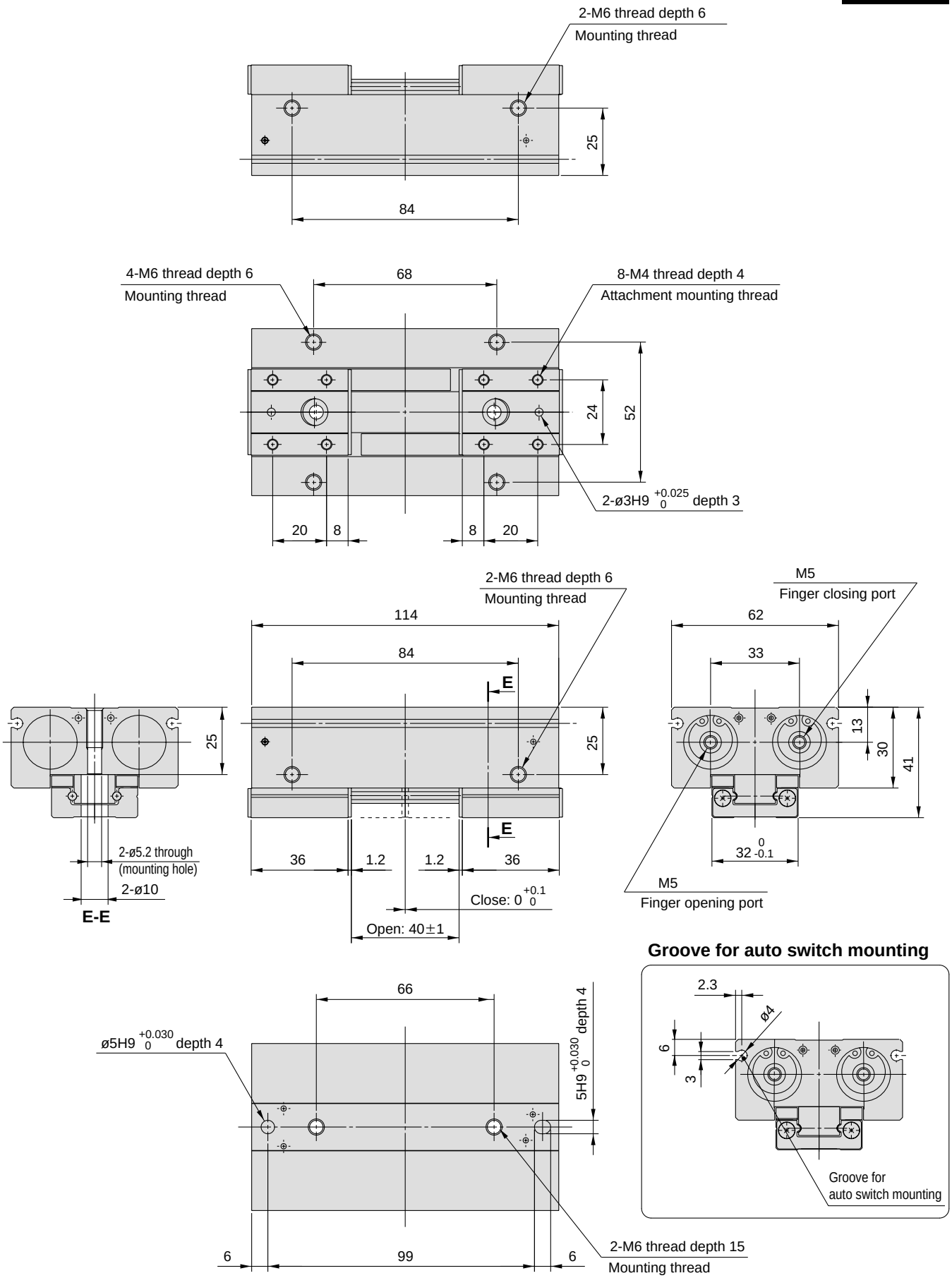
Scale: 50%



Dimensions

MHF2-20D1

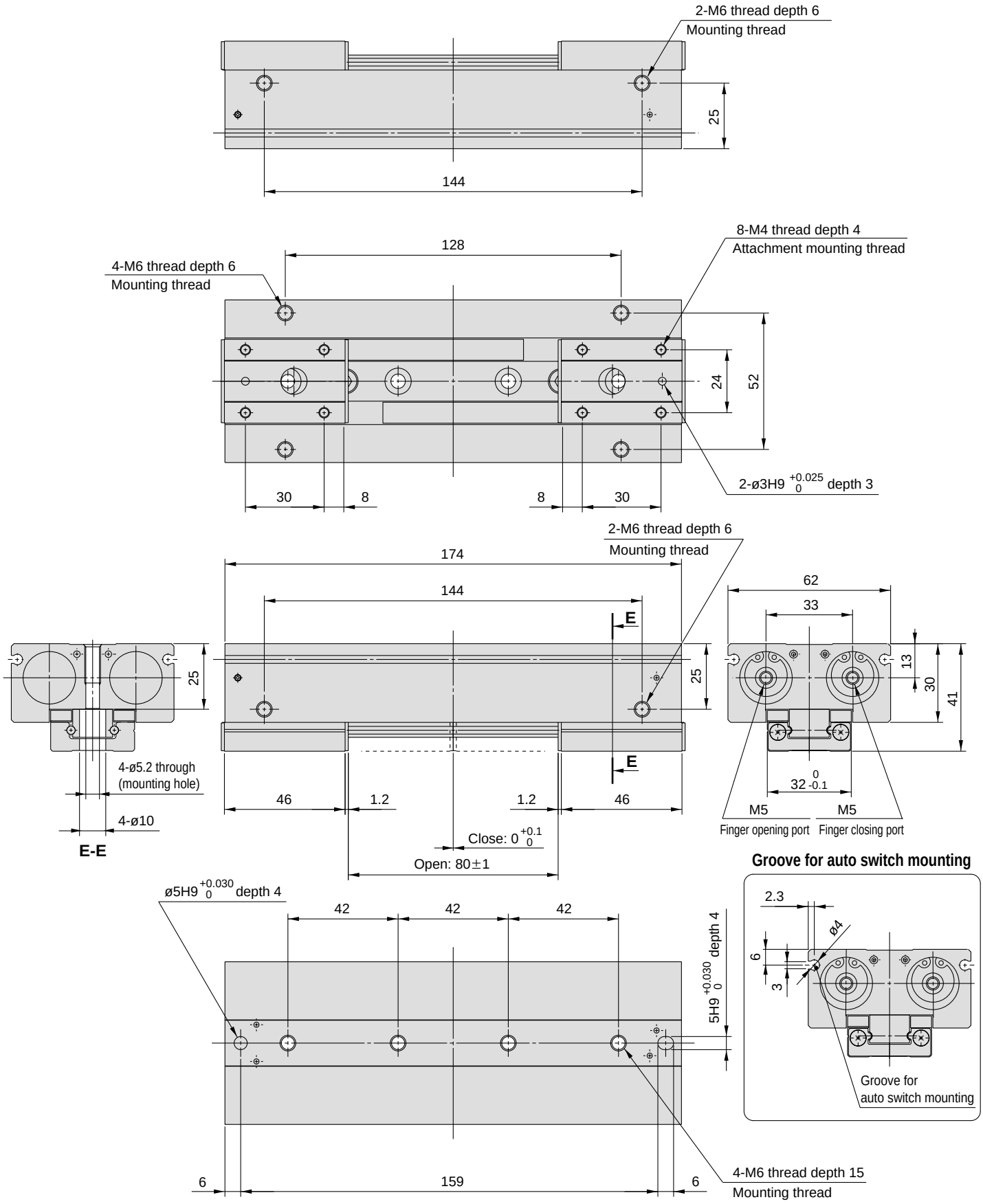
Scale: 50%



Dimensions

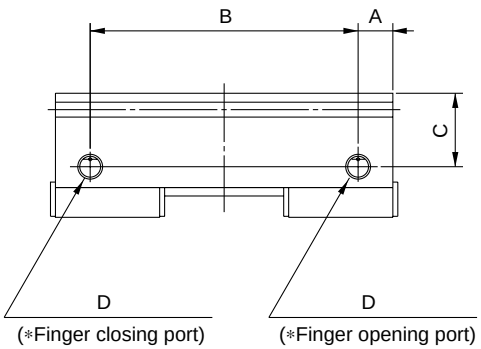
MHF2-20D2

Scale: 50%



Body Option: Side Piping Type

MHF2-□D□R



∗For dimensions not given above, please refer to the table of dimensions on pages 5-88 through 5-99.

