

A1-SDI Sensors

Status V2 (11/2005)



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1 Read before using

- Before using the sensors, please read the operating manual carefully and follow the instructions in every detail.
- Never carry out measurements on live electrical parts.
- Pay attention to the measurement ranges of the sensors (overheating can cause destruction).
- Only carry out sensor calibration with the aid of a suitable reference device.
- The sensors generally require an adjustment period of several minutes when changing to a location with a different climate.

Designated use:

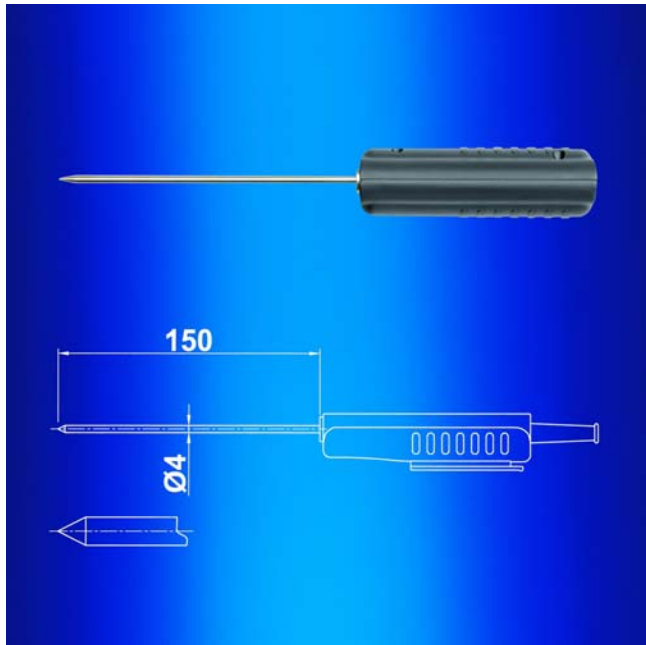


- The sensors must only be operated within the range of the specified technical data.
- The sensors must only be used under the conditions and for the purposes for which they were designed.
- Operating safety can no longer be guaranteed if the sensors are modified or reconstructed.

2 General

In addition to the standard functions of the lower menu on the A1-SDI, such as UNIT1, UNIT2, TIME, etc. (see A1-SDI Manual), there are also the arrow menus F1...F4. Dependent on the sensor, these arrows are used differently and may be assigned to both a function and a unit. The table on the following page provides a summary of the assignments. The list only includes sensors for which at least one arrow menu has been assigned.

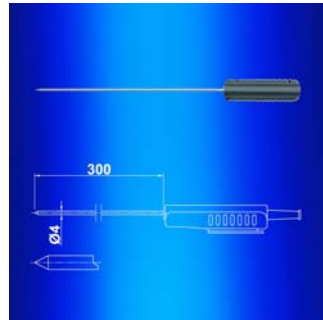
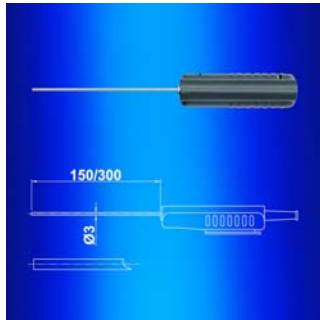
Sensor	F1	F2	F3	F4
T/H: 9130.52		g/kg	gr/lb	Pabs
T/H: 9130.53		g/kg	gr/lb	Pabs
T/HiOil: 9130.60	Oil para. A	Oil para. B		Aw value
V/T: 6120.51	fpm			Pabs
V/T: 6120.52	fpm			Pabs
V/T: 6120.53	fpm			Pabs



