Swing Clamps with Sturdy Swing Mechanism
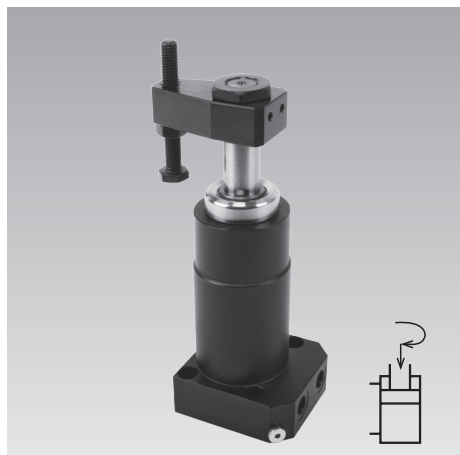## Bottom flange type, with optional position monitoring, double acting, max. operating pressure 350 bar

Indexing

Metallic wiper optional

Advantages

- 4 sizes available
- Compact design partially recessible
- High clamping force at low pressures
- Sturdy swing mechanism
- Insensitive against high flow rates
- Indexing of the clamping arm in a specified position is possible
- Special swing angle easily realizable
- Standard FKM wiper
- Metallic wiper optional
- Screw counterbores coverable
- Position monitoring available in six variants
- Hydraulic and pneumatic ports integrated in the flange
- Mounting position: any
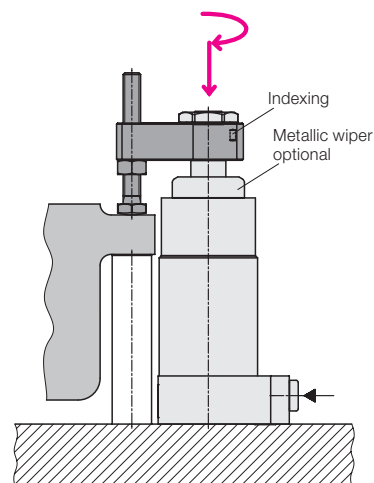
Application

Hydraulic swing clamps are used for clamping of workpieces, when it is essential to keep the clamping area free of straps and clamping components for unrestricted workpiece loading and unloading.

Due to the sturdy swing mechanism and the manifold possibilities of position monitoring these swing clamps are particularly suited for

- Automatic manufacturing systems
- Clamping fixtures with workpiece loading via handling systems
- Transfer lines
- Test systems for motors, gears and axes
- Assembly lines
- Special machine tools

Description

The hydraulic swing clamp is a pull-type cylinder where a part of the total stroke is used to swing the piston.

The favourable area ratio (piston/piston rod) allows high clamping forces already at relatively low oil pressures.

Due to the sturdy swing mechanism the angle position of the clamping arm remains the same after a slight collision with the workpiece during loading or unloading. Also a collision during the clamping process is not critical.

When using high flow rates the swing speed is limited by installed throttle points.
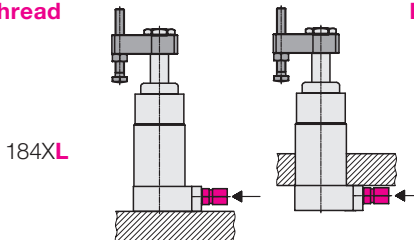
The FKM wiper at the piston rod can be protected against coarse and hot swarf by an optionally available metallic wiper (see page 6).

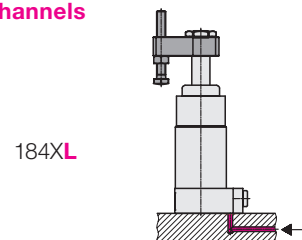The different possibilities of the position monitoring are presented at the side.

Important notes see page 6.

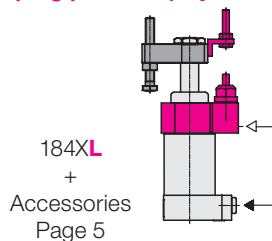## Installation and connecting possibilities

Pipe thread

184X**L**

Drilled channels

184X**L**

Pneumatic position monitoring
Monitoring of the clamping arm in clamping position (adjustable)

184X**L**
+
Accessories
Page 5

Position monitoring as accessories
Switch rod for external sensors

184X**M**
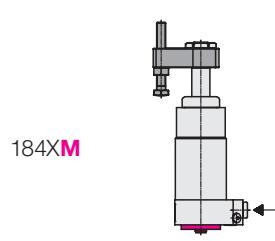
Monitoring of the piston in unclamping position

