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Operating instructions

ALMEMO® D7 digital sensors

Measuring connector ±64mV, ±250mV, ±2V, ±20V, ±60V, 20mA ZED700/1/2-FS(2)
Pt100 connector ZPD70x-FS
Pt100 connector ZPD700-FS2
Pt100 connector ZPD730-FS
Potentiometer connector ZWD700-FS
Bridge connector ZKD700-FS
Tensile and compressive force sensors FK0xx+ ZKD712-FS
Precision pressure transducer FD8214xx+ ZDD714-AK
Pressure transducer FD0602Lxx+ ZDD702-AKL
Conductivity sensor FYD741-LF
Meteo Multi sensor FMD760/770
GPS transducer FGD701
D7 thermocouple plug ZTD700-FS
D7-Pt1000-plug ZPD710-FS
pH and Redox connector ZYD7x0-AK
D7 UVE sensor FLD7 x3-UVE

V7

V3.1
05.09.2024

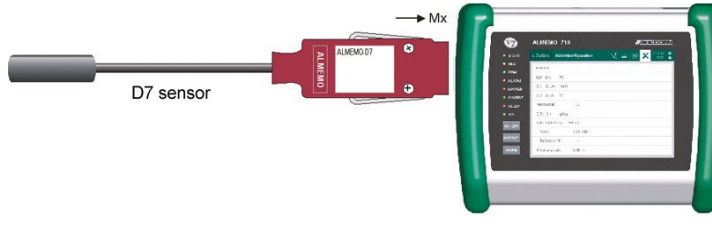
ALMEMO® D7 digital sensors

ALMEMO® D7 digital sensors

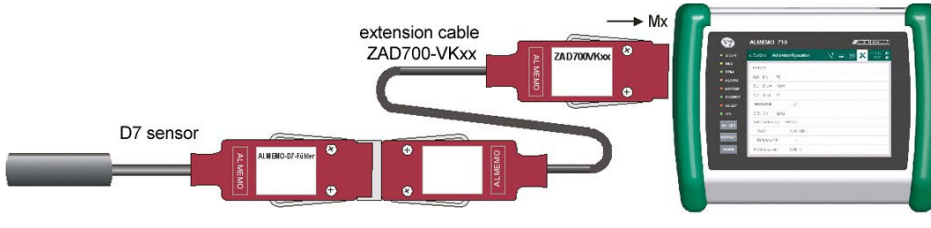
The latest ALMEMO® D7 digital sensors have been designed to overcome all the limitations experienced with earlier sensors regarding measurable variables, speed, range of measured values, and number of channels per sensor. It is also possible to perform efficient measuring operations simultaneously using high-speed and low-speed sensors with any range of measured values. It is even possible, via a menu stored in such sensors, to configure and use new measuring functions and quantities which ALMEMO® devices do not themselves support. All this makes the new ALMEMO® D7 system flexible and sustainable beyond compare. Communication between sensors and the measuring instrument is usually handled over a serial interface. D7 sensors can for this reason only be used in conjunction with new ALMEMO® V7 devices. A sliding average can be configured internally for up to four primary channels.

1. Operation as sensor on ALMEMO® V7 measuring instruments

ALMEMO® D7 sensors supply their definitive digital measured values from up to 10 measuring channels virtually simultaneously over the serial interface to the ALMEMO® V7 device where they are saved and / or output. Function channels can only be programmed and used by the device itself. If the user prefers that a particular measuring channel should not be displayed the measuring quantity and range can be switched off and deactivated as usual via the ALMEMO® device; it can be reactivated in the same way. The sensor is powered via the measuring instrument.



Extension



The operating radius of these sensors when connected to a measuring instrument can be extended by means of extension cable ZAD700-VKxx; measured values and connector programming can then be transmitted interference-free in serial form via an RS-422 driver. For electrical isolation adapter cable ZAD700-GT can be used.

1.1. Atmospheric pressure measurement and compensation

Some measurable variables (those in the measuring range list marked 'with PC') are affected by atmospheric pressure and failure to take account of this may lead to substantial

errors. To ensure the highest possible level of accuracy these D6 sensors are fitted as standard with an atmospheric pressure sensor; this is always used automatically for atmospheric pressure compensation (PC) - even if the particular channel is not activated. The atmospheric pressure is programmed by default as a climate variable and can thus be configured as reference function (s.6.3.6); the measured value can thus also be used to compensate other sensors.

1.2. Correction of measured values

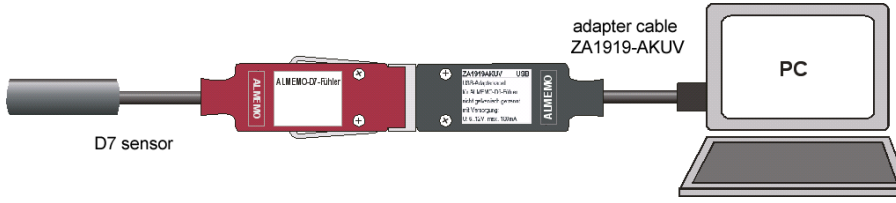
For the primary measuring channels adjustment values or multi-point adjustment can be stored in the D7 sensor (either at our factory or via a V7 measuring instrument using option KL). Correction values (zero-point, gain, base value, factor) are already processed in the sensor.

1.3. Sensor menu

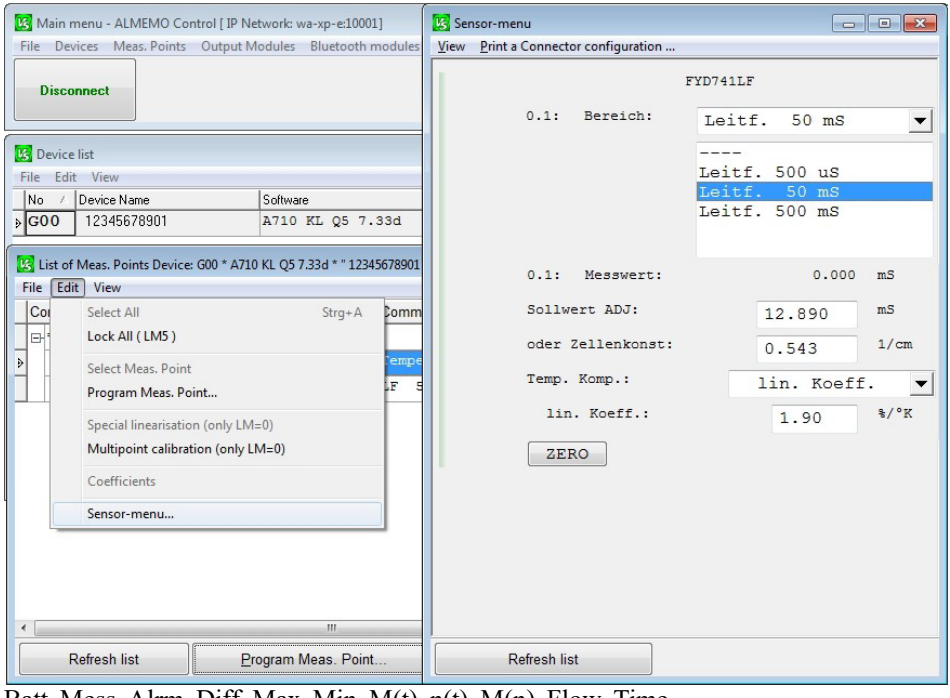
To ensure the long-term future sustainability of the new ALMEMO® V7 measuring system without having to change the measuring instrument each D7 sensor incorporates an individual sensor menu which can be downloaded over the serial interface. It is possible in this way to configure measuring quantities and ranges, the averaging times for measured value smoothing, or other specific sensor functions. As operating device either a new ALMEMO® V7 measuring instrument or a PC can be used.

1.4. Configuration on PC via USB adapter cable

The ALMEMO® D7 sensor can be connected directly to a PC using USB link adapter cable ZA1919-AKUV at a baud rate of 115.2 kilobaud. A microcontroller incorporated in the adapter cable automatically sets the power supply, baud rate, and device address that the sensor requires.



To run the sensor menu via the PC the ALMEMO® Control software should be used (from V. 5.14.0.330 up). The 'Sensor menu' is located in the measuring points list under 'Edit'. Here it is possible to program up to 10 measuring points with specific D7 measuring quantities and ranges for the D7 sensor and also other settings. The measuring quantities and ranges are shown at the interface using new clear and informative abbreviations. Not only the quantity and range are programmed but also automatically the units (up to six characters) and a comments text; and the channel is then locked at level 5.
Ranges can be deleted by selecting '- - - - ' in the list.
Function channels * are determined in the measuring instrument - either as parameters or the result of calculations. They can therefore only be programmed and used by the device itself. The following function channels are available:



Batt, Mess, Alrm, Diff, Max, Min, M(t), n(t), M(n), Flow, Time
However, if connected directly to the PC, these are not available. The advisory note '! unusable' will be displayed in the comments text.
Further parameters, depending on sensor type, can be set (e.g. setpoint adjustment, temperature / atmospheric pressure compensation).

Atmospheric pressure compensation

If the sensor incorporates an atmospheric pressure sensor atmospheric pressure compensation is set by default to 'Sensor'; the current measured value is displayed under 'Value'. However, if a particular value needs to be used (e.g. altitude above sea level, weather forecast, channel), this value can be programmed in menu item 'Value'. It is also possible, by simply clicking on the 'Reference' option here, to use the measured value 'Atmospheric pressure' to compensate other sensors connected to the same ALMEMO® device. This programs abbreviation '*P' in the comments text of measuring channel 'D AP', thus ensuring that this measured value is always available in the ALMEMO® device for the purpose of atmospheric pressure compensation (s.Man. 6.3.6).

Averaging period (smoothing)

All measured values on the primary channels are internally scanned all the time at the individual refresh rate. On most D7 sensors if measuring conditions make these values too unstable an averaging period can be entered in the menu for the primary channels; measured values will then be smoothed by a sliding average.