3 PT100 Temperature Sensors

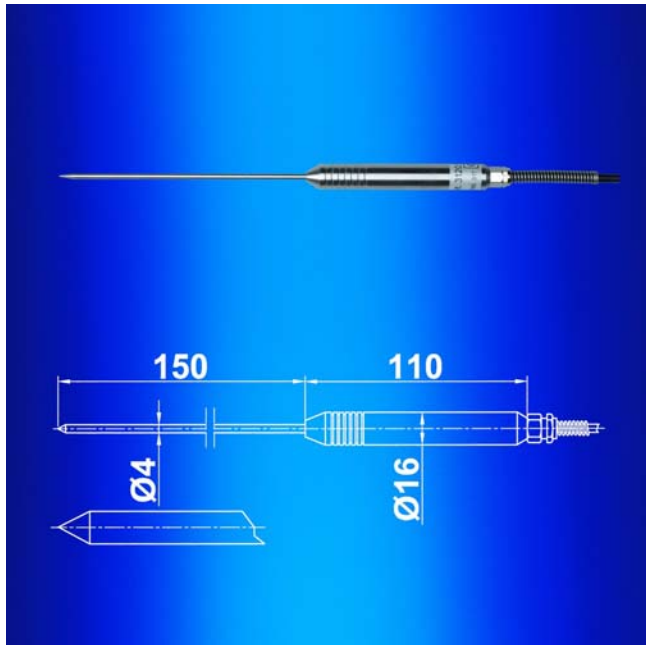
PT100 Plunge Sensor - 3120.51

- Application: Temperature measurement in solid, liquid and powdery media
- Response time: 10 seconds
- Measurement variable: Temperature [$^{\circ}\text{C}/^{\circ}\text{F}$]
- Calibration: Single point calibration (see A1-SDI Manual)
- The sensor is recognized automatically by the A1-SDI



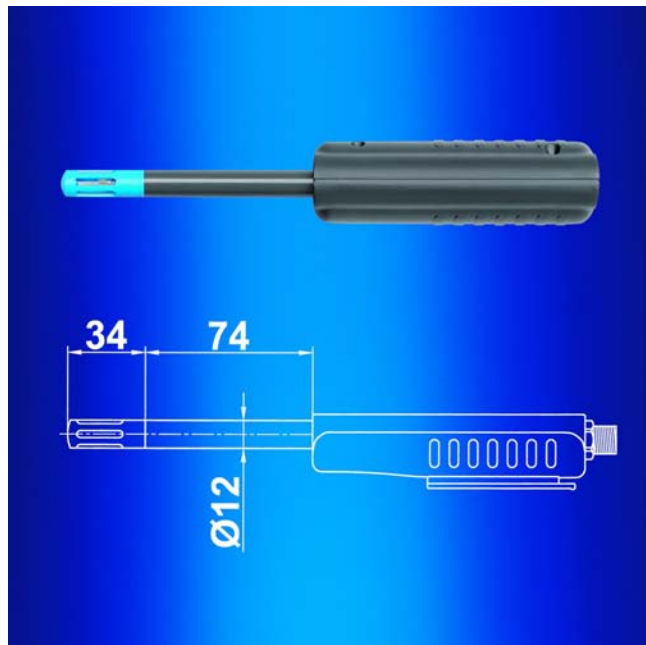
PT100 Plunge sensors - 3120.52 and 3120.54

- Application: Temperature measurement in gaseous, liquid and powdery media
- Response time: 10 seconds
- Measurement variable: Temperature [°C/°F]
- Calibration: Single point calibration (see A1-SDI Manual)
- The sensor is recognized automatically by the A1-SDI



PT100 Plunge Sensor - 120.55

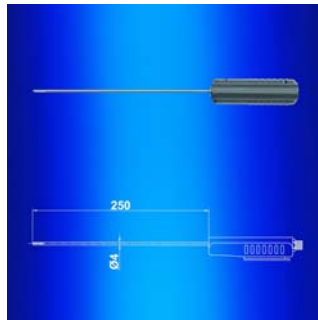
- Application: Temperature measurement in solid, liquid and powdery foods
- Response time: 10 seconds
- Measurement variable: Temperature [°C/°F]
- Calibration: Single point calibration (see A1-SDI Manual)
- The sensor is recognized automatically by the A1-SDI



