The importance of flow measurement

Plant safety, constant product quality, process optimization, environmental protection and energy conservation are some of the reasons why flow measurement is becoming increasingly important in industrial instrumentation.

SUTO provides practical, state-of-the-art, high-quality thermal mass flow meters for gas flow applications such as

- Compressed air flow and distribution
- Airflow and distribution of process gases like Carbon dioxide, Argon, Nitrogen, Oxygen
- Explosive gases like Natural gas, Hydrogen, Bio gas
- Corrosive gases like Bio gas
- Fuel and air supply to burners, boilers, industrial furnaces
- Air flow in chillers
- Dosing and gas injection control

Basically any gas mixture can be measured as long the mixing ratio and its components are known and constant.

In the modern factory instrumentation needs to provide interfaces to factory automation systems. SUTO flowmeters not only support the traditional 4-20 mA outputs and pulse outputs, but also fieldbus interface for HART, Modbus and M-Bus. Since the meters are based on a modular design other fieldbus can be easily adopted.

Flow meters are used in almost all industries

- Chemicals and petrochemicals
- Petroleum (oil and gas)
- Fueling with gas
- Pharmaceuticals
- Food production
- Breweries
- Dairies
- Power plants
- Shipbuilding
- Automotive
- Mining
- Textile

S 401/421 THERMAL MASS FLOW SENSORS

S 401 insertion type sensor where easy installation and flexibility is required

Common Features S 401 / 421

- Measures standard flow, mass flow, consumption and temperature
- Thermal mass flow, independent of pressure and temperature changes
- IP65 casing provides robust protection in rough industrial environment
- Very fast response time
- High accuracy and wide measuring range
- Isolated mA and pulse output signals or Modbus RTU interface
- Selectable gas type (some gases require real gas calibration!)
- App for mobile phones and tablets for wireless sensor settings
- Sensor can be calibrated in 2 different gases

Features S 401

- Tube diameters of DN25 to DN500.
- 2 installation types: center installation and 100 mm insertion depth installation for bigger pipes (> DN250)
- Installation under pressure through 1/2" ball valve

Features S 421

- Pipes sizes available: DN15, DN20, DN32, DN40, DN50, DN65, DN80
- Process connections available: R thread, flange EN1092-1, ANSI/B16.5
- Exchangeable sensor unit (easy sensor swap)

Optional color graphic display for online values and sensor settings, consumption can have up to 1,999,999,999

S 421 inline type where high accuracy is priority

Volumetric flow ranges S 401

Inch	DN	Di (mm)	S 401-S (m^3/h)	S 401-M (m^3/h)	S 401-H (m^3/h)
1″	DN25	27.3	0.5 ... 147.7	0.6 ... 294.7	0.6 ... 356.9
1¼″	DN32	36.0	0.9 ... 266.3	1.2 ... 531.5	1.2 ... 643.5
1½″	DN40	41.9	1.2 ... 366.7	1.5 ... 731.9	1.5 ... 886.2
2″	DN50	53.1	2.0 ... 600.1	2.5 ... 1197.6	3.0 ... 1450.0
2½″	DN65	68.9	3.5 ... 1026.5	5.0 ... 2048.6	5.0 ... 2480.4
3″	DN80	80.9	5.0 ... 1424.4	7.0 ... 2842.7	7.0 ... 3441.9
4″	DN100	100.0	10 ... 2183.3	12 ... 4357.2	12.0 ... 5275.7
5″	DN125	125.0	13 ... 3419.6	18 ... 6824.4	18.0 ... 8263.1
6″	DN150	150.0	18 ... 4930.1	25 ... 9838.9	25.0 ... 11913.1
8″	DN200	200.0	26 ... 8785.6	33 ... 17533.3	42.0 ... 21229.5
10″	DN250	250.0	40 ... 13743.9	52 ... 27428.5	60.0 ... 33210.7
12″	DN300	300.0	60 ... 19814.8	80 ... 39544.1	100.0 ... 47880.4

The table shows flow ranges up to 300 mm pipe diameter at standard conditions in air. Other standard conditions and gases flow ranges are available on request.
In larger pipe diameters flow can also be measured.

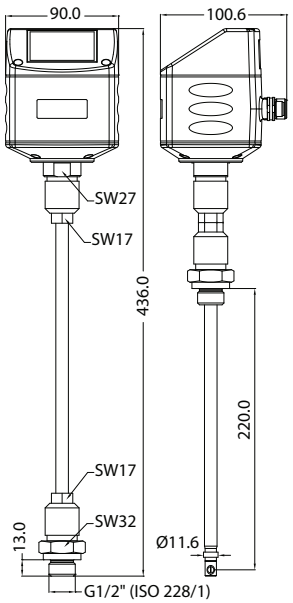
Volumetric flow ranges S 421

Inch	DN	Measuring range from to
½″	DN15	0.5 ... 90 m^3/h
¾″	DN20	0.9 ... 170 m^3/h
1	DN25	1.5 ... 290 m^3/h
1¼″	DN32	2 ... 500 m^3/h
1½″	DN40	3 ... 700 m^3/h
2″	DN50	4 ... 1000 m^3/h
2½″	DN65	6 ... 1500 m^3/h
3″	DN80	8 ... 2500 m^3/h

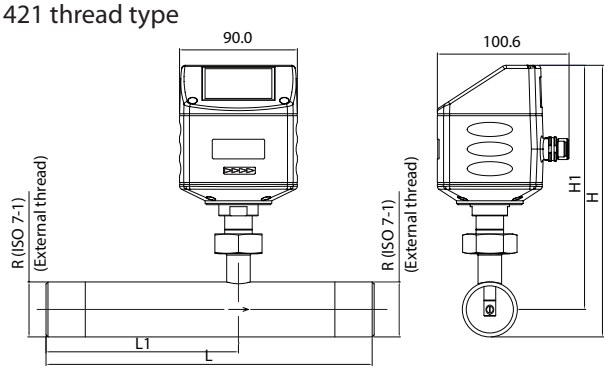
Stated flow values are at standard conditions of Ps = 0.1MPa(a) and Ts = 20°C with medium air.