2. D7 UI connectors ZED700-FS(2), ZED701-FS, ZED702-FS(2)

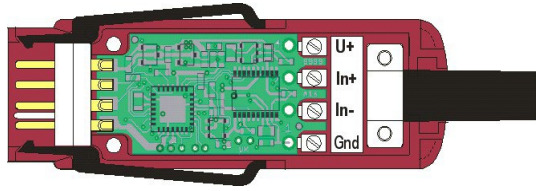
D7 connectors are used, depending on connector type, to record voltages and currents in three different variants and each of these at two rates; they do so by means of an integrated 24-bit delta-sigma A/D converter. At five measuring operations per second (mops) 200,000 digits can be acquired or at 500 mops, 20,000 digits. The necessary sensor supply (U+) and (Gnd) can be set via the device itself at 6, 9, or 12 V. The 4-wire configuration avoids measuring errors resulting from a voltage drop on Gnd.

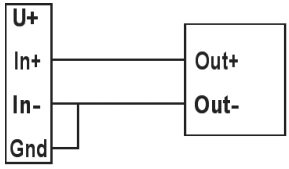
Measuring quantities and ranges - factory default settings

Designation	M/s	Quantity		Measuring range	Units	Resolution
ZED700-FS						
1. * U2.00000	5	B-01	D U25	-2.2...+2.2	V	0.01 mV
2. U2.0000	500	B-02	D U24	-2.2...+2.2	V	0.1 mV
3. U2.000	1000	B-03	D U23	-2.2...+2.2	V	1 mV
4. Fixed value 1V	5	B-04	D U10D	+1.00000	V	0.01 mV
ZED700-FS2						
1. * U250.000	5	B-01	D U254	-250...+250	mV	1 uV
2. U64.000	5	B-02	D U643	-64...+64	mV	1 uV
ZED701-FS						
1. * I20.0000	5	B-01	D I2O4	-20.0...+20.0	mA	0.1 uA
2. I20.000	500	B-02	D I2O3	-20.0...+20.0	mA	1 uA
3. I20.00	1000	B-03	D I2O2	-20.0...+20.0	mA	10 uA
4. Fixed val. 10mA	5	B-04	D I10D	+10.0000	mA	0.1 uA
ZED702-FS						
1. * U20.0000	5	B-01	D U2O4	-20.0...+20.0	V	0.1 mV
2. U20.000	500	B-02	D U2O3	-20.0...+20.0	V	10 mV
3. U20.00	1000	B-03	D U2O2	-20.0...+20.0	V	10 mV
4. Fixed val. 10V	5	B-04	D U10D	+10.0000	V	0.1 mV
ZED702-FS2						
1. * U60.000	5	B-01	D U603	-60.0...+60.0	V	1 mV
2. U60.00	500	B-02	D U602	-60.0...+60.0	V	10 mV
3. U60.00	1000	B-03	D U612	-60.0...+60.0	V	10 mV
4. Fixed val. 30V	5	B-04	D U30D	+30.000	V	1 mV

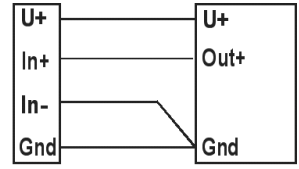
The preset measuring quantities and ranges are indicated by an asterisk (*).

2.1. Pin assignment





Sources without supply



Sensor with supply voltage

Configuration via the sensor menu

The multipoint table stored in the ALMEMO® connector (in the case of a multipoint adjustment) generally acts before the scaling values (zero point/slope and base value/factor). To ensure that an ALMEMO® connector can also be corrected after it has been scaled (e.g. to the physical value bar) using multipoint adjustment, it is also possible to allow the multipoint table to take effect between the scaling value pairs zero/pitch and base value/factor. The **Lin. to NK/SK** checkbox is available in the sensor menu for this purpose. If the check mark is deactivated, both pairs of scaling values act according to the multipoint table. If the checkbox is activated, the multipoint table is calculated according to the scaling value pair zero point/slope, which now enables scaling (e.g. to the physical value bar) with subsequent multipoint correction (of the displayed value in bar).

Technical data

Input resistance	110 kΩ (ZED700/702) 103kΩ (ZED702-FS2) 100Ω (ZED701)
Overload	ZED700-FS: ±3V / ZED700-FS2: ±2,8V / ZED702-FS: ±30V / ZED702-FS2: ±60V / ZED701-FS: ±28mA
A/D converter	Delta-sigma
Accuracy (5mops)	0.02 % ±2 digits
Temperature drift	maximum 30 ppm/K
Nominal temperature	+22 °C ±2 K
Refresh rate	200 ms (5 mops), 2 ms (500 mops)
Power supply	6 / 9 /12 V from the ALMEMO® measuring instrument
Power consumption	approx. 7.5 mA (5 mops), approx. 9.5 mA (500 mops)
Connector colors	Housing ruby red, levers black

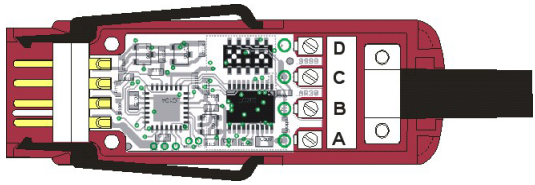
3. D7 Pt100 connector ZPD70x-FS

D7 Pt100 connector ZPD700-FS is used to record the sensor's temperature at the highest possible level of precision across the entire range from -200.00 up to +850.00 °C without linearization errors; it does so by means of an integrated 24-bit A/D converter. Since the sensor does not depend on an evaluating unit for its overall accuracy, it can undergo calibration and even multi-point adjustment independently. For a 3-wire configuration connector ZPD703-FS is available. The level of accuracy in this case depends on the difference in the line resistances.

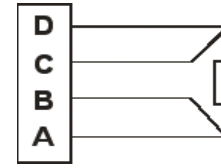
Measuring quantities and ranges - factory default settings

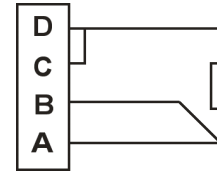
Designation	Quantity		Measuring range	Units	Resolution
ZPD700-FS 4-wire					
1. Pt100 10mops	B-01	DPO4	-200.00...+850.00	°C	0.01 K
ZPD703-FS 3-wire					
1. Pt100 10mops	B-01	DPO3	-200.00...+850.00	°C	0.01 K

3.1. Pin assignment



4-wire connection





3-wire connection

Technical data

Uses	Temperature (depending on sensor type)
Temperature sensor	ZPD700-FS Pt100, 4-wire
	ZPD703-FS Pt100, 3-wire
Measuring quantities and ranges	Temperature -200.00 to +850.00 °C
A/D converter	Delta-sigma
System accuracy	0.07 K ±2 digits
Temperature drift	maximum 30 ppm/K
Nominal temperature	+22 °C ±2 K
Refresh rate	0.1 seconds
Self-calibration	12.8 seconds
Supply voltage	6 to 13 VDC
Current consumption	approx. 8.5 mA
Connector colors	Housing ruby red, levers black

4. D7 double Pt100 connector ZPD700-FS2

The D7 double Pt100 connector ZPD700-FS2 uses its own 24-bit AD converter to record the temperature of two Pt100 sensors with maximum precision over the entire range from -200.00 to +850.00 °C, linearization with calculation method (no approximation method). As the overall accuracy of the sensor does not depend on an evaluation device, the sensor can also be calibrated and multi-point adjusted on its own.

Important note:

This plug is always supplied ready-made ex works only with selected sensor types (including with solder connection and special dimensions of the sensor cable); the sensor is not included in the scope of delivery of the plug. Offer/sale only after consultation with our sales department.

Measuring quantities and ranges - factory default settings

Designation	Quantity		Measuring range	Units	Resolution
ZPD700-FS2 4-wire					
1. Pt100 10mops	B-01	**DP24**	-200.00...+850.00	°C	0.01 K
2. Pt100 10mops	B-02	**DP24**	-200.00...+850.00	°C	0.01 K

4.1. Technical data

Uses	Temperature (depending on sensor type)
Temperature sensor	ZPD700-FS2 2x Pt100, 4-wire
Measuring quantities and ranges	Temperature -200.00 to +850.00 °C
A/D converter	Delta-sigma
System accuracy	0.07 K ±2 digits
Temperature drift	maximum 30 ppm/K
Nominal temperature	+22 °C ±2 K
Refresh rate	0.1 seconds
Supply voltage	6 to 13 VDC
Current consumption	approx. 9 mA
Connector colors	Housing ruby red, levers black

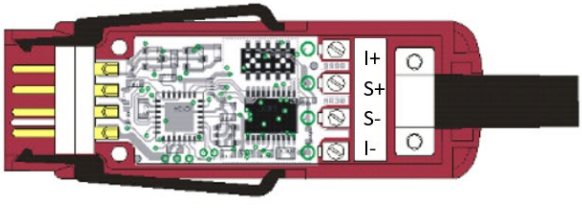
5. D7 precision Pt100 connector ZPD730-FS

The D7 Pt100 connector ZPD730-FS uses its own 24-bit AD converter to record the temperature of a Pt100 sensor with maximum precision over the entire range from -200.000 to +450.000 °C, linearization with calculation method (no approximation method). As the overall accuracy of the sensor does not depend on an evaluation device, the sensor can also be calibrated and multi-point adjusted on its own.

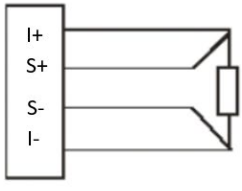
Measuring quantities and ranges - factory default settings

Designation	Quantity		Measuring range	Units	Resolution
ZPD730-FS 4-wire					
1. Pt100	B-01	**DP34**	-200.00...+450.00	°C	0.001 K

Pin assignment



4-wire connection



5.1. Technical data

Uses	Temperature (depending on sensor type)
Temperature sensor	ZPD730-FS Pt100, 4-wire
Measuring quantities and ranges	Temperature -200.00 to +400.00 °C
A/D converter	Delta-sigma
System accuracy	0.015 K ±2 digits
Temperature drift	maximum 30 ppm/K
Nominal temperature	+22 °C ±2 K
Refresh rate	3.4 seconds
Supply voltage	6 to 13 VDC
Current consumption	approx. 9 mA
Connector colors	Housing ruby red, levers black

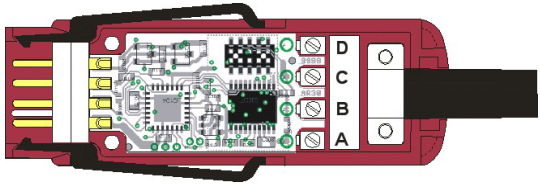
6. D7-Potentiometer connector ZWD700-FS

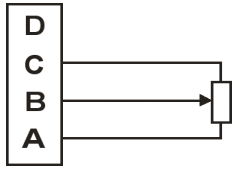
D7 potentiometer connector ZWD700-FS, operating at 100 measuring operations per second, is used to record the voltage drop at a potentiometer sensor fed with a 2V reference voltage from its integrated 24-bit A/D converter.