4 Temperature/Humidity Sensors

Heating, Air Conditioning Sensor & Ventilating (HACV) - 9130.54

- Application: HACV humidity and temperature measurement
- Response time: ≤ 7 seconds
- Measurement variables:
 - Unit 1: Temperature [$^{\circ}\text{C}/^{\circ}\text{F}$]
 - Unit 2: Relative humidity [%], absolute humidity [g/m^3], dewpoint temperature [$^{\circ}\text{C}/^{\circ}\text{F}$]
- Calibration: Single/two point calibration (see A1-SDI Manual)

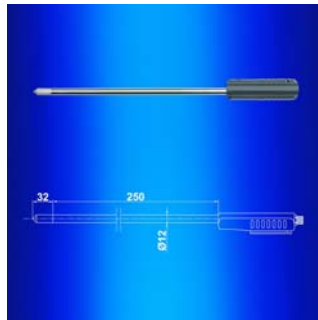


Temperature/Humidity Sensor with 4mm Ø - 9130.52

- Application: Humidity and temperature measurement in restricted space conditions, determination of equilibrium humidity in boreholes
- Response time: ≤ 15 seconds
- Measurement variables: Unit 1: Temperature [°C/°F]
Unit 2: Relative humidity [%], absolute humidity [g/m³], dewpoint temperature [°C/°F], mixing ratio [g/kg, gr/lb]
- Calibration: Single/two point calibration (see A1-SDI Manual)

F1	F2	F3	F4
	Unit g/kg	Unit gr/lb	Input Pabs

Functions of F1...F4



High Temperature/Humidity Sensor (-40°C...180°C) - 9130.53

- Application: Humidity and temperature measurement in process technology
- Response time: ≤ 30 seconds
- Measurement variables:

Unit 1: Temperature [°C/°F]

Unit 2: Relative humidity [%], absolute humidity [g/m³], dewpoint temperature [°C/°F], mixing ratio [g/kg, gr/lb]

- Calibration: Single/two point calibration (see A1-SDI Manual)

F1	F2	F3	F4
	Unit g/kg	Unit gr/lb	Input Pabs

Functions of F1...F4

H/[m]	p[hPa=mbar]	Correction Factor
0	1013.25	1.000
50	1006.94	1.006
100	1000.67	1.013
200	988.25	1.025
300	975.98	1.038
500	951.9	1.064
800	916.88	1.105

Pressure Dependence of the Mixing Ratio:

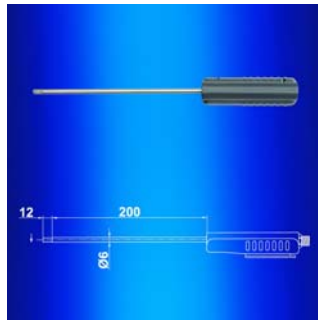
In order to precisely determine the mixing ratio in g/kg or gr/lb at different heights (h) above sea level, the effect of air pressure on the measurement can be corrected using the barometric height formula.

In practice, the mixing ratio is multiplied by a corresponding correction factor (quotient from average air pressure / actual air pressure) for this purpose.

h/[m]	p[hPa=mbar]	Correction Factor
1000	894.26	1.133
1500	840.11	1.206
2000	789.24	1.284
3000	696.56	1.455
4000	614.76	1.648
5000	542.57	1.868
10000	290.53	3.488

The calculated correction factor can be consulted by means of the special function - Pabs – in the measuring instrument.

Note: If the actual air pressure is not known, reference can be made to average values related to sea level, in order to minimise the pressure effect (see table opposite).



