English

Instruction and operation manual

S 452

Thermal mass flow sensor

Dear Customer,

thank you for choosing our product.

The operating instructions must be read in full and carefully observed before starting up the device. The manufacturer cannot be held liable for any damage which occurs as a result of non-observance or non-compliance with this manual.

Should the device be tampered with in any manner other than a procedure which is described and specified in the manual, the warranty is cancelled and the manufacturer is exempt from liability.

The device is destined exclusively for the described application.

CS-iTEC offers no guarantee for the suitability for any other purpose. CS-iTEC is also not liable for consequential damage resulting from the delivery, capability or use of this device.

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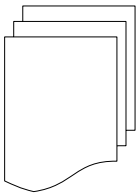
1. Safety instructions



Please check if this instruction manual accords to the product type.

Please observe all notes and instructions indicated in this manual. It contains essential information which have to be observed before and during installation, operation and maintenance. Therefore this instruction manual has to be read carefully by the technician as well as by the responsible user / qualified personnel.

This instruction manual has to be available at the operation site of the flow sensor at any time. In case of any obscurities or questions, regarding this manual or the product, please contact the manufacturer.

WARNING!

Compressed air!

Any contact with quickly escaping air or bursting parts of the compressed air system can lead to serious injuries or even death!

- Do not exceed the maximum permitted pressure range (see sensors label).
- Only use pressure tight installation material.
- Avoid that persons get hit escaping air or bursting parts of the instrument.
- The system must be pressureless during maintenance work.

WARNING!

Voltage used for supply!

Any contact with energized parts of the product, may lead to a electrical shock which can lead to serious injuries or even death!

- Consider all regulations for electrical installations.
- The system must be disconnected from any power supply during maintenance work.
- Any electrical work on the system is only allowed by authorized qualified personal.

WARNING!

Permitted operating parameters!

Observe the permitted operating parameters, any operation exceeding this parameters can lead to malfunctions and may lead to damage on the instrument or the system.

- Do not exceed the permitted operating parameters.
- Make sure the product is operated in its permitted limitations.
- Do not exceed or undercut the permitted storage and operation temperature and pressure.
- The product should be maintained and calibrated frequently, at least annually.

General safety instructions

- It is allowed to use the product in explosive areas. Please contact the manufacturer.
- Please observe the national regulations before/during installation and operation.

Remarks

- It is not allowed to disassemble the product.
- Always use spanner to mount the product properly.

ATTENTION!

Measurement values can be affected by malfunction!

The product must be installed properly and frequently maintained, otherwise it may lead to wrong measurement values, which can lead to wrong results.

- Always observe the direction of the flow when installing the sensor. The direction is indicated on the housing.
- Do not exceed the maximum operation temperature at the sensors tip.
- Avoid condensation on the sensor element as this will affect the accuracy enormously.

Storage and transportation

- Make sure that the transportation temperature of the sensor without display is between -30°C... 70°C and with display between -10°C... 60°C.
- For transportation it is recommended to use the packaging which comes with the sensor.
- Please make sure that the storage temperature of the sensor is between -10°C... 50°C.
- Avoid direct UV and solar radiation during storage.
- For the storage the humidity has to be <90%, no condensation.

2. Application

The S 452 is a flow sensor which is designed to measure the consumption of compressed air and gases within the permissible operating parameters. These parameters can be found in the technical data section.

The S 452 can measure the following values:

- Velocity of the compressed air or gas.
- Volume flow of the compressed air or gas.
- Total consumption of the compressed air or gas.

The default factory settings are: Velocity in m/s, Volume flow in m^3/h and Total Consumption in m^3. Other units can be programmed by the optional display or the service kit.

The S 452 flow sensor is developed to be used in explosive areas.

The S 452 flow sensor is mainly used in compressed air systems in industrial environment.

3. Features

- Direct measurement of mass flow and standard flow without the need of pressure and temperature compensation.
- Wide range of tube sizes are supported with insertion type for pipes and inline types for smaller pipes.
- No moving parts, no clogging.
- All sensor parts which come into contact with the measurement medium are made of stainless steel 316L.
- Robust metal enclosure is suitable for outdoor applications in harsh

environments.