Measuring quantities and ranges - factory default settings

Designation	Quantity		Measuring range	Units	Resolution
1. Poti 100mops	B-01	D U24	0.00...+100.00	%	0.01 %
2. Poti 10mops	B-02	D U25	0…+200000		

6.1. Pin assignment





Technical data

Measuring range	00.00 to 100.00 %
	0 to +200000 digits
A/D converter	Delta-sigma
System accuracy	0.02% ±2 digits
Temperature drift	maximum 30 ppm/K
Nominal temperature	+22 °C ±2 K
Refresh rate	0.01 seconds
	0.1 seconds
Supply voltage	6 to 13 VDC
Current consumption	approx. 8.0 mA
Connector colors	Housing ruby red, levers black

7. D7 bridge connector ZKD700-FS

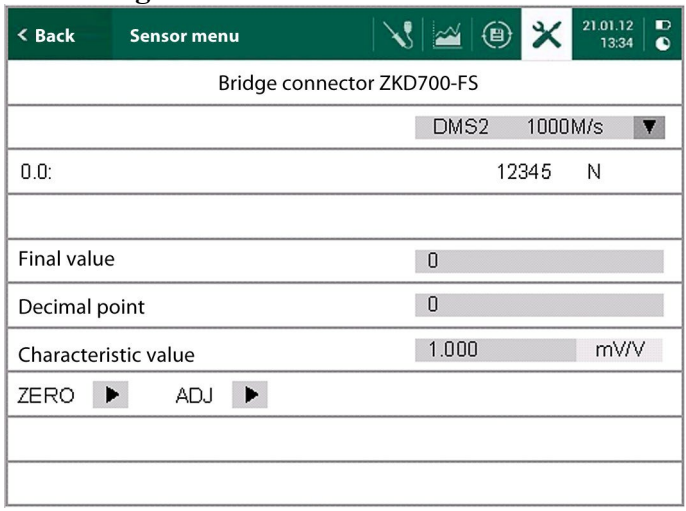
D7 bridge connector ZKD700-FS is used to record the output voltage of a 4-wire full bridge with a 5V supply (5V, Gnd); it does so by means of an integrated high-speed 24-bit A/D converter. It is thus possible to record dynamic changes in force by means of wire strain gauges at two different conversion rates, namely 10 or 1000 measuring operations per second. Connection is via four screw terminals.

Measuring quantities and ranges - factory default settings

Designation	Quantity		Measuring range	Final value	Units	Resolution
1. Force 10mops	B-01	**DMS1**	0..+200000.	200000	xx	1 xx

Adjustment is performed by means of internal high-precision resistors each time the device is switched on, a sensor is connected, or there is a change in the quantity being measured. Depending on the specifications of the wire strain gauges the measuring channel must be programmed with the required units. Scaling is performed via the sensor menu either on the V7 measuring instrument or on the PC.

7.1. Configuration via the sensor menu



The following four measuring ranges can be configured. (* factory default settings)

Designation	Quantity		Input range	Measuring range	Final value	Units	Res.
1. * Force 10mops	B-01	**DMS1**	29.3 mV	0..+200000.	200000	xx	1 xx
2. Force 1000mops	B-02	**DMS2**	29.3 mV	0..+50000.	50000	xx	1 xx
3. Force 10mops	B-03	**DMS3**	58.6 mV	0..+200000.	200000	xx	1 xx
4. Force 1000mops	B-04	**DMS4**	58.6 mV	0..+50000.	50000	xx	1 xx

7.2. Sensor adjustment and scaling

These two quantities offer two different conversion rates and thus also different measuring ranges and resolutions. It is important to strictly adhere to each of the maximum final values including the decimal point.

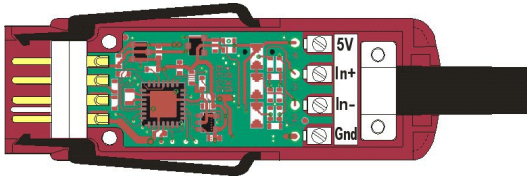
For the purpose of zero adjustment the 'ZERO' key is provided.

For configuring the sensor's individual gain and scaling there are two possible procedures.

1. If the sensor was supplied with a specific 'characteristic value ' in mV / V, this can easily be entered in the sensor menu; scaling will then be performed with the final value and decimal point.
2. Or, alternatively, the indicator can be deleted and the sensor can be subjected to a force equivalent to the final value. Scaling will then be performed, similarly, using the final value and the decimal point. Pressing the 'ADJ' key will adjust the gain accordingly.

For taring purposes the standard function for 'zero-setting' the measured value is available.

7.3. Pin assignment



Technical data

Power supply	from 6 V up, from the ALMEMO® device itself
Bridge voltage	5 V stabilized (terminals 5V and Gnd)
A/D converter	Delta-sigma, ratiometric (Bridge voltage = reference)
Common-mode range	0.25 to 4.75 V
Input range	-29.300 to +29.300 mV (terminals In+ and In-)
Display range	0 to ±200,000 (range DMS1 at 10 mops)
	0 to ±50,000 (range DMS2 at 1000 mops)
Input range	-58.600 to +58.600 mV (terminals In+ and In-)
Display range	0 to ±200,000 (range DMS3 at 10 mops)
	0 to ±50,000 (range DMS4 at 1000 mops)
Accuracy (10mops)	0.02% ±2 digits
Temperature drift	maximum 30 ppm/K
Nominal temperature	+22 °C ±2 K
Self-calibration	Each time the device is switched on or a sensor is connected
Refresh rate	DMS1/DMS3 100 ms, DMS2/DMS4 1 ms
Current consumption	approx. 15.5 mA
Connector colors	Housing ruby red, levers black

8. D7 tensile and compressive force sensors FK0xx

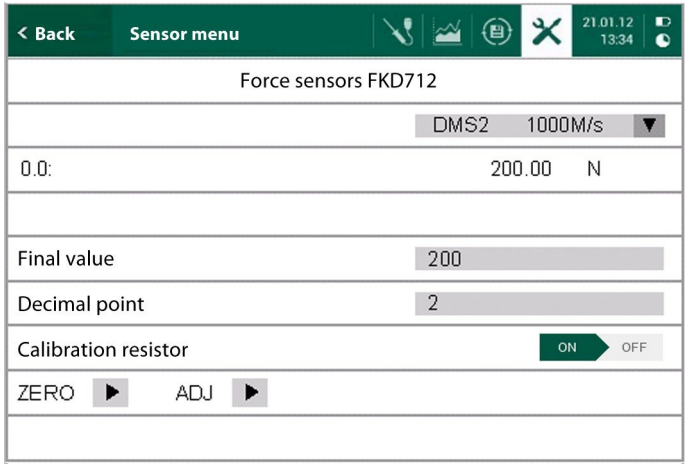
D7 tensile and compressive force sensors FK0xx incorporate wire strain gauges in the form of a 4-wire full bridge; these are fed via the electronics in the plug on connecting cable ZKD712FS with a 5V bridge supply and are evaluated via a high-speed 24-bit A/D converter. It is thus possible to record dynamic changes in force at two different conversion rates, namely 10 or 1000 measuring operations per second. To adjust the final value these sensors incorporate an internal adjustment resistor which can be activated as and when required via the sensor menu.

Measuring quantities and ranges - factory default settings

Designation	Quantity		Measuring range	Units	Resolution
1. Force 10mops	B-01	DMS1	+	+	+

+ Measuring range, units, and resolution depending on type (see data sheet)

8.1. Configuration via the sensor menu



The following four measuring ranges can be configured. (* factory default settings)

Designation	Quantity		Input range	Measuring range	Final value	Units	Res.
1. * Force 10mops	B-01	DMS1	29.3 mV	+	+	+	+
2. Force 1000mops	B-02	DMS2	29.3 mV	+	+	+	+
3. Force 10mops	B-03	DMS3	58.6 mV	+	+	+	+
4. Force 1000mops	B-04	DMS4	58.6 mV	+	+	+	+

+ Measuring range, units, and resolution depending on type (see data sheet)

8.2. Sensor functions

The user can set the sensor to zero at any time by pressing the 'ZERO' key. These two quantities are scaled by means of the factor according to the sensor's measuring range and at the conversion rate providing the highest resolution. Users wishing to scale the sensor themselves (e.g. to other units) can enter the required final value and the decimal points and then for the purposes of adjusting the gain activate the internal 'calibration resistor' corresponding to the final value and press the 'ADJ' key.

8.3. Technical data ZKD712-FS

s. page 14

9. D7 pressure sensors FD0602Lxx

Pressure sensors FD0602Lxx are used to record output voltage (0.2 to 2.2 V) in two possible resolutions and conversion rates; they do so by means of an integrated 24-bit delta-sigma A/D converter incorporated in the connector of adapter cable ZDD702AKLxx. At five measuring operations per second (mops) 200,000 digits can be acquired or at 500 mops (factory default setting), 50,000 digits. Exact details regarding the sensor's measuring quantities and ranges, units, conversion rate, and resolution are provided, depending on type, in the respective data sheets.

In case the measuring range respectively the measuring rate is reprogrammed, the scaling values will be deleted. The scaling must then be reprogrammed (e.g. by using the ALMEMO® Control software).