5 Flow Sensors

Flow Sensor 6mm / 0...2m/s - 6120.51

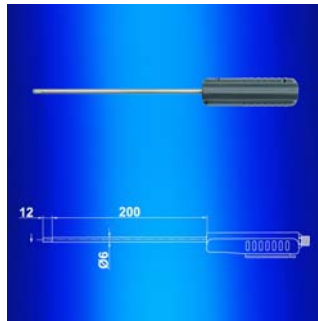
- Application: Flow measurement where high accuracy is demanded or in restricted space conditions
- Response time: ≤ 1.5 seconds
- Measurement variables:

Unit 1: Flow [m/s / fpm]

Unit 2: Temperature [$^{\circ}$ C/ $^{\circ}$ F]

F1	F2	F3	F4
Unit fpm			Input Pabs

Functions of F1...F4

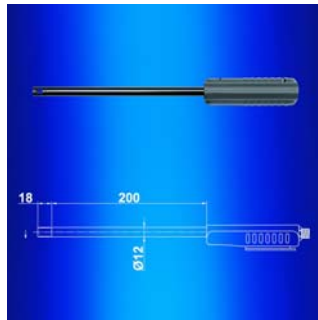


Flow Sensor 6mm / 0...20 m/s -6120.52

- Application: Flow measurement where high accuracy is demanded or in restricted space conditions
- Response time: ≤ 1.5 seconds
- Measurement variables:
 Unit 1: Flow [m/s / fpm]
 Unit 2: Temperature [$^{\circ}$ C/ $^{\circ}$ F]

F1	F2	F3	F4
Unit fpm			Input Pabs

Functions of F1...F4



Flow Sensor 12mm / 0...20 m/s - 6120.53

- Application: Low cost flow measurement in the HVAC sector
- Response time: ≤ 1.5 seconds
- Measurement variables:
 - Unit 1: Flow [m/s / fpm]
 - Unit 2: Temperature [$^{\circ}$ C/ $^{\circ}$ F]

F1	F2	F3	F4
Unit fpm			Input Pabs

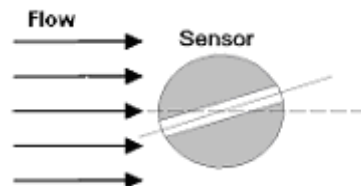
Functions of F1...F4

CAL1 initiates single point flow calibration. The flow set-point (Unit 1) is shown on the upper section of the display. A gradient correction factor, which may be changed to calibrate the flow between 0.8 and 1.2 in steps of 0.001, is shown on the lower section of the display. Set the gradient correction factor to 1.000 to obtain the factory settings.

The calibration value should be $> 50\%$ of the upper end value of the sensor measurement range. Select the direction of flow onto the probe from the straight handle side when calibrating.

Directional effect:

The hand-held flow sensors have only a low directional effect. The measurement error resulting from distorted positioning is less than 3% of the measurement in the range of $\pm 15^\circ$ (α).



CAL2 initiates single point temperature calibration. The temperature set-point (Unit 2) is shown on the lower section of the display. The temperature offset, which may be changed to calibrate by $\pm 10^{\circ}\text{C}$ ($\pm 18^{\circ}\text{F}$) in steps of 0.01°C , is shown on the upper section of the display. Set the temperature offset to 0.00°C to obtain the factory settings.

H/[m]	p[hPa=mbar]	Correction Factor
0	1013.25	1.000
50	1006.94	1.006
100	1000.67	1.013
200	988.25	1.025
300	975.98	1.038
500	951.9	1.064
800	916.88	1.105

Pressure Dependence of Flow Measurement:

In order to precisely measure flow at different heights (h) above sea level, the effect of air pressure on the measurement can be corrected using the barometric height formula.

In practice, the flow velocity is multiplied by a corresponding correction factor (quotient from average air pressure / actual air pressure) for this purpose.

The calculated correction factor can be consulted in the measuring instrument in [hPa], by means of the special

H/[m]	p[hPa=mbar]	Correction Factor
1000	894.26	1.133
1500	840.11	1.206
2000	789.24	1.284
3000	696.56	1.455
4000	614.76	1.648
5000	542.57	1.868
10000	290.53	3.488

function F4 (Pabs). The air pressure is set to 1013 mbar in the factory.