- Wireless bluetooth interface for connecting on site.
- Optional display directly on the sensor, showing flow rate, consumption, medium temperature and diagnostic result.

4. Technical Data

4.1 General

CE	
Parameters	Standard unit flow: m^3/h other units: m^3/min, l/min, l/s, cfm, kg/h, kg/min, kg/s Standard unit velocity: m/s
Reference conditions	ISO1217 20°C 1000 mbar (Standard-Unit) DIN1343 0°C 1013,25 mbar (Norm-Unit)
Principle of measurement	Thermal mass flow
Sensor	Resistive sensor
Measuring medium	Air, gas (non corrosive gas) -40°C... 150°C medium temp. insertion type
Operating temperature	-40°C... 65°C ambient temperature
Humidity of the meas. medium	< 90%, no condensation
Operating pressure	1.6 MPa (in line type) 4.0 MPa (insertion type)
Housing material	All alloy
Material of the probe tube, sensor head and the screwing	Stainless steel 316L
Protection class	IP 67
Dimensions	See dimensional drawing on the next page
Display (optional)	Graphic display, 128 x 64
Tube diameter	DN25 - DN80
Screwing thread	M32 x 1,5
Weight	1.25 kg (instrument only, doesn't include the measuring section)

4.2 Electrical Data

Power supply	16... 30 VDC, 7W

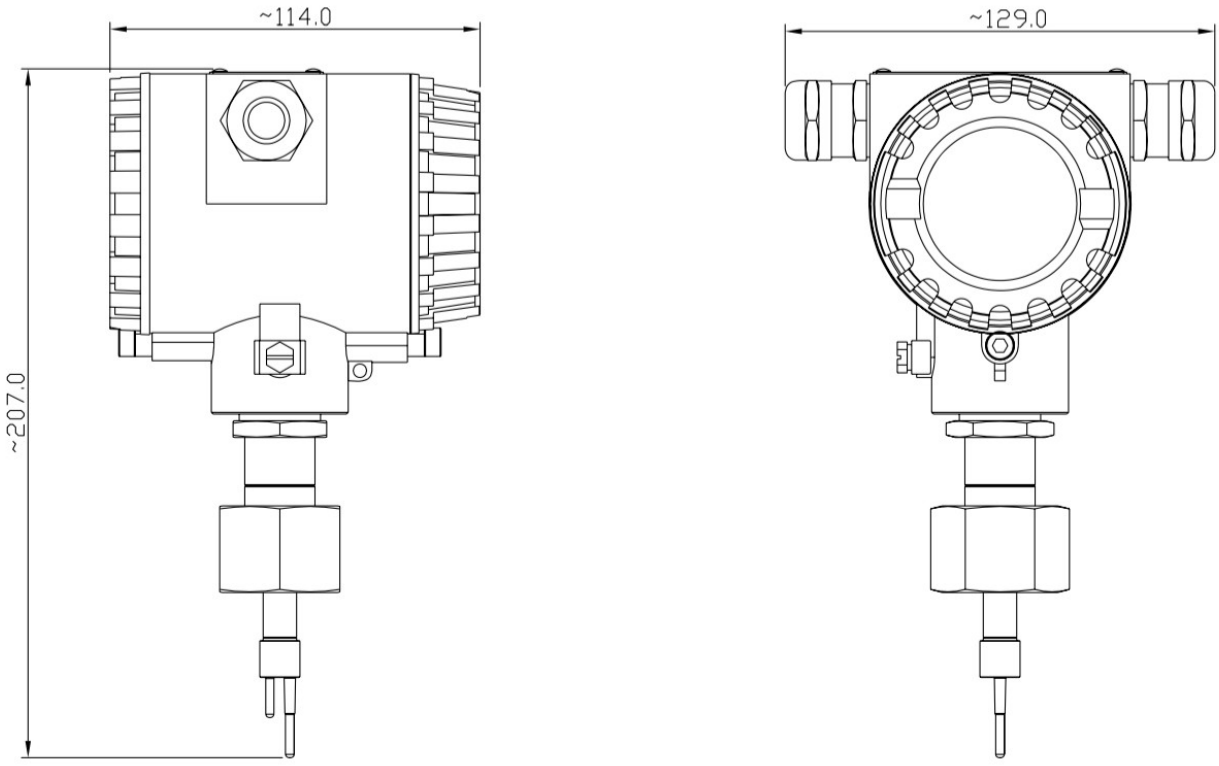
4.3 Output-Signals

Analog output	See chapter 9.1
Pulse output	See chapter 9.2
HART output	See chapter 9.3
Modbus output	See chapter 9.4
M-Bus output	See chapter 9.5