9.1. Technical data ZDD702AKLxx

Input	0.2 to 2.2 V 4-wire configuration
Output	0 to 200,000 (range DMS1 at 5 mops)
	0 to 50,000 (range DMS2 at 500 mops)
A/D converter	Delta-sigma
Accuracy (5mops)	0.02% ±2 digits
Temperature drift	maximum 30 ppm/K
Nominal temperature	+22 °C ±2 K
Refresh rate	200 ms (5 mops), 2 ms (500 mops)
Power supply	9 V from the ALMEMO® measuring instrument
Power consumption	approx. 11 mA, DMS1 including sensor
	approx. 13 mA, DMS2 including sensor
Connector colors	Housing ruby red, levers black

9.2. D7 pressure sensors FD8214xx

Pressure sensors FD8214xx are used to record output voltage (0 to 2.0 V) in two possible resolutions and conversion rates; they do so by means of an integrated 24-bit delta-sigma A/D converter incorporated in the connector of adapter cable ZDD714AKxx. At five measuring operations per second (mops) 200,000 digits can be acquired or at 500 mops, 50,000 digits. Exact details regarding the sensor's measuring quantities and ranges, units, conversion rate, and resolution are provided, depending on type, in the respective data sheets.

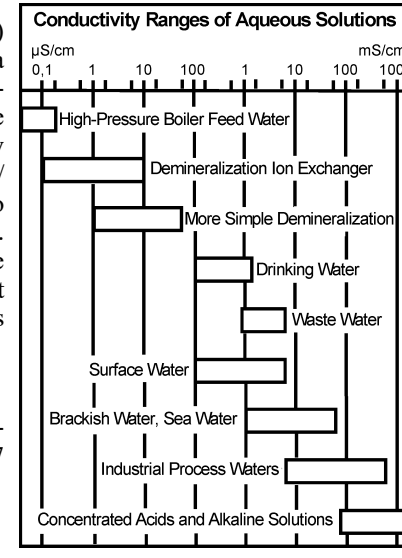
9.3. Technical data ZDD714AKxx

Input	0.0 to 2.0 V 4-wire configuration
Other useful data	see Chapter 7.1

10. D7 conductivity probe FYD741LF

10.1. Basic principles

The conductivity (unit S/m = Siemens/meter) is a measure for the ion concentration in a measuring solution. Conductivity is proportional to the amount of salt, acid, or base alkaline content measured in the solution, High-purity water has a conductivity of approx. 0.05 µS/cm (at +25 °C), natural water approx. 100 to 1000 µS/cm, and some alkaline solutions (e.g. potassium hydroxide solution) slightly more than 1200 mS/cm. The diagram on the right shows further relevant examples of aqueous solutions.



Standardization

The method for determining the electrical conductivity of water is defined in DIN EN 27 888.

Temperature compensation

Conductivity is a temperature-dependent variable. For most diluted, aqueous salt solutions within a certain temperature range conductivity is an approximately linear function of temperature T.

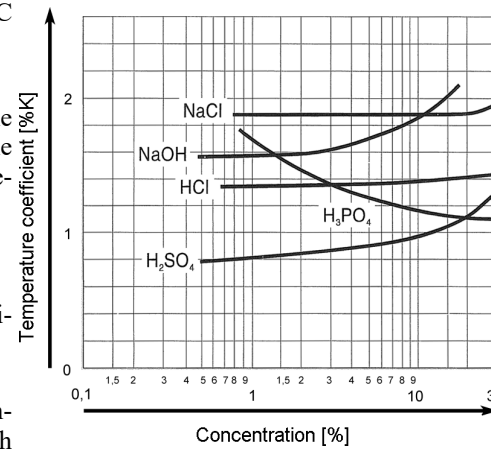
$$\kappa_T = \kappa_{25}\,(1+\alpha(T-25°C)/100)$$

Conductivity, at reference temperature 25°C κ25, is calculated as follows:

$$\kappa_{25} = \kappa_T / (1+\alpha(T-25°C)/100)$$

The temperature coefficient α describes the relative change in conductivity in % as the temperature changes with respect to reference temperature 25 °C.

$$\alpha = (\kappa_T - \kappa_{25}) * 100\% / \kappa_{25}\,(T-25)$$



Temperature coefficient α depends on:

- the chemical composition of the solution
- the concentration of the electrolyte
- the temperature, especially at low conductivity levels of <1 µS and at very high conductivity levels

10.2. Measuring principle

The conductivity in electrolytes is obtained via an electro-chemical resistance measurement using a 4-electrode measuring cell. An AC voltage with a frequency of approx. 1 kHz is applied to the electrodes. The current flowing through the test object is converted into a voltage. This voltage is rectified via a true RMS (TRMS) converter, smoothed, and then fed to an 18-bit A/D converter. The temperature is measured by means of an NTC sensor.

Measuring quantities and ranges

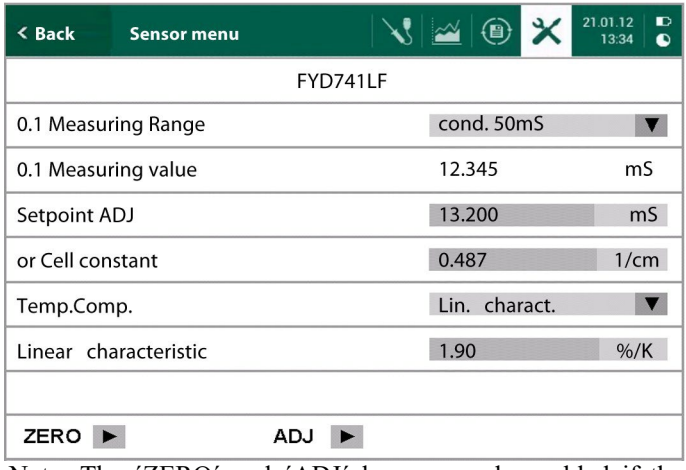
Two measuring channels (depending on type) are available (factory default settings).

Designation	Quantity	Measuring range	Units	Resolution
1. Temperature	D t	See technical data for probe	°C	0.01 K
2. Conductivity 50 mS	DLF2	See technical data for probe	mS	0.001 mS

The sensor is already adjusted on delivery and ready for use. Temperature compensation is preset to a linear characteristic with a temperature coefficient of 1.90 %/K. In the measuring operation the sensor must be lowered at least 30 mm into the liquid so that the electrodes are completely immersed.

10.3. Configuration via the sensor menu

The sensor parameters (measuring quantity and range, temperature compensation, probe adjustment) can be configured in the sensor menu either on a V7 measuring instrument or on the PC using the ALMEMO® Control software (V. 5.14.0.330 and above).



Note: The ´ZERO´ and ´ADJ´ keys are only enabled if the locking of the sensor (locking level 0) has been disabled.

10.3.1. Configurable measuring quantities and ranges

In the D7 sensor it is possible to configure not only the temperature range on the first measuring channel but also any one of three conductivity ranges from the following list on the second measuring channel. (* factory default settings)

Designation	Quantity		Measuring range	Units	Resolution
1. Conductivity LF1 500 uS	B-01	DLF1	0...500.00	uS	0.01 uS
2. * Conductivity LF2 50 mS	B-02	DLF2	0...50.000	mS	0.001 mS
3. Conductivity LF3 500 mS	B-03	DLF3	0...500.00	mS	0.01 mS

Ranges can be deactivated by selecting stops '--------' in the list.

Note: The measurable quantity can only be changed while sensor locking is disabled (locking level 0).

10.3.2. Cell constant

The cell constant is the indicator used for conductivity measuring cells as determined by the size and geometric arrangement of the measuring electrodes. It remains virtually unchanged. So long as the electrode surfaces are clean and free of any insulating deposits calibration is generally not necessary. However, after cleaning, repair, or probe replacement it may be necessary to correct the cell constant. It can then be reset as part of a calibration process using reference solutions. The cell constant is preconfigured to the following values. FYD741LFP: 0,500 FYD741LFE01: 0,550

Note: The cell constant can only be entered while sensor locking is disabled (locking level 0).

10.3.3. Setpoint

The probe adjustment method in which the cell constant is entered is generally less satisfactory than the method of adjusting the measuring ranges on the basis of a reference solution. In this method the conductivity of the reference solution is entered as setpoint and the probe is then adjusted by pressing the '**ADJ**' key. In so doing the cell constant is reset based on the quality of the reference solution.

Note: The probe can only be adjusted while sensor locking is disabled (locking level 0).

10.3.4. Temperature compensation

For this probe, under menu item 'Temp.Comp.', three different settings are available.

Temp. Comp.:

Off	No temperature compensation at low or very high conductivity values
Natural water	Temperature compensation with non-linear characteristic for natural water and high-purity water
Linear characteristic	Temperature compensation with linear characteristic and settable temperature coefficient

The linear temperature coefficient is entered in the next line

Temperature coefficient 1.90 %/K

If the temperature coefficient of a sample is not known, α can be defined experimentally. We measure electrical conductivity values $\kappa 25$ at (25 ± 0,1) °C and κT at a known temperature (T2 ± 0,1) °C; these values are then entered in the following equation $\alpha = (\kappa_T - \kappa_{25}) * 100\% / \kappa_{25} (T2-25)$.

If measuring is performed without temperature compensation, the conductivity measured at a known temperature can be converted to 25 °C using a correction factor.

10.4. Routine servicing and care

Minor dust and dirt can be removed using a soft brush. Cleaning on a more intensive scale, as required if the electrodes are very dirty, may result in the distances between electrodes being slightly altered; this may have an adverse effect on results.

Checking

In the following circumstances it makes good sense to check the probe:

- in the event of the geometry changing (e.g. electrode spacing)
- after use in extreme conditions (e.g. high temperatures)
- if the probe produces measured results that are not plausible

Adjusting the D7 conductivity probe

A conductivity probe of this type is adjusted at two measuring points:

1. **in a dry condition** at 0 mS/cm
   sensor adjustment by pressing key 'ZERO'
2. **in reference solutions** as per measuring range
   e.g. 147 µS/cm - 0.001 mol KCl reference solution at (25 ±0,1) °C
   in measuring range 500 µS or
   12.88 mS/cm - 0.1 mol KCl reference solution at (25 ±0,1) °C
   in measuring range 50 mS

Enter setpoint (reference value) in function 'Setpoint'
Sensor adjustment by pressing key 'ADJ'.

Throughout the adjustment procedure the solution must be kept at a constant temperature (25 ±0.1) °C

The probe can also be adjusted outside of standard conditions (25 ±0.1) °C.