184X**N**

Pneumatic position monitoring in clamping and unclamping position

184X**M**
+
Accessories
Page 5
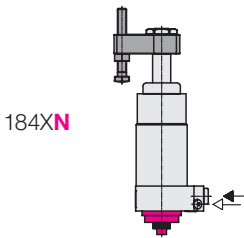
Both controls combined

184X**N**
+
Accessories
Page 5

Electrical position monitoring in clamping and unclamping position

184X**M**
+
Accessories
Page 6

L (without monitoring)

For indexing a pin 3m6x6 (3301 281) can be inserted. (Not included in the delivery).
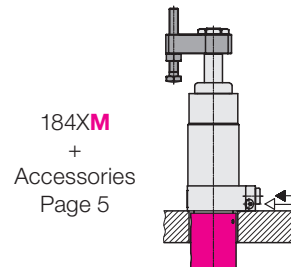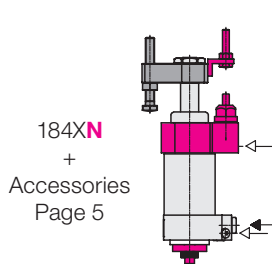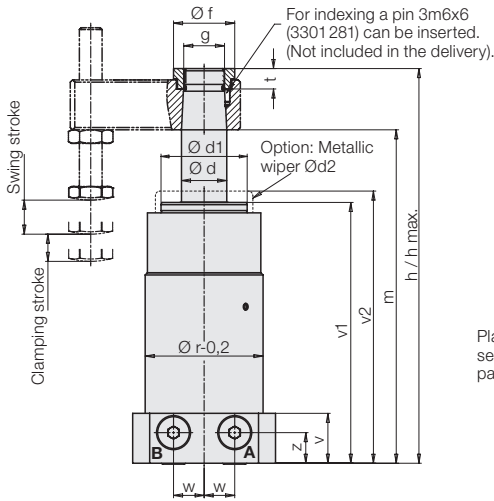
Option: Metallic wiper Ø d2

Ø f
g
Ø d1
Ø d
Ø r-0,2

Swing stroke
Clamping stroke
h / h max.
v1
v2
m
z
v
w w

B **A**
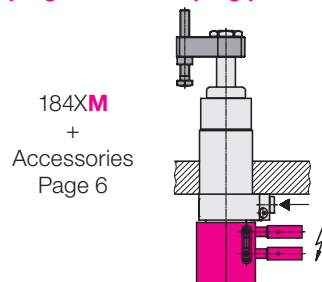
A = Clamping
B = Unclamping
E = Unclamped (pneumatic)
S = Clamped (pneumatic)

Clamping position ±1°

Swing direction **cw**
Swing direction **ccw**

Example for swing angle < 90° **off-position ±3°**

Swing angle 90° **off-position ±3°**

Indexing mark represented in clamping position

Plastic covers see page 4

n
Ø p1
Ø p2
L1
b
max. 5
e x 45°
G
a
L

Swing angle

1. Swing angle 90° (standard)

	Part no.
90° cw	184XX090RXX
90° ccw	184XX090LXX
0°	184XX00000XX

2. Swing angle α < 90°

α = 15° to 75° in gradation of 5°

By insertion of a distance plate the return stroke of the piston is reduced and thus the swing angle is reduced.
Clamping stroke and clamping position remain the same. The swing stroke and the dimensions h, h1, and m are reduced by y:

$y = (90° - α°) * k$ (k see chart page 3)

Dimensions 3 ±0.5 and o of the switch rod are lengthened by the value y.

Example:
Swing clamp   1845L090L30
Desired swing angle   **45° ccw**
Part no.   **1845L045L30**

Shortening:
$y = (90° - 45°) * 0.12 \text{ mm/°} = 5.4 \text{ mm}$

3. Swing angle > 90°
Available on request!

M (with switch rod)

Plastic covers see accessories page 4

p4
p3

Ø d3
M5 x 10 deep
Ø 36 f7

Stroke 3 ±0.5*

Screw plugs and O-rings are included in the delivery

Accessories: position monitorings see page 5 and 6

N (Monitoring "Unclamped")

M5 **"Unclamped"**
E

Ø s
Orifice plate
o*
Stroke

With blind hole, port S can be used for venting.