Note: If the actual air pressure is not known, reference can be made to average values related to sea level, in order to minimise the pressure effect (see table opposite).

Tips for correct sensor placement:

- Provide suitable sections to settle air flow after cross-sections, bends and branches (turbulence!).
- Always carry out measurements in the centre of the duct.
- The optimum placement for the sensor is after filters and rectifiers (no turbulence).
- Place sensors before diffusers and pipe contractions.



6 Oil Sensor

Oil Sensor 12 mm - 9130.60

- Application: Moisture measurement in mineral and synthetic oils
- Measurement range: 0...1 a_w / 0...20000 ppm / -40...120°C
- Response time: \leq 10 minutes (still oil)
- Measurement variables:

Unit 1: Temperature [°C/°F]

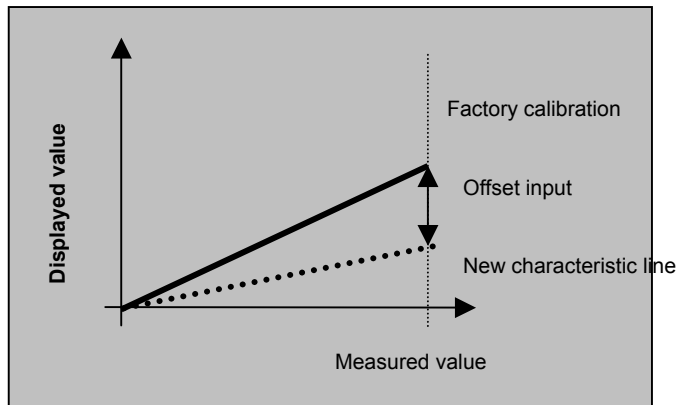
Unit 2: Water activity a_w [], alternatively water content x [ppm] via special function F4

F1	F2	F3	F4
Oil para. A	Oil para. B		Unit a_w

Functions of F1...F4

Single Point Temperature Calibration

CAL1 initiates single point temperature calibration. The temperature set-point (Unit 1) is shown on the upper section of the display. The temperature offset, which can be changed to calibrate by $\pm 10^{\circ}\text{C}$ ($\pm 18^{\circ}\text{F}$) in steps of 0.1°C , is shown on the lower section. Set the temperature offset to 0.00°C to obtain the factory settings.



Important: In the case of water activity, inputting the offset causes the characteristic curve to move in the direction of the zero point.

Single Point Water Activity Calibration

CAL2 initiates single point water activity calibration. The set-point (Unit 2) is shown on the lower section of the display. The offset value for Unit 2, which can be changed to calibrate water activity in the range from ± 0.100 in steps of 0.001, flashes in the upper section. Set the offset to 0.000 to obtain the factory settings. The calibration point should lie in the range from $0.3 \dots 0.95a_w$ (preferably $0.76 a_w$).



Important: Two point calibration should be carried out by an accredited laboratory. Set the offset to 0.000 to obtain the factory settings.

Two Point Water Activity Calibration

CAL2L / CAL2H: The lower calibration value can be calibrated in the CAL2L menu. The upper calibration value can be calibrated in the CAL2H menu. The lower value must lie in the range from 0.000...0.400 and the upper value in the range from 0.600...0.950. Two point calibration is not possible outside these ranges. The maximum offset per point is +/- 0.100 and can be entered in steps of 0.001. A failed calibration is confirmed by CAL FAIL and must be repeated.

Inputting oil-specific parameters for the calculation of water content:

Dependent on the type of oil, different parameters are required to calculate/display the water content in ppm. These sets of parameters describe the saturation behaviour of the oils and can be obtained from the manufacturer on request.

The parameter (A=-1663.3 / B=7.37) is provided by the manufacturer to calculate water content for mineral transformer oil.

The oil-specific parameter A (-1999.9...100.0) is entered via special function F1 and parameter B (0.00...20.00) is entered via special function F2. It is only possible to enter the parameters (A and B) via the special functions F1 and F2 when water content x [ppm] has been selected as the measurement variable.