

**ALMEMO® Measuring Instruments** 01

**Reference Measuring Instruments**

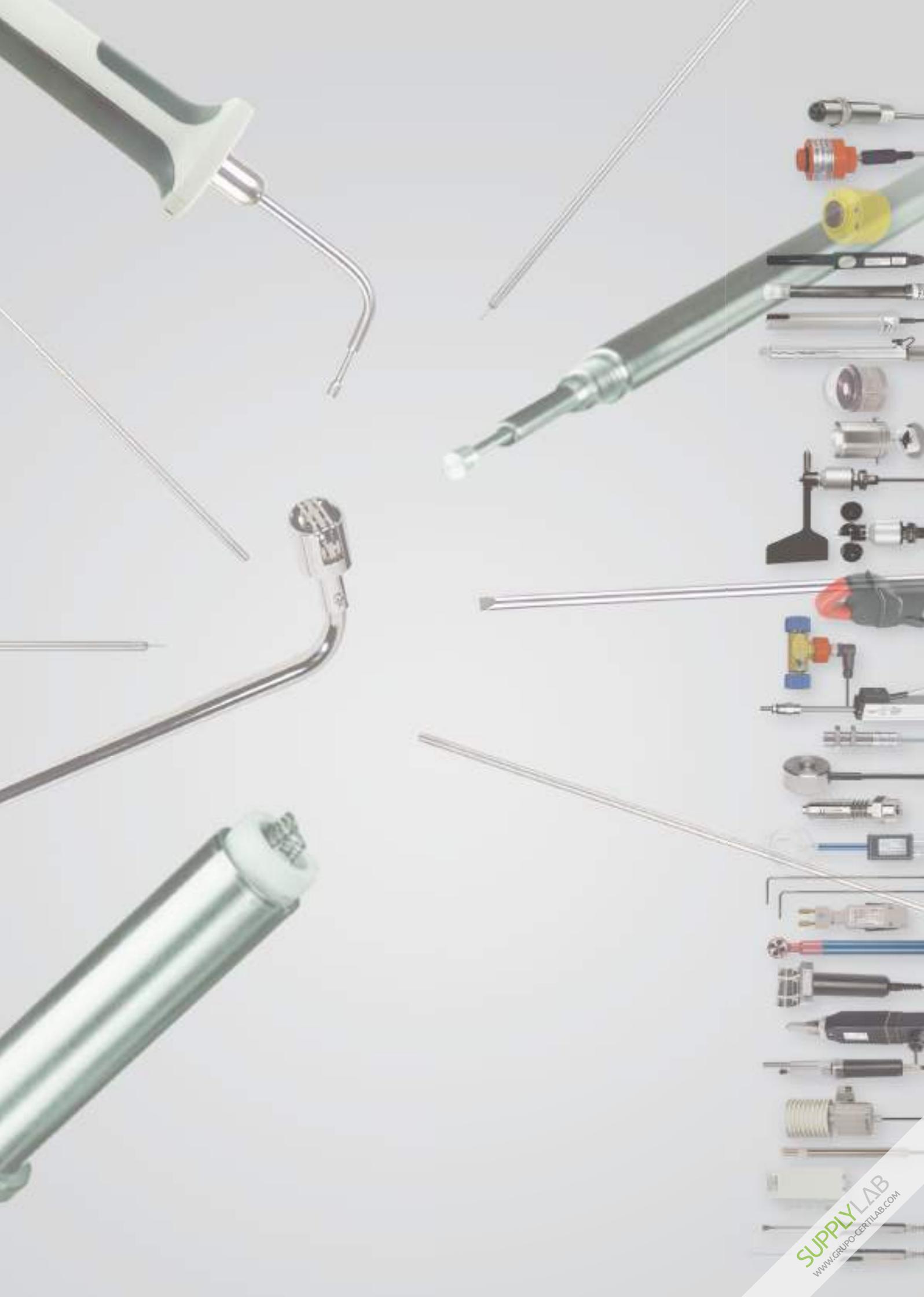
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# ALMEMO® Measuring Instruments



## The ALMEMO® system

The ALMEMO® system comprises an ALMEMO® measuring instrument and intelligent ALMEMO® connectors for the relevant sensor equipment.

An extensive range of measuring instrument variants is thus available - from the single-channel transmitter right through to data acquisition systems with over 1000 measuring points.

The only differences between most of the measuring instruments in the ALMEMO®

series concern their housing (i.e. handheld instruments, desktop instruments, 19-inch systems, fitted panel instruments, transmitters, etc.), the number of measuring inputs (1 to 250), the display, output, and operating controls, and their respective power supplies.

As soon as a sensor or interface cable is connected, the ALMEMO® measuring instrument will, thanks to the intelligent ALMEMO® connector system, be

completely programmed right through to process scheduling.

These measuring instruments provide a uniform range of functions with many configurable options. All parameters can be accessed via the interface and can, since the media in the connectors are always overwritten, be freely modified as and whenever necessary.

## The ALMEMO® principle: Only one measuring instrument for all sensors

An extensive range of transducers, sensors, and signals can be connected to any measuring input on virtually any ALMEMO® measuring instrument - all via the ALMEMO® plug system. Since all the sensor data is saved in the connector, no extra programming is required; as soon as a sensor is connected, the measuring

instrument is configured automatically. The sensor data memory (EEPROM) ensures that each sensor can be identified, scaled, and calibrated - all on the basis of its own unique designation. This system of individual sensor designations avoids confusion and makes the measuring setup clear and logical. Sensor errors can be

corrected within the plug, turning simple sensors into precision transducers.

Standard signals can be displayed in their original dimensions. For multi-purpose sensors (e.g. temperature and humidity) only one shared plug will usually be required. Programming can be protected by a graduated locking function.

## With ALMEMO® measuring instruments you will not need new sensors

For your existing sensors we will provide you with a matching adapter that you can fit quickly and easily.

You can also program ALMEMO® plugs yourself quickly and easily via keypad, terminal, or software. The data medium in

the plug can be overwritten as and whenever necessary.

## ALMEMO® measuring instruments are ideal for all sorts of application

All incorporate the same measuring input circuitry. For applications that are not sector-specific there are more than 60 standard measuring ranges available, e.g. for measuring :

Temperature, humidity, flow velocity, flow rate, heat flow, pressure, rotational speed,

frequency, resistance, current, voltage, force, strain factor, displacement, pH value, redox potential, conductivity, O<sub>2</sub>, CO<sub>2</sub>, CO, O<sub>3</sub>, etc. Maximum and minimum values are saved automatically. Measured values can be averaged over a series of individual measurements, over the output cycle,

or over the actual measuring duration; limit values can be monitored in terms of programmable maximum / minimum values. Measured values can be corrected with regard to zero point and gain and can be scaled by factor, base value, exponential, and units.

# ALMEMO® Measuring Instruments

## ALMEMO® measuring instruments are real individuals

ALMEMO® instruments automatically recognize the specifications of a sensor as it is connected. Specific functions will only be activated as and when the appropriate connector, interface cable, or module is detected. With humidity sensors the dew point, mixture ratio, vapor pressure, and enthalpy will be calculated automa-

tically. Measuring operations involving psychrometers, dynamic pressure probes, or probes for solute oxygen may require pressure compensation; for this purpose the prevailing atmospheric pressure can be entered manually or calculated automatically by an integrated pressure transducer. When measuring dynamic pressure, pH

value, atmospheric humidity, solute oxygen, or conductivity it is possible similarly to perform temperature compensation. When using flow sensors to measure volume flow the appropriate cross-section can be entered. For certain special sensors there are connectors available incorporating an integrated adapter circuitry.

## ALMEMO® measuring instruments meet even the most stringent requirements

ALMEMO® devices incorporate a high-resolution 16-bit A/D converter, digital linearization (for Pt100 sensors with the new ITS 90 temperature scale), and digital

calibration. Optimal cold junction compensation is ensured by means of precision thermistors incorporated in the socket spring. Measuring inputs, power supply,

and interfaces are all electrically isolated from each other.

## The ALMEMO® data acquisition system adapts to your requirements

The internal measured data memory incorporated in ALMEMO® data loggers can be expanded by adding external capacity and can be configured either as linear or ring memory.

This memory can be read out selectively according to time or number. The switchover between measuring points is electrically isolated using semiconductor relays that are totally wear-resistant. Continuous measuring point scanning at 10 or 50 measuring operations per

second can thus be performed trouble-free. Measuring point scans can be individually programmed. Measuring cycles and output cycles can be selected independently; measured values, average values, and maximum / minimum values can be selectively output and / or saved to memory. The start / stop of each measuring point scan can be variably controlled (by keypad or interface, by date and time-of-day, by limit values, or by an external signal). All measuring

instruments can be addressed via interface and are thus fully network-capable. Up to 100 devices can be networked either via cable or over a wireless link. The output of measured values from all devices in the whole network can be initiated from any one such device. For covering longer distances RS422 drivers and distributors are available. This system minimizes hardware requirements, cabling costs, and possible EMC problems, and can be expanded as and when required.

## ALMEMO® measuring instruments accept virtually any peripheral equipment while maintaining optimal data transmission

Analog or digital interfaces are not integrated in the measuring instruments themselves but in the connectors and connecting cables. Depending on

requirements a wide variety of adapters can be connected, e.g. analog outputs, various interfaces (RS232, RS422, optic fiber, current loop, Ethernet,

Bluetooth), alarm signaling devices, or trigger inputs. The data can also be transmitted via Internet or via mobile phone network.

## ALMEMO® measuring instruments provide evaluation of measured data easily and conveniently

Suitable output formats are provided for printers or spreadsheet software. For the

graphical presentation and the evaluation of measured data there are various soft-

ware packages available.

## ALMEMO® instruments can be programmed quickly and easily

The software protocol and the commands list are identical for all devices. Only one terminal is enough to program all

parameters and to scan the measured data. There is a free configuration software, ALMEMO® Control, with terminal,

available for this purpose.

# ALMEMO® Measuring Instruments

## ALMEMO® measuring instruments, overview

	Measuring inputs	Expansions	Display	Graphics display	Data logger function	Integrated memory	Interface / outputs	Precision class	Measuring rate (mops) max.	Measuring ranges	Multi-point adjustment	Portable device	Desktop device	Fitted device	Catalog page
<b>Compact measuring instrument</b>															
ALMEMO® 2450-1	1		✓			✓	C	2.5	35		✓				01.16
<b>Basic measuring instrument</b>															
ALMEMO® 2490-1	1		✓			✓	B	10	65		✓				01.18
ALMEMO® 2490-2	2		✓			✓	B	10	65		✓				01.18
<b>Professional measuring instrument</b>															
ALMEMO® 202 V7	2			✓	✓	✓		1000		opt.	✓				01.20
ALMEMO® 2470-1S/-SCRH	1		✓		✓	✓	A	10	65		✓				01.22
ALMEMO® 2470-2S	2		✓		✓	✓	A	10	65		✓				01.22
ALMEMO® 2470-2	2		✓			✓	A	10	65		✓				01.22
ALMEMO® 2590-2A	2			✓	✓	✓	A	10	65		✓				01.25
ALMEMO® 2590-4AS	4			✓	✓	✓	A	10	65		✓				01.25
<b>Precision measuring instrument</b>															
ALMEMO® 2690-8A	5			✓	✓	✓	AA	100	66	opt.	✓				01.28
ALMEMO® 2890-9	9			✓	✓	✓	AA	100	66	opt.	✓				01.30
ALMEMO® 710 V7	10			✓	✓	✓	AA	2000	66	opt.	✓				01.32
ALMEMO® 8590-9	9				✓	opt.	AA	100	66	opt.		✓			01.36
ALMEMO® 8690-9A	9				✓	opt.	AA	100	66	opt.		✓	✓		01.36
ALMEMO® 809 V7	9				✓	✓	AA	2000	66	opt.		✓	✓		01.38
ALMEMO® 5690-1M09	9	opt.			✓	opt.	AA	100	66	opt.		✓	✓		01.40
ALMEMO® 5690-2M09	9	opt.		✓	✓	✓	AA	100	66	opt.		✓			01.40
ALMEMO® 5790-2M09	9	opt.		✓	✓	opt.	AA	100	66	opt.			✓		01.40
ALMEMO® 5690-1CPU		opt.			✓	✓	AA	100	66	opt.		✓			01.48
ALMEMO® 5690-2CPU		opt.			✓	✓	AA	100	66	opt.		✓			01.48
ALMEMO® 5790-2CPU		opt.			✓	✓	AA	100	66	opt.			✓		01.48
ALMEMO® 500 CPU V7	20	opt.		✓	✓	✓	AA	4000	66	opt.		✓	✓		01.54
ALMEMO® 4390-2	1		✓		✓	✓	AA	100	66				✓		01.60
<b>Compact device (transmitter)</b>															
ALMEMO® 2450-1R02	1		✓			✓	C	2.5	35					✓	01.58
<b>Basic device (transmitter)</b>															
ALMEMO® 2490-1R02	1		✓			✓	B	10	65					✓	01.58
ALMEMO® 2490-2R02	2		✓			✓	B	10	65					✓	01.58
<b>Reference measuring instrument</b>															
ALMEMO® 1020-2 X6	2			✓	✓	✓	AS	1.25	4	✓	✓				01.62
ALMEMO® 1030-2 X6	2			✓	✓	✓	AS	1.25	1	✓	✓				01.65
ALMEMO® 1036-2 X6	2			✓	✓	✓	AS	1.25	7	✓	✓				01.67
ALMEMO® 8036 X6	9				✓	✓	AS	1.25	7	✓		✓			01.69

## Input connector

ALMEMO® input connector, also for existing sensors, see chapter ALMEMO® input connectors

### ALMEMO® standard plug

- The ALMEMO® measuring system makes it possible to process four channels per measuring input – depending on the sensor and the measuring instrument.
- The ALMEMO® plug incorporates 6 screw terminals - 2 for the sensor's power supply and 4 for its measuring signal.
- With Pt100 sensors using 4-conductor circuitry all 4 free connections will be required for the measuring signal. Only one sensor of this type can be connected therefore per measuring input.
- Electrical signals only require 2 connections for the measuring signal. One plug can thus acquire two different measuring signals over just one measuring channel.
- An atmospheric humidity sensor can example usually be combined with a temperature sensor. The associated operands (e.g. dew point, mixture ratio, partial vapor pressure, enthalpy) are programmed in the plug as additional measuring channels.



### ALMEMO® D6 plugs for digital sensors

- The digital ALMEMO® D6 sensor can be connected to any ALMEMO® measuring instrument without in any way affecting its measuring accuracy. The A/D converter incorporated in the ALMEMO® D6 sensor is exclusively responsible for the measuring accuracy of the whole system.
- The digital ALMEMO® D6 sensor is calibrated without involving the ALMEMO® measuring instrument (DAkS / factory) and can be replaced or exchanged as and whenever necessary.
- The connecting cable for the digital ALMEMO® D6 sensor can be extended using pluggable extension cables quickly and easily and without any line losses. (see chapter „General accessories“) These digital extension cables provide high transmission reliability; they have no effect on measuring accuracy.
- The configuration of the digital ALMEMO® D6 sensors (i.a. the selection of the measuring ranges) is effected by an ALMEMO® V7 measuring instrument, e.g. ALMEMO® 710 or ALMEMO® 202 (refer to chapter ALMEMO® Universal Measuring Instruments), or directly on the PC by using the USB adapter cable ZA1919AKUV (refer to chapter Network technology).



## New generation: **ALMEMO® V7** **ALMEMO® D7**

### ALMEMO® V7 measuring instrument and ALMEMO® D7 plug for digital sensors

- With the ALMEMO® D7 plug technology, the measurement ranges of the sensors are completely independent of the measuring instrument. Each ALMEMO® D7 measurement plug features up to 10 display and function channels.
- The new ALMEMO® D7 measurement plug enables high measuring speeds or high measuring accuracy applicable for a vast variety of measuring tasks.
- The ALMEMO® D7 plug measures dynamic processes using the setting High Speed Measuring Operations at high sampling rate. The ALMEMO® V7 measuring instrument saves the measured values, and the WinControl measuring software displays them in graphical form. In case high resolution and stable values are needed (e.g. for accuracy transducers), the ALMEMO® D7 measurement plug measures with reduced sampling rate, if the setting High Resolution is selected.
- The digital ALMEMO® D7 measurement plug comes with an integrated A/D converter. The measuring rate is solely determined by the A/D converter. All D7 measurement plugs run in parallel on the ALMEMO® V7 measuring instrument with their own measuring rate. The minimal scanning cycle of the measuring instrument is determined by the measuring rates of the D7 measurement plugs and is virtually independent from the number of plugs.
- The overall accuracy of the measurement is independent from the ALMEMO® V7 display device / data logger and from the extension cable used. The complete measuring chain, consisting of sensor and connected ALMEMO® D7 measurement plug, is calibrated.
- The measured values can be complemented with a unit featuring up to 6 characters. To designate a sensor it is possible to program comments with up to 20 characters. The user can easily perform the configuration via the ALMEMO® V7 measuring instrument.



**Important!** ALMEMO® D7 measurement plugs can only be connected to ALMEMO® measuring instruments of the V7 generation, i.a. ALMEMO® 500, ALMEMO® 710, ALMEMO® 809, ALMEMO® 202.

## General technical specifications

### Inputs

Channel switching  
between input sockets  
for analog sensors

4-contact with photo-MOS relays  
Potential separation maximum 50 V  
Measuring modules with higher potential separation (see chapter „Input modules“)  
Offset voltage <5 µV

### Cold junction compensation (CJC)

Nominal temperature  
Sensor power supply  
Self-calibration  
Monitoring functions

effective in range -30 to +100 °C, Accuracy ±0.2 K (±0.01 K / °C)  
22 °C ±2 K  
6 to 12 V depending on power supply  
Automatic zero-point correction, measuring current calibration  
Automatic sensor recognition and sensor breakage detection

		Basic measuring instruments	Professional measuring instruments	Precision measuring instruments	
Precision class	C	B	A	AA	
ALMEMO® series	2450, 2420	2490, 2590	2470, 2790 2590A	2890, 4390 5690, 8590, 8690	2690A, 710, 500 from ser. no. H1801xx: 2890, 5690-xM09, 8590, 8690
Measuring rates Measuring operations per second (mops)	2.5 mops	2.5 / 10mops	2.5 / 10mops	2.5 / 10 / 50 / 100mops Option 400mops*   Option 500mops *	
Input range	0.26 to +2.6 V	-2 to +5 V	meas. range 2.6 V: -2 to +3 V in all other meas. ranges -1.9 to +2.9 V	meas. range 2.6 V: -3 to +3 V in all other meas. ranges -2.3 to +1.3 V	meas. range 2.6 V: -2 to +3 V in all other meas. ranges -1.9 to +2.9 V
Overload	-4 to +5 V	-2 to +5 V	-2 to +5 V	± 12V	± 12V
Input current	< 2nA	< 20nA	100pA	Meas. range 2.6 V: 500 nA in all other meas. ranges 500 pA	100pA
Measuring current		Pt100/1000: 0.3mA	Pt100/1000: 0.3mA	Pt100: 1mA, Pt1000: 0.1mA	
System accuracy at 2.5 mops	0.1% of measured value ±4 digits	0.03% of mea- sured value ±4 digits	0.03% of measured value ±3 digits	0.02% of measured value ±2 digits	
Temperature drift	0.01% / K (100 ppm)	0.005% / K (50 ppm)	0.003% / K (30 ppm)	0.003% / K (30 ppm)	

\*Measuring rate 400 mops (Option SA0000Q4)

\*Measuring rate 500 mops (Option SA0000Q5):

It is also possible, in addition to the standard conversion rates, to set 400 or 500 mops (measuring operations per second). At the rate of 400 or 500 mops just one selected measuring channel can be saved. This can only be used with sensors with voltage or current ranges or with NTC sensors. Nor is it possible to change channels in the course of a measuring operation.

The resolution, accuracy, and sensitivity to disturbance caused by mains hum or electromagnetic interference are comparable with measuring operations performed at a rate of 50 mops. Care must be taken to ensure that the environment is free from interference and that the sensor lines are kept short.

Data can only be output to a micro SD card. Accessories ZA1904SD Memory connector with micro SD Data is saved in table format (separated by semi-colons) and with a time-stamp resolution of 0.0001 seconds. This format can be processed using the WinControl software (as of version 6.1.1.6).

## Outputs

<b>ALMEMO® socket A1</b>	<b>Digital interface</b>	Baud rates up to 115.2 kilobaud Data : 8 bit serial, 1 start bit, 1 stop bit, no parity ALMEMO® data link via USB, RS232, Ethernet wireless link via Bluetooth, WLAN, mobile, cloud, (see chapter „Networking“)
	<b>Analog output</b>	ALMEMO® analog cable and analog interface (see chapter „Output modules“)
<b>ALMEMO® socket A2</b>	<b>Networking</b>	ALMEMO® network cable or wireless via Bluetooth (see chapter „Networking“)
	<b>Saving data</b>	ALMEMO® memory connector with memory card (see chapter „General accessories“)
	<b>Analog output</b>	ALMEMO® analog cable and analog interface (see chapter „Output modules“)
	<b>Trigger input</b>	ALMEMO® trigger cable and trigger interface (see chapter „Output modules“)
	<b>Relay output</b>	ALMEMO® relay cable and relay interface (see chapter „Output modules“)
	<b>Relay output</b>	ALMEMO® relay cable and relay interface (see chapter „Output modules“)



Software for display and evaluation of measured values,  
software for ALMEMO® configuration,  
(see chapter „Software“)

## Mains adapter and DC supply cable

see chapter „General accessories“

## Measuring ranges

Sensor type	Type	Measuring range	Units	Resolution	Linearization accuracy	Connector programming
Resistance temperature detectors:						
Pt100 / Pt1000 -1 4-wire	FP Axxx	-200.0 to +850.0	°C	0.1 K	±0.05 K ±0.05 % of measured value	ZA 9030 FS1/4
Pt100 / Pt1000 -2 4-wire	FP Axxx	-200.00 to +400.00	°C	0.01 K	±0.05 K	ZA 9030 FS2 / 5
Pt100 -3 4-wire	FP Axxx	-8.000 to + 65.000	°C	0.001 K	±0.002 K	ZA 9030 FS7
Ni100/1000 4-wire		-60.00 to + 240.00	°C	0.1 K	±0.05 K	ZA 9030 FS3 / 6
NTC type N	FN Axxx	-50.00 to +125.00	°C	0.01 K	±0.05 K	ZA 9040 FS
Thermocouples						
NiCr-Ni (K)	FT Axxx	-200.0 to +1370.0	°C	0.1 K	±0.05 K ±0.05 % of measured value	ZA 9020 FS
NiCroSil-NiSil (N)		-200.0 to +1300.0	°C	0.1 K	±0.05 K ±0.05 % of measured value	ZA 9021 FSN
Fe-CuNi (L)		-200.0 to +900.0	°C	0.1 K	±0.05 K ±0.05 % of measured value	ZA 9021 FSL
Fe-CuNi (J)		-200.0 to +1000.0	°C	0.1 K	±0.05 K ±0.05 % of measured value	ZA 9021 FSJ
Cu-CuNi (U)		-200.0 to +600.0	°C	0.1 K	±0.05 K ±0.05 % of measured value	ZA 9000 FSU
Cu-CuNi (T)		-200.0 to +400.0	°C	0.1 K	±0.05 K ±0.05 % of measured value	ZA 9021 FST
PtRh10-Pt (S)		0.0 to +1760.0	°C	0.1 K	±0.3 K	ZA 9000 FSS
PtRh13-Pt (R)		0.0 to +1760.0	°C	0.1 K	±0.3 K	ZA 9000 FSR
PtRh30-PtRh6 (B)		+400.0 to +1800.0	°C	0.1 K	±0.3 K	ZA 9000 FSB
AuFe-Cr		-270.0 to +60.0	°C	0.1 K	±0.1 K	ZA 9000 FSA
Electrical and digital signals:						
Millivolts DC		-10.0 to +55.0	mV	1 µV	–	ZA 9000 FS0
Millivolts 1 DC		-26.0 to +26.0	mV	1 µV	–	ZA 9000 FS1
Millivolts 2 DC		-260.0 to +260.0	mV	0.01 mV	–	ZA 9000 FS2
Volts DC		-2.6 to +2.6	*	V	0.1 mV	– ZA 9000 FS3
Volts DC		-26 to +26	V	1 mV	–	ZA 9602 FS
For measuring bridges Supply 5 V (Example)		-26.0 to +26.0	mV	1 µV	-	ZA9650 FS1V
For potentiometers Supply 2.5 V		-2.6 to +2.6	*	V	0.1 mV	- ZA9025 FS3
Volt AC (50 Hz to 2 kHz) (Example)		0 to +26	V	0.1 V	–	ZA 9603 AK3
Volt AC (11 Hz to 250 Hz) (Example)		0 to +400	V	1 V	–	ZA 9903 AB5
Ampere AC (11 Hz to 250 Hz) (Example)		0 to +10.00	A	0.01 A	–	ZA 9904 AB2
Volts DC (sampling rate 1 kHz) (Example)		0 to +400	V	1 V	–	ZA 9900 AB5
Ampere DC (sampling rate 1 kHz) (Example)		0 to +10.00	A	0.01 A	–	ZA 9901 AB4
Milliamperes DC		-32.0 to +32.0	*	mA	1 µA	– ZA 9601 FS1
Percent (4 / 20mA DC)		0.0 to 100.0	%	0,01 %		ZA 9601 FS2
Ohms		0.00 to 500.00	*	Ω	0.01 Ω	– ZA 9003 FS
Ohms		0.0 to 5000.0	*	Ω	0.1 Ω	– ZA 9003 FS2
Frequency		0 to 15000	Hz	1 Hz	–	ZA 9909 AK1U
Pulses / measuring cycle		0 to 65000			–	ZA 9909 AK2U
Digital interface		0 to 65000			–	ZA 9919 AKxx
Digital input		0.00 to 100.00	%		–	ZA 9000 ES2
Capacitive humidity sensors:						
Rel: humidity	FH A646	5.0 to 98.0	%H	0,1 %	–	
Rel: humidity with TC	FH A646-R	5.0 to 98.0	%H	0,1 %	±0,5 %	
Dew-point temperature		-25.0 to +100.0	°C	0.1 K	±0.2 K	
Mixture ratio		0.0 to 500.0	g/kg	0.1 g/kg	±0.5 % of measured value	
Partial vapor pressure		0.0 to 1013.2	mbar	0.1 mbar	±0.1 mbar ±0.1 % of measured value	
Enthalpy		0.0 to 400.0	kJ/kg	0.1 kJ/kg	±0.5 % of measured value	
Psychrometer	FN A846					ZA 9846 AK
Wet temperature		0.00 to +100.00	°C	0.01 K	±0.05 K	
Relative humidity		0.0 to +100.0	%H	0.1 %	±1,0 %H	
Dew-point temperature		-25.0 to +100.0	°C	0.1 K	±0.2 K	
Mixture ratio		0.0 to 500.0	g/kg	0.1 g/kg	±0.5% of measured value	
Partial vapor pressure		0.0 to 1013.2	mbar	0.1 mbar	±0.1 mbar ±0.1% of measured value	
Enthalpy		0.0 to 400.0	kJ/kg	0.1 kJ/kg	±0.5% of measured value.	

\* Data may vary depending on device. (see relevant device data sheet)

Sensor type	Type	Measuring range	Units	Resolution	Linearization accuracy	Connector programming
<b>Flow sensors</b>						
Rot. vane, snap-on head	FV AD15-Sx (e.g.)	0.50 to 40,00	m/s	0.01 m/s	-	
Rotating vane Macro	FV AD15-MA1	0.10 to 20.00	m/s	0.01 m/s		
Water turbine	FV AD15-WM1	0.00 to 5.00	m/s	0.01 m/s		
Dynamic pressure sensor	FD A602-S1K	0.5 to 40.0	m/s	0.1 m/s	± 0.1 m/s	
Dynamic pressure sensor	FD A602-S6	1.8 to 90.0	m/s	0.1 m/s	± 0.1 m/s	
Hot-wire anemometer	FV A935-TH4	0 to 2.000	m/s	0.001 m/s	-	
Hot-wire anemometer	FV A935-TH5	0 to 20.00	m/s	0.01 m/s	-	
Hot-wire anemometer	FV A605-TA1	0.01 to 1.000	m/s	0.001 m/s	-	
Hot-wire anemometer	FV A605-TA5	0.15 to 5.00	m/s	0.01 m/s	-	
<b>Chemical probes</b>						
Conductivity	FY A641-LF (e.g.)	0 to 20.000	mS	0.001 mS	±0.2% of measured value	
O <sub>2</sub> dissolved saturation	FY A640-O2	0 to 260	%	1%	-	
O <sub>2</sub> dissolved, concentr:	FY A640-O2	0.0 to 40.0	mg/l	0.1 mg/l	±0.2 mg/l	
O <sub>2</sub> in gases	FY 9600-O2	1 to 100	%	1%	-	
O <sub>3</sub> in gases	FY 9600-O3	0 to 300	ppb	20 ppb	-	
CO probe	FY A600-CO (e.g.)	0 to 300	ppm	1 ppm	-	
CO <sub>2</sub> in gases	FY A600-CO2 (e.g.)	0.000 to 2.500	%	0.01%	±0.2% of measured value	
pH probe	FY96PH-Ex	0.0 to 14.00	pH	0.01 pH	-	ZA 9610 AKY4W
Redox probe	FY96RX-Ex	0.0 to 2600.0	mV	0.1 mV	-	ZA 9610 AKY5W
<b>Optical radiation (Examples)</b>						
Lux measuring probe	FL A613-VL	0 to 260000	lux	1 lux	-	
Lux measuring probe	FL A603-VL2	0.05 to 12500	lux	0.01 lux	-	
Lux measuring probe	FL A603-VL4	1 to 250000	lux	1 lux	-	
UV measuring probe	FL A613-UV	0 to 87.00	W/m <sup>2</sup>	0.01 W/m <sup>2</sup>	-	
UVA measuring probe	FL A603-UV24	0.0004 to 100	mW/cm <sup>2</sup>	0.1 μW/cm <sup>2</sup>	-	
Radiometric probe	FL A603-RW4	0.00004 to 10	mW/cm <sup>2</sup>	0.01 μW/cm <sup>2</sup>	-	
Photosynthesis probe	FL A603-PS5	0.0002 to 100	mmol/m <sup>2</sup> s	0.1 μmol/m <sup>2</sup> s	-	
<b>Other connectable sensors / transducers (Examples)</b>						
Heat flow plates	FQ Axxx	-260.0 to +260.0	mV	0.01 mV	-	ZA 9007 FS
Moisture content probe	FH A696-MF	0 to 50.0	%	0,1%	-	
Differential pressure	FD A612-SR	0 to 1000	mbar	0.1 mbar	-	
Barometer	FD A612-SA	0.0 to 1050 mbar		0.1 mbar	-	
Pressure transducer FDA	FD A602-xx (e.g.)	0.00 to 10.00	bar	0.01 bar	-	
Force transducer	FK Axxx (e.g.)	0.0 to 50.00	kN	0.01 kN	-	
Displacement transducer	FW Axxx(e.g.)	0.0 to 150.00	mm	0.01 mm	-	
Tachometer	FU A919-2	8 to 30000	rpm	1 rpm	-	ZA 9909 AK4U
<b>Function values</b>						
Differential					-	
Maximum value					-	
Minimum value					-	
Average value over time					-	
Average value over measuring point					-	
Summation over measuring points		0 to 65000			-	
Total number of pulses	ZA 9909-AK2U	0 to 65000			-	
Pulses / print cycle	ZA 9909-AK2U	0 to 65000			-	
Alarm value		0.0 to 100.00	%		-	
Thermal coefficient	M (q) / M (ΔT)				-	
Wet-bulb globe temperature (WBGT)	(0.1 TD + 0.7 TW + 0.2 TG)				-	
<b>Measured value</b>						
Cold junction temperature				°C		
Number of averaged values						
Volume flow		0 to 65000	m <sup>3</sup> /h	1 m <sup>3</sup> /h		

# ALMEMO® Measuring Instruments

## Measuring ranges, ALMEMO® 2450, 2490, 2470, 2590A series

Sensor type / Measuring range	ALMEMO® series Precision class Type	2450 C	2490 B	2470 A	2590A A
<b>Temperature</b>					
<b>Thermocouple sensor</b>					
NiCr-Ni Typ K (NiCr)	FTA xxx	X	X	X	X
NiCroSil-NiSil Typ N (NiSi)		X	X	X	X
Fe-CuNi Typ L/J (FeCo/IrCo)		X	X	X	X
Cu-CuNi Typ U/T (CuCo/CoCo)		X	X	X	X
PtRh10-Pt Typ S (Pt10)		X	X	X	X
PtRh13-Pt Typ R (Pt13)		Range	X	X	X
PtRh30-PtRh6 Typ B (EL18)		Range	X	X	X
AuFe-Cr (AuFe)		Range	X	X	X
<b>Resistance temperature detectors</b>					
Pt100/1000 (P104, P204)	FPA xxx	Range	X	X	X
Ni100/1000 (N104)		Range	X	X	X
NTC Typ N (NTC)	FNA xxx	X	X	X	X
<b>Heat flow</b>	FQA xxx, FQADxx	X	X	X	X
<b>Atmospheric humidity</b>					
Capacitive with NTC	FHA 646 xxx	X	X	X	X
Digital temperature / humidity sensor	FHAD 46x	X	X	X	X
Digital temperature / humidity sensor	FHAD 36 Rx	X	X	X	X
Psychrometric with NTC	FNA 846	Range	Function	Function	X
Psychrometric with Pt100 (2 plugs)	FPA 8363	Range	Function	Function	X
Digital psychrometer	FNAD46, FNAD463	X	X	X	X
<b>Dew point</b>					
Digital dewpoint sensor	FH A646 DTC1	X	X	X	X
Dew detector	FHA 9461	X	X	X	X
<b>Moisture in materials</b>					
Water detection probe	FHA 936 WD	X	X	X	X
Sensor for measuring moisture in materials	FHA 696 MF	Function	Function	X	X
Moisture probe for wood	FHA 636 MFx, FHA 696 MFS1	X	X	X	X
Material moisture sensor for granulates	FHA 696 GF1	X	X	X	X
Moisture in the soil	FDA 602 TM	X	X	X	X
<b>Air flow</b>					
Rotating vanes for air	FVAD 15 Sxxx, FVAD 15 MA1	X*	X*	X**	X
Differential pressure for Pitot tube	FDA 602 S1K, FDA 602 S6K	Range	X*	X**	X
Thermo-anemometer probe	FVAD 35 THxx	X*	X*	X**	X
Thermo-electric flow sensor	FVA 605 TAxX	X*	X*	X**	X
* An average value channel is not possible with flow measurement; (no start of continuous or cyclic measuring)					
** Smoothing is possible for 1 measuring channel					
<b>Pressure</b>					
Pressure transducer for liquid and gaseous media	FDA 602 Lxx	X	X	X	X
Temp.-compensated pressure transducer	FD 8214	X	X	X	X
Differential transmitter	FDA 602 D	X	X	X	X
Digital pressure sensor	FDAD 33, FDAD 35M	X	X	X	X
Pressure transducer, for wall mounting	FD 8612 DPS / APS / DPT	X	X	X	X
Barometric pressure	FDA 612 SA	Range	X	X	X
Barometric pressure, digital	FDAD 12 SA	X	X	X	X
Plug-in probe for differential pressure	FDA6 12 SR, FDA 602 SxK	Range	X	X	X
<b>Force</b>					
Push / pull force	FKA xxx	X*	X*	X*	X
* Only temporary zero-setting is possible; (no final value adjustment)					
<b>Tachometer</b>					
Tachometer	FUA 9192	X	X	X	X

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## Measuring ranges, ALMEMO® 2450, 2490, 2470, 2590A series

	ALMEMO® series	2450	2490	2470	2590A
Sensor type / Measuring range	Precision class Type	C	B	A	A
<b>Displacement</b>					
Displacement transducer, potentiometric	FVA xxx T	X*	X*	X*	X
Displacement gauge, potentiometric	FVA xxx TR	X*	X*	X*	X
* Only temporary zero-setting is possible; (no final value adjustment)					
<b>Flow</b>					
Axial turbine flowmeter for liquids	FVA 915 VTHxxx	X	X	X	X
Flow sensor with temperature	FVA 645 GVx	X	X	X	X
<b>Electrical variables</b>					
Split-core-type transformer for AC current	FEA 6042, FEA 604 MN, FEA 6044 N	X X	X X	X X	X X
<b>ALMEMO® measuring modules for</b>					
DC voltage, DC	ZA 9900 ABx, ZA 9901 ABx,	X	X	X	X
AC voltage, AC	ZA 9903 ABx, ZA 9904 ABx	X	X	X	X
<b>Meteorology</b>					
Meteo Multi (2 plugs)	FMA 510, FMA 510H	<i>Function</i>	X	X	X
Wind velocity sensor	FVA 615-2	X	X	X	X
Wind direction sensor	FVA 614	X	X	X	X
Rainfall and precipitation sensor	FRA 916, FRA 916 H	<i>Function</i>	<i>Function</i>	X*	X
Rainfall detector	FRA 616 D	X	X	X	X
Radiation probe head	FLA 613 x	X	X	X	X
Star pyranometer	FLA 628 S	X	X	X	X
* for ALMEMO® 2470-2 - function missing					
<b>Indoor climate and air conditioning</b>					
Globe thermometer	FPA 805 GTS	<i>Range</i>	X	X	X
<b>Optical radiation</b>					
Radiation sensor	FLA 603 x	X	X	X	X
Radiation sensor	FLA 613 x	X	X	X	X
Radiation sensor	FLA 623 x	X	X	X	X
Digital color temperature sensor	FLAD 23 CCTx	X	X	X	X
<b>Water analysis</b>					
pH One-Bar Measuring Chain	FY 96 PH x	<i>Adjustment</i>	X	X	X
Redox-One-Bar Measuring Chain	FY 96 RXEK	<i>Adjustment</i>	X	X	X
Conductivity probe	FYA 641 LF xxx	<i>Range</i>	X	X	X
Oxygen sensor	FYA 640 O2	<i>Adjustment</i>	X	X	X
<b>Gas concentrations in air</b>					
Digital carbon dioxide sensor, hand-held	FYAD 00 CO2	X	X	X	X
Carbon dioxide probe	FYA 600 CO2	<i>Range</i>	X	X	X
Carbon monoxide probe	FYA 600 CO	X	X	X	X
Oxygen probe	FYA 600 O2	<i>Adjustment</i>	X	X	X
Ozone measuring transducer	FYA 600 O3	X	X	X	X
Gas probes	FYA 600 Ax	X	X	X	X
<b>Infra-red temperature measurement</b>					
ALMEMO® infra-red probe head	FIA 844	X	X	X	X
Infra-red probe	MR 7838, MR 7842	X	X	X	X
Hand-held IR device	MR 781420 SB	X	X	X	X
Digital IR sensor	FIAD 43	X*	X*	X*	X
* Emissivity cannot be modified					

### Prerequisites missing for perfect functioning

- **Range:** Measuring range missing or restricted -> Measured value cannot be shown.
- **Function:** Function missing for showing sensor-specific measured data (e.g. average value / cycle) or for necessary programming
- **Adjustment:** Measured value adjustment of this sensor is not possible (pressure, force, displacement, O2, pH, conductivity)

## ALMEMO® 2450-1



**Compact ALMEMO®  
measuring instrument  
1 measuring input,  
over 35 measuring ranges**

## Technical data and functions

- Generously dimensioned 2-row segment display including units
- Easy and convenient to operate by means of 7 keys.
- Over 35 measuring ranges for
  - Thermocouple and NTC sensors  
For the customer's own sensors ready-to-use ALMEMO® connectors are available. (see chapter 07)
  - Atmospheric humidity sensor, capacitive, dewpoint sensor, water detection probe, moisture in wood FHA636MF (see chapter 13)
  - Pressure transducer FDA602L/D, FD8214, FD8612, Tachometer, turbine flowmeter (see chapter 10)  
Current clamps FEA604, Voltage / current measuring modules ZA990xAB (see chapter 11)
- Meteorological radiation probe heads FLA613 (see chapter 12)
- Carbon dioxide sensor FYAD00CO2, Carbon monoxide probe and ozone probe (see chapter 15),
- ALMEMO® plugs with multi-point adjustment are supported.
- Measuring functions: Measured value, zero-setting, saving of maximum / minimum values, hold function
- Test functions: Segment monitoring, range monitoring, sensor breakage indication, battery voltage check and display.
- 2 ALMEMO® output sockets, suitable for all interface cables, network cables, trigger / relay cables (except Ethernet data cable ZA1945-DK)
- Complete sensor and device programming via interface
- ALMEMO® DC socket for mains adapter.

## Technical data

Measuring input	1 ALMEMO® socket
Precision class	C (see page 01.06)
Measuring rate	2.5 mops
Measuring ranges (see 01.08 / 01.09)	
NiCr-Ni(K), NiCroSil-NiSil(N), Fe-CuNi(L), Cu-CuNi(U), Cu-CuNi(T), PtRh10-Pt(S), Fe-CuNi(J), NTC	-200 to +950 °C
Voltage	-26 to +26 mV, -260 to +260mV, 0 to 2.6V
Current	0 to 26 mA, 4 to 20 mA
	Double connectors with 2 x differential voltage / differential current (input D - B) are not possible.
Humidity, capacitive	0 to 100 % RH, (% RH, HcRH, HRH)
Dew point, mixture ratio, partial vapor pressure, enthalpy, rotating vanes, digital process (0 / 100 %), frequency, pulse, rotational speed, digital	
Resolution	(see page 01.08 / 01.09)
Linearization accuracy	(see page 01.08 / 01.09)
Sensor power supply	9 V, maximum 0.5 A
Option U	9 V, maximum 70 mA

Outputs	2 ALMEMO® sockets, suitable for all interface cables
with option OA2450I only	Internal RS485 interface, electrically isolated, via DC socket
Standard equipment	
LCD 7 segments	Measured value 5 characters, 15 mm
16 segments	Function 4½ characters, 9 mm
	Units 2 characters, 9 mm
	9 symbols
Keypad	7 silicone keys
Power supply	
Battery set	3 AA alkaline batteries
DC socket	10 to 30 VDC not electr. isolated
Mains adapter	ZA1312NA10 100 to 240 VAC to 12 VDC, 2 A
Current consumption	approx. 10 mA without input modules
Housing ABS	127 x 83 x 42 mm (LxWxH)
Operating temperature	-10 to +60 °C
Atmospheric humidity (ambient)	10 to 90 % RH (non-condensing)

## ALMEMO® 2450-1



**Compact measuring instrument with interface.  
Runs in battery mode or via mains unit**

### Accessories

Rubberized impact protection, gray  
DIN rail mounting  
Magnetic fastening  
Instrument case  
Mains adapter 12 V, 2 A, with ALMEMO® plug  
DC adapter cable 10 to 30 VDC, 12 V / 0.25 A, electrically isolated

### Order no.

ZB2490GS2  
ZB2490HS  
ZB2490MH  
ZB2490TK2  
ZA1312NA10  
ZA2690UK



DIN rail mounting



Rubberized protection



Magnetic fastening

### Connecting cables

USB data cable, electrically isolated  
Analog output cable, -1.25 to +2.0 V, 0.1 mV / digit  
V24 data cable, electrically isolated  
Network technology, Bluetooth modules (see chapter „Networking“)

### Order no.

ZA1919DKU  
ZA1601RK  
ZA1909DK5

### Option

Power supply, electrically isolated, 10 to 30 VDC, 80 mA including ALMEMO® plug for DC socket  
RS485 interface, internal including, Option U via ALMEMO® DC socket  
Analog outputs (socket P0), electrically isolated, integrated internally (see page 01.56) ALMEMO® transmitter  
Measuring instrument IP54 (if water-proof plugs are used)

### Order no.

OA2450U  
OA2450I  
OA2450W

### Standard delivery

Batteries, operating instructions, manufacturer's test certificate  
**Compact measuring instrument ALMEMO® 2450-1**

### Order no.

MA24501

DAkkS or works calibration KE90xx, electrical, for measuring instrument (see chapter „Calibration certificates“).  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

# ALMEMO® Measuring Instruments

## ALMEMO® 2490



### ALMEMO® basic measuring instrument

Ideal for all sorts of application, quick and easy to operate  
1 or 2 measuring inputs, over 65 measuring ranges

06/2018 • We reserve the right to make technical changes.

## Technical data and functions ALMEMO® 2490 series

- Generously dimensioned 2-row static 7 / 16 segment display including units
- Easy and convenient to operate by means of 7 keys
- Over 65 standard measuring ranges
- Memory sufficient for 100 measured values, can be called up and viewed in the display
- Good measuring accuracy, measuring rate up to 10 measuring operations per second (mops)
- Support for ALMEMO® plugs with multi-point adjustment, special linearization, and special measuring ranges
- Measuring functions : Measured value, zero-setting, sensor adjustment, saving of maximum / minimum values, memory for 100 values, cold junction compensation, and temperature compensation
- Test functions : Segment monitoring, range monitoring, sensor breakage indication, battery voltage check and display
- 2 ALMEMO® output sockets, suitable for all interface cables, network cables, trigger / relay cables (except Ethernet data cable ZA1945-DK)
- Complete sensor and device programming via interface
- ALMEMO® DC socket for mains adapter.

## Technical data ALMEMO® 2490 series

Precision class	B (see page 01.06)	Standard equipment	
Measuring rate	2.5 / 10 measuring operations per second	LCD 7 segments	Measured value 5 characters, 15 mm
Measuring ranges as on page 01.08 / 01.09 - but		16 segments	Function 4½ characters, 9 mm
Milliamperes DC	-26 to +26 mA	Keypad	Units 2 characters, 9 mm
Measuring input		Power supply:	9 symbols
2490-1	1 ALMEMO® input socket	Battery set	7 silicone keys
2490-2	2 ALMEMO® input sockets, el. isol., with semicond. relays (50V)	DC socket	
Additional channels	4 function channels, device-internal	Mains adapter	3 AA alkaline batteries
Sensor power supply	9 V, maximum 0.5 A	Current consumption	10 to 30 VDC not electr. isolated
Option U	9 V, maximum 70 mA	Housing	ZA1312NA10
Outputs	2 ALMEMO® sockets, suitable for all interface cables	Operating temperature	100 to 240 VAC to 12 VDC, 2 A
with option OA2490I only	RS485 interfac, internal electrically isolated, via DC socket	Atmospheric humidity (ambient)	approx. 20 mA without input modules

**ALMEMO® 2490-1**



**Basic measuring instrument,  
1 measuring input with interface  
Runs in battery mode or via mains unit**

**ALMEMO® 2490-2**



**Basic measuring instrument,  
2 measuring inputs with interface  
Runs in battery mode or via mains unit**

Accessories	Order no.
DIN rail mounting	ZB2490HS
Rubberized impact protection, green	ZB2490GS1
Magnetic fastening	ZB2490MH
Instrument case	ZB2490TK2
Mains adapter 12 V, 2 A, with ALMEMO® plug	ZA1312NA10
DC adapter cable 10 to 30 VDC, 12 V / 0.25 A, electrically isolated	ZA2690UK



DIN rail mounting



Rubberized protection



Magnetic fastening

Connecting cables	Order no.
USB data cable, electrically isolated	ZA1919DKU
Analog output cable, -1.25 to +2.0 V, 0.1 mV / digit	ZA1601RK
V24 data cable, electrically isolated.	ZA1909DK5
Network technology, Bluetooth modules (see chapter „Networking“)	

Option	Order no.
Power supply, electrically isolated, 10 to 30 VDC, 80 mA including ALMEMO® plug for DC socket	OA2490U
RS485 interface, internal, including option U	OA2490I
Analog outputs, electrically isolated, integrated internally (see page 01.56) ALMEMO® transmitter	
Measuring instrument IP54 (if water-proof plugs are used)	OA2490W

Standard delivery	Order no.
Batteries, operating instructions, manufacturer's test certificate	
<b>Basic measuring instrument ALMEMO® 2490-1</b>	<b>MA24901</b>
<b>Basic measuring instrument ALMEMO® 2490-2</b>	<b>MA24902</b>

DAkkS or works calibration KE90xx, electrical, for measuring instrument (see chapter „Calibration certificates“).  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## ALMEMO® 202



**ALMEMO® professional measuring instrument, latest V7 generation with data logger function**  
**Two measuring inputs for all digital ALMEMO® D6 and D7 sensors, for ALMEMO® standard sensors with the DIGI measuring range. Special functions for applications using ALMEMO® D7 sensors**

## Technical data and functions

### Professional measuring instrument from our latest V7 generation

Professional measuring instrument ALMEMO® 202 provides numerous outstanding functions for special applications using digital ALMEMO® D6 sensors and the latest ALMEMO® D7 sensors.

### Brightly lit graphics display, easy and convenient operation by means of soft-keys

The white, illuminated graphics display ensures that functions and measured values can be viewed in the clearest way possible. The device is easy and convenient to operate by means of 4 soft-keys and a cursor block. The menu guidance is clearly structured and easy-to-understand.

The sensor display shows the measured values together with all relevant sensor-specific functions, e.g. temperature compensation, atmospheric pressure compensation. Measured values, peak values, average values, and limit values can all be displayed in an easy-to-understand way in various forms, namely lists or bar charts.

Users can even configure their own customized user menus from a range of 50 different parameters to display exactly those parameters required by a particular application. Choice of languages : German, English, French

### End-to-end programming of all parameters for ALMEMO® D6 and D7 sensors

The ALMEMO® 202 professional measuring instrument provides a programming menu for the end-to-end programming of all the parameters needed for digital ALMEMO® D6 and D7 sensors. The required measuring ranges are selected (with ALMEMO® D7 sensors up to 10 measuring channels) and other relevant sensor parameters are configured, e.g. moving average, atmospheric pressure compensation, temperature compensation.

### One measuring instrument for every need

This compact, handy device can, as an option, be fitted with rubberized impact protection for mobile use. The latest energy-saving technology ensures long operating times. For stationary applications a DIN rail mounting is available.

### Data logger for all storage applications

To save measured values an external memory is available in the form of a plug-in SD card.

For autonomous long-term monitoring the data logger can also be run in energy-saving sleep mode.

### Two measuring inputs for all digital ALMEMO® D6 and D7 sensors

All new digital ALMEMO® D6 and D7 sensors for a wide variety of measurable variables can be connected and evaluated. ALMEMO® standard sensors with the DIGI measuring range can also be used, e.g. for crossflow turbines and high-voltage modules for thermocouples and DC and AC voltages. The ALMEMO® 202 supports all ALMEMO® functions.

### New digital ALMEMO® D7 sensors

With these digital ALMEMO® D7 sensors the ALMEMO® system is enhanced by many new functions and applications. ALMEMO® D7 sensors operate via an all-digital interface to the ALMEMO® 202 professional measuring instrument ensuring high-speed serial transmission of all measured values.

The measuring ranges of ALMEMO® D7 plugs are independent of the ALMEMO® measuring instrument being used and can be expanded as and when required for new applications.

Measured values can be displayed with up to 8 digits (depending on range) and the units with up to 6 characters. Sensor designation and information can be up to 20 characters.

Each connected D7 sensor has its own processor. They all work in parallel at their own sensor-specific sampling rate. D7 sensors thus attain very high measuring speeds in dynamic measuring operations. Scanning times on the ALMEMO® 202 professional measuring instrument can be set individually for quick-acting and slow-acting sensors.

The ALMEMO® D7 plug can process up to 10 channels for measured values and function values. This includes new applications, especially for multi-purpose sensors (e.g. Meteo sensors) and for linking up to complex third-party devices (e.g. chemical analysers, power analysers).

### Other equipment

The two ALMEMO® output sockets can be used to connect a PC / network and an ALMEMO® output interface with relays and analog output at the same time.

With option KL it is possible - for a digital ALMEMO® sensor (e.g. ALMEMO® D6 / D7 temperature or pressure sensors) - to program multi-point adjustment or linearization in the ALMEMO® plug itself. This option is possible with all digital ALMEMO® plug versions. Standard connector (DIGI), ALMEMO® D6 and D7 plugs.

## ALMEMO® 202



**Professional measuring instrument, latest V7 generation**  
**Two measuring inputs for all digital ALMEMO® D6 and D7 sensors**  
**for ALMEMO® standard sensors with the DIGI measuring range**  
**Data logger with external memory connector (accessory)**

**Technical data**

Measuring inputs	2 ALMEMO® input sockets for all digital ALMEMO® D6 and D7 sensors and for ALMEMO® standard sensors with the DIGI measuring range
Precision class	depends on the digital ALMEMO® sensor being used
Measuring rate	for ALMEMO® D6 sensors and ALMEMO® standard sensors with the DIGI measuring range 2.5 / 10 mops (measuring operations per second) for ALMEMO® D7 sensors Up to 1000 mops (depending on sensor)
Channels	Up to 20 measuring channels with ALMEMO® D7 sensors
Sensor power supply	6 / 9 / 12 V, maximum 0.4 A
Outputs	2 ALMEMO® sockets, suitable for all output modules (analog / data / trigger / relay cables, etc.)

Display	Graphics display, 128 x 64 pixels, 8 rows Illumination 2 white LEDs
Keypad	7 silicone keys (of which 4 soft-keys)
Date and time-of-day	Real-time clock, buffered by device battery
Memory, internal	99 measured values, can be called onto display
External mem. (accessory)	ALMEMO® plug-in memory with micro SD card, 512 MB (sufficient for up to 30 million measured values)
<b>Power supply</b>	
Battery set	3 AA alkaline batteries
Mains adapter	ZA1312NA10 100 to 240 VAC to 12 VDC, 2 A electrically isolated
DC adapter cable	ZA2690-UK 10 to 30 V, 0.25 A electrically isolated
Current consumption (without input and output modules)	Active mode approx. 35 mA With display illumination approx. 70 mA Sleepmode approx. 0.05 mA
Housing	127 x 83 x 42 mm (LxWxH) ABS Weight 290 g

**Standard equipment****Accessories**

	Order no.
Mains adapter 12 V / 2 A	ZA1312NA10
DC adapter cable, 10 to 30 VDC, 12 V / 0.25A, electrically isolated	ZA2690UK
Rubberized impact protection, gray	ZB2490GS2
Magnetic fastening	ZB2490MH
DIN rail mounting	ZB2490HS
Instrument case	ZB2490TK2
Network technology, Bluetooth modules (see chapter „Networking“)	

**Connecting cables**

	Order no.
USB data cable, electrically isolated	ZA1919DKU
Ethernet data cable, electrically isolated	ZA1945DK
Analog output cable, -1.25 to 2.0 V, 0.1 mV / digit	ZA1601RK
V24 data cable, electrically isolated	ZA1909DK5
Network technology, Bluetooth modules (see chapter „Networking“)	

**Option**

	Order no.
Multi-point adjustment and / or linearization can - with all digital ALMEMO® plug versions - be programmed by users themselves	OA202KL

**Standard delivery**

Measuring instrument, batteries, operating instructions,  
**ALMEMO® 202 professional measuring instrument**

Order no.

# ALMEMO® Measuring Instruments

## ALMEMO® 2470



**ALMEMO® professional measuring instrument with data logger function**

**Functions for all application areas, 1 or 2 measuring inputs**

**Also with integrated sensor for temperature, atmospheric humidity, atmospheric pressure**

### Technical data and functions, ALMEMO® 2470 series

- Segmented color display with bright, white illumination. Clear and easy-to-understand display of programming and measured values in 5 different colors and alarm display on a red background
- In the event of a limit value being overshoot / undershot various freely configurable alarm messages are available, namely acoustic signal, visual LED signal, alarm display on a red background.
- With the 2470-1S /-2S these alarm messages are also configurable for long-term recording; in sleep mode the messages remain active and the most recent measured value is displayed continuously.
- Good measuring accuracy, measuring rate up to 10 measuring operations per second (mops)
- More than 65 standard measuring ranges
- Support for ALMEMO® plugs with multi-point adjustment, special linearization, and special measuring ranges
- Easy and convenient to operate by means of 7 keys, with configurable locking for keys and functions
- Measuring functions : Maximum and minimum values, measured value smoothing, zero-setting, sensor adjustment
- Programming functions : Limit values, sensor correction with base value and factor
- All ALMEMO® functions programmable via interface
- Modern, compact housing (IP54 option)

### Technical data, ALMEMO® 2470 series

Precision class	A (see page 01.04)
Measuring rate	2.5 / 10 measuring operations per second
Sensor power supply	Battery mode Sensor voltage 6 V, 400 mA 9 V, 300 mA and 12 V, 200 mA
With mains adapter	12 V, 400 mA
Standard equipment	
Display	16 segments Measured value 5 characters, 15 mm Units 2 characters, 9 mm 7 segments Function 4½ characters, 9 mm 21 symbols, Illumination 2 RGB LEDs
Keypad	7 silicone keys

Power supply	1 ALMEMO® DC socket
Mains adapter	ZA1312NA10 100 to 230 VAC to 12 VDC, 2A, electrically isolated
DC adapter cable, el. isol.	ZA2690UK 10 to 30 V, 0.25 A
Current consumption (without input and output modules)	
Active without illumination	approx. 12 mA
Active with illumination	approx. 30 mA
Sleep mode	approx. 60 µA
Housing	127 x 83 x 42 mm (LxWxH) ABS, 290g

### ALMEMO® 2470 series, accessories

		Order no.
Rubberized impact protection, gray	ZB2490GS2	DC cable 10 to 30 V, 12 V / 0.25 A, electr. isol. ZA2690UK
Instrument case	ZB2490TK2	DIN rail mounting ZB2490HS
Mains adapter 12 V / 2 A	ZA1312NA10	Magnetic fastening ZB2490MH



Automatic alarm (red background). Display shows incorrect measured value



Dual display  
1. Humidity Measured value overshoots limit value (red).  
2. Temperature



1. Measured value is inside limit values (green).  
2. Peak value MAX overshoots limit value (red)



Programming of  
1. Save-to-memory cycle  
2. Sleep mode

## ALMEMO® 2470-1S



**Professional measuring instrument,  
1 measuring input  
Data logger with integrated memory**

### Technical data and functions

- Technical data and functions as for ALMEMO® 2470 series
- Data logger functions: Internal EEPROM, memory cycle, real-time clock
- Long-term recording in sleep mode with AA batteries
- Operating time up to 1.5 years with memory cycle of 15 minutes and temperature / humidity sensor.

### Technical data

Measuring inputs	1 ALMEMO® input socket
Outputs	ALMEMO® DC socket for mains adapter or USB cable with supply ZA 1919 DKU5
Memory, internal	EEPROM sufficient for 100,000 measured values
Date and time-of-day	Real-time clock, buffered by device battery
Power supply	3 AA batteries

## ALMEMO® 2470-1SCRH



**Professional measuring instrument,  
1 measuring input, Data logger with integrated  
memory, Integrated sensor for temperature,  
atmospheric humidity, atmospheric pressure**

### Technical data and functions

- Technical data and functions, as for ALMEMO® 2470 series
- Data logger functions
- Internal EEPROM, memory cycle, real-time clock
- Long-term recording in sleep mode with AA batteries
- Operating time up to 1.5 years with memory cycle of 15 minutes and temperature / humidity sensor.

### Technical data

Measuring inputs	1 ALMEMO® input socket
Outputs	ALMEMO® DC socket for mains adapter or USB cable with supply ZA 1919 DKU5
Memory, internal	EEPROM sufficient for 100,000 measured values
Date and time-of-day	Real-time clock, buffered by device battery
Power supply	3 AA batteries

Digital sensor for humidity / temperature / air pressure FH0D 46-C2, slotted sensor cap, plugged in on the measuring instrument. General description and technical data (see chapter „Atmospheric humidity“).