Zero-point adjustment is performed as described above. For the purposes of gain adjustment the value of the reference solution at a known temperature (see Table 1) is compared with the deviating value determined on site; this ratio is manually entered as correction value in the ALMEMO® plug under 'Gain correction' (GC).

Example

Adjustment of probe using 1 mol KCl reference solution at measured solution temperature 20.0 °C.

Value for reference solution at solution temperature 20.0 °C 102.09 mS/cm (Table 1)
Measured value at solution temperature 20.0°C : 98.72 mS/cm

$$G = \frac{\textit{Value for reference solution at solution temperature 20°C}}{\textit{Measured value at solution temperature 20°C}} = \frac{102{,}09}{98{,}72} = 1{,}034$$

Table 1:
Electrical conductivity κ in mS/cm of KCL standard solutions as a function of temperature t and concentration:

t [°C]	κ [mS/cm] 0,001 mol/l	κ [mS/cm] 0,01 mol/l	κ [mS/cm] 0,02 mol/l	κ [mS/cm] 1,00 mol/l
0		0,776	1,521	65,41
1		0,800	1,566	67,13
5		0,896	1,752	74,14
10		1,020	1,994	83,19
15		1,147	2,243	92,52
16		1,173	2,294	94,41
17		1,199	2,345	96,31
18	0,127	1,225	2,397	98,24
19	0,130	1,251	2,449	100,16
20	0,133	1,278	2,501	***102,09***
21	0,136	1,305	2,553	104,02
22	0,138	1,332	2,606	105,54
23	0,141	1,358	2,659	107,89
24	0,144	1,386	2,712	109,84
25	***0,147***	***1,413***	***2,765***	***111,8***

Reference solutions are available as accessories specific to each conductivity range. (See our main product catalog, pages 16.06 and 16.07

Solutions for calibrating conductivity probes are non-buffered systems. Their conductivity values are not stable; they are affected even by small amounts of contamination or dilution (e.g. water droplets on the probe). This applies in particular at low conductivity levels.

Clean measuring cells

Before starting calibration it is important to ensure that the probe is clean. Any contaminant residues should be rinsed off using distilled water. The probe should be dried and then rinsed with the recommended calibration solution.

Examples of typical conductivities

Distilled water	< 5	µS/cm
Rain water	50-100	µS/cm
Drinking water	500	µS/cm
Mineral water	> 1000	µS/cm
Industrial effluent	5	mS/cm
Sea water	50	mS/cm
1 mol/L NaCl	85	mS/cm
1 mol/L HCl	332	mS/cm

Technical data

Probe	**FYD741LFE01**	**FYD741LFP**
4-contact conductivity probe	Laboratory electrode	Process electrode
Measuring range Conductivity	10 µS to 500 mS	10 µS to 200 mS
Accuracy under nominal conditions	±2% of measured value ±0.2% of final value	±3% of measured value ±0.2% of final value
Temperature sensor	NTC sensor 30 kΩ	NTC sensor 10 kΩ
Temperature	0 to +80 °C	0 to +70 °C
Accuracy	0.2 °C	0.2 °C
Temperature compensation	automatic / not compensated	
Temperature coefficient	Natural water / linear (α = 0.00 to 9.99)	
Cell constant	approx. 0.5 cm^{-1}	approx. 0.5 cm^{-1}
Electrode material	Special carbon	Special carbon
Nominal temperature	25 ±2 °C	25 ±2 °C
Operating temperature	0 to +80 °C	0 to +70 °C
Minimum immersion depth	30 mm	30 mm
Shaft material	PC (+ABS)	PVC - C
Shaft length / shaft diameter	120 mm / 12 mm	130 mm / 20 mm
Fitted length / thread	- - -	145 mm / G ¾-inch
Maximum pressure	unpressurized	16 bar at +25 °C
Connector	ALMEMO® D7	
Cable length	1.0 m	1.5 m
Supply voltage	6 to 13 VDC	
Current consumption	approx. 10 mA	
Connector colors	Housing ruby red, levers black	
Refresh rate	2.5 seconds	
A/D converter	Delta-sigma, 18-bit resolution	
Sleep mode on the device	possible with sleep delay 5 seconds	

11. D7 Meteo-Multi FMD760/770

11.1. Safety instructions

- Assembly, installation, and putting into service should be performed exclusively by appropriately trained and qualified specialist personnel.
- Measuring operations should never be performed on live components; live components should never be touched.
- It is important to strictly adhere to the technical data, storage conditions, and operating conditions.

11.2. Intended use

- The device must only be operated according to the specified technical data.
- The device must only be used under the conditions and for the purposes for which it has been designed.
- If the device is in any way modified or converted its working safety and proper functioning can no longer be guaranteed.

11.3. Improper or unintended use

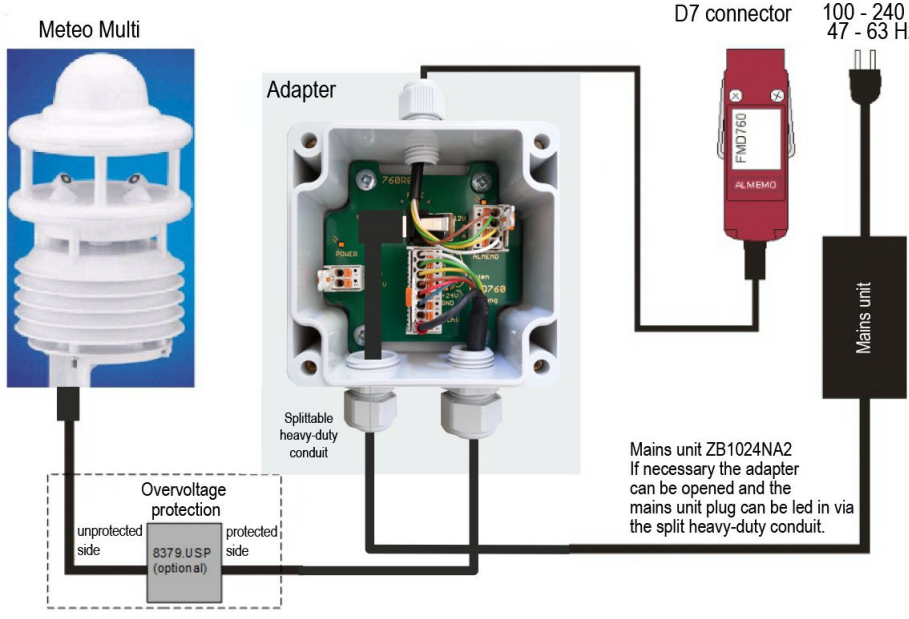
- If the device is not properly installed
- the device may not function properly or may not function at all
- the device may be permanently damaged
- the device may fall - with risk of injury to users

- If the device is not properly connected
- the device may not function
- the device may be permanently damaged
- there may be a risk of electric shock

11.4. Introduction

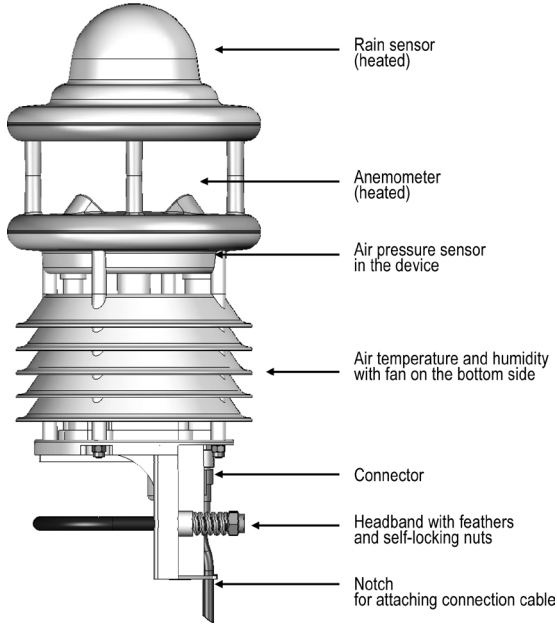
The Meteo Multi FMD760 / FMD770 is a compact, light-weight multi-sensor system for measuring all important meteorological variables. From 17 possible measuring quantities and ranges - temperature, relative humidity, atmospheric pressure, wind velocity, wind direction, rain, snow, radiation and hail - 10 variable combinations can be configured in the configuration menu and recorded simultaneously.

With the connector adapter it is possible to warm the sensor, activate the fan, or just to save the ALMEMO® device battery by using mains unit ZB1024NA2. (see Figure).



11.5. Overview of intelligent weather sensors

The Figure outlines the structure of the weather sensor system.



11.6. Putting into service

To put the weather station into service the following steps must be taken. A connection overview is shown in the Figure on page 24.

- Cabling between ALMEMO® connector and the sensor
- Feeding the necessary supply for heating and fan via external mains unit (via mains unit plug or WAGO terminal strip)
- Installation of overvoltage arrester (optional)
- Completing the wiring and then plugging the ALMEMO® connector into the measuring instrument
- Checking the signal LEDs in the adapter
- These LEDs and their respective meanings are listed in the following table.