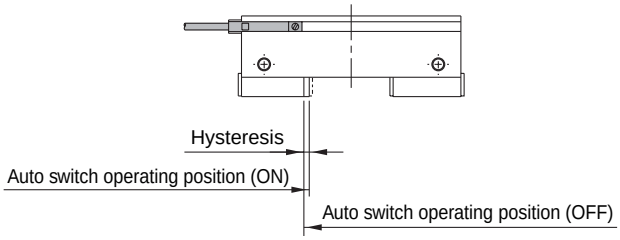
Body option dimension table

Unit: mm

Model	A	B	C	D
MHF2-8DR	5.5	25	11	M3
MHF2-8D1R		37		
MHF2-8D2R		61		
MHF2-12DR	7	38	14.8	M5
MHF2-12D1R		54		
MHF2-12D2R		90		
MHF2-16DR	9	54	19	M5
MHF2-16D1R		76		
MHF2-16D2R		124		
MHF2-20DR	10	66	23	M5
MHF2-20D1R		94		
MHF2-20D2R		154		

Auto Switch Hysteresis

Auto switches have hysteresis similar to micro switches. Use the table below as a guide when adjusting auto switch positions, etc.

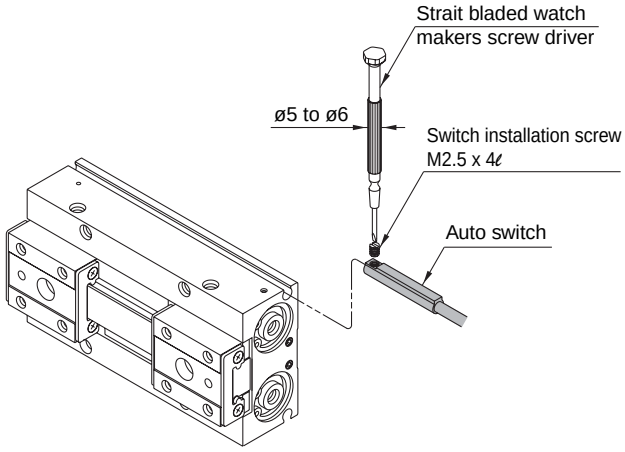


Hysteresis

	D-M9□(V)	D-M9□W(V)	
		Red ON	Green ON
MHF2-8D□	0.5	0.5	1
MHF2-12D□	0.5	0.5	1
MHF2-16D□	0.5	0.5	1
MHF2-20D□	0.5	0.5	1

Auto Switch Mounting

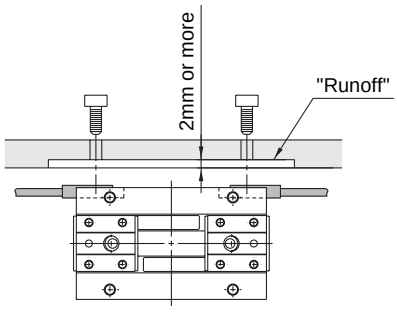
Insert the auto switch into the switch mounting groove in the air chuck in the direction shown below, and after setting the mounting position, tighten the attached switch mounting screw with a screwdriver.



Note) Use a screwdriver with a grip diameter of 5 to 6 mm to tighten the auto switch mounting screw. The tightening torque should be about 0.05 to 0.1N·m. When you begin to feel that the screw is being tightened, turn it further by 90.

⚠Caution

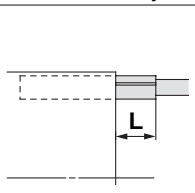
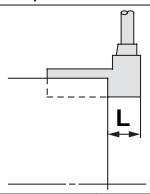
When using an auto switch on the mounting plate side, the switch will protrude from the end face as shown below. Please provide a run off apace of 2mm or deeper on the mounting plate.



Auto Switch Protrusion from the Body End Surface

- The amount of auto switch protrusion from the body end surface is shown in the table below.
- Use this as a standard when mounting, etc.

