Pascal

Sensing Swing clamp

Double acting 7 MPa

1 port 3 point sensor model model CTM-S10W

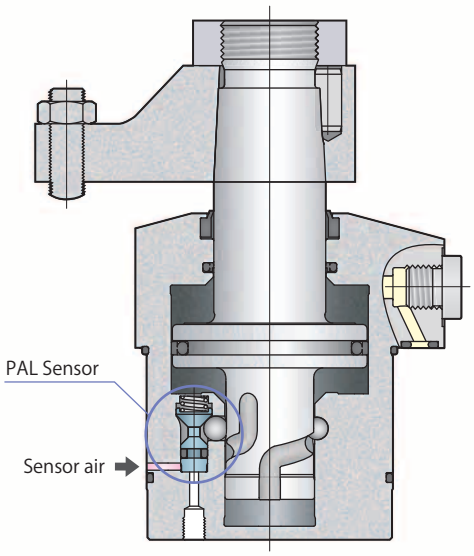
1 port 3 point sensor model
model CTM06-LS10W

1 port 3 point sensor model W

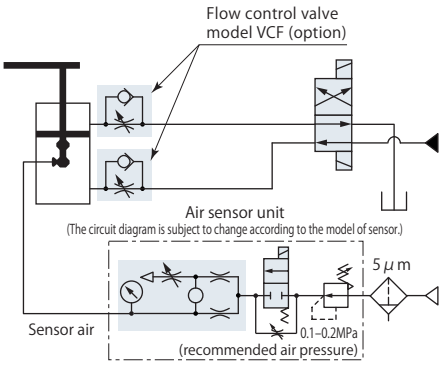
Clamp, Unclamp, Over clamp stroke (Incomplete clamp) detection

model **CTM□-□S10W** PAT.

3-point (clamp, unclamp, over clamp stroke) detection in a pneumatic circuit!



Hydraulic and pneumatic circuit diagram



Specifications

Size / Swing direction (when clamping) / Clamp stroke

CTM — Size: **04** / **05** / **06** / **10** / **16**

L : Counter-clockwise

R : Clockwise

S10 : 10mm

W : 1 port 3 point sensor model
Clamp, Unclamp, Over clamp stroke (Incomplete clamp) detection

indicates made to order.

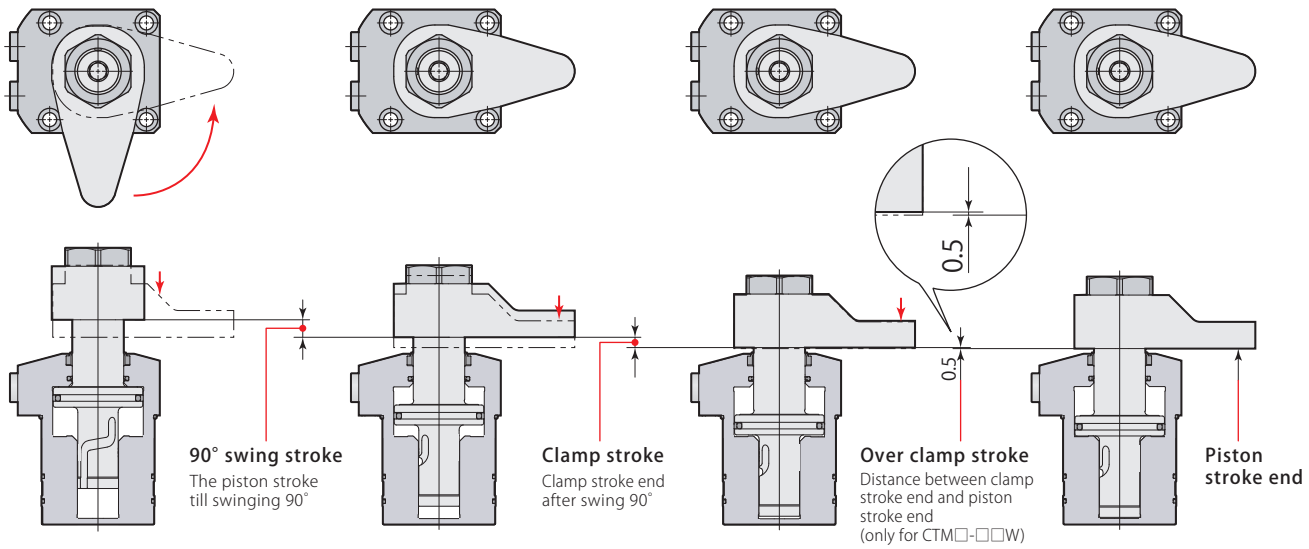
Contact Pascal for the details of variation codes (models) that are not described in the catalog.

Model	Size	CTM04-S10W	CTM05-S10W	CTM06-S10W	CTM10-S10W	CTM16-S10W
	Clamp stroke	10	10	10	10	10
Cylinder force (hydraulic pressure 7MPa)	kN	3.5	4.9	7.2	9.4	14.2
Cylinder inner diameter	mm	31	37	44	51	62
Rod diameter	mm	18	22	25	30	35.5
Effective area(Clamp)	cm^2	5.00	6.95	10.3	13.4	20.3
Swing angle		90°±3°				
Positioning pin groove position accuracy		±1°				
Repeated clamp positioning accuracy		±0.5°				
Full stroke	mm	17	18	19	20.5	22.5
90° swing stroke	mm	6.5	7.5	8.5	10	12
Over clamp stroke	mm	0.5				
Mass	kg	0.8	1.2	1.7	2.6	4.1
Recommended tightening torque of mounting screws*	N·m	7	7	12	12	29
Recommended tightening torque of nut	N·m	35	60	100	155	260

- Pressure range : 1.5～7 MPa
- Proof pressure : 10.5 MPa
- Operating temperature : 0～70 ℃
- Fluid used : General mineral based hydraulic oil (ISO-VG32 equivalent)
- Seals are resistant to chlorine-based cutting fluid.

*: ISO R898 class 12.9

Clamping must be done within the range of clamp stroke.



Performance table

Clamping force varies depending on the clamp arm length (LH) and hydraulic pressure (P).

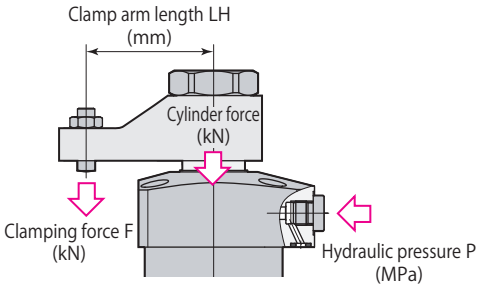
Clamping force calculation formula

F = P/(Coefficient 1 + Coefficient 2 × LH)

F: Clamping force P: Hydraulic pressure LH: Clamp arm length

CTM06 with clamp arm length (LH) = 50 mm at hydraulic pressure of 7 MPa, Clamping force F is calculated by 7/ (0.971+0.00333 × 50) = 6.2 kN

Do not use the clamp in the nonusable range. It may cause damage to the cylinder and rod.