### Connecting cable

USB data cable with 5-V power supply

### Order no.

**ZA1919DKU5**

### Connecting cable

USB data cable with 5-V power supply

### Order no.

**ZA1919DKU5**

### Option

Measuring instrument IP54  
(if water-proof plugs / sensors are used)

### Order no.

**OA2470W**

### Option

Measuring instrument IP54  
(if water-proof plugs / sensors are used)

### Order no.

**OA2470W**

### Standard delivery

Batteries, operating instructions, manufacturer's test certificate  
**Professional measuring instrument ALMEMO® 2470-1S  
MA24701S**

### Order no.

### Standard delivery

Batteries, digital plug-in sensor for temperature, atmospheric humidity and air pressure, operating instructions, manufacturer's test certificate. **Professional meas. instrument ALMEMO® 2470-1SCRH  
MA24701SCRH**

### Order no.

DAkkS or works calibration KE90xx, electrical, for measuring instrument (see chapter „Calibration certificates“).  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## ALMEMO® 2470-2



**Professional measuring instrument,  
2 measuring inputs**

### Technical data and functions

- Technical data and functions, as for ALMEMO® 2470 series
- Power supply, 3 AA rechargeable NiMH batteries, with charging via the device itself.

### Technical data

Measuring inputs	2 ALMEMO® input sockets el. isol., with semicond. relays (50 V)
Additional channels	4 channels, device-internal (e.g. difference)
Outputs	ALMEMO® sockets A1 and A2, suitable for all output modules (analog, data, trigger, relay cables, etc.) (see chapter „Networking“)
Individual value memory	99 individual measured values
Power supply	3 AA rechargeable NiMH batteries Integrated charge circuitry

### Connecting cables

	Order no.
USB data cable, electrically isolated	<b>ZA1919DKU</b>
USB data cable with 5-V power supply	<b>ZA1919DKU5</b>
V24 data cable, electrically isolated	<b>ZA1909DK5</b>
Ethernet data cable, electrically isolated	<b>ZA1945DK</b>
Analog output cable, -1.25 to +2.0 V, 0.1 mV / digit	<b>ZA1601RK</b>
Trigger and relay cable (2 relays, 500 mA, 50 V)	<b>ZA1006EKG</b>
Network technology, Bluetooth modules (see chapter „Networking“)	

### Option

	Order no.
Measuring instrument IP54 (if water-proof plugs / sensors are used)	<b>OA2470W</b>

### Standard delivery

	Order no.
Rechargeable batteries, operating instructions, manufacturer's test certificate, carry case, mains unit <b>Professional measuring instrument ALMEMO® 2470-2</b>	<b>MA24702KN</b>

## ALMEMO® 2470-2S



**Professional measuring instrument,  
2 measuring inputs,  
Data logger with internal memory**

### Technical data and functions

- Technical data and functions, as for ALMEMO® 2470 series
- Power supply, 3 AA rechargeable NiMH batteries, with charging via the device itself
- Data logger functions: Internal EEPROM or external memory connector (accessory), memory cycle, real-time clock
- Long-term recording in sleep mode, internal memory, AA rechargeable NiMH batteries. Operating time up to 1 year with memory cycle of 15 minutes and temperature / humidity sensor.

### Technical data

Measuring inputs	2 ALMEMO® input sockets el. isol., with semicond. relays (50 V)
Additional channels	4 channels, device-internal (e.g. difference)
Outputs	ALMEMO® sockets A1 and A2, suitable for all output modules (analog, data, trigger, relay cables, etc.) (see chapter „Networking“)
Memory, internal EEPROM	sufficient for 100,000 measured values
Date and time-of-day	Real-time clock, buffered by device battery
Power supply	3 AA rechargeable NiMH batteries Integrated charge circuitry

### Accessories

	Order no.
Memory connector with micro SD card	<b>ZA1904SD</b>

### Connecting cables

	Order no.
USB data cable, electrically isolated	<b>ZA1919DKU</b>
USB data cable with 5-V power supply	<b>ZA1919DKU5</b>
V24 data cable, electrically isolated	<b>ZA1909DK5</b>
Ethernet data cable, electrically isolated	<b>ZA1945DK</b>
Analog output cable, -1.25 to +2.0 V, 0.1 mV / digit	<b>ZA1601RK</b>
Trigger and relay cable (2 relays, 500 mA, 50 V)	<b>ZA1006EKG</b>
Network technology, Bluetooth modules (see chapter „Networking“)	

### Option

	Order no.
Measuring instrument IP54 (if water-proof plugs / sensors are used)	<b>OA2470W</b>

### Standard delivery

	Order no.
Rechargeable batteries, operating instructions, manufacturer's test certificate, carry case, mains unit <b>Professional measuring instrument ALMEMO® 2470-2S</b>	<b>MA24702SKN</b>

DAkKS or works calibration KE90xx, electrical, for measuring instrument (see chapter „Calibration certificates“).  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## ALMEMO® 2590A



**ALMEMO® professional measuring instrument with data logger function,  
Comprehensive range of functions for all application areas,  
Graphics display for showing measured values and programming,  
2 or 4 measuring inputs**

### Technical data and functions, ALMEMO® 2590A series

- Good measuring accuracy, measuring rate up to 10 measuring operations per second (mops)
- Over 65 standard measuring ranges
- Support for ALMEMO® plugs with multi-point adjustment, special linearization, and special measuring ranges
- Graphics display with white illumination, easy and convenient operation by means of 4 soft-keys and cursor block
- Clear and easy-to-understand menu system 3 measuring menus (1 menu can be freely configured by user from a range of 50 functions), measured values displayed numerically, 1 to 12 measured values can be displayed in two sizes or graphically in bar chart form.
- Intelligent sensor readings with sensor-specific functions old junction compensation, temperature compensation, and atmospheric pressure compensation
- Measuring functions  
Measured value, zero-setting, setpoint adjustment
- Function menus  
Maximum value, minimum value, memory sufficient for 99 measured values, average value over time / individual values / measuring points, smoothing, volume flow with center point measuring, two-point adjustment, scaling, data logger with configuration menus
- Option VN Volume flow determined from matrix measuring as per DIN EN 12599
- Programming menus for clear and easy-to-understand sensor programming, range, units, designation, right through to special functions, configuration of device parameters and of output modules
- Choice of languages : German, English, French
- 2 ALMEMO® output sockets, suitable for digital interfaces, analog output, trigger input, alarm contacts, memory card
- External memory connector with micro SD can simply be plugged in.
- Sleep mode for long-term recording

### Technical data ALMEMO® 2590A series

Precision class	A (see page 01.04)	Power supply	
Measuring rate	2.5 / 10 measuring operations per second	Battery set	3 AA alkaline batteries
Additional channels	4 function channels, device-internal	Mains adapter	ZA1312NA10 100 to 240 VAC to 12 VDC, 2 A electrically isolated
Sensor power supply	6 / 9 / 12 V, maximum 0.5 A	DC adapter cable, electrically isolated	ZA2690-UK 10 to 30 V, 0.25 A
Outputs	2 ALMEMO® sockets, suitable for all output modules (analog / data / trigger / relay cables, memory, etc.)	Current consumption (without input and output modules)	
Standard equipment		Active mode	approx. 12mA
Display	Graphics display, 128 x 64 pixels, 8 rows Illumination 2 white LEDs	With illumination	approx. 32 mA
Keypad	7 silicone keys (of which 4 soft-keys)	Sleep mode	approx. 0.05 mA
Date and time-of-day	Real-time clock, buffered by battery	Housing	127 x 83 x 42 mm (LxWxH) ABS, 290 g

## Serie ALMEMO® 2590A

### Accessories

	Order no.
Memory connector with micro SD (see page 06.02)	ZA1904SD
Mains adapter 12 V / 2 A	ZA1312NA10
DC adapter cable, 10 to 30 VDC, 12 V / 0.25 A, electrically isolated	ZA2690UK
Rubberized impact protection, green	ZB2490GS1
Magnetic fastening	ZB2490MH
DIN rail mounting	ZB2490HS
Instrument case	ZB2490TK2
Network technology, Bluetooth modules (see chapter „Networking“)	

### Connecting cables

	Order no.
USB data cable, electrically isolated	ZA1919DKU
Ethernet data cable, electrically isolated	ZA1945DK
Analog output cable, -1.25 to +2.0 V, 0.1 mV / digit	ZA1601RK
V24 data cable, electrically isolated.	ZA1909DK5
Network technology, Bluetooth modules (see chapter „Networking“)	



## ALMEMO® 2590-2A



**Professional measuring instrument, 2 measuring inputs, Data logger with external memory connector (accessory)**

### Technical data and functions

- Technical data and functions as for ALMEMO® 2590A series

### Technical data

Technical data as for ALMEMO® 2590A series

Measuring inputs	2 ALMEMO® input sockets, el. isol., with semicond. relays (50V)
------------------	---

### Option

Volume flow determined from matrix measuring as per DIN EN 12599  
 Temperature ranges for 8 refrigerants  
 Measuring instrument IP54  
 (if water-proof plugs are used)

### Order no.

OA2590VN  
 SB0000R2  
 OA2590W

### Standard delivery

Measuring instrument, batteries, operating instructions, manufacturer's test certificate

**Professional measuring instrument**  
**ALMEMO® 2590-2A**

### Order no.

MA25902A

## ALMEMO® 2590-4AS



**Professional measuring instrument, 4 measuring inputs, Data logger with internal memory or external memory connector**

### Technical data and functions

- Technical data and functions, as for ALMEMO® 2590A series
- Internal EEPROM sufficient for 100 000 measured values, configurable as linear or ring memory

### Technical data

Technical data as for Serie ALMEMO® 2590A series

Measuring inputs	4 ALMEMO® input sockets, el. isol., with semicond. relays (50V)
------------------	---

Memory, internal EEPROM	sufficient for 100,000 measured values
-------------------------	--

### Option

Volume flow determined from matrix measuring as per DIN EN 12599  
 Temperature ranges for 8 refrigerants  
 Measuring instrument IP54  
 (if water-proof plugs are used)

### Order no.

OA2590VN  
 SB0000R2  
 OA2590W

### Standard delivery

Measuring instrument, batteries, operating instructions, manufacturer's test certificate.

**Professional measuring instrument**  
**ALMEMO® 2590-4AS**

### Order no.

MA25904AS

Measuring instrument, batteries, rubberized impact protection ZB2490GS1, Mains unit ZA1312NA10, USB data cable ZA1919DKU, Case ZB2490TK2, Operating instructions, manufacturer's test certificate

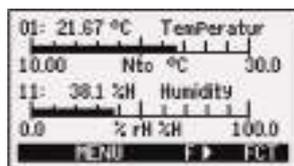
**Professional measuring instrument ALMEMO® 2590-4AS**  
**Case set** MA25904ASKSU

DAkKS or works calibration KE90xx, electrical, for measuring instrument (see chapter „Calibration certificates“).

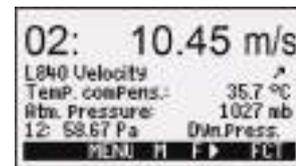
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.



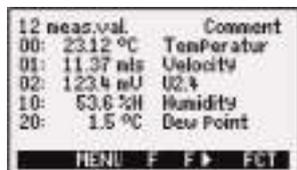
Humidity reading with further humidity variables, e.g. temperature, dew point, mixture ratio



Temperature / humidity display in bar chart form



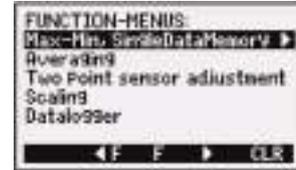
Flow reading, measured value with automatic temperature compensation and atmospheric pressure compensation



Overview of all sensors connected



pH reading, measured value with automatic temperature compensation



Function menus

# ALMEMO® Measuring Instruments

## ALMEMO® 2690-8A



**ALMEMO® precision measuring instrument with data logger function. Comprehensive range of functions for all application areas. Increased measuring accuracy, fast measuring rate. Generously dimensioned graphics display, bright illumination, 5 measuring inputs. Runs on rechargeable batteries, charging via the device itself**

06/2018 • We reserve the right to make technical changes.

## Technical data and functions ALMEMO® 2690-8A

- Increased measuring accuracy and stability
- Fast measuring rate, up to 50 measuring operations per second  
With SD memory card, up to 100 mops, optional for 1 channel up to 500 mops
- 5 measuring inputs, electrically isolated
- Integrated atmospheric pressure sensor, for automatic pressure compensation, inter alia for Pitot tube flow measurement and humidity variables
- Over 65 standard measuring ranges
- Support for ALMEMO® plugs with multi-point adjustment, special linearization, and special measuring ranges
- Option KL for independent multi-point adjustment or special linearization programmable in 30 points and management of calibration data saved in the sensor connector and the measuring instrument
- Option GT for higher measuring quality thanks to electrical isolation between measuring inputs and device power supply (device ground)
- Improved cold junction compensation with 2 sensors
- Data logger with internal EEPROM, sufficient for 200,000 measured values, configurable as linear or ring memory
- Memory connector with micro SD (accessory)
- Sleep mode for long-term recording
- Generously dimensioned graphics display, bright illumination, large display of measured values
- Measured values can be displayed graphically in line chart or bar chart form or numerically in various sizes.
- 3 user-defined menus can be freely configured from a range of 50 functions.
- Easy to operate by means of 4 soft-keys and cursor block, menu-guided with wizards and context-sensitive help windows
- Choice of languages : German, English, French
- 2 ALMEMO® output sockets, suitable for digital interfaces, analog output, trigger input, alarm contacts, memory card
- Runs on rechargeable batteries (standard), high-speed charging in the device itself using the mains unit, included in delivery
- Modern housing with rubberized impact protection and folding stand, splash-proof

## Technical data

Precision class	AA (see page 01.04)	Keypad	9 tactile silicone keys (4 soft-keys)
Measuring rate	(100), 50, 10 and 2.5 mops	Memory	EEPROM sufficient for 200,000 measured values
Measuring inputs	5 ALMEMO® input sockets	Date and time-of-day	Real-time clock, buffered with battery
Electrical isolation	with semiconductor relays (50 V) for analog sensors	Power supply	
Option GT	Additional electrical isolation between measuring inputs and power supply (device ground)	Rechargeable battery/ies	3 AA batteries NiMH or alkaline integrated, high-speed charging (2.5 hours)
Additional channels	4 function channels, device-internal	Mains adapter	ZA1312NA10 100 to 240 VAC to 12 VDC, 2 A electrically isolated
Sensor power supply		DC adapter cable	electrically isolated ZA2690-UK2 10 to 30 V, 1 A
Rechargeable battery/ies	6 / 9 / 12 V, maximum 0.5 A	Current consumption (without input and output modules)	
Mains adapter	12 V, maximum 0.5 A	Active mode	approx. 17 mA
Atmospheric pressure sensor	Integrated	With illumination	approx. 25 to 140 mA
Measuring range	700 to 1100 mbar	Sleep mode	approx. 0.05 mA
Accuracy	±2.5 mbar (at 23 °C ±5 K)	Housing	209 x 107 x 54 mm (LxWxH) ABS, 570 g
Outputs	2 ALMEMO® sockets, suitable for all output modules (analog / data / trigger / relay cables, memory, etc.)	Protective class	IP54 (if water-proof plugs / sensors are used)
Graphics display	128 x 128 pixels, 16 rows		
Illumination	5 white LEDs, 3 brightness levels		

## ALMEMO® 2690-8A



**Precision measuring instrument, 5 measuring inputs**  
**Data logger with internal memory or external memory connector (accessory)**

### Accessories

	Order no.
Memory connector with micro SD, including USB card reader (see chapter „General accessories“)	ZA1904SD
DC adapter cable, 10 to 30 VDC, 12 V / 1 A, electrically isolated	ZA2690UK2
Generously dimensioned carry case, aluminum profile frame / ABS	ZB2590TK2

### Connecting cables

	Order no.
Ethernet data cable, electrically isolated	ZA1945DK
Analog output cable, -1.25 to +2.0 V, 0.1 mV / digit	ZA1601RK
Trigger and alarm cable (2 relays, 0.5 A, 50 V)	ZA1006EKG
Network technology, Bluetooth modules (see chapter „Networking“)	

### Options

	Order no.
Measuring module electrically isolated	OA2690GT
Multi-point adjustment, special linearization, management of calibration data	OA2690KL
Temperature ranges for 8 refrigerants	SB0000R2
Measuring rate 500 mops (SD card required)	SA0000Q5
DIN rail mounting	OA2290HS

### Standard delivery

3 rechargeable NiMH batteries, rubberized protection, mains unit ZA1312NA10, USB data cable ZA1919DKU, Case ZB2490TK2, Operating instructions, manufacturer's test certificate

**Precision measuring instrument ALMEMO® 2690-8A in case set** MA26908AKSU

as above but with RS232 data cable ZA1909DK5

**Precision measuring instrument ALMEMO® 2690-8A in case set** MA26908AKS

DakKS or works calibration KE90xx, electrical, for measuring instrument (see chapter „Calibration certificates“).

DakKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Operating concept as for precision measuring instruments ALMEMO® 2690, 2890 und 5690 / 5790



Menu selection



Standard display



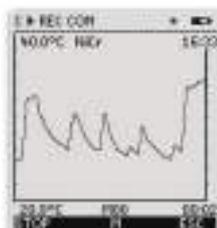
Multi-channel display



Measuring points list



Bar chart



Line diagram



Programming menu



Assistant menu

## ALMEMO® 2890-9



**ALMEMO® precision measuring instrument with data logger function. Comprehensive range of functions for all application areas. Increased measuring accuracy, fast measuring rate. Generously dimensioned graphics display, bright illumination. 9 measuring inputs Runs on rechargeable batteries, charging via the device itself**

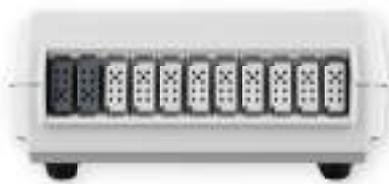
## Technical data and functions

- Increased measuring accuracy and stability
- Fast measuring rate, up to 50 measuring operations per second  
With SD memory card, up to 100 mops, optional for 1 channel up to 400 mops
- 9 measuring inputs, electrically isolated
- Over 65 standard measuring ranges
- Support for ALMEMO® plugs with multi-point adjustment, special linearization, and special measuring ranges
- Option KL for independent multi-point adjustment or special linearization programmable in 30 points and management of calibration data saved in the sensor connector and the measuring instrument
- Higher measuring quality thanks to electrical isolation between measuring inputs and device power supply (device ground)
- Improved cold junction compensation with 2 sensors
- Data logger with internal EEPROM, sufficient for 100,000 measured values, configurable as linear or ring memory
- Memory connector with micro SD (accessory)
- Sleep mode for long-term recording
- Generously dimensioned graphics display, bright illumination, large display of measured values
- Measured values can be displayed graphically in line chart or bar chart form or numerically in various sizes.
- 3 user-defined menus can be freely configured from a range of 50 functions.
- Easy to operate by means of 4 soft-keys and cursor block, menu-guided with wizards and context-sensitive help windows
- Additional thumb-wheel for extra cursor speed
- Choice of languages : German, English, French
- 2 ALMEMO® output sockets, suitable for digital interfaces, analog output, trigger input, alarm contacts, memory card
- Runs on rechargeable batteries (as standard), high-speed charging in the device itself using mains unit, included in delivery

## Technical data

Precision class	AA (see page 01.04)	Keypad	9 membrane keys (4 soft-keys), thumb-wheel
Measuring rate	(100), 50, 10 and 2.5 mops (measuring operations per second)	Memory, EEPROM	sufficient for 100,000 measured values
Measuring inputs	9 ALMEMO® input sockets	Date and time-of-day	Real-time clock, buffered with battery
Electrical isolation for analog sensors	with semiconductor relays (50 V) Additional electrical isolation between measuring inputs and power supply (device ground)	Power supply	Rechargeable battery pack 6 rechargeable NiMH batteries, 1600 mA Integrated high-speed charging (2.5 h)
Additional channels	4 function channels, device-internal	Mains adapter	ZB1112NA10 100 to 230 VAC to 12 VDC, 2 A electrically isolated
Sensor power supply	Rechargeable battery/ies 9 or 12 V, maximum 0.5 A Mains adapter 12 V, maximum 0.3 A	DC adapter cable	electrically isolated ZB2590-UK 10 to 30 V, 1 A
Outputs	2 ALMEMO® sockets, suitable for all output modules (analog / data / trigger / relay cables, memory, etc.)	Current consumption (without input and output modules)	Active mode approx. 37 mA With illumination approx. 45 to 100 mA Sleep mode approx. 0.05 mA
Standard equipment		Housing	204 x 109 x 44 mm (LxWxH) ABS, 550g
Display			
Graphics display	128 x 128 pixels, 16 rows		
Illumination	5 white LEDs, 3 brightness levels		

## ALMEMO® 2890-9



**Precision measuring instrument, 9 measuring inputs**  
**Data logger with internal memory or external memory connector (accessory)**

### Accessories

### Order no.

Memory connector with micro SD, including USB card reader (see chapter „General accessories“)  
 DC adapter cable, 10 to 30 VDC, 12 V / 1 A, electrically isolated  
 Generously dimensioned carry case, aluminum profile frame / ABS

**ZA1904SD**  
**ZB2590UK**  
**ZB2590TK2**

### Connecting cables

### Order no.

V24 data cable, electrically isolated  
 Ethernet data cable, electrically isolated  
 Analog output cable, -1.25 to +2.0 V, 0.1 mV / digit  
 Trigger and alarm cable (2 relays, 0.5 A, 50 V)  
 Network technology, Bluetooth modules (see chapter „Networking“)

**ZA1909DK5**  
**ZA1945DK**  
**ZA1601RK**  
**ZA1006EKG**

### Options

### Order no.

Multi-point adjustment, special linearization, management of calibration data  
 Temperature ranges for 8 refrigerants  
 Measuring rate 400 mops (SD card required)

**OA2890KL**  
**SB0000R2**  
**SA0000Q4**

### Standard delivery

### Order no.

Rechargeable battery pack, mains unit ZB1112NA10, USB data cable ZA1919DKU, case ZB2490TK2,  
 Operating instructions, manufacturer's test certificate

**Precision measuring instrument ALMEMO® 2890-9**

**MA28909**

DakkS or works calibration KE90xx, electrical, for measuring instrument (see chapter „Calibration certificates“).  
 DAKKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.



## ALMEMO® 710



**ALMEMO® precision measuring instrument, latest V7 generation**  
**With data logger function and touchscreen.**  
**Comprehensive range of functions for all application areas.**  
**Increased measuring accuracy, fast measuring rate.**  
**10 measuring inputs**

**Data logger from our latest V7 generation**

Data logger ALMEMO® 710 offers outstanding functions - thanks to our latest D7 sensors.

**High-quality display - easy and convenient touchscreen operation**

The brightly illuminated, generously dimensioned 5.7-inch color graphics display shows all measured values and functions clearly and precisely. The device is operated easily and conveniently via touchscreen. The menu guidance system, incorporating wizards and help windows, has a clear, straightforward structure.

Measured values, peak values, average values, and limit values can all be displayed in an easy-to-understand way in various forms, namely list, bar chart, or line graph (up to 5 lines).

Users can even configure their own customized user menus to display those parameters required by a particular application. Choice of languages : German, English, French, Czech

**One measuring instrument for every use**

The measuring instrument is enclosed in a handy, compact housing with rubberized impact protection. This device can be used in a wide variety of ways, in mobile applications or as a desktop unit, on a folding stand or as a stationary unit in a wall-mounted housing.

It incorporates a powerful rechargeable lithium battery to ensure a long operating time.

**Data logger for all storage applications**

For the purpose of saving measured values the device incorporates an 8-MB flash memory. This can also be configured as a ring memory for monitoring tasks.

To save larger data quantities an external memory is available in the form of a plug-in SD card.

For autonomous long-term monitoring the data logger can also be run in energy-saving sleep mode.

**Measuring inputs for 10 ALMEMO® sensors, all generations**

Data logger ALMEMO® 710 incorporates 10 measuring inputs. All new and already existing sensors designed for any measurable variable can be connected and evaluated.

Sensors using analog signals pass via the integrated high-speed, high-resolution A/D converter. Additional electrical isolation between measuring inputs and power supply (device ground) increases measuring quality.

Digital D6 and the latest digital D7 sensors transfer measured values to the measuring instrument directly in digital form.

The measuring instrument supports all ALMEMO® plug connectors and sensor functions. Digital D6 / D7 sensors can be configured directly via the touchscreen.

**New digital ALMEMO® D7 sensors**

With these digital ALMEMO® D7 sensors the ALMEMO® system is enhanced by many new functions.

They operate via an all-digital interface to the ALMEMO® 710 measuring instrument ensuring high-speed serial transmission of all measured values.

The measuring ranges of ALMEMO® D7 plugs are independent of the measuring instrument and can be expanded as and when required for new applications.

Measured values can be displayed with up to 8 digits (depending on range) and the units with up to 6 characters. Sensor designation and information can be up to 20 characters.

The ALMEMO® D7 sensor has its own processor. These all work in parallel at their sensor-specific sampling rate. D7 sensors thus attain very high measuring speeds in dynamic measuring operations. Scanning times on the ALMEMO® 710 can be set individually for quick-acting and slow-acting sensors.

The ALMEMO® D7 plug can process up to 10 channels for measured values and function values. This includes new applications, especially for multi-purpose sensors (e.g. Meteo sensors) and for linking up to complex third-party devices (e.g. chemical analysers, power analysers).

**Other equipment**

With 3 ALMEMO® output sockets it is possible to connect simultaneously a PC / network, an ALMEMO® output interface with relays and analog output, and an SD memory card.

The ALMEMO® 710 incorporates an atmospheric pressure sensor to ensure automatic pressure compensation for measuring operations involving inter alia air flow or humidity variables.

With option KL it is possible - for an ALMEMO® sensor (e.g. temperature or pressure sensors) - to program multi-point adjustment or linearization in the ALMEMO® plug itself.

This option is possible with all ALMEMO® plug versions.

Standard connector (analog or DIGI), ALMEMO® D6 and D7 plugs..



## ALMEMO® 710



**Precision measuring instrument, latest V7 generation, 10 measuring inputs  
Data logger with internal memory or external memory connector (accessory)**

## Technical data

<b>Measuring inputs</b>	10 ALMEMO® input sockets for ALMEMO® sensors, all generations analog sensors, D6 and D7 sensors	<b>Standard equipment</b>	
<b>Precision class</b>	AA (see page 01.04)	<b>Display</b>	
<b>Measuring rate for analog sensors, D6 sensors</b>	2.5 / 10 / 50 / 100 mops (measuring operations per second)	Graphics display	5.7-inch TFT LCD VGA, 640 x 480 pixels white LED, dimmable
<b>Electrical isolation for analog sensors</b>	with semiconductor relays (50 V) Additional electrical isolation between measuring inputs and power supply (device ground)	Illumination	Capacitive touchscreen and 3 additional touch keys
<b>Channels</b>	Up to 100 measuring channels per device	<b>Keypad</b>	
<b>Sensor power supply</b>	6 / 9 / 12 V, maximum 2 x 400 mA for supply via mains adapter 12 V, maximum 2 x 400 mA	<b>Memory</b>	8-MB flash memory (400,000 up to 1.5 million meas. values)
<b>Atmospheric pressure sensor Accuracy</b>	Integrated, meas. range 700 to 1100 mbar ±2.5 mbar (at 23 °C ±5 K)	<b>Date and time-of-day</b>	Real-time clock (4.7 ppm) buffered with lithium battery
<b>Outputs</b>	3 ALMEMO® sockets, suitable for all output modules (data / analog / trigger / relay cables, memory connector, etc.)	<b>Power supply</b>	
		Rechargeable battery/ies	2 rechargeable lith. batteries, total 15.6 Ah Integrated, high-speed charging (3 hours) ZA1312NA10 100 to 240 VAC to 12 VDC, 2 A, electr. isol.
		Mains adapter	
		<b>Current consumption (without input and output modules)</b>	
		Active mode	approx. 300 to 500 mA
		Sleep mode	approx. 0.05 mA
		<b>Housing</b>	222 x 169 x 61 mm (WxDxH) 1200 g ABS / TPE, 2-shot technology with rubberized impact protection
		ALMEMO® 710	with folding stand
		ALMEMO® 710 WG	with DIN rail fixture for wall-mounting, connections facing downwards

## Accessories

	Order no.
Memory connector with micro SD, including USB card reader (see chapter „General accessories“)	ZA1904SD
Large carry case, aluminum profile frame / ABS, inside dimensions 48 x 35 x 6+6 cm (WxDxH)	ZB2590TK2

## Connecting cables

	Order no.
Ethernet data cable, electrically isolated	ZA1945DK
USB data cable with 5V device supply from PC not electrically isolated	ZA1919DKU5
Analog output cable -1.25 to +2.0 V	ZA1601RK
Trigger and alarm cable (2 relays, 0.5 A, 50 VDC)	ZA1006EKG

Note on WinControl measuring software

As measuring software WinControl is suitable for current version 7 and above. For version 6 or earlier a WinControl update is required.

Variants and description (see chapter „Software“).

## Option

	Order no.
Multi-point adjustment and / or linearization can - with all ALMEMO® plug versions - be programmed by users themselves	OA710KL
Temperature ranges for 8 refrigerants	SB0000R2

## Standard delivery

	Order no.
USB data cable ZA1919DKU, Mains unit 12 V / 2 A ZA1312NA10, Manufacturer's test certificate	
Mobile device with folding stand, in case ZB9710TK <b>Precision measuring instrument ALMEMO® 710</b>	MA710
Stationary device with wall-mounting, <b>Precision measuring instrument ALMEMO® 710WG</b>	MA710W

DAkKS or works calibration KE90xx, electrical, for measuring instrument (see chapter „Calibration certificates“).

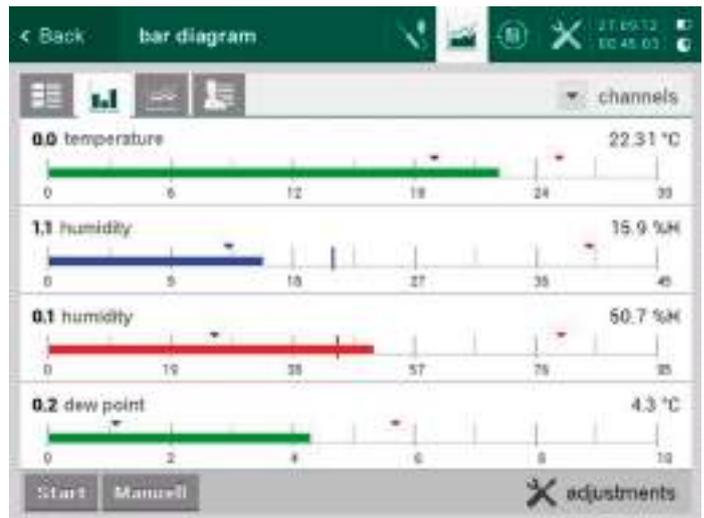
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## ALMEMO® 710 Clear, precise display - easy and convenient touchscreen operation

06/2018 • We reserve the right to make technical changes.

M0	FHA746-2	value	max	min
0.0	T, t	123.4 °C	234.6	79.4
0.1	RH, Uw	56.8 %RH	67.3	48.9
0.2	DT, td	15.2 °C	23.5	11.7
0.3	MH, r	11.2 g/kg	14.4	9.3
0.4	VP, e	8.8 mbar	9.4	4.6
0.5	AH, dv	8.2 g/m <sup>3</sup>	8.4	6.3
0.6	AP, p	998.8 mbar	999.8	834.9

List of active measuring channels



Display of measured values as a bar chart



Display of measured values as a line graph

Channel 3.0 temperature

channel select: °J C-J-temperature

use temp. sensor as external cold junction (°J):

use temp. sensor of connector as cold junction (°J):

convert flow parameters to standard (RN):

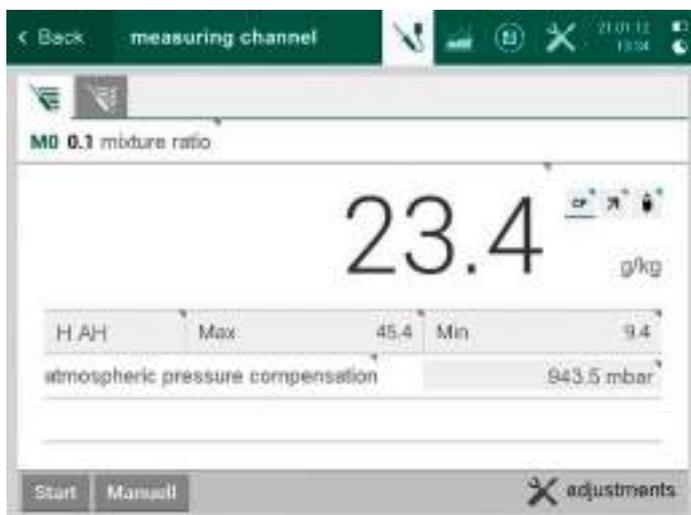
q w e r t z u i o p

a s d f g h j k l

y x c v b n m

123/4 \_ Cl ← OK

Keypad for programming



Generously dimensioned display of measured values

- 
- sensor adjustments
  - channel functions
  - display adjustments
  - data logger
  - output modules
  - device adjustments
  - locking mode
  - power supply
  - memory
  - info

Settings for all sensor and device parameters

## ALMEMO® PC interface / Data logger and Data acquisition systems



ALMEMO® 500  
with 2 Input boards  
for ALMEMO® sensors  
(example)



ALMEMO® 5690-1M09  
fully equipped (example)



ALMEMO® 5690-2  
with graphics display



ALMEMO® 8590-9



ALMEMO® 8690-9A



ALMEMO® 809

## ALMEMO® 8590 /8690 series



**ALMEMO® precision measuring instrument for measured data acquisition, with data logger function. Comprehensive range of functions for all application areas. Increased measuring accuracy, fast measuring rate 9 measuring inputs. Operates as data logger or PC interface, also with rechargeable batteries.**

### Technical data and functions, ALMEMO® 8590 /8690

- Increased measuring accuracy and stability
- Fast measuring rate, up to 50 measuring operations per second  
With SD memory card, up to 100 mops, optional for 1 channel up to 400 mops
- 9 measuring inputs, electrically isolated
- Over 65 standard measuring ranges
- Support for ALMEMO® plugs with multi-point adjustment, special linearization, and special measuring ranges
- Option KL for independent multi-point adjustment or special linearization programmable in 30 points and management of calibration data saved in the sensor connector and the measuring instrument
- Higher measuring quality thanks to electrical isolation between measuring inputs and device power supply (device ground)
- Improved cold junction compensation with 2 sensors
- Data logger option  
Internal EEPROM sufficient for 100,000 measured values (option S) configurable as linear or ring memory - or memory connector with micro SD (accessory)
- Sleep mode for long-term recording
- 2 ALMEMO® output sockets, suitable for digital interfaces, analog output, trigger input, alarm contacts, memory card
- 5 LEDs for indicating various operating states
- Key for switching on and start / stop measuring
- Complete sensor and device programming by means of AMR-Control software (included in delivery).

### Technical data ALMEMO® 8590 /8690

Precision class	AA (see page 01.04)	Operation	1 key, 5 LEDs, 2 coding switches
Measuring rate	(100), 50, 10 and 2.5 mops	Internal memory (option S)	Internal EEPROM sufficient for 100,000 measured values, configurable as linear or ring memory
Measuring inputs	9 ALMEMO® input sockets	External memory (accessory)	ALMEMO® memory connector with micro SD card
Electrical isolation for analog sensors	with semiconductor relays (50 V) Additional electrical isolation between measuring inputs and power supply (device ground)	Date and time-of-day	Real-time clock, buffered with lithium battery
Additional channels	4 function channels, device-internal	Current consumption (without input and output modules)	
Outputs	2 ALMEMO® sockets, suitable for all output modules (analog / data / trigger / relay cables, memory, etc.)	Active mode	approx. 25 mA
		Sleep mode	approx. 0.05 mA

### ALMEMO® 8590 /8690, accessories

	Order no.
Memory connector with micro SD, including USB card reader (see chapter „General accessories“)	ZA1904SD
DC adapter cable, 10 to 30 VDC, 12 V / 1 A, electrically isolated	ZB3090UK2

### ALMEMO® 8590 /8690, connecting cable

	Order no.
USB data cable, electrically isolated	ZA1919DKU
V24 data cable, electrically isolated	ZA1909DK5
Ethernet data cable, electrically isolated	ZA1945DK
Analog output cable, -1.25 to +2.0 V, 0.1 mV / digit	ZA1601RK
Trigger and alarm cable (2 relays, 0.5 A, 50 V)	ZA1006EK
Network technology, Bluetooth modules (see chapter „Networking“)	

## ALMEMO® 8590-9



**Precision measuring instrument, 9 measuring inputs**

**Data logger option with internal memory or external memory connector (accessory)**

## ALMEMO® 8690-9A



**Precision measuring instrument, 9 measuring inputs**

**Data logger option with internal memory or external memory connector (accessory)**

**Runs on rechargeable batteries, charging via the device itself**

### Technical data and functions

- Technical data and functions, as for ALMEMO® 8590 / 8690

### Technical data

Technical data, as for ALMEMO® 8590 / 8690

Sensor power supply	Mains adapter 12 V, maximum 0.5 A
Power supply	
Mains adapter	ZB1212NA10 100 to 240 VAC to 12 VDC, 2 A, electrically isolated
DC adapter cable	ZB3090UK2 10 to 30 VDC, 1 A, electrically isolated
Housing	180 x 49 x 137 mm (LxWxH) Polystyrene (PS) Weight approx. 490 g

### Technical data and functions

- Technical data and functions, as for ALMEMO® 8590 / 8690
- Runs on rechargeable batteries, high-speed charging in the device itself using mains unit, included in delivery

### Technical data

Technical data, as for ALMEMO® 8590 / 8690

Rechargeable battery pack	8 rechargeable NiMH batteries, 9 to 11 V, 1600 mAh With intelligent high-speed charging (3.5 hours)
Sensor power supply	
Mains adapter	12 V, maximum 0.5 A
Runs on rechargeable batteries	9 to 11.5 V, maximum 0.5 A
Power supply	
Mains adapter	ZB1212NA10 100 to 240 VAC, to 12 VDC, 2 A
DC adapter cable	electrically isolated ZB3090-UK2 10 to 30 VDC, 12 VDC, 1 A
Housing	218 x 77 x 145 mm (LxWxH) Polystyrene (PS) Weight approx. 1.2 kg

### Options

### Order no.

Internal data memory sufficient for 100,000 values	<b>OA8590S</b>
Multi-point adjustment, special linearization, management of calibration data	<b>OA8590KL</b>
Temperature ranges for 8 refrigerants (see 10.08)	<b>SB0000R2</b>
Measuring rate for 1 measuring channel, 400 mops (SD card required)	<b>SA0000Q4</b>
DIN rail mounting	<b>OA2290HS</b>

### Standard delivery

### Order no.

Mains plug assembly ZB1212NA10, operating instructions, manufacturer's test certificate	
<b>Precision measuring instrument ALMEMO® 8590-9 for measured data acquisition</b>	<b>MA85909</b>

### Options

### Order no.

Internal data memory sufficient for 100,000 values	<b>OA8590S</b>
Multi-point adjustment, special linearization, management of calibration data	<b>OA8590KL</b>
Temperature ranges for 8 refrigerants (see 10.08)	<b>SB0000R2</b>
Measuring rate for 1 measuring channel, 400 mops (SD card required)	<b>SA0000Q4</b>
DIN rail mounting	<b>OA2290HS</b>

### Standard delivery

### Order no.

Rechargeable batteries, mains plug assembly ZB1212NA10, Operating instructions, manufacturer's test certificate	
<b>Precision measuring instrument ALMEMO® 8690-9A for measured data acquisition</b>	<b>MA86909</b>

DAkkS or works calibration KE90xx, electrical, for measuring instrument (see chapter „Calibration certificates“).  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## ALMEMO® 809

**ALMEMO® precision measuring instrument, latest V7 generation****Nine measuring inputs for all sensors****Operates as data logger or PC interface****Increased measuring accuracy, fast sampling rate, with ALMEMO® D7 sensors up to 1000 measuring operations per second****Data logger from our latest V7 generation.**

Data logger ALMEMO® 809 offers outstanding functions and applications using our latest D7 sensors. This measuring instrument operates either as data logger or as PC interface using the WinControl measuring software (an accessory). The device parameters can be fully configured by means of the ALMEMO® Control software (included in delivery).

**New digital ALMEMO® D7 sensors**

With these digital ALMEMO® D7 sensors the existing ALMEMO® system is enhanced by many new functions. These operate via an all-digital interface to the ALMEMO® 809 measuring instrument ensuring high-speed serial transmission of all measured values. The measuring ranges of ALMEMO® D7 plugs are independent of the measuring instrument and can be expanded as and when required for new applications.

Measured values can be displayed with up to 8 digits (depending on quantity and range) and the units with up to 6 characters. Sensor designation and information can be up to 20 characters. Each ALMEMO® D7 sensor has its own processor. They all work in parallel at their own sensor-specific sampling rate. D7 sensors thus attain very high measuring speeds in dynamic measuring operations. Scanning times on the ALMEMO® 809 can be set individually for quick-acting and slow-acting sensors. The ALMEMO® D7 plug can process up to 10 channels for measured values and function values. This includes new applications, especially for multi-purpose sensors (e.g. Meteor sensors) and for linking up to complex third-party devices (e.g. chemical analysers, power analysers).

**Measuring inputs for nine ALMEMO® sensors, all generations**

Data logger ALMEMO® 809 incorporates nine measuring inputs. The measuring instrument can process up to 90 measuring channels - depending on the sensors connected. All new and already existing sensors designed for any measurable variable can be connected and evaluated. Sensors using analog signals pass via the integrated high-speed, high-resolution A/D converter. Additional electrical isolation between measuring inputs and power supply (device ground) increases measuring quality. Digital D6 and the latest digital D7 sensors transfer measured values to the measuring instrument directly in digital form.

The measuring instrument supports all ALMEMO® plug connectors and sensor functions. All sensor parameters for

ALMEMO® standard / D6 / D7 sensors can be fully configured by means of the ALMEMO® Control software (included in delivery).

**Data logger for all storage applications**

For the purpose of saving measured values the device incorporates an 8-MB flash memory. This can also be configured as a ring memory for monitoring tasks.

To save larger data quantities an external memory is available in the form of a plug-in SD card.

For autonomous long-term monitoring the data logger can also be run in energy-saving sleep mode.

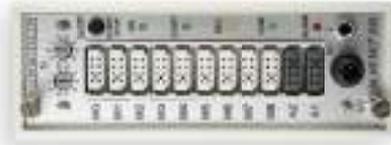
**Other equipment**

With two ALMEMO® output sockets it is possible to connect simultaneously a PC / network, an ALMEMO® output interface with relays and analog output, or an ALMEMO® memory connector with an SD card.

There are five LEDs for indicating various operating states. The operating key is used to switch on the device and to start / stop a measuring operation.

With option KL it is possible - for an ALMEMO® sensor (e.g. temperature or pressure sensors) - to program multi-point adjustment or linearization in the ALMEMO® plug itself. This option is possible with all ALMEMO® plug versions, standard connectors (analog or DIGI), ALMEMO® D6 and D7 plugs.

## ALMEMO® 809



**Precision measuring instrument, latest V7 generation, nine measuring inputs  
Data logger with internal memory or external memory connector (accessory)**

### Technical data

<b>Measuring inputs</b>	Nine ALMEMO® input sockets suitable for all generations of ALMEMO® sensors, analog sensors, D6 and D7 sensors	<b>Standard equipment</b>	
Precision class	AA see page 01.04	Operation	1 key, 5 LEDs, 2 coding switches
Sampling rate for analog sensors, D6 sensors	2.5 / 10 / 50 / 100 mops	Memory	8-MB flash memory (400,000 up to 1.5 million meas. values)
Electrical isolation for analog sensors	with semiconductor relays (50 V) Additional electrical isolation between measuring inputs and power supply (device ground)	Date and time-of-day	Real-time clock (4.7 ppm) with lithium buffer battery
Channels	Up to 90 measuring channels per device	<b>Power supply</b>	
Sensor power supply	12 V, maximum 400 mA	Mains adapter	ZB1212NA10 100 to 240 VAC to 12 VDC, 2 A, electrically isolated
<b>Outputs</b>	Two ALMEMO® sockets, suitable for all output modules (data / analog / trigger / relay cables, memory connector, etc.)	Current consumption without Input and output modules	
		active mode	approx. 50 mA
		Sleep mode	approx. 0.05 mA
		<b>Housing</b>	180 x 049 x 137 mm (LxWxH) Polystyrene (PS) Weight approx. 490 g

### Accessories

	Order no.
Plug-in memory with micro SD card, including USB card reader (see chapter 'General accessories')	<b>ZA1904SD</b>
DC adapter cable, 10 to 30 VDC, 12 V / 1 A, electrically isolated	<b>ZB3090UK2</b>
WinControl software for measured data acquisition per device up to 20 channels for any number of devices and channels	<b>SW5600WC1</b> <b>SW5600WC2</b>
Note on WinControl measuring software WinControl measuring software is suitable for version 7 and above. For version 6 or earlier a WinControl compatibility update is required. For versions and description see Chapter Software.	

### Connecting cables

	Order no.
USB data cable, electrically isolated	<b>ZA1919DKU</b>
Ethernet data cable, electrically isolated	<b>ZA1945DK</b>
Analog output cable -1.25 to +2.0 V	<b>ZA1601RK</b>
Trigger and alarm cable (2 relays, 0.5 A, 50 VDC)	<b>ZA1006EKG</b>

### Option

	Order no.
Multi-point adjustment and / or linearization can - with all ALMEMO® plug versions - be programmed by users themselves	<b>OA809KL</b>
Temperature ranges for 8 refrigerants	<b>SB0000R2</b>

### Standard delivery

	Order no.
Measuring instrument, Mains unit 12 V / 2 A ZB1212NA10, Manufacturer's test certificate <b>Precision measuring instrument ALMEMO 809</b>	<b>MA809</b>

## ALMEMO® 5690 data acquisition system



**ALMEMO® precision measuring instrument for measured data acquisition, with data logger function. Comprehensive range of functions for all application areas. Increased measuring accuracy, fast measuring rate. Up to 99 / 190 measuring inputs Operates as data logger or PC interface, also with generously dimensioned graphics display.**

### Technical data and functions, ALMEMO® 5690 and 5790 series

- Multi-functional data acquisition systems with up to 99 or 190 measuring inputs (applies to ALMEMO® 5690-xCPU with option XU or XM)
- Increased measuring accuracy and stability
- Fast measuring rate, up to 50 measuring operations per second With SD memory card, up to 100 mops, optional for 1 channel up to 400 mops (does not apply to ALMEMO® 5690-xCPU with option XM)
- Measuring rate increased to over 100 channels / second with several measuring circuit boards (applies to ALMEMO® 5690-xCPU with option XM) The measuring circuit boards operate in parallel, thus ensuring short scanning times for a large number of channels.
- Over 65 standard measuring ranges
- Option KL for independent multi-point adjustment or special linearization programmable in 30 points and management of calibration data saved in the sensor connector and the measuring instrument
- Higher measuring quality thanks to electrical isolation between measuring inputs and device power supply (device ground)
- Improved cold junction compensation with 2 sensors per input card
- Operates as data logger (internal EEPROM / RAM or SD memory card, sleep mode for long-term recording) or as interface for PC online operation
- ALMEMO® 5690-1 (variant without display), ALMEMO® 5690-2 (variant with display and operating controls)
- 5 LEDs for displaying the operating status of the measuring circuit and the CPU
- 8 rechargeable NiMH batteries with high-speed battery charging (accessory)
- Relay / trigger / analog interface as plug-in board (accessory) for output of alarm and control signals
- ALMEMO® output sockets, suitable for digital interfaces, analog output, trigger input, alarm contacts, memory card
- Housing in several variants: Desktop housing TG1, TG3, TG8 Wall-mounted housing WG3, Rack housing BT8 Protected industrial housingIG2.

### Technical data, ALMEMO® 5690 and 5790 series

Precision class	AA (see page 01.04)	Power supply	
Measuring rate	(100), 50, 10 and 2.5 mops	Mains adapter	ZB1212NA10 100 to 240 VAC to 12 VDC, 2 A
Electrical isolation for analog sensors	with semiconductor relays (50 V) Additional electrical isolation between measuring inputs and power supply (device ground)	DC adapter cable	electrically isolated ZB3090-UK2 10 to 30 VDC, 12 VDC, 1 A
Date and time-of-day	Real-time clock, buffered with lithium battery	Rechargeable battery pack	8 rechargeable NiMH batteries, 9 to 11 V, 1600 mAh With intelligent high-speed charging (3.5 hours)
Supply current	For system boards and sensor supply Entire system, max. 2.5 A, per board max. 0.5 A	Supply current	Entire system maximum 1.5 A

### ALMEMO® 5690 and 5790 series, accessories

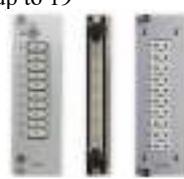
	Order no.
Rechargeable batteries, 1600 mAh, 1 slot	ES5690AP
DC cable, 10 to 30 VDC, 12 VDC, 1.25 A	ZB3090UK2
Relay / trigger / analog board (see chapter „Output modules“) 2 slots	ES5690RTA5
Carry case, aluminum profile frame / ABS, suitable for ALMEMO® 5690 in desktop housing TGx	ZB5600TK3
Rack case with handle, suitable for ALMEMO® 5690 in rack housing BT8	ZB5090RC

### ALMEMO® 5690 and 5790 series, connecting cables

	Order no.
USB data cable, electrically isolated	ZA1919DKU
Ethernet data cable, electrically isolated	ZA1945DK
Trigger and relay cable (2 relays, 0.5 A, 50 V)	ZA1006EKG
Analog output cable, -1.25 to +2.0 V, 0.1 mV / digit	ZA1601RK
V24 data cable, electrically isolated	ZA1909DKU
Network technology, Bluetooth modules (see chapter „Networking“) Relay trigger analog adapter (see chapter „Output modules“)	

## ALMEMO® data acquisition systems - a comparison

### Function

System type	5690-xM09	5690-xCPU	5690-xCPU with option XU	5690-xCPU with option XM
				
Measuring circuit	Master measuring circuit board with 9 measuring inputs	Measuring circuit CPU board (without measuring inputs)		
Measuring inputs	up to 99 inputs	up to 100 inputs	up to 190 inputs	up to 190 inputs
Number of channels	up to 99 channels	up to 100 channels	up to 250 channels	up to 250 channels
Expansions Selector switch boards	up to 9 	up to 10 	up to 19 	None
Expansions Active measuring circuit boards	None	None	None	up to 19 
Scanning time (approx.)  At conversion rate 10 Hz At conversion rate 50Hz	For 1 to 99 channels in total  0.1 to 10 seconds 0.02 to 2 seconds	For 1 to 100 channels in total  0.1 to 10 seconds 0.02 to 2 seconds	For 1 to 190 channels in total  0.1 to 19 seconds 0.02 to 4 seconds	For 100 / 190 channels in total = 10/19 measuring circuit boards with 10 channels each ... 1.1 / 1.1 seconds* ... 0.3 / 0.5 seconds* *for systems without display
ALMEMO® plug with special measuring range / multi-point calibration, linearization	Up to 9 ALMEMO® plugs (master measuring circuit)	Up to 100 ALMEMO® plugs	Up to 190 ALMEMO® plugs	Up to 190 ALMEMO® plugs
ALMEMO® outputs	Sockets A1 and A2	Sockets A1 to A5 for expanding the periphery, optional socket P0 (relay / trigger / analog outputs)		

### Operating modes

System type	5690-1M09	5690-2M09	5690-1CPU	5690-2CPU
				
Online operation via PC	yes		yes	
Display and operating controls	no	yes	no	yes
Data logger	Accessory ZA1904SD Memory connector including micro SD	Micro SD drive, integrated, including micro SD (as standard)	Accessory ZA1904SD Memory connector including micro SD	Micro SD drive, integrated, including micro SD (as standard)
Internal memory	512-KB EEPROM (option)		2-MB RAM, battery-buffered (standard) or 2-MB FeRAM, non-volatile (option)	

## ALMEMO® 5690-1M09

### Technical data and functions

- Technical data and functions, as for ALMEMO® 5690 series
- Master measuring circuit, 9 ALMEMO® input sockets, electrically isolated, suitable for 9 ALMEMO® sensors
- Up to 9 ALMEMO® connectors; special ranges / multi-point calibration / linearization possible (only on master measuring circuit)
- Expansion up to 99 inputs by means of various selector switch boards, maximum 99 measuring channels
- Data logger option : with internal EEPROM or external ALMEMO® memory connector with micro SD card

### Technical data

Technical data, as for ALMEMO® 5690 series

Measuring inputs	9 ALMEMO® input sockets Expansion up to 99 inputs by means of selector switch boards
Measuring channels	Expansion up to maximum 99 measuring channels
Internal memory (option S)	Internal EEPROM sufficient for 100,000 measured values, configurable

as linear or ring memory

External memory (accessory)	ALMEMO® memory connector with micro SD card
Outputs	2 ALMEMO® sockets, suitable for all output modules (analog / data / trigger / relay cables, etc.) Alarm signal transmitter, internal
Operation	1 key, 5 LEDs, 2 coding switches

### Accessories

Memory connector with micro SD, including USB card reader (see chapter „General accessories“)	<b>ZA1904SD</b>
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### Expansions

	<b>Order no.</b>
Selector switch boards U-A10, U-MU, U-TH2	(see page 01.46)
Relay / trigger / analog board, 2 slots Per system up to 7 boards are supported. (see chapter „Output modules“)	<b>ES5690RTA5</b>

### Optionen

	<b>Order no.</b>
Internal data memory sufficient for 100,000 values	<b>OA5690S</b>
Multi-point adjustment, special linearization, management of calibration data	<b>OA5690KL</b>
Temperature ranges for 8 refrigerants (see 10.08)	<b>SB0000R2</b>
Measuring rate for 1 measuring channel, 400 mops (SD card required)	<b>SA0000Q4</b>

### Standard delivery

Precision measuring instrument, data acquisition system with master measuring circuit board MM-A9, mains plug assembly ZB1212NA10, Operating instructions, manufacturer's test certificate

DAkkS or works calibration KE90xx, electrical, for measuring instrument (see chapter „Calibration certificates“).  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

# ALMEMO® Measuring Instruments

## ALMEMO® 5690-1M09TG1



Dimensions:  
77 x 145 x 218 mm  
(WxHxD)

Data acquisition system in desktop housing TG1, 9 inputs,  
1 free slot  
**MA56901M09TG1**  
Expansion with  
1 U-MU board (10 inputs)

## ALMEMO® 5690-1M09TG3



Dimensions:  
179 x 158 x 232 mm  
(WxHxD)

Data acquisition system in desktop housing TG3, 9 inputs,  
6 free slots  
**MA56901M09TG3**  
Expansion with  
3 U-A10 boards or U-TH2 (30 inputs)  
or 6 U-MU boards (60 inputs)  
or 3 RTA5 boards

## ALMEMO® 5690-1M09TG8



Dimensions:  
444 x 158 x 232 mm  
(WxHxD)

Data acquisition system in desktop housing TG8, 9 inputs,  
19 free slots  
**MA56901M09TG8**  
Expansion with  
9 U-A10 boards or U-TH2 or U-MU (90 inputs)  
or 7 RTA5 boards

## ALMEMO® 5690-1M09BT8



Dimensions:  
483 x 132 x 273 mm  
(WxHxD)

Data acquisition system in 19-inch rack housing, 9 inputs,  
19 free slots  
**MA56901M09BT8**  
Expansion with  
9 U-A10 boards or U-TH2 or U-MU (90 inputs)  
or 7 RTA5 boards



Carry case, aluminum profile frame ZB5600TK3  
for ALMEMO® 5690-1/ -2



Rack case with handle ZB5090RC  
for ALMEMO® 5690-xxBT8 in 19-inch rack housing

### Technical data and functions

- Technical data and functions, as for ALMEMO® 5690 series
- Master measuring circuit, 9 ALMEMO® input sockets, electrically isolated, suitable for 9 ALMEMO® sensors
- Up to 9 ALMEMO® connectors; special ranges / multi-point calibration / linearization possible (only on master measuring circuit)
- Expansion up to 99 inputs by means of various selector switch boards, maximum 99 measuring channels
- Generously dimensioned graphics display, bright illumination, large display of measured values
- Measured values can be displayed graphically in line chart or bar chart form or numerically in various sizes.
- 3 user-defined menus can be freely configured from a range of 50 functions.
- Easy to operate by means of 4 soft-keys and cursor block, menu-guided with wizards and context-sensitive help windows
- Choice of languages : German, English, French
- Data logger with micro SD (standard)
- Option, internal EEPROM.

### Technical data

Technical data, as for ALMEMO® 5690 series		Outputs	2 ALMEMO® sockets, suitable for all output modules (analog / data / trigger / relay cables, etc.) Alarm signal transmitter, internal
Measuring inputs	9 ALMEMO® input sockets Expansion up to 99 inputs by means of selector switch boards	Display	Graphics display 128 x 128 pixels, 16 rows Illumination 5 white LEDs, 3 brightness levels
Measuring channels	Expansion up to maximum 99 measuring channels	Operation	9 keys (4 soft-keys and cursor block) 9 status LEDs on front panel
Memory	Micro SD card, integrated drive		
Internal memory (option S)	Internal EEPROM sufficient for 100,000 measured values, configurable as linear or ring memory		

### Expansions

Expansions	Order no.
Selector switch boards U-A10, U-MU, U-TH2	(see page 01.46)
Relay / trigger / analog board, 2 slots Per system up to 7 boards are supported. (see chapter „Output modules“)	<b>ES5690RTA5</b>

### Options

Options	Order no.
Internal data memory sufficient for 100,000 values	<b>OA5690S</b>
Multi-point adjustment, special linearization, management of calibration data	<b>OA5690KL</b>
Temperature ranges for 8 refrigerants (see 10.08)	<b>SB0000R2</b>
Measuring rate for 1 measuring channel, 400 mops (SD card required)	<b>SA0000Q4</b>

### Standard delivery

Precision measuring instrument, data acquisition system with graphics display and operating controls, master measuring circuit board MM-A9, micro SD card, USB card reader, mains plug assembly ZB1212NA10, operating instructions, manufacturer's test certificate

DAkKS or works calibration KE90xx, electrical, for measuring instrument (see chapter „Calibration certificates“).  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## ALMEMO® 5690-2M09TG3



Dimensions:  
179 x 158 x 232 mm  
(WxHxD)

Data acquisition system in desktop housing TG3, 9 inputs,  
6 free slots  
**MA56902M09TG3**  
Expansion with  
3 U-A10 boards or U-TH2 (30 inputs)  
or 6 U-MU boards (60 inputs)  
or 3 RTA5 boards

## ALMEMO® 5690-2M09WG3



Dimensions:  
209 x 207 x 153 mm (WxHxD)  
(width includes fastening strips)

Data acquisition system in wall-mounted housing WG3,  
9 inputs, 1 free slot  
**MA56902M09WG3**  
Expansion with  
3 U-A10 boards or U-TH2 (30 inputs)  
or 6 U-MU boards (60 inputs)  
or 3 RTA5 boards  
The boards have their connections facing downwards. To facilitate wall-mounting four holes (5.3 mm) are provided on the protruding strips to the left and right of the housing's backplate (which cannot itself be removed).

## ALMEMO® 5690-2M09TG8



Dimensions:  
444 x 158  
x 232 mm  
(WxHxD)

Data acquisition system in desktop housing TG8, 9 inputs,  
19 free slots  
**MA56902M09TG8**  
Expansion with  
9 U-A10 boards or U-TH2 or U-MU (90 inputs)  
or 7 RTA5 boards

## ALMEMO® 5690-2M09BT8



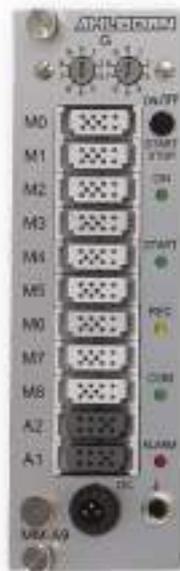
Dimensions:  
483 x 132  
x 273 mm  
(WxHxD)

Data acquisition system in 19-inch rack housing, 9 inputs,  
19 free slots  
**MA56902M09BT8**  
Expansion with  
9 U-A10 boards or U-TH2 or U-MU (90 inputs)  
or 7 RTA5 boards

# ALMEMO® Measuring Instruments

Master measuring circuit board, selector switch boards, and expansions for the ALMEMO® 5690-1M09 and 5690-2M09 systems

06/2018 • We reserve the right to make technical changes.



