

Swivel/gripper units HGDS-B

FESTO

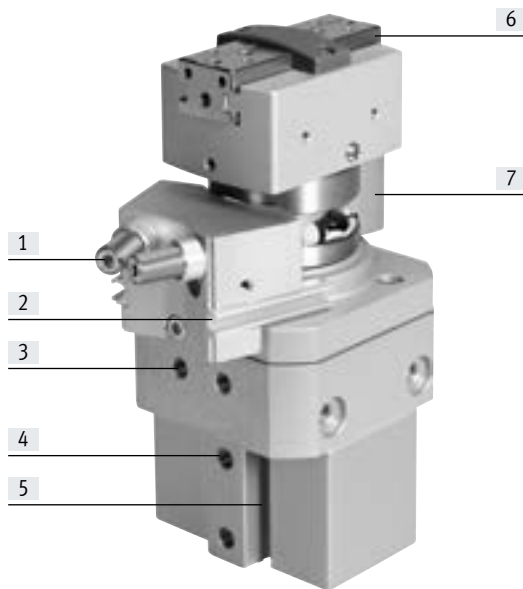


Key features

At a glance

- Combination of parallel gripper with T-slot guide and swivel module on the basis of swivel module DSM
- Infinitely adjustable swivel angle (max. 210°)
- Supply ports and position sensing outside the swivel range
- High performance (torque, mass moment of inertia)
- All connections accessible from one side
- Compact design and low weight

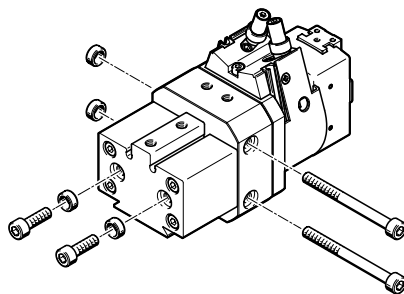
The technology in detail



- [1] Three types of cushioning for swivel motion:
 - Elastic cushioning components (P)
 - Adjustable, elastic cushioning components with metal fixed stop (P1)
 - Shock absorbers with metal fixed stop (YSRT)
- [2] Slot for proximity switch SME-/SMT-10 for sensing the swivel position
- [3] Supply port for swivelling function
- [4] Supply port for gripping function
- [5] Slot for proximity switch SME-/SMT-10 for sensing the gripping position
- [6] Gripper jaw with T-slot guide
- [7] Adjustable stop cams for adjusting the swivel motion

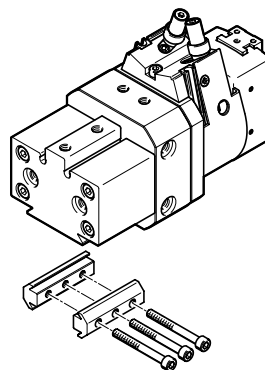
Mounting options

Direct mounting



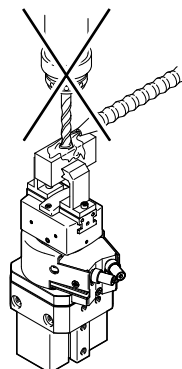
The swivel/gripper unit can be mounted on four sides.

Dovetail connection

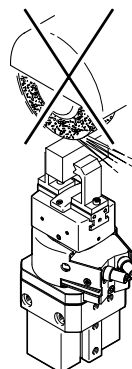


Note

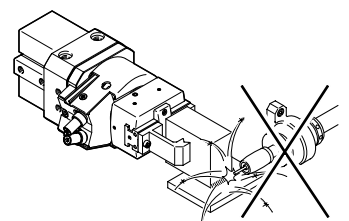
Swivel/gripper units are not suitable for the following or similar applications:



- Machining
- Aggressive media



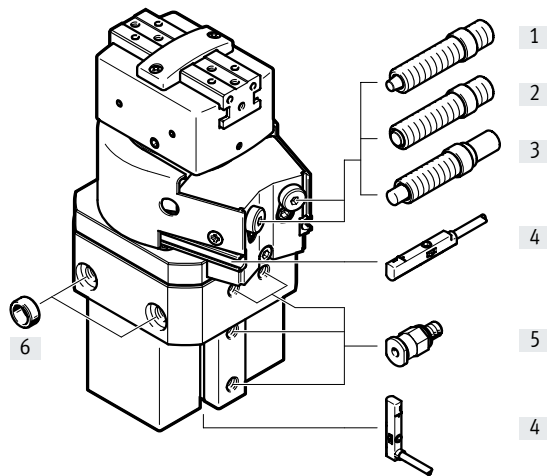
- Grinding dust



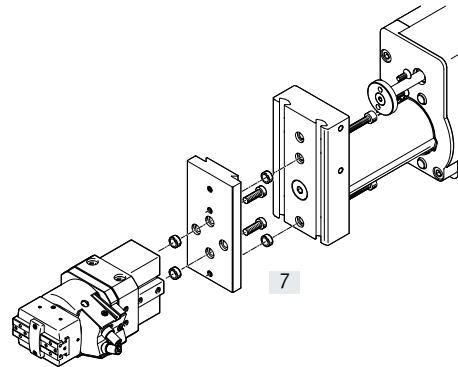
- Welding spatter

Peripherals overview and type codes

Peripherals overview



System product for handling and assembly technology



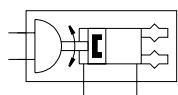
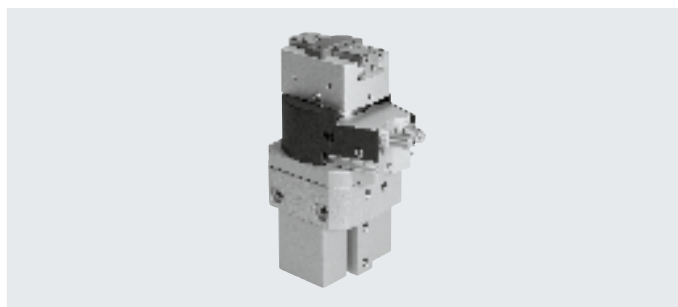
Accessories			
Type	Description		→ Page/Internet
[1] Cushioning P	Elastic cushioning components at both ends		16
[2] Cushioning P1	Elastic cushioning components at both ends, adjustable, with metal fixed stop		16
[3] Cushioning YSRT	Shock absorber at both ends, self-adjusting, with metal fixed stop		16
[4] Proximity switches SME/SMT-10	For sensing the gripping and swivelling position		16
[5] Push-in fitting QS	For connecting tubing with standard O.D.		qs
[6] Centring sleeve ZBH	For centring the gripper when mounting (2 included in the scope of delivery)		16
[7] Adapter kit HMSV	Drive/gripper connections		15

Type codes

001	Series	
HGDS	Swivel/gripper unit	
002	Gripper version	
PP	Parallel gripper	
003	Size	
12	12	
16	16	
20	20	

004	Cushioning	
P	Elastic cushioning rings/plates on both sides	
P1	Elastomer cushioning, adjustable on both sides, with fixed stop	
YSRT	Shock absorber, self-adjusting, linear, at both ends	
005	Position sensing	
A	For proximity sensor	
006	Generation	
B	Series B	

Data sheet


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- Ø - Size
 12, 16, 20 mm
- I - Stroke
 5, 9, 14 mm

General technical data			
Size	12	16	20
Design	Parallel gripper		
	Semi-rotary drive		
	Gripper module		
Mode of operation	Double-acting		
Pneumatic connection	M5		
Type of mounting	Via female thread and centring sleeve		
	Via through-hole and centring sleeve		
	Via dovetail slot		
Cushioning			
P cushioning	Elastic cushioning components at both ends		
P1 cushioning	Elastic cushioning components at both ends, adjustable		
YSRT cushioning	Shock absorber at both ends, self-adjusting		
Mounting position	Any		
Relubrication intervals of guide	10 million switching cycles		
Product weight [g]	505	730	1260
Technical data – Swivelling	→ Page 5		
Technical data Gripping	→ Page 8		

Operating and environmental conditions		
Operating pressure [bar]	3 ... 8	
Operating medium	Compressed air to ISO 8573-1:2010 [7:4:4]	
Note on the operating/pilot medium	Lubricated operation possible (in which case lubricated operation will always be required)	
Ambient temperature ¹⁾ [°C]	+5 ... +60	
Corrosion resistance class CRC ²⁾	2	

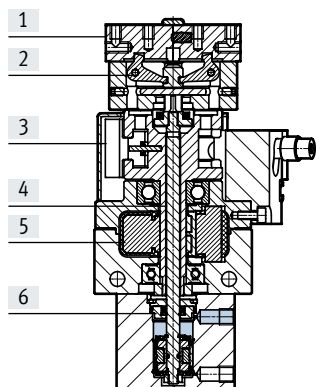
1) Note operating range of proximity sensors

2) Corrosion resistance class CRC 2 to Festo standard FN 940070

Moderate corrosion stress. Indoor applications in which condensation can occur. External visible parts with primarily decorative surface requirements which are in direct contact with a normal industrial environment.

Materials

Sectional view



Swivel/gripper unit		
[1]	Gripper jaw	Stainless steel
[2]	Lever	Hardened steel
[3]	Stop	Stainless steel
[4]	Piston rod	Stainless steel
[5]	Housing	Wrought aluminium alloy
[6]	Piston	NBR, polyurethane
-	Rubber buffer	NBR

Data sheet

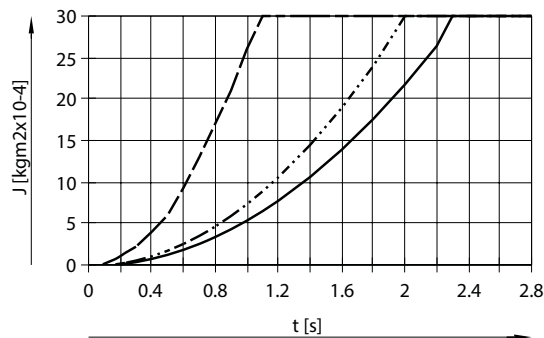
Technical data – Swivelling

Size		12	16	20
Swivel angle	[°]	0 ... 210		
Theoretical torque ¹⁾	[Nm]	0.85	1.25	2.5
Repetition accuracy ¹⁾				
P cushioning	[°]	< 0.2		
P1 cushioning	[°]	< 0.02		
YSRT cushioning	[°]	< 0.02		
Max. swivel frequency ¹⁾				
P cushioning	[Hz]	2		
P1 cushioning	[Hz]	2		
YSRT cushioning	[Hz]	1.5		
Position sensing		Via proximity switch		