model CTM04-□S Clamping force F=P/(2.00+0.00755×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN (Clamp arm length LH mm) 40	50	60	70	80	100	120	140	Max. arm length Max. LH mm
7	3.5	3.0	2.9	2.9	2.8					74
6.5	3.3	2.8	2.7	2.6	2.6	2.5	Nonusable range			81
6	3.0	2.6	2.5	2.4	2.4	2.3				90
5.5	2.8	2.4	2.3	2.2	2.2	2.1	2.0			101
5	2.5	2.2	2.1	2.0	2.0	1.9	1.8			116
4.5	2.3	2.0	1.9	1.8	1.8	1.7	1.6	1.5		135
4	2.0	1.7	1.7	1.6	1.6	1.5	1.5	1.4	1.3	163
3.5	1.8	1.5	1.5	1.4	1.4	1.3	1.3	1.2	1.1	↑
3	1.5	1.3	1.3	1.2	1.2	1.2	1.1	1.0	1.0	↑
2.5	1.3	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.8	↑
2	1.0	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	↑
1.5	0.8	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5	163

model CTM05-□S Clamping force F=P/(1.44+0.00543×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN (Clamp arm length LH mm) 50	60	80	100	120	140	160	180	Max. arm length Max. LH mm
7	4.9	4.1	4.0	3.7	3.5					105
6.5	4.5	3.8	3.7	3.5	3.3		Nonusable range			117
6	4.2	3.5	3.4	3.2	3.0	2.9				131
5.5	3.8	3.2	3.1	2.9	2.8	2.6	2.5			150
5	3.5	2.9	2.8	2.7	2.5	2.4	2.3	2.2		175
4.5	3.1	2.6	2.5	2.4	2.3	2.2	2.0	1.9	1.9	209
4	2.8	2.3	2.3	2.1	2.0	1.9	1.8	1.7	1.7	261
3.5	2.4	2.0	2.0	1.9	1.8	1.7	1.6	1.5	1.4	↑
3	2.1	1.8	1.7	1.6	1.5	1.4	1.4	1.3	1.2	↑
2.5	1.7	1.5	1.4	1.3	1.3	1.2	1.1	1.1	1.0	↑
2	1.4	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.8	↑
1.5	1.0	0.9	0.8	0.8	0.8	0.7	0.7	0.6	0.6	261

model CTM06-□S Clamping force F=P/(0.971+0.00333×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN (Clamp arm length LH mm) 50	60	80	100	120	140	160	180	Max. arm length Max. LH mm
7	7.2	6.2	6.0	5.7	5.4					112
6.5	6.7	5.7	5.6	5.3	5.0	4.7	Nonusable range			124
6	6.2	5.3	5.1	4.8	4.6	4.4				139
5.5	5.7	4.8	4.7	4.4	4.2	4.0	3.8			159
5	5.1	4.4	4.3	4.0	3.8	3.6	3.5	3.3	3.2	184
4.5	4.6	4.0	3.8	3.6	3.5	3.3	3.1	3.0	2.9	220
4	4.1	3.5	3.4	3.2	3.1	2.9	2.8	2.7	2.5	274
3.5	3.6	3.1	3.0	2.8	2.7	2.6	2.4	2.3	2.2	↑
3	3.1	2.6	2.6	2.4	2.3	2.2	2.1	2.0	1.9	↑
2.5	2.6	2.2	2.1	2.0	1.9	1.8	1.7	1.7	1.6	↑
2	2.1	1.8	1.7	1.6	1.5	1.5	1.4	1.3	1.3	↑
1.5	1.5	1.3	1.3	1.2	1.2	1.1	1.0	1.0	1.0	274

model CTM10-□S Clamping force F=P/(0.749+0.00238×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN (Clamp arm length LH mm) 60	80	100	120	140	160	180	200	Max. arm length Max. LH mm
7	9.4	7.8	7.5	7.1						111
6.5	8.7	7.3	6.9	6.6	6.3	Nonusable range				123
6	8.0	6.7	6.4	6.1	5.8					138
5.5	7.3	6.2	5.9	5.6	5.3	5.1				157
5	6.7	5.6	5.3	5.1	4.8	4.6	4.4	4.2		181
4.5	6.0	5.0	4.8	4.6	4.3	4.2	4.0	3.8	3.7	215
4	5.3	4.5	4.3	4.1	3.9	3.7	3.5	3.4	3.3	265
3.5	4.7	3.9	3.7	3.5	3.4	3.2	3.1	3.0	2.9	↑
3	4.0	3.4	3.2	3.0	2.9	2.8	2.7	2.5	2.4	↑
2.5	3.3	2.8	2.7	2.5	2.4	2.3	2.2	2.1	2.0	↑
2	2.7	2.2	2.1	2.0	1.9	1.8	1.8	1.7	1.6	↑
1.5	2.0	1.7	1.6	1.5	1.4	1.4	1.3	1.3	1.2	265

model CTM16-□S Clamping force F=P/(0.493+0.00138×LH)

Hydraulic pressure MPa	Cylinder force kN	Clamping force kN (Clamp arm length LH mm) 60	80	100	120	140	160	180	200	Max. arm length Max. LH mm
7	14.2	12.2	11.6	11.1	10.6					132
6.5	13.2	11.3	10.8	10.3	9.9	9.5	Nonusable range			147
6	12.2	10.4	9.9	9.5	9.1	8.7	8.4			164
5.5	11.2	9.6	9.1	8.7	8.4	8.0	7.7	7.4		187
5	10.1	8.7	8.3	7.9	7.6	7.3	7.0	6.7	6.5	217
4.5	9.1	7.8	7.5	7.1	6.8	6.6	6.3	6.1	5.9	259
4	8.1	6.9	6.6	6.3	6.1	5.8	5.6	5.4	5.2	↑
3.5	7.1	6.1	5.8	5.5	5.3	5.1	4.9	4.7	4.6	↑
3	6.1	5.2	5.0	4.8	4.6	4.4	4.2	4.0	3.9	↑
2.5	5.1	4.3	4.1	4.0	3.8	3.6	3.5	3.4	3.3	↑
2	4.1	3.5	3.3	3.2	3.0	2.9	2.8	2.7	2.6	↑
1.5	3.0	2.6	2.5	2.4	2.3	2.2	2.1	2.0	2.0	259

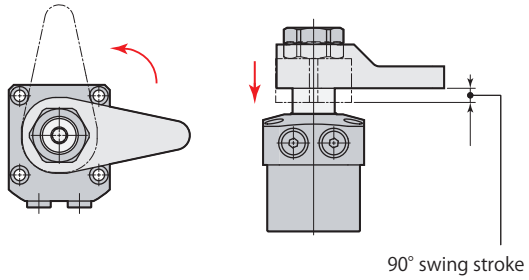
Swing speed adjustment

Swing time is restricted by the mass and length of the clamp arm (moment of inertia) since the 90° swing action impacts the cam shaft.

1.Calculate the moment of inertia according to the arm length and mass.

2.Adjust swing speed with flow control valve to ensure that 90° swing time of the clamp arm is greater than the shortest swing time in the graph shown below.

- The cam groove may be damaged in case the swing speed is set at the nonusable range in the graph.