Master measuring circuit board  
MM-A9



U-A10



U-MU



U-TH2



AP



RTA5

## Selector switch boards for ALMEMO® 5690-1M09 and 5690-2M09

### Technical data and functions of selector switch boards

- Selector switch boards for expanding the ALMEMO® 5690-1M09 and 5690-2M09 systems by additional inputs
- There are several design variants for different installations / input plugs.

#### Selector switch boards U-A10



**10 inputs for ALMEMO® single connectors**  
For flexible applications with individual sensors and measuring signals.

#### Technical data

Measuring inputs	10 ALMEMO® input sockets, electrically isolated
Measuring ranges	All ranges (see page 01.05)
Sensor supply	12 V, max. 0.3 A (per system max. 2.5 A)
Footprint	2 slots

#### Standard delivery

Selector switch board U-A10

**Order no.**  
ES5690UA10

ALMEMO® connector must be ordered separately.

#### Selector switch boards U-MU



**10 inputs for ALMEMO® 10 MU connectors**  
For permanently installing groups of 10, especially temperature sensors.

#### Technical data

Measuring inputs	10 inputs, electrically isolated, socket strip for ALMEMO® 10-way MU connector
Measuring ranges	all thermocouples, Pt100, Ni100, NTC, ohms, 2.6 V, 260 mV, 55 mV, 26 mV
Sensor supply	None
Footprint	1 slot

#### Standard delivery

Selector switch board U-MU  
ALMEMO® 10-way MU connector

**Order no.**  
ES5690UMU  
ZA5690MU

## Selector switch boards U-TH2



**10 inputs for miniature thermal connectors**  
**For any individual thermocouple temperature sensors with miniature thermal connector.**

### Technical data

Measuring inputs	10 miniature thermal sockets, electr. isolated ALMEMO® sensor parameters are saved in the measuring instrument.
Measuring ranges	all thermocouples
Sensor supply	None
Footprint	2 slots

### Standard delivery

Selector switch board U-TH2

Miniature thermal connectors must be ordered separately.

### Order no.

**ES5690UTH2**

### Technical data and functions

- Technical data and functions, as for ALMEMO® 5690 series
- CPU board with measuring circuit (without measuring inputs) and output sockets
- Up to 100 measuring inputs / 100 measuring channels via selector switch boards
- Option XU - up to 190 measuring inputs / 250 measuring channels via selector switch boards
- Option XM - high-speed measuring operations, up to 190 measuring inputs / 250 measuring channels via active measuring circuit boards. The measuring circuit boards operate in parallel, thus ensuring short scanning times for a large number of channels. The scanning time is determined by the measuring circuit board with the highest number of active measuring channels - or, at conversion rate 50 Hz, also by the processing time of the CPU.
- Option - 5 ALMEMO® output sockets for digital interfaces, analog outputs, trigger, alarm contacts, socket P0 for integrated relay outputs
- Data logger with internal RAM (standard) or FeRAM (option) or external ALMEMO® memory connector with micro SD card

### Technical data

Technical data, as for ALMEMO® 5690 series		External memory (accessory)
CPU board	Measuring circuit (without measuring inputs), input boards (see page 01.54)	ALMEMO® memory connector with micro SD card
Measuring inputs / measuring channels		Outputs
Standard	up to 100 inputs / 100 meas. channels via selector switch boards	5 ALMEMO® sockets, suitable for all output modules (analog / data / trigger / relay cables, etc.) . Alarm signal transmitter, internal Socket P0 for integrated relay outputs (option) Or trigger and analog output (by request)
Option XU	up to 190 inputs / 250 meas. channels via selector switch boards	
Option XM	up to 190 inputs / 250 meas. channels via active measuring circuit boards	
Memory, internal	sufficient for 400,000 values, linear or ring memory	Operation
Standard	RAM (buffered by battery)	1 key, 5 LEDs, 2 coding switches
Option SF	FeRAM (non-volatile)	

### Accessories

Memory connector with micro SD, including USB card reader (see chapter „General accessories“)	<b>ZA1904SD</b>
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### Input boards / expansions

	Order no.
Option XM - selector switch boards and active measuring circuit boards	(see page 01.54)
Relay / trigger / analog board, 2 slots Per system up to 4 boards are supported. (see chapter „Output modules“)	<b>ES5690RTA5</b>

### Options

	Order no.
Up to 190 measuring inputs / 250 measuring channels	<b>OA5690XU</b>
For active measuring circuit boards, up to 190 measuring inputs / 250 measuring channels	<b>OA5690XM</b>
Data memory, internal FeRAM, non-volatile (instead of battery-buffered RAM)	<b>OA5690SF</b>
Multi-point adjustment, special linearization, management of calibration data	<b>OA5690KL</b>
Temperature ranges for 8 refrigerants (see 10.08)	<b>SB0000R2</b>
Measuring rate for 1 measuring channel, 400 mops (SD card required) This cannot be combined with option XM.	<b>SA0000Q4</b>
For output socket P0	
SH2 2 semiconductor relays (normally open) internal, 0.5 A, 50 V	<b>OA5690SH2</b>
OH2 2 additional relays (normally closed) for option SH2 (thus 2 changeover relays)	<b>OA5690OH2</b>

### Standard delivery

Precision measuring instrument, data acquisition system with CPU board  
 Measuring circuit (without measuring inputs) Input boards must be ordered separately. (see page 01.54)  
 Mains plug assembly ZB1212NA10, Operating instructions, manufacturer's test certificate

DAkKS or works calibration KE90xx, electrical, for measuring instrument (see chapter „Calibration certificates“).  
 DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## ALMEMO® 5690-1CPUTG1



Dimensions:  
77 x 145 x 218 mm  
(WxHxD)

Data acquisition system in desktop housing TG1  
CPU board, 1 free slot  
**MA56901CPUTG1**  
Messeingänge über:  
Measuring inputs via 1 MU board (10 inputs)

## ALMEMO® 5690-1CPUTG3



Dimensions:  
179 x 158 x 232 mm  
(WxHxD)

Data acquisition system in desktop housing TG3  
CPU board, 6 free slots  
**MA56901CPUTG3**  
Measuring inputs  
via three A10 or TH2 boards (30 inputs)  
or 6 MU boards (60 inputs)  
or three RTA5 output boards

## ALMEMO® 5690-1CPUTG8



Dimensions:  
444 x 158  
x 232 mm  
(WxHxD)

Data acquisition system in desktop housing TG8  
CPU board, 19 free slots  
**MA56901CPUTG8**  
Measuring inputs  
via nine A10 or TH2 boards (90 inputs)  
or 19 MU boards (190 inputs)  
or four RTA5 output boards

## ALMEMO® 5690-1CPUBT8



Dimensions:  
483 x 132  
x 273 mm  
(WxHxD)

Data acquisition system in 19-inch rack housing  
CPU board, 19 free slots  
**MA56901CPUBT8**  
Measuring inputs  
via nine A10 or TH2 boards (90 inputs)  
or 19 MU boards (190 inputs)  
or four RTA5 output boards



Carry case, aluminum profile frame ZB5600TK3  
for ALMEMO® 5690-1/ -2



Rack case with handle ZB5090RC  
for ALMEMO® 5690-xxBT8 in 19-inch rack housing

### Technical data and functions

- Technical data and functions, as for ALMEMO® 5690 series
- CPU board with measuring circuit (without measuring inputs) and output sockets
- Up to 100 measuring inputs / 100 measuring channels via selector switch boards
- Option XU - up to 190 measuring inputs / 250 measuring channels via selector switch boards
- Option XM - high-speed measuring operations, up to 190 measuring inputs / 250 measuring channels via active measuring circuit boards. The measuring circuit boards operate in parallel, thus ensuring short scanning times for a large number of channels. The scanning time is determined by the measuring circuit board with the highest number of active measuring channels - or, at conversion rate 50 Hz, also by the processing time of the CPU.
- Option - 5 ALMEMO® output sockets for digital interfaces, analog outputs, trigger, alarm contacts, socket P0 for integrated relay outputs
- Generously dimensioned graphics display, bright illumination, large display of measured values
- Measured values can be displayed graphically in line chart or bar chart form or numerically in various sizes.
- 3 user-defined menus can be freely configured from a range of 50 functions.
- Easy to operate by means of 4 soft-keys and cursor block, menu-guided with wizards and context-sensitive help windows
- Choice of languages : German, English, French
- Data logger with internal RAM (standard) or FeRAM (option) and with micro SD card (standard).

### Technical data

Technical data, as for ALMEMO® 5690 series		Memory	Micro SD card, integrated drive
CPU board	Measuring circuit (without meas. inputs) Input boards (see page 01.54)	Outputs	5 ALMEMO® sockets, suitable for all output modules (analog / data / trigger / relay cables, etc.) Alarm signal transmitter, internal Socket P0 for integrated relay outputs (option) Or trigger and analog output (by request)
Measuring inputs / measuring channels		Display	
Standard	up to 100 inputs / 100 measuring channels via selector switch boards	Graphics display	128 x 128 pixels, 16 rows
Option XU	up to 190 inputs / 250 measuring channels via selector switch boards	Illumination	5 white LEDs, 3 brightness levels
Option XM	up to 190 inputs / 250 measuring channels via active measuring circuit boards	Operation	9 keys (4 soft-keys and cursor block) 9 status LEDs on front panel
Memory, internal			
Standard	sufficient for 400,000 values, linear or ring memory RAM (buffered by battery)		
Option SF	FeRAM (non-volatile)		

### Input boards / expansions

	Order no.
Option XM - selector switch boards and active measuring circuit boards	(see page 01.54)
Relay / trigger / analog board, 2 slots. Per system up to 4 boards are supported. (see chapter „Output modules“)	<b>ES5690RTA5</b>

### Options

	Order no.
Up to 190 measuring inputs / 250 measuring channels	<b>OA5690XU</b>
For active measuring circuit boards, up to 190 measuring inputs / 250 measuring channels	<b>OA5690XM</b>
Data memory, internal FeRAM, non-volatile (instead of battery-buffered RAM)	<b>OA5690SF</b>
Multi-point adjustment, special linearization, management of calibration data	<b>OA5690KL</b>
Temperature ranges for 8 refrigerants (see 10.08)	<b>SB0000R2</b>
Measuring rate for 1 measuring channel, 400 mops (SD card required). This cannot be combined with option XM.	<b>SA0000Q4</b>
For output socket P0	
SH2 2 semiconductor relays (normally open) internal, 0.5 A, 50 V	<b>OA5690SH2</b>
OH2 2 additional relays (normally closed) for option SH2 (thus 2 changeover relays)	<b>OA5690OH2</b>

### Standard delivery

Precision measuring instrument, data acquisition system with graphics display and operating controls, CPU board  
Measuring circuit (without measuring inputs) Input boards must be ordered separately. (see page 01.54) Micro SD card,  
USB card reader, mains plug assembly ZB1212NA10, Operating instructions, manufacturer's test certificate.

DAkKS or works calibration KE90xx, electrical, for measuring instrument (see chapter „Calibration certificates“).  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## ALMEMO® 5690-2CPUTG3



Dimensions:  
179 x 158 x 232 mm  
(WxHxD)

Data acquisition system in desktop housing TG3  
CPU board, 6 free slots **MA56902CPUTG3**  
Measuring inputs  
via three A10 or TH2 boards (30 inputs)  
or 6 MU boards (60 inputs)  
or three RTA5 output boards

## ALMEMO® 5690-2CPUWG3



Dimensions:  
209 x 207 x 153 mm  
(WxHxD)  
(width includes fastening strips)

Data acquisition system in wall-mounted housing WG3  
CPU board, 6 free slots **MA56902CPUWG3**  
Measuring inputs  
via three A10 or TH2 boards (30 inputs)  
or 6 MU boards (60 inputs)  
or three RTA5 output boards  
The boards have their connections facing downwards. To facilitate wall-mounting four holes (5.3 mm) are provided on the protruding strips to the left and right of the housing's backplate (which cannot itself be removed).

## ALMEMO® 5690-2CPUTG8



Dimensions:  
444 x H158  
x T232 mm  
(WxHxD)

Data acquisition system in desktop housing TG8  
CPU board, 19 free slots **MA56902CPUTG8**  
Measuring inputs  
via nine A10 or TH2 boards (90 inputs)  
or 19 MU boards (190 inputs)  
or four RTA5 output boards

## ALMEMO® 5690-2CPUBT8



Dimensions:  
483 x 132  
x 273 mm  
(WxHxD)

Data acquisition system in 19-inch rack housing  
CPU board, 19 free slots **MA56902CPUBT8**  
Measuring inputs  
via nine A10 or TH2 boards (90 inputs)  
or 19 MU boards (190 inputs)  
or four RTA5 output boards

# ALMEMO® Measuring Instruments

CPU board, selector switch boards, active measuring circuit boards and expansions for CPU systems ALMEMO® 5690-1CPU and 5690-2CPU

06/2018 • We reserve the right to make technical changes.



CPU

U-A10  
M-A10

U-MU

U-TH2

AP

RTA5

## Input boards for ALMEMO® 5690-1CPU and 5690-2CPU

### Technical data and functions

- Selector switch boards U-xx for CPU systems without options XU / XM or with option XU
- Active measuring circuit boards M-xx with own A/D converter for CPU systems with option XM
- There are several design variants for different installations / input plugs.

#### Input board U-A10 / M-A10



**10 inputs for ALMEMO® single connectors.**  
**For flexible applications with individual sensors and measuring signals.**

#### Technical data

Measuring inputs	10 ALMEMO® input sockets, electrically isolated
Measuring ranges	All ranges (see page 01.05)
Sensor supply	12 V, maximum 0.3 A (per system max. 2.5 A)
Footprint	2 slots

#### Standard delivery

Selector switch board U-A10  
Active measuring circuit board M-A10 (for CPU system with option XM)

**Order no.**  
**ES5690UA10**  
**ES5690MA10**

#### Input board U-MU



**10 inputs for ALMEMO® 10 MU connectors.**  
**For permanently installing groups of 10, especially temperature sensors.**

#### Technical data

Measuring inputs	10 inputs, electrically isolated, socket strip for ALMEMO® 10-way MU connector
Measuring ranges	all thermocouples, Pt100, Ni100, NTC ohms, 2.6 V, 260 mV, 55 mV, 26 mV
Sensor supply	None
Footprint	1 slot

#### Standard delivery

Selector switch board U-MU  
ALMEMO® 10-way MU connector

**Order no.**  
**ES5690UMU**  
**ZA5690MU**

## Input board U-TH2



**10 inputs for miniature thermal connectors.  
For any individual thermocouple temperature sensors with miniature thermal connector.**

### Technical data

Measuring inputs	10 miniature thermal sockets, electr. isolated ALMEMO® sensor parameters are saved in the measuring instrument.
Measuring ranges	all thermocouples
Sensor supply	None
Footprint	2 slots

### Standard delivery

Selector switch board U-TH2

Miniature thermal connectors must be ordered separately

### Order no.

ES5690UTH2

## ALMEMO® 500



**ALMEMO® precision measuring instrument and data logger, up to 90 measuring inputs. Comprehensive functions covering all application areas. Tablet control via app.**



ALMEMO® 500

## Solving complex measuring tasks using the ALMEMO® 500

The increasing digitalization and networking changes the entire chain of production. This also applies to measuring instruments that must be able to integrate themselves into existing networks – Keyword Industry 4.0. Our new web-based technology positions us future-proof for the era of increasing networking.

Our customer receives a scalable system for recording numerous measuring points with maximum precision. The device can be controlled via tablet and state-of-the-art interfaces such as USB. A web service makes the measurement data accessible anywhere and anytime.

The new networking features are perfect for e.g. monitoring climate or production processes.

It is possible to access all networking features and measured value enquiries via tablet app or – as usual with Ahlborn devices – via PC using the WinControl software.

### Modern control via app and web service

The user operates the ALMEMO® 500 via an included 8-inch tablet and a preinstalled app. An integrated web service enables access to the data logger.

However, the app not only visualizes the measurement data. The software also allows the user to configure the entire data logger as well as all attached sensors conveniently on the tablet. It is possible to export data to Excel as well. This is useful in case the measurement data shall be further processed in Excel or other programs.

Thanks to the web service it is possible for several users to simultaneously log into the device e.g. from different locations in case of decentralized measured value monitoring. An intelligent permission management ensures that measurements are not accidentally changed.

A Wi-Fi hotspot integrated in the data logger is responsible for the connection between the tablet and the data logger. In the standard configuration this is set up as an access point, which provides the user with a secure Wi-Fi network.

Alternatively, the data logger can also connect to an existing network as client. This is enabled by a special client mode in the measuring instrument that allows the user to access the data logger via a company network or an external VPN connection.

A configuration website integrated in the data logger allows the user to configure the Wi-Fi hotspot, e.g. network settings or encryption, in just a few steps. This works similar to the configuration of a router.

The ALMEMO® 500 enables the user to view historical measurement sequences saved on the measurement data storage using the app. The measurement sequences can be loaded offline as well as during measurement operations.

### Monitor up to 90 measuring inputs in fail-safe operation

Ahlborn features the ALMEMO® 500 standard version with 20 galvanically isolated measuring input sockets. Depending on the housing width, the device can be augmented to up to 90 measuring input sockets by inserting further plug-in cards.

For thermocouple measurements, the data logger features internal cold junction compensation.

Optionally available battery compartments enable fail-safe long-term measurements. Operated with batteries, the ALMEMO® 500 can be used as a mobile device as well.

### Store 600 million measured values internally

A 4GB SD memory card is integrated in the data memory of the ALMEMO® 500. Depending on the measurement resolution, this card is sufficient for up to 600 million measured values. For long-term measurements, it is possible to configure the data memory as a ring memory. In case the memory is not sufficient, the user can plug in additional memory in form of an USB flash drive or an USB hard disk via the USB port. The ALMEMO® 500 will then save all measurement data to the external medium.

### Networking thanks to state-of-the-art interfaces

It is possible to link several ALMEMO® 500 devices via the USB interfaces or via the integrated access point, using either Wi-Fi or LAN network. The user operates all devices via the ALMEMO® 500 app. Additionally, the measured values can also be queried and displayed using the measured value acquisition software WinControl.

### Depending on the use case: desktop housing or rack housing

Ahlborn features the ALMEMO® 500 with a desktop housing of type TG6 and TG8. The side frames are manufactured using two-component injection molding (2-shot-molding). The device can be carried on stable aluminum handles. Rubberized components prevent the ALMEMO® 500 from slipping. Thanks to the particular form of the side frames, the housings are stackable.

Apart from the desktop housing, Ahlborn features an additional device version in the classic 19-inch rack housing suitable for cabinet solutions..

## ALMEMO® 500



Ports for ALMEMO® sensors and for networking (OLED status display)

## Technical data and functions ALMEMO® 500

- ALMEMO® data logger from the latest V7 generation
- Access via integrated web service and access point, two Wi-Fi access modes: access point or client (for integration in an existing network)
- The device is easy and intuitive to use thanks to an 8-inch tablet with a preinstalled app (included in delivery)
- Visualizing measured values and configuring the data logger via the preinstalled app, simultaneous login of several users possible, integrated user and permission management
- Connecting the new ALMEMO® D7 sensor generation: Measuring rate up to 1000 mops, simultaneous operation of high speed and low speed sensors, display of measured values up to 8 digits, up to 10 channels per sensor, comments up to 20 characters, dimensions up to 6 characters, measured value damping for up to 4 channels per sensor
- Display of measured values as numerical single measurement values, value lists or freely configurable displays
- Graphic display of measured values as line graph for depicting up to 20 measurement sequences, integrated sidebar for switching quickly between three display modes
- Measurement function: measured value, minimum value, maximum value, zeroing, target value comparison, damping, average value over a period of time or over several measurement points, limit value monitoring, cold junction compensation and temperature compensation
- Stored measurement sequences can be displayed offline as well as during ongoing measurement operation
- Modern desktop housing in two variants: TG6 and TG8, side frames manufactured by the use of 2-shot-molding, stackable or available in 19-inch rack housing
- 20 ALMEMO® input sockets (galvanically isolated) for connecting up to 20 ALMEMO® sensors of all generations (standard), up to 200 sensor channels, can be upgraded to up to 90 ALMEMO® input sockets, up to 900 sensor channels
- 2 USB ports for connecting external memory and PC, Ethernet and Wi-Fi for accessing the web service via app
- Networking via integrated access point, using LAN or Wi-Fi network, or via USB using WinControl
- High speed and high resolution A/D Converter (ADC)
- Integrated 4GB SD card, sufficient storage for up to 600 million measured values, configurable as linear or ring memory, memory expansion possible via USB port
- Choice of languages: German, English (other options available on request)
- Programming menu for concise parametrization of e.g. cycles, times, memory and power supply
- OLED display (0.82 inch) and LED displays for visualization of network parameters and system messages directly on the device
- Option KL: multi-point adjustment, customer specific linearization
- Battery compartments (accessory) for fail-safe long-term measurements or for mobile device usage

## Technical data

**Measuring inputs:**

Standard configuration: 20 ALMEMO®-input sockets for all ALMEMO® sensors (standard, DIGI, D6, D7)

Channels (standard): up to 200 measurement channels

Expansion: up to 90 input sockets (depending on the device housing)

Precision class: AA (see Catalog, p.01.04)

Measuring rate for analog sensors, DIGI and D6 sensors: 100 / 50 / 10 / 2.5 mops

Galvanic Isolation for analog sensors using semiconductor relays (50V) additional galvanic isolation between measuring input and power supply (device ground)

Sensor power supply: 6 / 9 / 12V, per board max. 400mA, each data logger max. 1.2 A

**Interfaces:**

2 USB ports for additional memory and networking, Ethernet, Wi-Fi for accessing the web service and networking

**Standard equipment:**

Control unit industrial tablet (Samsung SM T365) with preinstalled app ALMEMO® 500

Memory: 4GB SD card (for up to 600 million measured values)

Date and time-of-day: Real-time clock (4.7ppm) buffered with lithium battery

**Power supply:**

Mains adapter: ZB1212NA10, 100 to 240VAC, 12VDC, 2A galvanically isolated

Recharg. battery (accessory): 2 lithium-batteries, total of 13.8 Ah, integrated high-speed charging (3h)

Power consumption (without input and output modules) approx. 300 mA without sensors (default configuration)

**Housing**

Desktop housing TG6 390 x 160 x 260 mm (W x H x D), appr. 4 kg  
 Desktop housing TG8 497 x 160 x 260 mm (W x H x D), appr. 4.5 kg  
 Rack housing BT8 483 x 132 x 273 mm (W x H x D), appr. 4.5 kg

for further general data: see ALMEMO® Technical Data, page 01.04

## ALMEMO® 500

### Numerous measured value displays

The ALMEMO® 500 app offers different measured value displays.

- Measured values can be displayed as numerical single measurement values, value lists or freely configurable measurement value displays.
- The measurement functions include inter alia measured value, minimum value, maximum value and average value.
- To graphically display the measured values, the line graph is able to show 20 measurement sequences.
- An integrated sidebar enables the user to quickly switch between three different display modes: automatic, manual and entire measurement.



Single measurement value displays for monitoring single measured values



Line graphs for monitoring measurement sequences for a set period of time



Value lists for displaying several measurement values and function values simultaneously

## Accessories

Order no.

Active measuring circuit card MA10 and MMU (expansion). 10 see next page  
 Li-Ion battery pack, 13.8 Ah. Required space: 2 slots. Included mains adapter ZB 1212 NA10  
 Carrying case, aluminum profile frame, suitable for ALMEMO® 500 in desktop housing TG6  
 Rack case with handle, suitable for ALMEMO® 500 in rack case BT8

ES500AP  
 ZB500TK1  
 ZB5090RC

## Option

Order no.

Multi-point adjustment or linearization can be programmed by the customer with any ALMEMO® plug version

OA500KL

## Standard delivery

Order no.

### Data logger ALMEMO® 500

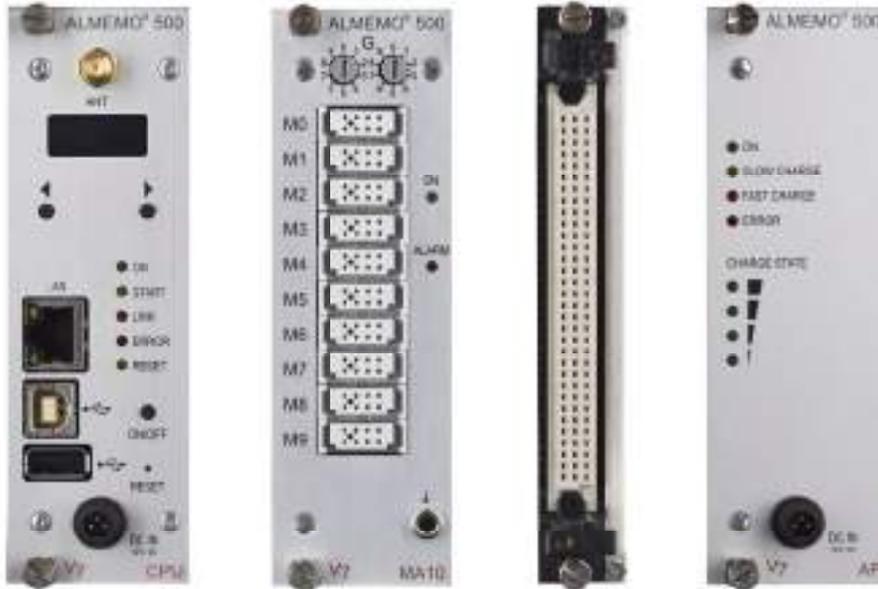
CPU card including interfaces and web service. 4GB SD memory card. 2 active measuring circuit cards MA10 featuring 20 input sockets for all ALMEMO® sensors (standard, DIGI, D6, D7). Manufacturer's test certificate. Mains adapter ZB 1212 NA10  
 PC connecting cable (USB, Ethernet). Control unit (Tablet Samsung SM T365) with preinstalled app, mount for control unit.

In desktop housing TG6, 9 free slots  
 In desktop housing TG8, 15 free slots  
 In 19-inch rack housing, 15 free slots

MA500CPUA20TG6B  
 MA500CPUA20TG8B  
 MA500CPUA20BT8B

DakKS / DKD or factory calibration KE90xx, electrical, for measuring instruments, see chapter Calibration certificates.  
 The DakKS calibration meets the requirements of DIN EN ISO/IEC 17025 for test equipment.

## CPU board, active measuring circuit boards and expansions for datalogger ALMEMO® 500



CPU

MA10

MMU

AP

## Input boards for ALMEMO® 500

### Technical data and functions

- Active measuring circuit boards with own A/D converter
- There are several design variants for different installations / input plugs.

#### Input board M-A10



**10 inputs for all ALMEMO® sensors. (default, digit, D6, D7)  
For flexible applications with individual sensors and measuring signals.**

#### Technical data

Measuring inputs	10 ALMEMO® input sockets, electr. isolated for all ALMEMO® connectors (default, digit, D6, D7).
Measuring ranges	All ranges (see page 01.05)
Sensor supply	6, 9 or 12 V, max. 400mA (per datalogger max. 1.2 A)
Footprint	2 slots

#### Standard delivery

Active measuring circuit board MA10

#### Order no.

ES500MA10

#### Input board MMU



**10 inputs for ALMEMO® 10 MU connectors.  
For permanently installing groups of 10, especially temperature sensors.**

#### Technical data

Measuring inputs	10 inputs, electrically isolated, socket strip for ALMEMO® 10-way MU connector
Measuring ranges	all thermocouples, Pt100, Ni100, NTC ohms, 2.6 V, 260 mV, 55 mV, 26 mV
Sensor supply	None
Footprint	1 slot

#### Standard delivery

Active measuring circuit board MMU  
ALMEMO® 10-way MU connector

#### Order no.

ES500MMU  
ZA5690MU

## Universal ALMEMO® transmitter 2450 / 2490



- 1 or 2 measuring inputs
- Various outputs - digital, analog
- Various power supplies

## ALMEMO® transmitter - a comparison

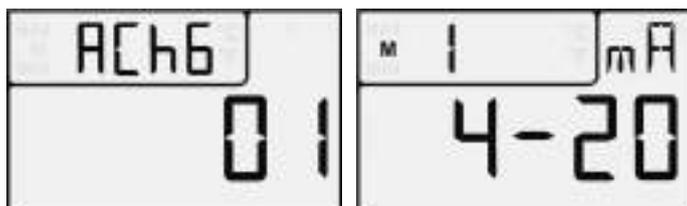
	<b>ALMEMO® 2450</b> <b>Compact measuring instrument</b>	<b>ALMEMO® 2490</b> <b>Basic measuring instrument</b>
Measuring ranges (see Table, page 01.09 / 01.10)	Over 35 measuring ranges, inter alia thermocouples, NTC, temperature / humidity, capacitive	Over 65 measuring ranges, inter alia Pt100, Pt1000, thermocouples, NTC temperature / humidity, capacitive temperature / humidity, psychrometric
Precision class technical data (see page 01.04)	C	B
Measuring inputs	ALMEMO® 2450-1x 1 measuring input	ALMEMO® 2490-1x 1 measuring input ALMEMO® 2490-2x 2 measuring inputs
Other technical data	(see ALMEMO® 2450, page 01.12)	(see ALMEMO® 2490, page 01.14)

## Common technical data

Analog outputs	10 V or 20 mA (programmable) 16-bit DAC, electrically isolated
0.0 to 10.0 V	0.5 mV / digit, load >100 kilohms
0.0 / 4.0 to 20.0 mA	0.1 mA / digit, load <500 ohms
Accuracy	0.1% of meas. v. +0.1% of final v.
Temperature drift	10 ppm / K
Time constant	100 ms

Standard equipment	LCD screen, keypad
Housing	ABS 127 x 83 x 42 mm (LxWxH)
Operating temperature	-10 to +60 °C
Atmospheric humidity	10 to 90 % RH (non-condensing)

Programming the analog output (Example)



Analog - start

Analog - end

## Compact measuring instrument ALMEMO® 2450-1x Universal transmitter with display for a wide variety of ALMEMO® sensors

### Technical data

Measuring input ALMEMO® 2450-1x	1 ALMEMO® socket
Measuring ranges	(see Table, page 01.09 / 01-10) Over 35 measuring ranges, inter alia  Thermocouples, NTC, temperature, humidity, capacitive

Other common data (see page 01.56)

### Variants

#### Digital transmitter

Measuring input for ALMEMO® sensors, LCD screen, 7 keys, with interface via 2 ALMEMO® output sockets A1, A2, and 1 ALMEMO® DC socket for mains adapter including 3 AA alkaline batteries, operating instructions, manufacturer's test certificate,  
**Compact measuring instrument ALMEMO® 2450-1**  
1 measuring input

### Order no.

**MA24501**

Analog transmitter, like the digital transmitter described above, plus integrated analog output via socket P0, electrically isolated (scaling via keypad), including ALMEMO® clamp connectors 2 analog outputs (common ground), electrically isolated, 10 V or 20 mA (programmable)

**Compact measuring instrument ALMEMO® 2450-1**,  
1 Messeingang **MA24501R02**

### Option

Protective class IP54 (if water-proof plugs are used)	OA2450W
Option U Power supply, electrically isolated	OA2450U
Option I RS485 interface	OA2450I

## Basic measuring instrument ALMEMO® 2490-1x / -2x Universal transmitter with display for all ALMEMO® sensors

### Technical data

Measuring input ALMEMO® 2490-1x ALMEMO® 2490-2x	1 ALMEMO® socket 2 ALMEMO® sockets
Measuring ranges	(see Table, page 01.09 / 01-10) Over 65 measuring ranges, inter alia Pt100, Pt1000, thermocouples, NTC Temperature / humidity, capacitive Temperature / humidity, psychrometric

Other common data (see page 01.56)

### Variants

#### Digital transmitter

Measuring input for ALMEMO® sensors, LCD screen, 7 keys, with interface via 2 ALMEMO® output sockets A1, A2, and 1 ALMEMO® DC socket for mains adapter including 3 AA alkaline batteries operating instructions, manufacturer's test certificate  
**Basic measuring instrument ALMEMO® 2490-1**  
1 measuring input

### Order no.

**MA24901**

**Basic measuring instrument ALMEMO® 2490-2**  
2 measuring inputs

**MA24902**

Analog transmitter, like the digital transmitter described above, plus integrated analog output via socket P0, electrically isolated (scaling via keypad), including ALMEMO® clamp connectors 2 analog outputs (common ground), electrically isolated, 10 V or 20 mA (programmable)

**Basic measuring instrument ALMEMO® 2490-1**  
1 measuring input **MA24901R02**

**Basic measuring instrument ALMEMO® 2490-2**  
2 measuring inputs **MA24902R02**

### Option

Protective class IP54 (if water-proof plugs are used)	OA2490W
Option U Power supply, electrically isolated	OA2490U
Option I RS485 interface	OA2490I

DAkKS or works calibration KE90xx, electrical, for measuring instrument (see chapter „Calibration certificates“)  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Accessories, options

### Power supply

100 to 240 VAC via mains unit 12 V, 2 A	ZA1312NA10
10 to 30 VDC, maximum 80 mA, electrically isolated, integrated including ALMEMO® clamp connector	see option U
10 to 30 VDC, maximum 200 mA, electrically isolated, via DC adapter cable, with banana plugs	ZA2690UK
10 to 30 VDC, not electrically isolated (not suitable for thermocouple measuring) including ALMEMO® clamp connector	ZA1312FS1

### Digital interface (see chapter „Networking“)

USB interface via ALMEMO® USB cable	ZA1919DKU
Ethernet interface via ALMEMO® Ethernet cable	ZA1945DK
RS232 interface via ALMEMO® RS232 cable	ZA1909DK5
RS485 interface, integrated including ALMEMO® clamp connector	see option I

(please order separately)

### Limit value contact (see chapter „Output modules“)

(Programming via digital interface, see above) 2 normally open contacts, 50 VDC / 500 mA (can also be programmed as inverted) via ALMEMO® relay cable, V6, clamped connection	ZA1006EKG
ALMEMO® limit value cable with banana plugs (for electrical socket adapter)	ZA1006GK
Electrical safety socket adapter, 250 V / 6 A (for ALMEMO® limit value cable)	ZB2280RA

### Installation

DIN rail	ZB2490HS
Magnet	ZB2490MH

## ALMEMO® 4390-2



**ALMEMO® precision measuring instrument in fitted panel design with data logger function. Comprehensive range of functions for all application areas. Increased measuring accuracy, fast measuring rate, 1 measuring input, 2 limit value relays, integrated. Option with double analog output.**

### Technical data and functions

- Increased measuring accuracy and stability
- Fast measuring rate, up to 50 measuring operations per second. With SD memory card, up to 100 mops, optional for 1 channel up to 400 mops
- 1 ALMEMO® input socket, suitable for all ALMEMO® sensors or 6-contact clamp connector socket, also for 26 V and 20 mA
- More than 65 standard measuring ranges
- Support for ALMEMO® plugs with multi-point adjustment, special linearization, and special measuring ranges
- Higher measuring quality thanks to electrical isolation between measuring inputs and device power supply (device ground)
- Data logger with internal EEPROM, sufficient for 16,000 measured values, configurable as linear or ring memory
- Memory connector with micro SD (accessory)
- As standard 2 limit value relays can also be driven via interface
- Option with double analog output can also be driven via interface
- 2 ALMEMO® output sockets, suitable for digital interfaces, analog output, trigger input, alarm contacts, memory card
- 8-character alphanumeric 14-segment display
- Programming functions displayed in normal text (3 languages)
- 5 programming menus: Measuring function, memory, sensor, device, output
- Measuring functions: Measured value, dual display, smoothing, zero-setting, setpoint adjustment, maximum / minimum / average values, temperature compensation, atmospheric pressure compensation
- Sensor programming: Measuring range, measured value correction, scaling, units, limit value monitoring, graduated locking of functions, scaling of analog output
- Device programming: Conversion rate, real-time clock with date, output cycle, baud rate, choice of languages

### Technical data

Precision class	AA (see page 01.04)	Option with double analog output	10 V or 20 mA (programmable)
Measuring rate	(100), 50, 10 and 2.5 mops	0.0 to 10.0 V	16-bit DAC, electrically isolated
Measuring inputs	1 ALMEMO® input socket, suitable for all ALMEMO® sensors or 6-contact screw connector with input for 26 V (integrated divider) or 20 mA (integrated shunt)	0.0 to 20.0 mA	0.5 mV / digit, load >100 kilohms
Accuracy	Divider / shunt ±0.1 % of measured value	Accuracy	0.1 mA / digit, load <500 ohms
Channels	4 channels for double sensors and function channels	Temperature drift	±0.1 % of measured value
Electrical isolation for analog sensors	between measuring input and power supply (device ground)	Time constant	±0.1 % of final value
Sensor power supply	12 V / 0.1 A; 9 V / 0.15 A; 6 V / 0.2 A	Standard equipment	10 ppm / K
Outputs	2 ALMEMO® sockets, suitable for all output modules (analog / data / trigger / relay cables, memory, etc.)	Display	100 µs
2 limit value relays	Mechanical changeover, 230 V, 2 A	Keypad	8-character 14-segment LED display
		Date and time-of-day	5 membrane keys
		Memory, internal EEPROM	Real-time clock, buffered with battery
		Power supply	Memory, internal EEPROM sufficient for 16,000 measured values
		Mains operation	90 to 250 VAC, 50 / 60 Hz
		Option U	10 to 30 V, 0.5 A, electrically isolated
		Housing	Standard plastic housing
		Panel opening	96 x 48 x 132 mm (WxHxD)
			90 x 42.5 mm

Accessories	Order no.
Memory connector with micro SD, including USB card reader (see chapter „Output modules“)	ZA1904SD

Options	Order no.
Measuring rate 400 mops (SD card required)	SA0000Q4
Power supply 10 to 30 VDC, electrically isolated	OA4390U
2 analog outputs (common ground), electrically isolated 10 V or 20 mA (programmable)	OA4390R02
Temperature ranges for 8 refrigerants	SB0000R2

Standard delivery	Order no.
Operating instructions, manufacturer's test certificate, Precision measuring instrument ALMEMO® 4390-2	MA43902

DAkKS or works calibration KE90xx, electrical, for measuring instrument (see chapter „Calibration certificates“).  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

# Reference Measuring Instruments



## High-precision measuring

The new reference measuring instruments ensure very high levels of resolution, precision, and linearity. They are thus ideally suitable as reference instruments in calibration laboratories and quality assurance procedures. They measure with resolution up to 0.001 K. These devices

are offered in a set including sensor. They come in a compact design (with an optional variant with protective class IP54), an illuminated graphics display, and easy and convenient operation by soft-keys and the cursor block. There are two output sockets which can be used

for connection to a PC or for networking. There is also a plug-on measured value memory available as an option. Delivery includes evaluation software, data cable, temperature sensor, DAkkS calibration certificate, mains unit, and measuring instrument case.

## ALMEMO® 1020-2



**Reference measuring instrument for temperature**  
**High-precision measuring by means of thermocouples**  
**Types N, S, R, B**  
**Resolution 0.01 K, up to 1800 °C**

### Technical features

- Temperature measurement with very high levels of resolution, precision, and linearity, using thermocouples Types N, S, R, B
- Suitable as reference device in calibration laboratories and quality assurance procedures
- Very high accuracy thanks to multi-point adjustment of the thermocouple temperature sensor
- Each temperature sensor has its own cold junction stored in the ALMEMO® plug or externally. The cold junction temperature in the ALMEMO® plug is measured to a very high resolution of 0.001 K by means of an NTC sensor.
- Two electrically isolated measuring inputs for thermocouples, types N, S, R, B
- Resolution 0.01 K
- Units °C, °F, K
- High-resolution A/D converter, delta-sigma, 24-bit, 1.25 mops (measuring operations per second)
- Two output sockets for digital interface, ALMEMO® memory connector
- Compact, modern, ergonomic design
- Graphics display, illuminated with white light
- Easy and convenient to operate by means of 4 soft-keys and cursor block
- Measured value display : 2 measured values, differential, measuring point list, cold junction temperature
- Measuring functions : Zero-setting, smoothing, maximum / minimum values, individual value memory for 100 values
- Data logger with ALMEMO® memory connector (accessory)
- Sensor programming : Smoothing, designation, units
- Device configuration : Illumination, contrast, device address, baud rate
- Choice of language : German, English, French

### Technical data ALMEMO® 1020-2

<b>Measuring inputs</b>	2 ALMEMO® input sockets for thermocouples	<b>Outputs</b>	2 ALMEMO® sockets for interface cable and ALMEMO® memory connector
Electrical isolation	Semiconductor relay (50 V)	<b>Standard equipment</b>	
A/D converter	Delta-sigma, 24-bit, 1.25 mops	Display	Graphics display, 128 x 64 pixels, 8 rows
Measuring ranges		Illumination	2 white LEDs
NiCrSi-NiSi Type N	-200 to +1300 °C	Keypad	7 silicone keys (of which 4 soft-keys)
PtRh10-Pt Type S	-50 to +1768 °C	Date and time-of-day	Real-time clock, buffered by battery
PtRh13-Pt Type R	-50 to +1768 °C	Individual value memory, internal	100 measured values
PtRh30-PtRh6 Type B	+250 to +1820 °C	<b>Power supply</b>	
Resolution	0.01 K	Battery set	3 AA alkaline batteries
Accuracy	±0.1 K ± 1 digit in range	Mains adapter	ZA1312NA10 100 to 240 VAC to 12 VDC, 2 A, electrically isolated
Type N	-200 to +1300 °C	Current consumption (without input and output modules)	approx. 20 mA
Type S	+50 to +1760 °C	With illumination	approx. 40 mA
Type R	+100 to +1760 °C	Housing	127 x 83 x 42 mm (LxWxH)
Type B	+500 to +1800 °C		ABS, 290g
Nominal conditions	23 °C ±2 K, 1013 mbar, battery mode		
Temperature drift	typical 10 ppm / K		
Cold junction temperature	Measuring operations with 0.001 K resolution		

### Accessories

Ethernet data cable  
 ALMEMO® memory connector with micro SD  
 Rubberized impact protection, gray  
 DIN rail mounting

### Order no.

ZA1945DK  
 ZA1904SD  
 ZB2490GS2  
 ZB2490GS

**Variants**

**Complete set comprising reference measuring instrument for temperature plus accessories, evaluation software, thermocouple sensor, with DAkkS calibration certificate**

Reference measuring instrument ALMEMO® 1020-2, including 3 AA alkaline batteries, mains unit ZA1312NA10, USB data cable ZA1919DKU, instrument case, and evaluation software ALMEMO® View SW5500AV (see page 06.16)

**Set with high-precision sheathed thermocouple sensor type N****Set**

with sheathed thermocouple sensor type N FTAN926L0500P2 with DAkkS calibration certificate at 0 / 100 / 500 / 1000 °C, including adjustment

**Accessories:** Aluminum profile case for 1 sensor (up to 500 mm in length)

**Order no.****SP10202ND****ZB9000TK1****Technical data:**

Sheathed thermocouple sensor type N FTAN926L0500P2	
Measuring element	NiCrSi-NiSi, type N, class 1
Measuring tip	Mineral-insulated sheathed line, d = 6 mm, L = 500 mm
Operative range	-200 to +1150 °C
Connecting cable	1.5 meters, thermal line (stranded wire) FEP / silicone (-50 to +200 °C)
ALMEMO® plug	Resolution 0.01 K with integrated cold junction compensation sensor

**Set with high-precision thermocouple sensor type S****Set**

with thermocouple sensor type S FTAS917L0700P2 replacement ceramic protective tube, case for sensors ZB9000TK2 with DAkkS calibration certificate at 500/1000/1200 °C, including adjustment

**Order no.****SP10202S1D****Technical data:**

Thermocouple sensor type S FTAS917L0700P2	
Measuring element	PtRh10-Pt, Type S, Class 1
Measuring tip	Thermowire, d = 0.5 mm in ceramic protective tube diameter = 7 mm, length = 700 mm
Operative range	up to +1400 °C
Connection head	ceramic protective tube, screwed
Connecting cable	1.5 meters, compensation line FEP / silicone (-50 to +200 °C)
ALMEMO® plug	Resolution 0.01 K with integrated cold junction compensation sensor

**Set with precision thermocouple sensor type S, with external cold junction****Set**

with thermocouple sensor type S, with external cold junction FTAS907L0700P2, replacement ceramic protective tube, Case for sensors ZB9000TK2 with DAkkS calibration certificate at 500 / 1000 / 1200 °C, including adjustment

**Order no.****SP10202S2D****Technical data:**

Thermocouple sensor type S, with external cold junction FTAS907L0700P2	
Measuring element	PtRh10-Pt, Type S, Class 1
Measuring tip	Thermowire, d = 0.5 mm in ceramic protective tube diameter = 7 mm, length = 700 mm
Operative range	up to +1600 °C
Connection head	ceramic protective tube, screwed
Connecting cable	0.75 meters, insulated, thermo-wires PtRh10-Pt as far as cold junction
Cold junction	Stainless steel protective tube diameter = 5 mm, length = 250 mm
Connecting cable	2 meters, stranded copper wire
ALMEMO® plug	Resolution 0.01 K

## Certificates

### Calibration certificate for ALMEMO® 1020-2 with precision sheathed thermocouple sensor type N (Example)

**Kalibriermessgegenstand**  
**Object of calibration**

1 Thermoelementfühler NiCr-Si-NiSi, Typ N, Ø 6 mm Länge 700 mm, angeschlossen an ein Temperaturanzeigergerät ALMEMO 1020-2, Serien-Nr. H12070031  
 1 thermocouple probe NiCr-Si-NiSi, type N, Ø 6 mm length 700 mm, connected with one temperature measuring device ALMEMO 1020-2, Serial-No. H12070031

**Messergebnisse / Test Result**

Kanal Channel	Serien-Nr. Serial No.	Prüftemperatur Test Temperature °C	Anzeige Indication °C	Abweichung Deviation K	Messunsicherheit Uncertainty K
NO	-	1150,00	1150,00	0,00	3,0
		1000,00	1000,00	0,00	1,5
		500,00	500,00	0,00	1,0
		100,00	100,00	0,00	0,3

Die Werte beziehen sich auf die internationale Temperaturskala von 1990 (ITS-90).  
 The values are based on the international Temperature Scale of 1990 (ITS-90).

### Calibration certificate for ALMEMO® 1020-2 with precision thermocouple sensor type S, with external cold junction (Example)

**Kalibriermessgegenstand**  
**Object of calibration**

1 Thermoelementfühler Pt10%Rh-Pt, Typ S, Schutzrohr: Keramik, Ø 8,2 mm, Länge 500 mm, mit externer Vergleichsstelle, angeschlossen an ein Temperaturanzeigergerät ALMEMO 1020-2, Serien-Nr. H12070031  
 1 thermocouple probe Pt10%Rh-Pt, type S, Sheath tube: ceramics, Ø 8,2 mm, length 500 mm, with external cold-junction, connected with one temperature measuring device ALMEMO 1020-2, Serial-No. H12070031

**Messergebnisse / Test Result**

Kanal Channel	Serien-Nr. Serial No.	Prüftemperatur Test Temperature °C	Anzeige Indication °C	Abweichung Deviation K	Messunsicherheit Uncertainty K
NO	12050001	1200,00	1200,00	0,00	1,5
		1000,00	1000,00	0,00	1,0
		500,00	500,00	0,00	0,5

Die Werte beziehen sich auf die internationale Temperaturskala von 1990 (ITS-90).  
 The values are based on the international Temperature Scale of 1990 (ITS-90).

**Die Korrektur der Messkette erfolgte über die Mehrpunktjustage-Funktion!**  
**The correction of the measuring system was realized by the multiple point function!**

**Bedingungen während der Kalibrierung**  
**Calibration Conditions**

Other certificates for measuring instruments and sensors (see chapter „Calibration certificates“)

## ALMEMO® 1030-2



**Reference measuring instrument for temperature.**  
**High-precision measuring with Pt100 sensors**  
**Resolution 0.001 K**

- Temperature measurement with very high resolution, precision, and linearity, using Pt100 sensors
- Suitable as reference device in calibration laboratories and quality assurance procedures
- Very high accuracy thanks to multi-point adjustment of the Pt100 temperature sensor
- 2 electrically isolated measuring inputs for Pt100 sensors
- Resolution : 0.001 K.
- Units °C, °F, K
- High-resolution A/D converter, delta-sigma, 24-bit, 1.25 mops (measuring operations per second)
- Two output sockets for digital interface, ALMEMO® memory connector
- Compact, modern, ergonomic design
- Graphics display, illuminated with white light
- Easy and convenient to operate by means of 4 soft-keys and cursor block
- Measured value display 2 measured values and differential
- Measuring functions: Zero-setting, smoothing, maximum / minimum values, individual value memory for 100 values
- Data logger with ALMEMO® memory connector (accessory)
- Sensor programming: Smoothing, designation, units, resolution
- Device configuration: Illumination, contrast, device address, baud rate
- Choice of language: German, English, French

### Technical data ALMEMO® 1030-2

<b>Measuring inputs</b>	2 ALMEMO® input sockets for Pt100 sensors	<b>Power supply</b>	Battery set 3 AA alkaline batteries
Electrical isolation	Semiconductor relay (50 V)	Mains adapter	ZA1312NA10 100 to 230 VAC to 12 VDC, 2 A, electrically isolated
A/D converter	Delta-sigma, 24-bit, 1.25 mops	Current consumption (without input and output modules)	approx. 20 mA
Measuring range	Pt100, -200 to +400 °C	With illumination	approx. 40 mA
Resolution	0.001 K or 0.01 K	Housing	127 x 83 x 42 mm (LxWxH) ABS, 290 g
Measuring current	1 mA	<b>Pt100 temperature sensor FPA923L0250</b>	
Accuracy	±0.010 K ±1 digit in range -50 to +400 °C	Measuring element	Pt100 as per DIN EN 60751
Nominal conditions	23 °C ±2 K, 1013 mbar, battery mode	Class	1/10 B (DIN EN 60751) at 0 °C
Temperature drift	typical 2 ppm / K	Measuring tip	Operative range -50 to +400 °C
<b>Outputs</b>	2 ALMEMO® sockets for interface cable and ALMEMO® memory connector	Response time T <sub>90</sub>	5 seconds
<b>Standard equipment</b>		Nominal length	250 mm
Display	Graphics display, 128 x 64 pixels, 8 rows	Shaft	Stainless steel, diameter 3 mm
Illumination	2 white LEDs	Connecting cable	2 meters, FEP / silicone
Keypad	7 silicone keys (of which 4 soft-keys)	ALMEMO® plug	Resolution 0.001 K
Date and time-of-day	Real-time clock, buffered by device battery	Other sensor designs are available on request.	
Individual value memory, internal	100 measured values		

### Accessories

Ethernet data cable	
ALMEMO® memory connector with micro SD	
Rubberized impact protection, gray	
DIN rail mounting	
Aluminum profile case for 1 sensor (up to 500 mm in length)	

### Order no.

ZA1945DK
ZA1904SD
ZB2490GS2
ZB2490HS
ZB9000TK

## Set with precision resistance temperature detector Pt100



Pt100-temperature sensor FPA923L0250

### Technical data FPA923L0250

Measuring element	Pt100 wire-wound	Nominal length	250 mm
Class	1/10 B (DIN EN 60751) at 0 °C	Shaft	Stainless steel, diameter 3 mm
Measuring tip	Operative range -50 to +400 °C	Connecting cable	2 meters, FEP / silicone
Response time $T_{90}$	5 seconds	ALMEMO® plug	Resolution 0.001 K

06/2018 • We reserve the right to make technical changes.

Options	Order no.
<p><b>new:</b> Added functions for ALMEMO 1030 and 1036:</p> <ol style="list-style-type: none"> <li>1. Extension of the measurement range with resolution 0.001 K (P314): -200...560 °C.</li> <li>2. New measurement range with resolution 0.01 K (P214): -200...850 °C.</li> <li>3. The 4 sensor specific parameters R0 and A, B, C of the Callendar–Van Dusen equation can be programmed for Pt 100 sensors by the user.</li> </ol>	OA1030FE

Standard delivery	Order no.
<p><b>Reference measuring instrument for temperature measurement with accessories, evaluation software, and Pt100 temperature sensor. Complete set including DAkkS calibration certificate:</b></p> <p>Reference measuring instrument ALMEMO® 1030-2 including 3 AA alkaline batteries, Desktop mains unit ZA1312NA10, USB data cable ZA1919DKU, Instrument case, evaluation software ALMEMO® View SW5500AV (see page 06.06) and Pt100 temperature sensor FPA923L0250 with DAkkS calibration certificate (2 temperature points at 0 and 100 °C, including adjustment)</p>	SP10302



## ALMEMO® 1036-2



**Reference measuring instruments for humidity and temperature**  
**High-precision measurement with the Pt100 psychrometer and Pt100 sensors**  
**Resolution Temperature 0.001 K**  
**Relative humidity 0.01 %**  
**Dew point 0.01 K**

### Technical features

- Humidity measurement with very high resolution, precision, and linearity, using Pt100 psychrometer
- Suitable as reference device in calibration laboratories and quality assurance procedures
- Very high level of accuracy using the Pt100 psychrometer thanks to multi-point adjustment of the two temperature sensors
- Pt100 psychrometer optimized for measuring operations involving high humidity levels performed over long periods
- Automatic atmospheric pressure compensation is provided for pressure-dependent humidity variables by means of a digital atmospheric pressure sensor integrated in the ALMEMO® device.
- Humidity calculation on the basis of formulae as per Dr. Sonntag and the enhancement factor as per W. Bögel (correction factor  $f_w(t,p)$  for real mixed gas systems). This substantially widens the measuring range and improves the accuracy of humidity variable calculations.
- Resolution : Temperature Pt100 0.001 K, Relative humidity 0.01%, Dew point 0.01 K
- The humidity variables are calculated from the three primary measuring channels (real measurable variables). Dry temperature (°C), humid temperature (°C), atmospheric pressure (mbar)
- Three humidity variables displayed simultaneously, freely selectable: Relative humidity (%), dew point (°C), mixture (g/kg), Absolute humidity (g/m<sup>3</sup>), vapor pressure (mbar), enthalpy (kJ/kg)
- Two electrically isolated measuring inputs for Pt100 sensors
- High-resolution A/D converter, delta-sigma, 24-bit, 1.25 mops (measuring operations per second)
- Two output sockets for digital interface, ALMEMO® memory connector
- Compact, modern, ergonomic design
- Graphics display, illuminated with white light
- Easy and convenient to operate by means of 4 soft-keys and cursor block
- Measured value display : Sensor display (up to 4 measured values), measuring points list, atmospheric pressure
- Measuring functions : Zero-setting, smoothing, maximum / minimum values, individual value memory for 100 values
- Data logger with ALMEMO® memory connector (accessory)
- Sensor programming : Smoothing, designation, measuring range selection, locking
- Device configuration : Illumination, contrast, device address, baud rate, atmospheric pressure
- Choice of language : German, English, French
- Humidity measurement in temperature range -100 to +200 °C, with precision digital capacitive temperature / humidity sensors FHAD 36 Rx, with ALMEMO® D6 connector (Accessories, see chapter „Atmospheric humidity“). Configuration of ALMEMO® D6 sensors on ALMEMO® device itself. For the digital sensors FHAD 36-Rx, it is not possible to program the multi-point adjustment via the measuring instrument.

### Technical data ALMEMO® 1036-2

<b>Measuring inputs</b>	Two ALMEMO® input sockets for Pt100 psychrometer FPA 836-3P3 or Precision digital capacitive temperature / humidity sensors FHAD 36 Rx	<b>Outputs</b>	Two ALMEMO® sockets for interface cable and ALMEMO® memory connector
Electrical isolation	Semiconductor relay (50 V)	<b>Standard equipment</b>	
A/D converter	Delta-sigma, 24-bit, 1.25 mops	Display	Graphics display, 128 x 64 pixels, 8 rows Illumination 2 white LEDs
Measuring range	Pt100, -200 to +400 °C	Keypad	7 silicone keys (of which 4 soft-keys)
Resolution	0.001 K	Date and time-of-day	Real-time clock, buffered by battery
Measuring current	1 mA	Individual value memory, internal	100 measured values
Accuracy	±0.010 K ±1 digit in range -50 to +400 °C	<b>Power supply</b>	
Nominal conditions	23 °C ±2 K, 1013 mbar, battery mode	Battery set	3 AA alkaline batteries
Temperature drift	typical 2 ppm / K	Mains adapter	ZA1312NA10 100 to 240 VAC to 12 VDC, 2 A, electrically isolated
Calculated humidity quantities	Analytic equation (not an approximation)	Current consumption (without input and output modules)	approx. 20 mA
<b>Digital atmospheric pressure sensor</b> (integrated in the device)		With illumination	approx. 40 mA
Measuring range	700 to 1100 mbar	Housing	127 x 83 x 42 mm (LxWxH)
Accuracy	±2.5 mbar (at 23 °C ±5 K)		ABS, 290g

<b>Accessories</b>	<b>Order no.</b>
Ethernet data cable	ZA1945DK
ALMEMO® memory connector with micro SD	ZA1904SD
Rubberized impact protection, gray	ZB2490GS2
DIN rail mounting	ZB2490HS
Spare wicks (2 pieces)	ZB98462ED
Extension cable for mains units, 3-pin bayonet coupling, length 5 meters	ZB5090VK05

## Set with Pt100 psychrometer FPA 836-3P3



Psychrometer FPA 836-3P3

## Technical data Pt100 psychrometer FPA 836-3P3

Operating temperature	up to +90 °C (no ice)	Housing	Plastic PMMA
Humidity measuring range	approx. 10 to 100 % RH	Dimensions	175 x 50 x 75 mm (LxWxH)
Measuring system	psychrometric	Ventilator power supply	12 VDC via mains unit cable, approx. 1.5 meters (included in delivery)
Accuracy	< ±1 % RH under nominal conditions	Connecting cables	2 cables, each 5 meters, FEP / silicone
Nominal conditions	23 °C ±2 K, 1013 mbar, 50 % RH	ALMEMO® plug	Pt100, resolution 0.001 K
Temperature sensors	sheet resistance 2 x Pt100 class B, ALMEMO® adjusted		

<b>Options</b>	<b>Order no.</b>
Added functions for ALMEMO 1030 and 1036: 1. Extension of the measurement range with resolution 0.001 K (P314): -200...560 °C. 2. New measurement range with resolution 0.01 K (P214): -200...850 °C. 3. The 4 sensor specific parameters R0 and A, B, C of the Callendar–Van Dusen equation can be programmed for Pt 100 sensors by the user	OA1030FE

<b>Standard delivery</b>	<b>Order no.</b>
<b>Reference measuring instrument for humidity measurement with accessories, evaluation software, and Pt100 psychrometer, Complete set including DAkkS calibration certificate</b>  Reference measuring instrument ALMEMO® 1036-2, with integrated digital atmospheric pressure sensor including 3 AA alkaline batteries, mains unit ZA1312NA10, USB data cable ZA1919DKU, instrument case, and evaluation software ALMEMO View SW5500AV (see page 06.16) and Pt100 psychrometer FPA 836-3P3 including mains unit, water bottle, pair of wicks with DAkkS calibration certificate Temperature at approx. +25 °C, relative humidity at approx. 30 % / 75 % RH, and atmospheric pressure in range 700 to 1100 mbar (5 points)	<b>SP10362D</b>

<b>Precision resistance temperature detector Pt100 (Accessories)</b>	<b>Order no.</b>
Precision temperature sensors for ALMEMO® 1030, 1036, 8036. Technical data see Page 01.64	FPA923L010

## ALMEMO® 8036-9



**Reference measuring instrument for temperature and humidity**

**Multi-channel measuring instrument with nine measuring inputs for Pt100 sensors and Pt100 psychrometers. High-precision measuring with resolution of 0.001 K**

**For calibration laboratories, quality assurance procedures, and monitoring of test and measuring rooms**

**For use either as PC interface or with external memory connector as data logger**

## Technical data and functions

### Multi-channel instrument for high-precision measuring

Reference measuring instrument ALMEMO® 8036-9 ensures very high levels of resolution, precision, and linearity when measuring temperature, using up to nine Pt100 sensors - or alternatively up to four Pt100 psychrometers.