N (Monitoring "Unclamped" and "Clamped")

Pneumatic valve (actuated by the clamping arm)

u 2
flush
max. 10 stroke
25.5

S M5 **"Clamped"**

Accessories:
Locking flange with pneumatic valve (see page 5)

E M5 **"Unclamped"**

o*
Stroke

* see 2. Swing angle α < 90°

View X

Nut included in the delivery. Spare nut see page 4.

h / h max.
X

Pneumatic position monitoring **"Unclamped"** Version M with accessory page 5 or version N

Pneumatic position monitoring **"Clamped"** Version M with accessory page 5

E **B** **A** **S**
w2
w1 w1

Connecting scheme

For O-ring sealing:
$\sqrt{R_z 4}$
0,04 | 100

Required for versions M and N

a
b
Ø 36 +0.2
p
c
u

Use screws 12.9

Bore holes A and B not required for pipe connection

E **B** **A** **S**
c1 c1
u1 u1

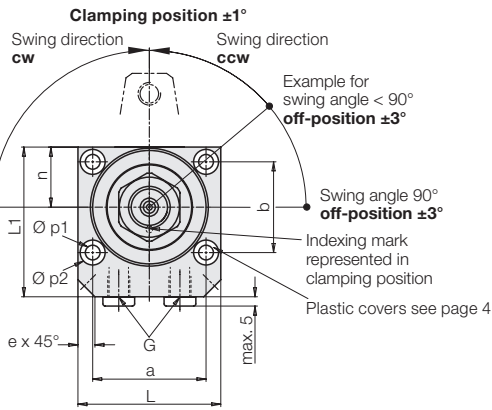Required for pneumatic position monitoring **"Unclamped"** Version M with accessory page 5 or version N

Required for pneumatic position monitoring **"Clamped"** Version M with accessory page 5

Connecting holes: 2 x hydraulics (A, B) max. Ø 5
Spare O-ring 8x1,5 Part no. 3000343
2 x pneumatics (E, S) max. Ø 2.5 (only as required)
Spare O-ring 3.68x1.78 Part no. 3000334

Pneumatic position monitoring for versions L and N with accessory locking flange

Unclamped
1
0
Clamped
1
0
1
0

Transition range

N (not adjustable)

L and N with accessory locking flange 035332X

with accessory locking flange 035342X see page 5

0,5   2   9
Valve stroke 10

Swing stroke | Clamping stroke

0 = Passage   1 = Closed
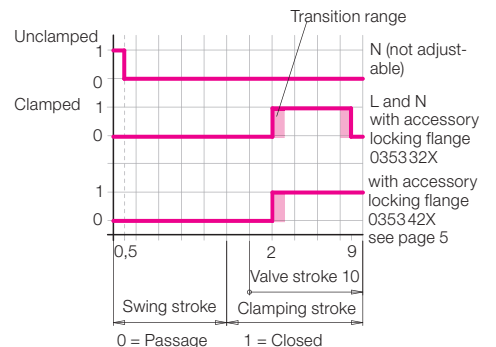
Attention danger of collision!

The contact bolt for the actuation of the pneumatic valve must be completely screwed into the angle bracket for start up (see page 4 dimension 3.5 mm)
The adjustment is made with clamped workpiece to approx. 5 mm valve stroke.

Important note!

The lower part of the swing clamp must be protected against swarf and dirt for trouble-free functioning of the orifice plate.