LED	Description
POWER	Signals the status of the external supply voltage LED active: External supply present LED inactive: External supply absent or defective
ALMEMO	Signals the status of the ALMEMO® supply voltage from the instrument LED active: ALMEMO® supply voltage active LED inactive: ALMEMO® supply defective
FMD760	Signals the status of the sensor supply LED active: Sensor supplied with 12 or 24 V LED inactive: Sensor not supplied Possible reasons: Defect in measuring instrument, mains unit, or sensor Circuit-breaker in adapter is opened

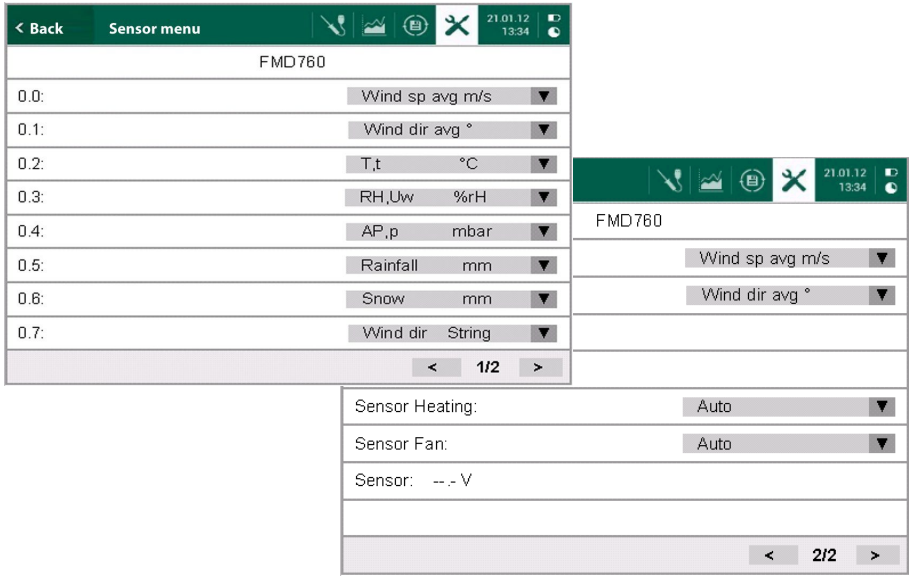
11.7. Measuring quantities and ranges - factory default settings

Designation	Quantity		Expo-nent	Measuring range	Units	Resolution
1. Wind direction, averaged	B-02	**D Davg**	0	0...+359	°	1 °
2. Wind velocity, averaged	B-05	**D Dvavg**	0	0.5... 60.0	m/s	0.1 m/s
3. Wind velocity, maximum	B-06	**D Dvmax**	0	0.5... 60.0	m/s	0.1 m/s
4. Atmospheric pressure	B-12	**D p**	0	600...1100.0	mbar	0.1 mbar
5. Temperature, at present	B-09	**D t**	0	-52...+60.0	°C	0.1 K
6. Relative humidity	B-11	**D Uw**	0	0... 100.0	%rH	0.1 % rH
7. Rainfall quantity	B-13	**D R**	0	0...999.99	mm	0.01 mm
8. Rainfall intensity	B-14	**D Ri**	0	0...200.0	mm/h	0.1 mm/h

11.8. Configuration via the sensor menu

Measuring quantities and ranges configurable via ALMEMO® Control or the device itself

Combinations for the measuring channels can be configured from a list of 17 possible measuring quantities and ranges. (* factory default settings):



Designation	Quantity		Ex-po-nent	Measuring range	Units	Resolution
1. Wind direction, minimum	B-01	**D Dmin**	0	0...+359	°	1 °
2. * Wind direction, averaged	B-02	**D Davg**	0	0...+359	°	1 °
3. Wind direction, maximum	B-03	**D Dmax**	0	0...+359	°	1 °
4. Wind velocity, minimum	B-04	**D vmin**	0	0.5... 60.0	m/s	0.1 m/s
5. * Wind velocity, averaged	B-05	**D vavg**	0	0.5... 60.0	m/s	0.1 m/s
6. * Wind velocity, maximum	B-06	**D vmax**	0	0.5... 60.0	m/s	0.1 m/s
7. Temperature, minimum	B-07	**D tmin**	0	-52...+60.0	°C	0.1 K
8. Temperature, averaged	B-08	**D tavg**	0	-52...+60.0	°C	0.1 K
9. * Temperature, at present	B-09	**D t**	0	-52...+60.0	°C	0.1 K
10. Temperature, maximum	B-10	**D tmax**	0	-52...+60.0	°C	0.1 K
11. * Relative humidity	B-11	**D Uw**	0	0... 100.0	%rH	0.1 % rH
12. * Atmospheric pressure	B-12	**D p**	0	600...1100.0	mbar	0.1 mbar
13. * Rainfall quantity	B-13	**D R**	0	0...999.99	mm	0.01 mm
14. * Rainfall intensity	B-14	**D Ri**	0	0... 200.0	mm/h	0.1 mm/h
15. Snow / hail quantity	B-15	**D H**	0	0...999.99	mm	0.01 mm
16. Snow / hail intensity	B-16	**D Hi**	0	0...200.0	mm/h	0.1 mm/h
17. Wind direction,Abbreviation	B-17	**D Dtxt**	0	0...+359	°	22.5 °
18. ~ Radiation W/m2	B-18	**D GR**	0	0 … 2000.0	W/m2	0.1

It is possible to automatically program not only the quantity and range but also all sensor-specific parameters, e.g. units, comments text, sensor supply, and locking level.

11.9. Sensor functions

The wind velocities is output from 0 m/s. The response threshold is 0.3 m/s.

With wind velocities under 0.5 m/s the measured values wind direction are not output. The maximum, minimum, and average values for the individual variables are calculated continuously by means of function channels Xmax, Xmin, Xavg, and the sensor-internal cycle of 2 seconds. To call up these values the required **output cycle** (2 seconds to 24 hours) must be programmed in the device.
In the sensor menu the humidity fan can be switched off with a view to saving energy and the station thus be operated on the ALMEMO® device with 12 V in energy saving mode 1 (approx. 25 mA). The rain radar is then only tested once per minute and the fan remains deactivated. If the 24-V mains unit is connected and automatic mode is set the heating, fan, and radar are activated automatically as and when needed. The sensor supply voltage can be checked in the display.

11.10. Limitations when operating without an external supply

If the Meteo Multi is operated without an external supply voltage, e.g. with an operating voltage below 12 VDC, the fan will - irrespective of the fan mode setting - not be activated. This may in conditions of strong direct sunlight affect the accuracy of temperature and humidity measurement.

11.11. Operating modes of the device heating

In the factory default settings the heating is configured to **AUTO**. This is the recommended operating mode for heating the intelligent weather sensor system. The following operating modes can also be set :

Automatic In the 'automatic' mode the device is kept at a constant standard temperature in order to usually avoid the adverse effects caused by snow and ice.

Off In the 'off' mode the heating is completely deactivated. In this mode winter operation is not possible because ice may prevent the rain sensor and wind measuring instruments from functioning properly.

11.12. Operating modes of fan

In the factory default settings the fan is configured to **AUTO**.

Automatic In the 'automatic' mode the fan is switched on and off on a cyclic basis.

OFF In the 'off' mode the fan can be switched off with a view to reducing consumption and saving energy.

Advisory note

If the fan is deactivated the heating will also be deactivated (energy saving mode 1). If the fan is deactivated this may in conditions of strong direct sunlight lead to discrepancies in temperature and humidity measurement. (see chapter 9.13)
If the weather station is supplied directly via the measuring instrument, the fan will be deactivated - irrespective of the setting AUTO / OFF setting. (see chapter 9.10)
In the AUTO setting the weather station will not switch to energy saving mode 1.

11.13. Energy saving mode 1

Energy saving mode 1 initiates the following measures:

- Ventilation of the temperature / humidity unit is deactivated.
- All heating is deactivated.
- The RADAR rainfall sensor does not operate continuously; the sensor is activated for one second per minute only; if during that period precipitation is detected, the sensor will remain activated until the end of such event; if no precipitation is detected, it is deactivated again after the one second.
- The compass direction is acquired once only - when the device is switched on. For this purpose the fan, which is otherwise usually deactivated, is switched on for a brief period.

Advisory note This operating mode is subject to the following limitations:

- If the fan is deactivated this may in conditions of strong direct sunlight lead to discrepancies in temperature and humidity measurement.
- Winter operation is only possible on a limited basis because ice may prevent the rainfall sensor and wind measuring instruments from functioning properly.
- The signal for rainfall detection may be delayed by up to two minutes. Short events may in certain circumstances not de detected at all. This may result in deviations affecting the accuracy of precipitation amounts detected.

11.14. Technical data

Dimensions	332 (~344mm) x 150 mm (height x diameter)
Operative range	Temperature -52 to +60 **°C**
Refresh rate	2 seconds for all channels
Connector colors	Housing ruby red, levers light gray
Interface	RS-485 (line length up to 100 meters possible)
Supply voltage	12 to 30 VDC
Current consumption, device	**Supply via mains unit 24 V**
	All functions are available.
	24 V from the mains unit, maximum 1.8 A
	12 V from the ALMEMO® device typical 10 mA
	Supply without mains unit 24 V (mobile operation)
	Fan and heating are both deactivated.
	12 V from the ALMEMO® device
	typical 130 mA With rainfall radar running continuously
	Operation in energy saving mode 1
	typical 25 mA No rainfall test / no rain
	typical 130 mA for 2 seconds per minute with rainfall test
	typical 130 mA continuously with rain
Sleep mode on the device	not possible

	Power supply	Heating	Fan	Rainfall RADAR
24/1	24 V via mains unit **Factory setting**	Setting AUTO Function Heating active	Setting AUTO Function Fan active	Function Continuous operation
24/2	24 V via mains unit	Setting OFF Function Heating deactivated	Setting AUTO Function Fan active	Function Continuous operation
24/3	24 V via mains unit	Setting OFF* Function Heating deactivated (Energy saving mode 1)	Setting OFF* Function Fan deactivated (Energy saving mode 1)	Function Rainfall test every minute If rainfall detected, continuously active (Energy saving mode 1)
12/1	<12 V via ALMEMO® device 130 mA Power consumption	Setting AUTO Function Heating deactivated (because no 24 V supply)	Setting AUTO Function Fan deactivated (because supply <12 V)	Function Continuous operation
12/2	<12 V via ALMEMO® device 130 mA Power consumption	Setting OFF Function Heating deactivated	Setting AUTO Function Fan deactivated (because supply <12 V)	Function Continuous operation
12/3	<12 V via ALMEMO® device 25 mA Power consumption No rainfall test / no rain 130 mA 2 seconds per minute for rainfall test 130 mA Continuous if rain	Setting OFF* Function Heating deactivated (Energy saving mode 1)	Setting OFF* Function Fan deactivated (Energy saving mode 1)	Function Rainfall test every minute If rainfall detected, continuously active (Energy saving mode 1)
*If fan setting is OFF, 'heating AUTO' is set automatically to 'heating OFF'.				

Note: The status of the sensor heating is not saved in the ALMEMO® connector. If the weather sensor is not connected, the "Off" status is always signaled. Once the sensor has been connected, the value stored in the sensor is read out and displayed.

