Hydraulic pipe measuring points + sensors

Installation on pressurized pipe ***Serv-Clip 1***

Installation on non-pressurized pipe ***Serv-Clip 2***

Refit measuring points in existing hydraulic plants faster and much more cheaply.

Installation in 3 minutes: no cutting of pipes and ready for use!

For pipes up to 630 bar (9,100 psi):

- 10 – 42 mm
- $^{3}/_{8}$” – 2” Tube / Inch
- $^{1}/_{4}$” – 3” Pipe / R-Zoll inch

over 3” (88.9 mm) with SC-XE-607

Diagnostic-System
Mobile Measuring kit FM-1-B
with Sensors:

- Flow rate
- Leakage
- Temperature
- Pressure

Edition 07.2019

DK-SC-FC-06-19

contents

Installation Instructions

Good maintenance practices for the Condition Monitoring
INSTALLATION IN 3 MINUTES

serv-Clip 1 (1/4" screw)
for mounting on pressurized pipes

serv-Clip 2 (3/8" screw)
for mounting on non-pressurized pipes

Required tools: Allen wrench 6mm and jaw wrench sw22

Installation location

screw down
clamp bolts

Installation location

screw the valve
to the right until it stops
then screw it to the left

remove paint

screw the valve
to the right until it stops
then screw it to the left

remove paint and
clean pipe

remove stirrup
and needle

clean pipe

ready to measure

clamp SC onto pipe

screw valve

clamp SC onto pipe

screw down
clamp bolts

ready to measure

-No contamination
-No leakages
-Vibration certificate

Available *Serv-Clip* Diagnostic Connectors

For mounting on steel and (3) stainless steel pipelines –no cutting pipelines

Type		**SC-1-A-..** **SC-2-A-..**		SC-1-P-.. SC-2-P-..			**SC-1-T-..** **SC-2-T-..**		**SC-1-P-..** **SC-2-P-..**		
Housing size	For pipes with OD (mm)	**A:** hydr.pipe DIN 2391 ***ND** **mm**	Pipe wall up to 5mm	threaded pipe DIN ID R-Inches	tube wall DIN 2440 medium heavy	DIN 2441 heavy	**Tube-OD** US-standard SAE Cold-drawn **OD** inches	**pipe wall** **mm**	**Pipe-ID** US-standard SAE warm rolled **ID inches**	pipe wall Schedule 80	Schedule 160
I	9.52						3/8	1.2			
	10	10	L / S								
	(2) 12	12	L / S								
	12.7						1/2	2.1			
	13.5			R1/4	2.4	2.9			1/4	3.0	-
	14	14	S								
	15	15	L								
	15.9						5/8	2.5			
	16	16	S								
	17.2			R3/8	2.4	2.9			3/8	3.2	-
	18	18	L								
II	19.05						3/4	2.9			
	20	20	S								
	21.4			R1/2	2.65	3.25			1/2	3.7	4.7
	22	22	L								
	25	25	S								
	25.4						1	3			
	26.9			R3/4	2.65	3.25			3/4	3.9	(1) 5.6
	28	28	L								
III	30	30	S								
	31.75						1 1/4	3			
	33.7			R1	3.25	4.05			1	4.5	(1) 6.4
	35	35	L								
	38	38	S								
	38.1						1 1/2	4			
	42	42	L								
	42.4			R11/4	3.25	4.05			1 1/4	4.85	(1) 6.4
IV	48.3			R11/2	3.25	4.05			1 1/2	5.08	(1) 7.14
	50	50	6								
	50.8						2	5			
	60.3			R2	3.65	4.5			2	5.53	x
	65	65	8								
	76.1			R21/2	3.65	4.5			2 1/2	7.01	x
	88.9			R3	4.05	4.85			3	7.62	x

(1) For ordering the PIPE (P) model between 1" to 2" please reconfirm to us the schedule 80 or 160. We deliver special mounting instructions / needle for schedule 160 upon request (no additional charge).

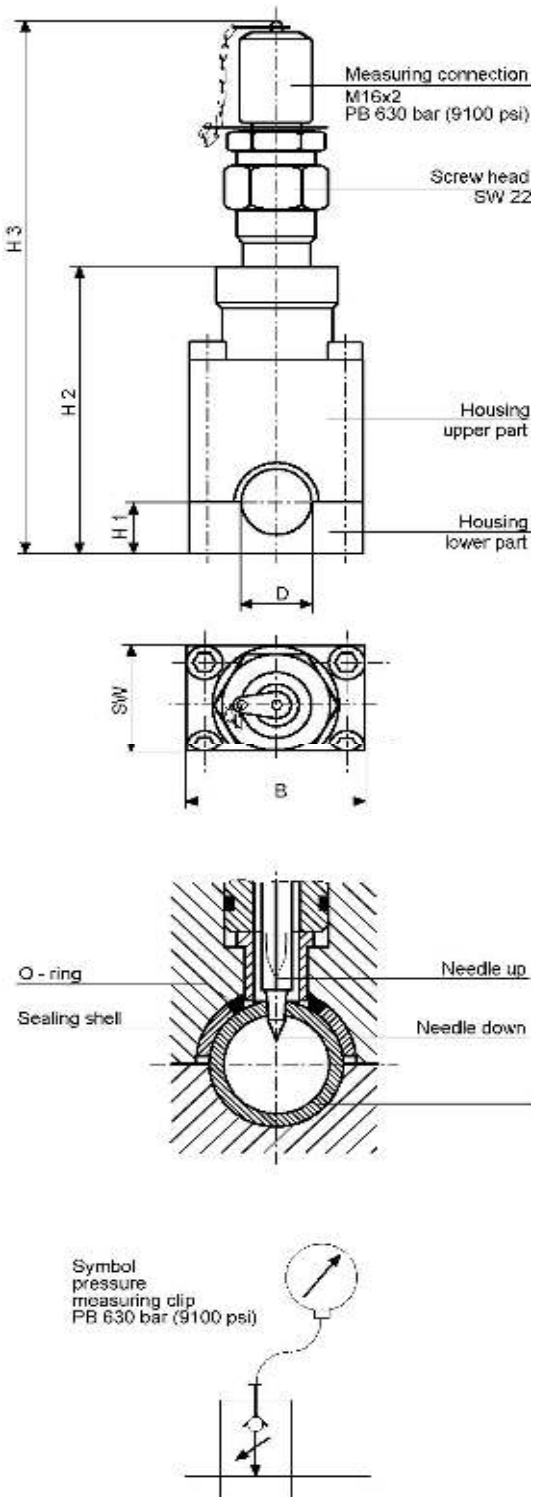
(2) The flow rate and leakage sensor can be used from pipe 12 x 1.5 mm to 5.5 mm wall thickness (Exception: 12x2mm not possible) with the Pipe measuring point Serv-Clip®. For pipes over 3" (88.9 mm) and wall thickness from 6 mm ask about our adapter SC-XE-607.

(3) We deliver an special needle for stainless steel pipelines only upon request (up to 5.5 mm wall thickness) with SC-1 (Part Nr. 501-040-02) and SC-2 (Part. Nr. 501-041-02) possible.

Available in stock

Only available in SC-2-..

Serv-Clip® Type 1
Installation on pressurized pipes



- Quick and cheap installation of approx. 3 minutes with the help of an Allen wrench 6 mm and jaw wrench SW 22.
- No need to cut pipes
- No downtime—installation on pressurized pipes
- No contamination of the fluid through swarfs
- Installation of gauges and sensors with screw ¼"
- Included valve M 16x2
- Measurement on hydraulic plants without switching off
- For use up to 630 bar (9,100 psi) working pressure
- Particle measurement according to ISO or NAS classes
- ***Serv-Clip*** is registered trade mark of Serv-Clip USA LLC

Description

The patented pressure measuring clip is simply screwed onto the cleaned surface of the pressurised hydraulic tube.
It is not necessary to interrupt the operation of the plant.
A specially shaped steel needle is inserted through the wall of the tube above the screw head.
The screw head is then screwed back. The created hole is then open, and it is possible to measure the pressure immediately.
This connection is simple, quick and safe to install. The procedure only takes a few minutes. No special tools are required to install the Serv-Clip. The system is completely leakproof.
Any pollution of the hydraulic liquid is impossible.
It is not necessary to dismantle the measuring clip on completion of the measuring procedure in order to save costs.
The operational safety of the hydraulic system is maintained.
The measuring point remains permanently available for taking measurements.