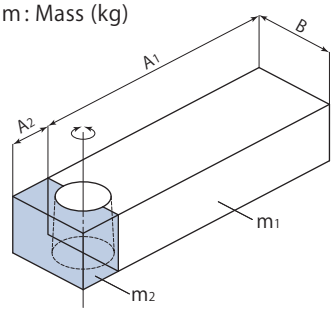


Example of calculation for moment of inertia

$$I = \frac{1}{12} m_1(4A_1^2 + B^2) + \frac{1}{12} m_2(4A_2^2 + B^2)$$

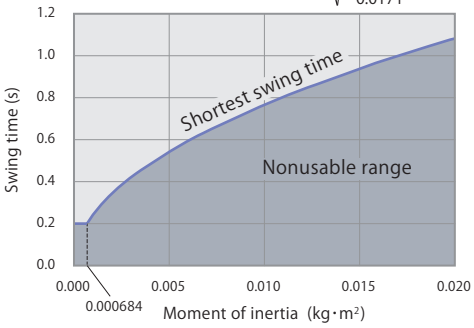
I : Moment of inertia (kg·m²)

m : Mass (kg)



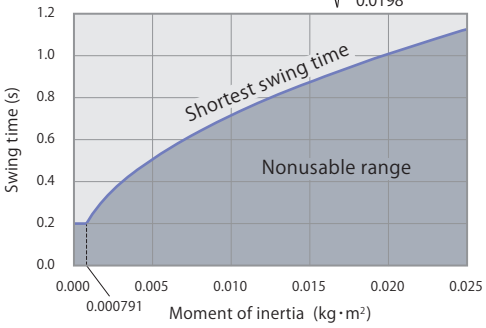
model CTM04

Shortest swing time calculation formula $t = \sqrt{\frac{I}{0.0171}}$



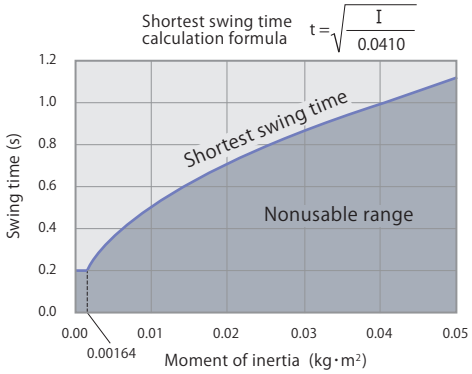
model CTM05

Shortest swing time calculation formula $t = \sqrt{\frac{I}{0.0198}}$



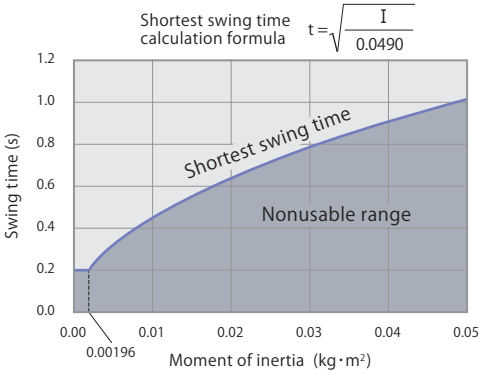
model CTM06

Shortest swing time calculation formula $t = \sqrt{\frac{I}{0.0410}}$



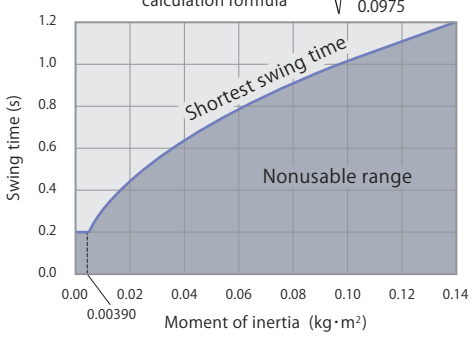
model CTM10

Shortest swing time calculation formula $t = \sqrt{\frac{I}{0.0490}}$



model CTM16

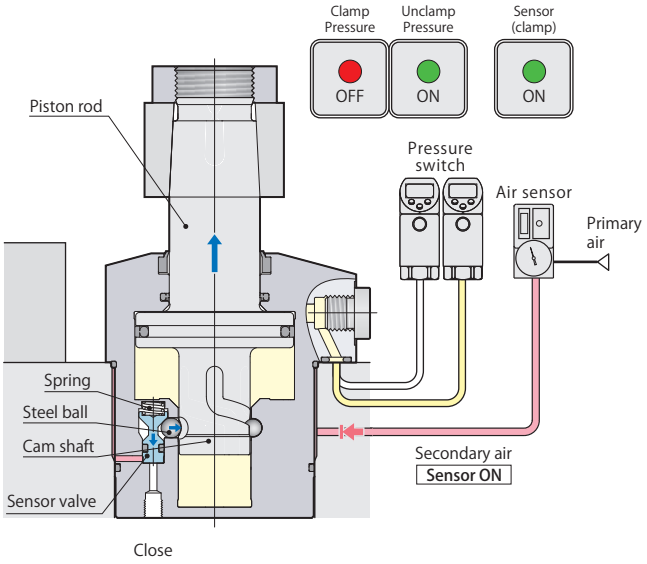
Shortest swing time calculation formula $t = \sqrt{\frac{I}{0.0975}}$



Clamp, Unclamp, Over clamp stroke detection signal

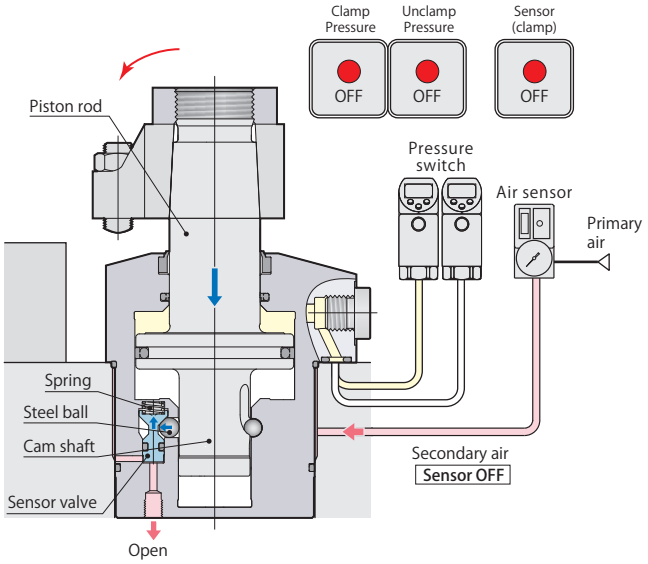
The "ON" and "OFF" indications of the sensor alone are not enough to make sure of the clamp status.
It should be used in conjunction with pressure switches in the hydraulic circuit.

Unclamp detection



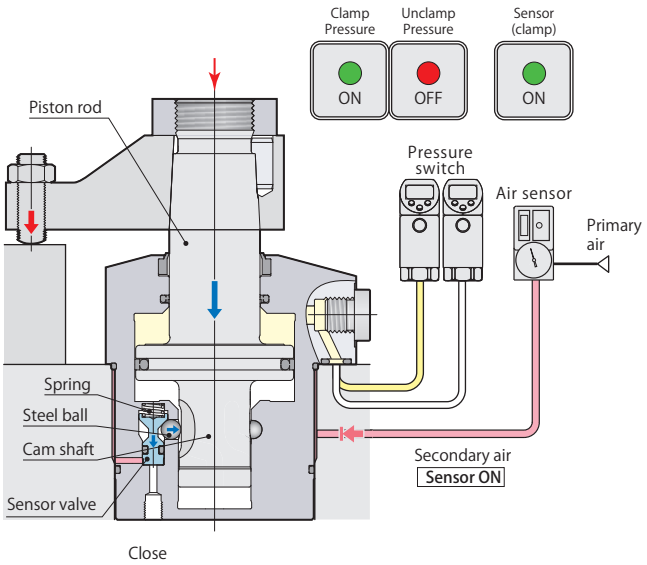
Sensor signal	ON	Unclamp
Hydraulic P.S. (Clamp)	OFF	
Hydraulic P.S. (Unclamp)	ON	