Technical data S 401/421	
Accuracy	1.5% of reading + 0.3% full scale
	Optional 1% of reading
Repeatability	0.25% of reading
Sampling rate	> 10 samples / sec
Reference conditions	Can be set by user. Standard conditions are Ps = 0.1 MPa and Ts = 20°C
Operating temperature	-30°C ... +140°C fluid temperature -30°C ... +70°C casing -10°C ... +50°C casing with display
Operating pressure	S 401: 0 ... 5.0 MPa (>1.6 MPa need installation device) S 421: 0 ... 1.6 MPa (Optional: 4.0 MPa)
Analogue output	Signal: 4 ... 20 mA, isolated Scaling: 0 ... max flow Max load: 250R
Pulse output	Signal: Isolated switch output, normally open, Max 30 VDC, 20 mA Scaling: 1 pulse per consumption unit
Modbus RTU	Isolated RS-485 with Modbus RTU protocol
Power supply	15 ... 30 VDC / 200 mA
Wetted material	Stainless steel 1.4404 (SUS 316L)

S 401

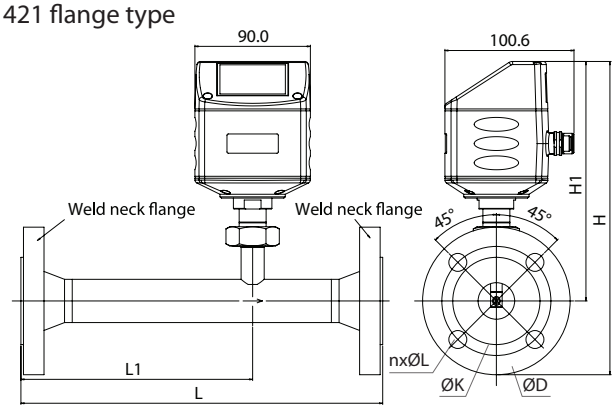


S 421 thread type



Pipe nominal size inch / (DN)	L total length (mm)	L1 total length (mm)	H total height (mm)	H1 from pipecenter to casing top (mm)	R External Thread
½"(DN15)	300	210	197.4	186.7	R½"
¾"(DN20)	475	275	200.2	186.7	R¾"
1"(DN25)	475	275	203.6	186.7	R1"
1¼"(DN32)	475	275	207.9	186.7	R1¼"
1½"(DN40)	475	275	210.9	186.7	R1½"
2"(DN50)	475	275	216.9	186.7	R2"

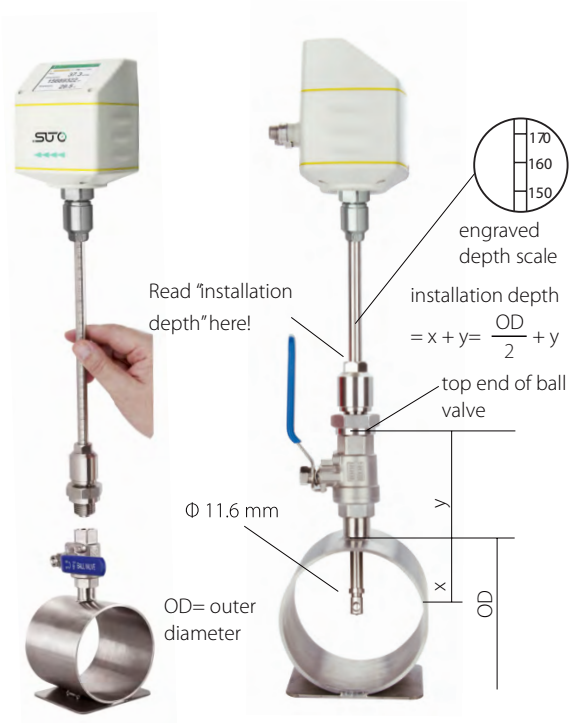
S 421 flange type



Pipe nominalsize inch / (DN)	L total length (mm)	L1 total length (mm)	H total height (mm)	H1 from pipecenter to casing top (mm)
½"(DN15)	300	210	234.2	186.7
¾"(DN20)	475	275	239.2	186.7
1"(DN25)	475	275	244.2	186.7
1¼"(DN32)	475	275	256.7	186.7
1½"(DN40)	475	275	261.7	186.7
2"(DN50)	475	275	269.2	186.7
2½"(DN65)	475	275	287.1	194.6
3"(DN80)	475	275	301.0	201.0