Materials

Housing	9SMnPb28k	Sealing shell	St 37.4
O-ring	Viton	Screw head	9SMnPb28k
Measuring needle	58CrV4		

Dimensions

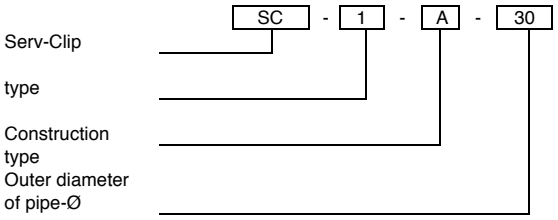
OD mm	type mm (A)	H1	H2	H3	B	SW
10 - L + S	SC-1-A-10	15	69	128	40	30
12 - L + S	SC-1-A-12	15	70	129	40	30
14 - S	SC-1-A-14	15	71	130	40	30
15 - L	SC-1-A-15	15	71.5	130.5	40	30
16 - S	SC-1-A-16	15	72	131	40	30
18 - L	SC-1-A-18	15	73	132	40	30
20 - S	SC-1-A-20	20	74	133	50	30
22 - L	SC-1-A-22	20	75	134	50	30
25 - S	SC-1-A-25	20	76.5	135.5	50	30
28 - L	SC-1-A-28	20	78	137	50	30
30 - S	SC-1-A-30	30	79	148	65	30
35 - L	SC-1-A-35	30	81.5	140.5	65	30
38 - S	SC-1-A-38	30	83	142	65	30
42 - L	SC-1-A-42	30	85	144	65	30
OD inch	**type Tube (T)**	**H1**	**H2**	**H3**	**B**	**SW**
3/8	SC-1-T-3/8	15	69	128	40	30
1/2	SC-1-T-1/2	15	70	129	40	30
5/8	SC-1-T-5/8	15	72	131	40	30
3/4	SC-1-T-3/4	20	78,5	137,5	50	30
1	SC-1-T-1	20	82	141	50	30
1 1/4	SC-1-T-1 1/4	30	95	154	65	30
1 1/2	SC-1-T-1 1/2	30	98	157	65	30

Serv-Clip for 2" Tube (T) for outer diameter 50.8mm in Type 2 available (Page 9)

Other diameters (ID) inches Pipe (P)- US standard SAE available:
Type 1: ½", ¾", 1",
Type 2: ¼", ⅜", ½", ¾", 1", 11/4"1½", 2", 2½", 3"

Serv-Clip® Type 1
Installation on pressurized pipes

Order Code



Tube recommendations according to the manufacturer of screwing fittings

Series L	10 x 1.5 / 12 x 1.5	Series S	10 x 3.0 / 12 x 3.5
	15 x 2.0 / 18 x 2.0		14 x 4.0 / 16 x 3.0
	22 x 2.0 / 28 x 2.0		20 x 3.5 / 25 x 4.5
	35 x 2.0 / 42 x 3.0		30 x 4.0 / 38 x 5.0

Safety instructions

To ensure a correct and safe installation of the Serv-Clip, please read our separate leaflet 12.B with installation instructions and a chapter on safety referring to pressure measuring clips.

The indicated measuring clips ***Serv-Clip*** are exclusively for use in fluid-technical plants. The field of application is Tubes with technical oils, like hydraulic systems and lubrication oil supply or cooling plants.

Use in air and gas tubes is forbidden.
We reserve ourselves the right to modifications which are useful for any further technical development.

Installation of the *Serv-Clip*

Prior to the installation a check must take place to ensure that the outer diameter of the tube concerned and that of the selected ***Serv-Clip*** match. It is not permitted to install a Serv-Clip onto tubes that are seriously rusted or seem to be cracked.

Furthermore, it is a precondition that the tube system should be laid and fixed in such a way that the ***Serv-Clip*** is not affected by any additional burdens, stress and tensions. Tubes are to be laid so as to be adequately stable in relation to the operational conditions and they are to be equipped with fixed points.

Then the part of the tube where the installation is to take place has to be cleaned and all paint and paint remains are to be removed. The tube should be smooth, clean and dry at this point.

Then the housing, consisting of two parts, is positioned on the tube. The four housing screws are now fastened firmly.

The last step is to turn the screw head to the right to the stop position, using a wrench (without extension). The screw head is then screwed back.

Thus, the connection has been made and the measuring point can be put to permanent use.

Tolerances of the outer diameter of the tube according to DIN 2391

Tube - ∅		Permitted Deviation
10 mm	3/8“	± 0.10 mm
12 – 30 mm	½“, 5/8“, ¾“, 1“	± 0.08 mm
35 – 38 mm	1 ¼“,1 ½“	± 0.15 mm
42 mm	-/-	± 0.20 mm

Tube recommendation for steel made Serv-Clips

Seamless drawn steel tubes made out of ST 35.4 material or pretreated basic material ST 37.4 according to DIN 1630 Condition when supplied NBA (normalizing, bright annealed) with outer tube diameter tolerances according to DIN 2391, maximum hardness: HRB 75. Construction dimensions of the Serv-Clip are adapted to the tubes and tolerances according to DIN 2391.

Pressure capacity

P_B 630 (9,100 psi) the indications with regard to pressure and safety are based on the installation according to this data leaflet

Working temperature

Steel: -40 to +120°C
O-Ring in Viton: -25 to + 200°C
The indicated temperature limits for sealing materials are guidelines as these temperature limits may be influenced considerably by the medium.

Clip Material	Temperature Range	Pressure Reduction
Steel	-40 to +120°C	---

Pressure reduction

Required pressure reduction due to the material in comparison to catalogue details in the case of increased or reduced temperatures.
If there are divergent definitions for permissible pressures, safety margins, temperatures and, if necessary, applicable pressure reductions due to standards, regulations or approvals for specific applications, the information provided by them is obligatory. Nominal pressures (P_N) and working pressures (P_E) detained in the catalogue are max. permissible working pressures including pressures peaks, whereby the temperature limits and pressure reductions detailed in the table above must be taken into consideration.
Functional safety under stationary load

Types with P_N indications: 4 times

Types with P_B indications: 2.5 times

Tested sample:	***Serv-Clip*** measuring clip
Tube diameter:	10 to 42 mm / 3/8" to 1-1/2"

Technical tests

Tube diameter:	10 to 42 mm / 3/8" to 1-1/2"
Installation method:	Direct installation
Liquid used in test:	Hydraulic oil Aero Shell Fluid 4

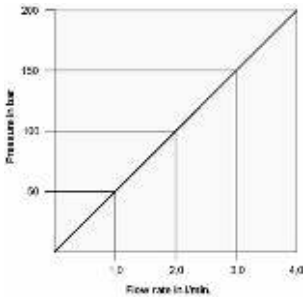
High pressure test

Stress:	Static
Test pressure:	2,400 bar (34,800 psi) No damages to the measuring clip could be detected.
Test result:	No leakages of the measuring clip could be detected.

Pulse pressure test

Stress:	Dynamic
Test frequency:	1 Hz
Impulse pressure:	400 bar (5,800 psi)
Cycles:	1 million
Test result:	After completion of this load alteration test neither damages to nor leakages of the measuring clip could be detected.