This reference measuring instrument is suitable for use as calibration standard in calibration laboratories, for quality assurance procedures, or as a multi-channel instrument for high-precision measuring operations, e.g. in test and measuring rooms or climate chambers.

With the Pt100 the measuring ranges have been expanded considerably, up to +670 °C at the highest resolution of 0.001 K and up to +850 °C at a resolution of 0.01 K. The measured value units can be programmed to either °C / K / °F.

Reference measuring instrument ALMEMO® 8036-9 operates with special ALMEMO® plugs incorporating expanded programming possibilities. These plugs, it should be noted, cannot be interchanged with the ordinary plugs used with ALMEMO® V6 / V7 measuring instruments.

### Very high precision thanks to multi-point adjustment and input of coefficients for the Pt100 characteristic

This very high level of precision is achieved by calibrating the measuring chain comprising Pt100 sensor and measuring instrument. For each individual sensor there are two error correction methods available.

1. Multi-point adjustment in up to 35 temperature points
2. Input of coefficients R0 and A, B, C for the Pt100 characteristic as per the Callendar / Van Dusen equation

Linearization is then performed using the sensor-specific Pt100 characteristic.

Both correction procedures can be used for any sensor simultaneously. The correction values from multi-point adjustment and the coefficients of the Pt100 characteristic are saved in the sensor connector.

Sensors are identified by means of a programmable 10-character alphanumeric designation stored in the sensor connector and a serial number. Similarly, for the purpose of monitoring the calibration interval, the date of the next calibration due and the calibration interval can be programmed and saved in the sensor connector.

### High-precision humidity measuring with atmospheric pressure compensation and calculation as per Dr. Sonntag and W. Bögel

The Pt100 psychrometer incorporates two temperature sensors assigned to two measuring inputs.

The digital atmospheric pressure sensor integrated in the ALMEMO® device ensures that any pressure-dependent humidity variables are pressure-compensated automatically.

Humidity is calculated on the basis of formulae as per Dr. Sonntag and the enhancement factor as per W. Bögel (correction factor  $fw(t,p)$ ) for real mixed gas systems). This substantially widens the measuring range and improves the accuracy of humidity variable calculations.

Temperature is measured to a resolution of 0.001 K, relative humidity to 0.01% RH, and dewpoint temperature to 0.01 K.

Humidity variables are calculated from the three primary measuring channels (real measurable variables) - dry temperature (TD °C), wet temperature (TW °C), and atmospheric pressure (mbar).

In the second ALMEMO® plug (dry sensor) there are up to three humidity variables, simultaneously programmable : relative humidity (%), dewpoint (°C), and mixture (g/kg). Abs. humidity (g/m<sup>3</sup>), vapor pressure (mbar), enthalpy (kJ/kg)

### Other equipment

- Five LEDs for indicating various operating states
- One pushbutton for switching the device on / off and to start / stop a measuring operation
- Data logger mode with plug-in ALMEMO® memory connector with micro SD card (accessory)
- Two ALMEMO® output sockets for simultaneously connecting a PC or network and an ALMEMO® memory connector

### ALMEMO® Control configuration software

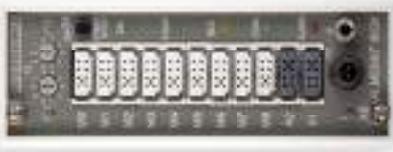
The ALMEMO® Control software (included in delivery) can be used on a PC to program all sensor parameters in the Pt100 sensor or in the Pt100 psychrometer : measuring range / resolution, units, smoothing, text description, calibration date and calibration interval, multi-point adjustment, locking level.

The ALMEMO® Control software also be used to completely program the device.

### WinControl software for measured data acquisition

The WinControl software (accessory) can be used to acquire and document measured values from the reference measuring instrument. In the calibration laboratory the reference measuring instrument (reference standard) and the ALMEMO® device (test item) can be networked together and evaluated using WinControl.

## ALMEMO® 8036-9



06/2018 • We reserve the right to make technical changes.

### Technical data

<b>Measuring inputs</b>	Nine ALMEMO® measuring inputs for Pt100 sensors and Pt100 psychrometers	<b>Digital atmospheric pressure sensor</b> (integrated in the device)	
Electrical isolation	Semiconductor relay (50 V)	Measuring range	700 to 1100 mbar
A/D converter	Delta-sigma, 24-bit, 1.25 mops	Accuracy	±2.5 mbar (at 23 °C ±5 K)
Measuring range	Pt100, 4 conductors, -200 to +670 °C Resolution 0.001 K Pt100, 4 conductors, -200 to +850 °C Resolution 0.01 K	<b>Outputs</b>	Two ALMEMO® sockets for interface cable and ALMEMO® memory connector
Measuring current	1 mA	<b>Standard equipment</b>	
Accuracy	±0.010 K ±1 digit in range -50 to +560°C Resolution 0.001 K ±0.05 K ±1 digit in range -100 to +850 °C Resolution 0.01 K	Operation	1 key, 5 LEDs, 2 coding switches
Nominal conditions	+23 °C ±2 K, 1013 mbar	Date and time-of-day	Real-time clock, buffered by lithium battery
Temperature drift	typical 2 ppm / K	<b>Power supply</b>	
Calculated humidity variables	Analytic equation (not an approximation)	Mains adapter	ZB1212NA10 100 to 240 VAC to 12 VDC, 2 A, electrically isolated
		Current consumption	without input and output modules approx. 35 mA
		Active mode	(with memory connector approx. 45 mA)
		Sleep mode	approx. 0.05 mA
		<b>Housing</b>	180 x 049 x 137 mm (LxWxH) Polystyrene (PS), approx. 490 g

### Input connector ALMEMO® 8036-9

#### Order no.

ALMEMO® input connector for the user's own third party high-precision sensors, Pt100, 4 conductors, 0.001 K resolution, for ALMEMO® 1030-2/1036-2/8036-9

**ZA9030FS7P3**

ALMEMO® input connector for the user's own third party high-precision sensors, Pt100, 4 conductors, 0.01 K resolution, for ALMEMO® 1030-2/1036-2/8036-9

**ZA9030FS2P3**

### Accessories

#### Order no.

Memory connector with micro SD, including USB card reader (see chapter 'General accessories')

**ZA1904SD**

WinControl software for measured data acquisition  
per device up to 20 channels  
for any number of devices and channels

**SW5600WC1**  
**SW5600WC2**

### Connecting cables

#### Order no.

USB data cable, electrically isolated

**ZA1919DKU**

Ethernet data cable, electrically isolated

**ZA1945DK**

### Standard delivery

#### Order no.

Reference measuring instrument ALMEMO® 8036-9, nine inputs for Pt100 sensors and Pt100 psychrometers, integrated atmospheric pressure sensor, including mains unit ZB1212NA10

**MA80369**

DAkkS / DKD calibration KD92xxD, atmospheric pressure, for measuring chain (sensor and device), see catalog chapter Calibration certificate  
The DAkkS calibration meets the requirements of DIN EN ISO/IEC 17025 for test equipment.

**Pt100 high-precision sensor FPA923L0250  
for reference measuring instrument ALMEMO® 1030-2/1036-2/8036-9**



### Technical data

Measuring element	Pt100 wire-wound	Nominal length	250 mm
Class	1/10 B (DIN EN 60751) at 0 °C	Shaft	Stainless steel, diameter 3 mm
Measuring tip	Operative range -50 to +400 °C	Connecting cable	2 meters, FEP / silicone
Response time T90	5 seconds	ALMEMO® plug	Resolution 0.001 K

### Accessories

	Order no.
Aluminum profile case for 1 sensor (up to 500 mm in length)	ZB9000TK1

### Standard delivery

High-precision temperature sensor, measuring element Pt100 1/10 DIN class B Sensor diameter 3 mm, length 250 mm Measuring tip -50 to +400 °C with 2-meter FEP / silicone cable and ALMEMO® plug Resolution 0.001 K for ALMEMO® 1030-2/1036-2/8036-9

Order no.
<b>FPA923L0250</b>

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

**Pt100 high-precision psychrometer FPA 836-3P3  
for reference measuring instrument ALMEMO® 1036-2/8036-9**



### Technical data

Operating temperature	up to +90 °C (no ice)	Housing	Plastic PMMA
Humidity measuring range	approx. 10 to 100 % RH	Dimensions	175 x 050 x 075 mm (LxWxH)
Measuring system	psychrometric	Ventilator power supply	12 VDC via mains unit
Accuracy	< ±1 % RH under nominal conditions		Cable, approx. 1.5 meters (included in delivery)
Nominal conditions	+23 °C ±2 K, 1013 mbar, 50 % RH	Connecting cables	2 cables, each 5 meters, FEP / silicone
Temperature sensors	sheet resistance 2 x Pt100 class B, ALMEMO® adjusted	ALMEMO® plug	Pt100, resolution 0.001 K

### Accessories

	Order no.
Spare wicks (2 pieces)	ZB98462ED
Extension cable for mains units, 3-pin bayonet coupling, length 5 meters	ZB5090VK05

### Standard delivery

Psychrometer with two Pt100 sensors Fitted cable, with two ALMEMO® plugs Resolution 0.001 K for ALMEMO® 1036-2/8036-9, mains unit, water bottle, 1 pair of wicks, carry case ZB2490TK2

Order no.
<b>FPA8363P3</b>

DAkkS / DKD calibration KD92xxD, atmospheric pressure, for measuring chain (sensor and device), see catalog chapter Calibration certificates  
The DAkkS calibration meets the requirements of DIN EN ISO/IEC 17025 for test equipment.



# Input connectors and adapter cables

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# Input connectors and adapter cables



## ALMEMO® Input connectors

The intelligent ALMEMO® input connector turns every measuring setup into an exceptionally flexible measuring system. Instead of preconfigured ALMEMO® sensors you can take your own existing sensors. We supply ALMEMO® plugs specially pre-programmed for this purpose with the necessary sensor parameters and the appropriate measuring range. These plugs have six screw terminals and can be easily and conveniently connected.

All devices and plugs offer the following functions:

- Each measuring point can be assigned a specific designation
- Sensor signals can be scaled
- Measured values can be corrected for zero-point and gain

Several measuring instruments offer the following options with the ALMEMO® plug:

- Multi-point calibration data can be saved in the plug.
- User-defined linearization with up to 30 points can be programmed in the plug.

- Control points with actual / setpoint value can be entered easily via the AMR-Control software.
- Any special measuring ranges programmed in the plug can be processed.
- Calibration schedules can be managed in the plug and are detected automatically
- The plug's exact designation can be called up.

The overall performance quality and the already high level of precision provided by ALMEMO® measuring technology is thus raised even further.

## New: Digital ALMEMO® D6- and D7-plugs

Numerous analog sensors and measurable variables can be digitized via the digital ALMEMO® D6 and D7 plugs. Thus, the ALMEMO® system is open for any desired extension of measured variables, measured values, and applications:

- Digital ALMEMO® D6 and D7 plugs enable new measuring ranges

and linearization independent of the ALMEMO® device.

- The overall accuracy of the digital ALMEMO® sensor is independent from the ALMEMO® display device / data logger and from the extension cables used. The complete measuring chain, consisting of sensor and

connected ALMEMO® D6 or D7 plug (with integrated A/D converter), is calibrated (DAkKS / factory) and can be replaced or exchanged as and whenever necessary.

- The pluggable digital extension cables (see chapter General accessories) provide high transmission reliability.

## New: Digital ALMEMO® D7-measurement plugs: Special applications / features

Important! ALMEMO® D7 measurement plugs can only be connected to ALMEMO® measuring instruments of the V7 generation, i.a. ALMEMO® 500, ALMEMO® 710, ALMEMO® 809, ALMEMO® 202.

- Every ALMEMO® D7 plug features up to 10 display and function channels.
- Digital ALMEMO® D7 plugs enable high measuring speeds or a high level of precision. Thus these plugs can be used for a vast variety of measuring tasks

- The ALMEMO® D7 plug measures dynamic processes using the setting High Speed Measuring Options at high sampling rate. In case high resolution and stable values are needed (e.g. for accuracy transducers), the ALMEMO® D7 measurement plug measures with reduced sampling rate, if the setting High Resolution is selected.
- The digital ALMEMO® D7 measurement plug comes with an integrated A/D converter. The measuring rate is solely determined by

the A/D converter. All D7 measurement plugs run in parallel on the ALMEMO® V7 measuring instrument with their own measuring rate. This makes it possible to obtain high measuring speeds.

- The measured values can be provided with a unit featuring up to 6 characters. To designate a sensor it is possible to program comments with up to 20 characters.
- The user can easily perform the configuration via the ALMEMO® measuring instrument.

# Input connectors and adapter cables

## ALMEMO® multi-point adjustment for precisely correcting measuring chains

### 1. Individual sensor linearization

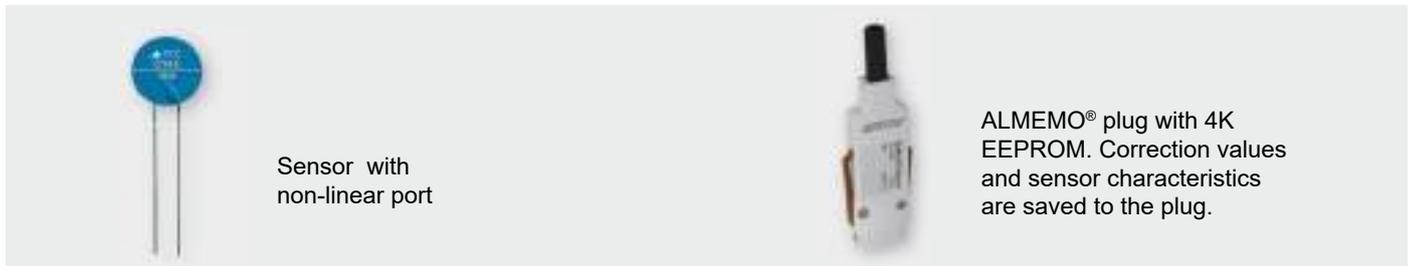
In addition to the sensor characteristics (e.g. range, dimension, scaling- and limit values, comments) it is now possible to save complete characteristic curves of a sensor in the ALMEMO® plug. This offers the great opportunity to connect also non-linear sensors to the ALMEMO® system whose linearizations (measuring ranges) are not saved to the device itself. Consequently, the variety of sensors

compatible with ALMEMO® devices is immensely increased.

#### Usage

The user is able to carry out the special linearization by himself. By means of the free software ALMEMO® CONTROL a linearization table is converted to an interpolation table containing over 30 basic values and saved onto the ALMEMO® plug. Using the function “consider

correction value zero and gradient” the linearization with the already pre-scaled readouts is carried out for a pre-scaled measuring range. This procedure requires an ALMEMO® device (e.g. ALMEMO® 2690-8) featuring the option “KL” (multi-point adjustment and special measuring ranges).



Special linearization

Menu point: 00

Range: C/M  include correction val. (pers. slope)

Interpolation points: 5

Next calibration: Interval: 8 Month

Reference/Setpoint: Dimension: 8

Indication/Actual value: Dimension: 11

Decimal places: 2

Interpolation point	Setpoint	Actual value	SP	IP	#
1.	0.54	-6.00	94	6	5324
2.	2.46	0.00	146	800	5058
3.	2.88	8.00	830	1000	8874
4.	8.88	18.00	110	2000	4913
5.	8.88	18.00			

Inserting Program

Delete line



Measuring instrument ALMEMO® 2690-8 with programming option KL



ALMEMO® 2470

The linearization table programmed on the ALMEMO® plug can be saved as a file to the PC and additionally as an Excel table for archiving purposes. Of course, it is possible to load the linearization table again from the archived file as well as from the ALMEMO® plug. Consequently, the user is able to access his special

linearizations at all times.

Hand units from series ALMEMO® 2470, 2490 as well as 2590 are already able to process ALMEMO® plugs with a programmed characteristic curve as standard. Individual linearizations are possible in all measuring ranges of the ALMEMO® measuring instruments.

# Input connectors and adapter cables

## 2. Maximum precision due to multi-point adjustment

Measurement deviations from a reference or a measurement standard, which were identified during the calibrating of the device, can be used to permanently correct a sensor or a measurement chain. In this case, we speak about adjustment.

To adjust a device, the readout of the measurement instrument (actual value) is as well as possible leveled to the reference value (setpoint) to obtain a correct readout. Measurement deviations concerning several measuring points are saved to

the ALMEMO® plug as fine adjustment. In this way it is possible to significantly increase the measurement accuracy of e.g. inexpensive standard sensors.

### Two-point adjustment

#### Sample table Two-point adjustment at 0°C and 100°C

(using the parameters ZPC = zero-point correction / SC = slope correction)  
example given: ZPC = -0,20 / SC = 1.0010

Measuring range PT100 204 (-200.00°C to 400.00 °C)			
basic value	setpoint	actual value	corrected value (= readout on test device)
1. Start of meas. range	-200	-200	
2.	-20	-20.25	-20.07
3.	0.00	-0.20	0.00
4.	50.00	49.80	50.05
5.	100.00	99.75	100.00
6.	150.00	149.60	149.95
7. End of meas. range	400.00	400.00	

Readout values concerning zero point and slope are corrected.

### Multi-point adjustment

#### Sample table multi-point adjustment at all five meas. points

Measuring range PT100 204 (-200.00°C to 400.00 °C)			
basic value	setpoint	actual value	corrected value (= readout on test device)
1. Start of meas. range	-200	-200	
2.	-20	-20.25	-20.00
3.	0.00	-0.20	0.00
4.	50.00	49.80	50.00
5.	100.00	99.75	100.00
6.	150.00	149.65	150.00
7. End of meas. range	400.00	400.00	

Multi-point adjustment allows to exactly correct the readout values to the reference values.

1. By default, a linear interpolation between the endpoints of the adjusted range and the device-specific upper and lower measuring range limits is carried out.
2. Optionally it is possible to disable any measurement outside the adjusted range (i.e. no incorrect measurements outside the adjusted range). The device will only signalize whether the result is exceeding or falling below the measurement range.

# Input connectors and adapter cables

## Usage

In case reference or correction values are available, the user can carry out the multi-point adjustment by himself. By means of the free software ALMEMO® CONTROL

a correction table is converted to an interpolation table containing over 30 basic values and saved to the ALMEMO® plug. Using the function “consider correction value zero and gradient” the readouts of

a pre-scaled sensor are corrected. This procedure requires an ALMEMO® device (e.g. ALMEMO® 2690-8) featuring the option “KL” (multi-point adjustment and special measuring ranges).



Sensor with multi-point adjustment

ALMEMO® plug with 4K EEPROM. Characteristic curve and sensor characteristics are saved to the plug

The correction table programmed on the ALMEMO® plug can be saved as a file to the PC and additionally as an Excel table for archiving purposes. Of course, it is possible to load the correction table again from the archived file as well as

from the ALMEMO® plug. Consequently, the user is able to access his multi-point adjustments at all times.

Hand units from series ALMEMO® 2450, 2470, 2490 as well as 2590 are already able to process ALMEMO® plugs with a

programmed multi-point adjustment as standard. For sensors that have special linearizations saved on the ALMEMO® plug, a multi-point adjustment is not possible.

Interpolation point	Tempoint	Actual value	SP	IP	S
Start of range	-5.00	-5.00	0	0	04619
1.	-3.50	-3.58	150	160	10341
2.	-1.50	-1.42	350	350	10288
3.	0.00	+0.20	500	450	27927
4.	1.50	1.94	650	490	10388
5.	3.50	3.44	850	844	16242
End of range		5.00			



Measuring instrument ALMEMO® 710 a precision measuring instrument with touchscreen

## Calibration

During the calibration of the ALMEMO® measuring technology, the sensor deviation is determined in every calibration point and saved as correction value to the ALMEMO® plug. The measured values

for such multi-point adjusted sensors are then listed in the calibration certificate. Compared to the reference values, the identified sensor deviations are close to zero. Measurements within the calibrated interval can then be carried out with minor

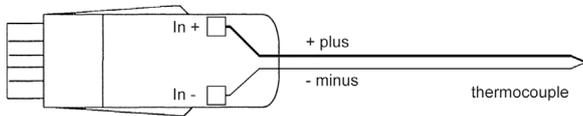
deviations. The measured value displayed on the ALMEMO® measuring instrument is the already corrected value and can be used directly. It is not necessary anymore to correct the displayed measured value on the basis of the calibration certificate.

## Digital ALMEMO® D7 measuring connector for thermocouple sensors of type K, N, T, J, R, S, B, E

Measure dynamic temperature changes with up to 100 measurement operations per second.  
One single connector for different thermocouple types (programmable).

Optimal linearization accuracy of the thermocouple characteristic by calculation methods as per the DIN IEC 584.

Increased accuracy thanks to multi-point adjustment of the thermocouple sensor during calibration. For current measuring instruments ALMEMO® V7, i.a. the precision measuring instruments ALMEMO® 710 or ALMEMO® 202.



### Technical data and functions

- The digital ALMEMO® D7 measuring connector for thermocouples can be used for a variety of thermocouple types. Once connected, the thermocouple type is programmed via the ALMEMO® V7 measuring instrument.
- new:** the range for thermocouple type E. For use at lowest temperatures.
- The thermocouple is connected via 2 screw terminals integrated in the measuring connector. Every measuring connector has an integrated temperature sensor directly in the screw terminals for measurement and automatic compensation of the cold junction temperature.
- The input of the ALMEMO® D7 measuring connector is galvanically isolated from the ALMEMO® V7 measuring instrument. Therefore the connected thermocouple sensor is galvanically isolated from the other connected ALMEMO® sensors as well.
- The digital ALMEMO® D7 measuring connector operates with its own integrated A/D converter. The linearization of the thermocouple characteristic is calculated using an error-free method in compliance with DIN IEC 584 (not an approximation).
- For measuring dynamic temperature changes, the ALMEMO® D7 measuring connector operates at a fast conversion rate. The measuring rate is determined exclusively by the integrated A/D converter.
- On the ALMEMO® V7 measuring instrument all D7 measuring connectors operate in parallel - each at its own measuring rate. The measuring instrument's very short scan cycle is determined by the measuring rates of the D7 measuring connectors - nearly irrespective of their number. The ALMEMO® V7 measuring instrument saves the measured values; the measuring software WinControl displays them graphically.
- The overall accuracy of the measuring operation is unaffected by the presence of an ALMEMO® V7 display device / data logger. In case the measuring chain - consisting of a thermocouple sensor and the connected ALMEMO® D7 measuring connector - is calibrated, the measuring chain can be connected to any ALMEMO® V7 measuring device without any additional measuring uncertainties.
- At constant ambient conditions, an increased system accuracy is achieved by calibrating the thermocouple sensor using multi-point adjustment.
- To designate a sensor it is possible to program comments with up to 20 characters.

### Technical data

Sensor type:	Thermocouple type: K, N, T, J, R, S, B, E	System accuracy at conversion rate 10 mops:		
Measuring input:	galvanically isolated, dielectric strength 50V	type K, K2, N, J, T	$\pm 0.2K \pm 0.02\%$ of measured value	
Measuring ranges:	K	-200.0 to +1370.0 °C	type E	$\pm 0.1K \pm 0.02\%$ of measured value
	N	-200.0 to +1300.0 °C	type R, S, B	$\pm 0.8K \pm 0.02\%$ of measured value
	J	-210.0 to +1100.0 °C	Temperature drift	0.003 %/K (30 ppm)
	E	-270.0 to +800.0 °C	Cold junction compensation sensor:	NTC 10K at 25°C
	T	-200.0 to +400.0 °C	Cold junction compensation effective in the range	-10 °C to +60 °C: -30°C to +100°C
	S	-50.0 to +1760.0 °C	System accuracy:	$\pm 0.2K \pm 0.01K/°C$
	R	-50.0 to +1760.0 °C	Nominal temperature:	23 °C $\pm$ 2 K
	B	+250.0 to +1820.0 °C	Operative range:	-10 to 60°C, 10 to 90 % RH. (non-condensing)
K2	-200.00 to +1370.00 °C	Supply voltage:	6, 9, 12 V from ALMEMO® device	
Resolution:	0.1 K* respectively 0.01 K for measuring range K2	Current consumption:	approx. 5 mA	
Conversion rate:	2.5*, 10, 50, 100 mops			
Linearization	error-free calculation method (not an approximation)			

\* Factory setting. The desired measuring range can be programmed on the ALMEMO® V7 device..

### Types:

ALMEMO® D7 measuring connector for thermocouples. Fast measuring rate. Integrated galvanic isolation.

### Order no.

ZTD700FS

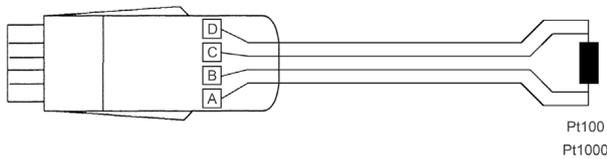
## Digital ALMEMO® D7 measuring connector for Pt100 / Pt1000 temperature sensor

High-level resolution of 0.01 K across the entire measuring range up to 850 °C

Linearization of the Pt100 / Pt1000 characteristic calculated error-free

Calibration with greater accuracy by subjecting the temperature sensor to multi-point adjustment

Only for latest ALMEMO® V7 measuring instruments, including ALMEMO® 500, 710, 809, 202.



The new ALMEMO® D7 measuring connector provides even greater precision!

### Technical data and functions

- The digital ALMEMO® D7 measuring connector uses its own integrated A/D converter. It provides a high-level resolution of 0.01 K across the entire measuring range up to 850 °C. Linearization of the Pt100 / Pt1000 characteristic is calculated error-free in compliance with DIN IEC 751 (not an approximation).
- The overall accuracy of the measuring operation is unaffected by the presence of an ALMEMO® V7 display device / data logger. The whole measuring chain, comprising e.g. a Pt100 / Pt1000 sensor and the connected ALMEMO® D7 measuring connector, can be calibrated end-to-end. Calibration can be performed with greater accuracy by subjecting the temperature sensor to a process of multi-point adjustment.
- The measuring rate is determined entirely and exclusively by the integrated A/D converter. On the ALMEMO® V7 measuring instrument all D7 measuring connectors operate in parallel at their own measuring rate. The measuring instrument's very short scan cycle is determined by the measuring rates of the D7 measuring connectors - irrespective of their number.
- Sensor identification can be programmed with designations up to 20 characters in length.

### Technical data

Sensor type	Pt100, 4 conductors or Pt1000, 4 conductors	Linearization	calculated error-free (not an approximation)
Measuring input	electrically interconnected with the power supply (ALMEMO® device ground)	Accuracy	
Measuring range	-200 to +850 °C	Pt100	0.07 K +2 digits
Resolution	0.01 K	Pt1000	0.08 K +2 digits
Conversion rate	10 mops	Nominal temperature	+22 °C ±2 K
Measuring current		Temperature drift	0.003 % / K (30 ppm) (resistance)
Pt100	approx. 1 mA	Operative range	-10 to +60 °C / 10 to 90 % RH (non-condensing)
Pt1000	approx. 0.1 mA	Supply voltage	from 6 V up. from ALMEMO® device (sensor supply voltage)
		Current consumption	approx. 9 mA

### Types:

Type	Measuring range	Range	Resolution
Pt100, 4 conductors	-200...+850 °C	DP04	0.01 K
Pt1000, 4 conductors	-200...+850 °C	DP14	0.01 K

### Order no.

ZPD700FS

ZPD710FS

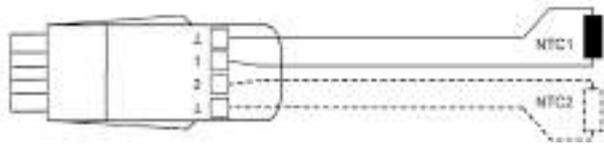
## Digital ALMEMO® D6 measuring connector for temperature sensors NTC

High levels of precision and resolution 0.001 K across measuring range -20 to +65 °C

Linearization of the NTC characteristic - calculated error-free using Galway Steinhart coefficients

Increased measured value accuracy - thanks to multi-point adjustment of the NTC sensor during calibration

For all ALMEMO® V6 and V7 measuring instruments, including ALMEMO® 2490 and ALMEMO® 202.



### Technical data and functions

- The digital ALMEMO® D6 measuring connector uses its own integrated A/D converter. Linearization of the NTC characteristic is calculated error-free using the Galway Steinhart coefficients (not an approximation). Across measuring range -20 to +65 °C this produces the very high resolution of 0.001 K.
- The digital temperature sensor reaches this high level of precision irrespective of any extension cables used and of any processing in the ALMEMO® display device / data logger. Overall accuracy is determined exclusively by the NTC sensor and the ALMEMO® D6 measuring connector. This increased measured value accuracy is achieved by subjecting the NTC sensor to multi-point adjustment during calibration.

### Technical data

Sensor type	NTC type N
Measuring input	Electrically interconnected with the power supply (ALMEMO® device ground)
Measuring ranges	see variants
Resolution	see variants
Refresh rate	0.3 seconds for up to two channels
Linearization	Calculated error-free (not an approximation)

Accuracy	
Range DNtc / DNt2	±0.05 K at -50 to +100 °C
Range DNtc3	±0.02 K at -20 to +65 °C
Nominal temperature	23 °C ±2 K
Temperature drift	0.004 % / K (40 ppm)
Operative range	-10 to +60 °C, 10 to 90 % RH (non-condensing)
Supply voltage	from 6 V up, from ALMEMO® device (sensor supply voltage)
Current consumption	approx. 4 mA

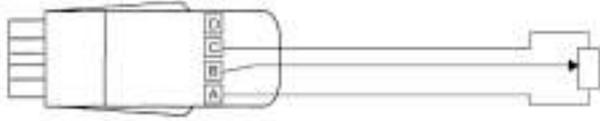
### Types:

Type / input	Measuring range	Range	Resolution	Order no.
NTC, 1 input	-50...+125 °C	DNtc	0.01 K	ZAD040FS
NTC, 2 inputs	-50...+125 °C	DNtc/DNt2	0.01 K	ZAD040FS2
NTC, 1 input	-20...+65 °C	DNt3	0.001 K	ZAD040FS3

## Digital ALMEMO® D7 measuring connector for potentiometric sensors (displacement transducers, etc.)

For displacement transducers and other potentiometric sensors

High-speed measuring at 100 measuring operations per second (mops) and a resolution of 10,000 digits  
Only for the latest ALMEMO® V7 measuring instruments, including ALMEMO® 500, 710, 809, 202.



This new, innovative ALMEMO® D7 measuring connector successfully combines high precision and high speed. The user can set the preferred configuration quickly and easily on the ALMEMO® V7 measuring instrument itself.

### Technical data and functions

- The ALMEMO® D7 digital measuring connector operates with its own integrated A/D converter. Overall measuring accuracy is unaffected by the presence of an ALMEMO® V7 display device / data logger. The whole measuring chain, comprising e.g. a displacement transducer and the connected ALMEMO® D7 measuring connector, can be adjusted end-to-end.
- The measuring rate is determined exclusively by the integrated A/D converter. On the ALMEMO® V7 measuring instrument all D7 measuring connectors operate in parallel - each at its own measuring rate. The measuring instrument's very short scan cycle is determined by the measuring rates of the D7 measuring connectors - more or less irrespective of their number.
- For measuring dynamic processes the ALMEMO® D7 measuring connector operates at a fast conversion rate. The ALMEMO® V7 measuring instrument saves the measured values; the measuring software WinControl displays them in graphical form.
- The voltage drop is measured at the potentiometer. The 2-volt reference voltage is supplied via the ALMEMO® D7 plug.
- The sensor is scaled to the physical quantity (e.g. displacement in mm); this is performed via the ALMEMO® V7 device (on the device itself or using ALMEMO® Control software) - with zero-point adjustment and final value adjustment. The measured value's assigned units can be up to 6 characters in length. Sensor identification can be programmed with a comments text up to 20 characters in length.

### Technical data

Sensor type	Potentiometer
Measuring input	Electrically connected to the power supply (ALMEMO® device ground)
Input range	-2 to +2 V
Display range	0.00 to 100.00 %
Resolution	0.01 %
Conversion rate	100 mops

Reference voltage	2 V
System accuracy	0.02 % ?*? ±2 digits
Nominal temperature	22 °C ±2 K
Temperature drift	0.003 % / K (30 ppm)
Operative range	-10 to +60 °C, 10 to 90 % RH (non-condensing)
Supply voltage	from 6 V up, via the ALMEMO® device itself (sensor supply)
Current consumption	approx. 8 mA (without sensor)

### Types:

Type	Display range	Resolution
Potentiometer	0...100 %	0.01 %

### Order no.

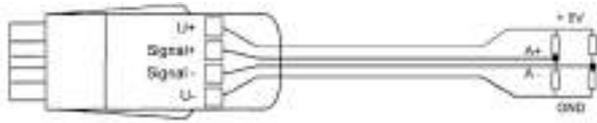
ZWD700FS

## Digital ALMEMO® D7 measuring connector for bridge differential mV

For force transducers (tension / compression), torque transducers, or strain gauges

High-speed measuring at 1000 measuring operations per second (mops) and resolution 50,000 digits or high-level resolution at up to 200,000 digits and 10 mops

Only for latest ALMEMO® V7 measuring instruments, including ALMEMO® 500, 710, 809, 202.



The new ALMEMO® D7 measurement plug enables high measuring speeds or high measuring accuracy applicable for a vast variety of measuring tasks. The user can select the preferred configuration quickly and easily on the ALMEMO® V7 measuring instrument itself.

### Technical data and functions

- The digital ALMEMO® D7 measuring connector uses its own integrated A/D converter. The overall accuracy of the measuring operation is unaffected by the presence of an ALMEMO® V7 display device / data logger. The whole measuring chain, comprising e.g. a force transducer and the connected ALMEMO® D7 measuring connector, can be calibrated end-to-end.
- The measuring rate is determined entirely and exclusively by the integrated A/D converter. On the ALMEMO® V7 measuring instrument all D7 measuring connectors operate in parallel at their own measuring rate. The measuring instrument's very short scan cycle is determined by the measuring rates of the D7 measuring connectors - irrespective of their number.
- For measuring dynamic processes the ALMEMO® D7 measuring connector operates in the high-speed range at a fast conversion rate. The ALMEMO® V7 measuring instrument saves the measured values; the measuring software WinControl

displays them in graphical form. If high-level resolution and stable values are required, e.g. precision transducers for force, the ALMEMO® D7 measuring connector operates in the „High-level resolution“ range but at a reduced conversion rate.

- Measurements are taken using a full bridge with a 4-conductor circuit. The bridge is powered from the ALMEMO® D7 plug.
- The sensor is scaled to its actual physical quantity (e.g. end value 1 kN with characteristic 2 mV / V); this is performed via the ALMEMO® V7 device (device itself or ALMEMO® Control software). - zero-point adjustment, - scaling of end value by entering characteristic mV / V or adjustment by loading the bridge with end value. The assigned units can be up to 6 characters in length. Sensor identification can be programmed with designations up to 20 characters in length.

### Technical data

Sensor type	Full bridge, 4 conductors
Measuring input	electrically interconnected with the power supply (ALMEMO® device ground)
Input range	-29.3 to +29.3 mV
Display range, Conversion rate,	see variants
Bridge power supply	5 V, self-calibrating with divider chain Accuracy 0.01 % Temperature drift 10 ppm / K

System accuracy	0.02 % +2 digits at 10 measurements / second
Nominal temperature	+22 °C ±2 K
Temperature drift	0.003 % / K (30 ppm)
Operative range	-10 to +60 °C / 10 to 90 % RH (non-condensing)
Supply voltage	from 6 V up. from ALMEMO® device (sensor supply voltage)
Current consumption	approx. 15 mA (without force transducer)

### Types:

Range	Display range	Conversion rate
DMS2*	±50 000 digits	1000 mops
or: DMS1	±200 000 digits	10 mops

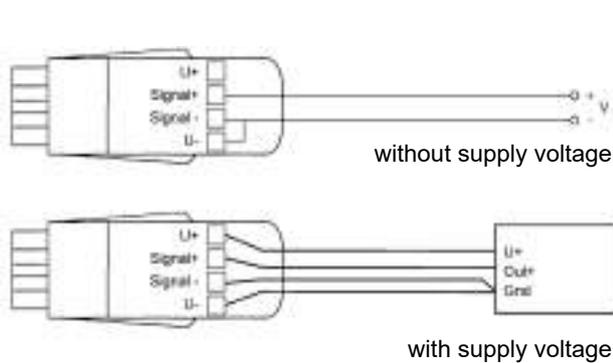
\* Factory setting : The desired measuring range can be programmed on the ALMEMO® V7 device itself.

### Order no.

**ZKD700FS**

## Digital ALMEMO® D7 measuring connector for DC voltage differential (volt) / DC current differential (mA)

Fast measuring rate, up to 1000 measuring operations per second (mops) at resolution up to 1 mV / 10 µA (2,000 digits) or High resolution up to 0.001 mV / 0.1 µA (200,000 digits) at 5 mops  
Only for latest ALMEMO® V7 measuring instruments, including ALMEMO® 500, 710, 809, 202.



The new ALMEMO® D7 measurement plug enables high measuring speeds or high measuring accuracy applicable for a vast variety of measuring tasks.

The user can select the preferred configuration quickly and easily on the ALMEMO® V7 measuring instrument itself.

### Technical data and functions

- The digital ALMEMO® D7 measuring connector uses its own integrated A/D converter. The overall accuracy of the measuring operation is unaffected by the presence of an ALMEMO® V7 display device / data logger. The measuring rate is determined entirely and exclusively by the integrated A/D converter. On the ALMEMO® V7 measuring instrument all D7 measuring connectors operate in parallel at their own measuring rate. The measuring instrument's very short scan cycle is determined by the measuring rates of the D7 measuring connectors - irrespective of their number.
- For measuring dynamic processes the ALMEMO® D7

measuring connector operates in the high-speed range at a fast conversion rate. The ALMEMO® V7 measuring instrument saves the measured values; the measuring software WinControl displays them in graphical form. If high-level resolution and stable values are required, e.g. precision transducers for pressure, the ALMEMO® D7 measuring connector operates in the high-resolution range but at a reduced conversion rate.

- Measuring transducers without their own mains unit and needing a power supply are powered from the ALMEMO® D7 plug. Each signal is scaled to its actual physical quantity (e.g. pressure 25 bar at voltage 10 volts); the assigned units can be up to 6 characters in length. Sensor identification can be programmed with designations up to 20 characters in length.

### Technical data

Measuring input	electrically interconnected with the power supply (ALMEMO® device ground)
Measuring range	see variants
Conversion rate, resolution	see variants
Overload	see variants
Internal resistance	see variants
Input current	100 pA
System accuracy	0.02 % +2 digits at 5 measurements / second

Nominal temperature	+22 °C ±2 K
Temperature drift	0.003 % / K (30 ppm)
Operative range	-10 to +60 °C, 10 to 90 % RH (non-condensing)
Supply voltage	6 / 9 / 12 V, from ALMEMO® device (sensor supply voltage)
Current consumption	approx. 8 mA (without transducer)
Sensor supply	6 / 9 / 12 V, from ALMEMO® device ZED70xFSV15: 15 V, max. 50 mA at device voltage 12 V ZED70xFSV24: 24 V, max. 30 mA at device voltage 12 V

### Accessories:

Galvanic isolation up to 50 V for ALMEMO® D7 sensors. pluggable cabel, length = 0,2 m

### Order no.

ZAD700GT

### Types:

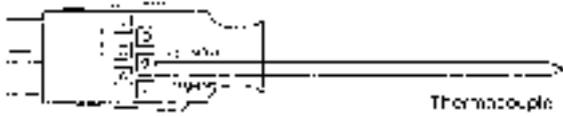
Measuring range	Resolution	Conversion rate (mops)	Internal resistance	Overload	Order no.
-2.2...+2.2 Volt	0.01 mV, 5 mops* / 0.1 mV, 500 mops / 1 mV, 1000 mops		110 kOhm	±3 V	ZED700FS
-250...+250 mV*	0.001 mV, 5 mops*		5 GOhm	±2.8 V	ZED700FS2
-64...+64 mV					ZED702FS
-20...+20 Volt	0.1 mV, 5 mops* / 1 mV, 500 mops / 10 mV, 1000 mops		110 kOhm	±30 V	ZED702FSV15** ZED702FSV24**
-20...+20 mA	0.1 µA, 5 mops* / 1 µA, 500 mops / 10 µA, 1000 mops		130 Ohm	±28 mA	ZED701FS ZED701FSV15** ZED701FSV24**

\* Factory setting : The desired measuring range can be programmed on the ALMEMO® V7 device itself.

\*\* Sensor supply see above: Technical data

# Input connectors and adapter cables

## ALMEMO® Connector for Thermocouple Types K, N, J, T



**new:** Digital ALMEMO® D7 measuring plug, see page 02.24

- One single plug for different thermocouple types (programmable).
- Fast measuring rate for dynamic temperature changes.
- Best linearization accuracy thanks to calculation methods.
- Calibrated sensor independent of the measuring instrument.
- Increased accuracy thanks to multi-point adjustment.

### Variants ( with thermal material)

Model	Meas. Range	Resolution	Order no.
NiCr-Ni (K)	-200.0 to +1370.0°C.	0.1 K	<b>ZA9020FS</b>
NiCroSil-NiSil (N)	-200.0 to +1300.0°C.	0.1 K	<b>ZA9021FSN</b>
Fe-CuNi (J)	-200.0 to +1000°C.	0.1 K	<b>ZA9021FSJ</b>
Cu-CuNi (T)	-200.0 to +400°C.	0.1 K	<b>ZA9021FST</b>

## ALMEMO® measuring module for thermocouples, types K, J, T, electrically isolated, up to 1000 V Type ZAD 950 AB



- Electrically isolated measurement of thermocouples (in particular bare thermo-wire types) on live parts
- Digital transfer of measured values to the ALMEMO® measuring instrument
- Connecting cable, fitted with ALMEMO® plug

### Technical data

Sensor	Thermocouple	Electrical isolation	1 kV DC/AC permanent, 4 kV for 1s
Measuring range		Sensor connection	4-mm safety sockets and safety plugs (with screw terminals)
ZAD950ABK	NiCr-Ni (K) -200 to 1370 °C	Power supply	6 to 13 VDC via ALMEMO® device
ZAD950ABJ	Fe-CuNi (J) -200 to 1000 °C	Current consumption	approx. 30 mA
ZAD950ABT	Cu-CuNi (T) -200 to 400 °C	Connecting cable	1.5 meters with ALMEMO® plug
Resolution	0.1 K	Housing	Dimensions (LxWxH) 127x83x38mm, ABS (acrylonitrile butadiene styrene)
Linearization accuracy	±0.05 K ±0.05 % of measured value		
Precision class	C (see page 01.05)		
Measuring rate	2.5 measurements/sec.		

### Types:

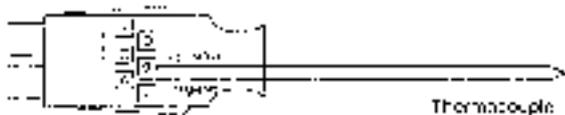
- ALMEMO® measuring module for NiCr-Ni (K), including 1.5 meters ALMEMO® connecting cable
  - ALMEMO® measuring module for Fe-CuNi (J) including 1.5 meters ALMEMO® connecting cable
  - ALMEMO® measuring module for Cu-CuNi (T) including 1.5 meters ALMEMO® connecting cable
- Please note : thermocouple must be ordered extra; e.g. thermo-wires see Chapter Temperature

**Order no.**  
**ZAD950ABK**  
**ZAD950ABJ**  
**ZAD950ABT**

DAkkS- or Factory calibration KE90xx, electrically, for digital measuring module, see Chapter Calibration.  
 DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

# Input connectors and adapter cables

## ALMEMO® Connector for Thermocouple Types U, L, S, R, B, AuFe-Cr



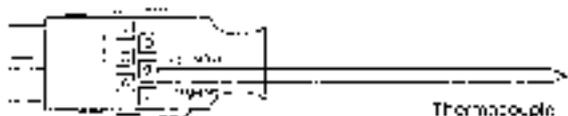
**new:** Digital ALMEMO® D7 measuring plug, see page 02.24

- One single plug for different thermocouple types (programmable).
- Fast measuring rate for dynamic temperature changes.
- Best linearization accuracy thanks to calculation methods.
- Calibrated sensor independent of the measuring instrument.
- Increased accuracy thanks to multi-point adjustment.

### Types

Model	Meas. Range	Resolution	Order no.
Cu-CuNi (U)	-200.0 to +600.0°C	0.1 K	ZA9000FSU
Fe-CuNi (L)	-200.0 to +900°C.	0.1 K	ZA9000FSL
PtRh10-Pt (S)	0.0 to +1760.0°C	0.1 K	ZA9000FSS
PtRh13-Pt (R)	0.0 to +1760.0°C	0.1 K	ZA9000FSR
PtRh30-PtRh6 (B)	+400.0 to +1800.0°C	0.1 K	ZA9000FSB
AuFe-Cr (A)	-270.0 to +60.0°C	0.1 K	ZA9000FSA

## ALMEMO® Connector with integrated cold junction sensor for all thermocouples



For especially exacting applications demanding the highest possible level of precision or performed under unfavorable conditions (e.g. subject to thermal irradiation)

### Programming:

1st channel, NTC, integrated cold junction sensor, resolution 0.01 K  
2nd channel, thermocouple, resolution 0.1 K; please specify type !

### Types:

Model	Meas. Range	Resolution	Order no.
NiCr-Ni (K)	-200.0 to +1370.0°C.	0.1 K	ZA9400FSK
NiCroSil-NiSil (N)	-200.0 to +1300.0°C.	0.1 K	ZA9400FSN
Fe-CuNi (L)	-200.0 to +900°C.	0.1 K	ZA9400FSL
Fe-CuNi (J)	-200.0 to +1000°C.	0.1 K	ZA9400FSJ
Cu-CuNi (T)	-200.0 to +400°C.	0.1 K	ZA9400FST
Cu-CuNi (U)	-200.0 to +600.0°C	0.1 K	ZA9400FSU
PtRh10-Pt (S)	0.0 to +1760.0°C	0.1 K	ZA9400FSS

## ALMEMO® Connector for Pt100 Sensors/Pt1000 Sensors



**New:** Digital ALMEMO® D7 measurement plug, see page 02.06

- Applicable for Pt100 sensors.
- High resolution of 0.01 K up to 850 °C.
- Linearization with accurate calculation method.
- Calibrated sensor independent from the measuring instrument.
- Increased accuracy due to multi-point adjustment.

### Types:

Model	Meas. Range	Resolution	Order no.
Pt100 4-conductor	-200.0 to +850.0°C	0.1 K	ZA9030FS1
Pt100 4-conductor	-200.0 to +400.0°C *	0.01 K	ZA9030FS2
Pt1000 4-conductor	-200.0 to +850.0°C *	0.1 K	ZA9030FS4

\* Data may vary depending on device; (see data sheet page 02.06)

# Input connectors and adapter cables

## ALMEMO® Connector for Ni100 Sensors/Ni1000 Sensors



### Types:

Model	Meas. Range	Resolution	Order no.
Ni100	-60.0 to +240.0°C	0.1 K	ZA9030FS3
Ni1000	-60.0 to +240.0°C	0.1 K	ZA9030FS6

## ALMEMO® Connector for Ntc Sensors



**New:** Digital ALMEMO® D6 measurement plug, see page 02.07

- Applicable for NTC sensors.
- High resolution of up to 0.001 K (-20 to 65 °C).
- Linearization with accurate calculation method.
- Calibrated sensor independent from the measuring instrument
- Increased accuracy due to multi-point adjustment.

### Types:

Model	Meas. Range	Resolution	Order no.
Ntc Typ N	-50.0 to +125.0°C	0.01 K	ZA9040FS
2xNtc Typ N	-50.0 to +125.0°C	0.01 K no electrical isolation	ZA9040FS2

## ALMEMO® Connector for Resistance



### Technical Data ZA9003SS4:

Connection	2-wire
Linearization accuracy:	±0,2 % ± 0,02 kOhm
	Linearization is saved in the ALMEMO® connector; (this is not available with ALMEMO® 2450, 8390)

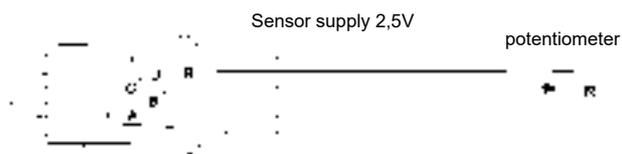
### Types:

Model	Meas. Range	Resolution	Order no.
Ohm	0.00 to 500.00	0.01 Ω*	ZA9003FS
Ohm	0.0 to 5000.0*	0.1 Ω*	ZA9003FS2
kOhm	0 to 110.00 kOhm	0.01 kOhm	ZA9003SS4

\* Data may vary depending on device; (see data sheet per device)

# Input connectors and adapter cables

## ALMEMO® Connector for Potentiometer pickoffs



### Technical Data

Sensor supply:	2.5 V
Temperature coefficient:	< 50 ppm/K

**New:** Digital ALMEMO® D7 measurement plug, see page 02.08

- High-speed measuring operations with 100 mops.
- Adjusted sensors independent from the measuring instrument.

### Types:

Model	Meas. Range	Resolution
2.6 V DC Differenz	-2.6 to +2.6*	0.1 mV

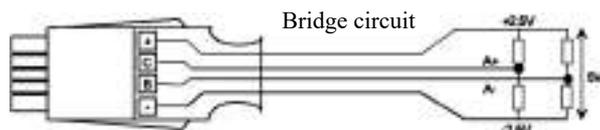
\* Data may vary depending on device; (see data sheet per device)

### Order no.

**ZA9025FS3**

## ALMEMO® Connector for measuring bridges, millivolt / volt differential

With zero-symmetrical voltage supply of  $\pm 2.5$  V stabilized from the ALMEMO® device



### Technical Data

#### Sensor supply

Voltage $U_F$ :	$5V \pm 0.05V$
Temperature coefficient:	<50ppm/°C
Output current:	max. 100mA
Ruhestrom:	approx. 3 mA
Energy saving	So long as the measuring point is not selected, the bridge voltage remains switched OFF.

**New:** Digital ALMEMO® D7 measurement plug, see page 02.10

- For measuring bridges (force transducer or similar)
- High-speed measuring operations with up to 1000 mops
- Alternatively high resolution with up to 200 000 digits.
- Accuracy independent from the measuring instrument.

### Types:

Model	Meas. Range	Resolution
55mV DC	-10.0 to +55.0	1 $\mu$ V
26mV DC	-26.0 to +26.0	1 $\mu$ V
260mV DC	-260.0 to +260.0	10 $\mu$ V
2.6V DC	-2.6 to +2.6*	0.1 mV

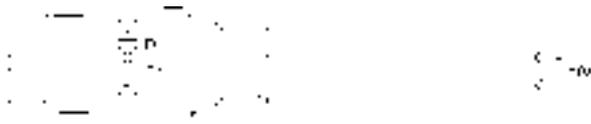
\* Data may vary depending on device; (see data sheet per device)

### Order no.

**ZA9105FS0**  
**ZA9105FS1**  
**ZA9105FS2**  
**ZA9105FS3**

# Input connectors and adapter cables

## ALMEMO® Connector for Voltage Millivolt

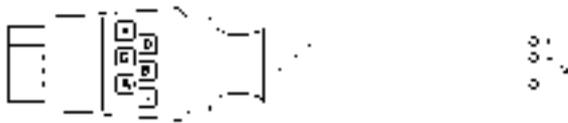


- New:** Digital ALMEMO® D7 measurement plug, see page 02.09
- Dynamic measuring operations of DC voltages.
  - High-speed measuring operations with up to 1000 mops.
  - Alternatively high resolution.
  - Accuracy independent from the measuring instrument.

### Types:

Model	Meas. Range	Resolution	Order no.
55 mV DC	-10.0 to +55.0	1 $\mu$ V	<b>ZA9000FS0</b>
26 mV DC	-26.0 to +26.0	1 $\mu$ V	<b>ZA9000FS1</b>
260 mV DC	-260.0 to +260.0	10 $\mu$ V	<b>ZA9000FS2</b>

## ALMEMO® Connector for Volt DC



### Technical Data

Accuracy divider:	only 5.5 / 26 V connector, $\pm 0.1\%$ of measured value
Temperature coefficient:	<10 ppm/K
Nominal temperature:	23°C $\pm 2$ K

- New:** Digital ALMEMO® D7 measurement plug, see page 02.09
- High-speed measuring operations with 1000 mops.

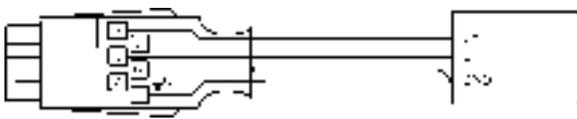
### Types:

Model	Meas. Range	Resolution	Order no.
2.6 V DC	-2.6 to +2.6*	0.1 mV	<b>ZA9000FS3</b>
5.5 V DC (divider 100:1)	-1.0 to 5.5	0.1 mV	<b>ZA9602FS4</b>
26 V DC (divider 100:1)	-26.0 to +26.0	1 mV	<b>ZA9602FS</b>
2 mal 26 V DC (2 x divider)	-26.0 to +26.0	1 mV no electrical isolation	<b>ZA9602FS2</b>

\* Data may vary depending on device; (see data sheet per device)

## ALMEMO® Connector for DC voltage difference millivolts / volt

for sensors / transmitters, Supply from ALMEMO® device



(Connection diagram for connectors with 4 clamps, see next page)

### Technical Data

Sensor supply	(for voltage see technical data of ALMEMO® device)
Accuracy divider:	only 26V connector $\pm 0,1\%$ of meas. value
Temperature coefficient:	<10 ppm/K
Nominal temperature:	23°C $\pm 2$ K

- New:** Digital ALMEMO® D7 measurement plug, see page 02.09
- High-speed measuring operations with up to 1000 mops.

### Types:

Model	Meas. Range	Resolution	Order no.
55 mV DC	-10.0 to +55.0	1 $\mu$ V	<b>ZA9000FS0D</b>
26 mV DC	-26.0 to +26.0	1 $\mu$ V	<b>ZA9000FS1D</b>
260 mV DC	-260.0 to +260.0	10 $\mu$ V	<b>ZA9000FS2D</b>
2.6 V DC	-2.6 to +2.6*	0.1 mV	<b>ZA9000FS3D</b>
26 V DC (divider 100:1)	-26.0 to +26.0	1 mV	<b>ZA9602FS3</b>

\* Data may vary depending on device; (see data sheet per device)

# Input connectors and adapter cables

## ALMEMO® Connector for DC Millivolt / Volt Differential

for sensors / transmitters, Supply : 12 V from the ALMEMO® device



### Technical Data

Sensor supply $U_F$ :	12.2 ... 12.5V (15V/24V on request)
Device voltage $U_G$ :	8 ... 12 V
Output current:	100mA at $U_G = 9 ... 12V$
Accuracy divider:	only 26V connector $\pm 0,1\%$ of meas. value Temperature coefficient: $< 10$ ppm/K Nominal temperature: $23^\circ\text{C} \pm 2$ K

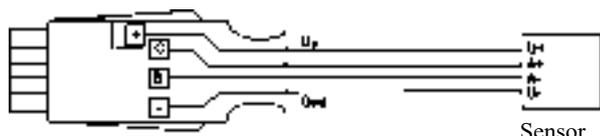
**New:** Digital ALMEMO® D7 measurement plug, see page 02.09  
• High-speed measuring operations with up to 1000 mops.

### Types:

Model	Meas. Range	Resolution	Order no.
55mV DC	-10.0 to +55.0	1 $\mu\text{V}$	<b>ZA9600FS0V12</b>
26mV DC	-26.0 to +26.0	1 $\mu\text{V}$	<b>ZA9600FS1V12</b>
260mV DC	-260.0 to +260.0	10 $\mu\text{V}$	<b>ZA9600FS2V12</b>
2.6V DC	-2.6 to +2.6*	0.1 mV	<b>ZA9600FS3V12</b>
26V DC (divider 100:1)	-26.0 to +26.0	1 mV	<b>ZA9602FS3V12</b>

\* Data may vary depending on device; (see data sheet per device).

for sensors / transmitters, Supply : 5 V from the ALMEMO® device



### Technical Data

Sensor supply $U_F$ :	5 V $\pm 2\%$ (max.)
Device voltage $U_G$ :	8 ... 12 V
Output current:	50 mA at $U_G = 9 ... 12V$
Accuracy divider:	$\pm 0,1\%$ v. Mw. Temperature coefficient: $< 10$ ppm/K Nominal temperature: $23^\circ\text{C} \pm 2$ K

### Types:

Model	Meas. Range	Resolution	Order no.
5.5 V DC (divider 100:1)	-1.0 to 5.5	0.1 mV	<b>ZA9602FS5V05</b>

## ALMEMO® Measuring Module for DC Voltage, with Electrical Isolation, 1kV



### Technical Data

see Chapter Electrical variables

**New:** Digital ALMEMO® D7 measurement plug with galvanic isolation up to 50 V, see page 02.09  
• Dynamic measuring operations of DC voltages.  
• High-speed measuring operations with 1000 mops.  
• Alternatively high resolution with up to 200 000 digits.  
• Accuracy independent from the measuring instrument.

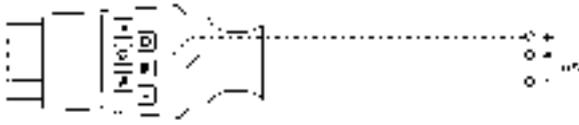
### Types:

Measuring range	Resolution	Overload	Internal resistance	Order no.
$\pm 2.000$ V	0.001V	$\pm 400$ V	800 k $\Omega$	<b>ZA9900AB2</b>
$\pm 20.00$ V	0.01V	$\pm 500$ V	1 M $\Omega$	<b>ZA9900AB3</b>
$\pm 200.0$ V	0.1V	$\pm 500$ V	1 M $\Omega$	<b>ZA9900AB4</b>
$\pm 400$ V	1V	$\pm 1000$ V	4 M $\Omega$	<b>ZA9900AB5</b>

DAkKS- or Factory calibration KE90xx, electrically, for digital measuring module, see Chapter Calibration.  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

# Input connectors and adapter cables

## ALMEMO® Connector for DC Current mA



### Technical Data

Accuracy shunt:	±0,1% of measured value
Temperature coefficient:	<25 ppm/K
Nominal temperature:	23°C ±2 K

**New:** Digital ALMEMO® D7 measurement plug, see page 02.09

- Dynamic measuring operations with up to 1000 mops.
- Accuracy independent from the measuring instrument.

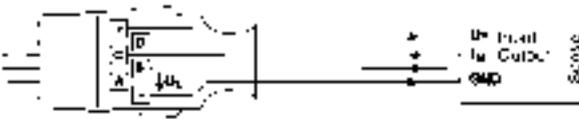
### Types:

Model	Meas. Range	Resolution	Order no.
32 mA DC	-32.0 to +32.0*	1 µA	<b>ZA9601FS1</b>
4/20 mA DC	0 to 100%	0.01 %	<b>ZA9601FS2</b>
2 mal 32 mA DC	-32.0 to +32.0*	1 µA no electrical isolation	<b>ZA9601FS3</b>
2 mal 4/20 mA DC	0 to 100%	0.01 % no electrical isolation	<b>ZA9601FS4</b>

\* Data may vary depending on device; (see data sheet per device)

## ALMEMO® Connector for DC mA Differential

for sensors / transmitters, Supply from the ALMEMO® device



### Technical Data

Sensor supply	(for voltage see technical data of ALMEMO® device)
Accuracy shunt:	±0,1% of measured value
Temperature coefficient:	<25 ppm/K
Nominal temperature:	23°C ±2 K

**New:** Digital ALMEMO® D7 measurement plug, see page 02.09

Dynamic measuring operations with up to 1000 mops.