S 401/421 THERMAL MASS FLOW SENSORS

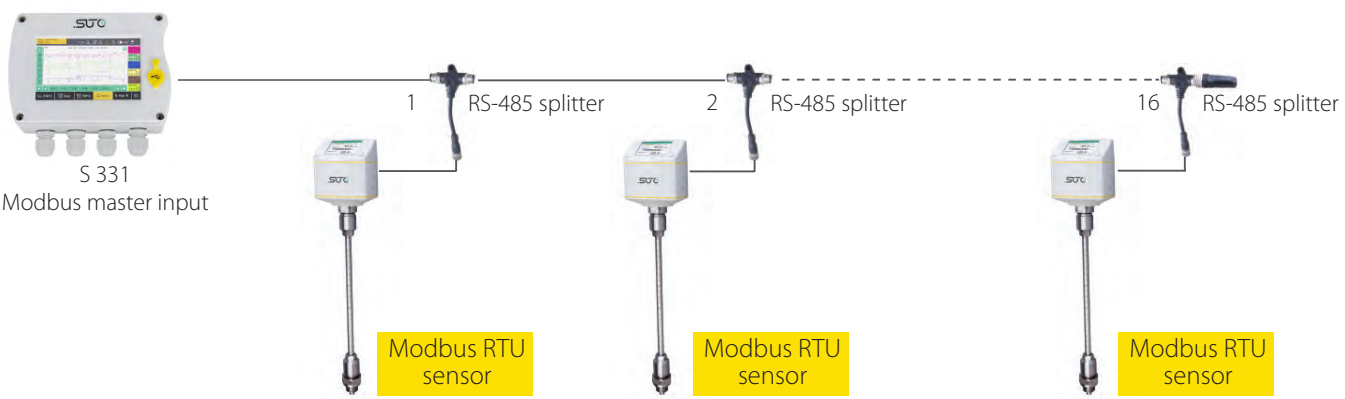
S 401 Installation



Removal of sensor unit S 421

Sensor configuration through wireless connection

Modbus connection of several sensors to a display unit



Order form

S 401/ S 421	Process connection	Size	Gas 1	Gas 2	Range	Calibration	Output	Display	Description
S695 4100									S 401, flow sensor, insertion type, 220 mm shaft
S695 4101									S 401, flow sensor, insertion type, 300 mm shaft
S695 4102									S 401, flow sensor, insertion type, 400 mm shaft
S695 4103									S 401, flow sensor, insertion type, 160 mm shaft
S695 4120									S 421, flow sensor, inline type
S695 4121									S 421, inline type flow sensor, 4 MPa version
S 401									
Standard	A								G ½",
A1006	B								PT ½" adapter
A1005	C								NPT ½" adapter
S 421									
A130X	A								R thread (ISO-7-1)
A132X	B								Flange, EN 1092-1, PN40
A134X	C								Flange ANSI 16.5
		1							DN15
		2							DN20
		3							DN25
		4							DN32
		5							DN40
		6							DN50
		7							DN65
		8							DN80
			A						Medium Air
A1008			B	B					Medium CO_2
A1009			C	C					Medium O_2 (oil & grease free cleaned)
A1010			D	D					Medium N_2
A1011			E	E					Medium N_2O
A1012			F	F					Medium Ar
A1013			G	G					Medium Natural gas (exact gas mix required)
A1014			H	H					Medium H_2
A1015			I	I					Others (please specify the gas or gas mix)
A1016			J	J					Medium He
A1017			K	K					Medium Propane C_3H_8
				Z					No 2nd gas
					A				Standard range
A1401					B				Max range (S 401 only)
A1402					C				High speed (S 401 only)
A1403					D				Low range calibration (1/3 of standard range)
A1404					E				High accuracy calibration (1% ± 0.3%FS)
						A			Standard calibration
A1405						C			Bi-directional calibration (S 401 only)
A1410							A		4 ... 20 mA + pulse
A1411							B		Modbus
A1413							C		4 ... 20 mA + pulse, compatible to S 400
								A	Without display
A1420								B	With display

Attention:

- R thread is only available from DN15 ... DN50
- Order number for connection and size of the inline type is combineed! Example: A1322 = Flange EN 1092-1, DN20

S 415/418 THERMAL MASS FLOW METER

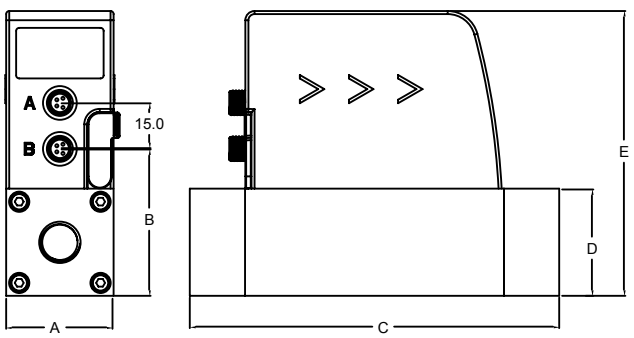
S 415 as DN8 or DN15 version

S 418 as DN20 or DN25 version

The SUTO S 415 and S 418 thermal mass flow meters offer gas flow and consumption measurement directly at the point of use. These highly economical units will help you improve system efficiency, while helping reduce compressed air usage and operating costs. Both versions come standard with Service App to help the user quickly and easily check the flow meter readings or adjust the settings via the SUTO flow meter App.

The S 415 is best suited to general process work where low cost and broad monitoring is required, while the S 418 is ideal for remote locations or high accuracy with its built in data logger and optional pressure sensing.

Dimensions



Dimensions in mm	A	B	C	D	E
DN8/DN15	35.0	48.0	120.4	35.0	93.0
DN20/DN25	48.0	61.0	178.0	48.0	106.0

Features / Benefits

- Thermal mass flow measurement, independent of pressure and temperature
- Eco Version S 415, Pro Version S 418
- Service App for setup and configuration
- Accuracy of 1.5% o. RDG (S 418) and 3% o. RDG (S 415)
- Output signal options:
  - analogue 4 ... 20 mA and pulse
  - digital Modbus
  - digital M-Bus
- Simple installation, no straight pipe required
- Measures the full flow, no bypass measurement
- 4-Digit LED display
- Available in DN8, DN15, DN20, DN25 process connection G inner thread
- S 418 comes standard with integrated data logger
- Optional pressure measurement available for S 418

Technical data	S 415	S 418
Measuring ranges	See separate table	
Accuracy	3% of reading	1.5% of reading
Turndown ratio	50:1	100:1
Pressure range	0 ... 1.0 MPa	
Power supply	18 ... 30 VDC / 120 mA	
Measured gas	Air, N_2	Non-corrosive gases, up to 2 calibrated gases
Ambient conditions	0°C ... 50°C	
Transport Temp.	-30°C ... +70°C	
Response time	T_{90} = 1 sec	T_{90} = 0.1 sec
Output signal (only 1 of it)	- 4 ... 20 mA and pulse, isolated - RS-485 (Modbus RTU)	
Interface	Wireless for Service App or USB for logger read out (S 418 only)	
Casing	Process connection: aluminum alloy Wetted parts: aluminum alloy Top casing: PC + ABS	
Classification	IP54	
Electrical connection	2 x M8, 4 poles	
Process connection	G inner thread, ISO 228-1: DN8, DN15, DN20, DN25	
Approvals	CE, RoHS	

Extra technical data S 418		
Data logger	Size: Channels: Sampling rate:	10,000,000 samples up to 3 channels 1 sec ... 1 h
Pressure option	Range: Accuracy:	0 ... 1.0 MPa 1 % F.S.

Measuring range [sl/min]				
	DN8	DN15	DN20	DN25
Size	0	1	2	3
Standard range (S)	250	1000	2000	3500
Low range (L)	50	200	400	700

Stated measuring ranges under following conditions:

- Standard flow in air
- Reference pressure: 1000 hPa
- Reference temperature: 20°C

Gas table	
	Gas type
A	Air
B	CO_2
C	O_2 (oil & grease free)
D	N_2
E	N_2O
F	Ar
G	Natural gas (mix ratio)
H	H_2 (real gas calibration)
I	Other gas (specify)
J	He (real gas calibration)
K	C_3H_8
Z	No gas

Sensors are calibrated in air. On request calibration can be performed in other gases.