Flow rate



The flow rate measured applies to the series SC-1-A-.....and its value remains the same for all ***Serv-Clip*** sizes ranging from 10 to 42 mm / 3/8" to 1-1/2", as all types are equipped with the same interior parts and needle diameters.

The flow rate was measured at an oil temperature of 25°C.

The test medium is the hydraulic oil HLP 46, which means its viscosity is 46 mm2/s at 40°C.

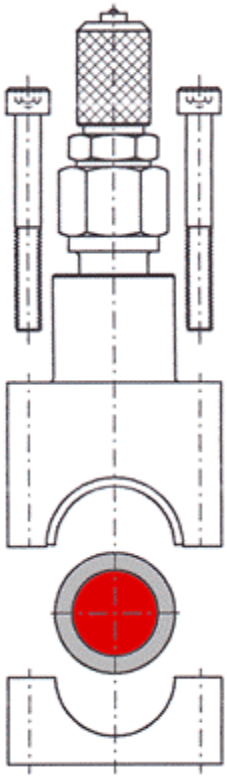
The measurement was taken by means of a measuring hose of 1 meter lengths featuring a M16x2 mm connection coupling.

Picture 1: Pressure measurement at a flow pickling line for grease oils with **Serv-Clip -1** and **pressure sensor DS-1-A**

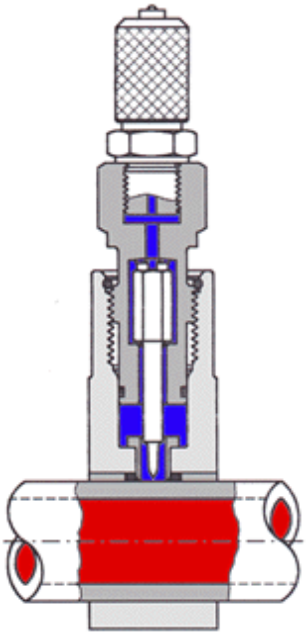
Picture 2: Pipe measuring point ***Serv-Clip -1*** with pressure sensor (threaded coupling G ¼")

Installation

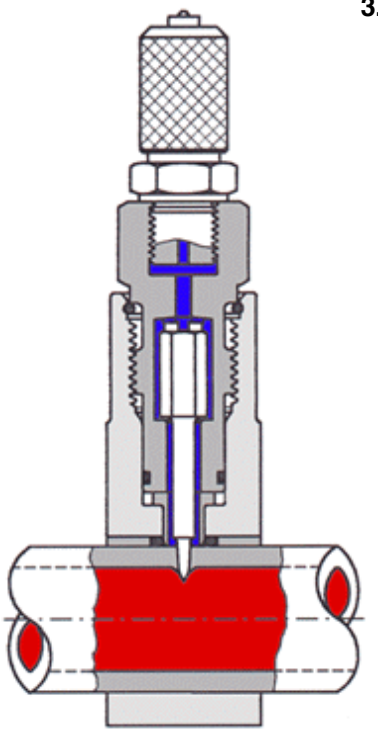
1. Place in position



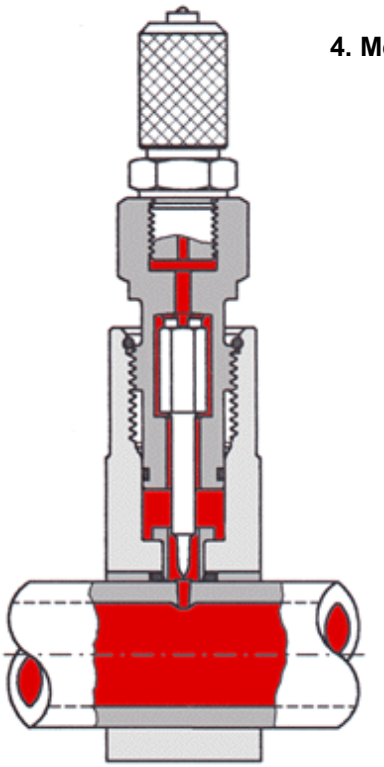
2. Screw down



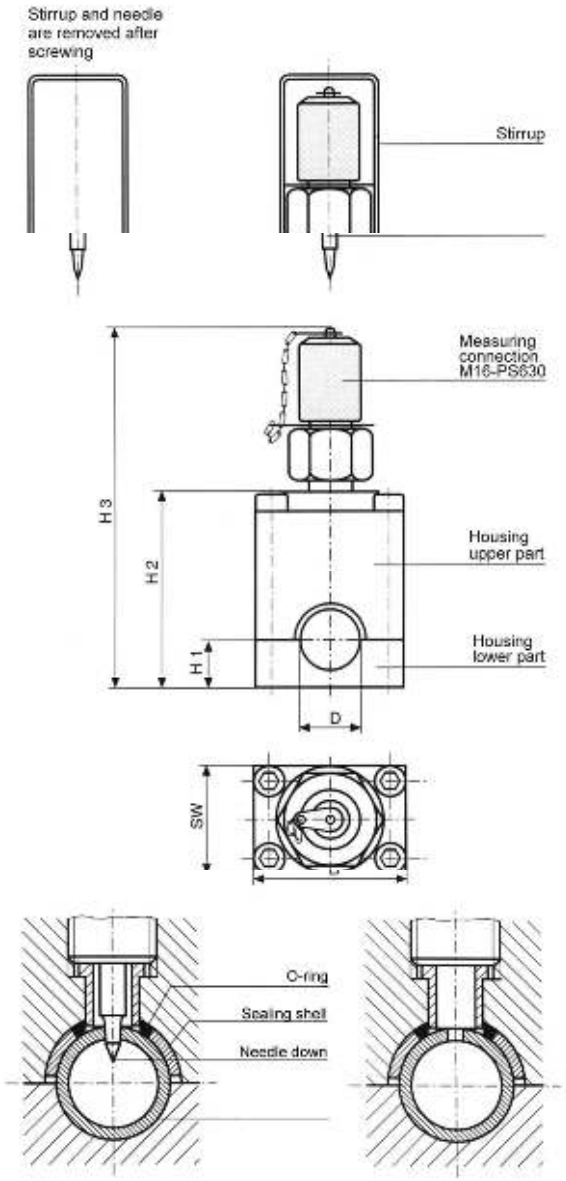
3. Insert



4. Measure



Serv-Clip® Type 2
Installation on non-pressurized pipes



- Quick and cheap installation of approx. 3 minutes with the help of an Allen wrench 6 mm and jaw wrench SW 22
- No need to cut pipes
- Minimized downtime -installation on non pressurized pipes
- No contamination of the fluid through swarfs
- Installation of gauges and sensors with screw3/8”
- Included valve M 16x2
- For use up to 630 bar (9100 psi) working pressure
- Particle measurement according to ISO or NAS classes
- ***Serv-Clip*** is registered trade mark of Serv-Clip USA LLC

Description

The patented measuring connector sc-2-A... has been developed for mounting to pressureless hydraulic tubes. Following installation, the measuring connector is capable of permanent use for a working pressure of 630 bar (9100 psi). The measuring connector sc-2-A... is supplied in a pre-assembled state with measuring connector and needle. Screwing in the measuring connector presses a special-shaped needle through the wall of the tube. Afterwards the measuring connector is screwed out and the needle removed along with the stirrup and a pressure disk. The measuring connector is now screwed back into the Serv-Clip. The measuring point is now sealed off and permanent pressure can be applied up to 630 bar (9100 psi).
This connection is quick and simple to make and is also reliable. The whole process takes only a few minutes to complete. No special tools are required for mounting the Serv-Clip.
The system is fully sealed off. Contamination of the hydraulic fluid is ruled out. The operating reliability of the system remains intact. The measuring point is now permanently available for measurements.