In the middle of swing stroke



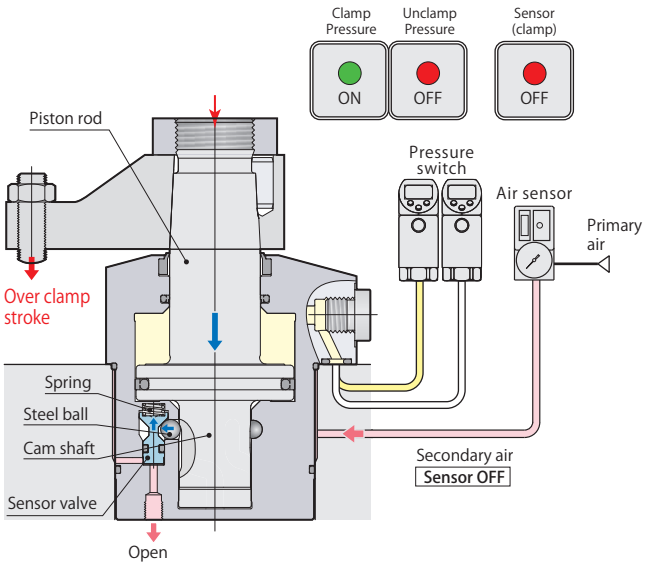
Sensor signal	OFF	In the middle of swing stroke
Hydraulic P.S. (Clamp)	OFF	
Hydraulic P.S. (Unclamp)	OFF	

Clamp detection



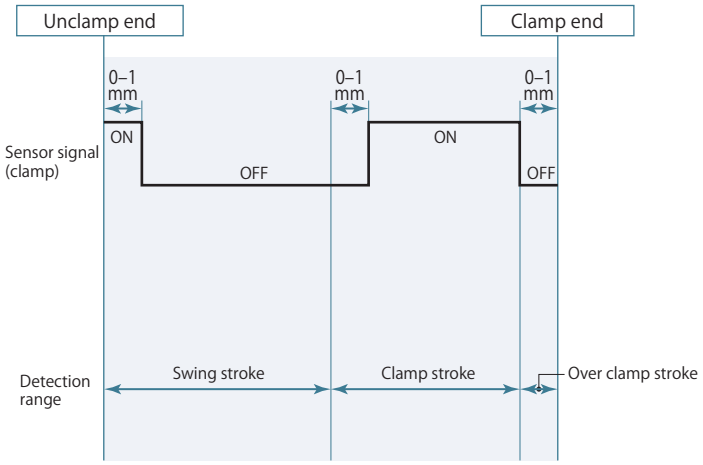
Sensor signal	ON	Clamp
Hydraulic P.S. (Clamp)	ON	
Hydraulic P.S. (Unclamp)	OFF	

Over clamp stroke (Incomplete clamp) detection



Sensor signal	OFF	Over clamp stroke (Incomplete clamp)
Hydraulic P.S. (Clamp)	ON	
Hydraulic P.S. (Unclamp)	OFF	

Air sensor triggering point



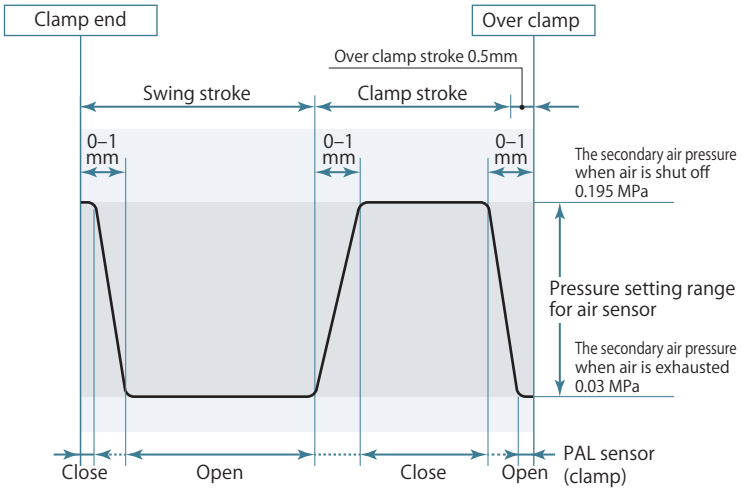
- Refer to the sensor supplier's instruction manual for the details of setting.
- Sensing performance such as detectable time and pressure differs depending on the supplier and model number of the sensor. Select the right model referring to sensor's application and characteristics.

Air sensor unit recommended condition of use

Supplier and model	ISA3-F/G series manufactured by SMC GPS2-05, GPS3-E series manufactured by CKD
Air supply pressure	0.1–0.2 MPa
Inner diameter of piping	ø4 mm (ISA3-F：ø2.5 mm)
Overall piping length	5 m or less

- Supply the dry and filtered air. Particulate size 5 μm or less is recommended.
- Use a solenoid valve with needle for air sensor unit and control it supplying air all the time in order to eliminate intrusion of chips or coolant.
- There is a case that air sensing cannot be successfully made as designed when it is used out of the above usage. Contact Technical service center for more details.

Relation between sensor air pressure, PAL sensor and piston stroke



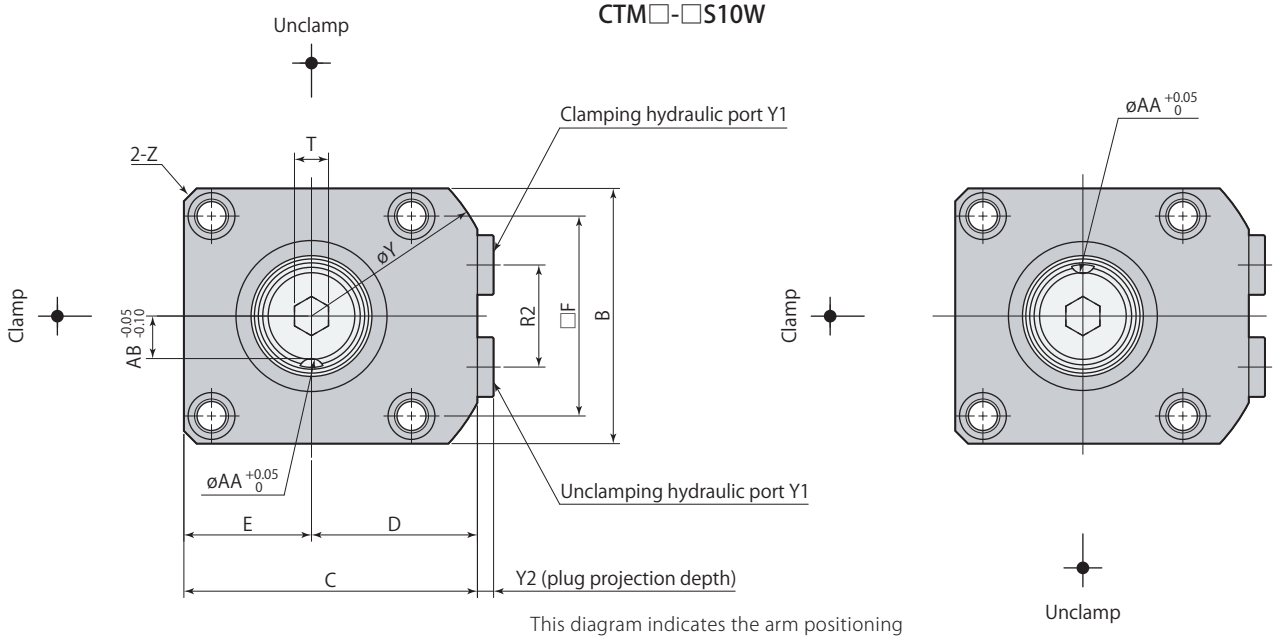
The diagram shown on the left indicates the relation between the PAL sensor, piston stroke, and secondary air pressure. (The pressure shown in the diagram is a reference based on the 0.2 MPa of primary air pressure for one piece of clamp.)