S 415 order table (air and N2 only)				
Order no.	Size	Range	Output	Description
S695 415				S 415, thermal mass flow meter, 3% o. RDG., 24 VDC, cable: 5m, M8 and open ends
	0 1 2 3			DN8 G inner thread DN15 G inner thread DN20 G inner thread DN25 G inner thread
		S		Standard range version of S 415
A1453		L		Low range version of S 415
A1450			A	Analogue 4 ... 20 mA, pulse
A1451			B	Digital Modbus RTU
A1452			C	Digital M-Bus
A1458				S 415 with imperial units instead of SI units

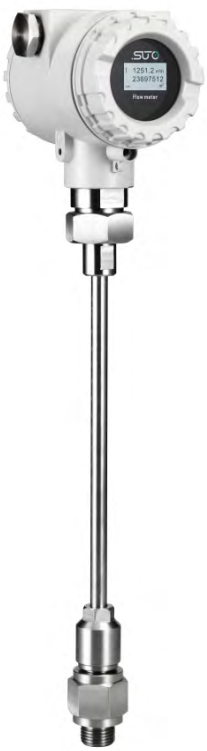
Example: S695 4152-SB: S 415, DN20, range 2000 l in Air, Modbus interface

S 418 order table						
Order no.	Size	Range	Output	Gas 1	Gas 2	Description
S695 418						S 418, thermal mass flow meter, data logger, 1.5% o. RDG, 24 VDC, cable: 5m, M8 and open ends
	0 1 2 3 5 6 7 8					DN8 G thread DN15 G thread DN20 G thread DN25 G thread DN8 G thread, pressure sensor 10 barg, 1 % F.S. DN15 G thread, pressure sensor 10 barg, 1 % F.S. DN20 G thread, pressure sensor 10 barg, 1 % F.S. DN25 G thread, pressure sensor 10 barg, 1 % F.S.
		S				Standard range version of S 418
A1453		L				Low range version of S 418
A1455			A			Analogue 4 ... 20 mA, pulse
A1456			B			Digital Modbus RTU
A1457			C			Digital M-Bus
				A-K	B-Z	See gas table above
A1459						S 418 with imperial units instead of SI units

Example: S695 4185-SAAF: S 418, DN8 with pressure sensor, range 250 l in Air, Analog and pulse output, gas 1 = Air, gas 2 = Argon

S 415/ S 418 accessories	
Order no.	Description
A554 3315	T-BOX for S 415/418 Modbus/M-Bus systems, including 2 m cable with M8 connector
A554 0109	Mains power supply 100-240 VAC / 24 VDC, 0.5 A, 2 m cable with M8 connector
A553 0137	Connection cable S415/418 to S 551, 5 m

S 450/452 HEAVY DUTY INDUSTRY FLOW/CONSUMPTION SENSOR



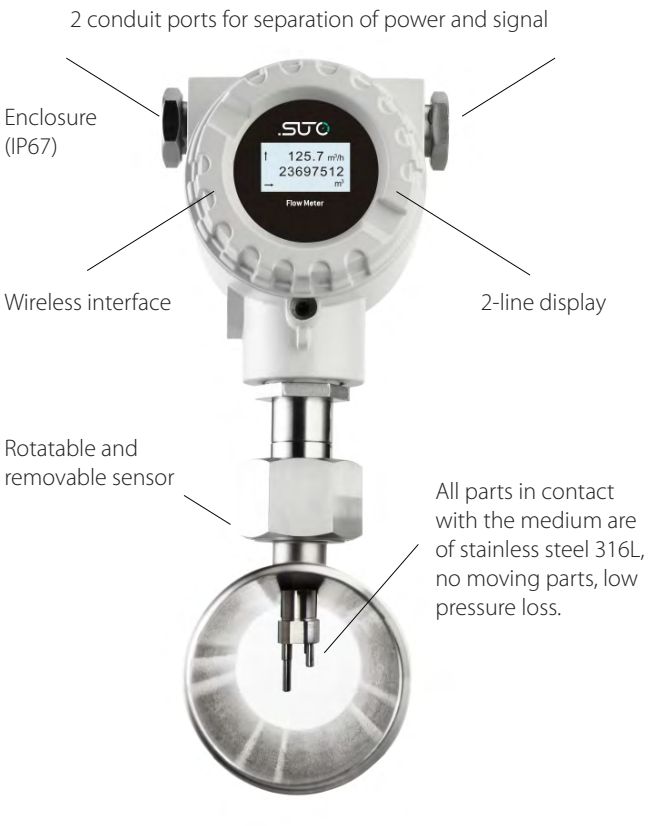
Features

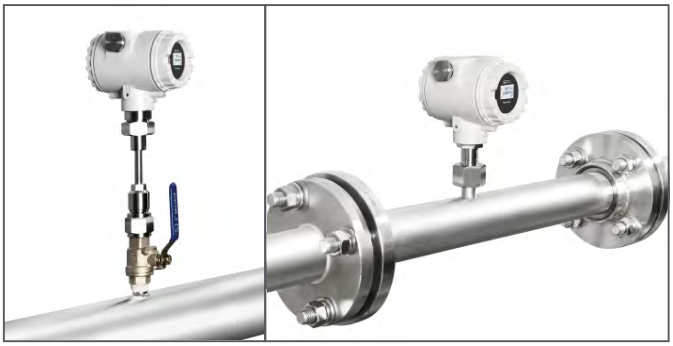
- Direct measurement of mass flow and standard flow without the need of pressure compensation
- Wide range of tube sizes are supported with insertion type for big pipe diameters and in line types for small pipe diameters
- No moving parts, non clogging
- All parts which come into contact with the measurement medium are made of stainless steel 316L
- Robust metal enclosure suitable for out-door applications in harsh environment
- Wireless interface for sensor settings on site
- Display showing flow rates, consumption, medium temperature and diagnostic results
- 2 analogue outputs (4-20 mA) and 1 pulse output
- Available options:
  - Fieldbus interface: HART, Modbus
  - Hazardous approval ATEX: II 2 G Ex d IIC T4
    IECEx approval
    GB Ex approval
  - Bi-directional measurement
  - Flow conditioning

The SUTO flow sensor S 450 is based on the thermal mass flow principle. It measures volumetric standard flow over a wide measuring range. The result is pressure and temperature independent.

The S 450 is designed specifically for harsh environments. The IP67 casing allows all-weather applications. All parts which come into contact with the measurement medium are made of stainless steel 316L. This allows applications in pharmaceutical and food industry, but also the measurement of corrosive and contaminated gas. Installations in explosive environments can be done through the optional ATEX approval. Various gases can be measured such as air, oxygen, argon, carbon dioxyde, natural gas, hydrogen, methane, etc.. Basically any gas mixture can be measured as long the mixing ratio and its components are known and constant.