Materials

Housing	9SMnPb28k	Sealing shell	St 37.4
O-ring	Viton	Measuring-needle	58CrV4

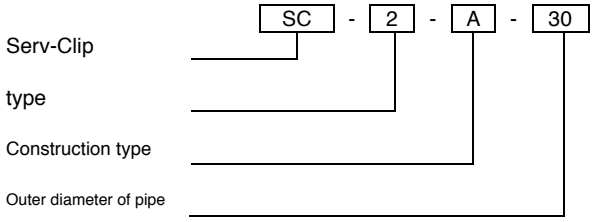
Dimensions

OD mm	Type mm (A)	H1	H2	H3	B	SW
10 - L + S	SC-2-A-10	15	49	94	40	30
12 - L + S	SC-2-A-12	15	50	95	40	30
14 - S	SC-2-A-14	15	51	96	40	30
15 - L	SC-2-A-15	15	51.5	96.5	40	30
16 - S	SC-2-A-16	15	52	97	40	30
18 - L	SC-2-A-18	15	53	98	40	30
20 - S	SC-2-A-20	20	59	104	50	30
22 - L	SC-2-A-22	20	60	105	50	30
25 - S	SC-2-A-25	20	61.5	106.5	50	30
28 - L	SC-2-A-28	20	63	108	50	30
30 - S	SC-2-A-30	30	74	119	65	30
35 - L	SC-2-A-35	30	76.5	121.5	65	30
38 - S	SC-2-A-38	30	78	123	65	30
42 - L	SC-2-A-42	30	80	125	65	30
OD inch	**Type Tube (T)**	**H1**	**H2**	**H3**	**B**	**SW**
3/8	SC-2-T-3/8	15	49	94	40	30
1/2	SC-2-T-1/2	15	50	95	40	30
5/8	SC-2-T-5/8	15	52	97	40	30
3/4	SC-2-T-3/4	20	58.5	103.5	50	30
1	SC-2-T-1"	20	62	107	50	30
1 1/4	SC-2-T-1 1/4"	30	75	120	65	30
1 1/2	SC-2-T-1 1/2"	30	78	123	65	30
2	SC-2-T-2"	30	23	138	90	30

Other diameters (ID) inches Pipe (P) available:
¼”, ⅜”, ½”, ¾”, 1”, 1 ¼”, 1½”, 2”, 2½”, 3”

Serv-Clip® Type 2
Installation on non-pressurized pipes

Order Code



Tube recommendations according to the manufacturer of screwing fittings

Series L	10 x 1.5 / 12 x 105	Series S	10 x 3.0 / 12 x 3.5
	15 x 2.0 / 18 x 2.0		14 x 4.0 / 16 x 3.0
	22 x 2.0 / 28 x 2.0		20 x 3.5 / 25 x 4.5
	35 x 2.0 / 42 x 3.0		30 x 4.0 / 38 x 5.0

Safety instructions

To ensure a correct and safe installation of the Serv-Clip, please read our separate leaflet 12.B with installation instructions and a chapter on safety referring to pressure measuring clips.

The measuring connector Serv-Clip is designed solely for use on technical fluid systems. The field of application covers tubelines with industrial oils such as hydraulic systems and lubricating-oil supply or cooling systems in a pressureless state when installing Serv-Clip 2.

Use in air and gas tubes is forbidden.

We reserve ourselves the right to modifications which are useful for any further technical development.

Installation of the *Serv-Clip*

Prior to installing, a check needs to be carried out to see whether the line is in the pressureless state. Afterwards check to see whether the proposed tubeline matches the outside diameter of the Serv-Clip that has been selected. Tubelines that are heavily corroded or appear unsound must not be used for installing a tube measuring connector.

Furthermore, it is a precondition that the tube system should be laid and fixed in such a way that the Serv-Clip is not affected by any additional burdens, stress and tensions. Tubes are to be laid so as to be adequately stable in relation to the operational conditions and they are to be equipped with fixed points.

Then the part of the tube where the installation is to take place has to be cleaned and all paint and paint remains are to be removed. The tube should be smooth, clean and dry at this point.

During the last operating, the screw-in head joint is turned in the clockwise direction as far as it will go using an open-jawed wrench (without extension). Afterwards the measuring connector is screwed out and the spring plug, needle and pressure disk removed. The measuring connector is then screwed back in and the measuring point is available for permanent use.

Tolerances of the outer diameter of the tube according to DIN 2391

Tube - ∅		Permitted Deviation
10 mm	3/8“	± 0.10 mm
12 – 30 mm	½“, 5/8“, ¾“, 1“	± 0.08 mm
35 – 38 mm	1 ¼“,1 ½“	± 0.15 mm
42 mm	-/-	± 0.20 mm

Tube recommendation for steel made Serv-Clips

Seamless drawn steel tubes made out of ST 35.4 material or pre-treated basic material ST 37.4 according to DIN 1630.
Condition when supplied NBA (normalizing, bright annealed) with outer tube diameter tolerances according to DIN 2391, maximum hardness: HRB 75. Construction dimensions of the Serv-Clip are adapted to the tubes and tolerances according to DIN 2391.

Pressure capacity

P_B 630 (9100 psi) the indications with regard to pressure and safety are based on the installation according to this data leaflet

Working temperature

Steel: -40 to +120°C
O-Ring in Viton: -25 to + 200°C
The indicated temperature limits for sealing materials are guidelines as these temperature limits may be influenced considerably by the medium.

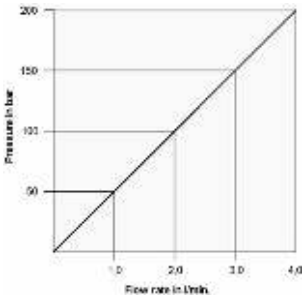
Clip Material	Temperature Range	Pressure Reduction
Steel	-40 to +120°C	---

Pressure reduction

Required pressure reduction due to the material in comparison to catalogue details in the case of increased or reduced temperatures.
If there are divergent definitions for permissible pressures, safety margins, temperatures and, if necessary, applicable pressure reductions due to standards, regulations or approvals for specific applications, the information provided by them is obligatory. Nominal pressures (PN) and working pressures (P_E) detained in the catalogue are max. permissible working pressures including pressures peaks, whereby the temperature limits and pressure reductions detailed in the table above must be taken into consideration.

Functional safety under stationary load
Types with P_N indications: 4 times
Types with P_B indications: 2.5 times

Flow rate



The flow rate measured applies to the series SC-1-A-....and its value remains the same for all ***Serv-Clip*** sizes ranging from 10 to 42 mm / 3/8" to 1-1/2", as all types are equipped with the same interior parts and needle diameters.

The flow rate was measured at an oil temperature of 25 °C.

The test medium is the hydraulic oil HLP 46, which means its viscosity is 46 mm2/s at 40 °C.

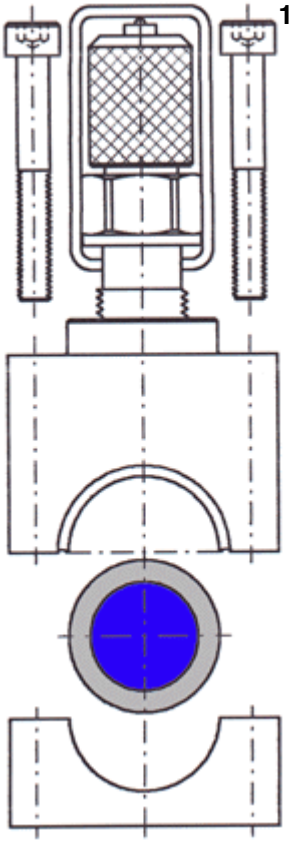
The measurement was taken by means of a measuring hose of 1 meter lengths featuring a M16x2 mm connection coupling.