4.4 Accuracy

Accuracy	Inaccuracy: ±1.5% of reading + 0.3% of full scale Repeatability: 0.25% of reading
Stated accuracy at	Ambient/process temperature 23°C ±3°C Ambient/process humidity <90% Process pressure at 0.6 MPa

5. Dimensional drawing



6. Determination of the installation point

In order to maintain the accuracy stated in the technical data, the sensor must be insert in the centre of a straight pipe section with unhindered flow characteristics.
Unhindered flow characteristics are achieved if the section in front of the sensor (inlet) and behind the sensor (outlet) are sufficiently long, absolutely straight and free of obstructions such as edges, seams, curves etc..
Please consider that enough space exists at your site for a adequate installation as described in this manual.

ATTENTION!

Wrong measurement is possible, if the sensor is not installed correctly.

- Careful attention must be paid to the design of the inlet and outlet section. Obstructions can cause counter-flow turbulence as well as turbulence in the direction of the flow.
- At an outdoor installation, the sensor must be protected from solar radiation and rain.
- It is strongly recommend not to install S 452 permanently in wet environment as it exists usually right after a compressor outlet.

7. Inlet and Outlet section

The S 452 with tube diameters from DN15-DN25 already has the required inlet and outlet sections.

For diameters from DN32 – DN80, the S 452 has a shortened inlet section and requires additional straight sections at the inlet and outlet. The additional length for the particular diameters are listed in the table below.

Flow obstructions before the measurement section	Additional length for DN32 [mm]		Additional length for DN40 [mm]		Additional length for DN50 [mm]		Additional length for DN65 [mm]		Additional length for DN80 [mm]	
	inlet	outlet	inlet	outlet	inlet	outlet	inlet	outlet	inlet	outlet
Slight curve	175	-	227.	9.5	362.	65.5	551.	144.	760.	204.

(bend <90°C)			8		2		8	5	8	5
Reduction (Tube narrows towards measurement section)	265	-	353.5	9.5	521.5	65.5	758.5	144.5	938.5	204.5
Expansion (Tube expands towards measurement section)	265	-	353.5	9.5	521.5	65.5	758.5	144.5	938.5	204.5
90°C bend or T piece	265	-	353.5	9.5	521.5	65.5	758.5	144.5	938.5	204.5
2 x 90°C bends on one level	445	-	563	9.5	787	65.5	1103	144.5	1343	204.5
2 x 90°C bends 3 dimensional change of direction	985	-	1191.5	9.5	1583.5	65.5	2136.5	144.5	2556.5	204.5
Shut-off valve	1345	-	1610.5	9.5	2114.5	65.5	2825.5	144.5	3365.5	204.5