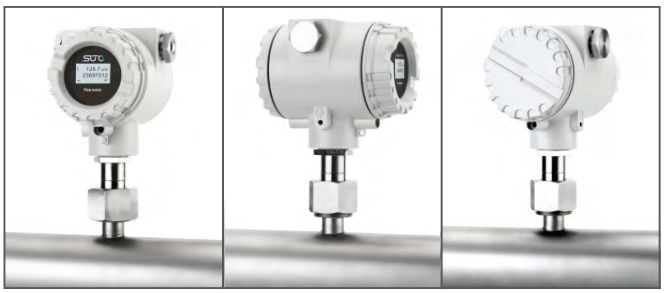
S 450/452 HEAVY DUTY INDUSTRY FLOW/CONSUMPTION SENSOR



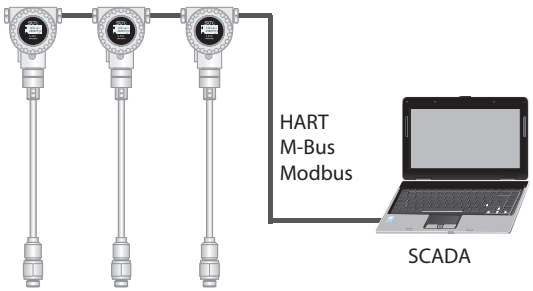


Insertion type installation through ball valve

In line type installation through flanges or R thread



Sensor head can be rotated in 90° steps through the screw nut



Industrial communication through Modbus, M-Bus, HART

Volumetric flow ranges S 450/452

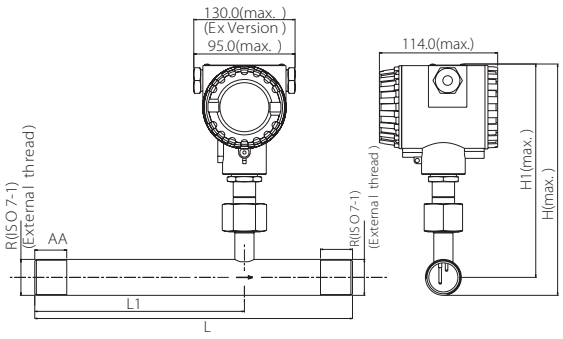
Inch	DN	S-Range (m3/h)	M-Range (m3/h)	HS-Range (m3/h)
½″	DN15	0.2 ... 45.6	0.4 ... 91.0	0.48 ... 110.16
¾″	DN20	0.4 ... 89.1	0.9 ... 177.8	1.09 ... 215.3
1″	DN25	0.6 ... 147.7	1.2 ... 294.7	1.82 ... 356.85
1½″	DN40	1.5 ... 366.7	2.9 ... 731.9	4.36 ... 886.18
2″	DN50	2.4 ... 600	4.8 ... 1198	7.26 ... 1450.04
2½″	DN65	4.1 ... 1027	8.2 ... 2049	12.1 ... 2480.44
3″	DN80	5.7 ... 1424	11.4 ... 2841	16.94 ... 3441.91
4″	DN100	8.7 ... 2183	17.4 ... 4357	24.2 ... 5275.71
5″	DN125	20 ... 3419.6	38 ... 6824.4	45.9 ... 8263.09
6″	DN150	20 ... 4930	39 ... 9839	70.18 ... 11913.10
8″	DN200	35 ... 8786	70 ... 17533	106.48 ... 21229.51
10″	DN250	55 ... 13744	110 ... 27429	165.77 ... 33210.69
12″	DN300	79 ... 19815	158 ... 39544	239.58 ... 47880.39

Stated flow values are at standard conditions of Ps = 0.1MPa(a) and Ts = 20°C with medium air.

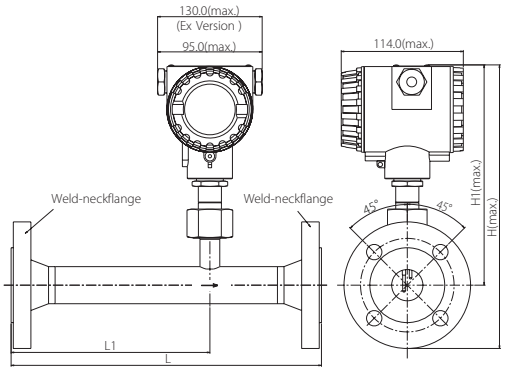
At other standard conditions and in other gases flow ranges are different and data are available on request.
In larger pipe diameters flow can also be measured.

S 450/452 HEAVY DUTY INDUSTRY FLOW/CONSUMPTION SENSOR

S 452



Pipe nominal size inch / (DN)	L total length (mm)	L1 inlet length (mm)	H total height (mm)	H1 from pipe center to casing top (mm)	R External Thread	A Thread Length (mm)
1/2″ (DN15)	300	210	210.8	200.15	R1/2″	20
3/4″ (DN20)	475	275	213.6	200.15	R3/4″	20
1″ (DN25)	475	275	217.0	200.15	R1″	25
1¼″ (DN32)	475	275	221.35	200.15	R1¼″	25
1½″ (DN40)	475	275	224.3	200.15	R1½″	25
2″ (DN50)	475	275	230.3	200.15	R2″	30

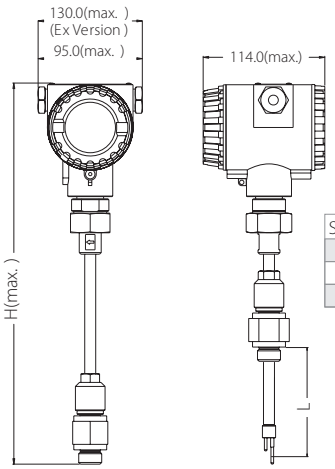


Pipe nominal size inch/(DN)	L total length (mm)	L1 inlet length (mm)	H total height (mm)	H1 from pipe center to casing top (mm)
1/2″ (DN15)	300	210	247.65	200.15
3/4″ (DN20)	475	275	252.65	200.15
1″ (DN25)	475	275	257.65	200.15
1¼″ (DN32)	475	275	270.15	200.15
1½″ (DN40)	475	275	275.15	200.15
2″ (DN50)	475	275	282.65	200.15
2½″ (DN65)	475	275	300.55	208.05
3″ (DN80)	475	275	314.45	214.45