Max. pulling force (350 bar)		[kN]	7.5	10.5	18.4	27.5
Effective clamping force		[kN]	see diagram page 3 or calculation of the clamping force on page 4			
Clamping stroke		[mm]	12	12	15	15
Swing stroke		[mm]	11	12	15	21
Total stroke ±0.2		[mm]	23	24	30	36
Min. operating pressure		[bar]	30	30	30	30
Max. flow rate	Clamping	[cm³/s]	10	14	32	57
(see page 4)	Unclamping	[cm³/s]	20	28	60	110
Effective piston area	Clamping	[cm²]	2.14	3.01	5.27	7.86
	Unclamping	[cm²]	4.15	6.15	10.17	15.9
Oil volume / stroke		[cm³]	4.9	7.2	15.8	28.3
Oil to return		[cm³]	9.6	14.8	30.5	57.2
Piston Ø		[mm]	23	28	36	45
a		[mm]	44	50	60	68
b		[mm]	35	40	46	62
c		[mm]	26	28.5	28.5	35.5
c1		[mm]	11	13.5	14	17
Ø d		[mm]	16	20	25	32
Ø d1		[mm]	28	38	45	48
Ø d2		[mm]	33	42	54	54.5
Ø d3		[mm]	10	10	12	12
e		[mm]	8.5	7.5	9	8 x 50°
Ø f		[mm]	27	30	36	40
g		[mm]	M14 x 1.5	M18 x 1.5	M20 x 1.5	M28 x 1.5
G			G 1/8	G 1/8	G 1/4	G 1/4
h +0.4/−0.3/h max.[1]		[mm]	161 / 162.3	174 / 175.8	203 / 204.8	233.5 / 233.9
k		[mm/°]	0.091	0.093	0.12	0.152
L		[mm]	55	63	77	85
L1		[mm]	60	66	75	90
m +0.5/−0.8[2]		[mm]	139.3	147.8	171.8	195.3
n		[mm]	23	26.5	31.5	39.5
o		[mm]	21	21	21	21
p		[mm]	M5	M6	M8	M8
Ø p1		[mm]	5.5	6.5	9	9
Ø p2 H13		[mm]	10	11	15	15
p3		[mm]	15	14	14	14
p4		[mm]	18	17	18	18
Ø r		[mm]	45	52	60	76
Ø s		[mm]	30	30	33	33
t		[mm]	7.5	9	10	10
u		[mm]	27	30.5	35	43
u1		[mm]	21	24	29	32.5
u2		[mm]	32	36	41	48
v		[mm]	22	22	25	25
v1		[mm]	108	115	132	151
v2		[mm]	113	120	137	156
w		[mm]	11	13.5	14	17
w1		[mm]	25	28.5	33.5	36
w2		[mm]	6	6.5	7	7
z		[mm]	13	13.5	14	14
Weight, approx.		[kg]	1.7	2.3	3.4	5.7
Part no.	Clockwise rotation 90°		**1843X090R23M**	**1844X090R24M**	**1845X090R30M**	**1846X090R36M**
	Swing direction 90° ccw		**1843X090L23M**	**1844X090L24M**	**1845X090L30M**	**1846X090L36M**
	0 degree		**1843X000023M**	**1844X000024M**	**1845X000030M**	**1846X000036M**

Code letter **X** see page 2.
[1] h = upper edge piston / h max. = upper edge nut
[2] = lower edge clamping arm

M = Option metallic wiper (see also page 6)

Effective clamping force with accessory clamping arm as a function of the oil pressure

1843 Lmax. [mm] 330 123 75 54 43 35 — L = 35 mm — 35*

1844 Lmax. [mm] 485 177 108 78 61 50 — L = 50 mm — 50*

1845 Lmax. [mm] 494 202 127 92 73 60 — L = 60 mm — 60*

1846 Lmax. [mm] 755 281 172 125 97 80 — L = 80 mm — 80*

(Effective clamping force FSp [kN] vs Operating pressure [bar])
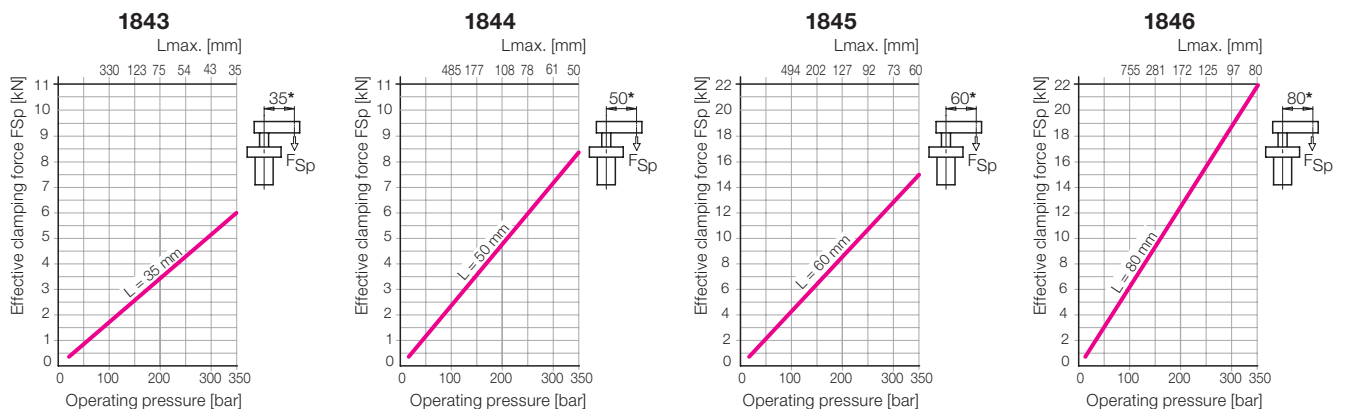
* Clamping force for other lengths see page 4.