8. Sensor Installation

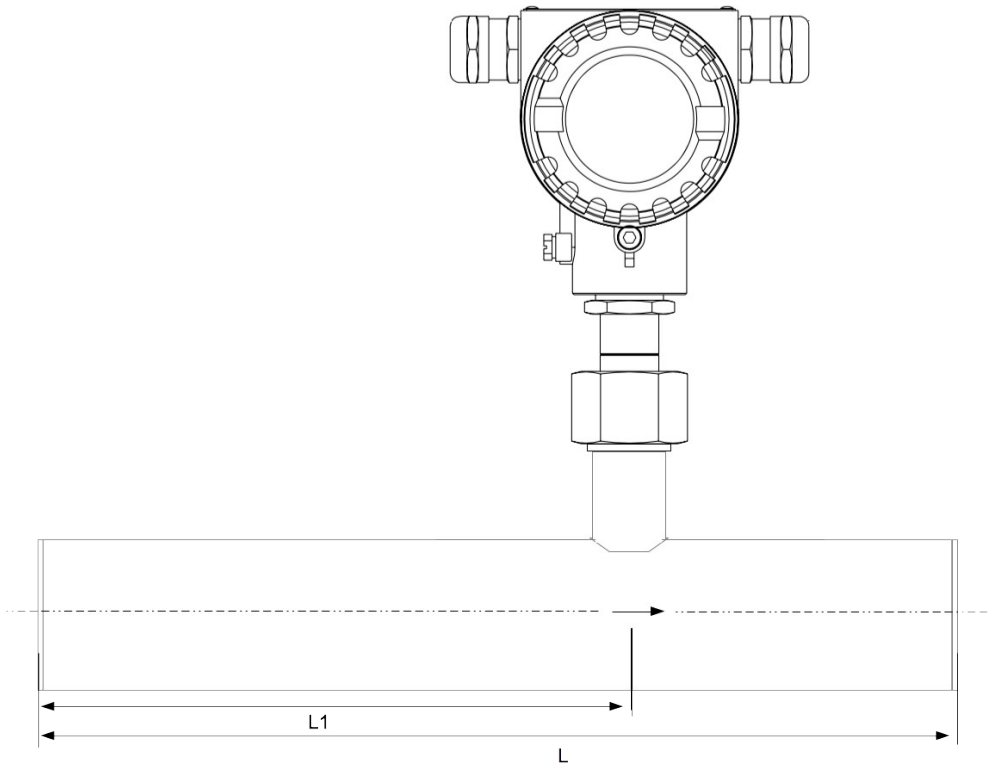
Before installing the sensor, please make sure that all components listed below are included in your package.

Qty	Description	Item No.
1	Sensor	0695 0452
1	Sealing ring	No P/N
1	Bluetooth dongle	No P/N
1	Measuring section	A1300 ... A1306 (R thread) A1321 … A1328 (Flange, EN-1092-1) A1341 … A1348 (Flange, ANSI 16.5)
1	Instruction manual	No P/N
1	Calibration certificate	No P/N

The S 452 is always shipped with mounted measurement section.

Please make sure that the sensor is installed correctly to the flow

direction in the tube. For this observe the flow direction indicated on the housing, it must match the flow direction of the compressed air or gas. The gas flows from the inlet (long pipe section) to the outlet (short pipe section) like illustrated in the picture below.



8.1 Removal of the flow sensor

The following steps explain the procedure of an appropriate removal of the sensor.

ATTENTION!

Only remove the sensor if the system is in a pressurless condition.

1. Hold the sensor.
2. Release the terminal nut at the connection thread.
3. Pull out the shaft slowly.
4. The measuring section can be closed with the optional closing cap, so the system can be operated normal during maintenance.

Re-installation after maintenance:

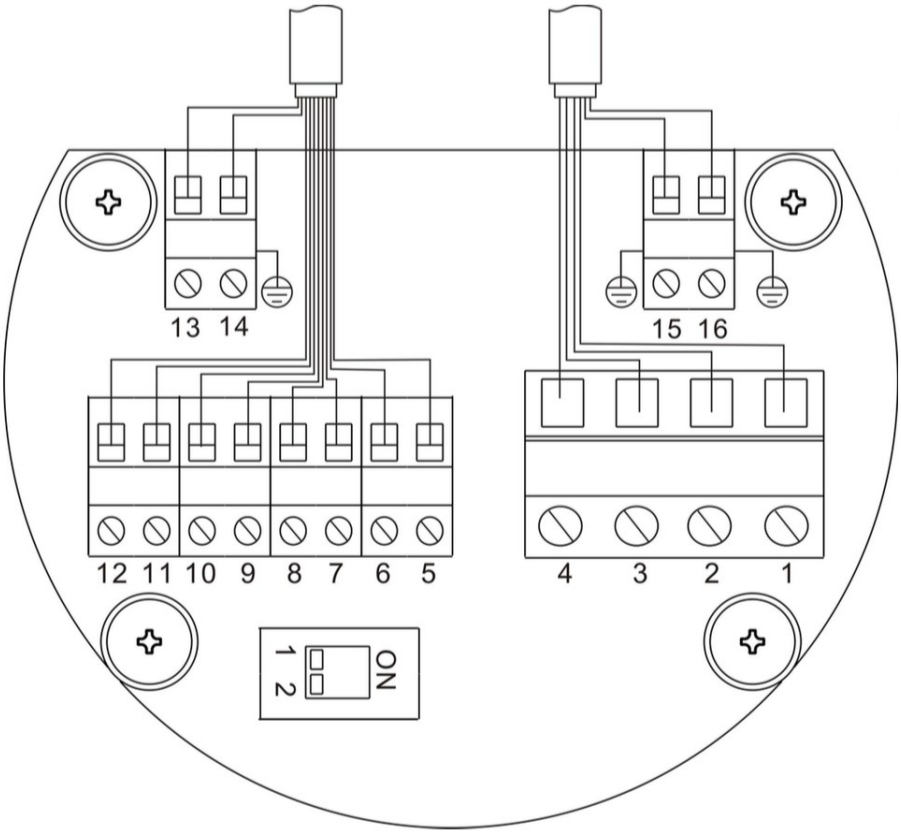
- The re-installation of the measurement device is simple as the sensor unit fits into the pipe section only in one position.
- Please make sure that the o-ring is inserted.
- Close the terminal nut tightly to mount the sensor correctly.