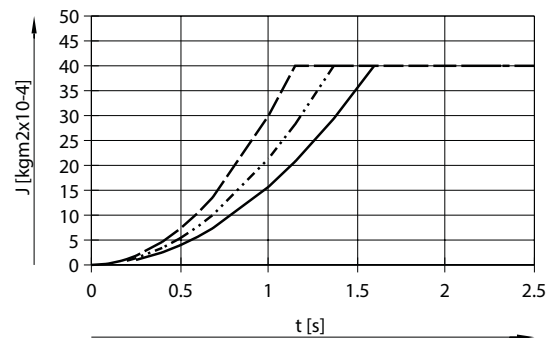
1) At an operating pressure of 6 bar

Mass moments of inertia J at 6 bar as a function of swivel time t and swivel angle

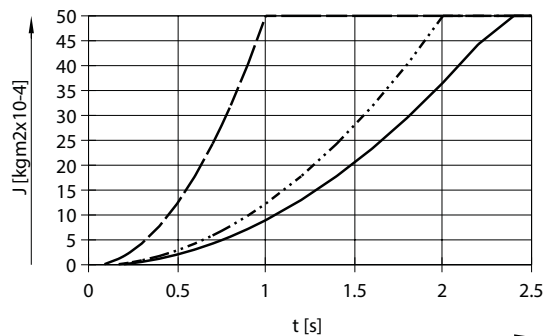
HGDS-PP-12-P-A-B



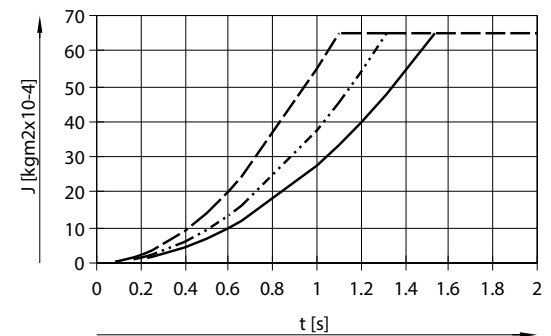
HGDS-PP-12-P1-A-B



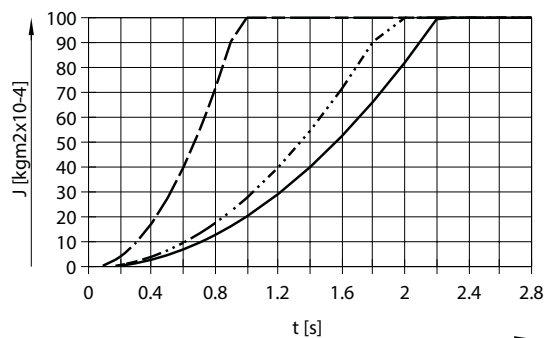
HGDS-PP-16-P-A-B



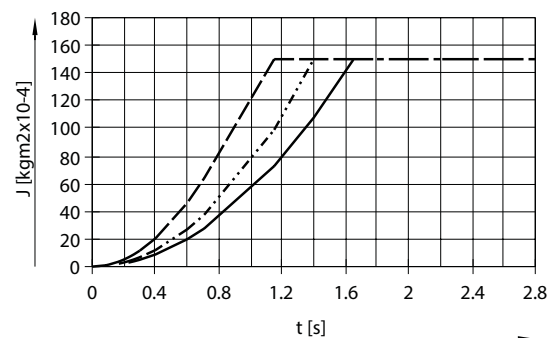
HGDS-PP-16-P1-A-B



HGDS-PP-20-P-A-B



HGDS-PP-20-P1-A-B

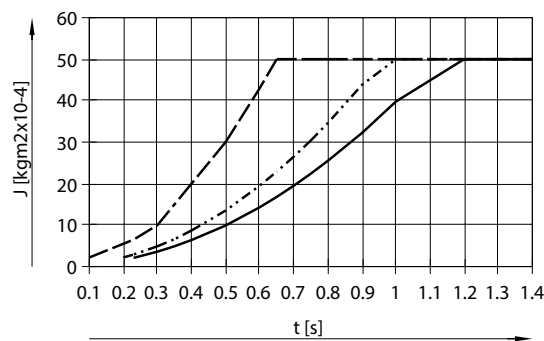


— Swivel angle 210°
 Swivel angle 180°
 - - - Swivel angle 90°

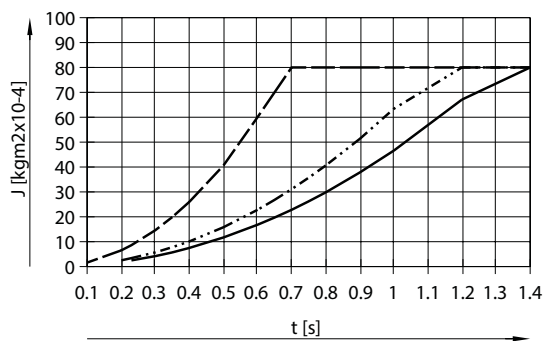
Data sheet

Mass moments of inertia J at 6 bar as a function of swivel time t and swivel angle