Picture 5: Temperature or pressure sensor fluid-Check with ***Serv-Clip-2***

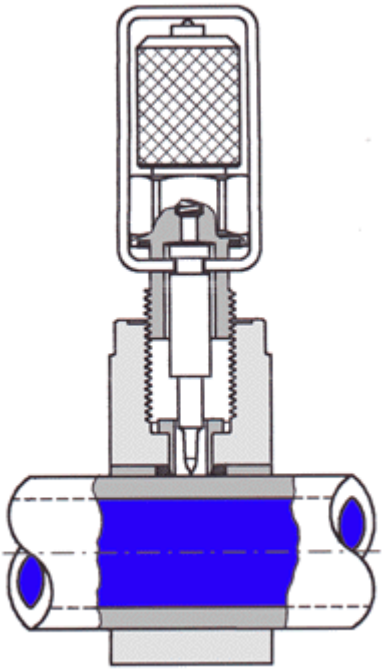
Picture 7: Installation comparison of conventional G-fitting and ***Serv-Clip -2***.
No need to cut open pipes -No more contamination
Installation in 3 minutes

Installation

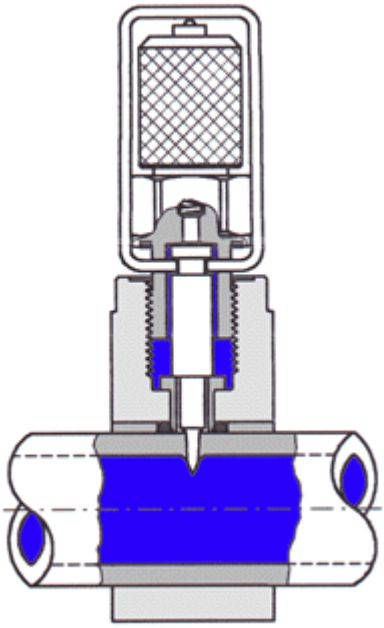
1. Place in position

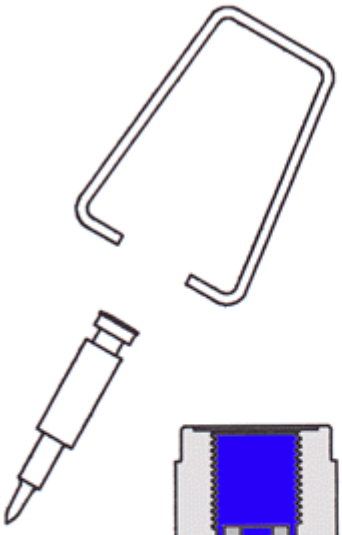


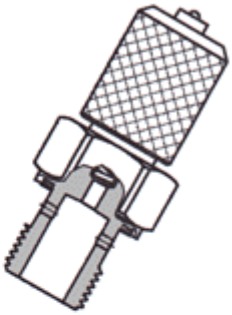
2. Screw down



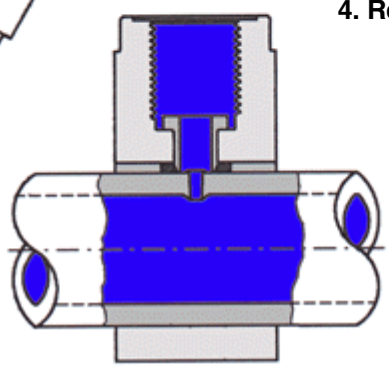
3. Insert



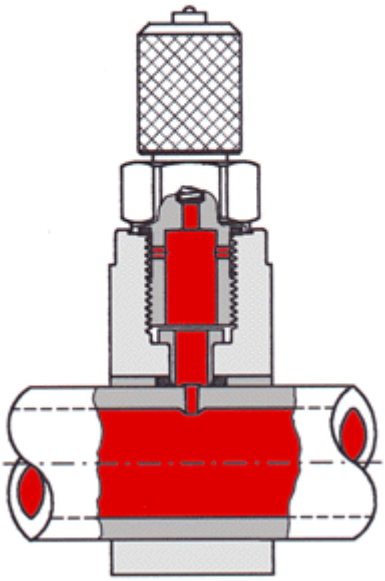




4. Remove needle and stirrup



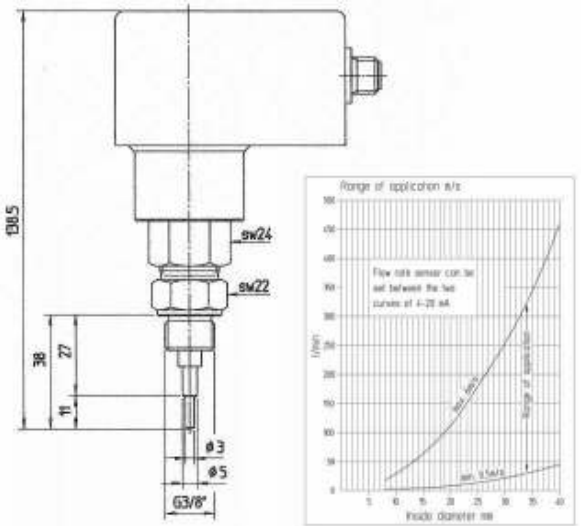
5. Measure

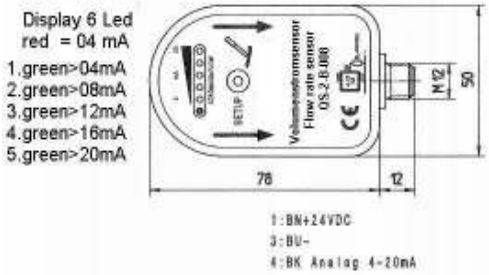


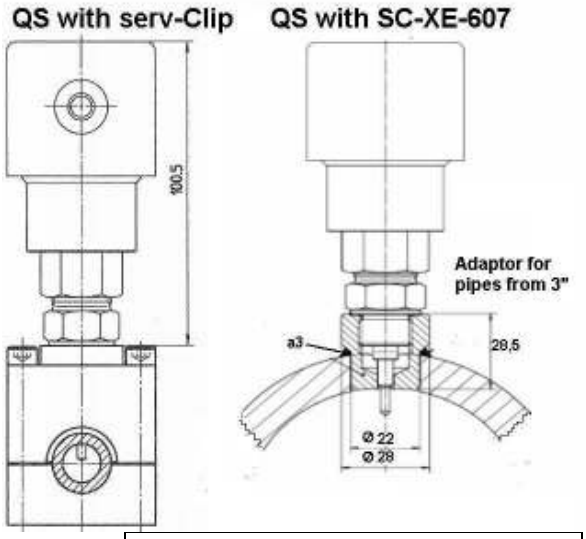
Picture 3: Leakage sensor with ***Serv-Clip -2*** for recognizing seal damages at cylinders of a reeling machine

Picture 4: Control of a lubrication oil line with flow rate sensors and ***Serv-Clip -2*** at a continuous pickling line.