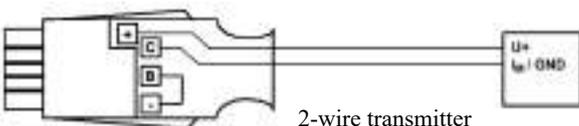
### Types:

Model	Meas. Range	Resolution	Order no.
32 mA DC	-32.0 to +32.0*	1 µA	<b>ZA9601FS5</b>
4/20 mA DC	0 to 100%	0.01 %	<b>ZA9601FS6</b>

\* Data may vary depending on device; (see data sheet per device)

## ALMEMO® for DC mA Differential

for sensors / transmitters, Supply 12V from the ALMEMO® device



2-wire transmitter  
(3-wire transmitter can also be connected)

### Technical Data

Sensor supply $U_F$ :	12,2 ... 12,5V (15V/24V on request)
Device voltage $U_G$ :	8 ... 12V
Output current:	100mA at $U_G = 9 ... 12V$
Accuracy shunt:	±0,1% of measured value
Temperature coefficient:	<25 ppm/K
Nominal temperature:	23°C ±2 K

**New:** Digital ALMEMO® D7 measurement plug, see page 02.09

### Types:

Model	Meas. Range	Resolution	Order no.
32mA DC	-32.0 to +32.0*	1 µA	<b>ZA9601FS5V12</b>
4-20mA DC	0 to 100%	0.01 %	<b>ZA9601FS6V12</b>

\* Data may vary depending on device; (see data sheet per device)

# Input connectors and adapter cables

## ALMEMO® Measuring Module for DC, with Electrical Isolation, 1kV



### Technical Data

see Chapter Electrical variables

**New:** Digital ALMEMO® D7 measurement plug with galvanic isolation up to 50 V, see page 02.09

- Dynamic measuring operations of DC voltages.
- High-speed measuring operations with 1000 mops.
- Alternatively high resolution with up to 200 000 digits.
- Accuracy independent from the measuring instrument.

### Types:

Measuring range	Resolution	Overload	Internal resistance	Order no.
±20.00 mA	0.01mA	±0.1 A*	10 Ω	ZA9901AB1
±200.0 mA	0.1mA	±1 A*	1 Ω	ZA9901AB2
±2.000 A	0.001A	±10 A*	0.1 Ω	ZA9901AB3
±10.00 A	0.01A	±20 A*	0.01 Ω	ZA9901AB4
±20,0 A	0,1 A	±30 A*	0.002 Ω	ZA9901AB5

\*Without fuse, overload condition only up to 1 minute maximum

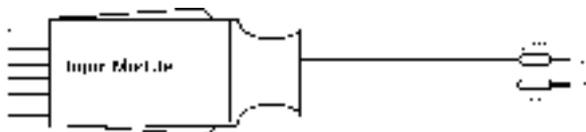
### DC via external shunt:

±200.0 mV	0.1mV	±40 V	50 kΩ	ZA9900AB1
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DAkKS- or Factory calibration KE90xx, electrically, for digital measuring module, see Chapter Calibration.

DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## ALMEMO® Adapter Cable for AC Voltage



### Technical Data

Frequency range: 50 Hz to 10 kHz

Accuracy: ± 0.2% of final val. ± 0.5% of meas. val.  
(40Hz ... 2kHz sinusoidal),

Crest factor: 3 (add. error 0.7%), 5 (add. error 2.5%)

! NEVER connect voltages higher than 50V!  
DANGER!

### Types:

Meas. Range	Resolution	Order no.
5 to 260mV <sub>eff</sub>	0.1 mV	ZA9603AK1
0.05 to 2.6V <sub>eff</sub>	0.001 V	ZA9603AK2
0.5 to 26.0V <sub>eff</sub>	0.01 V	ZA9603AK3

# Input connectors and adapter cables

## ALMEMO® Measuring Module for AC Voltage, with Electrical Isolation, 1kV



### Technical Data

see Chapter Electrical variables

#### Types:

Meas. range	Resolution	Peak	Overload	Internal resistance	Order no.
130.0mV <sub>eff</sub>	0.1mV	±0.2V	±400V	0.5MΩ	<b>ZA9903AB1</b>
1.300V <sub>eff</sub>	1mV	±2V	±400V	0.8MΩ	<b>ZA9903AB2</b>
13.00V <sub>eff</sub>	10mV	±20V	±500V	1MΩ	<b>ZA9903AB3</b>
130.0V <sub>eff</sub>	0.1V	±200V	±500V	1MΩ	<b>ZA9903AB4</b>
400V <sub>eff</sub>	1V	±1000V	±1000V	4MΩ	<b>ZA9903AB5</b>

DAkkS- or Factory calibration KE90xx, electrically, for digital measuring module, see Chapter Calibration.  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## ALMEMO® Measuring Module for AC, with Electrical Isolation, 1kV



### Technical Data

see Chapter Electrical variables

#### Types:

#### Order no.

Measuring range	Resolution	Peak	Overload	Internal resistance	Order no.
1.000A <sub>eff</sub>	1mA	±2A	±10A*	0.10 Ω	<b>ZA9904AB1</b>
10.00A <sub>eff</sub>	10mA	±20A	±20A*	0.01 Ω	<b>ZA9904AB2</b>
20.0 A <sub>eff</sub>	0.1 A	±30 A	±30 A*	0.002 Ω	<b>ZA9904AB3</b>

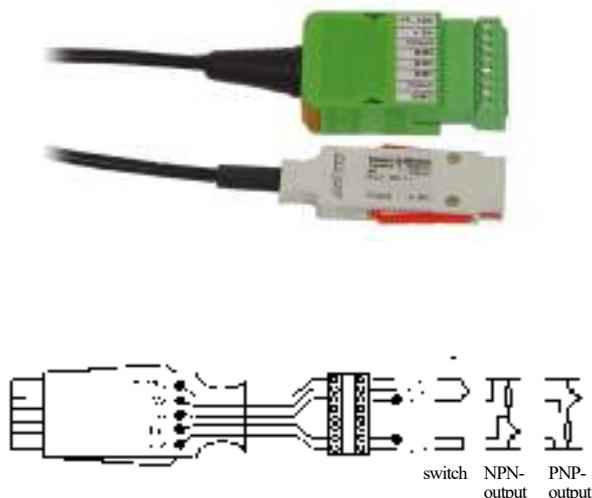
\*Without fuse, overload condition only up to 1 minute maximum

DAkkS- or Factory calibration KE90xx, electrically, for digital measuring module, see Chapter Calibration.  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

# Input connectors and adapter cables

## ALMEMO® Adapter Cable for Frequency / Pulse / Rotational Speed

for sensors, Supply : 5 V or direct from ALMEMO® device



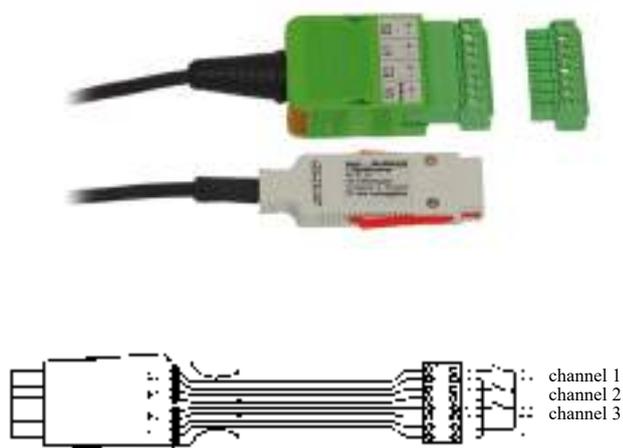
### Technical Data

Frequency range:	0 to 15000 Hz (Resolution 1 Hz) 0 to 3200.0 Hz (Resolution 0.1 Hz)
Speed range:	8 to 32000 rpm (Resolution: 1 rpm)
Max. pulse count:	65000
Pulse length:	> 50 ms
Input voltage	4 to 40 V, square-wave via optocoupler
Current consumption:	3 mA
Sensor supply	5 V or direct from ALMEMO® device (for voltage see technical data of ALMEMO® device)
Option V12	
Sensor supply:	13.5V ±0.5V
Output current:	100mA at $U_G = 12V$ 50mA at $U_G = 9V$ 20mA at $U_G = 7V$ ( $U_G =$ device voltage)

### Types: (Cable lengths, 1.5 meters)

Model	Meas. Range	Resolution	Order no.
Frequency	0 to 15000 Hz	1 Hz	
Frequency	0 to 3200,0 Hz	0.1 Hz (can, by inserting wire jumper, be switched to)	<b>ZA9909AK1U</b>
Pulses / Cycle	0 to 65000 Imp	1 Imp	<b>ZA9909AK2U</b>
Speed	8 to 32000 UpM	1 UpM	<b>ZA9909AK4U</b>
Option sensor supply 12 V			<b>OA9909V12</b>

## ALMEMO® Adapter Cable for Digital Input Signals



### Types: (cable length, 1.5m each)

Order no.
<b>ZA9000ES2</b>
<b>ZA9000EK2</b>

# Input connectors and adapter cables

## ALMEMO® Universal Adapter Cable with Free Ends



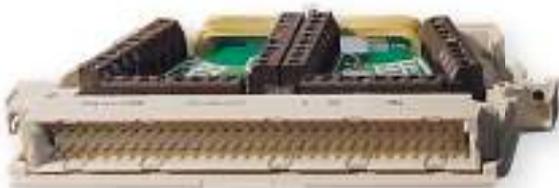
### Types:

The ALMEMO® universal connector ZA 9000-FS is also available with connecting cable and free ends, as adapter cable ZA9000AK. The sensor supply voltage is present on terminal U+; it is supplied by the ALMEMO® device (sensor supply voltage 5 V, can be stabilized on request). Connecting cable : 8-wire, 8 x 0.14 mm<sup>2</sup>, black, Length 1.5 m The wiring diagram and color code of the wires are consistent for all ALMEMO® sensors and cables, so that any pin configuration can be quickly and easily identified.

### Order no.

**ZA9000AK**

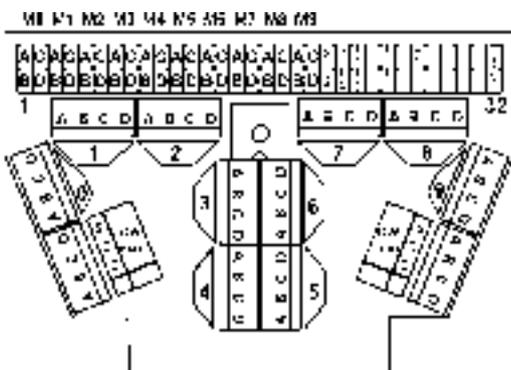
## ALMEMO® 10-Fold MU Connector for ALMEMO® Plug-In Boards with 64-Pin Spring Contact Strip



NOT suitable for sensors needing interface circuitry (e.g. 26 V, AC voltage, mA, humidity sensors, rotating vanes, frequency, pulse, rotational speed) no sensor supply possible)



The current MU connector version, ZA5690MU, can only be used in conjunction with the new ALMEMO® 5690 systems. The old MU connector version, ZA5590MU, can of course be used in conjunction with the old ALMEMO® 5590/5990 systems but is subject to certain restrictions with the current 5690 systems (e.g. only 1 measuring channel per input, no multi-point adjustment or connector linearization)



### Types:

ALMEMO® 10-fold connector (64-pin) with EEPROM sensor memory for connecting 10 sensors; on request pre-programmed to your specifications for Data acquisition systems ALMEMO® 5690 and 500 (not for ALMEMO® 5590 / 5990)  
For Data acquisition systems ALMEMO® 5590 und 5990

### Order no.

**ZA5690MU**

**ZA5590MU**

# Input connectors and adapter cables

## ALMEMO® Connector Adapter Cable, Digital Input of Third Party Device to ALMEMO® Device Type ZA 1000A KSW / ZAD 919A Kxx



Existing equipment incorporating a digital interface can, thanks to our flexible ALMEMO® system, continue being used. For this purpose, we can offer you the following service : 1. We program a device type protocol for you, which matches the output interface of your device. 2. We fit the interface cable for your device with the matching ALMEMO® connector.

### Description:

- Data acquisition from external devices with digital interface and integration in the data acquisition with ALMEMO® devices.
- The digital connector of the adapter cable provides an electrically isolated serial interface and includes an interface processor for protocol conversion.
- Value-adding to existing measuring technology at a very interesting price-performance ratio.

### Examples:

- Scales and weighing equipment
- Dial gauges and displacement transducers
- Multimeters
- Incremental displacement transducers
- Flue gas analysers

### Types:

For the purposes of programming the interface, please provide us with a detailed description of the output interface of the third-party device you want to have integrated, or a matching cable, or a connector including the pin configuration, plus the third-party device itself for the purposes of testing and checking.

Interface programming for the device type protocol of the device to be integrated  
ALMEMO® connector adapter cable

### Order no.

**ZA1000AKSW**  
**ZAD919AK**



## Content

ALMEMO® trigger cable ZA1000ET/ZA1006EK2	03.03
ALMEMO® trigger / relay cable V6 Typ ZA1006EKG/ETG	03.03
ALMEMO® relay cable, V6, ZA 1006 GK and electrical socket relay adapter ZB2280RA	03.04
ALMEMO® analog output cable ZA1601RK	03.04
ALMEMO® relay trigger adapter, analog ZA8006-RTA3	03.05
ALMEMO® trigger output interface ES5690-RTA5	03.06

# ALMEMO® Output modules

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## ALMEMO® Output modules

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A modern measuring instrument must be able to communicate with its environment, i.e. transfer its measured data to peripheral equipment, execute commands from a computer, trigger alarm signals, and respond to switching pulses.

To cover all possibilities while also keeping the hardware needed to a minimum all necessary interfaces have been integrated in our ALMEMO® output connector. This

concept allows the user - with one and the same ALMEMO® measuring instrument - to choose freely from a wide variety of output interfaces to best suit the particular task in hand .

For the purposes of connecting the modules virtually all ALMEMO® devices are equipped with two output sockets A1 and A2; these also allow the devices to participate in digital networking. The

output modules, just like the sensors, are detected automatically; no extra programming is required.

Please note that many ALMEMO® output modules can only be operated in conjunction with ALMEMO® devices version 6 and above (not 2390, 8390). Labeled V6 (device firmware update may be needed).

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Describing all the many options provided by the ALMEMO® system with output modules would be beyond the scope of this catalog.

Please ask for our ALMEMO® Manual. It will provide you with valuable tips and a detailed description of our ALMEMO® output modules.

We shall of course be pleased to offer you competent advice and support to help you solve your particular measuring tasks. Or you can arrange a date for a demonstration. Our experts will be pleased to visit you - to introduce and explain the numerous application options that the ALMEMO® system offers.

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## ALMEMO® trigger cable V6 ZA 1006 ET / ZA 1006 EK2



### Technical Data

Trigger input	
ZA1006ET	Trigger variants can be programmed with key
ZA1006EK2	For external zero-potential contact (not electrically isolated) and for external voltage 4 to 30 VDC (optocoupler), trigger variants can be programmed

Current consumption approx. 3 mA

Cable length 1.5 meters

Connection (see variants)

### Variants

ALMEMO® trigger cable, V6, with 1 key

ALMEMO® trigger cable, V6, with 2 trigger inputs

for external contacts or voltages, with clamp connector

### Order no.

**ZA1006ET**

**ZA1006EK2**

## ALMEMO® trigger / relay cable V6 ZA 1006 EKG / ETG



### Technical Data:

Trigger input	For external zero-potential contact (not electrically isolated) or for external voltage 4 to 30 VDC (optocoupler) Trigger variants - can be programmed (V6 only)
---------------	---

Relay	Normally open contact (semiconductor relay) Can also be programmed as inverted (V6 only) Load capacity: 50 VDC, 0.5 A, 1 ohm
-------	--

Current consumption approx. 3 mA

Cable length 1.5 meters

Connection Clamp connector

### Variants

ALMEMO® trigger / relay cable, V6, with 2 trigger inputs (programmable trigger variant) for external voltages and 2 normally open contacts

ALMEMO® trigger / relay cable, V6, with 2 trigger inputs (programmable trigger variant) for external zero-potential contacts and 2 normally open contacts

### Order no.

**ZA1006EKG**

**ZA1006ETG**

# ALMEMO® Output modules

## ALMEMO® relay cable, V6, ZA 1006 GK and electrical socket relay adapter, ZB 2280 RA



### Technical Data

Relay cable, V6, type ZA 1006 GK	
Relay	Normally open (semiconductor relay) Can also be programmed as inverted (V6 only) Load capacity 50 VDC, 0.5 A, 1 ohm
Current consumption	approx. 3 mA
Cable length	1.5 meters
Connection	Banana plugr



### Technical Data

Relay adapter ZB2280RA	
Control input	for optocoupler output or switching contact R <10 kW
Output	Electrical safety socket, mechanical relay, load capacity 230 V, 6 A
Switching status	OFF idle; ON alarm

### Variants

ALMEMO® relay cable, V6,  
with 1 normally open contact

### Order no.

**ZA1006GK**

### Variants

Relay adapter for switching mains supplied devices  
combined with relay cable ZA1006GK/ZA1000GK

### Order no.

**ZB2280RA**

## ALMEMO® analog output cable ZA 1601 RK



### Technical Data:

Output voltage	-1.250 to 2 000 V, not electr. isolated
Gain	0.1 mV / digit
Load	>100 kΩ
Accuracy	±0.1% ± 6 digits
Temperature drift	1 digit / K
Time constant	100 ms
Current consumption	approx. 3 mA
Cable length	1.5 meters

- Measured values can be recorded using a chart recorder or a similar output device.
- A signal converter is integrated in the connector.
- The device signal is converted into voltage corresponding to the linearized measured value.
- To obtain a high response speed a conversion rate of 10 mops can be set in the ALMEMO® device.
- The output signal can be scaled as required.

### Variants

Analog output cable -1.250 to 2.000 V (0.1 mV / digit) not electrically isolated

### Order no.

**ZA1601RK**

## ALMEMO® relay trigger adapter, analog ZA 8006 RTA3 for connecting to ALMEMO® devices



ZA 8006 RTA3 V6.01	ZA 8006 RTA3 Socket: A2
All Ports	Port: 0 1 2 3 4 5 6 7 8 9
Single Ports	Type: R R R R - - A A T T
Device Configuration	Activ: ✓ ✓ ✓
Messages	×Y23: 1 / / 1 U A
F ▶ *ON	TR8 MENU P *ON TR9

menu selection

all peripherals

ZA 8006 RTA3 Socket: A2	Messages: 2
Port: 0 Adr: 20	Port: 0 3
Relay: Normally open 0.5A	Port 3:
-8: external steered inv	Furnace overheated
State: active	Tel: 08024-3007-99
Contact: ×2-×3 open	OFF P *ON
TR8 MENU P *ON TR9	

relais

messages

device or computer addressing

ZA 8006 RTA3 Socket: A2	ZA 8006 RTA3 Socket: A2
Port: 8 Adr: 28	Port: 6 Adr: 26
Trigger: Key + Optokoppler	AnalogOutput: 0-10 V
0: Start-Stop	2: int. assigned M01
State: inactive	Analogue value: 3.4560 V
Connection: ×3: - ×2: +	Connection: ×3: - ×2: +
TR8 MENU P *ON TR9	TR8 MENU P *ON TR9

trigger inputs

analog outputs

- Universal trigger output interface for connecting to output sockets on ALMEMO® devices - from version V6 up (not 2390, 8390). device firmware update may be needed.
- Up to 10 peripheral elements (relays, trigger inputs, analog outputs) each with individually configurable function
- Relay functions, total alarm, assignment to particular limit values, or addressing via interface
- Integrated alarm signaling device can be assigned to all relay functions.
- Inverse relay addressing for alarm in the event of power failure
- Programmable messages to be issued when relays are activated
- Comprehensive trigger features with the aid of command macros, addressing via 2 keys or electrical signals
- Either 2 or 4 analog outputs (10 V or 20 mA) can be assigned to any measuring channels, scalable sub-areas, or alternatively addressing via interface.
- Analog output type 10 V or 20 mA (programmable)
- All programming and peripheral states shown on illuminated graphics display
- Keypad for selecting menu and port
- Watchdog function in the event of a failure of ALMEMO®

- Connection of peripherals via ALMEMO® clamp connectors, cable with anti-kink protective sleeve and strain relief
- Power supply via the ALMEMO® device; in case of the analog output option a mains adapter may also be required.
- Modern, compact housing - also suitable for DIN top-hat rail mounting



**On request:** ALMEMO® output interface ZA8006RTA4 for connection to the PC (directly or via network).

### Technical Data

Trigger inputs	Optocoupler, 4 to 30 V, Ri >3 kohms
Relay	Semiconductor relay 50 V, 0.5 A, 1 ohms
Analog outputs	10 V or 20 mA (programmable) 16-bit DAC, electrically isolated
0.0 to 10.0 V	0.5m V / digit, Load > 100 kohms
0.0 to 20.0mA	0.1 mA / digit, Load <500 ohms
Accuracy	0.1% of meas. val. +0.1% of final val.
Temperature drift	10 ppm / K
Time constant	100 µs
Power supply	via ALMEMO® device

or mains adapter	ZA1312NA10 (recommended for analog output option)
Current consumption (with 9V supply)	approx. 10 mA, Lighting approx. 15 mA 2 analog outputs approx. 30 mA + 1.6 I <sub>Out</sub>
Display	Graphics 128 x 64 (55 x 30 mm) Lighting 2 white LEDs
Keypad	7 silicone keys (4 soft-keys)
Housing	127 x 83 x 42 mm (LxWxH) ABS (maximum 70°C), 290 g

**Basic version** 2 trigger inputs and 4 normally open relays

**Options** 2 additional relays (normally open) OA8006SH2

Per normally open pair 2 additional normally closed relays (with normally open relays 2 changeover relays) OA8006OH2

2 analog outputs (common ground), electrically isolated  
10 V or 20 mA (programmable) OA8006R02

### Possible combinations

1x OA8006SH2 (+2 relays)  
or 1x OA8006SH2 (+2 relays) + 1x OA8006R02 (+2 analog outputs)  
or 2 x OA8006OH2 (+4 analog outputs)

### Accessories

Mains unit, 12 V, 2 A ZA1312NA10  
DIN tophat rail mounting ZB2490HS

### Variants

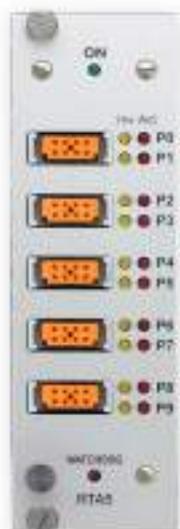
ALMEMO® relay trigger adapter with 2 trigger inputs, 4 normally open relays, DC socket, graphics display, and keypad, including 1.5-meter ALMEMO® connecting cable and 3 ALMEMO® clamp connectors

**Order no.**

**ZA8006RTA3**

# ALMEMO® Output modules

## ALMEMO® trigger output interface, ES 5690 RTA5, for ALMEMO® data acquisition systems



### Technical Data:

Trigger inputs	Optocoupler 4 to 30 V, $R_i > 3$ kohms
Relays	Semiconductor relays 50 V, 0.5 A, 1 ohm
Analog outputs	10 V or 20 mA (programmed) 16 bit DAC, electrically isolated
0.0...10.0 V	0.5 mV/Digit. Load $> 100$ kohms
0.0...20.0 mA	0.1 mA/Digit. Load $< 500$ ohms
Accuracy	0.1% of meas. val. +0.1% of final val.
Temperature drift	10 ppm/K
Time constant	100 $\mu$ s
Power supply	via ALMEMO® measuring system
Current consumption	Standard: approx. 10 to 20 mA 2 analog outputs: approx. 15 mA + 1.8·IOut
Module	19" 8-DU (2 slots)

- Universal trigger output interface for ALMEMO® 5690 data acquisition systems
- System (master measuring circuit or CPU module) addressed via an internal SPI bus
- Up to 10 peripheral elements (relays, trigger inputs, analog outputs) each with individually configurable function
- Relay functions, total alarm, assignment to particular limit values, or addressing via interface
- Inverse relay addressing for alarm in the event of power failure
- Relay states shown via LEDs
- Watchdog function in the event of a failure of ALMEMO® device or computer addressing
- Comprehensive trigger features with the aid of command macros, addressing via electrical signals
- Either 2 or 4 analog outputs (10 V or 20 mA programmable) can be assigned to any measuring channels, scalable sub-areas, or alternatively addressing via interface.
- On request : 10 analog outputs per plug-in module (without trigger inputs, without relays)
- Connection of peripherals via ALMEMO® clamp connectors, cable with anti-kink protective sleeve and strain relief
- Power supply via ALMEMO® system.



ALMEMO® clamp connector

**Basic version** 2 trigger inputs and 4 normally open relays

**Options** 2 additional relays (normally open) OA8006SH2

Per normally open pair 2 additional normally closed relays  
(with normally open relays 2 changeover relays) OA8006OH2

2 analog outputs (common ground), electrically isolated  
10 V or 20 mA (programmable) OA8006R02

#### Possible combinations

- 2x OA8006SH2 (+4 relays)
- or 1x OA8006SH2 (+2 relays) + 1x OA8006R02 (+2 analog outputs)
- or 2 x OA8006R02 (+4 analog outputs)

### Variants

ALMEMO® relay trigger module - with 2 trigger inputs,  
4 normally open relays, and 3 ALMEMO® clamp connectors

### Order no.

ES5690RTA5

## Content

ALMEMO® networking technology	04.02
ALMEMO® PC connection using USB data cable ZA 1919 DKU	04.05
ALMEMO® PC connection using Ethernet data cable ZA1945-DK	04.05
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Wireless link between PC and WLAN module	04.06
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ALMEMO® Network Interface Cables with Fiber Optics	04.07
Wireless data links using ALMEMO® Bluetooth modules	04.08
Wireless PC link with Bluetooth	
Bluetooth USB CPU module ZA 1719 BCU	04.09
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Bluetooth measuring instrument ALMEMO® 2790 with integrated Bluetooth module	04.11
Mobile Internet and Cloud with ALMEMO® measurement technology	04.12
Mobile communications modem ZA 1709 GPRS	04.14



## ALMEMO® networking technology

The ALMEMO® system provides optimal support for networked, decentralized measured data acquisition. Measured data can be acquired locally on site using short sensor signal lines and small modular measuring instruments and can then be evaluated all together on a central computer. This not only minimizes wiring requirements but also goes a long way to solving EMC problems (especially if optic fiber cables are used).

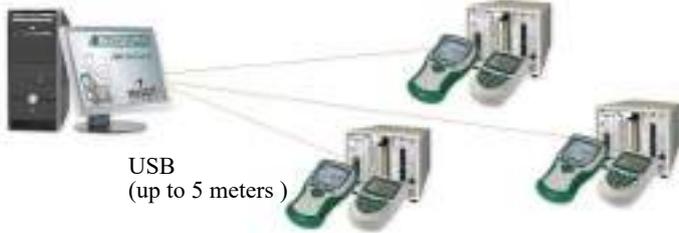
Via the cascable interface provided by ALMEMO® devices it is possible, thanks to our ALMEMO® networking technology, to manage up to 100 ALMEMO® measuring instruments from just one computer. User-friendly software packages (see Chapter 05) are available for automatically scanning measuring points within the network, for evaluating

the measured values, and for graphically representing results in line chart or bar chart form. This permits measuring setups in which devices can be used with such high operational reliability and with such great flexibility that even the most demanding measuring tasks can be solved. For example:

- Data connection from the PC to ALMEMO® devices via USB, Ethernet, WLAN, RS232, Bluetooth, mobile communications, modem.
- Can be combined in a wide variety of ways via the output sockets A1 and A2 on the ALMEMO® measuring instrument
- Various networking arrangements can be implemented.
- Measuring instruments can be installed in separate rooms; considerable distances can be bridged.

- ALMEMO® devices / networks can be connected to the PC via an existing Ethernet / WLAN network.
- **New** Wireless connection between the wireless ALMEMO® sensor respectively wireless ALMEMO® interface for ALMEMO® D7 sensor and the wireless ALMEMO® data logger 470-1, see chapter ALMEMO® Measuring Instruments.
- PC and devices can be connected over a wireless link using Bluetooth modules.
- Measured data can be acquired and also read out from the measured value memory on an ALMEMO® data logger - all online - using the WinControl software package

# ALMEMO® Network technology



## PC connection via USB

(over a wireless Bluetooth link, see page 04.03)

Inexpensive for relatively short distances (up to 5 m) several connections in parallel (star-configured network) for mobile use, e.g. notebook

Necessary component

ZA 1919 DKU

see page 04.05



## PC connection via Ethernet / WLAN

(over a wireless Bluetooth link, see page 04.03)

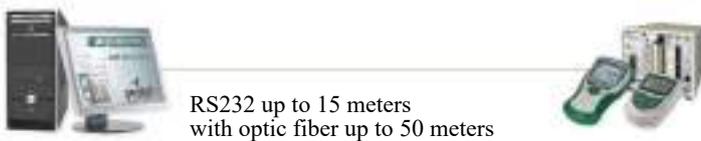
Measured data acquisition, on a decentralized basis, using existing LAN cabling / WLAN, relatively long distances, via Internet worldwide.

Necessary component(s)

ZA 1945 DK see page 04.05



ZA 1719-WL, see page 04.06



## PC connection via RS232

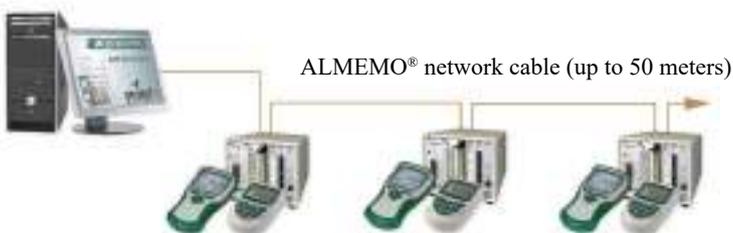
(over a wireless Bluetooth link, see page 04.03)

Single connection

via COM interface up to 15 meters,  
and with optic fiber up to 50 meters

Necessary component

ZA 1909 DK5 see page 04.05



## Connection between ALMEMO® measuring instruments over ALMEMO® network cable

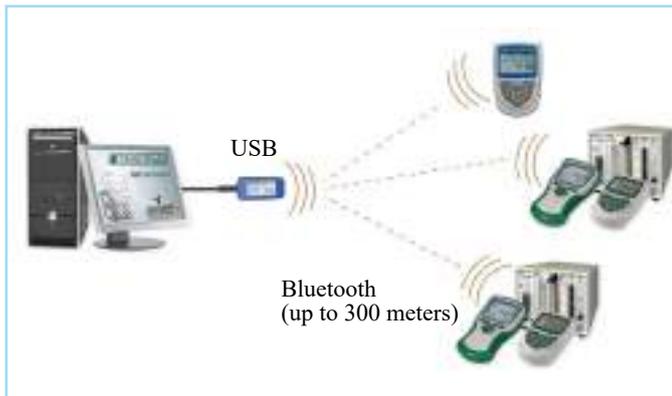
(over a wireless Bluetooth link, see page 04.03)

Inexpensive linear network solution, flexible,

plug-and-play, easy to expand.

Necessary component ZA 1999 NK5

see page 04.06



## Wireless Bluetooth link PC - USB

Inexpensive USB for mobile applications expandable for up to 7 ALMEMO® measuring instruments in parallel (star-configured network).

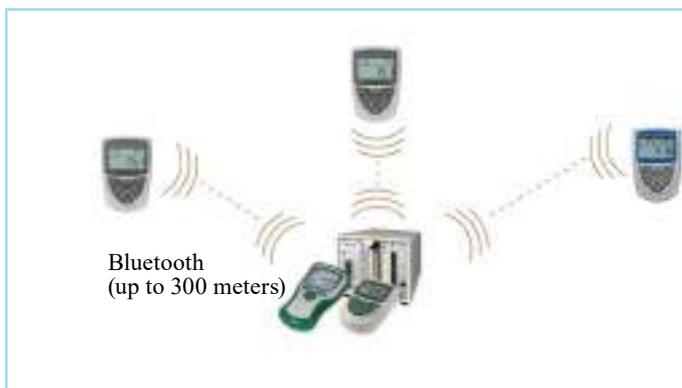
Necessary components  
ZA1719BPVU,  
ZA1719BT1XS  
see page 04.08



## Wireless Bluetooth link between ALMEMO® measuring instruments

For mobile networking highly flexible network topology (linear / star-configured network) all connections expandable for up to 7 ALMEMO® measuring instruments in parallel.

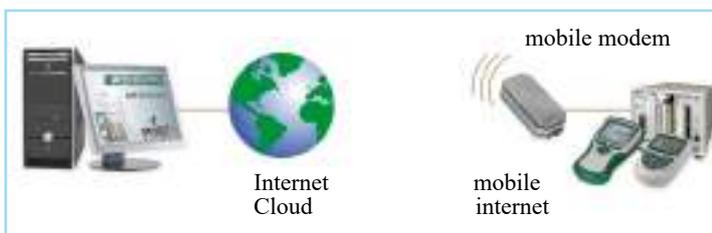
Necessary components  
ZA1719BNV,  
ZA1719BT1XS or Bluetooth meas. instrument  
see page 04.10



## Wireless sensor connection via Bluetooth (ALMEMO® wireless sensor)

Single connection from a measuring Bluetooth device (wireless sensor) to a receiving ALMEMO® device with display and saving of measured values (also without PC). Any number of sensor connections in parallel.

Necessary components  
MA2790BTFV  
(with Bluetooth measuring instrument)  
see page 04.11



## PC connection via mobile modem : Online or Cloud

Mobile operation over any distance.

Necessary components:  
ZA 1709 GPRS  
see page 04.12



**neu:** Wireless connection of sensor and interface to wireless data logger ALMEMO® 470-1

See chapter ALMEMO® Measuring Instruments.

## ALMEMO® PC connection using USB data cable ZA 1919 DKU RS232 data cable, type ZA 1909 DK5, USB adapter cable ZB 1909 USB



- ALMEMO®-USB data cable for data connection between an ALMEMO® device and a PC with a USB interface
- ALMEMO® RS232 data cable with a DSUB socket for data connection between an ALMEMO® device and a PC with a COM interface
- ALMEMO® optic fiber cable (RS232) for absolute electrical isolation and extensive protection against lightning.

### Types:

USB data cable, electrically isolated, maximum 115.2 kbaud, cable length 1.5 meters, including CD with Windows driver  
 As above but cable length 5 meters  
 RS232 data cable electrically isolated, max. 115.2 kbaud,  
 Current consumption : approx. 1 mA, cable length : 1.5 m  
 As above, but cable lengths 5m / 10m / 15m  
 RS232 data cable with optic fiber, max. 115.2 kbaud, Cable length 1,5 m  
 Longer optic fiber (up to 50 m) for interiors, Duplex plastic 2.2 x 4.3mm, per meter

### Order no.

**ZA1919DKU**  
**ZA1919DKU-05**  
  
**ZA1909DK5**  
**ZA1909DK5-05 /-10 /-15**  
**ZA1909DKL**  
**LL2243L**

## ALMEMO® PC connection using Ethernet data cable ZA 1945 DK



- For connecting almost any ALMEMO® measuring instrument to an Ethernet PC network.
- Linking up to the Internet now possible.
- Terminal operation using our AMR-Control software, available free-of-charge.
- Device-Installer configuration software also included on the AMR CD.
- Measured data acquisition via several Ethernet modules using our Win-Control software. (Version SW5600WC2 and above, see chapter Software).

### Technical data

Ethernet:	Socket RJ45 (10/100 base-T) Automatic switchover 10 / 100 MHz	Power supply	12 V DC via measuring instrument (suitable mains supply unit recommended)
ALMEMO®	ALMEMO® connector for socket A1 Baud rate standard 9600 bd, max. 115.2 kbd (can be changed via Device-Installer and browser)	Current consumption	<60 mA (10 MHz), <90 mA (100 MHz)

### Accessories

Patch cable RJ45, plug / plug, 2 meters

**Order no.**  
**ZB1904PK2**

### Type

Ethernet data cable, RJ45 socket on ALMEMO® connector, cable length 1.5 meters

**Order no.**  
**ZA1945DK**

## Data cable for configuring digital ALMEMO® D6 / D7 sensors

### Types

ALMEMO® USB adapter cable length 1.5 meters  
 for connecting an ALMEMO® D6 sensor to the USB port on a PC (power supply via USB)

### Order no.

**ZA1919AKU**

# ALMEMO® Network technology

## Wireless link between PC and ALMEMO® WLAN module ZA 1719-WL

Wireless link between a PC connected to a local WLAN radio network and an ALMEMO® measuring instrument connected to an ALMEMO® WLAN module.



WLAN-module  
ZA 1719-WL

- WLAN module ZA 1719-WL, equipped with an active internal antenna, can be plugged into the A1 socket of any ALMEMO® measuring instrument (instead of the data cable) and thus be linked into a local WLAN radio network.
- Use of the existing infrastructure
- Range up to 400 meters (unobstructed)
- LEDs showing status of the power supply and data traffic
- All the usual encryption and authentication protocols can be configured.
- Configuration on the PC via USB adapter cable ZA 1919-AKUVW using configuration software
- Quick and easy incorporation in the WinControl data acquisition software via an Ethernet port.

### Technical data

Standard features	WLAN 802.11a/b/g/e/i/h/j
Frequency band	2.4 GHz, channels 1– 13 5.0 GHz, channels 36– -165 (U-NII band 1, 2, 2e, 3)
Output power	100 mW (20 dBm)
Throughput	500 kbit/s
Operating range	400 meters (unobstructed)
Encryption and authentication	WPA-PSK, WPA2-PSK, PEAP, LEAP WEP64/128, TKIP, AES (CCMP)
Protocol	TCP/UDP
Ethernet port	10001 (default)
Power supply	via ALMEMO® device
Current consumption	approx. 70 mA with 9V supply
Module housing	61 x 30 x 12 mm (LxWxH) ABS PC GF (-20 to +70 °C)
ALMEMO® data rate	1200 baud up to 115.2 kbaud



#### Advisory note

Inside a building the operating range of the wireless link will be substantially lower.



Example  
ALMEMO® WLAN  
with access point ALMEMO® 500

### Accessories

USB adapter cable for configuring an ALMEMO® WLAN module ZA 1719-WL

### Option

Cable between ALMEMO® plug and module, Length = 1 meter

### Variants

Wireless PC link (WLAN) for one ALMEMO® measuring instrument  
ALMEMO® WLAN module for output socket A1 on the ALMEMO® device.

Order no.

ZA1919AKUVW

OA1719BK

Order no.

ZA1719WL

## ALMEMO® Network Interface Cables ZA 1999 NK5



### Uses:

- Especially suitable for short distances and mobile measuring setups.
- Up to 100 ALMEMO® measuring instruments can be networked.

### Advantages:

- Devices can be quickly and easily interconnected and networked.
- Low power consumption (approx. 1 mA) without additional power supply.
- You can easily assemble the network cable yourself, up to 50m in length, using just two single network connectors ZA1999FS5 (a couple) and one four-wire cable.

! The device network will be blocked if the measuring instrument fails to operate.  
No further peripheral devices can be connected (analog output, alarm relay etc.)

### Types

Network cable for cascading several devices for baud rates up to 115.2 kbaud current loop, electrically isolated, 1.5 m long  
As above, but cable lengths 5m / 10m / 15m  
2 Network connectors (a couple) with screw terminals for local self-assembly

### Order no.

**ZA1999NK5**  
**ZA1999NK5 -05/ -10 / -15/ -xx**  
**ZA1999FS5**

## ALMEMO® Network Interface Cables with Fiber Optics ZA 1999 NKL



### Uses:

- Especially suitable for safe and reliable data transmission in industrial environments with high levels of interference.
- Up to 10 ALMEMO® measuring instruments can be networked (at 9600 baud, double this number, if the transmission rate is halved).

### Advantages:

- Devices can be quickly and easily interconnected and networked.
- No EMC problems, highest possible immunity to interference, absolute electrical isolation of the instruments - even under high voltages.
- No additional voltage supply is required.
- You can easily assemble the network cable with plastic optic fiber yourself, up to 50m in length, using just two single network connectors ZA1999FSL, without needing any special tools.

! The device network will be blocked if the measuring instrument fails to operate.  
No further peripheral devices can be connected (analog output, alarm relay etc.)

### Types

Network cable with optic fiber for cascading several devices 1.5 m long for baud rates up to 115.2 kbaud  
As above, but cable lengths 5m / 10m / 15m  
Longer optic fiber cable for interiors, Duplex plastic 2.2 x 4.3 mm  
Network connector with optic fiber converter for local self assembly

### Order no.

**ZA1999NKL**  
**ZA1999NKL -05/ -10 / -15/ -xx**  
**LL2243L** (please specify length L)  
**ZA1999FSL**

### Various types of connection are possible

#### Wireless PC connection see page 04.09

Wireless connection from a PC with ALMEMO® Bluetooth CPU to up to 7 ALMEMO® measuring instruments each with Bluetooth slave

#### Wireless device connection see page 04.10

Wireless connection from an ALMEMO® measuring instrument with Bluetooth CPU to up to 7 ALMEMO® measuring instruments each with Bluetooth slave

#### Wireless sensor connection see page 04.12

Wireless sensor connection from a Bluetooth measuring device to a measuring input of a receiving ALMEMO® device with Bluetooth sensor module. Up to 4 measuring channels can be transmitted per connection..

### Common technical data

Bluetooth	class 1 with active antenna
Protocol	SPP (sequence packet protocol) (128-bit encryption)
Operating range	300 meters (free field)*
ALMEMO® data rate	1200 baud up to 115.2 kbaud
Module housing ZA 1719-Bx	(LxWxH) 61 x 30 x 12 mm Polystyrene (-10 to +70 °C)
Cable length	for plug-in module ZA 1719-Bx with option OA1719BK Length = 1 meter

\* Inside a building the operating range of the wireless link will be substantially lower.

### Advantages of ALMEMO® connections using Bluetooth compared with other wireless technologies

- Bluetooth wireless technology is industrial standard in compliance with IEEE 802.15.1; it ensures high transmission reliability.
- The frequency hopping procedure used ensures robustness against interference. The Bluetooth partners move continually to and from among the 79 wireless channels available.
- Any number of Bluetooth connections can operate in parallel with complete reliability.

- The multi-digit PIN code ensures that all Bluetooth participants are identified reliably and unequivocally.
- These links - once configured - will, as soon as the device is switched ON, be automatically setup - and, in the event of interruption, be automatically restored.
- One Bluetooth CPU supports up to 7 parallel connections to Bluetooth slaves.
- These powerful new Bluetooth class 1 wireless modules incorporate an integrated active antenna ensuring an especially wide operating range (up to 300 meters free field); there is no need for an extra antenna.

### Common technical features

- Bluetooth links are supplied already paired, i.e. simply plug in and start measuring.
- In the event of interruption to the Bluetooth connection the USB / COM interface in the PC remains available for the software being used. For continuous monitoring purposes this ensures very high transmission reliability. Advisory note : The Bluetooth links integrated in some laptops / PCs cannot be used for these purposes because in the event of interruption the operating system deactivates the COM interface and this must then be reactivated manually each time.
- Any ALMEMO® measuring instrument with a Bluetooth slave module connected can be used.
- Using the Bluetooth CPU on the PC or a plug-in Bluetooth CPU module on the ALMEMO® measuring instrument up to

7 measuring instruments with Bluetooth slave modules can participate in a star-configured network. Compared with paired single connections star-configured networking saves on additional master modules.

- The plug-in module variant with a 1-meter cable can, in order to optimize the wireless link, be positioned away from the measuring instrument between the ALMEMO® connector and the module (option OA1719BK) and specially aligned (using Velcro fastener).
- All (multiple) connections can be configured end-to-end quickly and easily either with the AMR-Control software.
- To search through and select from all the available Bluetooth slave partners the user simply enters the appropriate PIN codes.

## Wireless PC link with Bluetooth

### Bluetooth USB CPU module ZA 1719 BCU

Wireless connection from a PC with ALMEMO® Bluetooth CPU to up to 7 ALMEMO® measuring instruments with Bluetooth slave



### Technical data

Common technical data see page 04.07

Cable	ZA1719BCU	Length = 1.5 meters
Voltage supply	ZA1719BCU	via USB interface on the PC
	ZA1719BT1XS	via ALMEMO® measuring instrument, approx. 35 mA (9 V)



ZA 1719 BCU      ZA 1719 BT1XS

- Connection of the CPU module to the USB interface on a PC
- Connection of the plug-in slave module to socket A1 on an ALMEMO® device

**Option** for plug-in module ZA1719BT1XS

Cable between ALMEMO® connector and module Length = 1 meter

**Order no.**

OA1719BK

### Variants

**Order no.**

**Paired wireless PC connection (USB) for 1 ALMEMO® measuring instrument (configured and ready-to-operate)**

Bluetooth CPU module with USB (ZA1719BCU)  
and plug-in Bluetooth slave module (ZA1719BT1XS)

ZA1719BPVU

**Extension for multiple connections**

Plug-in Bluetooth slave module for 1 ALMEMO® device

ZA1719BT1XS

# ALMEMO® Network technology

## Wireless device connection with Bluetooth

Wireless connection from an ALMEMO® measuring instrument with Bluetooth CPU to up to 7 ALMEMO® measuring instruments with Bluetooth slave.



### Technical data

Common technical data see page 04.07

Voltage supply	
ZA1719BC	via ALMEMO® measuring instrument, approx. 20 mA (9 V)
ZA1719BT1XS	via ALMEMO® measuring instrument, approx. 35 mA (9 V)



ZA 1719 BC

ZA 1719 BT1XS

- Connection of the plug-in CPU module to socket A2 on an ALMEMO® device
- Connection of the plug-in slave module to socket A1 on a second ALMEMO® device

**Order no.**

**Option for plug-in module ZA1719BT1XS:**

Cable between ALMEMO® connector and module Length = 1 meter

OA1719BK

### Variants

**Paired wireless device connection (configured and ready-to-operate) between 2 ALMEMO® measuring instruments comprising:**

Plug-in Bluetooth CPU module (ZA1719BC)  
and plug-in Bluetooth slave module (ZA1719BT1XS)

**Order no.**

**ZA1719BNV**

**Extension for multiple connections:**

Plug-in Bluetooth slave module for 1 ALMEMO® device

**ZA1719BT1XS**

## Wireless sensor connection via Bluetooth

Wireless sensor connection from a Bluetooth measuring device to a measuring input of a receiving ALMEMO® device with Bluetooth sensor module. Four measuring channels per connection can be transmitted. Any number of sensor connections in parallel is possible.



## Sensor connection via Bluetooth sensor measuring device ALMEMO® 2790 with built-in Bluetooth module



MA 2790-BTFM



ALMEMO® 2790  
with sensors for humidity,  
temperature, atmospheric pressure  
option OA 2790-RHA



ZA 1729-BTFS

### Technical data MA 2790-BTFM

Measuring input:	1 ALMEMO® input socket
A/D converter, measuring ranges, standard equipment, housing:	as for ALMEMO® 2490-1, see page 01.14, but:
Sensor supply:	6 / 9 / 12 V (depending on the programmed minimal sensor supply voltage-in the ALMEMO® plug), max. 150 mA
Power supply:	5 to 13V DC not galvanically isolated.
Rechargeable battery:	3 AA rechargeable NiMH batteries, integrated charge circuitry
Current consumption:	approx. 14 mA with radio link (without sensor)
ALMEMO® socket DC:	for mains unit /interfaces
Bluetooth connection:	master module integrated

- Connection of an ALMEMO® sensor to the measuring input M0 of the ALMEMO® Bluetooth device.
- Connection of the plug-in sensor module to the input socket Mxx of a receiving ALMEMO® device.

### Technical features:

- 1 measuring input for all ALMEMO® sensors.
- Optional: Integrated digital sensor for humidity, temperature, atmospheric pressure. Sensors can be plugged in, replaced and individually calibrated (without any measuring instrument).
- Power supply with 3 AA rechargeable NiMH batteries, with charging via the device itself. (Please order the mains unit separately)
- Power saving sleep mode (save-to-memory cycle starting at one minute). Operating time (per charged battery) up to 200 hours with memory cycle of 1 minute, respectively 1 year with memory cycle of 1 hour.
- modern, compact housing, also for DIN rail mounting housing
- Generously dimensioned 2-row static 7 / 16 segment display including units
- Operating functions: cycle, keys can be locked via password, atmospheric pressure compensation.

### Accessories:

mains unit 12V/2A  
DC adapter cable 10 to 30 V DC,  
12V/0.25A galvanically isolated  
DIN rail mounting

### Order no.

ZA1312NA10

ZA2690UK

ZB2490HS

### Option:

Integrated digital sensor for humidity, temperate, atmospheric pressure, (technical data FHAD 46-C2 see chapter Air humidity)

### Order no.

OA2790RHA

### Technical data ZA 1729-BTFS

Common technical data see page 04.07	
Power supply:	via ALMEMO® measuring instrument, approx. 25 mA (9 V)
Module housing:	ALMEMO® plug, 61 x 20 x 8 mm (LxWxH), ABS

### Variants

Paired wireless sensor connection (configured and ready-to-operate) with Bluetooth sensor measuring device ALMEMO® 2790, comprising:

Bluetooth sensor measuring device ALMEMO® 2790, 1 measuring input, integrated Bluetooth, including 3 AA rechargeable NiMH batteries (MA2790BTFM), and Bluetooth sensor plug-in module (ZA1729BTFS)

### Order no.

MA2790BTFM

# ALMEMO® Network technology



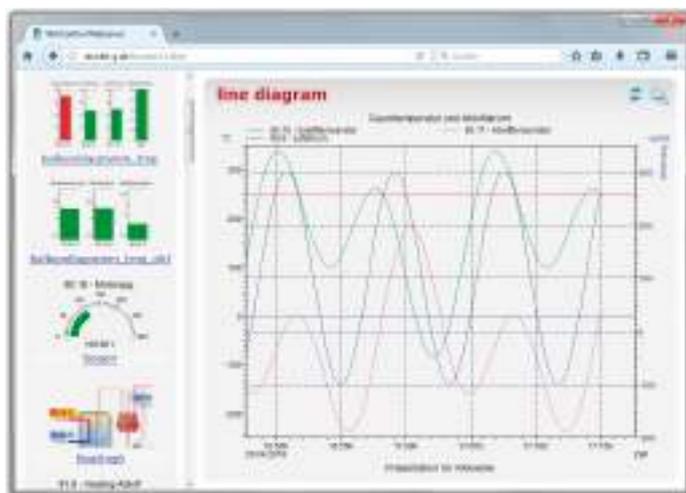
Mobile internet, combined with keywords such as cloud computing and web access, is a topical issue. Thanks to our solutions, you can connect your ALMEMO® measuring technology via the internet and record it centrally. It is irrelevant where the measuring technology is located. You have worldwide access to the recorded data of all the measuring devices via the browser on your PC in your office.

It is possible to connect via LAN, WLAN, or via mobile communications. Requirement for this setup is a corresponding data cable (ZA 1945-DK), WLAN module (ZA 1719-WL), or modem (ZA 1709GPRS), and an internet connection respectively a sufficient coverage for mobile communication on site



The akrobit® cloud server (responsible for the acquisition of measured data) queries the data from the measuring devices, saves the data and provides the data in a variety of formats to be downloaded or sent via email. RMT WinControl is recommended to display and evaluate the data (e.g. with arithmetic channels).

In the access-protected area, current measured values and measurement processes can be viewed in a browser. It is possible to set an alarm email that is triggered by a component failure or a limit value infringement



Alternatively, a direct connection to the measuring device is provided as well. In that case, the user himself is responsible for data acquisition, data storage and the alerting procedure. To manage this, the AMR WinControl software is recommended since

this software has been specially developed for the convenient handling of ALMEMO® devices. The measuring device can be accessed via a secure VPN connection

Cloud service	C1	C2	C3	C4	CD
Measured value files available for download (can also be sent by email)	✓	✓	✓	✓	
Online-Visualization via web browser		✓		✓	
Alert in case of component failure or a limit value infringement (email)			✓	✓	
Customer can directly access the measuring device					✓
Contract with akrobit (24 month/ extension 12 month)					
Customer software (recommended)					
AMR WinControl					✓
RMT WinControl	✓	✓	✓	✓	

The cloud service is provided by the akrobit software GmbH. The actual prices depend on the number of devices and the desired services. Data acquisition via the mobile communications implies additional costs for the SIM card and for the transmit-

ted data. The customer can either provide a suitable SIM card himself or the akrobit software GmbH can offer one. In case the modem is used outside Europe, it is mandatory that the customer himself provides the SIM card.

**On request, we will be pleased to provide a demo version.**

# ALMEMO® Network technology

## Mobile communications modem ZA 1709 GPRS



- Remote interrogation and remote control of ALMEMO® devices
- Ideal for measuring operations at remote sites
- Automatic memory readout or inexpensive 24-hour online measuring - thanks to a charges structure according to actual data usage.

### Technical data

Frequency range	Quad band 850 / 900 / 1800 / 1900 MHz UMTS: 800/850/900/1900/2100 MHz
Connections	RS-232 (9600 baud, 9-contact. sub-D socket) FME antenna connection (male) Power supply, SIM card reader
Power supply	10 to 30 V, via mains unit, included in delivery or via cable for external voltage
Current consumption	maximum 1 A at 12 V
Operating temp.	-30 to +75 °C (mains unit 0 to +40 °C)
Dimensions	65 x 74 x 33 mm
Weight	approx. 110 g
Mains unit	Input voltage 110 to 240 VAC Output voltage 10.5 to 13.5 VDC Operating temperature 0 to +40 °C

### Advisory note:

For technical reasons a special data tariff and a VPN access are required; these can be arranged via „akrobit software GmbH“. Akrobit software GmbH offers various tariffs for VPN and mobile communications; depending on the tariff chosen, the Mobile communications modem can be used within Germany, within Europe, or worldwide.

A VPN client software must also be installed on the computer used for evaluation. The VPN client software is included in delivery free-of-charge. For automatic memory readout the software AMR WinControl is required together with additional module „Automatic ALMEMO® memory readout“ SW5600WCZM9.

### Accessories

### Order no.

Additional protocol „Automatic memory readout“ for WinControl (SW5600WC1/2/3/4)

**SW5600WCZM9**

Power supply cable with plug to the modem and free ends  
for external voltage 10 to 30 V DC, minimum of 1.2 A for 12 V DC

**ZB1709EK**

### Variants:

Mobile communications modem for connecting to ALMEMO® devices, including data cable ZA1909DK5, adapter ZA1709AS, mains unit, documentation, antenna with magnetic base Cable approx. 2.5 meters.

### Order no.

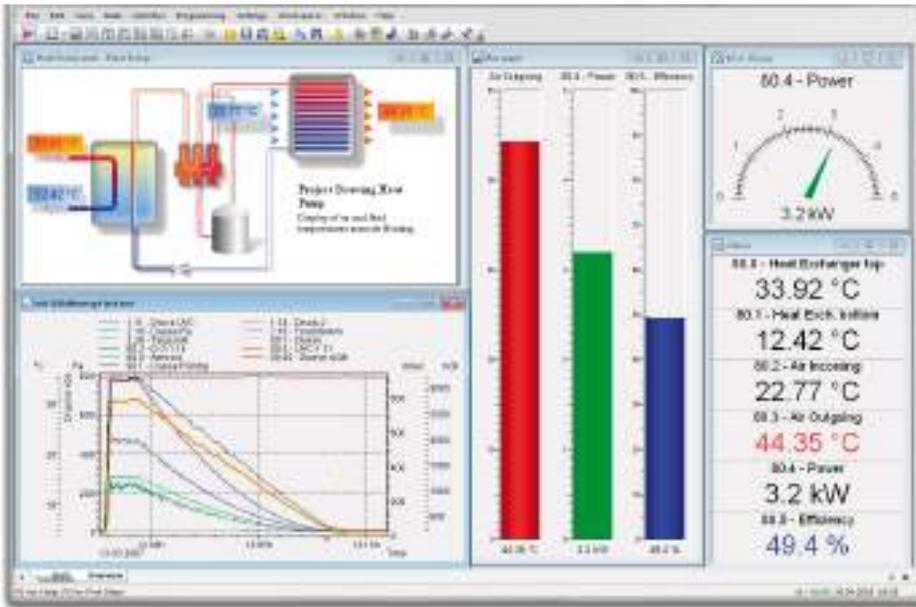
**ZA1709GPR**

## Content

State-of-the-art measuring instruments must be able to interconnect with their environment.	05.02
ALMEMO® Control (included in the delivery)	05.02
AMR WinControl the software for all ALMEMO® instruments	05.06
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WinControl Client OCX and Simple ASCII Server	05.19
ALMEMO® View	05.20

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# Software



## State-of-the-art measuring instruments must be able to interconnect with their environment.

Special ALMEMO® software programs give you complete control of the whole measuring setup and ensure convenient device handling.

Once measured values have been acquired by the ALMEMO® measuring instrument, this data can be transmitted to a computer via modem, data line, optic fiber, or radio link.

“ALMEMO® Control”, the WINDOWS configuration software, is included free-of-charge with all ALMEMO® devices. This software package lets you program all the device parameters and scan all measured data via a single computer.

The “AMR WinControl” package has been specially developed for data acquisition and measured data processing with ALMEMO® equipment.

Acquired measured values can be displayed, arithmetically processed, stored, printed out, and exported to other software applications for further processing. ALMEMO® measuring instruments can thus be addressed in an already established corporate network.

A demo version of AMR WinControl can be downloaded free-of-charge from [www.ahlborn.com](http://www.ahlborn.com)

## ALMEMO® Control : Full Control over the Instrument Setup and Convenient Device Handling

The software ALMEMO® Control is supplied with each ALMEMO® data logger and allows for the complete programming of the sensors, for the configuration of the measuring instrument and for the read-out of the data memory via serial interface.

The only item required is an ALMEMO® data cable. The integrated terminal even allows to obtain online measurements from the PC.

As a result, you can keep a constant overview and can completely control your measuring task!

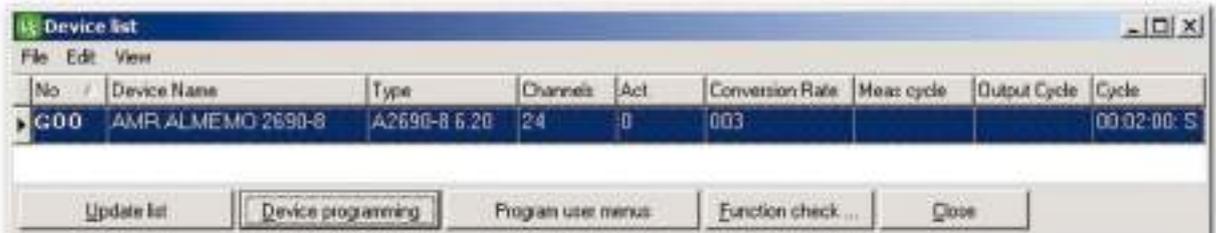
The latest program version is available for download from [www.ahlborn.com](http://www.ahlborn.com).