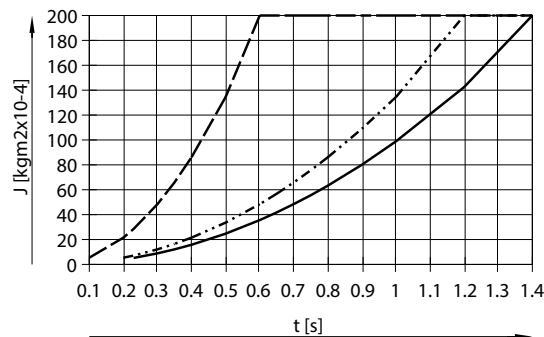
HGDS-PP-12-YSRT-A-B



HGDS-PP-16-YSRT-A-B



HGDS-PP-20-YSRT-A-B



— Swivel angle 210°
 Swivel angle 180°
 - - - Swivel angle 90°

Dependency between operating pressure and swivel time

Reducing the operating pressure reduces the gripping force.
 To ensure that the grippers jaws do not open during swivelling, the swivel time must be increased by 15% per bar of operating pressure (with the same mass moment of inertia).

Example:

Assuming:

HGDS-PP-16-YSRT-A-B

Operating pressure 6 bar

Swivel angle 90°

$J = 40 \text{ kgm}^2 \times 10^{-4}$

Swivel time at 6 bar = 0.5 s, see graph opposite

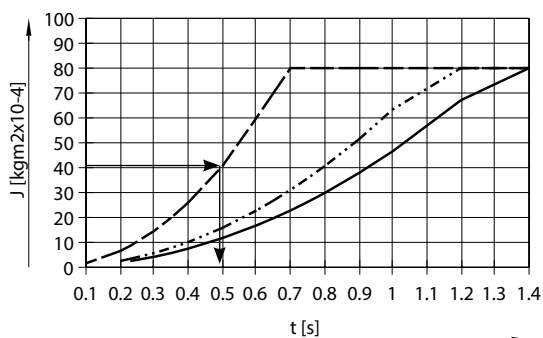
Swivel time at 4 bar:

$t = 0.5 + 2 \times 15\% = 0.65 \text{ s}$

Cushioning time of the shock absorber = 0.1 s

This yields a total swivel time of

$t_{\text{total}} = 0.65 \text{ s} + 0.1 \text{ s} = 0.75 \text{ s}$



To be calculated:

Swivel time at an operating pressure of

4 bar

Data sheet

Precision adjustment of the swivel angle

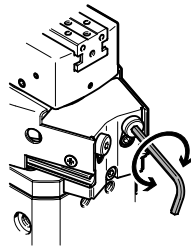
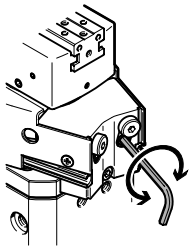
The swivel angle can be roughly adjusted by moving the cam stops → page 2.

The procedure for precision adjustment is the same for all cushioning variants (P, P1 and YSRT).

The swivel angle can be precisely adjusted by unscrewing or screwing in the cushioning component.

Swivelling to a metal stop enables high repetition accuracy.

- 1) Loosen the locking screw underneath the cushioning element.
- 2) Adjust the cushioning element as required. Note the adjustment range.



Size		12	16	20
Precision adjustment range				
P cushioning	[°]	-6		
P1 cushioning	[°]	-6		
YSRT cushioning	[°]	-2.5		
Adjustment range of the cushioning component				
P cushioning	[mm]	2	2.6	2.8
P1 cushioning	[mm]	2	2.6	2.8
YSRT cushioning	[mm]	1	1.3	1.4

Data sheet

Technical data – Gripping

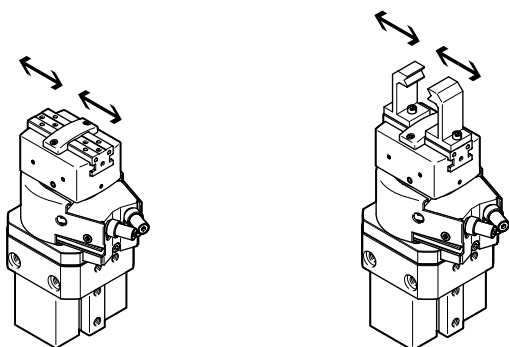
Size		12	16	20
Gripper function		Parallel		
Number of gripper jaws		2		
Max. mass per gripper finger ¹⁾	[g]	30	50	100
Stroke per gripper jaw	[mm]	2.5	4.5	7
Max. gripper jaw backlash	[mm]	0.02		
Max. gripper jaw angular backlash	[°]	0.1		
Repetition accuracy	[mm]	±0.01		±0.015
Max. operating frequency	[Hz]	4		
Position sensing		Via proximity switch		

1) Applies to unthrottled operation

Opening and closing times [ms] at 6 bar

Without external gripper fingers

With external gripper fingers



The indicated opening and closing times [ms] have been measured at room temperature and 6 bar operating pressure with vertically mounted swivel/gripper unit without additional gripper fingers. The grippers must be throttled for larger masses [g]. Opening and closing times must then be adjusted accordingly.