Flow rate sensor QS for Serv-Clip® 2
- No need cutting pipelines -







RECOMMENDED MEASURING RANGES					
Range	**OD-Pipe in mm**	**Tube Inch (OD)**	**Pipe Inch (ID)**	**ID-Pipe in mm**	**Recommended Measuring range l/min**
001	12	-	-	8 - 10	0.5 - 38
002	14 - 15	1/2	1/4	11 - 12	0.7 - 52
003	16 - 18	5/8	3/8	12 - 14	0.9 - 75
004	20 - 22	3/4	1/2	15 - 17	1.4 - 110
005	25 - 28	1	3/4	19 - 22	2.2 - 190
006	30 - 35	1-1/4	1	23 - 29	4.0 - 320
007	38 - 42	1-1/2	1-1/4	30 - 36	6.0 - 500
008	-	-	-	-	Upon request

Calibration is adjusted only for a measuring range. Other measuring ranges are possible
For a quotation: Let us know (for the Serv-Clip) outer diameter and wall thickness of the pipeline in mm and (for calibration) wished quantity min/max in Liter/Minutes

For Hydraulic and gear oils

Flow rate sensor (up to 600 l/min):

- Monitoring flow rate and wear of pumps
- Operability of accumulators
- Filter transmittance
- Heat exchangers
- Nozzle flow rate
- Speed of hydraulic motors
- Lubrication lack of gears

Options: Stainless steel housing (QS-**1**-B-008) or
PBT housing (QS-**2**-B-008)
Leakages detection? Our solution LS Sensor (catalogue-page 16)
Mobile Measurement kit FM-1-B for sensors (catalogue-page 18)

Description

The flow rate sensor QS was developed for monitoring hydraulic systems. The installation takes few minutes with the help of the **pipe measuring point Serv-Clip® Type 2- no cutting pipes**. A screw driver 6 mm and a jaw wrench sw 22 will be needed for the installation only.
The flow rate sensor will be installed with the applicable pipe measuring point ***Serv-Clip®*** for **steel pipelines from 12 mm x 1.5 mm up to 5.5 mm wall thickness.** Exception: with 12x2 mm use no possible
For pipes from 3" (88.9 mm) and wall thickness from 6 mm can be used the welding adaptor SC-XE-607.
Serv-Clip Type 2 special needles for stainless steel pipelines up to 5.5 mm wall thickness can be provided upon request.
The measurement system is based on the **calorimetric principle**, which provides a direct measurement of the flow velocity in l/min rather than measuring the volume flow. It means sensor head has an intern thermo element and a heating (calorimetric principal). The running oil temperature will be measured. The sensor head temperature raises at 2°C. The time for this will be measured and the flow rate will be calculated. The needed time for measuring is 15 seconds. The measuring cycle takes 3 seconds.

Calibration service (please see chart of the left side)

For the ID-pipe with the wished measuring range from/to in l/min.
With your instructions for calibration you get a data sheet with curves mA in l/min.

Installation with Serv-Clip® 2 –no cutting pipes- no oil contamination

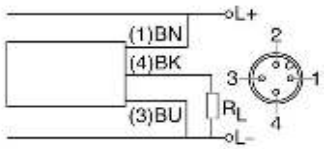
The patented measuring connector **sc-2-...** was developed for installation on pressureless hydraulic pipes. Installation takes few minutes no cutting pipes. After installation, the measuring connection can continuously be used, supporting operating pressures of up to 630 bar.
The measuring connection **sc-2-...** comes pre-mounted, including measurement coupling and needle, and is mounted as described in the corresponding installation instructions.
Now the flow rate sensor can be screwed into the ***Serv-Clip®*** . The measuring connection is completely tight and is ready for continuous use.
Using the ***Serv-Clip®*** **sc-2-...**, the flow rate sensor can be installed easily, quickly and safely even by non-technical staff. The whole process takes a few minutes only. No special tools are required for the installation of the ***Serv-Clip®*** and the **flow rate sensor**.
The system is completely tight, preventing any contamination of the hydraulic oil and ensuring sustained operational safety. The measuring connections are continuously available for measurement applications.

Specifications

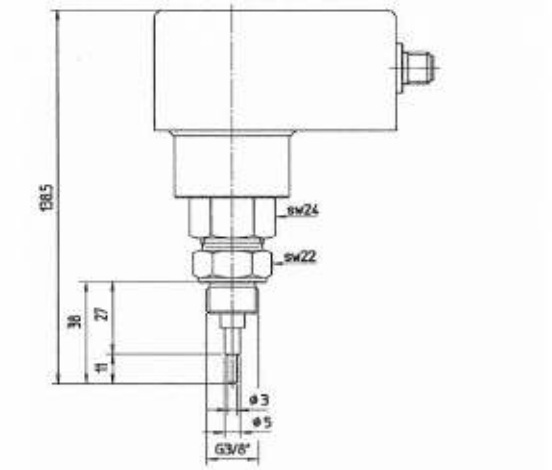
Measuring range	0.05 to 8 Meter/Second
Flow rate	up to 600 l/min, depending on ID
Pressure	630 bar (9100 psi)
Temperature	-20 to 80°C
Threaded coupling	G 3/8"
Accuracy	+/- 2% at 65°C
Output signal	4 to 20 mA (analogue)
Power supply	24 V DC +/- 10%; 150mA
Connection	M12 Universal system
Setting	Per Micro button
Display	6 LED lights
Protection mode	IP 65
Sensor head	stainless steel 1.4571
Housing options	Stainless steel or PBT

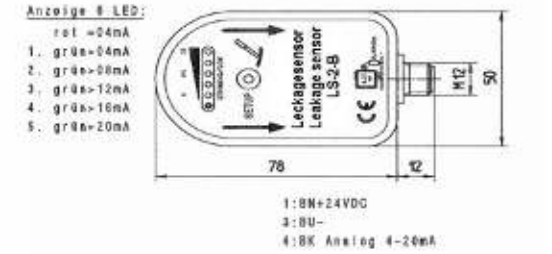
Example :
Choose the correct QS for 16 mm pipe-Ø
Type QS-1 or 2-B-**003**

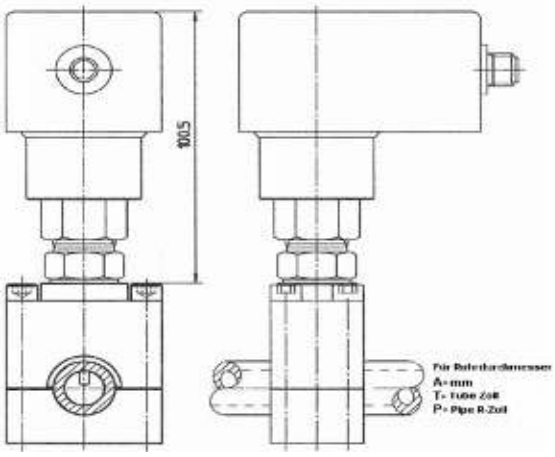
Flow rate › from 0.09 l/min by 4 mA
to 75 l/min by 20mA measurable



Leakage sensor LS for Serv-Clip® 2
- No need cutting pipelines







Leakage sensor types

Type Code	A mm	Tube Inch OD	Pipe Inch ID	Flow l/min
001	12	-	-	0.02-5
002	14-15	1/2	1/4	0.03-5
003	16-18	5/8	3/8	0.05-5
004	20-22	3/4	1/2	0.08-5
005	25-28	1	3/4	0.12-10
006	30-35	1-1/4	1	0.40-10
007	38-42	1-1/2	1-1/4	0.70-10

Calibration is adjusted only for a measuring range. Other measuring ranges are possible.

What can I measure? Hydraulic and gear oil
With the LS-2-B- leakage sensor (from 0.02 l/min):

Leakage
Sealing damages
Options: stainless steel housing (QS-**1**-B-…) or
PBT housing (QS-**2**-B-…)

Flow rate detection? (catalogue page 14)
Mobile measuring suitcase FM-1-B for sensors (catalogue page 18)

Description
The leakage sensor LS was developed for monitoring hydraulic systems recognizing and reporting very small leakage and sealing damages (from 0.02 l/min). The installation takes few minutes with the help of the **pipe measuring point Serv-Clip® Type 2- no cutting pipes**. A screw driver 6 mm and a jaw wrench sw 22 will be needed for the installation only. The flow rate sensor will be installed with the applicable pipe measuring point ***Serv-Clip®* Type 2** for **steel pipelines from 12 mm x 1.5 mm up to 5.5 mm wall thickness.** Exception: with12x2 mm use no possible.
Serv-Clip Type 2 special models for stainless steel pipelines up to 5.5 mm wall thickness can be provided upon request.
The measurement system is based on the **calorimetric principle**, which provides a direct measurement of the flow velocity in l/min rather than measuring the volume flow. It means sensor head has an intern thermo element and a heating (calorimetric principal). The running oil temperature will be measured. The sensor head temperature raises at 2°C. The time for this will be measured and the flow rate will be calculated. The needed time for measuring is 15 seconds. The measuring cycle takes 3 seconds.
Calibration service (please see chart of the left side)
For the ID-pipe with the wished measuring range from/to in l/min.
With your instructions for calibration you get a data sheet with curves mA in l/min.
How do I choose an LS?
Confirm the pipe outer diameter of the installation place (eg 16 mm). Select the type of the LS - see chart above (eg Type **003**). Determine switch-point 4-20 mA (eg 8.5 mA).
For the leakage sensor LS-1 or 2-B-**003** you need a ***Serv-Clip®*** SC-2-A-**16**.