Clamping arm, max. 350 bar

M4 x 5 deep
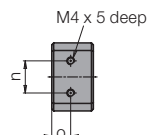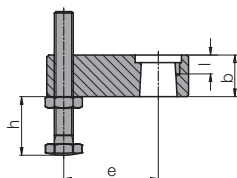
Clamping arm complete with angle

Special clamping arm
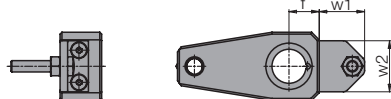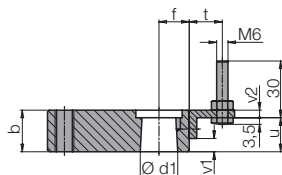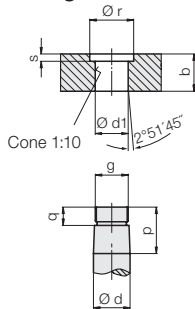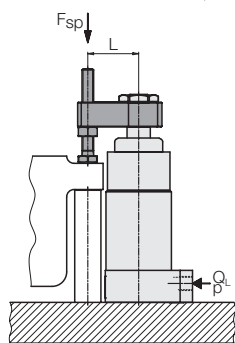**1. Connecting dimensions**

Cone 1:10 $2°51'45'$

2. Admissible flow rate Q*

In the chart on page 3, the admissible flow rates for clamping and unclamping with the clamping arms (accessories) are specified. Longer special clamping arms have a higher torque of inertia. To avoid an overload of the swing mechanism, the flow rate has to be reduced:

2.1 Moments of inertia are known

$$Q_L = Q_e * \sqrt{\frac{J_e}{J_L}} \text{ cm}^3/\text{s}$$

Q_L = Flow rate with special clamping arm
Q_e = Flow rate as per chart (page 3)
J_e = Moment of inertia of the clamping arm (accessory) with contact bolt (chart)
J_L = Moment of inertia special clamping arm

* Only for vertical mounting position!

Swing clamps		1843	1844	1845	1846
a	[mm]	58	75	93	120
b	[mm]	17	22	26	32
c	[mm]	28	36	45	60
c1	[mm]	14	20	23	28
Ød f7	[mm]	16	20	25	32
Ød1 +0.1/+0.05	[mm]	15.8	19.8	24.8	31.8
e	[mm]	35	50	60	80
f	[mm]	16	16	22	26
g	[mm]	M14x1.5	M18x1.5	M20x1.5	M28x1.5
g1	[mm]	M8	M10	M12	M16
h min/max	[mm]	5/45	6/64	7/70	9/85
Ø k +0.1	[mm]	3	3	3	3
l +0.5	[mm]	9.5	11	11	11.5
m ±0.05	[mm]	7.8	9.8	12	15
n	[mm]	11	17	20	20
o	[mm]	6	10	12	20
p	[mm]	22.5	27	32	39
q	[mm]	9	10	11	12.7
Ø r	[mm]	20	24.5	31	34.5
s	[mm]	2.5	4	4	4.5
t	[mm]	16	20	19	22
u	[mm]	17	18	21	19
v1	[mm]	6	7	8	6
v2	[mm]	4	4	5	5
w1	[mm]	23	26.5	26	29
w2	[mm]	21	27	30	30
Part no. Clamping arm					
– with contact bolt		**0354152**	**0354153**	**0354154**	**0354155**
Weight, approx.	[kg]	0.19	0.39	0.69	1.43
Moment of inertia of J_e	[kgm²]	0.00011	0.00046	0.0011	0.00398
– without thread g1		**3548660**	**3548661**	**3548803**	**3548804**
Weight, approx.	[kg]	0.16	0.34	0.62	1.28
Moment of inertia of J_e	[kgm²]	0.00007	0.00033	0.00084	0.00298
– complete with angle		**0354167**	**0354168**	**0354158**	**0354169**
Angle bracket complete		**0184006**	**0184007**	**0184005**	**0184008**
Plastic cover**		**3300686**	**3300685**	**3300684**	**3300684**
Metallic wiper		**0341104**	**0341107**	**0341105**	**0341100**
Spare nut		**3527092**	**3527014**	**3527099**	**3527015**
Tightening torque	[Nm]	16	30	42	90

Special clamping arm
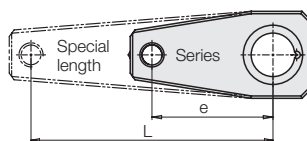
**Order 4 off swing clamps