Since the new PAL sensor works with less air-leakage compared to previous sensor valve,

- Enhances the pressure setting range of the sensor which enables the sensor to set easily.
  (Ex. Pressure setting range 0.03–0.195 MPa in the diagram)
- Allows the use for a number of clamps by one air sensor because of better pressure holding when air is shut off.
  (Maximum number of clamps to be detected by one sensor is 10.)
- Allows to choose less air-consumed, i.e. small orifice diameter type, air sensor.
- Can create large differential-pressure when opening and closing the PAL sensor so that sensor primary pressure can be set as low as possible and reduce the consumption of air.

Dimensions

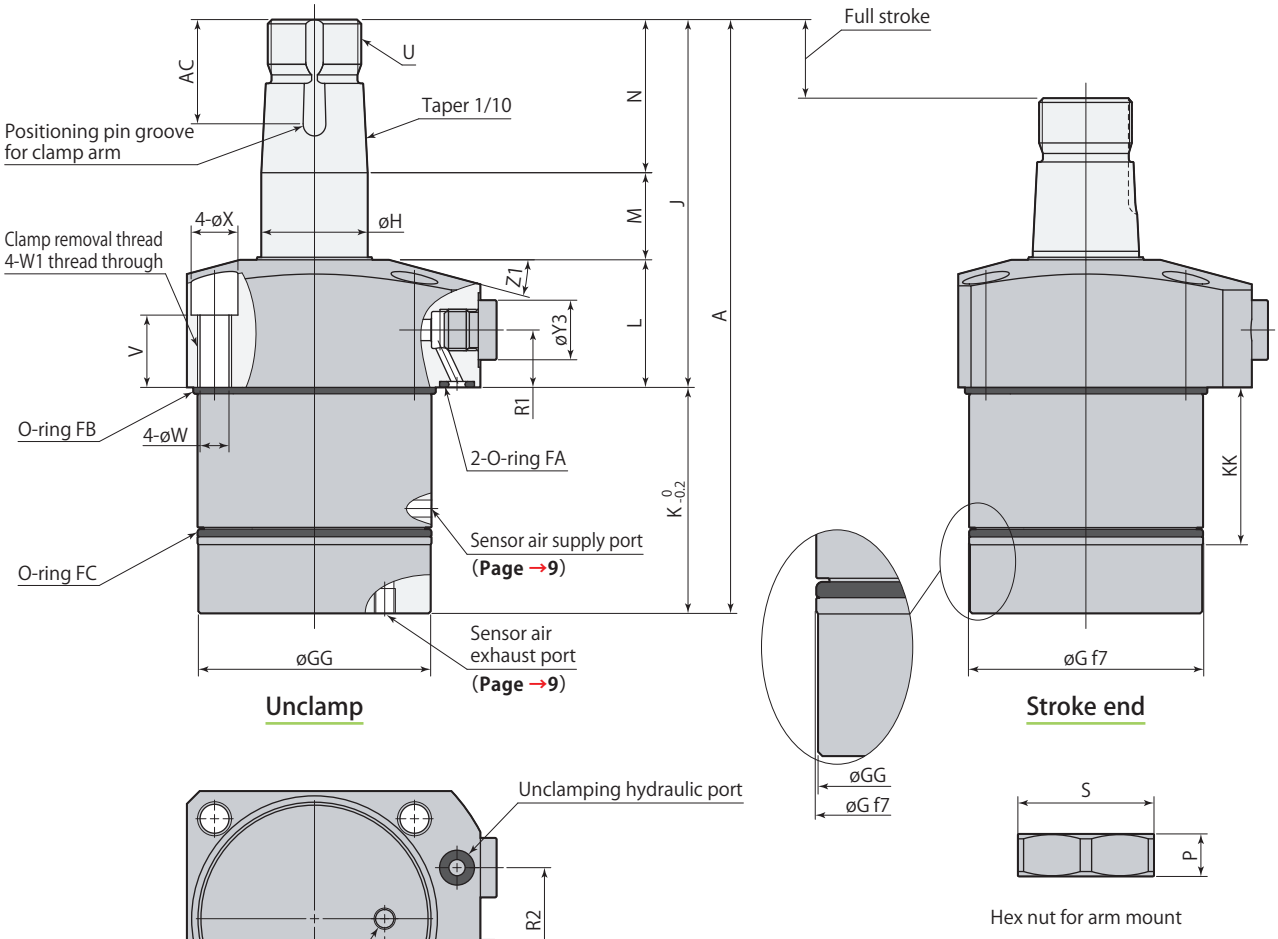
CTM□-□S10W



Swing direction L (counter-clockwise)

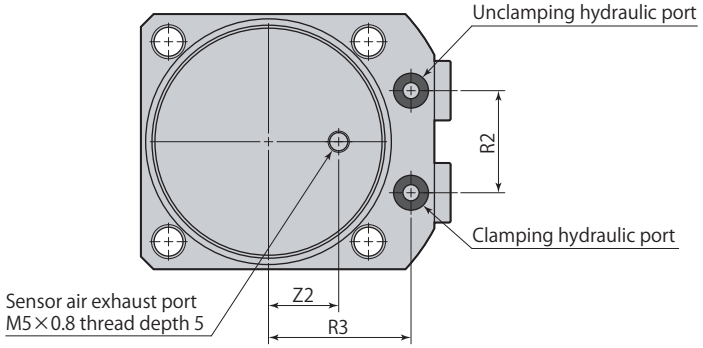
This diagram indicates the arm positioning pin groove at unclamped condition.

Swing direction R (clockwise)



Unclamp

Stroke end



Hex nut for arm mount

- Hex. nut for arm mount is included.
- Refer to separate catalog for the details of perfect nut.
- Clamp arm, positioning pin and mounting screws are not included.