With external gripper fingers (as a function of the mass per gripper finger)

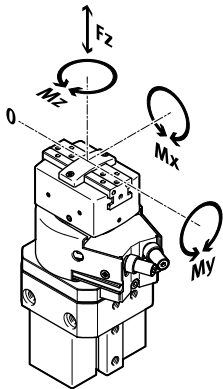
Size		12	16	20
Max. mass		30 g	50 g	100 g
Unthrottled	Opening	40	40	60
	Closing	60	60	70

With external gripper fingers (as a function of the mass per gripper finger)

Size		12		16		20	
Mass		100 g	200 g	100 g	200 g	100 g	200 g
Throttled	Closing	100	150	100	200	100	250

Data sheet

Static characteristic load values per gripper jaw



The indicated permissible forces and torques apply to a single gripper jaw.
 The indicated values include the lever arm, additional weight forces caused by the workpiece or external gripper fingers, as well as forces which occur during movement.
 The zero coordinate line (gripper jaw guide) must be taken into consideration when calculating torques.

Size	12	16	20
Max. permissible force F_z [N]	90	150	250
Max. permissible torque M_x [Nm]	6	11	22
Max. permissible torque M_y [Nm]	6	11	22
Max. permissible torque M_z [Nm]	6	11	22

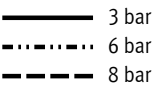
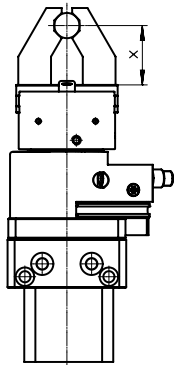
Gripping force [N] at 6 bar with a lever arm of 25 mm

Size	12	16	20
Gripping force per gripper jaw			
Opening	42	58	96
Closing	37	51	84
Total gripping force			
Opening	84	116	192
Closing	74	102	168

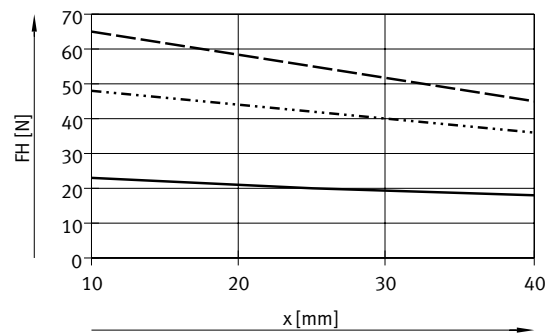
Data sheet

Gripping force F_H per gripper jaw as a function of operating pressure p

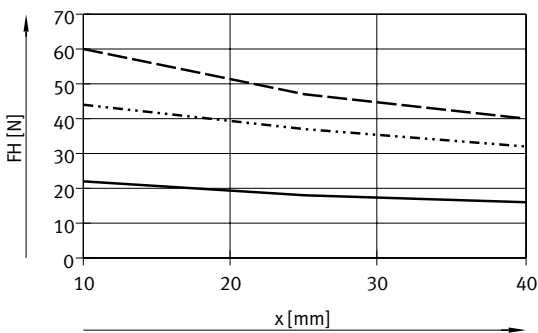
Gripping forces as a function of operating pressure and lever arm can be determined for the various sizes using the following graphs.



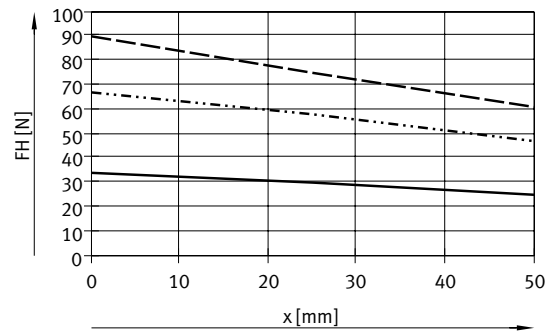
HGDS-12
Opening



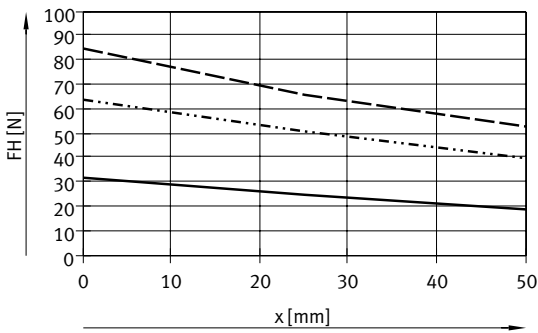
Closing



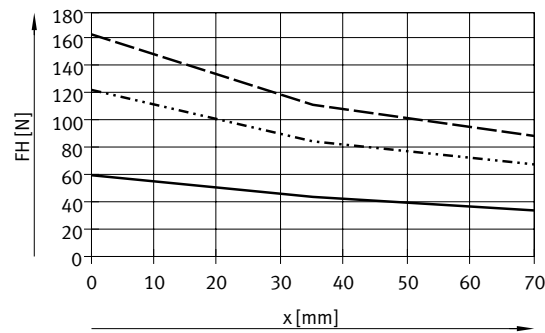
HGDS-16
Opening



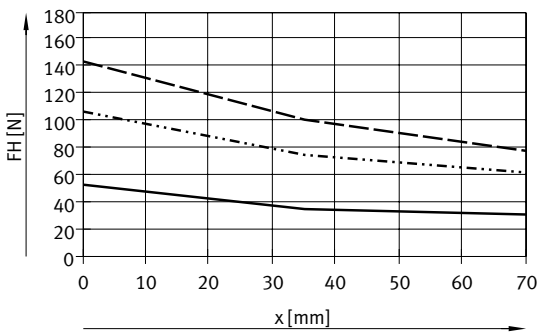
Closing



HGDS-20
Opening



Closing



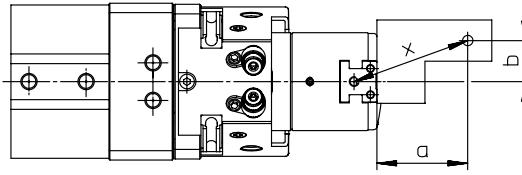
Data sheet

Gripping force F_H per gripper jaw at 6 bar as a function of lever arm x and eccentricity a and b

The following formula must be used to calculate the lever arm x with eccentric gripping:

$$x = \sqrt{a^2 + b^2}$$

The gripping force F_H can be read from the graphs (→ page 10) using the calculated value x .