12. D7 GPS positioning sensor FGD701

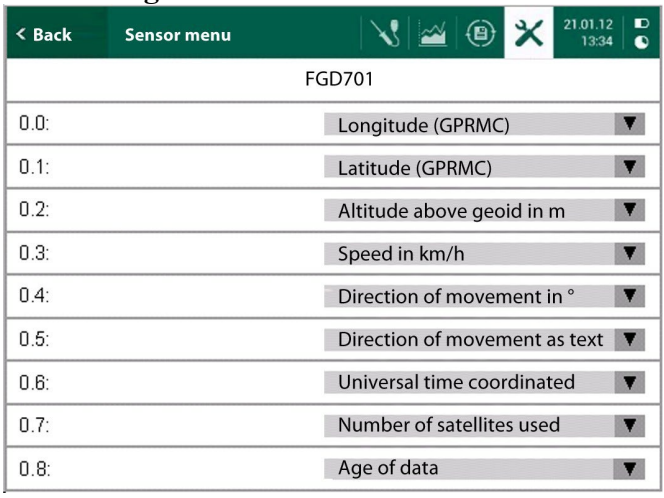
D7 GPS positioning sensor FGD701 records the user's position with longitude and latitude (compatible with GPRMC and Google), altitude in meters, speed of movement (in km/h, m/s, mph, kn), direction of movement in degrees or abbreviated compass reading, and coordinated universal time (UTC) (without one-second increments) Output also includes the number of satellites used and the age of the data.

Measuring quantities and ranges - factory default settings

Designation	Quantity	Measuring range	Units	Resolution
1. Longitude (GPRMC)	B-01 D LG_G	0 to ±180°	°	
2. Latitude (GPRMC)	B-03 D BG_G	0 to ±90°	°	
3. Altitude above geoid in meters	B-06 D HGeo	0 to 9999.9	m	0.1 m
4. Speed in km/h	B-09 D vkmh	0 to 9999.9	km / hour	0.1 km/h
5. Direction of movement in °	B-11 D D	0 to 359.0	°	0.1°
6. Direction of movement as text (compass reading)	B-12 D Dtxt	0 to 337.5	°	22.5°
7. Universal time coordinated (UTC)	B-05 D UTC	23:59:59	h:m:s	1 second
8. Number of satellites used	B-13 D NSat	3 to 20		1
9. Age of data	B-14 D TAlt	0 to 999.99	seconds	0.01 s

When putting into service for the first time (or returning to service after a long period of non-use) it may take up to two minutes before measured values are calculated. To obtain a measured value for direction of movement the speed of movement must be at least 0.5 km/hour.

12.1. Configuration via the sensor menu



Configurable measuring quantities and ranges

Combinations for the measuring channels can be configured from a list of 14 possible measuring quantities and ranges. (* factory default settings)

Designation	Quantity abbreviation		Measuring range	Units	Resolution
1. Longitude (Google)	B-01	D LG_G	0 to E179.999999		
2. * Longitude (GPRMC)	B-02	D LG_N	0 to E179°59.9999		
3. Latitude (Google)	B-03	D BG_G	0 to N89.999999		
4. * Latitude (GPRMC)	B-04	D BG_N	0 to N089°59.9999		
5. * Altitude above geoid in meters	B-06	D HGeo	0 to 9999.9	m	0.1 m
6. * Speed in km/h	B-09	D vkmh	0 to 9999.9	km / hour	0.1 km/h
7. Speed in m/s	B-10	D v ms	0 to 99,999	m/s	0.001 m/s
8. Speed in mph	B-08	D vmph	0 to 9999.9	mph	0.1 mph
9. Speed in kn	B-07	D v kn	0 to 9999.9	knots	0.1 kn
10. * Direction of movement in ° (degrees)	B-11	D °	0 to 359.9	°	0.1°
11. * Direction of movement as text (compass reading)	B-12	D °txt	0 to 337.5	°	22.5°
12. * Universal time coordinated (UTC)	B-05	D UTC	23:59:59	h:m:s	1 second
13. * Number of satellites used	B-13	D NSat	3 to 20		1
14. * Age of data	B-14	D TAlt	0 to 999.99	seconds	0.01 s

It is possible to automatically program not only the quantity and range but also all sensor-specific parameters, e.g. units, comments text, sensor supply, and locking level.

Technical data

Measuring input	GPS mouse
Accuracy	Position <10 m Altitude <50 meters
Interface GPS mouse	RS-232 (Line length 1.5 meters)
Interface ALMEMO®	5 V TTL (transistor-transistor logic) (Line length 0.5 meters, maximum 5 meters)
Baud rate	4800 baud
Refresh rate	2 seconds for all channels
Connector colors	Housing ruby red, levers light gray
Supply voltage	6 to 12 VDC
Current consumption	approx. 100 mA
Sleep mode on the device	not possible

13. D7 thermocouple plug ZTD700-FS

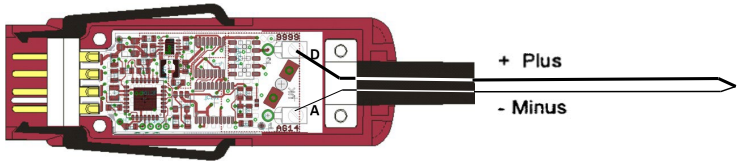
The D7 thermocouple plug ZTD700-FS acquires by means of its own 24bit A/D converter the temperature of a thermocouple with maximum precision in 4 selectable speeds. Regarding the measuring range, a selection of nine noble metal and base metal thermocouples is available.
Since the overall accuracy of the sensor does not depend on the evaluation unit, the sensor can also be calibrated individually and can even be multi-point adjusted.

Measuring ranges at delivery state

Designation	Range		Measuring range	Dim	Resolution
1. * Type K	B-01	**NiCrNi**	-200.0 ... +1370.0	°C	0.1 K
2. Type N	B-02	**NiSil**	-200.0 ... +1300.0	°C	0.1 K
3. Type J	B-03	**IrCo**	-210.0 ... +1100.00	°C	0.1 K
4. Type E	B-04	**NiCrCu**	-270.0 ... +800.00	°C	0.1 K
5. Type T	B-05	**CoCoT**	-200.0 ... +400.00	°C	0.1 K
6. Type S	B-06	**PtRh10**	-50.0 ... +1760.0	°C	0.1 K
7. Type R	B-07	**PtRh13**	-50.0 ... +1760.0	°C	0.1 K
8. Type B	B-08	**El18**	+250.0 ... +1820.0	°C	0.1 K
9. Type K2	B-09	**NiCrNi**	-200.00 ... +1370.00	°C	0.01 K
10. Type N2	B-10	**NiSil**	-200.00 ... +1300.00	°C	0.01 K
11. Milivolt U643	B-11	**U643**	-10.000 ... +64.000	mV	0.001 mV
12. Milivolt U324	B-12	**U324**	-10.000 ... +32.0000	mV	0.0001 mV
13. Constant 10mV	B-13	**U10D**	+10.0000	mV	0.0001 mV
14. ColdJunction	B-14	**CJ**	-30.00 ... +100.00 °C	°C	0.01 K

*factory default setting

13.1. Pin assignment



Thermocouple

Technical data

Operating range:	temperature depending on sensor type	
Temperature sensor:	ZTD700-FS	
Measuring range:		
Temperature	type K:	-200.0 to 1370.0 °C
	type N:	-200.0 to 1300.0 °C
	type J:	-210.0 to 1100.0 °C
	type E:	-270.0 to 800.0 °C
	type T:	-200.0 to 400.0 °C
	type S:	-50.0 to 1760.0 °C
	type R:	-50.0 to 1760.0 °C
	type B:	250.0 to 1820.0 °C
	type K2:	-200.00 to 1370.00 °C
	type N2:	-200.00 to 1300.00 °C
	Cold Junction:	-30.00 to +100.00 °C
Voltage	U643	-10.000 to +64.000 mV
	U324	-10.0000 to +32.0000 mV
A/D converter:	Delta-Sigma	
Accuracy for 10 mops:		
Thermocouples:	±0.2K ± 0.02% (type K, K2, N, J, T)	
	±1.0K ± 0.02% (type E)	
	±0.8K ± 0.02% (type R,S,B)	
Voltage:	±8 Digit ± 0.02% (U324, U643)	
Temperature drift:	max. 30ppm/K	
Cold junction compensation:	valid within the range -10 to +60 °C, accuracy: ±0.2 K ± 0.01 K/°C,	
Nominal temperature:	23°C ± 2 K	
Operative range:	-10 to +60 °C, 10% to 90% RH (non-condensing)	
Refresh rate:	* 400 ms (2.5 mops), 100 ms (10 mops), 20 ms (50 mops), 10 ms (100 mops)	
Supply voltage:	6, 9, 12V from the ALMEMO® measuring instrument	
Power consumption:	approx. 5 mA	
Plug color:	housing ruby red, black levers	

*factory default setting

Note:
Only associated voltage and thermocouple ranges can be displayed together within the plug.

Precious thermocouples:	Type B, S, R, T	Milivolt U324
Base thermocouples:	Type K, N, J, E, K2, N2	Milivolt U643

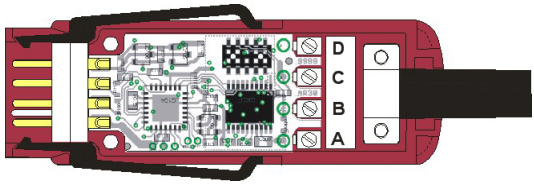
14. D7-Pt1000-plug ZPD710-FS

Thanks to its 24bit A/D converter, the D7-Pt1000 plug ZPD710-FS measures the temperature of the sensor with the highest possible precision in the entire range of -200.00 to +850.00°C without linearization errors. Since the overall accuracy of the sensor does not depend on the evaluation unit, the sensor can be calibrated individually and can even be multi-point adjusted.