2.2 Moments of inertia not known

This simplified calculation is only applicable for clamping arms of the above shape.
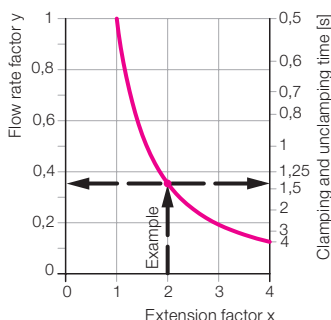
Example: Swing clamps 1843
L = 70 mm
e = 35 mm as per above chart
Q_e = 10 cm³/s (as per chart page 3)

1. Extension factor $x = \dfrac{L}{e} = \dfrac{70 \text{ mm}}{35 \text{ mm}} = 2$

2. Flow rate factor
as per diagram   → y = 0.35

3. Max. flow rate
$Q_L = y * Q_e = 0.35 * 10 \text{ cm}^3/\text{s} = 3.5 \text{ cm}^3/\text{s}$

4. Min. clamping time
as per diagram   → approx. 1.4 s

Adm. flow rate and clamping time as a function of the clamping arm extension

Clamping force and admissible operating pressure

Effective clamping force (general)

$$F_{Sp} = \frac{p}{A + (B * L)} \le F_{adm.} \quad [\text{kN}]$$

Admissible clamping force

$$F_{adm} = \frac{C}{L} \quad [\text{kN}]$$

Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E \le 350 \quad [\text{bar}]$$

L = special length [mm]   p = pressure [bar]

A, B, C, D, E = constants as per chart

Constant	1843	1844	1845	1846
A	46.64	33.15	18.98	12.72
B	0.335	0.17	0.073	0.04
C	210	420	900	1760
D	9795	13926	17078	22386
E	70.26	71.33	65.44	70.36

Example: Swing clamps 1843
L = 70 mm

1. Admissible clamping force

$$F_{adm} = \frac{C}{L} = \frac{210}{70} = 3 \text{ kN}$$

2. Admissible operating pressure

$$p_{adm} = \frac{D}{L} + E = \frac{9795}{70} + 70.26 = 210 \text{ bar}$$

Subject to modifications

Application

A prerequisite for automated processes of workpiece clamping are hydraulic clamping elements whose position can be monitored at any time.

The pneumatic position monitorings signal the following conditions by closing two bore holes:

1. Piston extended, clamping arm in off-position.
2. Piston in clamping area, clamping arm in clamping position.

By the pressure increase in the pneumatic line an electro-pneumatic pressure switch or a differential pressure switch can be actuated.

The electrical switching devices are integrated in the electric control so that on the clamping fixture no electricity is required.

Description

The pneumatic position monitoring consists of the stainless control housing with fit signal sleeve, to be connected to the switch rod of the swing clamp by means of the delivered screw. Four fixing screws are included in our delivery.
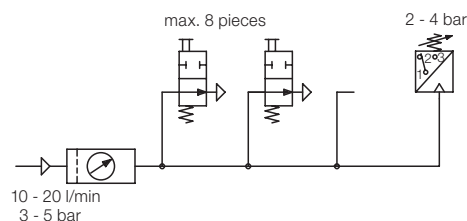
Pneumatic port

Drilled channels

The swing clamp with the mounted position monitoring is inserted into the location hole and is immediately ready for use with the mounted O-rings.

Hose connection

Remove the plugs M5 and screw-in connecting nipple M5 (accessory) Sealing to the flange area is made by the two O-rings.

M5 "Unclamped" M5 "Clamped"
Through hole Ø 41
Outlet air via air filter G1/8
O-rings and screw plugs are included in the delivery
Connecting dimensions see page 2

Technical data

Connection		O-ring or thread M5
Nominal diameter	[mm]	2
Max. air pressure	[bar]	10
Range of operating pressure	[bar]	3…5
Differential pressure*) at		
3 bar system pressure	[bar]	min. 1.5
5 bar system pressure	[bar]	min. 3.5
Air flow rate **)	[l/min]	10…20

*) Required pressure drop if one or several position monitorings are not operated.
**) For measuring of the flow rate appropriate devices are available. Please contact us.

Function chart

Swing angle < 90°
Unclamped
Clamped
10 ±5°
1 ±0,5 mm
Swing angle
Clamping stroke
0 = Passage   1 = Closed

Part no.