Technical data S 450/452

Measuring range:	0.4 ... 92.7 sm/s (standard range calibration) 0.8 ... 185 sm/s (max range calibration) (refer to table for flow measurement ranges in different tube diameters) * sm/s: standard meter per second	
Accuracy:	±(1.5% of reading + 0.3% full scale)	
Stated accuracy at:	Ambient/process temperature 23°C ±3°C Ambient/process humidity <90%, no condensation Process pressure at 0.6 MPa	
Repeatability:	0.25% of reading	
Response time t95:	< 5 seconds	
Sampling rate:	Display and outputs are refreshed every 200 msec	
Tube diameter:	Insertion type: DN25 ... DN1500 In line type: DN15 ... DN80	
Process connection:	Insertion type: In line type:	½″ G type thread (ISO 228-1) R thread (ISO 7-1), Flange EN 1092-1, ANSI / B16.5, JIS B2220
Measuring medium:	Any gases where the components and the mixing ration are constant and known. See order information for a list of standard gases.	
Operating temperature:	-40°C ... +150°C (medium temp. insertion type) -40°C ... +100°C (medium temp. in line type) -40°C ... +65°C (ambient temperature)	
Operating pressure:	S 450: 0 ... 4.0 MPa (>1.6 MPa need installation device) S 452: 0 ... 1.6 MPa (Optional: 4.0 MPa)	
Analogue output:	2 x 4 ... 20 mA, up to 400 R load, active/ passive selectable, measurement channel selectable, scaling programmable	
Pulse/Alarm output:	Either alarm or pulse output. 1 pulse per 1, 10 or 100 consumption units, Alarm programmable	
Power supply:	16-30 VDC, 5 W	
Enclosure:	IP67	
Sensor material:	Stainless steel 1.4404 (SUS 316L)	
Approvals:	CE, RoHS ATEX: II 2 G Ex d IIC T4 / GB3836 / IECEx(Optional)	
Fieldbus: (Optional)	Modbus RTU HART	

S 450



Shaft option	L(mm)	H(mm)
A	220	469
B	160	409
C	300	549

Order form

* R thread only up to DN 50

S 450/ S 452	Shaft/ line size	Process connection	Gas medium	Calibration	Hazardous area approval	Output	Display	Description		
S695 0450								S 450, flow sensor insertion type		
S695 0452								S 452, flow sensor, inline type		
								S695 0450	S695 0452	
	A							A1200 220mm	DN15	*Standard*
	B							A1201 160mm	DN20	
	C							A1202 300mm	DN25	
	D								DN32	
	E								DN40	
	F								DN50	
	G								DN65	
	H								DN80	
		A						G ½"	R thread (ISO 7-1)*	*Standard*
		B						PT ½" adaptor	EN-1092-1, PN40	
		C						NPT ½" adaptor	Flange ANSI 16.5	
		D							Flange JIS B2220	
A1007			A					Medium Air		*Standard*
A1008			B					Medium CO_2		
A1009			C					Medium O_2 (oil & grease free cleaned)		
A1010			D					Medium N_2		
A1011			E					Medium N_2O		
A1012			F					Medium Ar		
A1013			G					Medium Natural gas (exact gas mix required)		
A1014			H					Medium H_2 (real gas calibration)		
A1015			I					Others (please specify the gas or gas mix)		
A1016			J					Medium He (real gas calibration)		
A1017			K					Medium Propane C_3H_8		
				A				Standard range calibration		*Standard*
A1271				B				Max range calibration		
A1272				C				Bi-directional standard range calibration (S 450 only)		
A1273				D				Bi-directional max. range calibration (S 450 only)		
A1274				E				High speed calibration		
A1279					A			None		*Standard*
A1280					B			ATEX / GB3836 / IECEx		
A1284						A		2 x 4 ... 20 mA + pulse		
A1285						B		1 x 4 ... 20 mA + HART + pulse		
A1286						C		1 x 4 ... 20 mA + Modbus + pulse		
A1294							A	Without display		*Standard*
A1295							B	With display		

Order No.	Description
R200 0005	Oil & grease free cleaned option for flow sensors (for Oxygen it is already included in A 1009)
R200 0020	Real gas calibration in selected gas to ensure best accuracy
A553 0121	Sensor cable, 6 pole, AWG22, 7.5 mm outer diameter, w/shielding, black (per meter)
A553 0123	RS-485 cable, 2 pole, AWG (per meter)

S 430 PITOT TUBE FLOW / CONSUMPTION SENSOR

The S 430 is based on the pitot tube principle to measure flow. Properly installed (refer to instruction manual for details) the sensor can measure in wet and dirty gases as occurring, for example, at the discharge of a compressor.

The sensor features long term stability, wide turn-down ratio and good temperature stability. It can be used in compressed air and non-corrosive gases.

The sensor can be installed through a ball valve while the system is pressurised.

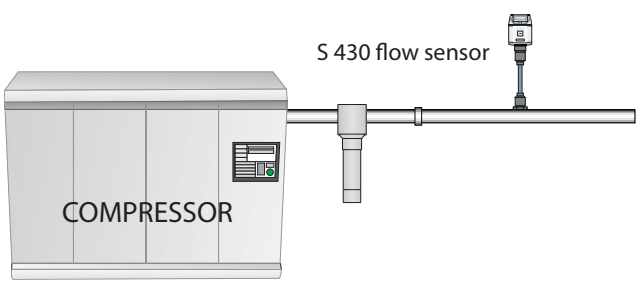
Various output signals allow the sensor to be connected to SUTO displays and/or third party displays and PLCs.

Colour graphic display for online values and sensor settings

Features

- Flow and consumption measurement in wet air or high mass flow / velocity applications
- Measurement at compressor outlet
- Tube diameters of 1" to 10" through center installation, bigger diameters through non-center installation
- Insertion type, easy installation under pressure through ball valve possible
- High temperature applications up to 200°C
- No mechanical wear parts
- All parts which are in contact with flow medium are made of stainless steel
- Compressor-FAD-Measurement
- Steam mass flow and consumption measurement

Technical data S 430		
Flow range	Refer to Instruction Manual	
Pressure range	0 ... 1.6 MPa	
Temperature range	-40°C ... +200°C	
Accuracy	Flow: Pressure: Temperature:	±(1.5%+0.3% full scale) 0.5% F.S. 0.5°C
Reference conditions	Programmable, default P = 1000 hPa(a), T = 20°C	
Medium	Wet and dry air, non-corrosive gases, steam	
Output signals	SDI (SUTO specific) 4 ... 20 mA and Pulse (optional) Modbus RTU (optional)	
Medium temp.	-40°C ... +230°C	
Ambient temp.	-20°C ... +60°C	
Power supply	24 VDC, 150 mA	
Display option	2.4" color graphics display with keypad	
Process connection	3/4" G type (ISO 228-1)	
Sensor material	Stainless steel 1.4404 (SUS 316L)	