8.2 Electrical connection

When installing the cables please consider following points:

- Keep the stripped and twisted length of cable shield as short as possible.
- Screen and ground the signal lines.
- Unused cable entries must be closed with closers.
- Cable outer diameter should be between 6 and 8 mm.
- Single wire cross section area should be between 0.25... 0.75 mm^2.
- The thread size for the cable glands is M20 / 1.5.

Connection diagram



Pin	Pulse and analog	Modbus	M-Bus	HART
1	GND_{SDI}	GND_{SDI}	GND_{SDI}	GND_{SDI}
2	$+V_B$	$+V_B$	$+V_B$	$+V_B$
3	$-V_B$	$-V_B$	$-V_B$	$-V_B$
4	SDI	SDI	SDI	SDI
5	D1	D1	D1	D1
6	D2	D2	D2	D2
7	P1	P1	P1	
8	P2	P2	P2	
9	$-I_1$	$-I_1$	$-I_1$	$-I_1$ / -HART
10	$+I_1$	$+I_1$	$+I_1$	$+I_1$ / +HART
11	$-I_2$	+D	M1	

12	$+I_2$	-D	M2	
13		GND_M		
14	Earth	Earth	Earth	Earth
15	Earth	Earth	Earth	Earth
16	Earth	Earth	Earth	Earth

Legend to pin assignment

SDI	= Digital signal (internal use)	P1	= Pulse output 1
GND_{SDI}	= Ground for SDI	P2	= Pulse output 2
$+V_B$	= Positive supply voltage	D1	= Direction input D1 (flow switch)
$-V_B$	= Negative supply voltage	D2	= Direction input D2 (flow switch)
$+I_1$	= Positive signal output (analog 1)	+D	= Modbus data+
$-I_1$	= Negative signal output (analog 1)	-D	= Modbus data -
$+I_2$	= Positive signal output (analog 2)	M1	= M-Bus 1
$-I_2$	= Negative signal output (analog 2)	M2	= M-Bus 2

9. Signal outputs

9.1 Analog output

The S 450 in the standard configuration comes with 2 analog outputs and 1 pulse output. All signals are electrically isolated. The analog output can be used as an active output (current is sourced through the positive connection pin) or passive output. In the passive configuration a current signal is modulated into the external signal voltage.

Active : 4 to 20mA, RL < 400 Ω

Passive : 4 to 20mA, supply voltage 18... 30 VDC, RL < 500 Ω

For HART : RL ≥ 250 Ω

Uncertain : < 0.3 % of reading

ly

Resolution : 0.005 mA

9.2 Pulse output

No switch, no polarity requried, galv. Isolate

Max. rating : 30 VDC, 200 mA

Pulse width : 10... 100 msec (depending on flow rate)

The maximum number of pulse per second is limited to 45 pulse per second. As a result depending on the flow rate and the selected consumption unit the maximum flow rate is limited to the values in the table below.