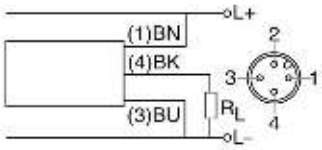
Installation with Serv-Clip® 2- No cutting pipes- no oil contamination
The patented measuring connector **sc-2-...** was developed for installation on pressureless hydraulic pipes. Installation takes few minutes only.
After installation, the measuring connection can continuously be used, supporting operating pressures of up to 630 bar.
The measuring connection **sc-2-...** comes pre-mounted, including measurement coupling and needle, and is mounted as described in the corresponding installation instructions.
To install the flow rate sensor, the created 2 mm hole must be widened. In the first step, the short needle of the measurement coupling is screwed down completely - without applying much force - until the stop is reached. Then it is unscrewed again. In the second step, the long needle is screwed down completely and unscrewed again, too.
Now the flow rate sensor can be screwed into the ***Serv-Clip®***. The measuring connection is completely tight and is ready for continuous use.
Using the ***Serv-Clip®* sc-2-...**, the flow rate sensor can be installed easily, quickly and safely even by non-technical staff. The whole process takes a few minutes only. No special tools are required for the installation of the ***Serv-Clip®*** and the **flow rate sensor**.
The system is completely tight, preventing any contamination of the hydraulic oil and ensuring sustained operational safety. The measuring connections are continuously available for measurement applications.

Specifications

Measuring range	0.05 to 8 Meter/Second
Leakage	from 0.02 L/min, depending on ID
Pressure	630 bar (9,100 psi)
Temperature	-20 to 80°C
Threaded coupling	G 3/8"
Accuracy	+/- 2% at 65°C
Output signal	4 to 20 mA (analogue)
Power supply	24 V DC +/- 10%; 150mA
Connection	M12 Universal system
Setting	Per Micro button
Display	6 LED lights
Protection mode	IP 65
Sensor head	stainless steel 1.4571
Housing options	Stainless steel **or** PBT

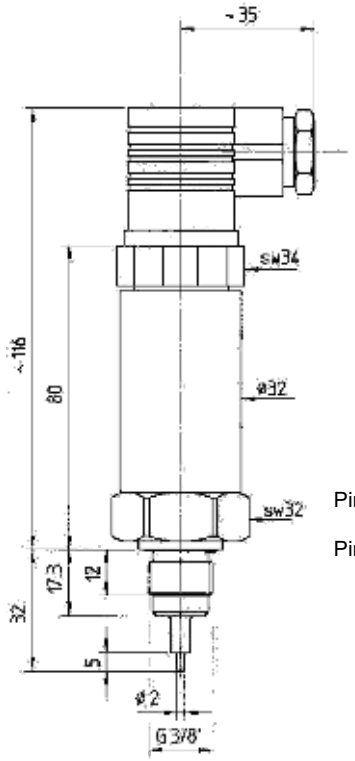
Example:
Choose the correct LS for 16 mm pipe-Ø
Type LS-1 or 2-B-**003**

Flow rate › from 0.05 l/min by 4 mA
to 5 l/min by 20mA measurable



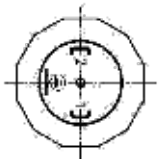
For a quotation: Let us know (for the Serv-Clip) the outer diameter and wall thickness of the pipeline in mm and (for calibration) wished quantity min/max in Liter/Minutes

Temperature sensor TS-1-A-120-3/8" for Serv-Clip® 2
- No need cutting pipelines -

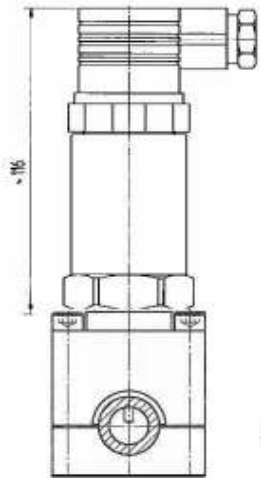


Pin 1=Out / GND

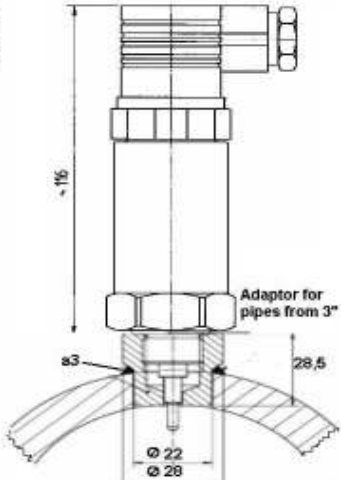
Pin 2=+Vcc



TS with Serv-Clip



TS with SC-XE-607



- **Temperature sensor: Type L thermocouple**
- **Temperature range: -30 to +120°C**
- **Output: 4 to 20 mA / 2 wires**
- **Protection mode: IP 65**
- **RIght-angle plug connection: DIN 43650A**
- **Robust stainless steel housing**

Description

In all industries, sheathed (mineral-insulated) thermocouples are increasingly used for temperature measurement applications.

Compared to other thermocouples and resistance thermometers, they respond to temperature changes more quickly and are smaller in size, which makes it possible to use them in constricted areas and places that are difficult to access. In addition, they are shock-resistant, pressure-resistant and excel by their long durability.

The temperature sensor **TS-1-A-120-3/8"** can be used for direct temperature measurements inside pipes such as hydraulic and lubricating oil pipes.

In addition to its robust and compact design, it stands out by its high accuracy and its extensive measurement range.
As a standard, the housing and all parts exposed to the liquid are made of stainless steel (Type 1.4571). Soft seals consist of Viton.

Typical fields of application include systems and plant engineering, automation, air conditioning and refrigeration.

Installation with Serv-Clip 2

The patented measuring connector **sc-2-...** was developed for installation on pressureless hydraulic pipes.
After installation, the measuring connection can continuously be used, supporting operating pressures of up to 630 bar.
The measuring connection **sc-2-...** comes pre-mounted, including measurement coupling and needle. By screwing the measurement coupling onto the pipe, a specially shaped needle is pressed through the pipe wall. Afterwards the measurement coupling is unscrewed again.
In the next step, the temperature sensor can be screwed into the ***Serv-Clip***. The measuring connection is completely tight and is ready for continuous use.

Using the ***Serv-Clip® sc-2-...***, the temperature sensor can be installed easily, quickly and safely even by non-technical staff. The whole process takes a few minutes only. No special tools are required for the installation of the ***Serv-Clip*** and the temperature sensor.
The system is completely tight, preventing any contamination of the hydraulic oil and ensuring sustained operational safety. The measuring connections are continuously available for measurement applications.

Installation with welding adaptor SC-XE-607
For pipes from 3" (88.9 mm) and wall thickness from 6 mm can be used the welding adaptor SC-XE-607.