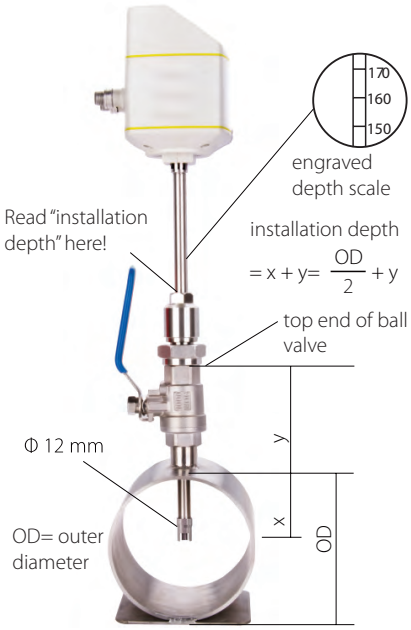
Compressor air delivery measurement and FAD calculation

Flow ranges

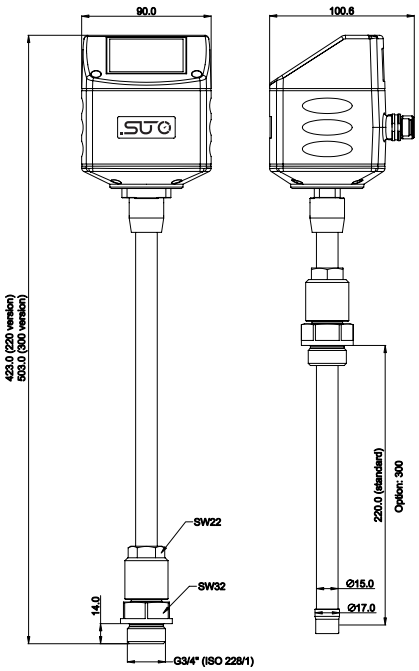
Tube		Volumetric flow					
Inch	mm	m³/h		m³/min		cfm	
		Min	Max	Min	Max	Min	Max
1	27.3	23	229	0.38	3.8	13	135
1¼"	36.0	51	507	0.85	8.5	30	298
1½"	41.9	76	756	1.26	12.6	45	445
2"	53.1	130	1298	2.16	21.6	76	764
2½"	68.9	227	2274	3.79	37.9	134	1338
3"	80.9	318	3175	5.29	52.9	187	1869
4"	100.0	488	4880	8.13	81.3	287	2872
5"	125.0	763	7625	12.71	127.1	449	4488
6"	150.0	1099	10993	18.32	183.2	647	6470
8"	200.0	1961	19611	32.69	326.9	1154	11543
10"	250.0	3064	30642	51.07	510.7	1804	18035
12"	300.0	4412	44125	73.54	735.4	2597	25971

Flow range for Air at 6 barg, 50°C and 90% humidity. For other gas and condition please download Flow Range software from www.suto-itec.com
All above flow rates are standard flows with reference to P = 1000 hPa(a) and T = 20°C.

Installation



Dimensions



S 430	Process connection	Gas medium	Fieldbus	Calibration	Display	Description
S695 4300						S 430, pitot tube flow sensor, insertion type, 220 mm shaft
S695 4302						S 430, pitot tube flow sensor, insertion type, 300 mm shaft, for steam application
	A					G ¾" *standard*
A1006	B					PT ¾" adaptor
A1005	C					NPT ¾"adaptor
A1007		A				Medium Air
A1008		B				Medium CO_2
A1009		C				Medium O_2 (oil & grease free cleaned)
A1010		D				Medium N_2
A1011		E				Medium N_20
A1012		F				Medium Ar
A1013		G				Medium Natural gas (exact gas mix required)
A1014		H				Medium H_2
A1015		I				Others (please specify the gas or gas mix)
A1016		J				Medium He
A1019		K				Steam
A1061			A			Modbus RTU
A1062			B			Analog, Pulse
A1063			C			M-Bus
				A		Standard
A1066				B		Bi-directional
A1067				C		High speed: Max flow increased by 30%
					A	Without Display
A1060					B	With Display *standard*

S 460 ULTRASONIC FLOW METER

S 460-W, wall mountable controller

Complete wall mountable set: S 460-W + transducer pair
(metal stretcher and coupling agent are included in S 460-W)

The S 460 ultrasonic flow meter uses the proven clamp-on transit-time correlation technique. The ultrasonic transducers are simply clamped onto the outside of the pipe and never come in contact with the fluid.
The transducers are connected to a controller which is available as hat rail, or portable version. The stationary models can be connected to the S 330/331 series of displays and data loggers where the portable model is connectable to the S 551.

Features

Measurement of liquid flows and consumption such as:

- Chemical addition
- Cooling and heating water
- Drinking water
- Broad range of refined hydrocarbons
- Potable water
- De-ionized and demineralized water
- Sanitary flow rate measurements
- Purified water

Technical data S 460	
Velocity range	0.03 ... 20 m/s
Repeatability	0.2%
Accuracy	±1%
Temperature sensor	PT100 3 wire
Output	4 ... 20 mA
Communication	Modbus RTU, Modbus ASCII
Pipe sizes	32 ... 6000 mm (depend on transducer type, inner diameter)
Temperature range controller transducer	 -30°C ... +80°C -30°C ... +90°C (standard) -30°C ... +160°C (High temperature)
Physical units	Selectable
Supply	24 VDC / 1.5 W (S 460-P) 230 VAC or 24 VDC (S 460-W)
Dimensions:	Wall version: 190 x 155 x 85 mm Portable version: 177 x 177 x 60 mm

Clamp on temperature sensors are used for energy calculation in heating and cooling systems

Ultrasonic transducer pair, screw terminals

To calculate the flow range please use this formula:

$Q=Di^2 * 0.01979$

Q [m3/h]

Di [mm]

Order form

D554 0074 Wall mountable

S 460-W, ultrasonic flow meter controller, wall mountable, including 5 m connection cable to transducers, metal stretcher and coupling agent