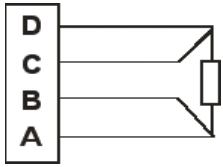
Measuring range upon delivery

Designation ZPD710-FS	Range		Measuring range	Dim	Resolution
1. Pt1000 10 mops	B-01	**DP14**	-200.00...+850.00	°C	0.01 K

14.1. Pin assignment



4-conductor connection



Technical data

Temperature sensor:	ZPD710-FSl
Measuring range:	temperature: -200.00 to 850.00°C
A/D converter:	Delta-Sigma
System accuracy:	0.10K
Temperature drift:	max. 30ppm/K
Nominal temperature:	23°C ± 2 K
Refresh rate:	0.1 sec.
Self-calibrating:	12.8 sec.
Supply voltage:	6, 9, 12V from the ALMEMO® measuring instrument
Power consumption:	approx. 8 mA
Plug colors:	Housing ruby red, black lever

15. D7 pH and Redox connector ZYD7x0-AK

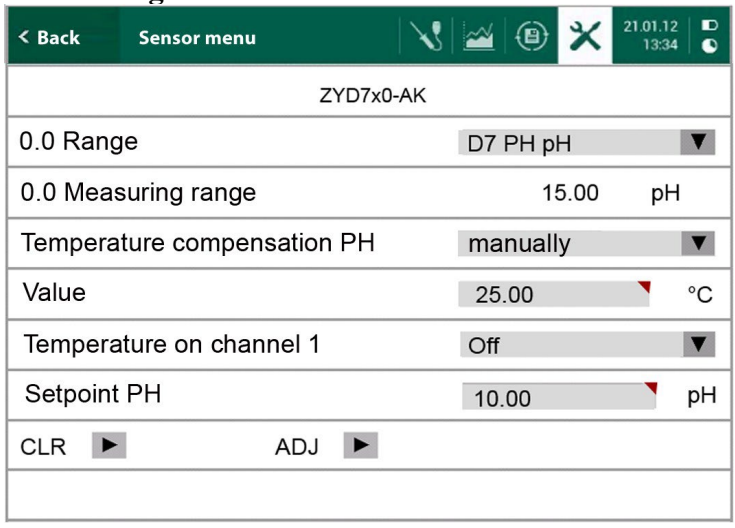
The D7 pH and Redox connector ZYD7x0-AK uses its own 24bit AD converter to measure the voltage of the pH or Redox electrode with highest precision and displays it in the ranges 0.00 ... 14.00 pH or -1100.00 ... +1100.00 mV (Redox). In addition, the connector has an integrated galvanic isolation, which also allows simultaneous measurement with different probes on one measuring device. pH and Redox probes are calibrated with reference solutions either by manual entry of the target value or by automatic recognition at PH 4, 7 or 10 via the sensor menu integrated in the sensor using the ADJ. The calibration values can also be deleted with the CLR key after unlocking the connector lock. In addition, the connector has an external NTC connection option, which allows temperature compensation via the external NTC sensor in addition to manual temperature compensation with fixed value. Since the adjustment in the ALMEMO® connector is maintained, the probe can also be operated on other devices.

Versions:	with NTC	without NTC
	ZYD740-AK	ZYD710-AK

15.1. Measuring ranges at delivery

Reference	Range	Measuring range	Dim	Resolution
1. PH, pH	B-01 `D PH1`	0.00 ... 14.00	pH	0.01 pH

15.2. Configuration via the sensor menu



CLR: Deletes the calibration (only with sensor lock 0).
ADJ: Performs automatic or manual calibration. For manual calibration, the target value must be entered in the *Target Value PH* field.

15.3. Adjustable measuring ranges

Designation	Range	Measuring range	Dim	Resolution
1. * PH, pH	B-01 `D PH1`	0.00 … 14.00	pH	0.01 pH
2. Redox, mV	B-02 `D RDX`	-1100.0 .. 1100.0	mV	0.1 mV
3. Temperature, °C	B-03 `D NTC`	-50.00 … 125.00	°C	0.01 K

* factory setting

Apart from the range, all sensor-specific parameters, such as dimension, comment, sensor supply and locking are programmed automatically.

Technical data

pH- and Redox connector:	ZYD7x0-AK
Measuring ranges:	
pH:	0.00 … 14.00 pH
Redox:	-1100.00 … +1100.00 mV
Temperature:	-50.00 … 125.00°C
AD-converter:	Delta-Sigma
Accuracy:	
pH/Redox:	0.02% of meas. value ±2 digits
Temperature:	± 0.05K in the range -50.00 … 100.00°C
Temperature drift:	max. 40ppm/K
Nominal temperature:	23°C ± 2 K
Application range:	-10 … +60 °C, 10% … 90% r.H. (non-condensing)
Refresh rate:	0.8 s
Power supply voltage:	6, 9, 12V from the ALMEMO® measuring instrument
Power consumption:	approx. 8 mA
Connector colours:	housing ruby-red, black handles

16. D7 UVE connector FLD7 x3-UVE

The D7-UVE connector FLD7 x3-UVE records the erythema effective UV radiation in the form of the UVE radiation intensity and calculates

- the UV Index,
- the erythema effective dose,
- the relative Minimal erythema effective dose (MED) referred to 1 MED (=erythema effective threshold radiation) of the set skin type (1 to 6),
- the remaining time of the irradiation in minutes, until the dose 1 MED of the set skin type is reached,
- the current, predicted maximum irradiation duration in minutes, until the dose 1 MED oft the set skin type is reached,
- the relative Standard erythema effective dose (SED)

16.1. Adjustable measuring ranges

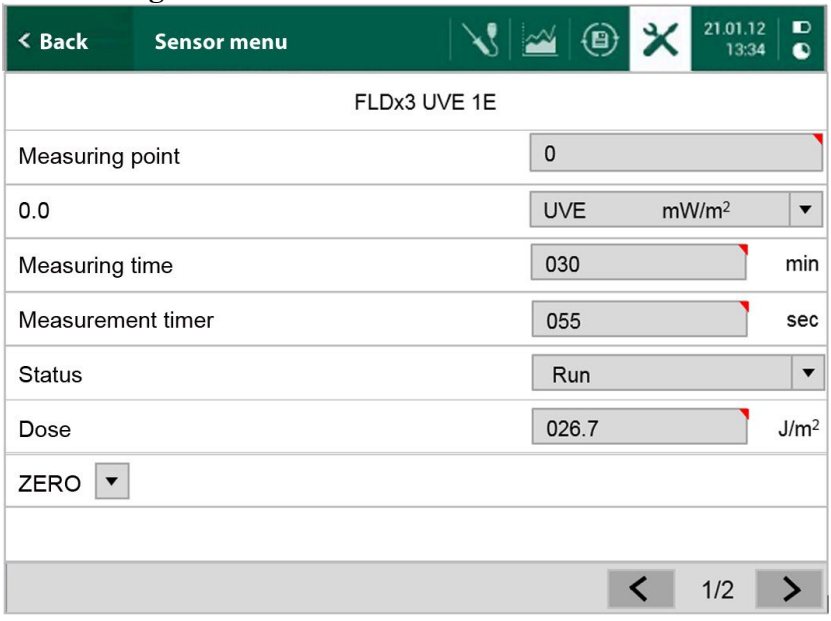
Designation	Range		Measuring range	Dim	Resolution
1. UVE*	B-01	D UVE	0.00 … 650.00	mW/m²	0.1
2. UVI*	B-02	D UVI	0 … 50		1
3. Dose*	B-03	D Dosis	0.0 … 6500.0	J/m²	0.1
4. MED type 1*	B-04	D ME1	0.00 … 650.00	%	0.01
5. MED type 2	B-05	D ME2	0.00 … 650.00	%	0.01
6. MED type 3	B-06	D ME3	0.00 … 650.00	%	0.01
7. MED type 4	B-07	D ME4	0.00 … 650.00	%	0.01
8. MED type 5	B-08	D ME5	0.00 … 650.00	%	0.01
9. MED type 6	B-09	D ME6	0.00 … 650.00	%	0.01
10. SED*	B-10	D SED	0.00 … 650.00	%S	0.01
11. tD type 1	B-11	D tD1	0.00 … 650.00	min	0.01
12. tD type 2	B-12	D tD2	0.00 … 650.00	min	0.01
13. tD type 3	B-13	D tD3	0.00 … 650.00	min	0.01
14. tD type 4	B-14	D tD4	0.00 … 650.00	min	0.01
15. tD type 5	B-15	D tD5	0.00 … 650.00	min	0.01
16. tD type 6	B-16	D tD6	0.00 … 650.00	min	0.01

(* factory setting)

Description of the measuring ranges

Designation	Description
UVE	Current UVE radiation intensity (power) in mW/m²
UVI	UV-Index calculated from the current value of the radiation intensity
Dose	Dose (energy) in J/m² · calculated from the current radiation intensity (power) via the time period.
MED type x	Relative Minimal erythema effective dose in %, calculated from the sum of the radiation intensity via the time period (=dose) in relation to the MED of the set skin type.
SED	Relative Standard erythema effective dose in %, calculated from the sum of the radiation intensity via the time period (=dose) in relation to the SED (100 Ws/m²).
tD type x	Current, predicted maximum irradiation duration in minutes until 1 MED of the set skin type is reached.

16.2. Configuration via the sensor menu



Measuring time:	Configurable measuring time in minutes (Max.- value = 9999 min). After this time the calculation of the measuring channels Dose, MED 1...6, SED and the remaining time of irradiation tD 1...6 is stopped.
Measurement timer:	Displays the remaining time in seconds until the set measuring time is reached.
Status:	This can be used to start or stop the measurement. Run: Dose, MED 1...6, SED and tD 1...6 are calculated continuously. Stop: Dose, MED 1...6, SED and tD 1...6 are stopped.
Dose:	The current value of the calculated erythema effective dose in J/m^2 is displayed here.
ZERO:	Resets the measurement channels erythema effective Dose, MED 1...6 and SED to the value zero. The measuring channels tD 1...6 then display the current, predicted maximum irradiation duration in minutes.

Technical data

Measuring input:	UVE sensor
Interface sensor:	I2C
Refresh rate:	1 sec. for all channels
Settling time:	3 s (For data logger operation in sleep mode a sleep delay of 3 s must be programmed).
Power supply voltage:	from 6 V DC out of the ALMEMO® instrument
Connector colours:	housing ruby-red, black handles
Power consumption:	approx. 5 mA

further technical data please see data sheet.

17. Your contact partner

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