Calculation example

Assuming:

Distance $a = 25$ mm

Distance $b = 20$ mm

To be calculated:

The gripping force at 6 bar
with an HGDS-16,
used as an external gripper

Procedure:

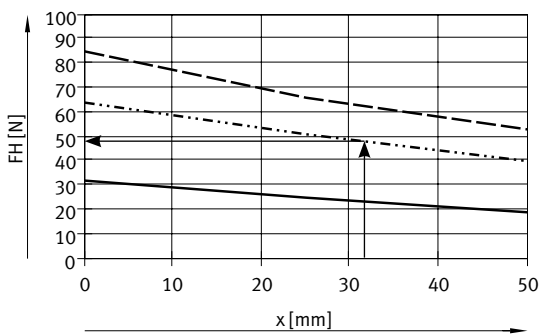
Calculating the lever arm x

$$x = \sqrt{25^2 + 20^2}$$

$$x = 32 \text{ mm}$$

The graph (→ page 10) gives a

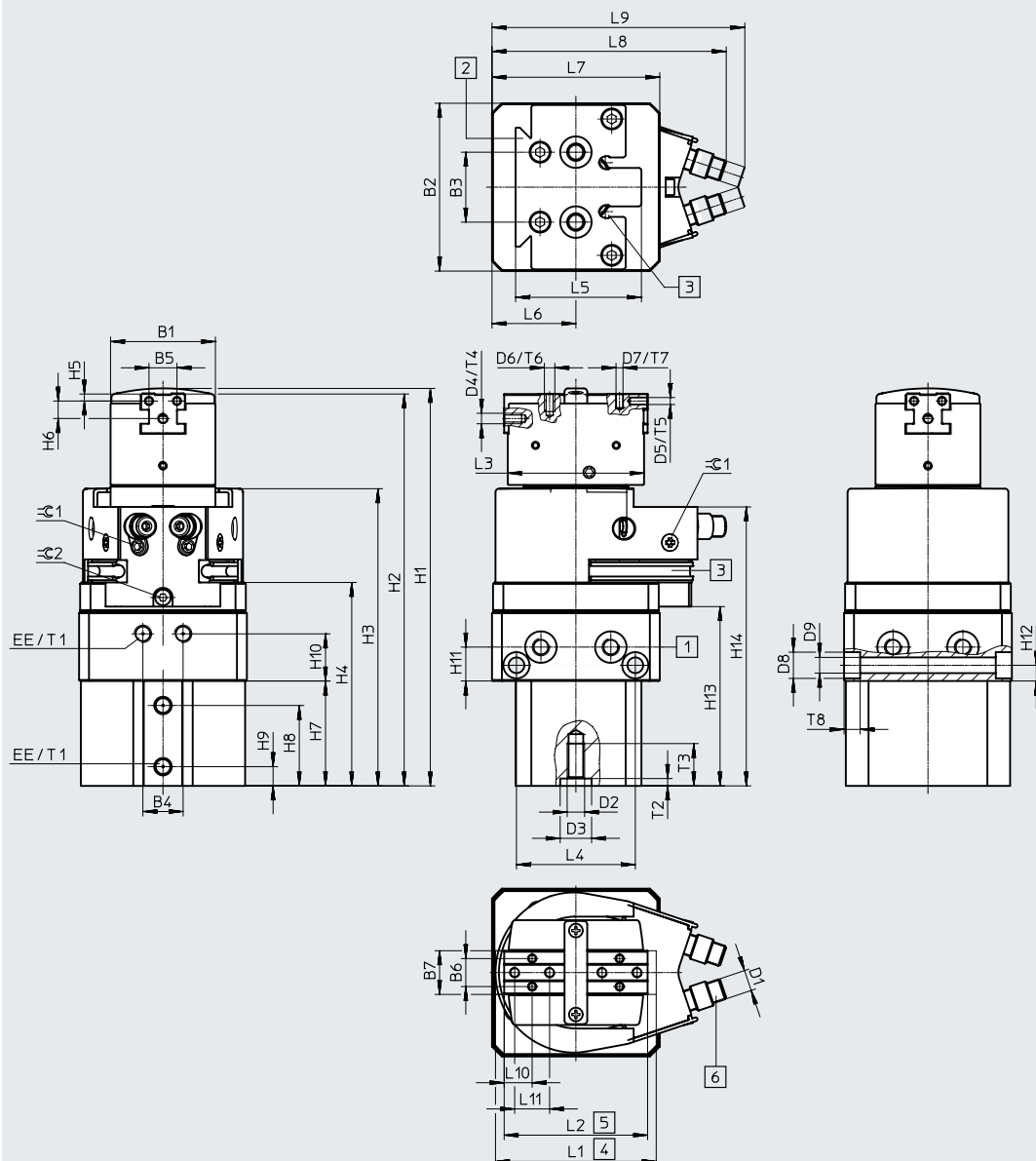
value of $F_H = 47$ N for the gripping
force.