Auto switch protrusion

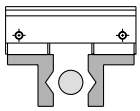
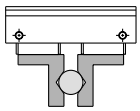
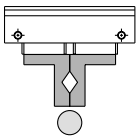
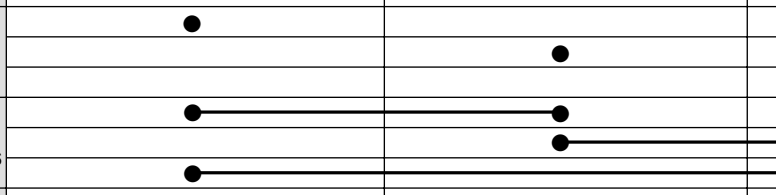
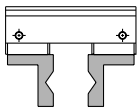
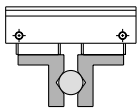
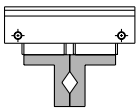
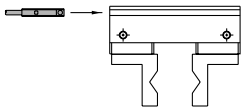
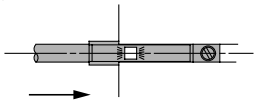
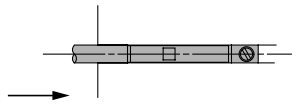
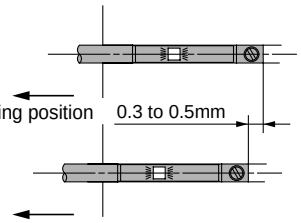
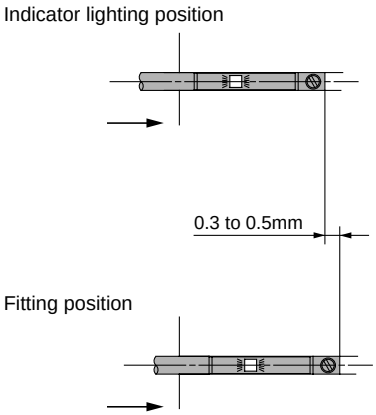
Lead wire type / Auto switch / Finger position / Model		In-line entry		Perpendicular entry	
Illustration					
		D-M9□	D-M9□W	D-M9□V	D-M9□WV
MHF2-8D	Open	6.5	6.5	4.5	4.5
	Close	6.5	6.5	4.5	4.5
MHF2-8D1	Open	6.5	6.5	4.5	4.5
	Close	6.5	6.5	4.5	4.5
MHF2-8D2	Open	0.5	0.5	—	—
	Close	0.5	0.5	—	—
MHF2-12D	Open	3	3	1	1
	Close	3	3	1	1
MHF2-12D1	Open	1	1	—	—
	Close	1	1	—	—
MHF2-12D2	Open	—	—	—	—
	Close	—	—	—	—
MHF2-16D	Open	—	—	—	—
	Close	—	—	—	—
MHF2-16D1	Open	—	—	—	—
	Close	—	—	—	—
MHF2-16D2	Open	—	—	—	—
	Close	—	—	—	—
MHF2-20D	Open	—	—	—	—
	Close	—	—	—	—
MHF2-20D1	Open	—	—	—	—
	Close	—	—	—	—
MHF2-20D2	Open	—	—	—	—
	Close	—	—	—	—

Note) There is no protrusion for sections of the table with no values entered.

Installation and Setting of Auto Switch

Various auto switch applications are possible through different combinations of auto switch quantity and detecting positions.

1) Detection of work (External holding)