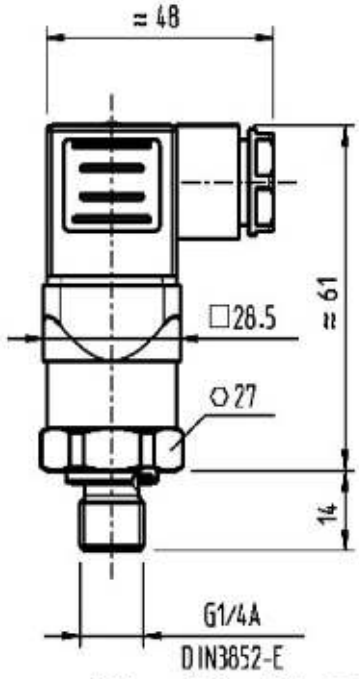
Special needle (Art. 501-041-02) for Serv-Clip for installation on stainless steel pipes up to 5.5 mm wall thickness can be provided.

Specifications

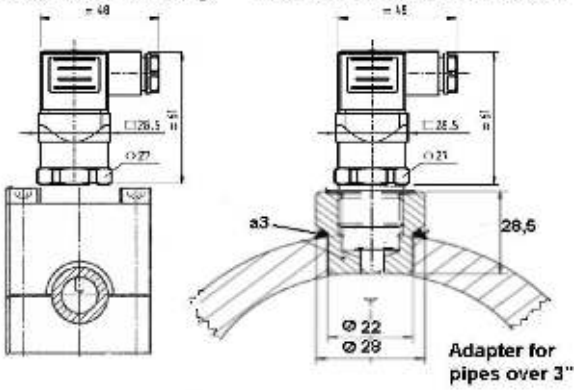
Temperature range	-30 to +120°C
Accuracy	+/- 2 K
Repeatability	Better than 1 K
Pressure range	Up to PB 630 bar
Output signal	4 to 20 mA
Power supply	15 to 30 V DC, protected against reverse connection
Configuration	2 wires
Protection mode	IP 65
Linearity	0.2 % typ. / max. 0.5 %
Threaded coupling	G 3/8" male
Electrical connection	Right-angle plug connection Type DIN 43650 A

Pressure sensor DS-1-A-400-1/4” or 3/8” for Serv-Clip® 2

-No need cutting pipes-



DS with serv-Clip **DS with SC-XE-607**



Electric connection
EN 175301-803A

Pin 1 = Out / GND
Pin 2 = OV

- Measurement range 0 to 400 bar
- Output 4 to 20 mA / 2 wires
- Operating temperature –30 to 100°C
- Protection mode IP 65
- Right-angle plug connection DIN EN 175301-803A
- Robust stainless steel housing
- Fully encased sensor element made of stainless steel

Description

The piezo-resistive pressure sensor DS-1-A-400- ... was developed for a wide range of general measurement applications in the field of industrial hydraulics.
Typical applications include systems and plant engineering, automation, air conditioning, and refrigeration.
In addition to its robust and compact design, it stands out by its high accuracy and its extensive measurement range.
As a standard, the housing and all parts exposed to the liquid are made of stainless steel (Type 1.4571).
The standard connection is G1/4“, with soft seals made of NBR

Installation with Serv-Clip 1

Before mounting the measurement connector sc-1..., the standard measurement coupling is replaced by the pressure sensor.
The patented measuring connector is simply screwed onto the pressurized pipe (after cleaning the pipe surface) without having to interrupt the operation of the system.

Installation with Serv-Clip 2

The patented measuring connector sc-2-... was developed for installation on pressureless hydraulic pipes. After installation, the measuring connection can continuously be used, supporting operating pressures of up to 630 bar.
The measuring connection sc-2-... comes pre-mounted, including measurement coupling and needle. By screwing the measurement coupling onto the pipe, a specially shaped needle is pressed through the pipe wall. Afterwards the measurement coupling is unscrewed again. The measuring connection is completely tight and is ready for continuous use

Using the Serv-Clips sc-1-... and sc-2-..., the pressure sensor can be installed easily, quickly and safely even by non-technical staff. The whole process takes a few minutes only. No special tools are required for the installation of the Serv-Clips.

The system is completely tight, preventing any contamination of the hydraulic oil and ensuring sustained operational safety. The measuring connections are continuously available for measurement applications.

Installation with welding adaptor SC-XE-607
For pipes from 3” (88.9 mm) and wall thickness from 6 mm can be used the welding adaptor SC-XE-607.

Installation with Serv-Clip on stainless steel pipes up to 5.5 mm wall thickness with special needle for Serv-Clip (Part Nr. 501-040-02 for Type 1) and (Part Nr. 501-041-02 for Type 2) upon request.

Specifications

Pressure range	0 to 400 bar, against 1 bar
Overpressure	600 bar
Output signal	4 to 20 mA
Power supply	8 to 30V DC
Operating temperature	-30 to 100°C
Ambient temperature	-30 to 100°C
Configuration	2 wires
Protection mode	IP 65 DIN EN 175301-803A
Accuracy	1.0%
No-Linearity	0.5% BFSL
Pressure connection	G1/4” male / G3/8“ male

Mobile Measurement kit FM-1-B in suitcase for:

- **Flow rate sensors**
- **Leakage sensors**
- **Temperature sensors**
- **Pressure sensors**

Mobile Measurement kit FM-1-B with multi-propose display AX 345 (1 input)

Examples for:

Fixed displacement pumps	Pumping capacity
Variable capacity pumps	Percentage of leak oil
Oil coolers	Flow characteristics
Water coolers	Leak oil
Differential cylinders	Sealing damages
Synchronous cylinders	Moving speed
Plunger cylinders	Moving speed
Oil motors	Leak oil
Pressure accumulators	Bladder control
	Charging behaviour
	Nitrogen charge

Technical Data:

- Switch cabinet with multi-purpose display with one analogue input, 4 to 20 mA and scaling facility.
- Suitable for display of input channel A or input channel B as well as the sum A+B, the differential A-B or the ratio A:B.
- Display range +/- 4 1/2 decades at 15 mm size.
- Power supply 115 / 230 VAC or 18 – 30 VDC
- Setup of zero and full scale by means of two front keys and menu support.
  Selectable linearization functions

Multi-propose display AX 345
For sensors. Separate unit without switch cabinet with 2 inputs.
Available upon request.

Included:

- Power cord 230V AC
- Connecting cable with plug M12 connector for kit and sensors
- Suitcase made of plastic (black/blue) Outer dimension 340 x 275 x 84 mm
- Technicaldocumentation and operating instructions

Ordering instructions

Description	Type	Photo
Flow rate sensor suitable for Serv-Clip Type 2 + calibration service	QS-1-B-… Housing in Stainless steel	
Leakage sensor suitable for Serv-Clip Type 2 + calibration service	LS-1-B-… Housing in Stainless steel	
Flow rate sensor suitable for Serv-Clip Type 2 + calibration service	QS-2-B-… Housing in PBT (plastic)	
Leakage sensor suitable for Serv-Clip Type 2 + calibration service	LS-2-B-… Housing in PBT (plastic)	
Temperature sensor suitable for Serv-Clip Type 2	TS-1-A-120-3/8”	
Pressure sensor suitable for Serv-Clip Type 1	DS-1-A-400-1/4”	
Pressure sensor suitable for Serv-Clip Type 2	DS-1-A-400-3/8”	
Mobile measuring kit in suitcase for: QS; LS, TS, DS sensors	FM-1-B-008 with AX 345 analogue (input for one sensor)	

SYSTEM COMPONENTS

Serv Clip Diagnostic Connectors

For all pipe Ø
from 10-42 mm
3/8"-2" Tube (external Ø)
1/4"-3" Pipe (internal Ø)

serv-Clip 1
for mounting on pressurized pipes

Pressure Sensor

Combinated with

Suitcase with mobile measuring system
FM-1-B for Q,L,P,T Sensor

serv-Clip 2
for mounting on non-pressurized pipes

Temperature Sensor | Pressure Sensor | Flow rate and Leakage Sensor

Combinated with

For mounting on pipe

Tube connection

serv-Clip provides the basis for

The sensor monitoring and diagnostic system is equipped with a touch-screen based symbol display and ensures optimized maintenance of systems when combined with serv-Clip.