Unit	Max flow		
Pulse / consumption unit	1/1	1/10	1/100
m^3/h	162,000	1620000	16,200,000
m^3/min	2,700	27,000	270,000
l/min	2,700	27,000	270,000
cfm	2,700	27,000	270,000
Kg/h	162,000	1,620,000	16,200,000
Kg/min	2,700	27,000	270,000
Kg/s	45	450	4,500
	Default	To be configured by service software	

9.3 HART output

The HART signal is modulated on analog output 1. In case S 450 is used in a multi drop configuration (more than 1 salve on the 4-20 mA line) the analog output can not be used anymore.

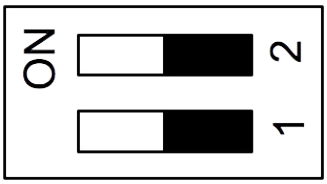
Device type : Slave

Polling address : 1 to 15
Bus address can be set through software

Physical interface	: BELL 202
Protocol version	: V 5.2
Tag	: S 450
Tag description	: Flow meter
Frame/parity/Stop	: 8, O, 1

9.4 Modbus output

The version with modbus comes with one analog output and one pulse output. The modbus communication requires to activate terminal resistors at the last device on the bus system. If the S 450 is the last device on the bus system, the DIP switches on the connector board should be set to “ON” position.



Termination resistor network switch

Device type	: Slave
Address rage	: 1 to 251 Bus address can be set through software
Physical interface	: RS485 in accordance with EIA/TIA-485 standard
Baudrates	: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
Transm. mode	: ASCII, RTU
Response time	: Direct data access = 0 to 255 ms (can be configured)

9.5 M-Bus output

The version with M-Bus comes with one analog output and one pulse output.

Device type	: Slave
Address rage	: 1 to 251 Bus address can be set through software
Physical interface	: Meter-Bus, EN1434-3
Baudrates	: 300, 2400, 9600 Baud
Frame/parity/Stop	: 8, E, 1

10. Configuration

In order to fully utilize the functionality of S 450 a configuration is required. There are various parameters which need to be set in the flow meter. The table below gives an overview about the available settings.

Area	Available settings	Default
Measurement	Tube diameter Flow unit Consumption unit Reference conditions Gas type selection Consumption counter Operation pressure Flow direction	According the ordered section m^3/h m^3 P_s= 1000 hPA; T_s= 20°C Air 0 m^3 0.6 MPa Standard
Analogue output 1	Measurement channel Scaling Active / passive	Flow 4 mA: 0 m^3/h 20 mA: max flow Active
Analogue output 2	Measurement channel Scaling Active / passive	Medium Temperature 4 mA: -50°C 20 mA: 200°C Active
Pulse output	Pulse / Alarm	Pulse

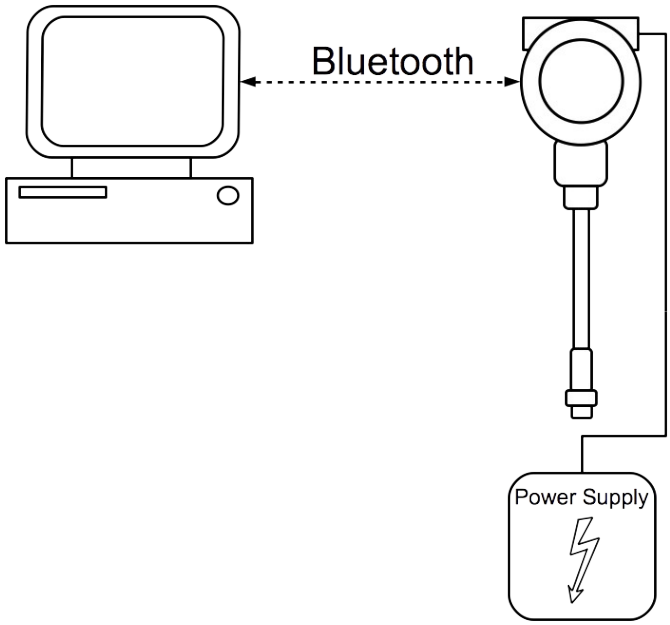
	Pulses per consumption unit	1
HART	Fieldbus address Manufacturer ID Device type code	0 255 0
Modbus	Device address Baudrate Framing/parity/Stop bit Transmission mode	1 19200 8, N, 1 RTU
M-Bus	Address Manufacturer code Baudrate Access number	0 END 300 0

Configuration settings have to be done through the service software which is included in the scope of delivery. The service software can be installed on any PC with windows operating system. To communicate with the sensor the PC needs to have a Bluetooth interface, if the PC doesn't have a blue tooth interface, the dongle which comes with the sensor can be used. . Alternatively a service kit can be used which is as option available. Through the service kit, the S 452 is connected to one USB port of the PC.