## ALMEMO® Control, initial screen

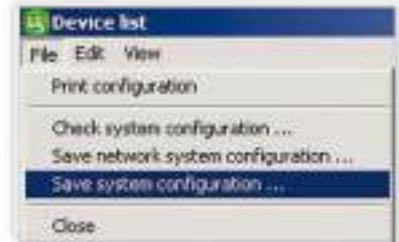
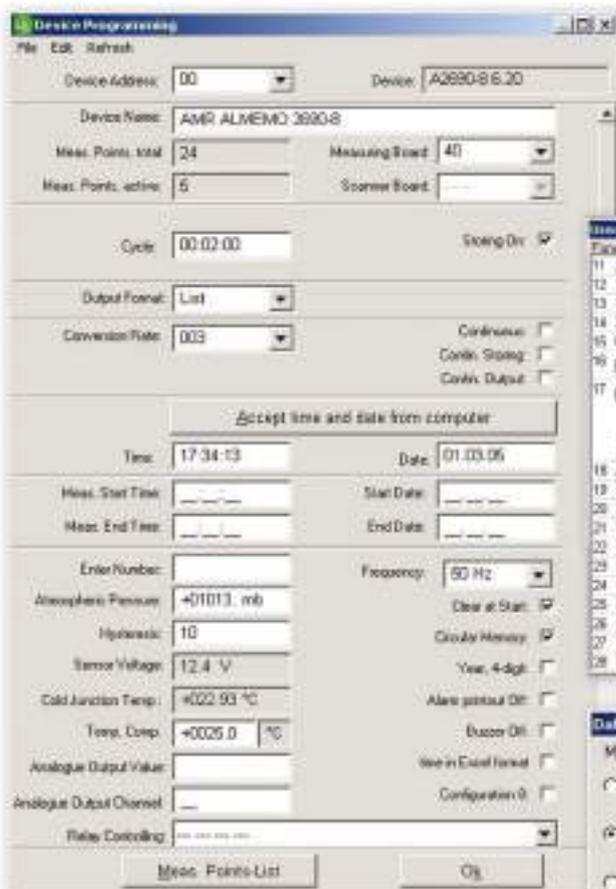


## Devices list

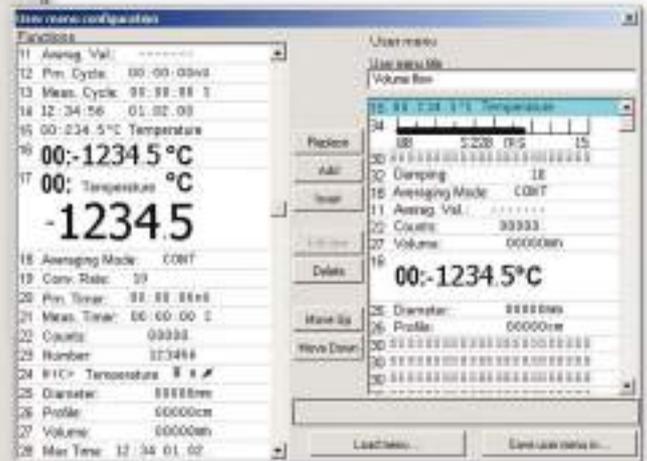


**System Configuration**  
(programming of devices and connectors)  
testing / saving

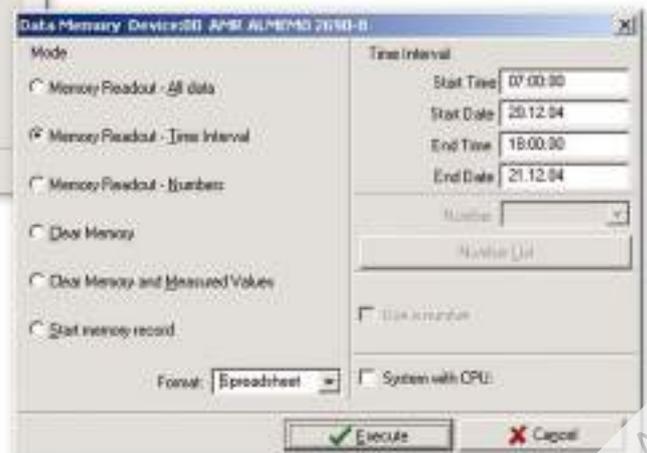
## Device Programming



**Programming user menus**  
(on ALMEMO® 2690 and 2890)



**Reading out from the measured value memory**



## List of connectors / measuring points

Connector	Cha.	Range	Dim	Comment	LV Max	LV Min	Base	Factor	Exp	Zero ...	Slope C...	Lo...
000: A2690-0	6.20			AMR ALMEMO								
=M 0												
1.	00	Ntc	°C		---	---	---	---	+0	---	---	6
2.	10	% rH	%H	Feuchte	---	---	---	---	+0	---	---	5
3.	20	HDT	°C	Taupunkt	---	---	---	---	+0	---	---	5
4.	30	H AH	gk	Mischung	---	---	---	---	+0	---	---	5
=M 5												
3.	25	S220			---	---	---	---	+0	---	---	0

## Programming measuring points / programming connectors

**Saving / loading connector / measuring point programs**

**Creating / saving multi-point calibration, special linearization see Chapter Input connectors**

Point	Reference / setpoint	Display / actual value
Range start	-200.0	-200.0
1.	0.0	0.5
2.	100.0	100.7
3.	200.0	199.9
4.	300.0	299.4
Range end	1370.0	1370.0

## Measured values list with zero-setting / adjusting/ deleting

Connector	Channel	Range	Comment	Meas.Val	Dim	Maximum	Minimum	Avg.Val	Mode	Counts
-H 0 [ 1.]	00	Ntc	Temperatur	+021.80	°C	+022.03	+021.80	---	CONT	00018.
-H 0 [ 2.]	10	% rH	Feuchte	+0016.2	%H	+0019.3	+0015.8	---	CONT	00018.
-H 0 [ 3.]	20	H DT	Taupunkt	-0005.0	°C	-0002.5	-0005.2	---	---	00000.
-H 0 [ 4.]	30	HAH	Mischung	+0000.4	gk	+0000.5	+0000.4	---	---	00000.

Buttons: Manually, Rgozt, Clear Maximum, Clear Minimum, Clear Avg.Val, Clear all, Start, Update list, Adjust, Close

## Output modules list

Loc...	Abbr.	Type	No.	Name	Comment
A1	DK0	DK	0	Data Cable	RS232, RS422, DSR hardware handshake
A2	RK	RK		Analogue Cable	Analogue output

Buttons: Update List, Program A2 Module, Close

## Terminal for online measuring operations and for direct programming

```

AMR ALMEMO 2690-B
MS BER.  GW-MAX  GW-MIN  BASIS  D FAKTOR  EXP  MITTEL  KOMMENTAR!
00:Ntc  ---  ---  ---  °C  ---  E+0  CONT  Temperatur
01:Ntc  ---  ---  ---  °C  ---  E+0  ---
10:% rH  ---  ---  ---  %H  ---  E+0  CONT  Feuchte
20:H DT  ---  ---  ---  °C  ---  E+0  ---  Taupunkt
30:H AH  ---  ---  ---  gk  ---  E+0  ---  Mischung
MESSZYKLUS: 00:00:00  50500.0  E0506.0  A  W010  C-5--
DRUCKZYKLUS: 00:00:10  S  9600  bd
S2
DATUM: 15.01.00
20:27:50 00: +022.13 °C 01: +0020.2 °C 10: +0019.3 %H 20: -0002.4 °C 30: +0000.6 gk
20:28:00 00: +022.14 °C 01: +0020.2 °C 10: +0019.9 %H 20: -0001.9 °C 30: +0000.6 gk
X
    
```

Start	Programming	Memory	Meas. Value	List Format	Cycle 10s	10 M/s
Stop	Progr. extended	Mem. free space	All Meas. Val.	Columns	Memory On	Cyclic
Manual	Device Program	Clear Memory	Version	Spreadsheet	Memory Off	Continuously

## AMR WinControl the software for all ALMEMO® measuring instruments



### Software Description:

- Software for acquiring, displaying and processing measured data of the ALMEMO® device series (V5, V6, and V7.)
- Convenient programming and operation of the devices.
- Graphical display, mathematical processing and printing (measurement report) of current and saved data.
- Appropriate for long term measurements (GMP) or for control and monitoring tasks. Can be easily adapted to every project.
- Fast familiarization and safe operation thanks to Windows interface and the context-sensitive help.
- Further information and the current demo version are available under [www.akrobit.de](http://www.akrobit.de).

### Software Versions:

**Light:** For 20 measuring points and one instrument

**Standard:** For any number of measuring points and instruments

**Profi:** For any number of measuring points and instruments, all options included (except Data server, Web server and additional modules)

**Server:** For any number of measuring points and devices, all options included (except add-on modules), with an integrated data server (simultaneous access by several RMT WinControl clients).

**Update:** of the latest software version for older versions  
of the latest software version for newer versions

### Order no.

SW5600WC1

SW5600WC2

SW5600WC3

SW5600WC4

SW5600WCU3

SW5600WCU4

### Options:

Network capability (for addressing several ALMEMO® devices)

Automatic generation of measured data files (daily files / weekly files)

Alarm function (alarm record, output to ALMEMO® relays, starting other applications)

Data server see 05.15

Web server see 05.16

Extended evaluation functions see page 05.11

Fast scanning of measured values for V7 devices (up to 1000 mops online)

**new:** PIMEX Player: combined measured value display and video display(see 05.17)

### Additional modules:

Thermal comfort and air-conditioning calculations (as per DIN 1946, EN ISO 7730); (see 05.12)

Password protection (see 05.13)

Test bench manager (prerequisite : WC3 / WC4 or WC1 / WC2 + WCO2) (see 05.14)

Thermal transmittance (U) wizard (see 05.12 and chapter Building physics)

Thermal quantity wizard (see 05.13)

OPC export (see 05.14)

Additional protocol (selectable, requires WC3 / WC4) (see system integration, page 05.15)

Security package (requires WC3 / WC4) (see 05.16) including watchdog card

The memory is read out automatically (see 05.10 connecting options)

Automated printing (line diagrams, tables) (needed: WC3/WC4 oder WC1/WC2 + WCO2)

ODBC-Support (export to SQL-databases) (see 05.14)

Assistant for calibrating measuring sensors (needed: WC3/WC4) (see 05.12)

Assistant for calibrating climate cabinets (needed: WC3/WC4) (see 05.13)

**new:** PIMEX Recorder: combined measured value recording and video recording (requirement: WC3/WC4)

### Complete packages (see 05.16 - 05.17):

Long-term / continuous monitoring

**new:** CAN Trace: combined measured data recording and CAN data recording as well as evaluation functions

### Hardware copy protection (see 05.17):

USB dongle

USB network dongle

05.06

### Order no.

SW5600WCO1

SW5600WCO2

SW5600WCO5

SW5600WCO8

SW5600WCO9

SW5600WCO10

SW5600WCO11

SW5600WCO12

### Order no.

SW 5600 WCZM1

SW 5600 WCZM2

SW 5600 WCZM3

SW 5600 WCZM4

SW 5600 WCZM5

SW 5600 WCZM6

SW 5600WCZM7

SW 5600 WCZM8

SW 5600 WCZM9

SW5600WCZM10

SW5600WCZM11

SW5600WCZM12

SW5600WCZM13

SW5600WCZM14

### Order no.

SW 5600 WCV

SW5600WCCAN

### Order no.

SW 5600 HL

SW5600NHL

Function overview	WC1	WC2	WC3	WC4	WCV
<b>Measured values - scanning</b>					
Number of measuring points supported	20	unlimited.	unlimited.	unlimited.	unlimited.
Number of connections supported	1	unlimited.	unlimited.	unlimited.	unlimited.
Support for ALMEMO® network		✓	✓	✓	✓
Fast scanning of measured values for V7 devices (up to 1000mops online)			✓	✓	✓
<b>Connection types</b>					
Serial (COM), TCP/IP	✓	✓	✓	✓	✓
Modem, GSM, and wireless modem support			✓	✓	✓
Schedule-controlled connection setup			✓	✓	✓
<b>Measured values - display</b>					
Display of measured values (numeric, bar chart, wind rose, round gauges)	✓	✓	✓	✓	✓
Line graph (YT), XY graph	✓	✓	✓	✓	✓
Save / load presentation characteristics as format type	✓	✓	✓	✓	✓
Table, overview	✓	✓	✓	✓	✓
Zoom functions	✓	✓	✓	✓	✓
Project icons	✓	✓	✓	✓	✓
Work surfaces			✓	✓	✓
<b>Measured values - saving</b>					
Saving to hard disk - manual	✓	✓	✓	✓	✓
Saving to hard disk - automatic	✓	✓	✓	✓	✓
Automatic generation of daily, weekly, monthly files			✓	✓	✓
Automatic saving on an event-controlled basis			✓	✓	✓
Automatically saved files - sent by e-mail			✓	✓	✓
Automated printing of files as line diagram or table					✓
Automatically saved files - backed up automatically					✓
Fail-safe (only devices with failsafe mode and internal memory)					✓
<b>Measured values - analysis</b>					
Two measuring cursors with statistics function	✓	✓	✓	✓	✓
Displaying local maximum and minimum values in a line graph			✓	✓	✓
Loading comparative characteristics in a line graph			✓	✓	✓
<b>Arithmetic channels</b>					
Global arithmetic channels	✓	✓	✓	✓	✓
Local arithmetic channels for files already saved	✓	✓	✓	✓	✓
Calculations based on external table values	✓	✓	✓	✓	✓
Formeleditor mit Syntax-Hervorhebung	✓	✓	✓	✓	✓
Formelvorlagen für viele Anwendungsfälle	✓	✓	✓	✓	✓
<b>Measured values - processing</b>					
Linking /splitting of files	✓	✓	✓	✓	✓
Grouping measured value files in a particular folder (wild card search)			✓	✓	✓
Grouping measured value files over a particular period of time			✓	✓	✓
<b>Exporting measured values</b>					
Clipboard	✓	✓	✓	✓	✓
File formats (MS-Excel XLS / XLSX, TXT / CSV, FAMOS, QS-STAT, DIAdem, binary)	✓	✓	✓	✓	✓
Dynamic data exchange (DDE, OLE)	✓	✓	✓	✓	✓
Online data transmission to MS-Excel	✓	✓	✓	✓	✓
<b>Measured values - import</b>					
ASCII (list, columns, table formats)	✓	✓	✓	✓	✓
ALMEMO® View files	✓	✓	✓	✓	✓
<b>Programming of measuring points and devices</b>					
Programming the characteristics of measuring points and devices	✓	✓	✓	✓	✓
Automated scaling of third-party sensors	✓	✓	✓	✓	✓
Measuring points programming - save to file / load from file	✓	✓	✓	✓	✓

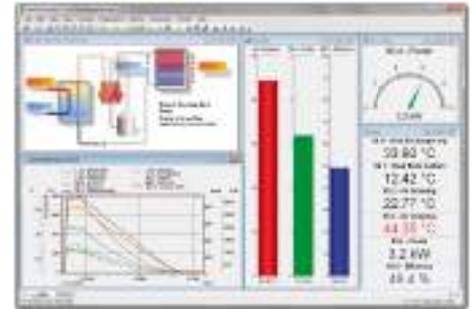
# Software

Editing the programmed file (similar to Excel tables)	✓	✓	✓	✓	✓
<b>Data reduction</b>					
Averaging function (ONLINE and OFFLINE)	✓	✓	✓	✓	✓
Smoothing (over time / over number of values, ONLINE and OFFLINE)	✓	✓	✓	✓	✓
<b>Data logger functions</b>					
Programming the data logger (including averaging functions)	✓	✓	✓	✓	✓
Read out from device memory (all / selective measured values)	✓	✓	✓	✓	✓
Display of memory occupancy status	✓	✓	✓	✓	✓
<b>Alarm functions</b>					
Alarm value display in measuring points list and in all measured value displays	✓	✓	✓	✓	✓
Alarm report with confirmation and comments text			✓	✓	✓
Events list (audit trail)			✓	✓	✓
Start a program in the event of a particular fault			✓	✓	✓
Send e-mail / SMS in the event of an alarm			✓	✓	✓
Switch ALMEMO® output relays (specific to measuring point).			✓	✓	✓
In case of an alarm, tones and sound recording are played back (via a sound card)			✓	✓	✓
Control commands dependent on measured values (KwikScript)			✓	✓	✓
Advance warning alarm					✓
Alarm log printout					✓
Schedules for alarm processing					✓
Automatic checking of system configuration					✓
<b>Password protection</b>					
Protection against unauthorized access					✓
Protection against operator error by assigning individual access rights					✓
Traceability of activities by means of an events list					✓
Alarm confirmation with user identification					✓
<b>Control and regulation</b>					
Two-point controller with ALMEMO® output relay?*/s			✓	✓	✓
Proportional controller with ALMEMO® analog output modules			✓	✓	✓
PID controller with ALMEMO® analog output modules and arithmetic channels			✓	✓	✓
<b>Automation by means of user-defined operating controls</b>					
Keys and buttons in project icons and as a toolbar	✓	✓	✓	✓	✓
Setting constants	✓	✓	✓	✓	✓
Starting / stopping a measuring operation	✓	✓	✓	✓	✓
Switching relays			✓	✓	✓
Setting analog output values			✓	✓	✓
<b>Configuration management</b>					
Save / load interface configuration		✓	✓	✓	✓
<b>Printout</b>					
Diagrams, meas. value tables, meas. point list, file overview including comments	✓	✓	✓	✓	✓
<b>Network server functions</b>					
Displaying measured values and diagrams on Intranet or Internet				✓	✓
Embedding diagrams and project icons on your own Internet pages				✓	✓
Accessing the integrated web server via any browser				✓	✓
Accessing measured data and history data via TCP/IP (open text protocol)				✓	✓
Forwarding measured data to RMT WinControl				✓	✓
Availability of already acquired measured data even after program restart				✓	✓
Alarm confirmation via web server					✓

After initial installation AMR WinControl will run in demo mode - comprising the full functionality of the professional version (WC3) - for a trial period of 30 days, after which time it will have to be registered. All the functions incorporated in the professional version can be tried without restriction and without engagement. If further functions (additional modules) are needed for test purposes, these can also be enabled on a temporary basis. Users can thus try the software for the duration of the trial period with the full range of functions normally needed and then place an order after the system has been running to their complete satisfaction. Registration does not need reinstallation.

## Main Window/General View

- The main window is the platform for all operations with AMR WinControl. All actions run within this window and can be minimised to a symbol, within the window or together with the window, and run in the background.
- The measuring data can be presented as follows: Numeric presentation of measured values, bar diagram, wind rose, round instruments, line diagram, XY diagram, table, file overview.
- Windows can be distributed over various work surfaces between which it is possible to switch by means of tabs.
- The program can be operated by means of menu commands. Only those commands, which can be executed in the corresponding situation, will be available. For a faster operation context-sensitive menus, keyboard commands and symbols in the tool bar are available.
- Comprehensive help information is available via the function descriptions in the status line, notes in the tool bar and a context-sensitive help system.



## List of Measuring Points, devices and connections

- As soon as the program is started and the serial interface is assigned, all sensors that are programmed and connected to the measuring instrument(s) will be recognized automatically and displayed in the list of measuring points.
- Apart from sensor specific data regarding the measuring range, comment, limit values, correction values the list also contains symbols for limit value exceeding, sensor breakage and online storage.
- Device-specific information, e.g. device type, memory occupancy, and settings for operating the data logger are also displayed.
- Measuring instruments can be connected via various interfaces (COM, TCP, modem) simultaneously; mixed-mode operation over various connections is possible. Information regarding the current status of connections is displayed here.

## Arithmetic channels / new formula editor

- Acquired measured values can be further processed and displayed via arithmetic channels during as well as after the measuring operation.
- The arithmetic channel feature of the program offers the possibility to calculate further variables from the measured data, to derive statuses, and to verify conditions.
- The new formula editor facilitates the color highlighting and checking of the syntax (syntax highlighting) as well as the convenient selection and integration of measuring points.
- For common calculations and tasks there are now formula templates available that can be directly entered and combined in the formula editor.
- Depending on the definition, an arithmetic channel is available either globally in the entire program as a virtual measuring point or just locally in one data record (line diagrams or XY diagrams, table).
- It is also possible to extend already saved data records by any desired number of arithmetic channels.
- Arithmetic channels can be saved together in one file and can be loaded again at any time. This enables a convenient evaluation of saved data with just a few clicks.



## Line graph, measuring cursors and statistics function

- The line graph displays the temporal evolution of the values of ongoing measurement operations or of saved data.
- Customer specific settings for the line graph can be saved as a template and can be applied in two clicks to other files. Alternatively it is also possible to create a new diagram with the saved template.
- The zoom function and the possibility to shift the axes with the mouse enable an easy navigation through the data.
- Two measuring cursors help to analyze the acquired data.
- The integrated statistics function calculates differences, minimum, maximum, average value and standard deviation of the range defined by the cursors and displays the data in a table.
- The diagram and the table can be printed, or can be copied to the clipboard..



## Work spaces



- Better overview and fast navigation between different views thanks to tabs as used in a web browser.
- Division of projects into different views with clear designations of the tabs done by the user himself.
- It is no longer necessary to minimize a window to enable the user to see what he wants to see.
- Automatic switching on an event controlled basis or via active elements in a project illustration that e.g. serves as an overview.
- The navigation between work spaces can be restricted by password protection in order to oblige user to one particular view.
- The structural division of the windows into work spaces can also be fetched via the web server.

## Data logger functions



- Settings necessary for operating the data logger can also be programmed via the AMR WinControl software.
- The memory can be read out and deleted. The time of the data logger can be synchronized with the one of the system.
- Important information regarding the memory and the set cycles of the device are displayed in the overview of the measuring device.
- The readout of the memory devices can occur individually or combined for all data loggers in the measuring network, whereat a preview of already read values is displayed in a line diagram.
- Optionally it can be determined that only a selection of the saved values (not all measured values) shall be read out of the device memory.

## The memory is read out automatically



- This module greatly facilitates the task of reading out from the device memory of an autonomous data logger.
- Saving data to the data logger is interrupted, its memory is read out, and, if this is successful, the memory content is deleted. The time-of-day is synchronized and saving data to the data logger is resumed.
- Reading out from memory can be completely automated in the form of schedules.
- All steps and possible errors are documented in the events list..

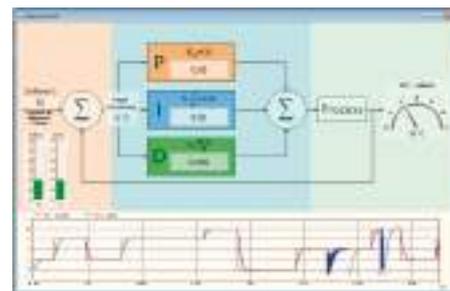
## Monitoring Functions



- An alarm can be triggered by a component failure or a limit value infringement.
- Alarm processing can be activated individually for each measuring point.
- Alarms are reported visually and / or acoustically.
- The cause and the duration of events responsible for triggering the alarm are documented in an events list.
- Alarm reports can be confirmed either individually or all together.
- If the cause of an alarm persists uncorrected an alarm reminder is issued to ensure that the alarm is not forgotten after it has been confirmed.
- A line graph with settable history can be generated for the variable triggering an alarm.
- In the event of an alarm being triggered e-mails can be sent, ALMEMO® output relays can be switched, and programs or scripts can be executed.
- Alarm reports can be forwarded via the network.
- In the event of a limit value being infringed program control commands can be executed (KwikScript).

## Control and regulation

- Two-point controllers, proportional controllers, and time-based controls are available.
- It is also possible, using arithmetic channels, to define PID controllers.
- Setpoint curves and process sequences can be specified by means of files with coordinates pairs.
- Values can be specified and process sequences can be modified - all via command buttons in project icons or the toolbar.



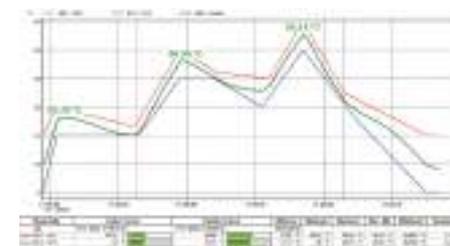
## Automatic saving-to-memory

- Measured data can be saved to memory - manually or on a time-controlled or event-driven basis.
- Not only daily / weekly / monthly files can be specified but also files with any random periods of time.
- Data is saved to memory automatically in the background - irrespective of any opened diagrams, tables, or displays.
- Measured value files can be exported automatically on completion of a save-to-memory cycle and be sent by e-mail (as an option with the events list).



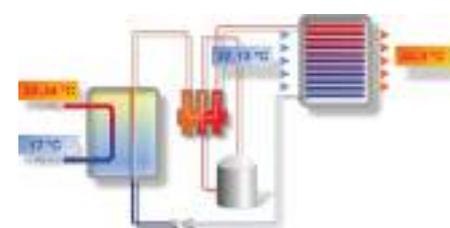
## Extended evaluation functions

- Measured value files can be incorporated in new or already existing line charts in the form of comparative characteristics.
- Folders containing a large number of measured value files can be conveniently grouped using various patterns based on file names and filters according to time and measuring point.
- Local maximum and minimum values can be shown in a line chart as any measured value curve required. The search radius between maximum and minimum can be freely set.



## Project illustrations

- Project illustrations allow for visualizing the setup of measurements and processes by using individually designed graphics and/or photographs (bitmaps).
- The presentation of the acquired data is provided in measured value fields that can be freely positioned; size and colors (including limit value violation) can be freely selected.
- Text fields can be filled with legend information and descriptions and can be freely positioned.
- By means of dynamic text fields it is possible to display texts in relation to measured values or conditions.
- All opened diagrams (line diagram, bar diagram, etc.) and displays can be inserted as a live element and arranged as desired.
- Command buttons (keys and switches) can be freely positioned in the project icon and allow changes to values for performing calculations or controlling processes (switching of relays or valves, etc.).
- The design of the command buttons can be changed in any way in the form of icons; the measurement setup can thus be visualized in a completely integrated way.
- Any number of project illustrations can be opened at the same time, allowing, for example, to give a presentation of the total view and detailed views of a project.



## Individual operation and display panels



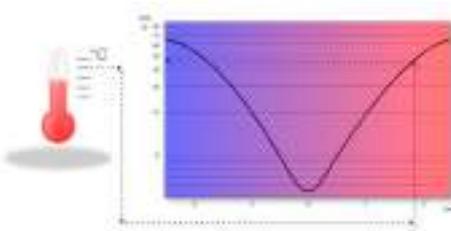
- Combination of the operations and display elements into a clearly structured overall entity, focusing on fundamental aspects.
- Direct control and programming of devices, test procedures, and software features.
- Display of conditions – visually or in form of predefined, explanatory, changing texts.
- Integration of opened line diagrams, bar diagrams, and displays directly in the panel.
- The user is able to create the operation and display panels according to his own needs by means of the project illustration.
- We offer the service to create panels in case a visually appealing and sophisticated solution is desired.

## Thermal transmittance (U) wizard



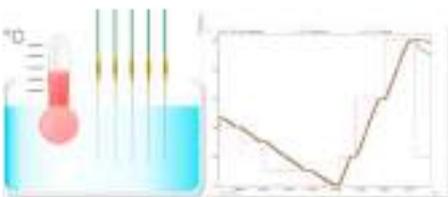
- The thermal transmittance (U) wizard is available for Online and Offline calculations; it guides the user through all the required steps.
- The user can choose from a selection of calculation methods - for the experimental thermal transmittance value, for the thermal transmittance value according to DIN 4108, and for the official calculated value.
- Determination of the currently calculated value and the sliding average value.
- The calculation methods will be described and the allocation of the corresponding measuring variables will be provided.
- After completing all steps a line diagram will be created, which will then be filled with the measuring data and the calculated variables.
- The cursor function can be used to open the statistic table, which provides further evaluation options (see above).

## PPD / PMV wizard (comfort index measurement)



- Calculation of thermal comfort as per DIN 1946 Part 2 and ISO 7730
- User guidance by means of a wizard and easy-to-understand evaluation
- Output in the form of “predicted mean vote” (PMV) and “predicted percent of dissatisfied” (PPD)
- Online and offline calculation of PMV and PPD in real time or on the basis of measured values already existing
- Graphical representation of measured data and calculated values in a format suitable for export (e.g. ASCII, MS Excel, DiaDEM, etc.)
- Calculation parameters can be saved as a model for subsequent calculations.
- Additional PMV / PPD functions are available for use in arithmetic channels.

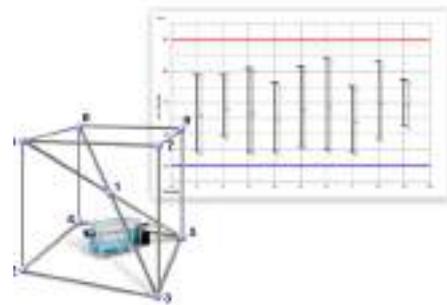
## Assistant for calibrating measuring sensors



- Multilevel calibration via self-defined calibration programs with set point lists and stability criterion
- Hardware profile with set point, reference and calibration measuring points.
- Automated procedure with measured value recording
- Drive a calibrator (set point specification)
- Any desired number of measuring points can be calibrated simultaneously
- Saving the values as AMR, CSV or Excel file
- Saving a configurable number of values per calibration step in case the stability criterion is met
- Overview window with progress bar
- The price for the module depends on the number of calibration station and calibrators that are to be supported simultaneously.

## Assistant for the calibration of climate chambers

- Calibration according to directive DAkkS-DKD-R 5-7
- Support of methods A and B with 9 and more measuring points
- Intuitive user navigation
- Analysis is possible online as well as offline
- Direct involvement of the climate chambers in the online measurement operation
- Online visualization of the calibration process for all measuring points
- Calculation of local humidity measured on the temperature monitoring points
- Determining measurement uncertainties
- Logging of deviations from the display value
- Automatic, convenient analysis with protocol creation in PDF format.



## Thermal quantity wizard

- The thermal quantity is calculated automatically from the volume flow and the temperature difference.
- You can enter settings easily and conveniently using the wizard.
- Data tables for water are included in delivery; users can define their own extensions for other media themselves.
- The thermal quantity can be calculated in real time or on the basis of existing measured value files.

$$\delta Q = c_v \cdot m \cdot dT$$



## Password protection

- Thanks to the integrated user management system, unauthorized access to AMR WinControl is impossible. This policy reduces the security risks to a minimum.
- Every change of user is logged in the events list for subsequent evaluation.
- Access rights can be defined individually per user or can be copied.
- Access limitations can be defined for every single program feature.
- Alarm confirmations can be assigned unequivocally to particular users.
- The password protection is the minimum requirement for the system validation according to FDA 21 CFR Part 11.



## Data Export:

- The data files can be, Online and/or at any later point in time, stored in the following formats Excel (XLS / XLSX), ASCII (TXT / CSV), WK1, FAMOS, QS-STAT, DIAdem.
- With ODBC measured data can be exported in SQL databases (structured query language). This supports all data sources for which an ODBC driver is installed and set up on the system.
- The line and XY diagrams and the tables can be copied to the clipboard and, for example, be inserted into a protocol text.
- Via dynamic data exchange (DDE) it is possible to transfer measured values Online to other applications, for example MS-EXCEL.
- Furthermore, line diagrams can be embedded into text documents (e.g. a MS Word document) via the OLE function.



# Software

## OPC export: Process control system connection



- „Openness, Productivity, and Collaboration”
- OPC is an established industrial standard for access procedures on a multi-vendor basis irrespective of manufacturer.
- AMR WinControl operates as an OPC client; it writes current measured values to the global variables provided by an OPC server.
- Data can be transferred in parallel to several OPC servers.
- Data from AMR WinControl can, with the aid of OPC, be visualized online in LabView™.

## ODBC support: SQL database connection



- Open database connectivity
- ODBC is a standardized database interface used by SQL as its database language.
- Recorded measured values can thus be transferred to a database.
- Current measured values can be interrogated from a database per measuring cycle.
- A suitable ODBC driver for the database must be installed and set up on the system.

## Test bench manager



- Several autosave managers can be operated and organized via a convenient, easy-to-use graphical user interface.
- Measured data can thus be saved simultaneously to different files.
- Autosave managers can be started and stopped independently of one another and according to various criteria (time-driven or event-driven).
- Different measuring locations (operating in parallel) can thus be treated separately.
- Measured value files can be indicated as write-protected already during recording.
- Including 10 autosave managers (optionally more available)
- If required, we offer to implement individual automations of test stations including input of test parameters, test procedure, signaling (optical/acoustic), and protocol printout.

## Connecting Options



- AMR WinControl can handle single measuring instruments as well as a network of measuring instruments of the ALMEMO® series.
- The connection to the measuring instrument(s) can be established via serial interface, USB, Bluetooth, or mobile modem.
- In a similar way, the measuring instruments can be addressed via a computer network (TCP/IP address) and VPN.
- Connections can be set up on a time-controlled basis. Reading out from the memory on ALMEMO® devices can be automated. The memory can on request be cleared and saving to memory can be resumed automatically. Any problems encountered are noted in the events list.
- Via mobile radio it is possible to establish connections to devices that have been installed in remote locations. The connection can be established inexpensively and permanently, as the billing is volume-oriented.

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## Protocol printout

- With a few clicks, recorded measured values can be printed out as a protocol.
- The customer can create his own individual templates or customize the available sample templates.
- The protocol may include the line graph, measured values, calculated variables, times, and comments.
- Ideal for compiling measurement reports or protocols for customers without having to bother with Excel and data export



## System integration

- Optionally, AMR WinControl offers support for protocols for measured value enquiry from devices from other manufacturers simultaneously for any number of connections.
- MODBUS: flexible protocol and industry standard
- CAN Bus: with PEAK-CAN or USB2CAN adapter
- OPC DA: measured data acquisition from measuring devices/systems or data transfer to an OPC server (e.g. LabVIEW)
- ODBC: SQL data base (Oracle, MSSQL, MySQL, ...)
- Climate chambers: Feutron®, CTC, Binder, Memmert, Vötsch, and Weiss Umwelttechnik
- Dew point mirror: DPM 373, DewMaster
- Gas analyzers: ECO Physics CLD 8xx, ABB, MRU Nova H8, as well as Emerson devices X-Stream, MLT, CLD, and NGA
- Power meters & energy meters: Yokogawa WT230 & WT310, Janitza®, Infratek 106A & 108A, Simeas-T, and Hioki
- Calibrators: Julabo, ISOTECH, and AMETEK® (JofraTM)
- Precision measuring device: Fluke 8508A (with full precision)
- Barcode scanner protocol: network-compatible and serial scanners
- Simple ASCII: implementation of your own measuring devices
- The use of AMR WinControl for acquiring measured data of further devices is possible upon request.



## Barcode scanner protocol

- Acquisition of barcodes in text format via USB, TCP/IP or Bluetooth by using appropriate scanners.
- Analysis of the barcode to control program features (e.g. automatic saving) and test procedures.
- The barcode is automatically imported into the name of the file.
- Display of the scanned barcode in text format and storage of numeric barcodes in measured value files.
- Several scanners can be operated in parallel.



## Measured value server

- With the measured value server up to 200 users simultaneously can access current measured values and the measured values history via a TCP network (Intranet / Internet).
- Interface to any data acquisition and process control system
- Online transmission of measured data to other operating systems (e.g. LINUX, WINDOWS CE, UNIX, etc.)
- Data distribution according to any specified criteria
- Customized solutions can be implemented using straightforward ASCII commands issued via the TCP protocol; all these commands are fully documented.
- Open “read-only” interface for any user-defined connection software
- “REMOTE WinControl” and “WinControl Client OCX” provide powerful standard solutions for the measured value clients.

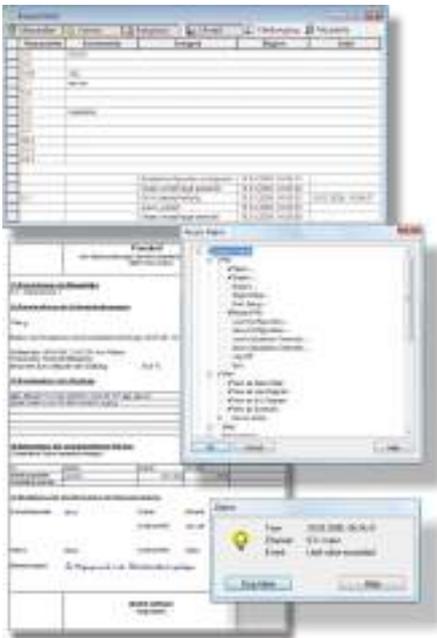


## Web server



- AMR WinControl provides a full range of web server functions for publishing web pages (HTML) in the Intranet / Internet. It also incorporates additional functions that can be used to output the contents of AMR WinControl windows directly onto web pages.
- Current measured values and measured value histories can be displayed in a variety of ways (line diagrams, XY diagrams, project illustrations) in the Intranet / Internet.
- Visualization of processes and systems
- Visual remote monitoring
- Confirmation of alarms via the browser (only with alarm function and password protection)
- Linking presentation and real-time data on web pages
- The way in which measured values are displayed does not depend on the operating system; only a browser is needed (MS Internet Explorer, Firefox, Chrome, Opera, etc.).
- Diagrams and measured values can also be displayed on smartphones and tablet PCs.
- Security provided by SSL / TLS and user authentication
- Very easy to use : Images generated from the contents of a window can be transmitted as soon as the program starts - without needing any further settings. For particularly demanding tasks the HTML pages must first be adapted and connected to the web server.
- The wide variety of image formats and special parameters make for transparency and loss-free scaling and permit automatic updating. Powerful real-time compression algorithms minimize the volume of data to be transmitted.
- All the layout facilities available in HTML, DHTML, and CSS can be exploited; combining with JavaScript is also possible.
- Graphics, text, and measured value displays can be combined and merged completely seamlessly.
- The web designer is free to specify, more or less independently of AMR WinControl, how the measured value displays are to appear.
- The user receives current measured data without being exposed to any sort of security risk - because there is no need for Java or special plug-ins.

## SW5600WCV Package for long-term / continuous monitoring



This package, based on the AMR WinControl “professional” version, contains all the options and modules needed to implement long-term and continuous monitoring of critical measurable variables.

- Integrated user management with individually settable access rights and password protection
- Tamper-proof event list with sort and filter functions
- Trend monitoring - pre-alarm for signaling trend developments
- Signaling of alarms and events with user-specific confirmation and comments
- Alarm confirmation per web server (authentication and SSL / TLS available)
- Schedules : Automatic switching ON / OFF of alarm treatment for each measuring point, e.g. alarm treatment on working days between 06 and 18 o'clock only.
- Temporarily withdrawing certain measuring points from alarm treatment, e.g. for defrosting a cold room
- In the event of alarm an MS-Excel log can be printed out automatically. Users can modify the log provided or create their own.
- Failsafe : Automatic reading out of the device memory after loss of connection to the device
- Requirements: ALMEMO® device with failsafe mode and internal memory
- System configuration
- Integrity check on all measuring points and measuring instruments after program start
- Processing of measured and calculated variables in control and regulation functions
- Automatic printout and / or e-mail with daily files and event lists
- Including security package.

### Security package

- Data security : Automatic backup of all automatically recorded data (daily and weekly files, measured values recorded on an event-controlled basis, event lists, etc.)
- Fail-safe : In the event of failure a watchdog is triggered for PC restart and / or signaling via relay.
- Including watchdog card

## PIMEX: combined measured value recording and video recording

- Simultaneous acquisition of measured values from ALMEMO® devices together with video data from a digital source
- The measured data and video signal are synchronized and displayed together.
- The modes available are preview, record, and playback.
- PIMEX player is included in the professional version (WC3). The recording function is available as module (ZM14).
- Possible applications : Documentation / visualization of the process environment (e.g. for safety in the workplace, quality management, etc.)



## CAN trace: combined measured value recording and CAN data recording

new

- Synchronous recording and display of measured data and CAN messages
- Navigation with cursor in the line graph and display of the associated CAN messages in a table
- Configurable decoding and color highlighting of the CAN data
- Search and filtering of the CAN data
- Export of CAN data to a TRC file
- Import of CAN data from a TRC file to measured data
- Support of PEAK-CAN adapter (USB or PCIe)



## Copy protection

- AMR WinControl incorporates a copy protection system which requires a PC-dependent code to enable it. To receive this code the user must first register the software by telephone, fax, or e-mail. Per licence purchased the software may be installed and operated on one computer.
- It is also possible as an option to request a hardware copy protection mechanism, a dongle; with this the software can be installed on any number of computers but will only run on that PC into which the dongle is currently plugged.
- A network dongle may contain more than one licence; with this it is possible - without the inconvenience of moving the dongle - to run the software simultaneously on as many computers in a company network as there are licences encoded in the dongle.



## AMR WinControl system requirements

Components :	Minimum configuration	Recommended configuration
Computer	Windows-PC (x86/x64)	Windows-PC
Operating system	Windows Vista, 7, 8.1, 10, 2008, 2012 (32 and 64 bit)	Windows 7, 8, 10
Memory	2048 MB	4096 MB
Free hard-disk capacity	30 MB	100 MB
Interfaces	USB	COM (RS232), USB, network

## RMT WinControl software for evaluating, monitoring, networking



### Program description

- Access to measured values on one or more AMR WinControl data servers in a local network or via the Internet
- Access to one measuring system by any number of users simultaneously
- Open and evaluate AMR files
- Same range of functions as AMR WinControl except for device access
- At our site ([www.akrobit.de](http://www.akrobit.de)) you can find all the latest information regarding software versions and updates and also download the most recent trial version of the software.



### RMT WinControl can perform the following:

- Monitoring of measured data from WinControl data servers at various locations
- Evaluation of acquired measured data / files independent of the recording computer
- Safe and secure access to the data acquisition system by “read-only” protocol
- Additional alarm handling and recording independent of the recording computer
- Since the measured value history is scanned, the evaluating computer therefore does not need to run continuously.

### Software versions

- Basic version (like SW5600WC2 except for device access and maximum 1 connection)
- Professional version (like SW5600WC3 except for device access and maximum 1 connection)
- Web server (like SW5600WC4 except for device access and any number of connections)
- Update to the latest software version

### Order no.

- SW5600WCR2**
- SW5600WCR3**
- SW5600WCR4**
- SW5600WCRU**

### Options

- Automatic generation of measured data files (daily files / weekly files)
- Modem support
- Alarm function (event list, alarm e-mail / SMS, switching of ALMEMO® output relays)
- Data server see page 05.13
- Web server see page 05.14
- Extended evaluation functions see page extended evaluation 05.11

### Order no.

- SW5600WCRO2
- SW5600WCRO3
- SW5600WCRO5
- SW5600WCRO8
- SW5600WCRO9
- SW5600WCRO10

### Additional modules

- Thermal comfort calculations as per DIN 1946, EN ISO 7730 see page 05.12, 12.14
- Password protection see page 05.12
- Test bench manager (prerequisite : WCR3 / WCR4 or WCR2 + WCRO2) see page 05.15
- Thermal transmittance (U) wizard see page 05.11, 13.03
- Thermal quantity wizard see page 05.12
- OPC export see page 05.12

- SW5600WCRZM1
- SW5600WCRZM2
- SW5600WCRZM3
- SW5600WCRZM4
- SW5600WCRZM5
- SW5600WCRZM6

### Hardware copy protection see page 05.15

- Hardlock USB dongle
- Hardlock USB network dongle

- SW5600HL
- SW5600NHL

### Minimum system requirements

Component	Minimum configuration	Recommended configuration
Computer:	Windows-PC (x86/x64)	Windows-PC (x86/x64)
Operating system	Windows XP, 2003, Vista, 2008, 7, 8, 10 (32 and 64 bit)	Windows 7, 8, 10
RAM	1024 MB	4096 MB
Free hard-disk capacity	25 MB	100 MB
Interfaces	USB	COM (RS232), USB Network card , Modem or ISDN

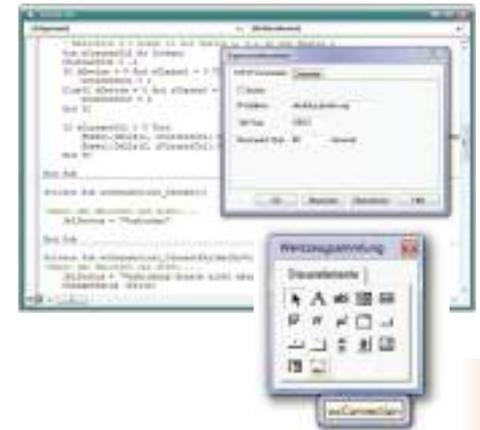
## WinControl client OCX and SimpleASCII server

### WinControl Client OCX

- Access to measured values on a WinControl data server in a local network or via Internet
- MS ActiveX® universal components for integrating in your own applications
- Client licence for data server included
- Including documentation and simple application example for MS Excel
- This requires an AMR WinControl WC4 or option WCO8.



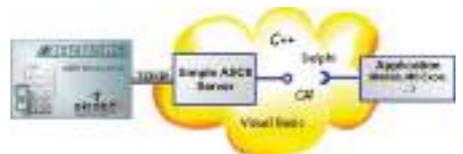
- Measured values from a WinControl data server can be transferred to your own applications by the WinControl client OCX.
- Current values and the measured value history can be scanned.
- Using OCX shortens development times appreciably because it relieves the developer of tasks involving communication with the data server.
- It can be incorporated in any application supporting OLE (Object Linking and Embedding) (e.g. MS Excel, Matlab, MS Access, MS SQL Server, etc.).
- Any programming language can be used for this purpose (C++, C#, Visual Basic (VB, VBA, VBS), Delphi, etc.).
- Since multiple objects can be used simultaneously, data from various data servers can be acquired and recorded. OCX needs to be installed on the system only once.



### Simple ASCII server

- Server component for sending data to AMR WinControl using the SimpleASCII protocol via TCP/IP
- MS ActiveX® universal components for integrating in your own applications
- including SimpleASCII protocol licence .
- Including documentation and simple application example for MS Excel.

- Using the SimpleASCII server measured values or data can be transferred to AMR WinControl from another source (application or measuring instrument).
- Using this component shortens development times appreciably because it relieves the developer of tasks involving the programming of a TCP/IP server; (in programming languages (e.g. VBA, VBS) this is not possible without additional components).
- It can be incorporated in any application supporting OLE (Object Linking and Embedding) (e.g. MS Excel, Matlab, MS Access, MS SQL Server, etc.).
- Any programming language can be used for this purpose (C++, C#, Visual Basic (VB, VBA, VBS), Delphi, etc.).
- With ActiveX-Control you can e.g. develop your own driver for incorporating an additional measuring instrument in AMR WinControl.



### Software version

Client licence with OCX (client licence for the AMR WinControl server and OCX developer's licence)  
SimpleASCII server (SimpleASCII protocol licence for AMR WinControl with ActiveX-Control)

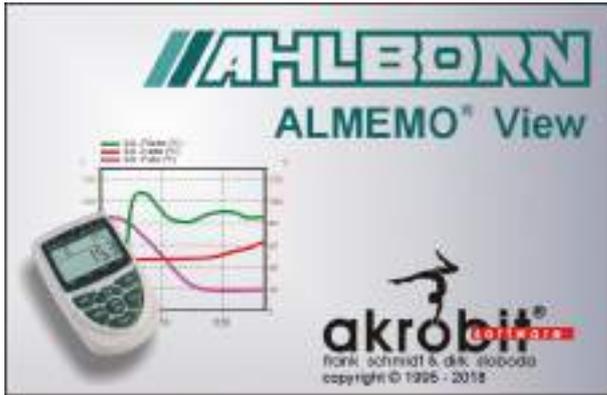
### Order no.

**SW560COCX**  
**SW560WCZM7**

### Minimum system requirements

The configuration actually needed depends on the software in which ActiveX-Control is integrated.

## ALMEMO® View



**ALMEMO® View** is a software package that can be used to evaluate and display measured data on one ALMEMO® device with up to four measurement channels.

**ALMEMO® View** runs under MS-Windows and can be used to drive an ALMEMO® device with up to four measuring points.

As soon as the connection between the computer and the measuring instrument has been established the program detects and lists these measuring points automatically.

The measured values are then read at a sampling rate selected by the user.

### Datenlogger

The measured value memory on an ALMEMO® data logger (maximum four measuring points) can be read out, displayed as a line chart or table, and saved to a file. The parameters needed to operate the measuring instrument can be set via a dialog and programmed with **ALMEMO® View**

### Display of measured values

The recorded data can be displayed in numeric form, in a table, and as a line chart. It is possible to display just one measuring point or several measuring points at the same time in different modes.

### Saving measured values

Measured values can be archived in line chart or table form.

### Printing out

**ALMEMO® View** can also be used directly to print out diagrams, tables, or a list of all measuring points with their associated correction values, e.g. for the purposes of technical documentation. The results can be viewed in advance before printing out in the print preview. The program supports all printers that can normally be installed under MS-Windows.

### Documentation

To compile protocols using some other software the line charts, tables, and lists in **ALMEMO® View** can be copied via the MS-Windows clip-board to other application programs.

### Software versionen

Basic ALMEMO® View software for maximum four measuring channels  
(recommended for 1 measuring instrument with a maximum of 4 measuring channels,  
connection via 1 COM interface)

### Order no.

**SW5500AV**

### System requirements:

**ALMEMO® View** can be run on a computer (x86/x64) with Windows XP or newer

## Content

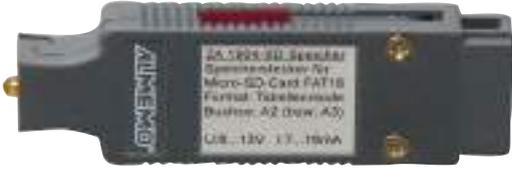
ALMEMO® memory connector with micro-SD ZA 1904 SD	06.02
GPS mouse for determining position	06.03
Extension cable	06.04
Accessories for measuring instruments	06.07
Rechargeable Batteries	06.07
Mains Adapter, Power Supply Cables	06.08
Carry cases, Rack case	06.09

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# General accessories

## ALMEMO® memory connector with micro-SD ZA 1904 SD

06/2018 • We reserve the right to make technical changes.



- for ALMEMO® data loggers, as of version 6
- Large memory
- High data security
- Measured values can be saved to a text file.
- The memory card in the data logger can be replaced quickly and easily on site.
- Files can be transferred to a PC quickly and easily via a card reader

### Technical data

Measuring instruments	for ALMEMO® 2590-2/-3S/-4S, 2690, 2890, 4390, 5690, 5790, 8490, 8590 Memory connector on device output socket A2	Measured values	With 512 MB approx. 30 million measured values
ALMEMO® memory connector	Integrate drive for micro-SD card	Ring memory	no
Memory card	MicroSD industry standard (Industrial Grade SSD SLC Technology) with high performance, reliability and durability, possible up to 2 GB, standard FAT16 format	File format	ASCII text file, measured values in table format, separated by semi-colons
		Reading device	USB card reader for removable storage media
		Measuring software	WinControl (as of version 6), see Chapter Software

### Variants

ALMEMO® memory connector with micro-SD memory card (512 MB) including USB card reader  
Micro-SD memory card (512 MB as replacement)

**Order no.**  
**ZA1904SD**  
**ZB1904SD**



Micro-SD memory card (as replacement)

## ALMEMO® GPS mouse for determining current geographical data

Using the ALMEMO® GPS mouse makes it possible to display and save geographical data on an ALMEMO® measuring instrument. The data storage can occur automatically with the measuring cycle or manually. The measured values of the connected sensors are saved simultaneously with the geographical data. This method makes it possible to assign the logged measured values to the geographical data determined at the time of measurement.



## ALMEMO® GPS mouse ZAD 919-GPS

- The ALMEMO® GPS mouse determines the current geographical position.
- The ALMEMO® GPS mouse measures the northern / southern latitudes and the eastern / western longitudes in degrees and decimal minutes and displays them in 4 channels:  
Example: Position latitude 47 degrees 53,1624 minutes north and longitude 11 degrees 42,2056 minutes east  
1st channel: 47.53 Latitude  
2nd channel: 0.1624 m  
3rd channel: 11.42 Longitude  
4th channel: 0.2056 m
- The ALMEMO® measured values that are transformed to coordinates can be e.g. entered in Google Earth, and by doing so, the geographical position can be displayed.
- The power for the GPS mouse is supplied by an ALMEMO® device (6 to 12 V, approx. 100 mA). The device cannot operate in sleep mode.

## ALMEMO® GPS mouse FGD7 01

- The ALMEMO® D7 GPS mouse determines the current geographical data.
- For current ALMEMO® V7 measuring instruments, i.a. ALMEMO® 202, 710, 809, 500.
- 14 measuring variables can be acquired. Via the ALMEMO® D7 plug it is possible to display 10 measuring channels simultaneously.
- 9 measuring channels are preprogrammed on leaving our factory:  
1st channel: degree of longitude GPRMC, up to E179°59,9999  
2nd channel: degree of latitude GPRMC, up to N089°59,9999  
3rd channel: height above Geoid in meters  
4th channel: Speed in km/h  
5th channel: direction of movement in °  
(display possible at a speed of > 0.5 km/h)  
6th channel: direction of movement in text from  
7th channel: Universal Time (UTC), resolution 1 second  
8th channel: display of the satellites  
9th channel: age of the data in seconds
- Alternatively further measuring variables are selectable: degree of longitude Google, up to E179.999999 and degree of latitude Google, up to N89.999999, Speed in m/s or mph or kn.
- The power for the GPS mouse is supplied by an ALMEMO® device (6 to 12 V, approx. 100 mA). The device does not operate in sleep mode
- Note regarding the analysis of the saved measured values by means of the ALMEMO® Control software: Once the measuring operating is completed, the measured values saved in the ALMEMO® device are retrieved. By means of a new feature of the ALMEMO® Control software, the measured values can be transformed into a Google Earth compatible markup language to enable the description of geographical data (KML = Keyhole Markup Language). Thus, waypoints (geographical positions) and saved measured values can be visualized together in Google Earth.



Track and measured data visualization in Google Earth (Example)

### Variants

GPS mouse with approx. 2 meters cable, terminal box, with 0.5 m cable and ALMEMO® plug (range DIGI)

**Order no.**  
**ZAD919GPS**

### Variants

GPS-mouse with 2 meters cable, terminal box, with 0.5 m cable and ALMEMO® D7-plug

### Order no.

**FGD701**

# General accessories

## ALMEMO® extension cable up to 4 meters length for all ALMEMO® devices (V5, V6, V7)

Passive extension cable ZA 9060-VK for all ALMEMO® sensors (analog, DIGI, D6, D7) except for thermocouple sensors.



### Technical data and functions

- The passive ALMEMO® extension cables ZA 9060-VK are used for all ALMEMO® sensors (analog, DIGI, D6, D7) except for thermocouple sensors and for all ALMEMO® devices (V5, V6, V7).
- The extension cables have an ALMEMO® connector/ coupling and are plugged between the ALMEMO® sensor plug and the ALMEMO® measuring instrument.
- The measuring signal or the digital measured values and the parameters saved in the ALMEMO® sensor plug are evaluated by the ALMEMO® measuring instrument via the extension cable.

- Note: Many ALMEMO® sensors can be delivered with a longer connecting cable. Please do not hesitate to ask!



### Please note:

Connecting cables must not be plugged together!

### Variants:

Passive extension cable for all ALMEMO® sensors (analog, DIGI, D6, D7) except for thermocouple sensors, for all ALMEMO® devices (V5, V6, V7).

- 1 meter long
- 2 meters long
- 4 meters long

### Order no.

ZA9060VK1  
ZA9060VK2  
ZA9060VK4

## Passive extension cable ZA 9020-VK up to 4 m length for ALMEMO® sensor NiCr-Ni



### Technical data and functions

- The passive ALMEMO® extension cables NiCr-Ni ZA 9020-VK are used for ALMEMO® sensors NiCr-Ni and for all ALMEMO® devices (V5, V6, V7).
- The extension cables NiCr-Ni feature a specific cable with integrated compensating cable NiCr-Ni, have an ALMEMO® connector / coupling, and are plugged between the ALMEMO® sensor plug and the ALMEMO® measuring instrument.
- The measuring signal and the parameters saved in the ALMEMO® sensor plug are evaluated by the ALMEMO® measuring instrument via the extension cable
- Note: ALMEMO® extension cables are only available for

thermocouple type K, NiCr-Ni. Many ALMEMO® thermocouple sensors can be delivered with a longer thermal line / compensation line. Please do not hesitate to ask.



### Please note:

Connecting cables must not be plugged together!

### Variants:

Passive extension cable for ALMEMO® sensor NiCr-Ni and for all ALMEMO® devices (V5, V6, V7).

- 1 meter long
- 2 meters long
- 4 meters long

### Order no.

ZA9020VK1  
ZA9020VK2  
ZA9020VK4

## ALMEMO® extension cable up to 100 meters in length for all ALMEMO® devices (V5, V6, V7)

Intelligent extension cable ZA 9090-VKC up to 100 meter in length for all ALMEMO® sensors, analog, D6, except for D7, except for thermocouple sensors.



### Technical data and functions

- The intelligent ALMEMO® extension cables ZA 9060-VKC are used for analog ALMEMO® sensors, D6, except for D7, except for thermocouple sensors and for all ALMEMO® devices (V5, V6, V7).
- The extension cables have an ALMEMO® connector/ coupling (each with a microcontroller) and are plugged between the ALMEMO® sensor plug and the ALMEMO® measuring instrument. The current consumption of the extension cable is approximately 8 mA.
- The analog measuring signals are transferred analogy via the intelligent extension cable, the digital measured values and the

parameters saved on the ALMEMO® sensor plug are digitally transferred via CRC and evaluated by the ALMEMO® measuring instrument.

- The ALMEMO® sensors can be exchanged arbitrarily. The intelligent extension cable does not influence the measurement operation even in case calibrated sensors with adjustment / multi-point adjustment or sensors with special linearizations (saved on the ALMEMO® sensor plug) are used.
- Note: Many ALMEMO® sensors can be delivered with a longer connecting cable. Please do not hesitate to ask!



### Please note:

The intelligent extension cables ZA 9090-VKC are

#### not suitable for:

- ALMEMO® plug for frequency, pulse, rotational speed ZA 9909-AKx,
- ALMEMO® rotational speed sensor FU A919-2,
- ALMEMO® plug for digital signals (voltage) ZA 9000-ES2/EK2,
- ALMEMO® measuring module for DC voltage / DC ZA 9900-AKx, ZA 9901-AKx (no average value),
- ALMEMO® flow sensors FV A915-Vx,
- ALMEMO® vane anemometer FV A915-x (new variant FVAD 15-x can be used),
- Meteorological transducer FM A510.

Connecting cables must not be plugged together!

If the intelligent extension cable ZA 9090-VKC is used, the device cannot operate in sleep mode.

### Variants:

Intelligent extension cable for ALMEMO® sensors, analog, D6, except for D7, except for thermocouple sensors\*, for all ALMEMO® devices (V5, V6, V7).

- 5 meters long
- 10 meters long
- 20 meters long
- 30 meters long
- 50 meters long
- 100 meters long

\*ALMEMO® extension cable with compensating cable for thermocouple sensor NiCr-Ni on request!

### Order no.

- ZA9090VKC5
- ZA9090VKC10
- ZA9090VKC20
- ZA9090VKC30
- ZA9090VKC50
- ZA9090VKC100

## ALMEMO® D7 extension cable, up to 100 meters in length and electrically isolated, for ALMEMO® V7 devices and ALMEMO® D7 sensors

Digital extension cable ZAD7 00-VK, up to 100 meters in length, for ALMEMO® D7 sensors



### Technical data and functions

- ALMEMO® digital extension cable ZAD7 00-VK is used for ALMEMO® V7 devices and for ALMEMO® D7 sensors.
- Each such extension cable incorporates an ALMEMO® plug / coupling (each with integrated microcontroller); it should be connected between the ALMEMO® sensor plug and the ALMEMO® measuring instrument. Current consumption for this extension cable is approx. 2 mA.
- The digital measured values and the parameters saved in the ALMEMO® sensor plug are transferred in digital form via an RS485 link with CRC to the ALMEMO® measuring instrument, which then evaluates them.

- The ALMEMO® sensors can be freely interchanged. The digital extension cable has no effect on the measuring operation; this also applies to calibrated sensors with adjustment / multi-point adjustment.
- With digital extension cable ZAD7 00-VK device operation in sleep mode is possible; (sleep delay must be programmed in the sensor plug).



### Please note:

Connecting cables must not be plugged together!

### Variants:

Digital extension cable for ALMEMO® V7 devices and for ALMEMO® D7 sensors.

- 5 meters long
- 10 meters long
- 20 meters long
- 30 meters long
- 50 meters long
- 100 meters long

### Order no.

- ZAD700VK05
- ZAD700VK10
- ZAD700VK20
- ZAD700VK30
- ZAD700VK50
- ZAD700VK100

## ALMEMO® D7 electrical isolation element ZAD7 00-GT



### Technical data and functions

- Electrical isolation element ZAD7 00-GT is used to isolate the ALMEMO® V7 device and the ALMEMO® D7 sensor from one another. This also electrically isolates the ALMEMO® D7 sensor with respect to the other connected ALMEMO® sensors.
- The electrical isolation element is a short pluggable cable with ALMEMO® plug / coupling. The ALMEMO® coupling incorporates an integrated 12V DC/DC converter ensuring electrical isolation between the power supply to the ALMEMO® electronics and that to the connected sensor. The digital data link is electrically isolated via an optocoupler. The maximum insulation voltage is 50V (continuous).
- The electrical isolation element is plugged directly onto the ALMEMO® V7 device. Current consumption for this electrical isolation element is approx. 8 mA. It is also possible to use an ALMEMO® D7 extension cable between the electrical isolation

element and the ALMEMO® D7 sensor.