CTM□-□S10W	Swing clamp 1 port 3 point sensor model	7MPa	Double acting

mm

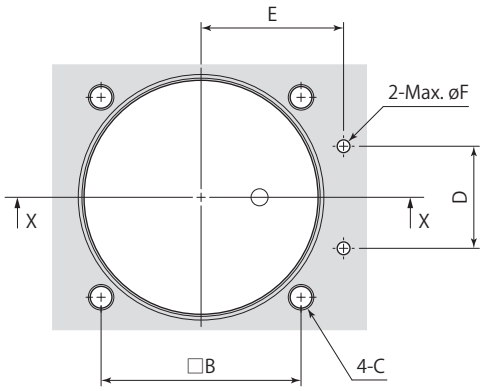
Model		CTM04-□S10W	CTM05-□S10W	CTM06-□S10W	CTM10-□S10W	CTM16-□S10W
Clamp stroke		10				
Cylinder capacity (cm^3)	clamp	8.5	12.5	19.6	27.4	45.7
	Unclamp	12.8	19.4	28.9	41.9	67.9
A		118.5	125.5	139.5	151	175
B		45	51	60	70	80
C		54	61	69	81	92
D		31.5	35.5	39	46	52
E		22.5	25.5	30	35	40
F		34	40	47	55	63
øG		$40^{-0.025}_{-0.050}$	$48^{-0.025}_{-0.050}$	$55^{-0.030}_{-0.060}$	$65^{-0.030}_{-0.060}$	$75^{-0.030}_{-0.060}$
øGG		39.7	47.6	54.6	64.6	74.6
øH		18	22	25	30	35.5
J		70.5	79.5	86.5	93	108
K		48	46	53	58	67
KK		34.5	30	36.5	39	44
L		25	28	30	31	38
M		18.5	19.5	20.5	22	24
N		27	32	36	40	46
P		8	9	10	11	11
R1		12.5	14	13.5	14	16
R2		18	22	24	30	32
R3		26	30	33.5	39.5	45
S (nut width across flats)		24	30	32	41	46
T (hex. socket)		6	8	8	10	10
U		M16×1.5	M20×1.5	M22×1.5	M27×1.5	M30×1.5
V		15	17.5	17	17	21
øW		5.5	5.5	6.8	6.8	9
W1		M6×1	M6×1	M8×1.25	M8×1.25	M10×1.5
øX		9	9	11	11	14
øY		73	83	88	106	116
Y1		G1/8	G1/8	G1/8	G1/8	G1/4
Y2		3.8	3.8	3.8	3.8	4.8
øY3		14	14	14	14	19
Z		C3	C3	C3	C4	C5
Z1		12°	15°	15°	15°	15°
Z2		11	13.5	16.5	19	22.5
øAA (pin groove diameter)		4	5	6	6	8
AB		7	9	10	12.5	14
AC		18.5	21.5	24.5	27.5	28.5
Positioning pin (dowel pin)		ø4(h8)×10	ø5(h8)×12	ø6(h8)×14	ø6(h8)×16	ø8(h8)×16
O-ringFA (FKM-90)		P5	P5	P5	P7	P7
O-ringFB (FKM-70)		38×1.5 (inner diameter×thickness)	AS568-031	AS568-034	AS568-037	AS568-040
O-ringFC (FKM-70)		AS568-028	AS568-031	AS568-033	AS568-036	AS568-039
Taper sleeve		CTH04-MS	CTH05-MS	CTH06-MS	CTH10-MS	CTH16-MS
Flow control valve*	Meter-in	VCF01S	VCF01S	VCF01S	VCF01	VCF02
	Meter-out	VCF01S-O	VCF01S-O	VCF01S-O	VCF01-O	VCF02-O
Air bleeding valve*		VCE01	VCE01	VCE01	VCE01	VCE02

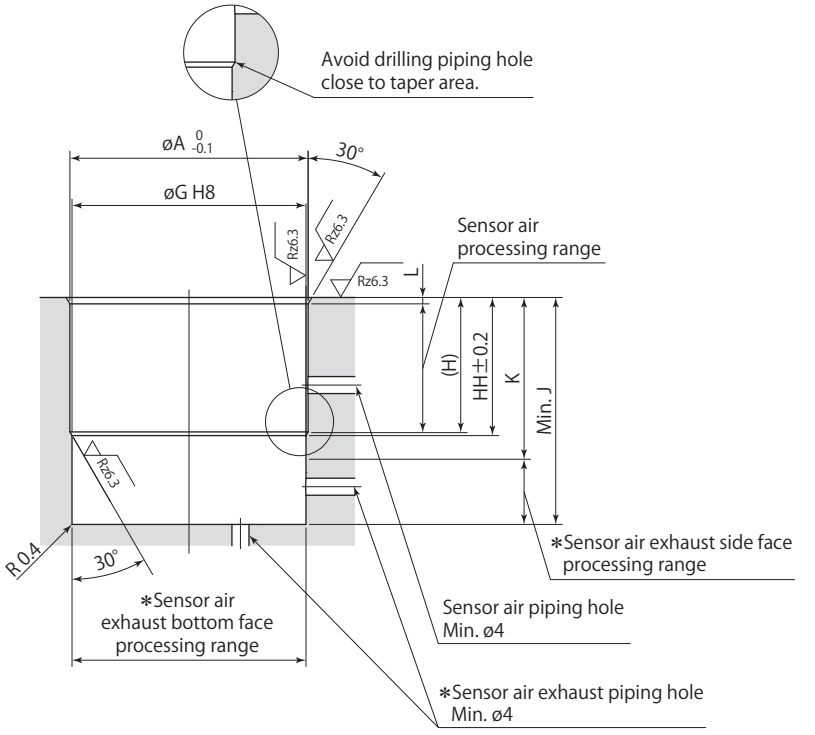
∗ : Select the right model of VCF and VCE according to the size of the clamp.

Refer to each page for the details of options.

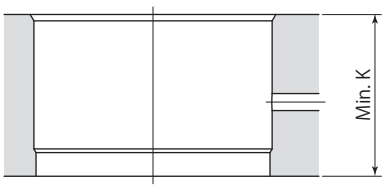
● Taper sleeve **page→12** ● Refer to separate catalog(CLS-53J) for the details of Flow control valve and Air bleeding valve.

Mounting details





In blind hole X-X



In through hole X-X

*: Sensor air exhaust piping hole must be made on either side or bottom face.

- Apply an appropriate amount of grease to the chamfer and the bore when mounting. Excessive grease may be a blockage in the air passage, causing malfunction of the sensor.
- The 30° taper machining must be provided to avoid the damage of the O-ring. Ensure that there are no interference on taper area when drilling the hole for sensor air.

Mounting details

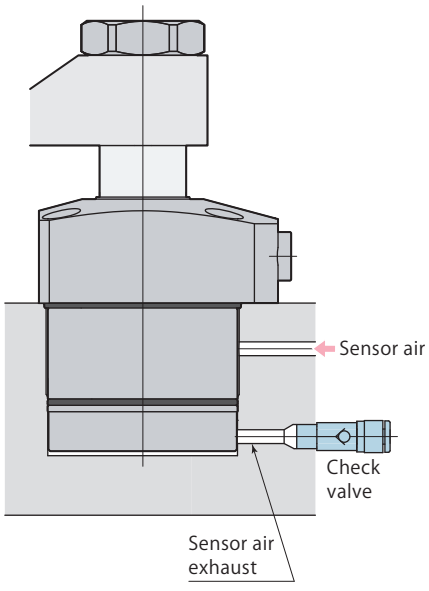
mm

Model	CTM04-□S10W	CTM05-□S10W	CTM06-□S10W	CTM10-□S10W	CTM16-□S10W
øA	40.8	49	56	66	76
B	34	40	47	55	63
C	M5	M5	M6	M6	M8
D	18	22	24	30	32
E	26	30	33.5	39.5	45
øF	3	3	3	5	5
øG	$40^{+0.039}_{0}$	$48^{+0.039}_{0}$	$55^{+0.046}_{0}$	$65^{+0.046}_{0}$	$75^{+0.046}_{0}$
H	29.5	25	31.5	34	39
HH	30.2	25.9	32.4	34.9	39.9
J	48.5	46.5	53.5	58.5	67.5
K	34.5	30	36.5	39	44
L	1.2	1.5	1.5	1.5	1.5

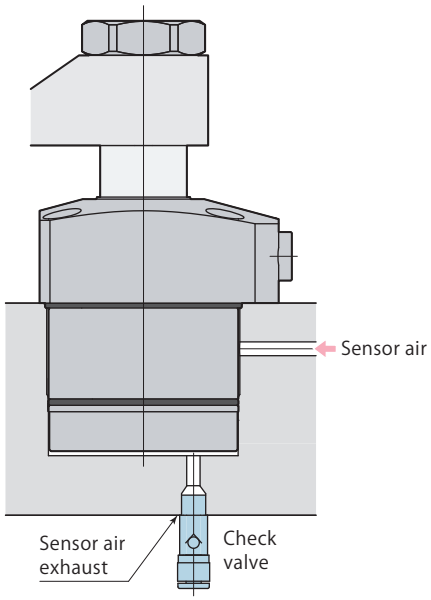
Caution for piping

Refer to the diagram shown below for the sensor air exhaust port.