Bluetooth

Bluetooth provides a convenient way of configuring the sensor without the hazel of cable connection. S 450 needs to be powered up.

- Ensure that the distance between S 450 and PC is not more than 5 meter.
- Ensure that the PC Bluetooth antenna should point roughly in the direction of the display (front part).
- Please follow the instruction in the service software and the help file.



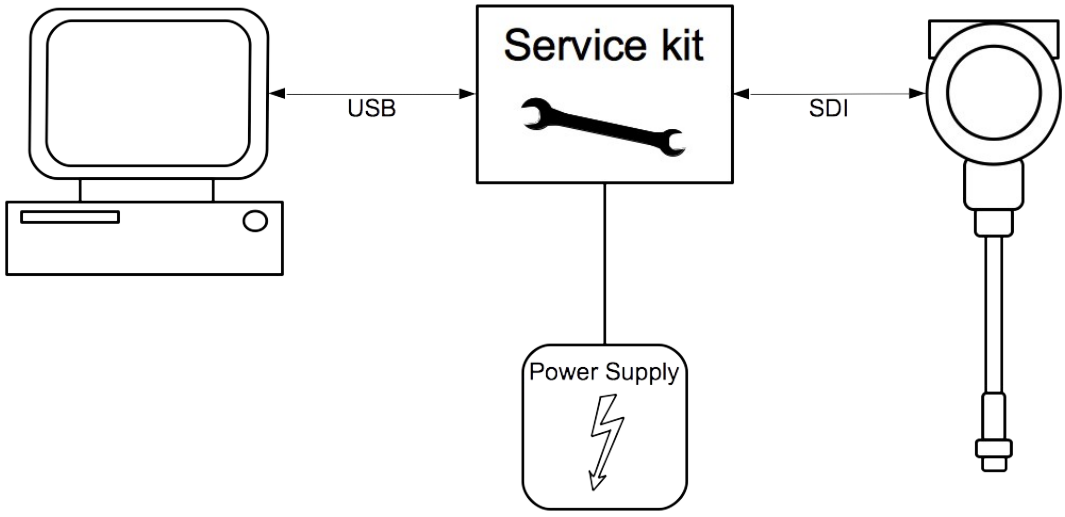
11. Optional extra accessories

11.1 Sensor display

With the Sensor display it is possible to show the values of the velocity, the flow and the consumption, moreover it shows error messages.

11.2 Service kit

The diagram below shows the connection when using the optional service kit. Please ensure that also in this case the power supply of either S 452 or of the service kit is connected because the USB port is not supplying enough power.



12. Calibration

It is recommended to calibrate respectively adjust the sensor annually. For this please contact the manufacturer. Please check the date of the last calibration in the attached calibration certificate.

13. Maintenance

To clean the sensor it is recommended to use distilled water or isopropyl alcohol only.

ATTENTION!

Do not touch the surface of the sensor plate.

Avoid mechanical impact on the sensor (e.g with a sponge or a brush).

If the contamination can not be removed the sensor has to be inspected and maintained by the manufacturer.

14. Disposal or waste

Electronic devices are recyclable material and do not belong in the household waste.
The sensor, the accessories and its packings must be disposed according to your local statutory requirements. The dispose can also be carried by the manufacturer of the product, for this please contact the manufacturer.

15. Warranty

CS-iTEC provides a warranty for this product of 24 months covering the material and workmanship under the stated operating conditions from the date of delivery. Please report any findings immediately and within the warranty time. If faults occurring during the warranty time CS-iTEC will repair or replace the defective unit, without charge for labour and material costs but there is a charge for other service such as transport and packing costs.
Excluded from this warranty is:

- Damage caused by:
  - Improper use and non-adherence to the instruction manual.
  - Use of unsuitable accessories.
  - External influences (e.g. damage caused by vibration, damage

during transportation, excess heat or moisture).