Data sheet

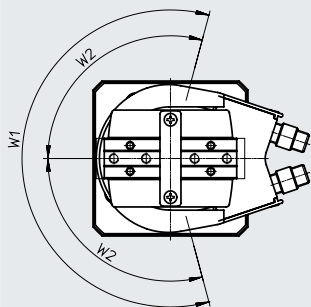
Dimensions

Download CAD data → www.festo.com



- [1] Cross-section through mounting holes → page 13
- [2] For dovetail connection with connecting adapter HAVB-3
- [3] Sensor slot for SME-/SMT-10
- [4] Gripper jaw open
- [5] Gripper jaw closed
- [6] Cushioning

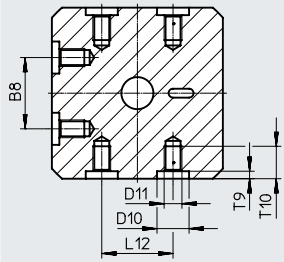
Swivel angle



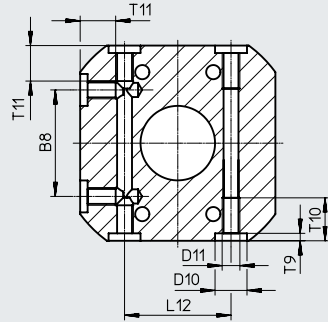
Data sheet

Cross-section through [1]

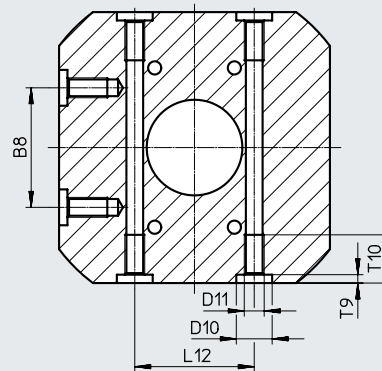
Size 12



Size 16



Size 20



Size	B1	B2	B3	B4	B5	B6	B7	B8 ¹⁾	D1	D2	D3 Ø H7	D4
[mm]		±0.03	±0.02		±0.02	±0.02	±0.1					
12	30	48	20	11.5	8	8	12.5	20	M6x0.5	M5	9	M3
16	34	55	30	13	10	10	16	30	M8x1	M5	9	M3
20	40	67.4	30	16	12	12	20	30	M10x1	M5	9	M4

Size	D5 Ø H8	D6	D7 Ø H8	D8 Ø H13	D9 Ø H13	D10 Ø H7	D11	EE	H1 +1/-0.6	H2 +0.8/-0.4	H3 +1.3/-0.2	H4 +0.8/-0.2
[mm]												
12	2	M3	2	7.5	4.5	9	M5	M5	113.4	111.9	85	58.2
16	2	M3	2	–	4.2	9	M5	M5	121.7	120.1	92.3	64.3
20	2.5	M4	2.5	–	4.2	9	M5	M5	154.8	152.8	112.3	81.7

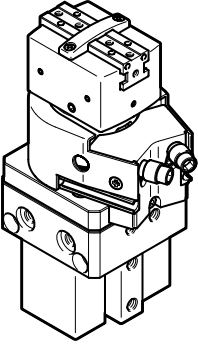
Size	H5	H6	H7	H8	H9	H10	H11	H12	H13	H14	L1	L2
[mm]	±0.02	±0.12	±0.1	±0.1			-0.1		+1/-0.2	+1/-0.2	±0.5	±0.5
12	2	5	30	23	7.5	13.5	9.7	4.5	51.3	79.8	46	41
16	3	5	34.5	26	6.3	14	8	–	58.2	86.7	58	49
20	3	7	43	34.6	5.3	19	9	–	73.1	105.6	78	64

Size	L3	L4	L5	L6	L7	L8 ±1 P	L9 ±1		L10	L11	L12 ¹⁾	T1
[mm]	±0.5	±0.1		±0.05	±0.03		P1	YSRT	±0.02			min.
12	39	34	36	24	48	67	72.4	72.4	8	10	20	5.3
16	47	–	40.5	27.5	55	80.2	81.6	81.6	8	10	30	5
20	61	–	40.5	34	67.4	93.3	97	97	12	14	30	6

Size	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	W1	W2	≈ 1	≈ 2
[mm]	+0.1		±0.4	max.	min.	max.		+0.1						
12	2.1	12.1	6	5	3.5	6	4.6	2.1	10	–	210°	105°	2	2
16	2.1	12.1	6	6	4.5	6	–	2.1	12.1	10	210°	105°	2.5	2.5
20	2.1	12.1	9	8	6	7.5	–	2.1	12.1	–	210°	105°	3	2.5

1) Tolerance for centring hole Ø9 H7,
Tolerance for thread M5 ±0.1 mm

Data sheet

Ordering data			
	Size [mm]	Part no.	Type
	With cushioning P		
	12 ¹⁾	1187955	HGDS-PP-12-P-A-B
	16 ¹⁾	1187958	HGDS-PP-16-P-A-B
	20 ¹⁾	1187961	HGDS-PP-20-P-A-B
	With cushioning P1		
	12 ¹⁾	1187956	HGDS-PP-12-P1-A-B
	16 ¹⁾	1187959	HGDS-PP-16-P1-A-B
	20 ¹⁾	1187962	HGDS-PP-20-P1-A-B
	With cushioning YSRT		
	12 ¹⁾	1187957	HGDS-PP-12-YSRT-A-B
	16 ¹⁾	1187960	HGDS-PP-16-YSRT-A-B
	20 ¹⁾	1187963	HGDS-PP-20-YSRT-A-B

1) Two centring sleeves are included in the scope of delivery of the swivel/gripper unit.