- As with the ALMEMO® D7 extension cable, the ALMEMO® sensors can be freely interchanged. The electrical isolation element has no effect on the measuring operation; this also applies to calibrated sensors with adjustment / multi-point adjustment.
- As with the ALMEMO® D7 extension cable, device operation in sleep mode is possible; (sleep delay must be programmed in the sensor plug).



### Please note:

It is not permitted to connect several electrical isolation elements in series.

### Variants:

Electrical isolation element for ALMEMO® V7 devices and for ALMEMO® D7 sensors  
Plug-in cable Length = 0.2 meters

### Order no.

ZAD700

## Accessories for measuring instruments ALMEMO® 2450, 2490, 2590 and output interface ZA 8006 RTA



Rubber safety holster, green  
 Rubber safety holster, gray  
 including carry strap

**Order no.**  
**ZB2490GS1**  
**ZB2490GS2**



Vent plug with handle,  
 to close unneeded ALMEMO® sockets,  
 suitable for ALMEMO 2450, 2490, 2470, 2590, 2690, 202,  
 710, 1020, 1030, 1036, output interface RTA3/4

**GR2400BAG**



Top hat rail mounting  
 1 battery compartment cap with top hat rail holder fitted,  
 including top hat

**ZB2490HS**



Magnetic fastening  
 2 pot magnets, including 2 screws  
 (for battery compartment cap)

**ZB2490MH**

## Rechargeable batteries



Types	Order no.
Rechargeable battery, 12 V, 1600 mAh, NiMH with intelligent high-speed charging housed in case 174 x 29 x 137 mm (LxWXH) (without plug connections) voltage output via 3-pin socket	<b>ZB5690AP</b>
Connector mains unit, 100 to 240 VAC for charging the battery	<b>ZB1212NA10</b>
Connecting cable from battery to ALMEMO® device length = 1.5 meters, with ALMEMO® plug for ALMEMO® 2450, 2490, 2470, 2590-2/-3S/-4S, 2690	<b>ZA1012AKA</b>
With 3-pin bayonet coupling for ALMEMO® 5690, 8590, 8690	<b>ZB5090EKA</b>
With hollow connector for ALMEMO® 2890, 6290	<b>ZB2290EK</b>

# General accessories

## Batteries and Rechargeable Batteries



Types:	Order no.
AA battery, 1.5 V	<b>ZB2000B1</b>
AA NiMH rechargeable battery, 1.2 V, 1600 mA, coded for charging in ALMEMO® unit (e.g. ALMEMO® 2690-8)	<b>ZB2000A1NM</b>

## Mains Adapter



Variants	Order no.
<b>Switching power supply / connector variant</b> <b>100 to 240 VAC</b>	
12 VDC, 2 A ALMEMO® connector e.g. for hand-held devices ALMEMO® 2450, 2490, 2590, 2690, 710, 202	<b>ZA1312NA10</b>
12 VDC, 2 A 3-pin bayonet coupling e.g. for ALMEMO® 5690, 8590, 8690, 8036, 500	<b>ZB1212NA10</b>
12 VDC, 2 A DIN hollow connector for ALMEMO® 2890-9, 6290-7B2	<b>ZB1112NA10</b>
12 VDC, 2 A With free ends	<b>ZB1012NA10</b>
<b>Accessories</b>	
Conversion connector for mains-powered devices Euro-plug to US standard (flat-pin)	<b>ZB1000UA</b>

## DC Power Supply Cables



### Supply cables for DC voltages

- Usage for car and electric fence batteries.
- For instruments that need to be supplied from the car battery.

Variants	Order no.
10 to 30 V DC, electrically isolated, with DIN hollow connector for ALMEMO® 2890-9, 6290-7B2 Output : 12V DC / 1 A (max.)	<b>ZB2590UK</b>
10 to 30 V DC, electrically isolated, with ALMEMO® connector for ALMEMO® 2450, 2490, 2590, 2690-8 710, 202 Output: 12 V DC / 250 mA (max.)	<b>ZA2690UK</b>
Output: 12 V DC / 1 A (max.)	<b>ZA2690UK2</b>
10 to 30VDC, electr. isol., with bayonet coupling for ALMEMO® 8590, 8036, 809 Output: 12VDC/250mA (max.)	<b>ZB3090UK</b>
10 to 30VDC, electr. isol., with bayonet coupling, for ALMEMO® 5690-9, 8690, 500 output: 12V DC / 1.25A (max.)	<b>ZB3090UK2</b>
Adapter cable with universal car connector	<b>ZB1000AKU</b>
<b>New</b> ALMEMO® power supply plug, 9 to 12 VDC, not electr. isolated, with clamp connector for ALMEMO® DC socket on hand-held devices ALMEMO® 2450, 2490, 2590, 2690, 710, 202 Programming 0.2 A	<b>ZA1312FS1</b>
Programming 1 A	<b>ZA1312FS8</b>

## Instrument Cases



ZB 2590 TK2



ZB 5600 TK3



ZB 2490 TK2



ZB 5090 RC

### Types

### Order no.

#### Carry cases (approx. dimensions in cm)

Carry case, large, aluminum profile frame / ABS (acrylonitrile butadiene styrene) - e.g. for ALMEMO® 710, 2690, 2890 data logger, Inside dimensions 48 x 35 (WxD) x 6 (H) + 6 cm (removable insert)

**ZB2590TK2**

Carry case, universal, high, aluminum profile frame / ABS, e.g. for ALMEMO® 5690 measuring systems

Inside dimensions 48 x 25 (WxD) x 16 (H) + 10 cm (removable insert)

**ZB5600TK3**

Instrument case for all ALMEMO® handheld devices, inside dimensions (WxDxH) 42 x 30 x 9 (divided into compartments, see photograph)

**ZB2490TK2**

#### Rack case (approx. dimensions in cm)

Rack case with carrying handle, for ALMEMO® MA5690xxBT8 and MA500xxBT8x measuring systems, in 19-inch sub-rack, 84 DU, height 5 HU Outside dimensions (WxDxH) 54 x 50 x 27, with integrated lockable rack draw, inside dimensions (WxDxH) 40 x 37 x 7 (for cables, accessories, or laptop)

**ZB5090RC**



ALMEMO® input connector also for existing sensors (see Chapter Input Connectors)



ALMEMO® output modules (analog, relay, trigger) (see Chapter Output Connectors)



ALMEMO® data connection, network technology, Bluetooth modules  
Wireless and modem transmission (see Chapter Network Technology).



Software for the presentation and evaluation of measuring data, including many notes, is described in Chapter Software.

The software 'ALMEMO® Control' for measurement setup and convenient device handling, as well as the manual, are included with the delivery of all ALMEMO® devices with digital outputs.



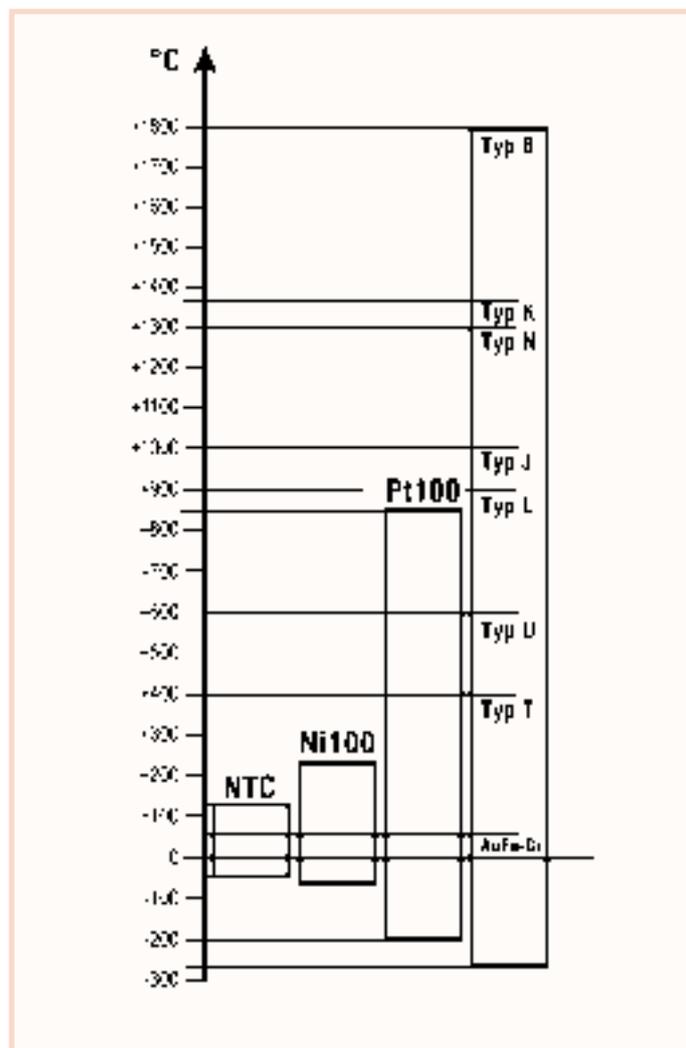
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# Temperature



## The Right Temperature Sensor For Any Measuring Task



Selecting the right type of temperature sensor depends on your measuring task. For example, thermocouples, resistor-based sensors (Pt100 and Ntc) and pyrometers (infrared sensors) are available.

### Rule of Thumb:

- Thermocouples are very fast and provide a large measuring range.
- Resistor-based sensors are more accurate but slower.
- Ntc sensors are very fast, accurate, but they have a limited measuring range.
- Infrared sensors do not contact the device under test and they have very small time constants, but they depend on the emission grade.
- The larger the measuring range, the more universal the possible range of applications.

### Selection Criteria:

Select the temperature sensor that suits your measuring task according to the criteria below:

- Meas. range
- Accuracy
- Response time
- Stability
- Type of construction

## Thermocouples

Thermocouples consist of two spot-welded wires of different metals or alloys. The thermoelectric effect at the contact surface is used to measure temperatures. A relatively small thermoelectric voltage is caused, which depends on the temperature

difference between the measuring point and the connecting terminals.

### Accuracy, Operating Temperatures:

The basic values for the thermoelectric voltages and for the permissible tolerances of thermocouples are specified in standard

DIN/IEC 584. Our thermocouple sensors are available in two tolerance classes as per DIN/IEC 584-2.

According to DIN/IEC 584-2, the thermocouple sensors are available in different accuracy classes.

### Accuracy classes for the thermocouples type K or type N (extract)

class	range of validity	limiting deviation (in each case the greater value applies)
1 -	40 to 1000°C	$\pm 1.5 \text{ K}$ or $\pm 0.004 \times  t  \text{ K}$
2 -	40 to 1200°C	$\pm 2.5 \text{ K}$ or $\pm 0.0075 \times  t  \text{ K}$

The accuracy class is specified for every thermocouple sensor. The accuracy applies within the above specified range of validity. The operative range is specified for every sensor – depending on its construction. These values refer to the sensor tip. Additionally, the operative

ranges of the connecting cable and the transition sleeve (or similar) have to be considered.

The sensor handles and cables are usually resistant to temperatures up to +80 °C. Heat-resistant cables are also available on

request. Various types of thermocouples are available; these can be distinguished in terms of their temperature range, sensitivity, and in particular their compatibility with the test substance. The most popular thermocouple is the NiCr-Ni (type K)

## Connecting cable with thermal line (stranded wire)

### There is no adverse temperature effect at the juncture from measuring element to cable

With immediate effect, the sensor connecting cables for many sensor types will use a new thermal line (stranded wire, thermal line class 2) instead of the conventional compensation line. The transition from measuring element (sensor tip) to connecting cable (in the cable sleeve or in the handle) thus remains, even

over a wide temperature span (up to 200 °C), unaffected by temperature error; the usual measuring errors caused by temperature differences at the juncture when using a conventional compensation line can thus with the new thermal line be avoided.

For just a few sensor types and extension cables a compensation line will continue to be used as previously. The compensation lines generally comply with Class 2 as per DIN 43722. For type K the operating temperature range of the compensation line is 0 to 150 °C.

## Resistor-Based Sensors (Pt100 Sensors)

When measuring the temperature the increase in resistance at increasing temperatures is utilised at the Pt100 sensors. The measuring resistor is fed with a constant current and the voltage drop at the resistor is measured as a function of the temperature. Due to the

small resistance variation (0.3 to 0.4Ω/°C) the 4-conductor circuit should always be used to exclude any influences from the lead wires.

### Accuracy, operating temperatures:

According to DIN/IEC 751, measuring resistors are used for the Pt100 sensors. Several accuracy classes are defined for the Pt100 sensor.

### Accuracy classes of the Pt100 sensors (extract)

class	range of validity		limiting deviation
	wire-wound resistors	film resistor	
B	-196 to +600 °C	-50 to +500 °C	$\pm(0.3 + 0.005  t ) \text{ K}$
A	-100 to +450 °C	-30 to +300 °C	$\pm(0.15 + 0.002  t ) \text{ K}$

The accuracy class is specified for every Pt100 sensor. Depending on the construction of the sensor, the higher

accuracies class A and 1/5 DIN class B are available on request. The accuracy applies within in the above specified range of

validity. Regarding the accuracy 1/5 DIN class B, the range of validity is sensor specific.

# Temperature

## Examples of Pt100 limiting deviations

temperature	limiting deviations		
	DIN class B	DIN class A	1/5 DIN class B*
0°C	±0.3 K	±0.15 K	±0.06 K
100°C	±0.8 K	±0.35 K	
200°C	±1.3 K	±0.55 K	
300°C	±1.8 K	±0.75 K	
	Higher accuracies available at extra cost	order no. OPG2**	order no. OPG5**

\*range of validity is sensor specific

\*\* On request, depending on the construction of the sensor

The operative range is specified for every sensor – depending on its construction. These values refer to the sensor tip. Additionally, the operative ranges of the connecting cable and the transition sleeve (or similar) have to be considered. The

sensor handles and cables are usually resistant to temperatures up to +80 °C. Heat-resistant cables are available on request.

### Measuring ranges, resolution:

PT100 probes FP Axxx are by default

assigned measuring range PT100-1 (resolution 0.1 K). Measuring range PT100-2 (resolution 0.01K) can be programmed as alternative on the 1st channel or in addition on the 2nd channel.

## Thermistors (NTC Sensors)

NTC sensors (thermistors) have a significantly higher resistance than Pt100 sensors. When measuring temperatures their negative temperature coefficient is utilised, i.e. the resistance is decreasing with increasing temperatures.

### Accuracy, operating temperatures:

The accuracy of the sensor element is manufacturer-specific. The sensor element is installed in a sensor and provided with a connecting cable and an ALMEMO® plug. Processing, crossing

points, terminal points and connecting cable influence the accuracy of the temperature sensor.

The following accuracy is specified for the NTC temperature sensor with a cable length of 2 meters:

### Accuracy of the NTC sensors

Range of validity	limiting deviation
-20 to < 0 °C	±0.4 K
0 to 70 °C	±0.2 K
>70 to 100 °C	±0.6 K

The accuracy applies within in the above specified range of validity.

The operative range is specified for every sensor – depending on its construction.

These values refer to the sensor tip. Additionally, the operative ranges of the connecting cable and the transition sleeve (or the like) have to be considered.

The handle of the sensor and the cable are heat resistant up to 80 °C.

## Types and Fields of Application

The construction variants of temperature sensors are as many and diverse as the measuring tasks.

$T_{max}$  is the maximum operating temperature of the sensor tip.

$T_{90}$  is the time required by the sensor to reach 90% of the step response after a jump in temperature .  
The specified  $T_{90}$  times refer to measuring operations in a moving liquid.

The temperature sensors listed are also available, on request, with other lengths and diameters

<b>Surface sensors with flat measuring tip</b>	For measurements on good heat conductors, on even and plain surfaces.
<b>Surface sensor with spring-type thermocouple band</b>	For quick measurements, also on non-plain surfaces.
<b>Immersion probes</b>	For measurements in liquids, as well as powdery substances, air and gases.
<b>Sensors with heat-resistant measuring tip</b>	For measurements at extremely high temperatures.
<b>Sensor with penetrating tip</b>	For measurements in plastic and pasty substances.
<b>Sword probe</b>	For measurements in paper, cardboard and textile stacks.
<b>Transducer with free sensor</b>	For measurements in air and gases

## ALMEMO® temperature measurement

Every ALMEMO® sensor can be adjusted, i.e. correction values of the sensor can be stored in the connector.

Thus, the measuring accuracy can be significantly increased.

During DAkkS/DKD or factory

calibrations performed by the Ahlborn Company, the correction values are recorded, stored in the sensor plug and locked. The adjustment can be realized in 2 points (zero, gradient) or in over 30 points as multi-point adjustment. Thanks

to this procedure the slightest deviations are archived on the calibrated temperature points.

The multi-point adjustment is described in detail in chapter "Input connectors" and in chapter "Calibration certificates".

## Precise temperature measurement thanks to digital ALMEMO® sensors

Digital ALMEMO® sensors are used to measure temperatures with high precision. Any Pt100 and NTC sensor can become a digital sensor with the appropriate ALMEMO® measurement plug.

For Pt100 sensors, the digital ALMEMO® D7 measurement plug is used in combination with an ALMEMO® D7

measuring instrument. For NTC sensors, the digital ALMEMO® D6 measurement plug is used in combination with any current ALMEMO® measuring device.

The overall accuracy is determined only by the temperature sensor with the connected ALMEMO® measurement plug, independent from the ALMEMO®

display device / data logger. The complete measuring chain, consisting of temperature sensor and the connected ALMEMO® measurement plug can be calibrated. An increased accuracy can be achieved by a multi-point adjustment of the sensor during the calibration process.

## Temperature sensor Pt100 with digital ALMEMO® D7 measurement plug

**High resolution 0.01 K within the complete measuring range up to 850°C.**

**Linearization of the Pt100 characteristic with accurate calculation method.**

**Increased accuracy for calibrated sensors thanks to multi-point adjustment of the Pt100 sensor.**

The digital ALMEMO® D7 measurement plug works with an own, integrated A/D converter. The high resolution of 0.01 K can be achieved within the complete measuring range going up to 850°C. The linearization of the Pt100 characteristic is

calculated accurately according to DIN IEC 751 (no approximation procedure).

To designate a sensor it is possible to program comments with up to 20 characters in the ALMEMO® D7 measurement plug

For technical data regarding the ALMEMO® D7 measurement plug Pt100 ZPD700FS, see chapter "Input connectors".

## Temperature sensor NTC with digital ALMEMO® D6 measurement plug

**High precision. High resolution 0.001K within the measuring range of -20 to +65°C.**

**Linearization of the NTC characteristic according to Galway Steinhart with accurate calculation method.**

**Increased accuracy thanks to multi-point adjustment of the NTC sensor during the calibration process.**

The digital ALMEMO® D6 measurement plug works with an own, integrated A/D converter. The linearization of the NTC characteristic is calculated accurately with the Galway Steinhart coefficient

(no approximation procedure). For the measuring range of -20 to +65°C, a high resolution of 0.001 K can be achieved. The high precision of the digital temperature sensor is independent from connected

extension cables.

For technical data regarding the ALMEMO® D6 measurement plug, see chapter "Input connectors".



If you do not find a suitable sensor in this catalogue, we can manufacture it according to your specifications (technical drawing or detailed specification) and supply you with a customised sensor!

# Temperature

## Sheathed sensors



- These reasonably priced sensors are for universal use (-200 to +1100 °C) and suitable for immersion measurements in liquids, air, and gases. The sheathed line, depending on diameter, can be bent - within certain limits.
- Different connection variants :  
With cable and ALMEMO® connector Order no. FxAxx, with cable and free ends, Order no. Fx0xx.  
Connector options :  
With THERM circular connector : Option T9020RS,  
with miniature Thermo flat connector : Option OT9020FS.

### Thermocouple sheathed sensors FTAx and FTANxx

Accuracy:	FTAx; NiCr-Ni thermocouple, type K, DIN class 1* FTANxx; NiCrSi-NiSi thermocouple, type N, DIN class 1*
Sensor tip, sheathed line :	diameter, length, operating temperature; see table; material Inconel 2.4816 Here the sensor tip and sheathed line are of the same diameter. These types are therefore also suitable for mounting with clamped screw connections.
Cable sleeve :	Brass, hexagonal, L = 65 mm, circumdiameter = 9 mm, operating temp. -40 to +160 °C
Standard cable :	1.5 meter FEP / silicone thermal line (stranded wire)* Operating temp. -50 to +200°C There is no adverse temperature effect at the juncture from measuring element to cable.
Cable options :	Compensation line, PVC / PVC, insulated, operating temperature -20 to +105 °C The compensation line is also available, on request, with FEP / FEP, insulated.
ALMEMO® connector	FTAx NiCr-Ni ZA9020FS with resolution 0.1 K FTANxx NiCrSi-NiSi ZA9021FSN with resolution 0.1 K

### Pt100 sheathed sensors FPAxx

Accuracy :	Pt100 film resistor, DIN class B*
Options :	DIN class A, 1/5 DIN class B Pt100 wire wound measuring resistor
Sensor tip :	diameter, length, operating temperature; see table; material stainless steel
Sheathed line :	diameter, length; see table; material stainless steel On certain types the sensor tip and sheathed line are of different diameter; (i.e. the sensor tip is thicker). These types are therefore not suitable for mounting with clamped screw connections. Types suitable for clamped screw connections are available on request.
Cable sleeve :	Brass, hexagonal, L = 65 mm, circumdiameter = 9 mm, operating temp. -40 to +160 °C
Standard cable :	1.5 meters line, FEP / silicone, insulated, operating temperature -50 to +200 °C
Cable options :	Line, PVC / PVC, insulated, operating temperature -20 to +105 °C The line is also available, on request, with FEP / FEP, insulated.
ALMEMO® connector	Pt100, ZA9030FS1, with resolution 0.1 K Option : Pt100 ZA9030FS2 with resolution 0.01 K (standard with 1/5 DIN class B)

### NTC sheathed sensors FNAxx

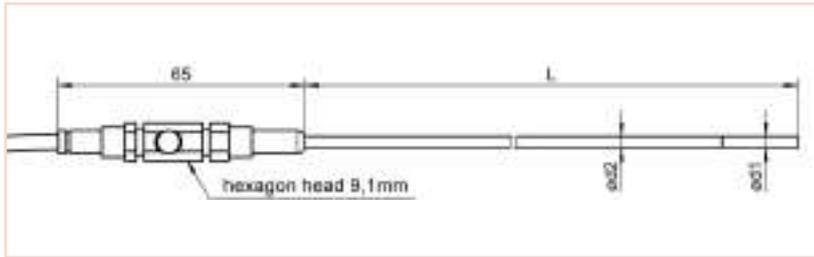
Accuracy :	NTC type N (see 07.04)
Sensor tip :	diameter, length, operating temperature; see table; material stainless steel
Sheathed line :	diameter, length; see table; material stainless steel On certain types the sensor tip and sheathed line are of different diameter; (i.e. the sensor tip is thicker). These types are therefore not suitable for mounting with clamped screw connections. Types suitable for clamped screw connections are available on request.
Cable sleeve :	Brass, hexagonal, L = 65 mm, circumdiameter = 9 mm, operating temp. -40 to +160 °C
Standard cable :	1.5 meters line, PVC / PVC, insulated, operating temperature -20 to +105 °C
Cable options :	Line, FEP / silicone, insulated, operating temperature -50 to +200 °C The line is also available, on request, with FEP / FEP, insulated.
ALMEMO® connector	NTC, ZA9040FS, with resolution 0.01 K.

\* Range of validity see page 07.03

\*\* No temperature influence at the transition from the measuring element to the cable (see page 07.03)

DakKS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)  
DakKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Sheathed sensors



Sensor with :  
 Sensor tip, dimensions d1,  
 sheathed line, dimensions d2,  
 overall length (including sensor tip) L,  
 Cable sleeve, dimensions length = 65 mm,  
 circumdiameter = 9 mm, Cable

### Thermocouple sheathed sensors NiCr-Ni, type K

Typical Application: universal, in range -40 ° C to 900 ° C

Diameter d1=d2	Operating temperature Sensor tip	Length L	Order no
0.5 mm	-200...900°C	50 mm	FTA05L0050
0.5 mm	-200...900°C	100 mm	FTA05L0100
0.5 mm	-200...900°C	250 mm	FTA05L0250
0.5 mm	-200...900°C	500 mm	FTA05L0500
0.5 mm	-200...900°C	1000 mm	FTA05L1000
1.5 mm	-200...1100°C	100 mm	FTA15L0100
1.5 mm	-200...1100°C	250 mm	FTA15L0250
1.5 mm	-200...1100°C	500 mm	FTA15L0500
1.5 mm	-200...1100°C	1000 mm	FTA15L1000
3.0 mm	-200...1100°C	100 mm	FTA30L0100
3.0 mm	-200...1100°C	250 mm	FTA30L0250
3.0 mm	-200...1100°C	500 mm	FTA30L0500
3.0 mm	-200...1100°C	1000 mm	FTA30L1000

Connection cable	Operative range	Length	Order no
FEP/silicone Thermal line (stranded wire)	-50...200°C	1.5 m	default
		5 m	OTK01L0050
PVC/PVC Compensation line	-20...105°C	1.5 m	OTK02L0015
		5 m	OTK02L0050

### Thermocouple sheathed sensors NiCrSi-NiSi, type N

Typical application: in the range -200 ° C to 1150 ° C, long-term stability at high temperatures

Diameter d1=d2	Operating temperature Sensor tip	Length L	Order no
1.5 mm	-200...1150°C	500 mm	FTAN15L0500
1.5 mm	-200...1150°C	750 mm	FTAN15L0750
1.5 mm	-200...1150°C	1000 mm	FTAN15L1000
3.0 mm	-200...1150°C	500 mm	FTAN30L0500
3.0 mm	-200...1150°C	750 mm	FTAN30L0750
3.0 mm	-200...1150°C	1000 mm	FTAN30L1000
6.0 mm	-200...1150°C	500 mm	FTAN60L0500
6.0 mm	-200...1150°C	750 mm	FTAN60L0750
6.0 mm	-200...1150°C	1000 mm	FTAN60L1000

Connection cable	Operative range	Length	Order no
FEP/silicone Thermal line (stranded wire)	-50...200°C	1.5 m	default
		5 m	OTNK01L0050

DAkKS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)  
 DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO 9001:2015.

# Temperature

## Resistor-based sensors Pt100 4L

Typical Application: universal, in range -40°C to 400°C

Diameter d1 Sensor tip	Diameter d2, Sheathed line	Operating temp. Sensor tip	Length L	Order no.
1.5 mm	1.5 mm**	-40...400°C	100 mm	FPA15L0100
1.5 mm	1.5 mm**	-40...400°C	250 mm	FPA15L0250
1.5 mm	1.5 mm**	-40...400°C	500 mm	FPA15L0500
2.2 mm*	2.0 mm	-40...400°C	100 mm	FPA22L0100
2.2 mm*	2.0 mm	-40...400°C	250 mm	FPA22L0250
2.2 mm*	2.0 mm	-40...400°C	500 mm	FPA22L0500
3.2 mm*	2.8 mm	-40...400°C	100 mm	FPA32L0100
3.2 mm*	2.8 mm	-40...400°C	250 mm	FPA32L0250
3.2 mm*	2.8 mm	-40...400°C	500 mm	FPA32L0500

\* This sensor type (reinforced tip) is not suitable for clamped screw connections.

Suitable types FPA20Lx or FPA30Lx with same end-to-end diameter are available on request.

\*\* Too strong bending of / kinking of the sheathed line should be avoided.

Options	Order no.
Accuracy class B	default
Accuracy class A	OPG2
Accuracy class 1/5 DIN Class B	OPG5
<b>Wire-wound measuring resistor</b> operating range -200 ... 450 ° C	OPM1

Connection cable	Operative range	Length	Order no.
FEP/silicone	-50...200°C	1.5 m 5 m	default OPK01L0050
PVC/PVC	-20...105°C	1.5 m 5 m	OPK02L0015 OPK02L0050

## Resistor-based sensors NTC

Typical Application: universal, in range 0°C to typ. 70°C

Diameter d1 Sensor tip	Diameter d2, Sheathed line	Operating temp. Sensor tip	Length L	Order no.
2.0 mm	2.0 mm	-20...100°C	100 mm	FNA20L0100
2.0 mm	2.0 mm	-20...100°C	250 mm	FNA20L0250
2.0 mm	2.0 mm	-20...100°C	500 mm	FNA20L0500
3.2 mm*	2.8 mm	-20...100°C	100 mm	FNA32L0100
3.2 mm*	2.8 mm	-20...100°C	250 mm	FNA32L0250
3.2 mm*	2.8 mm	-20...100°C	500 mm	FNA32L0500

\* This sensor type (reinforced tip) is not suitable for clamped screw connections.

Suitable types with same end-to-end diameter are available on request.

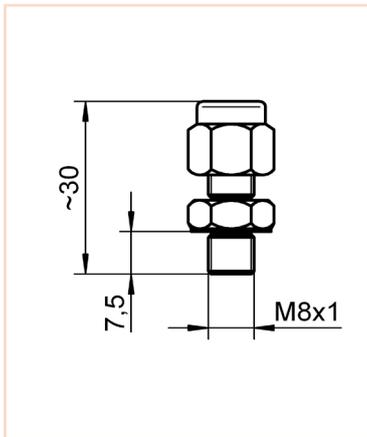
Connection cable	Operative range	Length	Order no.
PVC/PVC	-20...105°C	1.5 m 5 m	default OPK02L0050

## Handle for sensors with hexagonal cable sleeve



Option Handle including fitting **Order no. OFH1**

## Clamp screw connection ZT943xKV



**Operative range**  
For sheath elements

**Option:**  
Notched steel ring  
(once fitted, cannot be removed),  
 $T_{max} = 800\text{ °C}$   
For ZT9431KV  
Order no. OT9431ST  
For ZT9432KV  
Order no. OT9432ST

Variants (with PTFE clamping ring)	Order no.
for types FTA15Lxxxx, FPA16Lxxxx	<b>ZT9431KV</b>
for types FTA30Lxxxx, FPA30Lxxxx and FNA30Lxxxx	<b>ZT9432KV</b>

### Technical data

Operating temperature	up to maximum 250 °C with option up to 800 °C
Thread	M8x1, 14 AF

## Heat-conducting paste ZB9000WP

For surface measurement, operative range -30 to +200 °C, heat-conducting paste, tube, 12 ml **Order no. ZB9000WP**

# Temperature

## NiCr-Ni-sensor FTA 15 P1



For immersion measurement

Accuracy: NiCr-Ni class 1\*  
Measuring tip: Operative range -200...+1100 °C  
200x1.5 mm, sheathed line, Inconel  
 $T_{90}$ : \* 1.5 s  
Cable: 1.5 m FEP/silicone thermal line\*\*  
with ALMEMO® connector

L = 200 mm **Order no. FTA15P1**  
(No variants available)  
Option: Handle mounted **Order no. OFH1**

## Pt100-sensor FPA 32 P1



For immersion measurement

Accuracy: Pt100 film resistor, class B\*  
Measuring tip: Operative range -40...+400 °C  
200 x 2.8 Measuring tip reinforced 3.2 mm,  
sheathed line stainless steel  
 $T_{90}$ : \* 10 s  
Cable: 1.5 m PVC / PVC  
with ALMEMO® connector

L = 200 mm **Order no. FPA32P1**  
(No variants available)  
Option: Handle mounted **Order no. OFH1**

## NTC-sensor FNA 305



For Indoor air measurements

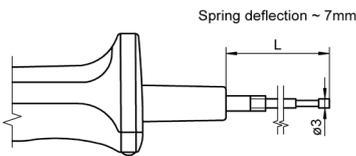
Accuracy: NTC, see page 07.04  
Measuring tip: Operative range -10 to +60 °C  
(non-condensing)  
Protective tube in stainless steel  
Diameter = 3.0mm, length = 50 mm  
mounted directly on ALMEMO® connector  
 $T_{90}$  8 s

L = 50 mm **Order no. FNA305**  
(No variants available)

\* Range of validity see page 07.03

\*\* There is no adverse temperature effect at the juncture from measuring element to cable. see page 07.03

## NiCr-Ni sensor with handle FTA 120x

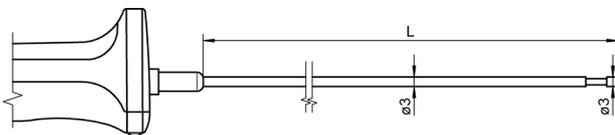


Accuracy: NiCr-Ni class 1\*  
 Measuring tip: Operative range -200...+400 °C  
 Silver rivet, level, spring-loaded, not electrically isolated  
 $T_{90}$ : \* 3 s  
 Handle: \* 138 mm  
 Cable: 1.5 m PVC

For surface measurement and immersion measurement

L = 30 mm **Order no. FTA1201**  
 L = 150 mm **Order no. FTA1202**

## NiCr-Ni sensor with handle FTA 122 LxxxxH

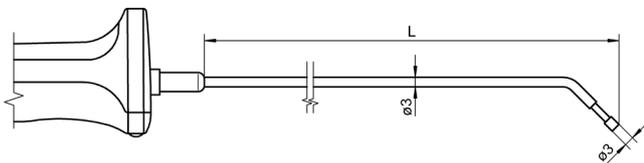


Accuracy: NiCr-Ni class 1\*  
 Measuring tip: Operative range -200...+400 °C  
 Silver rivet, level, not electr. isolated  
 $T_{90}$ : \* 3 s  
 Handle: \* 127 mm  
 Cable: 1.5 m FEP/silicone thermal line\*\*

For surface measurement and immersion measurement

L = 50 mm **Order no. FTA122L0050H**  
 L = 100 mm **Order no. FTA122L0100H**  
 L = 200 mm **Order no. FTA122L0200H**

## NiCr-Ni sensor with handle FTA 121 LxxxxH

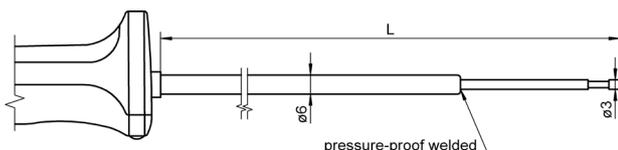


Accuracy: NiCr-Ni class 1\*  
 Measuring tip: Operative range -200...+400 °C  
 Silver rivet, level, angled, not electrically isolated  
 $T_{90}$ : \* 3 s  
 Handle: \* 127 mm  
 Cable: 1.5 m FEP/silicone thermal line\*\*

For surface measurement and immersion measurement

L = approx. 50 mm **Order no. FTA121L0050H**  
 L = approx. 200 mm **Order no. FTA121L0200H**

## NiCr-Ni sensor with handle FTA 150 LxxxxH



Accuracy: NiCr-Ni class 1\*  
 Measuring tip: Operative range -200...+800 °C  
 Stainless-steel rivet, level, electrically isolated  
 $T_{90}$ : \* 3 s  
 Handle: \* 127 mm  
 Cable: 1.5 m FEP/silicone thermal line\*\*

For surface measurement and immersion measurement

L = 350 mm **Order no. FTA150L0350H**  
 L = 700 mm **Order no. FTA150L0700H**  
 L = 1250 mm **Order no. FTA150L1250H**

\* Range of validity see page 07.03

\*\* There is no adverse temperature effect at the juncture from measuring element to cable. see page 07.03

# Temperature

## NiCr-Ni sensor FTA 109 P



For surface measurement

Accuracy: NiCr-Ni class 2\*  
Measuring tip: Operative range -50...+500 °C  
Thermal ribbon, not electr. isolated  
Measuring head approx. 15 mm diameter  
 $T_{90}$ : \* 1 s  
Cable: 1.5 m FEP/silicone thermal line\*\*

L = approx. 180 mm  
Sensor with handle  
(No variants available)

**Order no. FTA109P**  
**Order no. FTA109PH**

## NiCr-Ni sensor FTA 104 P



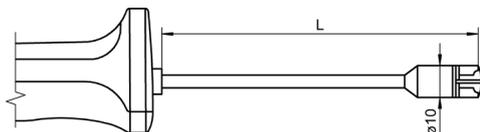
For surface measurement

Accuracy: NiCr-Ni class 2\*  
Measuring tip: Operative range -50...+500 °C  
Thermal ribbon, not electr. isolated  
Measuring head approx. 15 mm diameter  
 $T_{90}$ : \* 1 s  
Cable: 1.5 m FEP/silicone thermal line\*\*

L = approx. 180 mm,  
with 90° angle, approx. 50 mm  
Sensor with handle  
(No variants available)

**Order no. FTA104P**  
**Order no. FTA104PH**

## NiCr-Ni sensor with handle FTA 153 LxxxxH

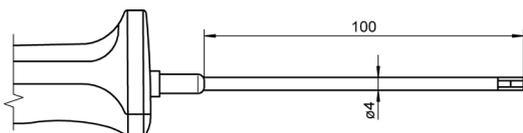


For surface measurement

Accuracy: NiCr-Ni class 2\*  
Measuring tip: Operative range -200...+250 °C  
Thermal ribbon, crossed,  
not electrically isolated  
 $T_{90}$ : \* 1.5 s  
Handle: \* 127 mm  
Cable: 1.5 m PVC

L = 100 mm **Order no. FTA153L0100H**

## NiCr-Ni sensor with handle FTA 1535 LxxxxH



For surface measurement

Accuracy: NiCr-Ni class 2\*  
Measuring tip: Operative range -200...+250 °C  
Thermal ribbon, not electr. isolated  
 $T_{90}$ : \* 2 s  
Handle: \* 127 mm  
Cable: 1.5 m PVC

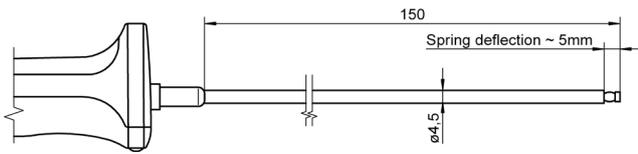
L = 100 mm **Order no. FTA1535L0100H**

\* Range of validity see page 07.03

\*\* There is no adverse temperature effect at the juncture from measuring element to cable. see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## NiCr-Ni sensor with handle FTA 420 LxxxxH

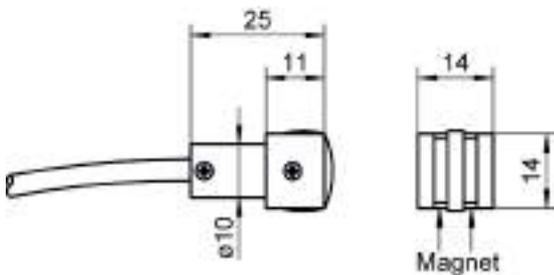


For surface measurement on level surfaces

Accuracy: NiCr-Ni class 1\*  
 Measuring tip: Operative range -50...+500 °C  
 Silver disc, spring-loaded,  
 not electrically isolated  
 $T_{90}$ : \* 2 s  
 Handle: \* 127 mm  
 Cable: 1.5 m PVC

L = 150 mm      **Order no. FTA420L0150H**

## NiCr-Ni sensor FTA 025 P



Magnet sensor for surface measurement

Accuracy: NiCr-Ni class 2\*  
 Measuring tip: Operative range -50...+300 °C  
 Thermal ribbon, not electr. isolated  
 Fastened by magnet  
 $T_{90}$ : \* 1.5 s  
 Cable: approx. 2 m PVC

Magnet sensor  
 (No variants available)      **Order no. FTA025P**



Magnet sensor with Velcro fastener e.g. for pipework

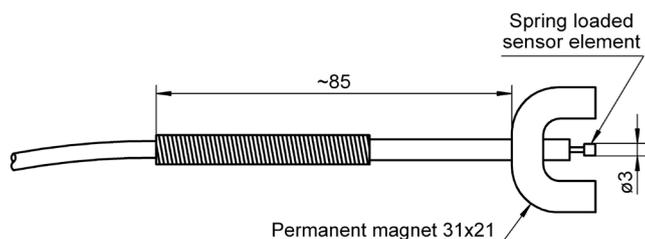
Klettband: approx. 400 mm,  
 for pipe diameter appr. 10 to 75 mm  
 Operating range: -10 ... +110 °C  
 mounted on sensor tip

Magnet sensor, including Velcro fastener  
**Order no. FTA025PKB**

\* Range of validity see page 07.03

# Temperature

## NiCr-Ni sensor FTA 131

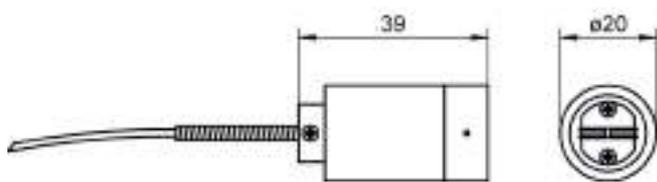


Magnet sensor For surface measurement

Accuracy: NiCr-Ni class 2\*  
Measuring tip: Operative range -50...+100 °C  
Silver rivet, level, spring-loaded,  
not electrically isolated  
Fastened by magnet  
 $T_{90}$ : \* 3 s  
Cable: 3 m FEP/silicone

Magnet sensor **Order no. FTA131**

## NiCr-Ni sensor FTA 026 P

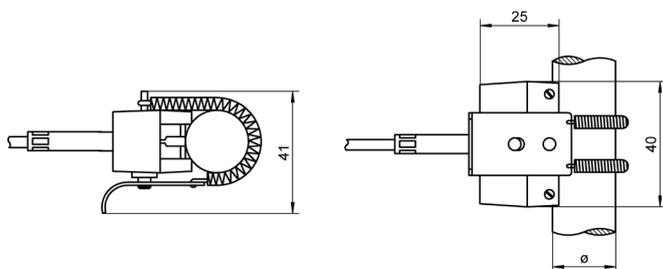


For surface measurement

Accuracy: NiCr-Ni class 1\*  
Measuring tip: Operative range -50...+300 °C  
Thermal ribbon,  
not electrically isolated  
 $T_{90}$ : \* 1.5 s  
Cable: approx. 0.9 m line, fabric insulation

Ribbon sensor **Order no. FTA026P**  
(No variants available)

## NiCr-Ni sensor FTA 8068



For surface measurement on pipes

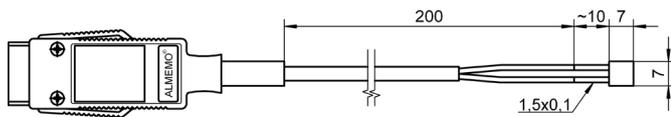
Accuracy: NiCr-Ni class 2\*  
Measuring tip: Operative range -50...+120 °C  
Thermal ribbon, not electr. isolated  
Fastened by pipe clamp  
(spring-loaded)  
 $T_{90}$ : \* 3 s  
Pipe diameter: 12...25 mm  
Cable: 1.2 m PVC

Pipe clamp sensor **Order no. FTA8068**

\* Range of validity see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## NiCr-Ni film thermocouple FTA 683



For surface measurement

Accuracy: NiCr-Ni class 2\*  
 Measuring tip: Operative range -100 to +200°C  
 Folie, Insulation Kresol  
 $T_{90}$ : \* 2 s

with permanently connected FEP / silicone thermal line (stranded wire)\*\*

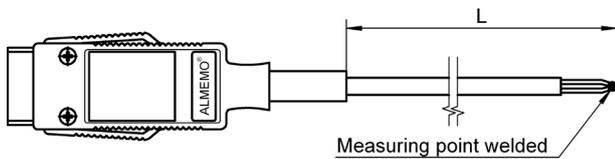
-50 to +200°C, 2 meters, with ALMEMO® connector

**Order no. FTA683**

Measuring element without cable, free ends

(for your own sensors) **Order no. FT0683**

## NiCr-Ni sensor FTA 390 x



For surface measurement

Accuracy: NiCr-Ni class 2\*  
 Measuring tip: Thermowire, welded,  
 not electrically isolated  
 $T_{90}$ : \* 3 s  
 Wire: 1.5 m

Insulation, glass fiber,

Operative range -25...+400 °C

**Order no. FTA3900**

Insulation FEP,

Operative range -200...+205 °C

**Order no. FTA39010**

\* Range of validity see page 07.03

\*\* There is no adverse temperature effect at the juncture from measuring element to cable. see page 07.03

## Digital infra-red sensor for measuring surface temperature FIAD43



Operative range: -40...600 °C,  
 Miniature probe head, with cable and ALMEMO® D6 plug  
 and 1 mounting nut

Cable length = 1 m

**Order no. FIAD4332**

Cable length = 3 m

**Order no. FIAD4332L3**

For technical data, see page 07.34

DAkKS or factory calibration KI9xxx temperature for digital sensor (see chapter Calibration certificates)

## Compact infra-red probe head FIA844



Operative range: -20...500 °C,  
 Probe head, with cable and ALMEMO® plug  
 and 2 mounting nuts

Cable length = 1 m

**Order no. FIA844**

Cable length = 3 m

**Order no. FIA844L3**

For technical data, see page 07.36

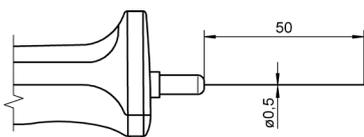
Factory calibration KI9xxx temperature for sensor (see chapter Calibration certificates)

DAkKS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)

DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO 9001:2015.

# Temperature

## NiCr-Ni sensor with handle FTA 05 L0050H

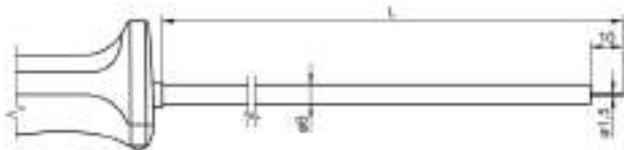


For immersion measurement

Accuracy: NiCr-Ni class 1\*  
 Measuring tip: Operative range -200...+500 °C  
 Sheathed line, Inconel  
 $T_{90}$ : \* 0.8 s  
 Handle: \* 127 mm  
 Cable: 1.5 m FEP/silicone thermal line\*\*

L = 50 mm **Order no. FTA05L0050H**

## NiCr-Ni sensor with handle FTA 125 LxxxxH

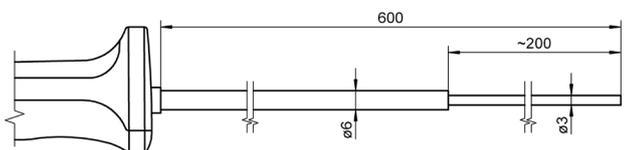


For immersion measurement

Accuracy: NiCr-Ni class 1\*  
 Measuring tip: Operative range -200...+800 °C  
 Sheathed line, Inconel  
 $T_{90}$ : \* 1.5 s  
 Handle: \* 127 mm  
 Cable: 1.5 m FEP/silicone thermal line\*\*

L = 300 mm **Order no. FTA125L0300H**

## NiCr-Ni sensor with handle FTA 126 LxxxxH

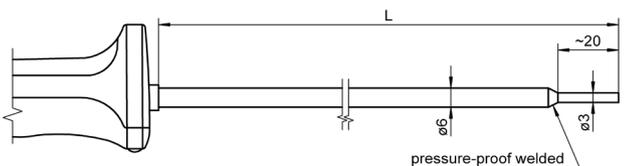


For immersion measurement

Accuracy: NiCr-Ni class 1\*  
 Measuring tip: Operative range -200...+800 °C  
 Sheathed line, Inconel  
 $T_{90}$ : \* 2.5 s  
 Handle: \* 127 mm  
 Cable: 1.5 m FEP/silicone thermal line\*\*

L = 600 mm **Order no. FTA126L0600H**

## NiCr-Ni sensor with handle FTA 1261 LxxxxH



For immersion measurement in plastic and pasty substances,  
 e.g. bitumen

Accuracy: NiCr-Ni class 1\*  
 Measuring tip: Operative range -200...+500 °C  
 Sheathed line, Inconel  
 $T_{90}$ : \* 3 s  
 Handle: \* 127 mm  
 Cable: 1.5 m FEP/silicone thermal line\*\*

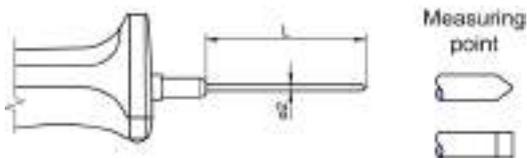
L = 150 mm **Order no. FTA1261L0150H**  
 L = 300 mm **Order no. FTA1261L0300H**

\* Range of validity see page 07.03

\*\* There is no adverse temperature effect at the juncture from measuring element to cable. see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)  
 DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## NiCr-Ni sensor with handle FTA 123 LxxxxH

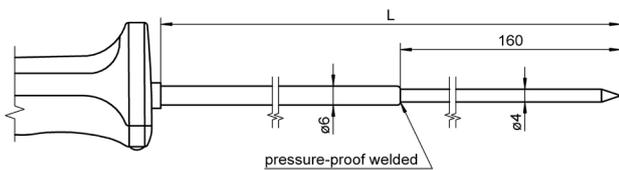


For immersion measurement in plastic and pasty substances

Accuracy: NiCr-Ni class 1\*  
 Measuring tip: Operative range -200...+300 °C  
 Penetrating tip  
 $T_{90}$ : \* 3 s  
 Handle: \* 127 mm  
 Cable: 1.5 m FEP/silicone thermal line\*\*

L = 50 mm      **Order no. FTA123L0050H**  
 L = 100 mm     **Order no. FTA123L0100H**

## NiCr-Ni sensor with handle FTA 1231 LxxxxH



For immersion measurement in plastic and pasty substances

Accuracy: NiCr-Ni class 1\*  
 Measuring tip: Operative range -200...+400 °C  
 Penetrating tip, cone  
 stainless steel 1.4541  
 $T_{90}$ : \* 6 s  
 Handle: \* 127 mm  
 Cable: 1.5 m FEP/silicone thermal line\*\*

L = 250 mm      **Order no. FTA1231L0250H**

\* Range of validity see page 07.03

\*\* There is no adverse temperature effect at the juncture from measuring element to cable. see page 07.03

# Temperature

## NiCr-Ni thermowire T 190-0



Accuracy: NiCr-Ni class 2\*  
Insulation : Glass fiber (wires and sheath)  
Operating temp.: -25°C to +400°C  
Wire diameter: 0.5 mm  
External diameter: approx. 1.3 x 2.1 mm

NiCr-Ni thermowire per meter  
with glass fiber covering **Order no. LT01900**  
NiCr-Ni thermowire sensor, welded tip, with  
ALMEMO® connector 1.5m long **Order no. FTA3900**  
ALMEMO® connector 5m long **Order no. FTA3900L05**

## NiCr-Ni thermowire T 190-1



Accuracy: NiCr-Ni class 2\*  
Insulation : Glass fiber (wires and sheath)  
Operating temp.: -25°C to +400°C  
Wire diameter: 0.2 mm  
External diameter: approx. 0.6 x 1.0 mm

NiCr-Ni thermowire per meter  
with glass fiber covering **Order no. LT01901**  
NiCr-Ni thermowire sensor, welded tip, with  
ALMEMO® connector 1.5 m long **Order no. FTA3901**  
ALMEMO® connector 5m long **Order no. FTA3901L05**

## NiCr-Ni thermowire T 190-2



Accuracy: NiCr-Ni class 2\*  
Insulation : PVC (wires and sheath)  
Operating temp.: -10°C to +105°C  
Wire diameter: 0.5 mm  
External diameter: approx. 2.2 x 3.4 mm

NiCr-Ni thermowire per meter  
with PVC insulation **Order no. LT01902**  
NiCr-Ni thermowire sensor, welded tip, with  
ALMEMO® connector 1.5 m long **Order no. FTA3902**  
ALMEMO® connector 5 m long **Order no. FTA3902L05**

## NiCr-Ni thermowire T 190-3



Accuracy: NiCr-Ni class 2\*  
Insulation : Silicone (wires and sheath)  
Operating temp.: -45°C to +200°C  
Wire diameter: 0.5 mm  
External diameter: approx. 4 mm

NiCr-Ni thermowire per meter  
with silicone insulation **Order no. LT01903**  
NiCr-Ni thermowire sensor, welded tip, with  
ALMEMO® connector 1.5 m long **Order no. FTA3903**  
ALMEMO® connector 5 m long **Order no. FTA3903L05**

\* Range of validity see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## NiCr-Ni thermowire T 190-10



Accuracy: NiCr-Ni class 2\*  
 Insulation : FEP (Wires and sheath)  
 Operating temp.: -200°C to +205°C  
 Wire diameter: 0.5 mm  
 External diameter: approx. 1.5 x 2.5 mm

NiCr-Ni thermowire per meter with FEP insulation **Order no. LT019010**  
 NiCr-Ni thermowire sensor, welded tip, with ALMEMO® connector 1.5m long **Order no. FTA39010**  
 ALMEMO® connector 5m long **Order no. FTA39010L05**

## NiCr-Ni thermowire T 190-11



Accuracy: NiCr-Ni class 2\*  
 Insulation : FEP (Wires and sheath)  
 Operating temp.: -200°C to +205°C  
 Wire diameter: 0.2 mm  
 External diameter: approx. 1.3 x 2.0 mm

NiCr-Ni thermowire per meter with FEP insulation **Order no. LT019011**  
 NiCr-Ni thermowire sensor, welded tip, with ALMEMO® connector 1.5m long **Order no. FTA39011**  
 ALMEMO® connector 5m long **Order no. FTA39011L05**

## NiCr-Ni thermowire T 190-7



Accuracy: NiCr-Ni class 2\*  
 Insulation : Ceramic fiber (Wires and sheath)  
 Operating temp.: -40°C to +1200°C  
 Wire diameter: 0.8 mm  
 External diameter: approx. 3 x 4 mm

NiCr-Ni thermowire per meter with ceramic fiber insulation **Order no. LT01907**  
 NiCr-Ni thermowire sensor, welded tip, with ALMEMO® connector 1.5m long **Order no. FTA3907**  
 ALMEMO® connector 5m long **Order no. FTA3907L05**

Nur für trockene, nicht aggressive Umgebung!

## NiCr-Ni compensation line T 191-1



compensation line: NiCr-Ni  
 Insulation : PVC (Wires and sheath)  
 Operating temp.: -10°C to +105°C  
 Wire diameter: 0.5 mm  
 External diameter: approx. 3.6 mm

NiCr-Ni bunched conductor with PVC insulation, for each meter **Order no. LT01911**

### Other types are available on request.

LT01912 Insulation Silicone/silicone/glass filament, up to 200°C  
 LT01913 Insulation PVC / screening film / PVC, up to 105°C

## NiCr-Ni thermal line (Litze) T 191-6



Thermal line (stranded wire): NiCr-Ni\*  
 Insulation: Wires : FEP, sheath : silicone  
 Operating temp.: -50...+200°C  
 Wire diameter: 0.7 mm  
 External diameter: approx. 3.8 mm

NiCr-Ni thermal line (stranded wire) with FEP / silicone insulation, per meter **Order no. LT01916**

\* Range of validity see page 07.03

\*\* There is no adverse temperature effect at the juncture from measuring element to cable. see page 07.03

# Temperature

## ALMEMO® connector for thermocouples (see Chapter Input connectors)



### For Types K, N, L, J, T

(no thermo-electric transition / with thermal material)

NiCr-Ni (K)	Order no. ZA9020FS
NiCroSil-NiSil (N)	Order no. ZA9021FSN
Fe-CuNi (J)	Order no. ZA9021FSJ
Cu-CuNi (T)	Order no. ZA9021FST

### For Types U, S, R, B, AuFe-Cr

Cu-CuNi (U)	Order no. ZA9000FSU
PtRh10-Pt (S)	Order no. ZA9000FSS
PtRh13-Pt (R)	Order no. ZA9000FSR
PtRh30-PtRh6 (B)	Order no. ZA9000FSB
AuFe-Cr (A)	Order no. ZA9000FSA

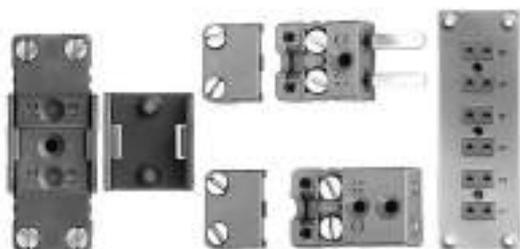
## ALMEMO® adapter plug with miniature flat socket



### For Types K, J, T, S

NiCr-Ni (K)	Order no. ZKA029RA
Fe-CuNi (J)	Order no. ZJA029RA
Cu-CuNi (T)	Order no. ZTA029RA
PtRh-Pt (S)	Order no. ZSA029RA

## Miniature flat connectors for thermocouples types K, J, T, S, E



### Examples for NiCr-Ni (K):

NiCr-Ni flat socket	Order no. ZK9029FB
NiCr-Ni flat connector	Order no. ZK9029FS
Locking plate (10 pieces)	Order no. ZB9026VP
NiCr-Ni single built-in socket	Order no. ZK9029FE
1-row panel with NiCr-Ni socket	Order no. ZK9029FB1
6-row panel with NiCr-Ni socket	Order no. ZK9029FB6

- Connectors with thermo contacts for avoiding voltage corruption at thermocouple junctions.
- For ambient temperatures -183 to +200 °C.
- Locking plate for complete coupling.

Order numbers for the above examples are compiled from the following coding elements : Z①9029F②③.

The coding elements can be taken from the table below.

### Ordering:

Type ①	Color (IEC 584)	Variant ②	Panel ③	Panel dimensions
NiCr-Ni (K)	green	Male connector = S	1-er (1-rhg)	38 x 38 x 2.5 mm
Fe-CuNi (J)	black	Female connector = B	6-er (1-rhg)	113 x 38 x 2.5 mm
Cu-CuNi (T)	brown		12-er (1-rhg)	203 x 38 x 2.5 mm
NiCr-CuNi (E)	lilac		24-er (2-rhg)	203 x 76 x 2.5 mm
PtRh-Pt (S)	orange			mounting depth: 25.4 mm

DAkKS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Pt100 temperature sensors for special applications in humid conditions up to 150 / 250 °C

High-grade Pt100 resistance sensor  
For measuring operations in very humid atmospheric conditions  
Operative over a wide range of temperatures

## Pt100 temperature sensors for applications in laboratories and medical engineering



### Technical data

Accuracy:	Pt100 film resistor, class A*
Protective tube	Stainless steel, diameter 3 mm, length 20 mm
Operative range	-30 to +150 °C
Cable	PFA, length 5 m
Working pressure	maximum 3.0 bar
Protective class	IP69K
ALMEMO® plug	Pt100 with resolution 0.01 K.

Especially suitable for measuring temperatures in autoclaves, sterilizing units, high-temperature steam applications, vacuum applications, and freeze drying units

### Variants

Pt100 sensor, cable length = 5 m, ALMEMO® plug

**Order no. FPA30K20L0020**

## Pt100 temperature sensors for industrial applications in air-conditioning / heat cabinets



### Technical data

Accuracy:	Pt100 film resistor, class B*
Protective tube	Stainless steel, diameter 4 mm, length 50 mm
Operative range	-100 to +250 °C
Cable	PFA
Protective class	IP68
ALMEMO® plug	Pt100 with resolution 0.01 K.