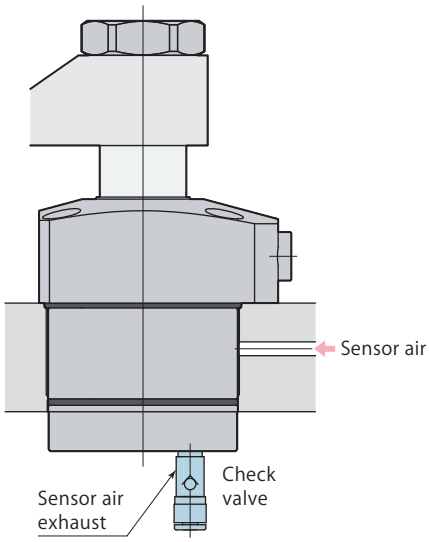
Mounting in blind hole
(Sensor air exhaust：side face)



Mounting in blind hole
(Sensor air exhaust：bottom face)



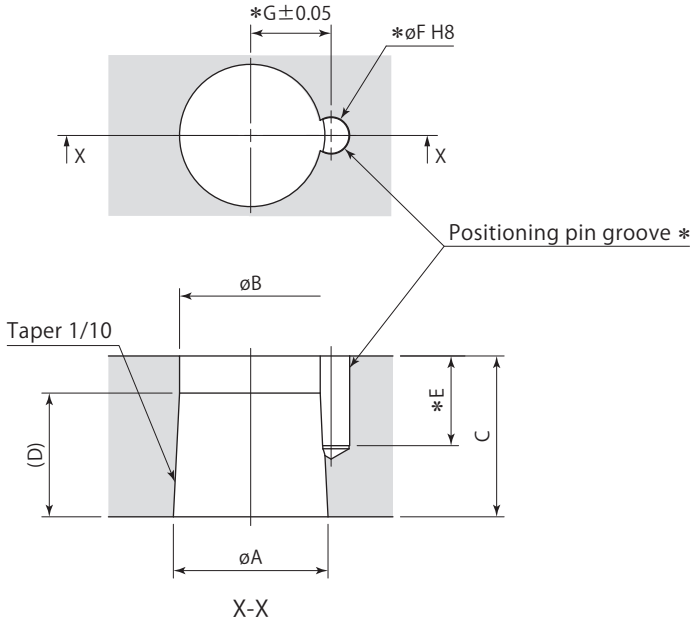
Mounting in through hole



● Use a check valve with cracking pressure of 0.005 MPa or less if there is a risk of metal chips or coolant intrusion. Recommended check valve：AKH or AKB series manufactured by SMC.

Clamp arm mounting details

Clamp arm is not included. Manufacture a clamp arm with the dimensions shown in the table below.



∗：No need to machine the pin groove (E, øF, G) unless positioning pin is used for the arm.
The positioning pin enables a clamp arm to locate on the clamp firmly and easily.

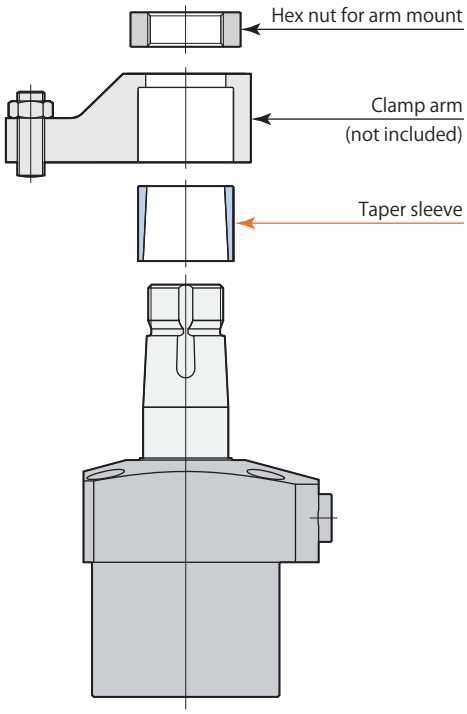
mm

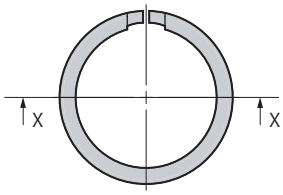
Swing clamp	CTM04	CTM05	CTM06	CTM10	CTM16
øA	18 $^{-0.016}_{-0.034}$	22 $^{-0.020}_{-0.041}$	25 $^{-0.020}_{-0.041}$	30 $^{-0.020}_{-0.041}$	35.5 $^{-0.025}_{-0.050}$
øB	16.5	20.5	23	28	(32)
C	19	23	26	29	35
D	15	15	20	20	–
E	10.5	12.5	14.5	16.5	17.5
øF (pin groove diameter)	4 $^{+0.018}_{0}$	5 $^{+0.018}_{0}$	6 $^{+0.018}_{0}$	6 $^{+0.018}_{0}$	8 $^{+0.022}_{0}$
G	9	11.5	13	15.5	18

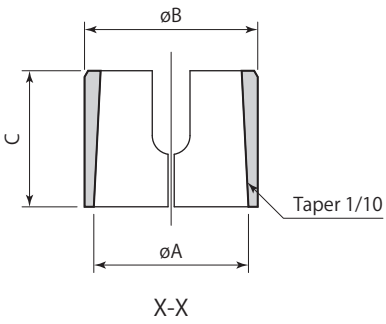
Taper sleeve

Size

CTH 04 / 05 / 06 / 10 / 16 — MS : Taper sleeve







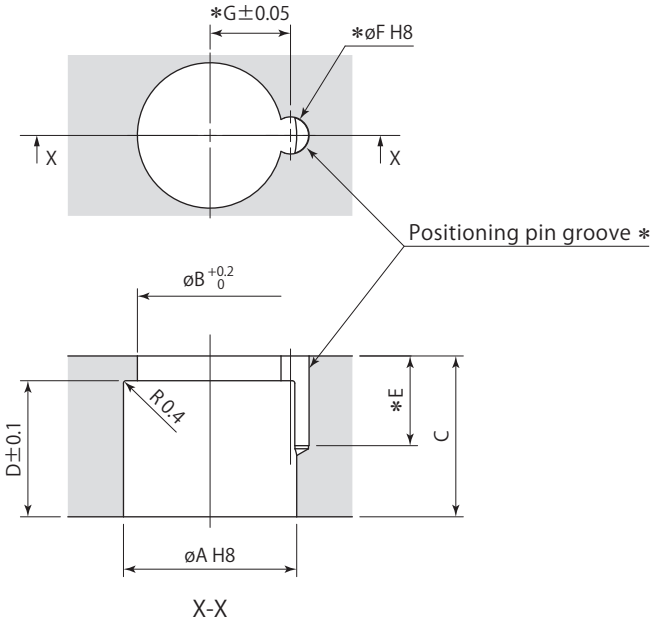
mm

Taper sleeve	CTH04-MS	CTH05-MS	CTH06-MS	CTH10-MS	CTH16-MS
Applicable swing clamp	CTM04	CTM05	CTM06	CTM10	CTM16
øA	18	22	25	30	35.5
øB	20	25	28	34	40
C	16	19	22	25	31

Clamp arm mounting details

(Using taper sleeve)

Clamp arm is not included. Manufacture a clamp arm with the dimensions shown in the table below.



∗：No need to machine the pin groove (E, øF, G) unless positioning pin is used for the arm.
The positioning pin enables a clamp arm to locate on the clamp firmly and easily.