Accessories

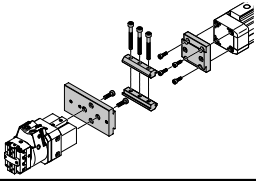
Adapter kit
HMVA, HMSV, HAVB

Material:
Wrought aluminium alloy
Free of copper and PTFE
RoHS-compliant

**Note**

The kit includes the individual mounting interface as well as the necessary mounting material.

Permissible drive/gripper combinations with adapter kitDownload CAD data → www.festo.com

Combination	Drive	Gripper	Mounting option		Adapter kit		
	Size	Size			CRC ¹⁾	Part no.	Type
DGPL/HGDS	DGPL	HGDS			HMSV, HMVA		
	DGPL-25	12, 16, 20	■	■	2	177653	HMSV-7
						534290	HMSV-38
						196788	HMVA-DLA1 8/25
	DGPL-40	12, 16, 20	■	■		177653	HMSV-7
						534290	HMSV-38
						196790	HMVA-DLA40

1) Corrosion resistance class CRC 2 to Festo standard FN 940070

Moderate corrosion stress. Indoor applications in which condensation can occur. External visible parts with primarily decorative surface requirements which are in direct contact with a normal industrial environment.

Accessories

Ordering data					
	For size	Brief description	Part no.	Type	PU ¹⁾
Cushioning kit for P/P1/YSRT cushioning					
	12	P cushioning: • Elastic cushioning component	1731537	HGDS-12-P-B	1
	16		1731540	HGDS-16-P-B	
	20		1731544	HGDS-20-P-B	
	12	P1 cushioning: • Elastic cushioning component • Adjustable • Via metal fixed stop	1731536	HGDS-12-P1-B	
	16		1731539	HGDS-16-P1-B	
	20		1731542	HGDS-20-P1-B	
	12	YSRT cushioning: • Shock absorbers • Self-adjusting • Via metal fixed stop	1731538	HGDS-12-YSRT-B	1
	16		1731541	HGDS-16-YSRT-B	
	20		1731545	HGDS-20-YSRT-B	

1) Packaging unit

Ordering data						Data sheets → Internet: zbh
	For size	Weight [g]	Part no.	Type	PU ¹⁾	
Centring sleeve ZBH						
	12, 16, 20	1	150927	ZBH-9	10	

1) Packaging unit

Ordering data – Proximity sensor for C-slot, magneto-resistive							Data sheets → Internet: smt
	Type of mounting	Electrical connection, outlet direction of connection	Switching output	Cable length [m]	Part no.	Type	
N/O contact							
	Insertable in the slot from above	Cable, 3-wire, lengthwise	PNP	2.5	551373	SMT-10M-PS-24V-E-2.5-L-OE	
		Plug M8x1, 3-pin, in-line		0.3	551375	SMT-10M-PS-24V-E-0.3-L-M8D	
		Cable, 3-wire, lateral		2.5	551374	SMT-10M-PS-24V-E-2.5-Q-OE	
		Plug M8x1, 3-pin, lateral		0.3	551376	SMT-10M-PS-24V-E-0.3-Q-M8D	

Ordering data – Proximity sensor for C-slot, magnetic reed							Data sheets → Internet: sme
	Type of mounting	Electrical connection, outlet direction of connection	Switching output	Cable length [m]	Part no.	Type	
N/O contact							
	Insertable in the slot from above	Cable, 3-wire, lengthwise	Contacting	2.5	551365	SME-10M-DS-24V-E-2.5-L-OE	
		Cable, 2-wire, lengthwise		2.5	551369	SME-10M-ZS-24V-E-2.5-L-OE	
		Plug M8x1, 3-pin, in-line		0.3	551367	SME-10M-DS-24V-E-0.3-L-M8D	
		Cable, 3-wire, lateral		2.5	551366	SME-10M-DS-24V-E-2.5-Q-OE	
		Cable, 2-wire, lateral		2.5	551370	SME-10M-ZS-24V-E-2.5-Q-OE	
		Plug M8x1, 3-pin, lateral		0.3	551368	SME-10M-DS-24V-E-0.3-Q-M8D	

Ordering data – Connecting cables						Data sheets → Internet: nebu
	Electrical connection, left	Electrical connection, right	Cable length [m]	Part no.	Type	
	Straight socket, M8x1, 3-pin	Cable, open end, 3-wire	2.5	541333	NEBU-M8G3-K-2.5-LE3	
			5	541334	NEBU-M8G3-K-5-LE3	
	Angled socket, M8x1, 3-pin	Cable, open end, 3-wire	2.5	541338	NEBU-M8W3-K-2.5-LE3	
			5	541341	NEBU-M8W3-K-5-LE3	