S694 4606 / S694 4607 / S694 4608

S694 4606 - Ultra sound sensor pair, DN32 ... DN100, screw terminals, for stationary, TS-2
S694 4607 - Ultra sound sensor pair, DN100 ... DN700, screw terminals, for stationary, TM-1
S694 4608 - Ultra sound sensor pair, DN 300 ... DN6000, screw terminals, for stationary, TL-1

P554 0070 Portable

S 460-P, ultrasonic controller for liquid flow sensor, connectable to S 551, including 5 m connection cable to S 551 and to transducers, metal stretcher and coupling agent

Optional

S694 4603 / S694 4604 / S694 4605

S694 4603 - Ultra sound sensor pair, DN32 ... DN100, socket terminals, for portable, TS-2
S694 4604 - Ultra sound sensor pair, DN100 ... DN700, socket terminals, for portable, TM-1
S694 4605 - Ultra sound sensor pair, DN300 ... DN6000, socket terminals, for portable, TL-1

A553 0124

Transducer cable pair, red and blue connector, 5 m
(included in P554 0070)

A553 0127

Transducer cable pair, open wire, 2 pole, outer diameter 7mm, shielding
(2 x 5 m included in D554 0074)

A553 0121

Sensor cable, 6 pole, AWG22, 7.5 mm outer diameter, w/ shielding, black [per meter]
(for connection to S 330/331 displays)

A554 0075

Coupling agent, ultrasonic transducers, 100 g, temporary installations
(included in P554 0070)

A554 0077

Metal stretcher for installations of transducers (2 pieces)
(2 pieces included in D554 0074 + P554 0070)

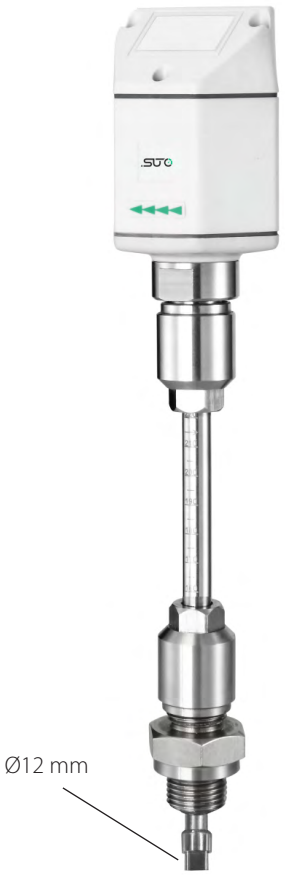
A554 0078

Coupling agent, ultrasonic transducers, 100 g, permanent installations
(included in D554 0074)

S604 0107

Temperature sensor, Pt100, 3-wire, with 2 m cable, clamp on sensor for pipes, including stretcher (2 sensors required for energy calculation / only for stationary applications)

S 409 FLOW DIRECTION SWITCH FOR COMPRESSED AIR/GASES



Features

Measurement of liquid flows and consumption such as:

- Detects smallest changes < 0.1 m/s referred to 20°C and 1000 hpa
- No mechanical wear parts
- Easy installation under pressure

Technical data S 409	
Detection range	0.02 ... 25 m/s @ 7barg, 20°C
Sensor	2 x Pt 1000
Medium	air, gases
Medium humidity	< 100% (no condensation)
Medium temp.	-20°C ... +80°C
Ambient temp.	-20°C ... +70°C
Operating pressure	0 ... 1.6 MPa
Power supply	24 VDC, 60 mA
Output	2 x Relay, 60V, 1A
Process connection	1/2" G type (ISO 228-1)
Sensor material	Stainless steel 1.4404 (SUS 316L)

The thermal mass flow direction switch S 409 allows the detection of direction of the flow. It can be used in compressed air and non-corrosive gases.

The sensor element is very robust and completely of stainless steel. Through a 1/2"G-type ball valve the switch can be inserted into the pipe under pressure.

The flow and direction information is output through 2 normally open relay switches. The signals can be transferred to the SUTO flow sensor to activate and deactivate the flow measurement depending on the flow direction.

Thermal mass flow sensor element

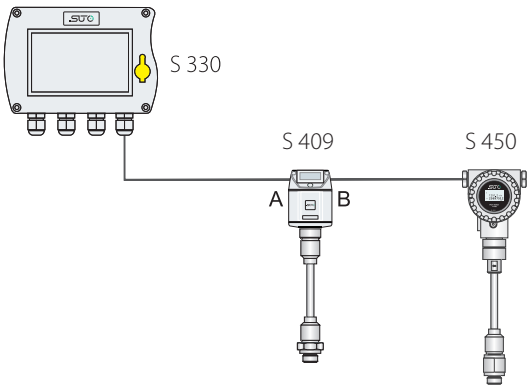
S 409 FLOW DIRECTION SWITCH FOR COMPRESSED AIR/GASES

Pin arrangement of flow switch

	Pin1	Pin2	Pin3	Pin4	Pin5
A	SDI	-VB	+VB	DIR1	DIR1
B	SDI	-VB	+VB	DIR2	DIR2

Relay output at switch

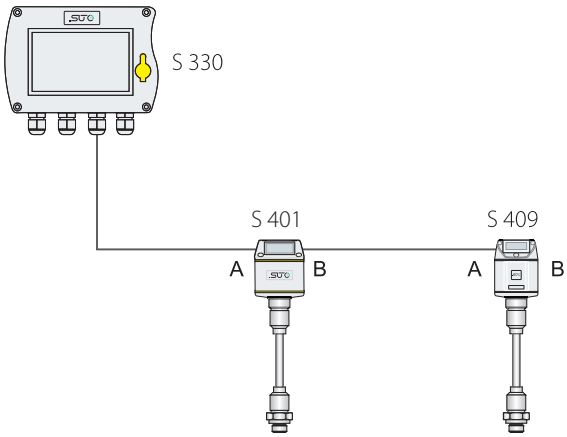
Connection of S 330 to S 450 via flow switch



S 409 (B)	S 450
1	4
2	3
3	2
4	5
5	6

Connection between S 409 and S 450/452

Connection of S 330 to S 401 with flow switch



Attention: Flow sensors S 450/S 401 need to have the bi-directional calibration option to operate in both directions

Order No.	Description
S695 0409	S 409, flow direction switch, insertion type
A554 0007	Mains unit in wall housing
A553 0104	Sensor cable 5 m, with M12 connector, open wires, AWG24 (0.2 mm²)
A553 0105	Sensor cable 10 m, with M12 connector, open wires, AWG24 (0.2 mm²)
A1005	NPT ½" adaptor
A1006	PT ½" adaptor