Swing clamps		1843M0XX	1844M0XX	1845M0XX	1846M0XX
L	[mm]	52	52	75	75
L1	[mm]	50	50	73	73
Swing angle (see page 2)					
0 or 90°		**0353913**	**0353913**	**0353914**	**0353916**
15 to 75° = **XX**		**03539130XX**	**03539130XX**	**03539140XX**	**03539160XX**

Monitoring by pneumatic pressure switch

max. 8 pieces   2 - 4 bar
10 - 20 l/min
3 - 5 bar

For the evaluation of the pneumatic pressure built-up standard pneumatic pressure switches can be used. It is possible to monitor with one pressure switch up to 8 position monitorings connected in series (see circuit diagram). It has to be considered that process-safe functioning of pneumatic position monitorings is only guaranteed with throttled air and system pressure. The nominal values are indicated below technical data.

Locking flange with pneumatic valve

With the integrated pneumatic valve the clamping position can be monitored directly at the clamping arm.

The fixing at the swing is made by tightening both locking screws.

The precise adjustment is made in clamping position with clamped workpiece. The valve tappet has to be pushed by approx. 5 mm (function chart see page 2).

Ø 6
Stroke max. 10
25.5
21
26.5
M5
Silencer
Pneumatic connection
2 locking screws
a
e
f x 45°
c
Ø d
b
20°
g
h

| Swing clamps		1843	1844	1845	1846
a	[mm]	68	76	85.5	100
b	[mm]	50	58	66	82
c	[mm]	25	29	33	41
Ød	[mm]	43	50	58	74
e	[mm]	32	36	41.5	48
f	[mm]	12	16	18	22
g	[mm]	12	14	16	18
h	[mm]	43	47	52.5	89
Switching area 2 ÷ 9 mm					
Part no. complete		**0353320**	**0353321**	**0353322**	**0353323**
Pneumatic valve*		**0353933**	**0353933**	**0353933**	**0353933**
Switching area 2 ÷ 10 mm					
Part no. complete		**0353420**	**0353421**	**0353422**	**0353423**
Pneumatic valve*		**0353934**	**0353934**	**0353934**	**0353934**

* Installation dimensions for pneumatic valve see B 1.853 page 5
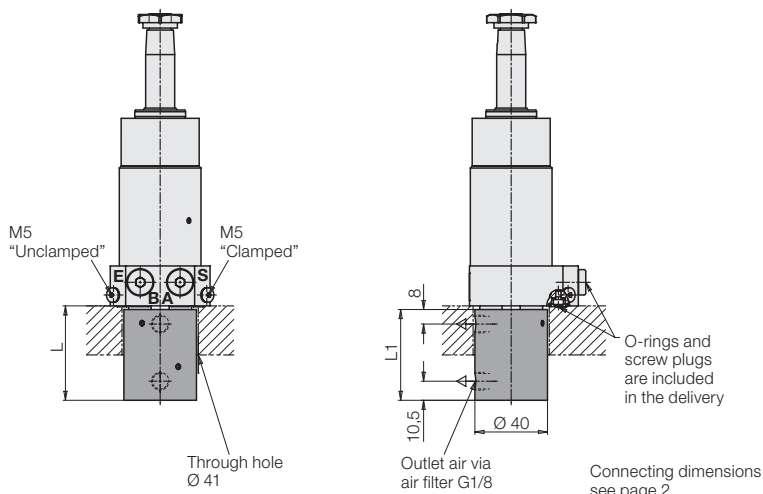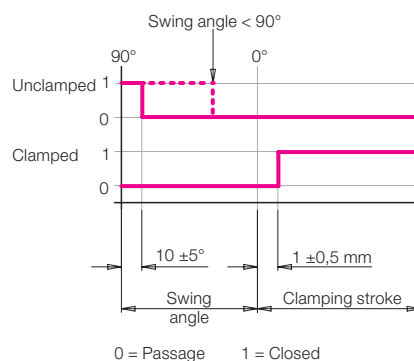
Application

Electrical position monitorings signal the following conditions due to damping of two inductive proximity switches:

1. Piston extended, clamping arm in off-position.
2. Piston in clamping area, clamping arm in clamping position.
3. Piston in final position, no workpiece inserted. ***)**

*) If this function is not desired, e.g. in setting mode, the proximity switch can be adjusted so that the switch is still damped at the stroke end (see function chart).

Only for pipe thread!