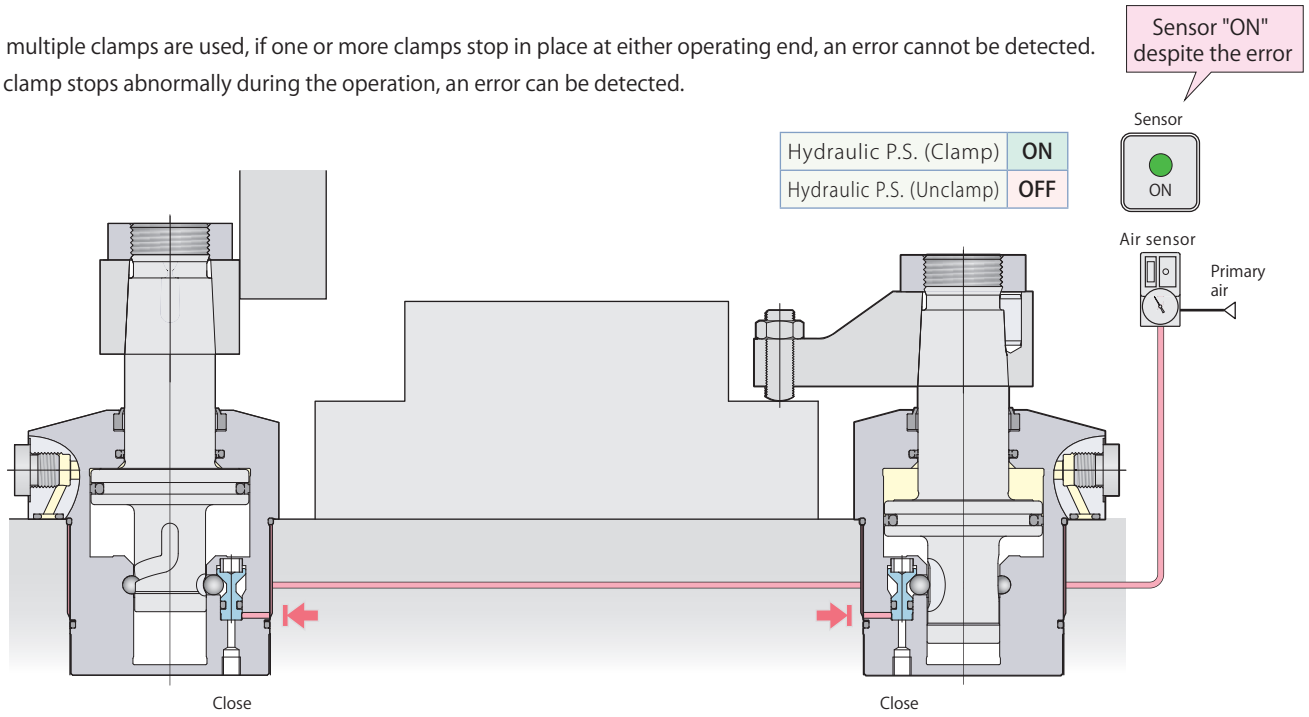
mm

Taper sleeve	CTH04-MS	CTH05-MS	CTH06-MS	CTH10-MS	CTH16-MS
Applicable swing clamp	CTM04	CTM05	CTM06	CTM10	CTM16
øA	20 +0.033 0	25 +0.033 0	28 +0.033 0	34 +0.039 0	40 +0.039 0
øB	17	21	23.5	29	33
C	19	23	26	29	35
D	16	19	22	25	31
E	10.5	12.5	14.5	16.5	17.5
øF (pin groove diameter)	4 +0.018 0	5 +0.018 0	6 +0.018 0	6 +0.018 0	8 +0.022 0
G	9	11.5	13	15.5	18

Caution in use

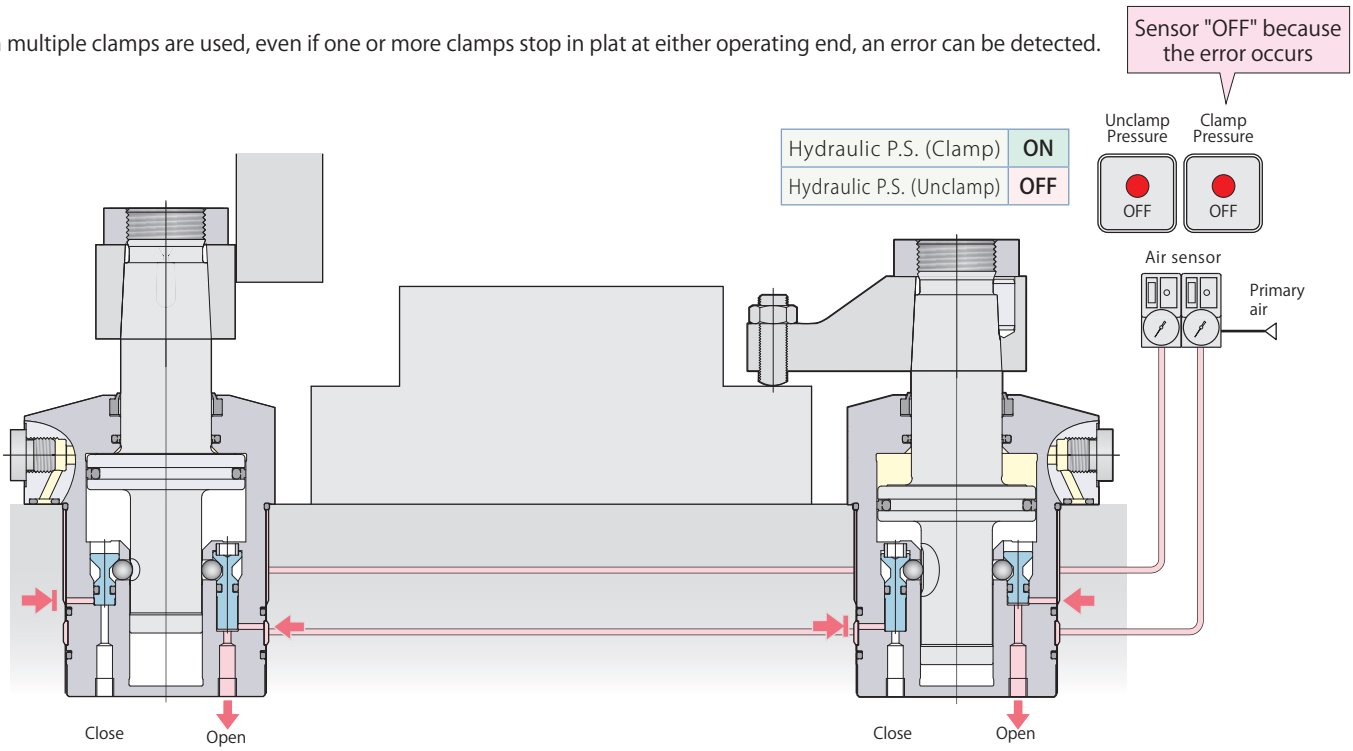
1 port 3 point sensor model CTM-W

When multiple clamps are used, if one or more clamps stop in place at either operating end, an error cannot be detected.
If the clamp stops abnormally during the operation, an error can be detected.



3 point sensor model CTM-T (conventional)

When multiple clamps are used, even if one or more clamps stop in plat at either operating end, an error can be detected.



The 1-port, 3-point sensor model cannot detect errors when it is used in conjunction with hydraulic circuit pressure in case the condition shown in the above diagram occurs, i.e. clamp arm interferes the obstacles or other reasons.
The conventional 3-point sensor model can reliably detect errors and is recommended to use it in this case.

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