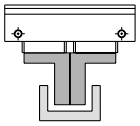
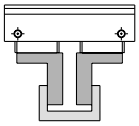
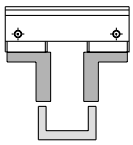
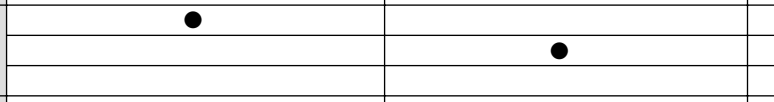
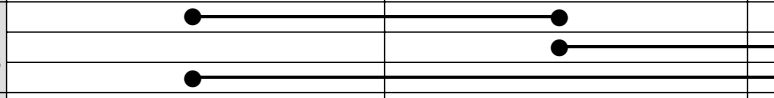
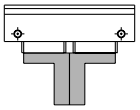
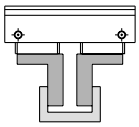
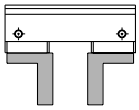
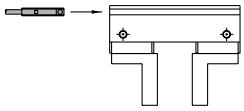
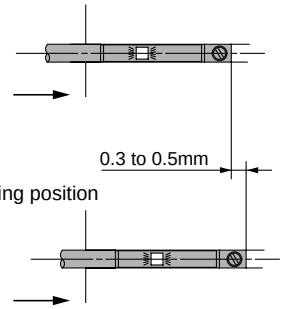
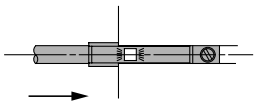
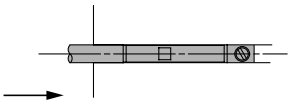
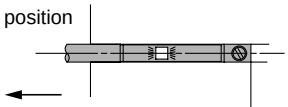
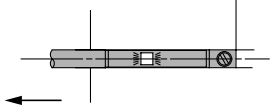
Detection example	① Confirmation of finger reset position	② Confirmation of work holding	③ Confirmation of work releasing
Detecting position	Finger fully open position 	Work holding position 	Finger fully closed position 
Operation of auto switch	Switch ON at finger reset position (Light: ON)	Switch ON at work holding position (Light: ON)	At work holding position [Normal operation] : Switch OFF (Light: OFF) Work releasing condition [Abnormal operation] : Switch ON (Light: ON)
Combination of detection — **One auto switch**			
Combination of detection — **Two auto switches**			
Auto switch mounting position /setting procedure	**Procedure 1)** Fully open the fingers. 	**Procedure 1)** Locate the fingers in the work holding position. 	**Procedure 1)** Locate the fingers in the fully closed position. 
∗Connect a switch applying no or low voltage and follow the procedures for setting.	**Procedure 2)** Insert the auto switch mounting groove from the direction shown in the figure. 		
	Procedure 3) Slide auto switch in the direction of the arrow until the indicator light comes on.  **Procedure 4)** Slide the auto switch a further distance in the direction of the arrow until the indicator light goes out.  **Procedure 5)** Move the auto switch in the opposite direction, as shown by the arrow, a distance of 0.3 to 0.5mm and set. 	**Procedure 3**) Slide auto switch in the direction of the arrow until the indicator lights. Move switch a further 0.3 to 0.5mm in the direction of the arrow and set. 

Note) •It is recommended that work be held at the center of the finger stroke.
•If work is held around the end position of finger opening stroke, the above detecting combination may be limited due to the ON/OFF differential of the auto switches.

Installation and Setting of Auto Switch

Various auto switch applications are possible through different combinations of auto switch quantity and detecting positions.

2) Detection of work (Internal holding)

Detection example	① Confirmation of finger reset position	② Confirmation of work holding	③ Confirmation of work releasing
Detecting position	Finger fully closed position 	Work holding position 	Finger fully open position 
Operation of auto switch	Switch ON at finger reset position (Light: ON)	Switch ON at work holding position (Light: ON)	At work holding position [Normal operation] : Switch OFF (Light: OFF) Work releasing condition [Abnormal operation] : Switch ON (Light: ON)
Combination of detection — **One auto switch**			
Combination of detection — **Two auto switches**			
Auto switch mounting position /setting procedure	**Procedure 1)** Fully open the fingers. 	**Procedure 1)** Locate the fingers in the work holding position. 	**Procedure 1)** Locate the fingers in the fully closed position. 
∗Connect a switch applying no or low voltage and follow the procedures for setting.	**Procedure 2)** Insert the auto switch mounting groove from the direction shown in the following drawing. 		
	Procedure 3) Slide auto switch in the direction of the arrow until the indicator lights comes on. Move switch a further 0.3 to 0.5mm in the direction of the arrow and set. Indicator lighting position  Fitting position	**Procedure 3)** Slide auto switch in the direction of the arrow until the indicator lights.  **Procedure 4)** Slide the auto switch a further distance in the direction of the arrow until the indicator light goes out.  **Procedure 5)** Move the auto switch in the opposite direction, as shown by the arrow, a distance of 0.3 to 0.5mm and set. Indicator lighting position  Fitting position 

Note) •It is recommended that work be held at the center of the finger stroke.
•If work is held around the end position of finger opening stroke, the above detecting combination may be limited due to the ON/OFF differential of the auto switches.