"Unclamped"

LED

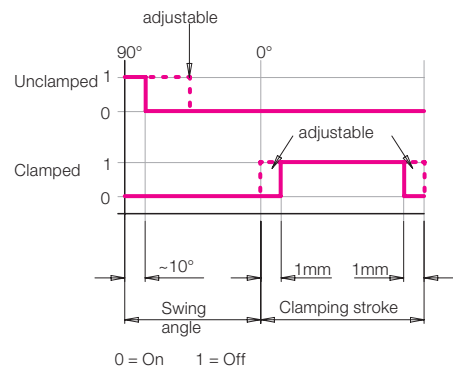"Clamped"

approx. 71 with right angle plug
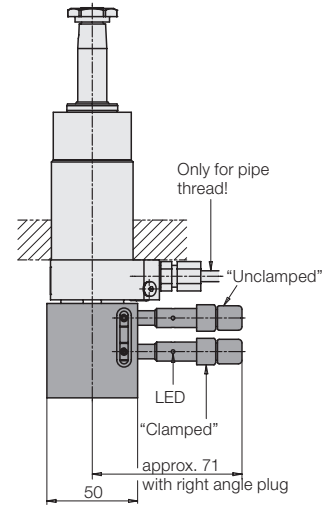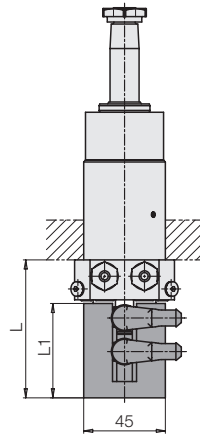
Description

The electrical position monitoring consists of the housing with two adjustable inductive proximity switches and one switching cam fixed at the switch rod of the swing clamp. The fixing screws are included in our delivery. The housing can also be mounted turned by 180°. The radial distance of the proximity switches to the switching cam should be 0.5 mm. It is secured by means of a set screw M4. After untightening of the locking screw M4 the proximity switches can be axially displaced.

Please note:

Careful design is required. According to the corresponding application conditions, safety measures have to be planned and checked later on.
Inductive position monitorings are not suitable for the use in coolant and swarf areas.

Technical data

Operating voltage	10…30 V DC
Max. residual ripple	15 %
Max. constant current	200 mA
Switching function	interlock
Output	PNP
Body material	stainless steel
Thread	M 8 x 1
Code class	IP 67
Environmental temperature	−25…+70 °C
LED Function display	yes
Protected against short circuits	yes
Connection type	Right angle plug
Length of cable	5 m

Function chart

adjustable

90°   0°

Unclamped 1
0

adjustable

Clamped 1
0

~10°   1mm   1mm

Swing angle   Clamping stroke

0 = On   1 = Off

Part no.

Swing clamps		1843M0XX	1844M0XX	1845M0XX	1846M0XX
L	[mm]	76	76	100	100
L1	[mm]	52	52	73	73
With switch and plug		**0353905**	**0353905**	**0353915**	**0353915**
Without switch and plug		**0353906**	**0353906**	**0353917**	**0353917**

Important notes

Swing clamps must only be used for clamping of workpieces in industrial applications and may only be operated with hydraulic oil. They can generate very high forces. The workpiece, the fixture or the machine must be in the position to compensate these forces.

In the effective area of piston rod and clamping arm there is the danger of crushing. The manufacturer of the fixture or the machine is obliged to provide effective protection devices.

The swing clamp has no overload protection device. When mounting the clamping arm, the clamping arm or the hexagon socket in the piston have to be backed up for tightening and untightening the fixing nut. During loading and unloading of the fixture and during clamping a collision with the clamping arm has to be avoided.

Remedy: Mount position adaptor.

Operating conditions, tolerances and other data see data sheet A 0.100.

Wiper system

The standard FKM wiper has a high chemical resistance against most cooling and cutting fluids.
The optional metallic wiper protects the FKM wiper against mechanical damage due to big or hot swarf.
It consists of a radially floating wiping disk and a retaining disk.
The metallic wiper can be delivered already mounted ("M") or as an accessory for retrofitting (see page 4).

Attention!

The metallic wiper is not suitable for dry machining or minimum quantity lubrication. Also in applications with very little grinding swarf, the standard FKM wiper has a better protection effect.
If there is any danger that small particles stick to the piston rod, the metallic wiper disk can also be replaced by a hard plastic disk.

Throttling of the flow rate

A flow rate throttling always has to be effected in the supply line to the swing clamp. This avoids a pressure intensification and thereby pressures exceeding 350 bar.

Free flow

Direction of flow control