The warranty is cancelled:

- If the user opens the measurement instrument without a direct request written in this instruction manual.
- If repairs or modifications are undertaken by third parties or unauthorised persons.
- If the serial number has been changed, damaged or removed.

Other claims, especially those for damage occurring outside the instrument are not included unless responsibility is legally binding.

Warranty repairs do not extend the period of warranty.

ATTENTION!

Batteries have a reduced warranty time of 12 month.

Appendix

Scaling table analogue output:

Standard range; Medium: Air at ISO 1217; 20°C; 1000 mbar

Tube			Flow							
inch	nominal Diameter	mm	m³/h	m³/min	l/min	l/s	cfm	kg/h	kg/min	kg/s
1/2”	DN 15	16.10	29.33	0.49	488.9	8.15	17.3	34.8	0.58	0.01
3/4”	DN 20	21.70	57.34	0.96	955.7	15.93	33.7	68.1	1.14	0.02
1”	DN 25	27.30	95.03	1.58	1583.8	26.40	55.9	112.9	1.88	0.03
1 1/4”	DN 32	36.00	171.37	2.86	2856.1	47.60	100.9	203.5	3.39	0.06
1 1/2”	DN 40	41.90	235.99	3.93	3933.1	65.55	138.9	280.3	4.67	0.08
2”	DN 50	53.10	386.14	6.44	6435.7	107.26	227.3	458.6	7.64	0.13
2 1/2”	DN 65	68.90	660.53	11.01	11008.9	183.48	388.8	784.6	13.08	0.22
3”	DN 80	80.90	916.17	15.27	15269.6	254.49	539.2	1088.2	18.14	0.30

Max. range; Medium: Air at ISO 1217; 20°C; 1000 mbar

Tube			Flow							
inch	nominal Diameter	mm	m³/h	m³/min	l/min	l/s	cfm	kg/h	kg/min	kg/s
1/2”	DN 15	16.10	58.55	0.98	975.8	16.26	34.5	69.5	1.16	0.02
3/4”	DN 20	21.70	114.44	1.91	1907.3	31.79	67.4	135.9	2.27	0.04
1”	DN 25	27.30	189.66	3.16	3160.9	52.68	111.6	225.3	3.75	0.06
1 1/4”	DN 32	36.00	342.01	5.70	5700.2	95.00	201.3	406.2	6.77	0.11
1 1/2”	DN 40	41.90	470.99	7.85	7849.8	130.83	277.2	559.4	9.32	0.16
2”	DN 50	53.10	770.67	12.84	12844.5	214.07	453.6	915.4	15.26	0.25
2 1/2”	DN 65	68.90	1318.30	21.97	21971.7	366.19	775.9	1565.8	26.10	0.43
3”	DN 80	80.90	1828.51	30.48	30475.1	507.92	1076.2	2171.8	36.20	0.60

High speed range; Medium: Air at ISO 1217; 20°C; 1000 mbar

Tube			Flow							
inch	nominal Diameter	mm	m³/h	m³/min	l/min	l/s	cfm	kg/h	kg/min	kg/s
1/2”	DN 15	16.10	110.16	1.84	1836.0	30.60	64.8	130.8	2.18	0.04
3/4”	DN 20	21.70	215.33	3.59	3588.8	59.81	126.7	255.8	4.26	0.07
1”	DN 25	27.30	356.85	5.95	5947.5	99.13	210.0	423.9	7.06	0.12
1 1/4”	DN 32	36.00	643.52	10.73	10725.3	178.76	378.8	764.4	12.74	0.21
1 1/2”	DN 40	41.90	886.19	14.77	14769.8	246.16	521.6	1052.6	17.54	0.29
2”	DN 50	53.10	1450.06	24.17	24167.6	402.79	853.5	1722.3	28.71	0.48
2 1/2”	DN 65	68.90	2480.46	41.34	41341.1	689.02	1459.9	2946.2	49.10	0.82
3”	DN 80	80.90	3440.45	57.34	57340.9	955.68	2025.0	4086.5	68.11	1.14

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