Especially suitable for measuring temperatures in air-conditioning / heat cabinets with high atmospheric humidity  
Operative over a wide range of temperatures

### Variants

Pt100 sensor, cable length = 5 m, ALMEMO® plug

Pt100 sensor, cable length = 10 m, ALMEMO® plug

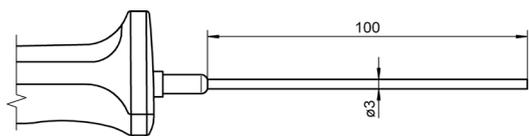
**Order no. FPA40ST0050S01KL0050**

**Order no. FPA40ST0050S01KL0100**

\* Range of validity see page 07.03

# Temperature

## Pt100 sensor with handle FPA 106 LxxxxH

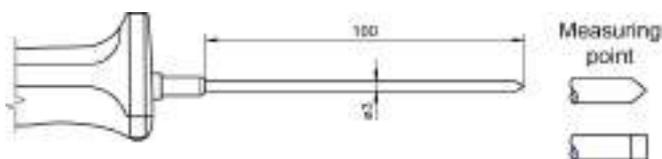


For immersion measurement

Accuracy: Pt100 film resistor, class B\*  
Measuring tip: Operative range -40...+400 °C  
Sheath element, stainless steel  
 $T_{90}$ : \* 8 s  
Handle: \* 127 mm  
Cable: 1.5 m FEP/silicone

L = 100 mm **Order no. FPA106L0100H**

## Pt100 sensor with handle FPA 123 LxxxxH

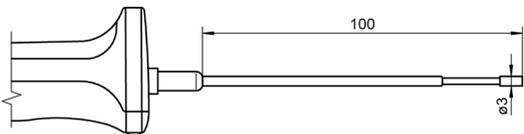


For immersion measurement in plastic and pasty substances

Accuracy: Pt100 film resistor, class B\*  
Measuring tip: Operative range -40...+400 °C  
Penetrating tip  
 $T_{90}$ : \* 8 s  
Handle: \* 127 mm  
Cable: 1.5 m FEP/silicone

L = 100 mm **Order no. FPA123L0100H**

## Pt100 sensor with handle FPA 124 LxxxxH



For surface measurement and immersion measurement

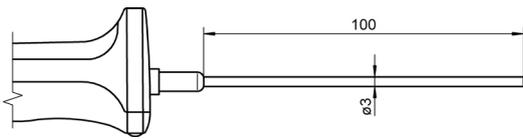
Accuracy: Pt100 film resistor, class B\*  
Measuring tip: Operative range -40...+300 °C  
Silver rivet, level  
 $T_{90}$ : \* 10 s  
Handle: \* 127 mm  
Cable: 1.5 m FEP/silicone

L = 100 mm **Order no. FPA124L0100H**

\* Range of validity see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## NTC sensor with handle FNA 106 LxxxxH

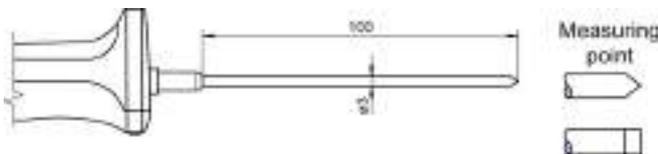


For immersion measurement

Accuracy: NTC, see page 07.04  
 Measuring tip: Operative range -20...+100 °C  
 Sheath element, stainless steel  
 $T_{90}$ : \* 8 s  
 Handle: \* 127 mm  
 Cable: 1.5 m PVC

L = 100 mm      **Order no. FNA106L0100H**

## NTC sensor with handle FNA 123 LxxxxH

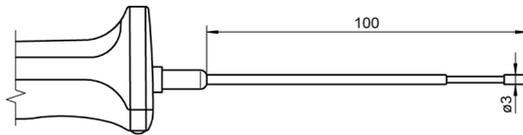


For immersion measurement in plastic and pasty substances

Accuracy: NTC, see page 07.04  
 Measuring tip: Operative range -20...+100 °C  
 Penetrating tip  
 $T_{90}$ : \* 8 s  
 Handle: \* 127 mm  
 Cable: 1.5 m PVC

L = 100 mm      **Order no. FNA123L0100H**

## NTC sensor with handle FNA 124 LxxxxH



For surface measurement and immersion measurement

Accuracy: NTC, see page 07.04  
 Measuring tip: Operative range -20...+100 °C  
 Silver rivet, level  
 $T_{90}$ : \* 10 s  
 Handle: \* 127 mm  
 Cable: 1.5 m PVC

L = 100 mm      **Order no. FNA124L0100H**

## NTC sensor FNA 305



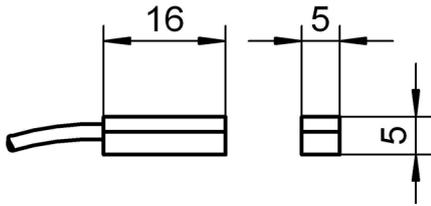
For room air measurement

Accuracy: NTC, see page 07.04  
 Measuring tip: Operative range -10...+60°C  
 (non-condensing), Protective tube  
 in stainless steel  
 diameter = 3.0mm, length = 50mm  
 mounted directly on ALMEMO® connector  
 $T_{90}$ : 8 s

L = 50 mm      **Order no. FNA305**  
 (No variants available)

# Temperature

## Pt100 sensor FPA 611 x



For surface measurement



Accuracy: Pt100 film resistor, class B\*  
Measuring tip: Operative range see below  
Copper, level  
Improved thermal transfer thanks to innovative sensor element and new contact technology  
T<sub>90</sub>\*: 20 s  
Cable: see below

Surface sensor  
-10...+90°C, Cable PVC, 2 m **Order no. FPA611**  
-10...+110°C, Cable, PFA, 3m for more demanding mechanical stress ALMEMO® connector, resolution 0.01 K  
**Order no. FPA611S01**

Accessories  
Fixture for fastening with cable ties **Best-Nr. ZB9611RM**

## Pt100 film sensor FPA 686

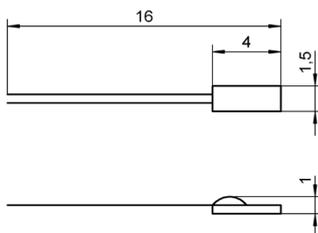


For surface measurement

Accuracy: Pt100 wire-wound, class B\*  
Messfläche: Operative range -50...+200 °C,  
temperature-resistant foil,  
15 x 40 mm, approx. 0.5 mm thick  
T<sub>90</sub>\*: 2 s  
Cable: Stranded wire PFA, 4-wire twisted

Length 2 m **Order no. FPA686**  
Length 10 m **Order no. FPA686L10**

## Pt100 ceramic chip sensor element FP 0802



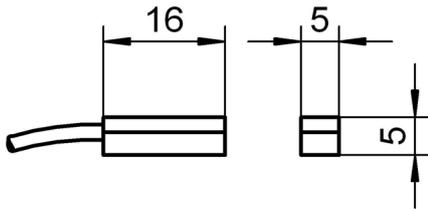
Unprotected sensor element for constructing your own sensors

Accuracy: Pt100 film resistor, class B\*  
Measuring tip: Operative range -40...+400 °C  
Ceramic chip sensor  
Connection wires: 10 mm, bare  
Ceramic chip sensor **Order no. FP0802**

\* Range of validity see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## NTC sensor FNA 611



For surface measurement

Accuracy: NTC, see page 07.04  
 Measuring tip: Operative range -10...+90 °C  
 Copper, level  
 $T_{90}$ : \* 20 s  
 Cable: 2 m PVC

Surface sensor **Order no. FNA611**



Accessories  
 Fixture for fastening  
 with cable ties

**Best-Nr. ZB9611RM**

## NTC sensor FN 0001 K



Unprotected sensor element with cable



Accuracy: NTC, see page 07.04  
 Measuring tip: Sensor element, unprotected  
 Operative range: -20...+100°C  
 Connection wires: appr. 180 mm, fluoropolymer insulation  
 Connecting cable: 2 meters, PVC, thin stranded pick-up  
 wire, Operative range -10 to +90 °C  
 Cable juncture, in shrink-fit

NTC sensor with cable,  
 free ends

**Order no. FN0001K**

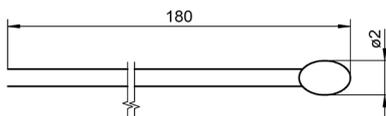
Option:

ALMEMO® connector including assembly

Single connectors for 1 sensor Order no. OT9040AS

Double connector for 2 sensors Order no. OT9040AS2

## NTC sensor element FN 0001



Unprotected sensor element for constructing your own sensors

Accuracy: NTC, see page 07.04  
 Measuring tip: Operative range -20...+100 °C  
 Sensor

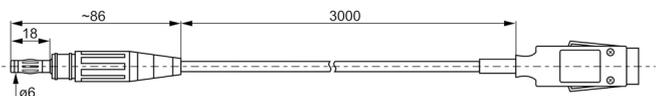
Connection wires 180 mm, fluoropolymer insulation

Sensor

**Order no. FN0001**

# Temperature

## Pt100 Plug-in laboratory sensor FPA 416

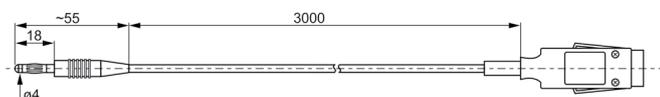


Measuring element integrated in the socket of a 6 mm laboratory connector made of brass (nickel-plated).

Accuracy: Pt100 film resistor, class B\*  
Measuring tip: Operative range -40...+150 °C  
 $T_{90}^*$ : 15 s  
Cable: Silicone/FEP 3m  
ALMEMO® connector: resolution 0.01 K

Plug-in laboratory sensor **Order no. FPA416**

## Pt100 Plug-in laboratory sensor FPA 414



Measuring element integrated in the socket of a 4 mm laboratory connector made of brass (gold-plated).

Accuracy: Pt100 film resistor, class B\*  
Measuring tip: Operative range -40...+150 °C  
 $T_{90}^*$ : 15 s  
Cable: Silicone/FEP 3m  
ALMEMO® connector: resolution 0.01 K

Plug-in laboratory sensor **Order no. FPA414**



Plug-in laboratory sensor, examples of use  
Measuring object with hole for inserted PT100 plug-in laboratory sensor.

\* Range of validity see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Pt100 cable sensor



Inexpensive resistance-based temperature sensors.  
 For immersion measurements in air and gases.  
 Rigid protective tube made from stainless steel  
 A wide variety of cable variants.  
 Operating temperature (depending on variant) -40 to +400°C.

### Technical data

Accuracy:	Pt100 film resistor, class B* (no other variants in stock)
Protective tube:	Diameter, length see Variants, stainless steel 1.4301
Junction of protective tube / connecting cable:	Direct, hard-crimped for dry uses
Cables:	Length = 1.5 meters, Other lengths are available as options. Cable diameter is never larger than the diameter of the protective tube.
Operating temperature:	see variants, Always for whole sensor (i.e. sensor tip and cable)
ALMEMO® connector:	resolution 0.01 K.



#### Please note:

Only for usage in a dry environment

#### Note:

For temperature sensors suitable for usage in humid environments (e.g. climatic chamber) see page 07.21



## Variants

### With FEP / FEP cable (black),

Operative range -40...+250°C:

Diameter	Length	Order no.
3.0 mm	50 mm	<b>FPA30K03L0050</b>
3.0 mm	100 mm	<b>FPA30K03L0100</b>
4.0 mm	50 mm	<b>FPA40K03L0050</b>
4.0 mm	100 mm	<b>FPA40K03L0100</b>

#### A longer cable is available as an option

Total length 5 m                      OPK03L0050

Total length 10 m                     OPK03L0100

### With FEP / silicone cable (red),

Operative range -40...+200°C:

Diameter	Length	Order no.
5.0 mm	50 mm	<b>FPA50K01L0050</b>
5.0 mm	100 mm	<b>FPA50K01L0100</b>
6.0 mm	50 mm	<b>FPA60K01L0050</b>
6.0 mm	100 mm	<b>FPA60K01L0100</b>

#### A longer cable is available as an option

Total length 5 m                      OPK01L0050

Total length 10 m                     OPK01L0100

### Cable with glass-fiber / glass-fiber / VA wire shielding,

Operative range -40...+400°C:

Diameter	Length	Order no.
5.0 mm	50 mm	<b>FPA50K06L0050</b>
5.0 mm	100 mm	<b>FPA50K06L0100</b>
6.0 mm	50 mm	<b>FPA60K06L0050</b>
6.0 mm	100 mm	<b>FPA60K06L0100</b>

#### A longer cable is available as an option

Total length 5 m                      OPK06L0050

Total length 10 m                     OPK06L0100

\* Range of validity see page 07.03

# Temperature

## Pt100 glass thermometer with immersion depths as per ASTM



### Operative range:

For immersion measurement in liquid media at low immersion depths.

### Technical data

Accuracy:	Pt100 wire-wound, class A*
Measuring tip	Operative range -50 to +310 °C Glass, tapered Diameter = 3 mm, length = 15 mm
Shaft	Glass, Diameter = 6 mm NL= 250 mm (total nominal length) Labeling codes for immersion depths : identification rings on the shaft as per ASTM specifications (American Society for Testing and Materials)
T <sub>90</sub>	2.5 seconds
Cable junction sleeve	Stainless steel, 8 x 40 mm Cable exit secured with shrink-fit sleeve
Cable	2 meters, FEP / silicone
ALMEMO® connector	Resolution 0.01 K

### Variants

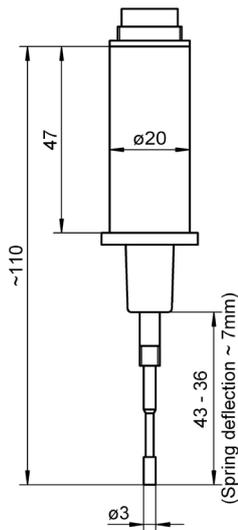
Pt100 glass thermometer with immersion depths as per ASTM specifications, with ALMEMO® connector (including 2-meter FEP / silicone cable)

### Order no.

**FPA910**

\* Range of validity see page 07.03

## Insertable sensor NiCr-Ni with round mounting plug T 820-6



### Operative range:

Measuring tip, spring-loaded, for surface and immersion measurement.

### Accessories:

ALMEMO® connecting cable, 2 meters Order no. ZA9020BK2

### Technical data

Accuracy:	NiCr-Ni class 2*
Measuring tip	Operative range -40 to +400 °C Silver rivet, level, spring-loaded not electrically isolated
T <sub>90</sub> *	3 s
Insert length	60 mm (see layout drawing)
Fixture	Plastic, Ø 20 mm, resistant up to +120 °C
Connection	Round mounting plug

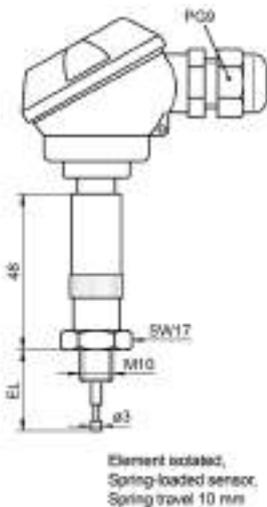
### Types

Insertable sensor NiCr-Ni  
with round mounting plug

### Order no.

**FT98206**

## Insertable sensor NiCr-Ni with terminal head FT 0477



### Operative range:

Spring-loaded measuring tip, for surface and immersion measurement

### Options:

3-meter compensation line PVC, mounted, free ends:  
Order no. OT9020K02L0030  
ALMEMO® plug including assembly for NiCr-Ni-sensor  
Order no. OT9020AS

### Technical data:

Accuracy:	NiCr-Ni class 2*
Measuring tip:	Operative range -40 to +400°C Silver rivet, level, spring-loaded, electronically isolated
Thread:	M10
Insert length:	25 mm (see layout drawing)
Terminal head:	Clamp connector

### Types

Screw-in sensor NiCr-Ni  
with terminal head

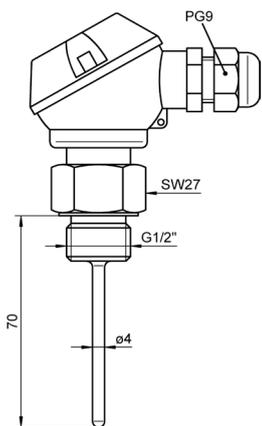
### Order no.

**FT0477**

\* Range of validity see page 07.03

# Temperature

## Insertable sensor Pt100 with terminal head FP 0463



### Operative range:

For immersion measurements, pressure-sealed up to 15 bar.

### Options:

3 meters cable PVC, assembled, free ends  
OT9030K02L0030  
ALMEMO® connector including assembly for Pt100 sensor  
OT9030AS

### Technical data

Accuracy:	Pt100 film resistor, class B*
Sensor tube	Stainless steel
Operative range:	-40...+350°C
Thread	1/2", with copper ring seal, pressure-sealed up to 15 bar
Insert length	70 mm (see layout drawing)
Terminal head	Clamp connector

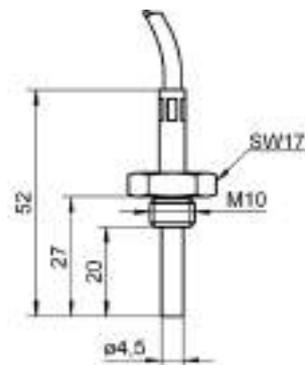
### Variants

Insertable sensor with terminal head

### Order no.

**FP0463**

## Screw-in sensor Pt100, NiCr-Ni with fitted cable Fx 0710 L27M10



### Operative range:

For immersion measurement

### Option:

ALMEMO® connector including assembly for Pt100 sensors:  
Order no. OT9030AS

### Technical data FP0710L27M10

Accuracy:	Pt100 film resistor, class B*
Sensor material:	stainless steel
Operative range:	-40 to +200 °C
Thread:	M10
Insert length:	27 mm (see layout drawing)
Cable:	3 meters, FEP / wire shielding, / FEP free ends

### Variants

Screw-in sensor Pt100 with cable, free ends

Option cable length 5 meters

### Order no.

**FP0710L27M10**

**OPK04L0050**

### Technical data FT0710L27M10

Accuracy:	NiCr-Ni class 2*
Sensor material:	stainless steel
Operative range:	-100 to +400 °C
Thread:	M10
Insert length:	27 mm (see layout drawing)
Cable:	3 meters, thermal line glass filament / glass filament / VA wire shielding, free ends

### Variants

Screw-in sensor NiCr-Ni with cable, free ends

Option cable length 5 meters

### Order no.

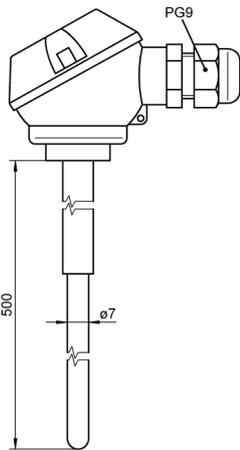
**FT0710L27M10**

**OTK06L0050**

\* Range of validity see page 07.03

DAkKS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Insertable sensor PtRh-Pt (S) with terminal head FT 0425



### Operative range:

For immersion measurements, up to 1400 or 1600 °C.

### Technical data

Accuracy:	Thermowire PtRh-Pt (S) class 1*
Measuring tip	Ceramic tube see under variants
Operative range	see under variants
Insert length	500 mm
Protective tube	Ceramic, replaceable, 7 x 1 mm
Cable	2-meter compensation line silicone insulation, free ends

### Accessories

Ceramic protective tube for T04251 Order no. ZB9425SR1

Ceramic protective tube for FT04252 Order no. ZB9425SR2

### Options

ALMEMO® connector with assembly Order no. OT9020AS

### Variants

Insertable sensor PtRh-Pt type S with terminal head and compensation lines, free ends)

$T_{max} = 1400^{\circ}\text{C}$ , element- $\varnothing = 0.35$  mm, ceramic 610

**FT04251**

$T_{max} = 1600^{\circ}\text{C}$ , element- $\varnothing = 0.5$  mm, ceramic 710

**FT04252**

**FT04252**

\* Range of validity see page 07.03

# Infrared measuring technology



## Why Infrared Measurements?

Infrared measuring instruments provide large advantages with regard to measuring tasks that cannot be solved with conventional contact thermometers. Examples:

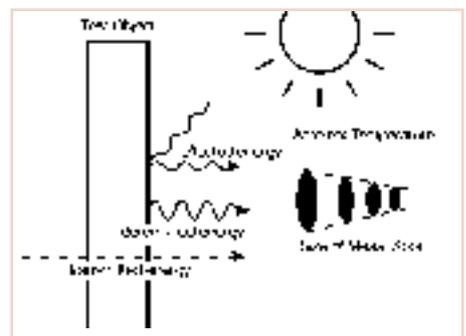
- Measurements of very high temperatures not allowing the use of thermocouples.
- Measurements at surfaces with low thermal conduction and bodies with low thermal capacity.
- Measurements at moving, inaccessible or live parts with a high rate of response (<1s).
- Measurements at objects, which must not be influenced by contact measurements.

## What is Infrared Radiation?

Every substance with a temperature above absolute zero emits an infrared radiation (spectral range of wavelengths from 0.7 to 1000 $\mu\text{m}$ ) that corresponds to its temperature. This range is located below the longer red wavelength range and is not visible to the human eye. For measurements the most interesting range is located between 0.7 and 20 $\mu\text{m}$ .

The infrared radiation emitted by the test object follows the known optical rules and, therefore, can be deviated, bundled with lenses or reflected from catoptric elements.

The **emissivity** of a test object indicates how much infrared energy has been absorbed or released by radiation. The value can be between 0 and 1.0. The fact that the emissivity depends on the wavelength is relevant for measurements. With increasing object temperature the radiation maximum shifts to the short wave range. Therefore, IR thermometers are equipped with filters, which allow only one particular wavelength to pass through for the measurement. The spectral range for spe-



cific materials must be considered for the application.

## How Infrared Thermometers Operate

The optical system of an infrared thermometer captures the energy emitted from a circular measuring spot and focuses it onto a detector. A material with a high transmission factor is used for the lenses. The

energy captured by the detector is electronically amplified and converted into an electrical signal. The optical resolution results from the ratio of the measuring distance to the size of the measuring spot.

The measuring spot must always be smaller than the test object or the measuring point of interest. The higher the optical resolution the smaller the measuring spot can be measured at further distances.

## What is Intermittent Photometry?

Using intermittent photometry eliminates the thermal drift and immunises devices against thermal shock. The stability resul-

ting from this, combined with noise-optimised signal processing, leads to an excellent temperature resolution and allows the

measurement of smallest test objects and fast response times.

## Special Infrared Pyrometers

**Ratio Pyrometers** determine the temperature from the ratio of the energy radiated in each of two wavelength ranges. This method allows for exact measuring results, even in case of a limited view to the test object due to vapour, steam, dust, dirty windows or lenses (up to 95% reduction of meas. signal). Furthermore, test objects, which are smaller than the measuring spot

(e.g. measurement at wires), or low or varying emissivities at fast moving objects, do not affect the measuring result.

**Line Scanners** measure the object temperature along a line. Fixed installed line scanners provide coloured heat flow charts from a product passing under the measuring head (e.g. conveyors, rotary furnaces), but can also be moved to pass above

objects (e.g. heat flow chart of a house wall). The infrared scanner measuring head AMiR 7880 scans up to 256 dots over an angle of 90°. 20 lines can be scanned within one second. One measuring tape can be divided into 3 sectors, side by side or overlapping.

## What You Should Consider For Infrared Measurements

### What to do in case of dust, vapour and aerosols at the measuring point?

If the atmosphere at the measuring point is contaminated with dust, vapour and aerosols, the radiation energy impinging on the sensor can be influenced by contaminated lenses. This can be avoided by using an air blow attachment that keeps the lens clean.

### What to do in case of high ambient temperatures?

If the ambient temperature exceeds the temperature specified for the measuring head of the IR sensor, the measuring head must be protected by mounting an air or water cooling system along with an air blow attachment (to avoid water condensing on the lens). Furthermore, cables and cable routings with high temperature stability must be used.

### What to do in case of heat sources located next to the measuring object?

If heat sources are located next to the test object, these can transmit or reflect additional energy. Such ambience radiations occur, for example, at measurements in industrial furnaces where the wall temperature is often higher than the temperature of the test object. Many infrared instruments allow for a compensation of the ambient temperature.

### What to do in case of measurements in a vacuum?

In case of vacuum furnaces and similar applications it is necessary to mount the measuring head outside of the vacuum area and to perform the measurement through a window. When selecting the measuring window the transmission values of the window must match the spectral sensitivity of the sensor. Quartz glass or quartz are typically used for high temperatures. In case of low temperatures within the 8 to 14µm band the use of a special material, which is translucent for IR, is necessary, e.g. germanium, amir, zinc selenide or sapphire. When selecting the window the temperature requirements, window thickness and pressure difference, as well as the possibility of keeping the window on both sides clean, must be considered. It might be advisable to consider an additional antireflective coating on the window on the window to increase the transmission capacity. Furthermore, it must be considered that not all window materials are translucent in the visible range.

### Why is the emissivity so important?

In case of ideal radiators the reflected and transmitted energy equals zero and the emitted energy corresponds 100% to the characteristic temperature. However, many bodies emit less radiation at the same temperature (non-selective radiator). The ratio of real radiation value and that of the ideal radiator is defined as the

emissivity  $\epsilon$ . For example, a mirror has an emissivity of 0.1 while a so-called 'black body' has an emissivity of 1.0. Many non-metals such as wood, rubber, stone, and organic materials have only low reflecting surfaces and, as a result, high emissivities between 0.8 and 0.95. However, metals, especially if they have glossy surfaces, can have  $\epsilon = 0.1$ . Therefore, IR thermometers provide an option for setting the emissivity. The emissivity should be known as exact as possible. If a too high emissivity has been set, the indicated temperature is lower than the actual temperature, given that the temperature of the test object is higher than the ambient temperature. For example, if 0.95 has been set, while the emissivity is actually only 0.9, a temperature that is lower than the actual temperature will be indicated.

### How can the emissivity be determined?

Several methods can be used to determine the emissivity. As a first starting point, the following emissivity table can be consulted. The table data only represents average values, as the emissivity of a material is influenced by various factors. These include: temperature, angle of measurement, surface geometry (plane, concave, convex), thickness, surface quality (polished, rough, oxidised, sand-blasted), spectral range of the measurement and transmission capacity (e.g. in case of thin plastic foils)

# Infrared measuring technology

## Application Examples for Infrared Thermometers

Temperature Range	Spectral Sensitivity	Application Examples
appr. 0 ... 800°C	8 to 14 $\mu\text{m}$ 3 to 5 $\mu\text{m}$ 7 to 15 $\mu\text{m}$ 7 to 18 $\mu\text{m}$	All non-metals, wood, paper, textiles, floor coverings, asphalt, lime floor, edibles, pharmaceuticals, as well as use with print, coating, laminating, drying/hardening, wave soldering and reflow soldering, for indoor installations, fire control, dust tips etc.
appr. 10 ... 360°C	nominal 7.9 $\mu\text{m}$	Fabrication and processing of polyester foil, fluoroplastics, fluoropolymer, acrylate, nylon (polyamide), acetylene cellulose, polyamides, polyurethanes, PVC, polycarbonates.
appr. 260 ... 1650°C	nominal 5.0/5.2 $\mu\text{m}$	Surface measurement on glass for heating up, forming, sealing, laminating, bending.
appr. 200 ... 1200°C	3.9 $\mu\text{m}$	Metal finishing, furnaces, melting furnaces, blast furnaces, measurements on thick glass. Measurements slightly influenced by CO, atmosphere (combustion gases).
appr. 30 ... 340°C	nominal 3.43 $\mu\text{m}$	Fabrication and processing of polyethylene, polypropylene, polystyrene and other foils.
appr. 400 ... 3000°C	2 to 2.7 $\mu\text{m}$	Processing of ferrous and nonferrous metals, induction furnaces, glass production, melting furnaces, lab research.
appr. 200 ... 1800°C	1.6 $\mu\text{m}$	Heat treatment of steel, bending, hardening, warming up.
appr. 500 ... 3000°C	1 $\mu\text{m}$	Steel production, molten baths, for highest precision with shaping, casting and processing of metals, as well as the processing of glass, ceramics, semiconductors and chemicals.

## Compact Glossary of Important Terms

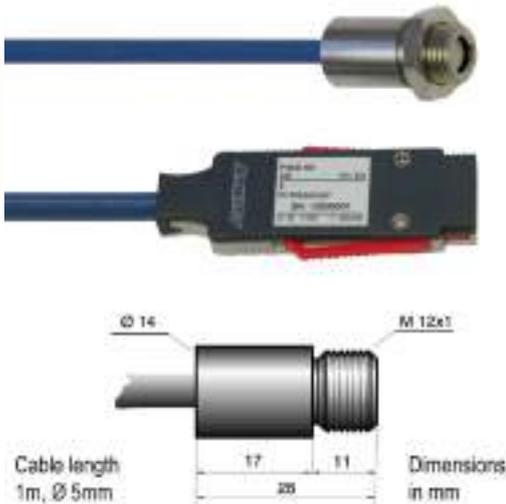
Atmospheric Windows:	The wavelength ranges within the infrared spectrum, in which the atmospheric radiation energy is transmitted and the atmospheric absorption is minimal, approximately 3 ... 5 $\mu\text{m}$ and 8 ... 14 $\mu\text{m}$ .
Focal Point, Focal Distance:	Measuring distance where the maximum optical resolution is reached.
Far Field:	Measured distance, which is significantly larger than the focal length of a device, in most cases is larger than ten times the focal length.
Field of View:	The test object area, which is measured by the infrared thermometer; the diameter of the measuring spot is proportioned to the distance from the test object; often also specified as an angular variable at the focal point. Also see optical resolution.
Non-Selective Radiator:	Radiating body with an emissivity that, for all wavelengths, bears the same constant ratio to the emissivity of a full radiator at the same temperature, which is opaque to radiation of infrared energy.
Background Temperature:	From the view of the measuring instrument the ambient temperature or the temperature behind the test object.
Measuring Spot:	Diameter of the test object area, which is subject to a temperature measurement; the measuring spot is defined by the circular area, which typically allows to capture 90% of the infrared energy radiating from the test object to the optical receiving aperture of the measuring instrument.
Optical Resolution:	Also called the distance ratio: The 'measuring distance/measuring spot size' ratio (distance ratio E:M) of an IR measuring spot. The measuring distance is typically defined as the distance from the focal point and the measuring spot size as the diameter of the IR measuring spot measured at the focal point (typically the 90% energy measuring spot diameter). The optical resolution can be also defined for the far field, by using the values for the measuring distance and measuring spot size within the far field.
Degree of Reflection:	Ratio of the radiation energy reflected from a surface to the incident radiation of the same surface; for a perfect mirror the value is approximately 1, for a full radiator the reflection is zero.
Full Radiator:	Also: black body; ideal radiator. Body, which absorbs the whole impinging radiation energy of all wavelengths and which does not reflect nor transmit any radiation. The surface of a full radiator has a uniform emissivity of 1.
Spectral Sensitivity:	Wavelength range for which an infrared thermometer is sensitive.

# Infrared measuring technology

## Emissivities of Various Materials Depending on the Spectral Range

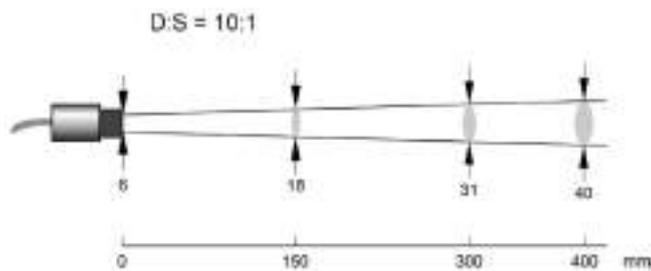
		1 $\mu\text{m}$	2.2 $\mu\text{m}$	5.1 $\mu\text{m}$	8–14 $\mu\text{m}$
<b>Metals</b>					
Aluminium	non-oxidised	0.1–0.2	0.02–0.2	0.02–0.2	0.02–0.1
	oxidised	0.4	0.2–0.4	0.2–0.4	0.2–0.4
Alloy A3003,	oxidised	–	0.4	0.4	0.3
	etched	0.2–0.8	0.2–0.6	0.1–0.4	0.1–0.3
	polished	0.1–0.2	0.02–0.1	0.02–0.1	0.02–0.1
Lead	polished	0.35	0.05–0.2	0.05–0.2	0.05–0.1
	etched	0.65	0.5	0.4	0.4
	oxidised	–	0.3–0.7	0.2–0.7	0.2–0.6
Chromium		0.4	0.05–0.3	0.03–0.3	0.02–0.2
Iron	oxidised	0.4–0.8	0.7–0.9	0.6–0.9	0.5–0.9
	non-oxidised	0.35	0.1–0.3	0.05–0.25	0.05–0.2
	rusty	–	0.6–0.9	0.5–0.8	0.5–0.7
	molten	0.35	0.4–0.6	–	–
Iron, cast	oxidised	0.7–0.9	0.7–0.95	0.65–0.95	0.6–0.95
	non-oxidised	0.35	0.3	0.25	0.2
	molten	0.35	0.3–0.4	0.2–0.3	0.2–0.3
Iron, wrought	dull	0.9	0.95	0.9	0.9
Gold		0.3	0.01–0.1	0.01–0.1	0.01–0.1
Haynes	alloy	0.5–0.9	0.6–0.9	0.3–0.8	0.3–0.8
Inconel	oxidised	0.4–0.9	0.6–0.9	0.6–0.9	0.7–0.95
	sand-blasted	0.3–0.4	0.3–0.6	0.3–0.6	0.3–0.6
	electropolished	0.2–0.5	0.25	0.15	0.15
Copper	polished	0.05	0.03	0.03	0.03
	etched	0.05–0.2	0.05–0.2	0.05–0.15	0.05–0.1
	oxidised	0.2–0.8	0.7–0.9	0.5–0.8	0.4–0.8
Magnesium		0.3–0.8	0.05–0.2	0.03–0.15	0.02–0.1
Brass	polished	0.8–0.95	0.01–0.05	0.01–0.05	0.01–0.05
	high polished	–	0.4	0.3	0.3
	oxidised	0.6	0.6	0.5	0.5
Molybdenum	oxidised	0.5–0.9	0.4–0.9	0.3–0.7	0.2–0.6
	non-oxidised	0.25–0.35	0.1–0.3	0.1–0.15	0.1
Monel (Ni–Cu)		0.3	0.2–0.6	0.1–0.5	0.1–0.14
Nickel	oxidised	0.8–0.9	0.4–0.7	0.3–0.6	0.2–0.5
	electrolytic	0.2–0.4	0.1–0.2	0.1–0.15	0.05–0.15
Platinum	black	–	0.95	0.9	0.9
Mercury		–	0.05–0.15	0.05–0.15	0.05–0.15
Silver		0.04	0.02	0.02	0.02
Steel	cold-rolled	0.8–0.9	–	0.8–0.9	0.7–0.9
	heavy plate	–	0.6–0.7	0.5–0.7	0.4–0.6
	polished sheet metal	0.35	0.2	0.1	0.1
	melt steel	0.35	0.25–0.4	0.1–0.2	–
	oxidised	0.8–0.9	0.8–0.9	0.7–0.9	0.7–0.9
	stainless	0.35	0.2–0.9	0.15–0.8	0.1–0.8
Titanium	polished	0.5–0.75	0.2–0.5	0.1–0.3	0.05–0.2
	oxidised	–	0.6–0.8	0.5–0.7	0.5–0.6
Tungsten	polished	0.35–0.4	0.1–0.3	0.05–0.25	0.03–0.1
Zinc	oxidised	0.6	0.15	0.1	0.1
	polished	0.5	0.05	0.03	0.02
Tin	(non-oxidised)	0.25	0.1–0.3	0.05	0.05
<b>Nonmetals</b>		1 $\mu\text{m}$	2.2 $\mu\text{m}$	5.1 $\mu\text{m}$	8–14 $\mu\text{m}$
Asbestos		0.9	0.8	0.9	0.95
Asphalt		–	–	0.95	0.95
Basalt		–	–	0.7	0.7
Concrete		0.65	0.9	0.9	0.95
Ice		–	–	–	0.98
Soil		–	–	–	0.9–0.98
Paint	(non alkaline)	–	–	–	0.9–0.95
Gypsum		–	–	0.4–0.97	0.8–0.95
Glass	pane	–	0.2	0.98	0.85
	molten mass	–	0.4–0.9	0.9	–
Rubber		–	–	0.9	0.95
Wood, natural		–	–	0.9–0.95	0.9–0.95
Limestone		–	–	0.4–0.98	0.98
Carborundum		–	0.95	0.9	0.9
Ceramics		0.4	0.8–0.95	0.85–0.95	0.95
Pebble stones		–	–	0.95	0.95
Carbon	non-oxidised	0.8–0.95	0.8–0.9	0.8–0.9	0.8–0.9
	graphite	0.8–0.9	0.8–0.9	0.7–0.9	0.7–0.8
Paper	(any colour)	–	–	0.95	0.95
Plastic	(translucent, over 0.5mm)	–	–	0.95	0.95
Fabric	(cloth)	–	–	0.95	0.95
Sand		–	–	0.9	0.9
Snow		–	–	–	0.9
Argil		–	0.8–0.95	0.85–0.95	0.95
Water		–	–	–	0.93

## Digital infra-red sensor for measuring surface temperature FIAD43 Miniature probe head, integrated electronics, ALMEMO® D6 plug



- Digital infra-red probe head with integrated signal processor
- All sensor characteristics and adjustment data are stored in the probe head itself.
- Digital transmission ensures that measured values are not affected by the sensor cable being moved, bent, or twisted.
- Surface temperature is measured over a wide range up to 600°C.
- Robust stainless steel housing, protection class IP65
- The probe head, thanks to its small dimensions, can be installed in cramped and restricted conditions.
- The probe head is threaded for quick and easy installation.
- The sensor cable in polyurethane (PUR) is suitable for industrial use and is resistant to oily, acidic, basic environments.
- The sensor can be connected directly via the cable's ALMEMO® D6 plug to any ALMEMO® device.
- One measuring channel is preprogrammed on leaving our factory - surface temperature (°C).
- Emissivity 0.95 are preprogrammed (on leaving our factory).
- This can be programmed from 0.1 to 1.0 at the current ALMEMO® V6 devices via the device or via interface (some only via interface).
- Transmittance 1.0 is preprogrammed (on leaving our factory). When using the focal point lens attachment or the protective window, the transmittance of the focal point lens attachment or the protection window must be adjusted. Transmittance can be modified in the ALMEMO® D6 sensor menu directly on the PC using USB adapter cable ZA1919AKUV (see page 04.05) 35/5000 or with an ALMEMO® V7 measuring device..

### Measuring Field



**General features and accessories, ALMEMO® D6 sensors**  
see page 01.08

### Options fitted at our factory



Air blower attachment

OR7843LB



Deflecting mirror with integrated air blower attachment

OR7843US1



Air-cooled housing and T adapter including air hose, insulation, and air blower attachment

Length of air hose 0.8 meters

OR7843KL1

Length of air hose 2.8 meters

OR7843KL2



Deflecting mirror for air-cooled housing

OR7843US

### Standard delivery

Infra-red probe head with cable and ALMEMO® D6 plug and 1 mounting nut

Cable length = 1 meter

Cable length = 3 meters

### Order no.

FIAD4332

FIAD4332L3

DAkKS or factory calibration KI9xxx temperature for digital sensor (see chapter Calibration certificates).

DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Technical data

### Digital infra-red probe head (including A/D converter)

Temperature measuring range	-40 to +600 °C		
Spectral sensitivity	8 to 14 µm		
Optical resolution (90 % energy)	10:1 with focal point lens attachment 1 mm at distance of 10 mm Transmittance can be programmed to 0.75. (see below)		
Accuracy	±1 % of meas. value or ±1 K (whichever value is higher) ±2 K for meas. values <20 °C		
Reproducibility	±0.5 % of measured value or ±0.5 K (whichever value is higher)		
Nominal conditions	23 °C ±5 K, emissivity 1.0		
Temperature coefficient	±0.05 K / K or ±0.05 % of measured value / K (whichever value is higher)		
Temperature resolution	0.1 K		
Response time	130 ms (90 %)		
Emissivity	0.95 (preprogrammed on leaving our factory) This can be programmed from 0.1 to 1.0 at the current ALMEMO® V6 devices via the device (some only via interface).		
Transmittance the focal point lens attachment or the protective window :	1.0 (preprogrammed on leaving our factory) This can be programmed from 0.1 to 1.0 directly on the PC using USB adapter cable ZA1919AKUV. (please place a special order) (see "General accessories for ALMEMO® D6 sensors")		
Protection class	IP65 (NEMA 4) (National Electric Manufacturers Association)		
Ambient temperature	-10 to +120 °C with air-cooled housing -10 to +200 °C		
Storage temperature	-20 to +120 °C		
Relative atmospheric humidity	10 to 95 % non-condensing		
Housing	Stainless steel		
Dimensions	Probe head Length 28 mm x Ø 14 mm Thread M12 x 1		
Weight	Probe head 50 grams with 1-meter cable		
Connecting cable(s)	permanently fitted with ALMEMO® D6 plug	Polyurethane (PUR)	For available lengths see variants.
ALMEMO® D6 plug	Refresh time	0.25 seconds for all channels	
	Supply voltage	6 to 13 VDC	
	Current consumption	4 mA	

## Accessories



Focal point lens attachment (cannot be used together with air blower attachment or air-cooled housing)

Transmittance 0.75 ZR7843CFL



Protective window (cannot be used together with air blower attachment or air-cooled housing)

Transmittance 0.75 ZR7843PW



Mounting bracket, rigid

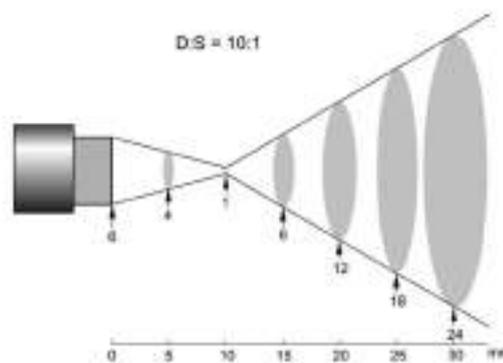
ZR7842H



Mounting bracket, adjustable

ZR7842JH

Measuring field with focal point lens attachment

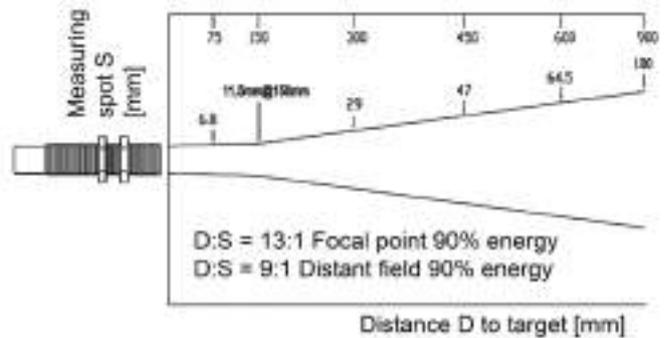
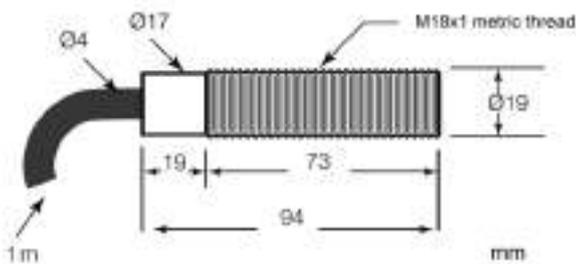


# Infrared measuring technology

## Compact infra-red probe head AMiR FIA 844 suitable for all ALMEMO® devices



- Compact inexpensive infra-red probe head for measuring surface temperature
- Other measuring ranges -20 to +500 °C
- High optical resolution Measuring spot 11.5 mm at distance 150 mm, in distant field 9:1
- Sturdy stainless steel housing Protection IP65
- Quick and easy to install thanks to screw-fit housing
- Integrated electronics, cable permanently fitted
- Can be connected directly to the ALMEMO® device using an ALMEMO® connector.



### Accessories

Mounting bracket, rigid  
Mounting bracket, adjustable  
Air blower attachment Thread M18x1

### Order no.

ZR7844FB  
ZR7844JB  
ZR7844APM

### Variants (including 2 mounting nuts):

ALMEMO® infra-red probe head Measuring range -20 to +500 °C  
with permanently fitted cable and ALMEMO® connector, Cable length = 1 meter

Same as above Cable length = 3 meters

Factory calibration KI9xxx temperature for sensor (see chapter Calibration certificates)

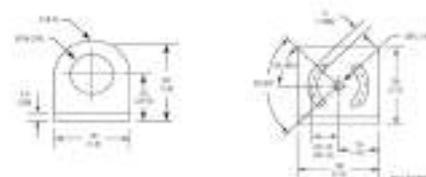
FIA844

FIA844L3

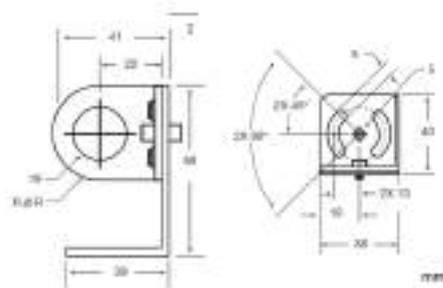
## Technical data

Temperature range	-20 to +500 °C
Spectral sensitivity	8 to 14 μm
Optical resolution (90 % energy)	13:1 (11.5 mm at 150 mm distance), distant field 9:1
Accuracy	±1.5 % of measured value or ±2 K (whichever value is higher) ±3.5 K for measured values <0 °C
Reproducibility	±0.5 % of measured value or ±1 K (whichever value is higher)
Nominal conditions	23 °C ±5 K, Emissivity 0.95
Temperature resolution	0.1 K
Response time	150 ms (95 %)
Emissivity	0.95, fixed setting
Voltage supply	via ALMEMO® connector (12 VDC)
Protection	IP65
Ambient temperature	-10 to +70 °C
Storage temperature	-20 to +85 °C
Relative atmospheric humidity	10 to 95 % non-condensing
Housing	Stainless steel
Dimensions	Length 94 mm Thread M18x1
Connecting cable	permanently fitted, 1 or 3 meters, -30 to +105 °C including ALMEMO® connector, programmed
Weight	approx. 160 g (1-meter cable)

Mounting bracket  
Order no. ZR7844FB



Mounting bracket, adjustable  
Order no. ZR7844JB



Air blower attachment  
Thread M18x1  
Order no. ZR7844APM



# Infrared measuring technology

## Infra-red transmitter for measuring surface temperature AMiR 7843

### Miniature probe head, transmitter box with display / operating controls, with analog output



- Surface temperature is measured over a wide range up to 600 / 1000 °C.
- The probe head, thanks to its small dimensions, can be installed in cramped and restricted conditions.
- Robust stainless-steel housing, protective class IP65
- The probe head is threaded for quick and easy installation.
- The sensor cable is suitable for industrial use and is resistant to oily, acidic, and alkaline environments.
- Transmitter box with display and operating controls
- Analog output 10 V / 20 mA, freely selectable and scalable.

! Infra-red sensor suitable for direct connection to ALMEMO® measuring instruments see Digital sensor FIAD43x with ALMEMO® D6 plug (see page 01.08)

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#### Accessories MR7843 series

#### Order no.

Mounting bracket, rigid	ZR7842H	Focal point lens attachment (cannot be used together with air blower attachment or air-cooled housing)	ZR7843CFL
Mounting bracket, adjustable	ZR7842JH	10:1 optics Measuring spot diameter 1 mm at distance of 10 mm	
Protective window (cannot be used together with air blower attachment or air-cooled housing)	ZR7843PW	22:1 optics Measuring spot diameter 0.5 mm at distance of 10 mm.	

#### Accessories for MR7843-12 / -32 / -42

#### Order no.

Air blower attachment	ZR7842LB	90° deflecting mirror (only for air-cooled housing and air blower attachment)	ZR7842US
Air-cooled housing and T branch, including 0.8-meter air hose, insulation, and air blower attachment	ZR7842KL1	90° deflecting mirror with integrated air blower attachment	
Same as above but with 2.8-meter air hose	ZR7842KL2		ZR7842US1

#### Options for MR7843-12 / -32 / -42

#### Order no.

Factory test certificate (only with delivery of new devices) OR7843KZ1 DAkkSDKD or factory calibration KI9xxx, temperature, for sensors (see	chapter „Calibration certificates“). DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.
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#### Standard delivery

Probe head (including mounting nut) with cable, PUR, mounted on transmitter box

Temperature range	Optical resolution	Ambient temperature, probe head	Order no. Probe head cable, 1 m	Order no. Probe head cable, 3 m*
-40 to 600°C	2:1	-10 to 120°C	MR784312	MR784312L03
-40 to 600°C	10:1	-10 to 120°C	MR784332	MR784332L03
0 to 1000°C	22:1	-10 to 120°C	MR784342	MR784342L03

\* Available on request longer probe head cable, 8 / 15 / 30 meters

#### Options for MR7843-33 / -43

#### Order no.

Air blower attachment, only fitted at our factory	OR7843LB1	Factory test certificate (only with delivery of new devices) OR7843KZ1
90° deflecting mirror (only with air blower attachment OR7843LB1)	OR7843KZ1	DAkkS or factory calibration KI9xxx, temperature, for sensors (see chapter „Calibration certificates“). DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

#### Standard delivery

Probe head (including mounting nut) with cable, fluoropolymer, with separate electronics Ø14 mm, approx. 52 mm long, with 0.5 m cable, mounted on transmitter box

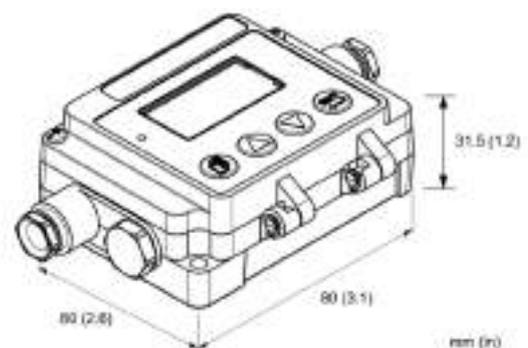
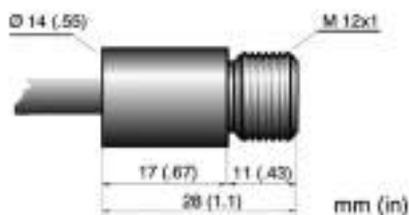
Temperature range	Optical resolution	Ambient temperature, probe head	Order no. Probe head cable, 1 m	Order no. Probe head cable, 3 m*
-40 to 600°C	10:1	-10 to 180°C	MR784333	MR784333L03
0 to 1000°C	22:1	-10 to 180°C	MR784343	MR784343L03

\* Available on request longer probe head cable 8 / 15 / 30 meters

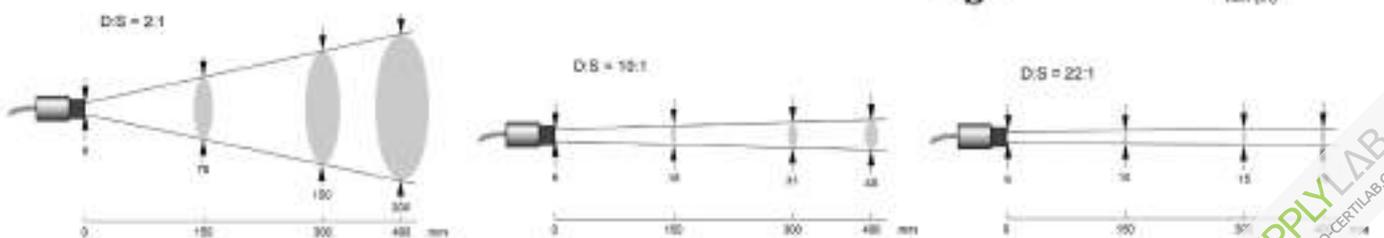
## Technical data

Probe head	
Temperature measuring range	depending on type -40 to +600 °C or 0 to +1000 °C
Spectral sensitivity	8 to 14 μm
Optical resolution (90 % energy)	depending on type 2:1 / 10:1 / 22:1, typical (21:1 guaranteed)
Response time (90%)	130 ms
Accuracy	±1 % of measured value or ±1 K (whichever value is higher) ±2 K for measured values <20 °C
Reproducibility	±0.5 % of measured value or ±0.5 K (whichever value is higher)
Nominal conditions	at ambient temperature +23 °C ±5 K, Emissivity factor 1.0 and calibration geometry
Temperature coefficient	±0.05 K / K or ±0.05 % of measured value / K (whichever value is higher)
Ambient temperature	depending on type -10 to +120 °C (with air cooling up to +200 °C) or -10 to +180 °C
Protective class	IP65 (NEMA-4) / IEC 60529
Relative humidity	10 to 95 % non-condensing
Housing	Stainless steel
Dimensions	L = 28 mm, Ø = 14 mm, Thread M12x1
Probe head cable	depending on type polyurethane (PUR) or fluoropolymer
Electronics:	integrated in the measuring head. For type MR784333x / 784343x: separate electronics.
Weight	50 g (with 1-meter cable)
Transmitter box	
Output (selectable)	0 to 5 V / 0 to 10 V; 0 to 20 mA / 4 to 20 mA (Temperature range can be programmed in each case.) Thermocouple, type J, K, R, S Not electrically isolated from supply voltage
Temperature resolution	±0.1 K for temperature range < 500 °C
Accuracy	±1 K for output mA / V ±1.5 K for output, thermocouple
Temperature coefficient	±0.02 K / K for output mA / V, ±0.05 K / K for output, thermocouple
Emissivity	0.100 to 1.100
Transmittance	0.100 to 1.000
Signal processing	Saving of maximum / minimum / average value retention period up to 998 seconds
Alarm output	zero-potential contact (semiconductor relays) 48 V / 300 mA
Power supply	8 to 32 VDC, maximum 6 W
Ambient temperature	-10 to +65 °C
Protective class	IP65 (NEMA-4) / IEC 60529
Relative humidity	10 to 95 % non-condensing
Housing	Zinc die casting
Dimensions	80 x 60 x 31.5 mm (LxWxH)
Weight	370 g

## Dimensions



## Measuring field (90% energy)



# Infrared measuring technology

## Infrared Measuring Heads in Two-Wire Design AMiR 7838

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- Compact, robust and precise infrared measuring heads.
- Wide range of versions for applications in intelligent process control and monitoring systems, as well as in production and test lab.
- Low cost standard version with fixed set temperature and output current range and emissivity can be manually set at the measuring head.
- The standard version without programming functions is ideally suitable for connecting to ALMEMO® devices.
- Measuring heads also available as addressable and remotely programmable versions.

Accessories	Order no.
ALMEMO® connecting cable, 2 meters, ALMEMO® connector, programmed for the probe head's temperature range, Sensor supply via ALMEMO® device (use of the device mains unit is recommended) (cable not suitable for ALMEMO® 4490-2, available here on request)	ZA7838AK
for programmable measuring heads MR7838xP	
Protective window, snap-on, according to above lens detail	ZR7838SF
Remote control set incl. HART adapter and software	OR7838SH
Industrial mains adapter 110/220V – 24VDC	ZR7838NT

Options	
Other focus point optics (also see page 07.44 / 07.45)	
Water/air cooling housing including air blow attachment, factory mounted	OR7838KL
Inherent safety (Ex in IIC T4), only available with programmable meas. heads without cooling jacket	OR7838IS4
Factory test certificate, based on DAkKS/NIST certified sensors (only with delivery of new devices)	OR7800KZ1

Types (incl. rigid mounting angle and fastening screw)	Order no.
For universal applications, standard optics OR7838OS1 (Fresnel Lens) Meas. range –18 to 500°C, spectral range 8 to 14 µm, response time 165ms, optical resolution 15:1	<b>MR783810(P)</b>
For universal applications, standard optics OR7838OS3 (Amtir Lens) Meas. range –18 to 500°C, spectral range 8 to 14 µm, response time 165ms, optical resolution 33:1	<b>MR783811(P)</b>
For high temperature measurements in metal finishing and in rotary tubular kilns, standard optics OR7838OS3 (Sapphire Lens) Meas. range 200 to 1000°C, spectral range 3.9 µm, response time 165ms, optical resolution 33:1	<b>MR783821(P)</b>
For maximum temperature measurements in metal finishing, standard optics OR7838OS6 (Float Glass Lens) Meas. range 500 to 2000°C, spectral range 2.2 µm, response time 100ms, optical resolution 60:1	<b>MR783851(P)</b>
For high temperature measurements in glass production and at heating up and hardening, standard optics OR7838OS3 (Calcium Fluoride Lens) Meas. range 250 to 1650°C, spectral range 5.0 µm, response time 165ms, optical resolution 33:1	<b>MR783831(P)</b>
For low temperature measurements in the production of plastic foils and normal foils, standard optics OR7838OS3 (Calcium Fluoride Lens) Meas. range 10 to 360°C, spectral range 7.9 µm, response time 165ms, optical resolution 33:1	<b>MR783841(P)</b>

(P) Measuring heads remotely programmable

DAkKS- oder Factory calibration KI9xxx temperature for sensor (see chapter Calibration certificates).

DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Device Functions

### only AMiR 7838-xxP (programmable AMiR Heads)

Programming:	through PC via HART® adapter (OR7838SH)
Emissivity:	0.10 to 1.00 programmable
Data functions:	max, min, average value hold, compensation of ambience radiation
Limit value programming:	1 limit value incl. hysteresis, also usable for monitoring the temperature of the measuring head
ALMEMO® application:	To acquire and save measured values using those measuring head variants which cannot be addressed and remotely programmed we recommend our ALMEMO® 4390-2 panel meters. For other ALMEMO® devices please see Chapter 01. Measuring instruments

## Technical Data

Accuracy:	±1% of meas. value or ±1.4°C, the higher value of either is always valid
Reproducibility:	±0.5% of meas. value or ±0.7°C, the higher value of either is always valid
Response time:	165ms, at 7838 - 51(P) 100ms
Nominal temperature:	+23°C, ±5°C
Temperature resolution:	AMiR 7838 -10, -11: 0.125°C, AMiR 7838 -21, -31, -41, -51: 1°C
Relative humidity:	10 to 95%, non-condensing, at 30°C max.
Power supply:	12–24VDC, for AMiR 7838xxP: 24VDC
Output signal:	4 ... 20mA linear, two-wire technology
Emissivity:	0.10 to 1.00 manually adjustable at measuring head (only noprogrammable heads)
Operating temperature:	without cooling: 0 to 70°C, with air cooling: 0 to 120°C with water cooling: 0 to 175°C, with protective housing: 0 to 315°C
Protection system:	IP 65, (IEC 529)
Shock:	IEC 68-2-27 (MIL STD 810D), 50G, each axis, 11ms
Vibration:	IEC 68-2-6 (MIL STD 810D), 3G, each axis, 11 to 200Hz
Dimensions:	without water cooling housing: 187mm long, Ø 42mm with water cooling housing: 187mm long, Ø 60mm
Weight:	without water cooling housing: 330 g with water cooling housing: 595 g

# Infrared measuring technology

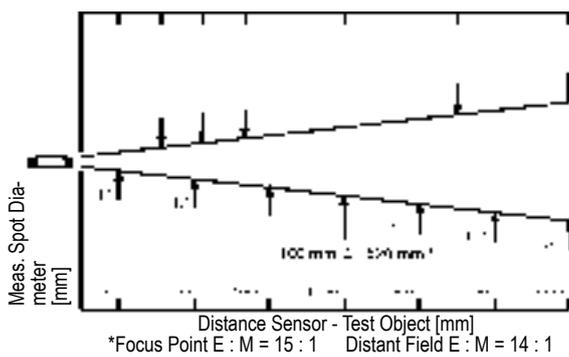
## Digital Signal Processing and Configuration

HART® protocol:	The Hart® protocol ('Highway Accessible Remote Transducer Protocol') is one of the most popular intelligent field bus protocols. It is more often used in industry than any other protocol and is supported by a large number of products and software of other manufacturers. The Hart® signal combines the standard output of 4 to 20mA with a simultaneously running digital remote data transmission. As a result, the measuring heads can, additionally, digitally communicate through the 2-conductor current loop (4 to 20mA) with the measuring computer.	
Single installation:	The most frequently used installation method is the single current loop. Analog displays and controls, recorders or measuring equipment within the current loop will not be influenced by digital signals in the current loop.	
Parallel working:	Up to 15 measuring heads can be switched in parallel and the measured values can be digitally further processed. For evaluation a powerful software with a menu-driven and user-friendly interface is available. It allows a graphical display of the ONLINE data including storing the measured values as an ASCII file for data export to other applications.	
Configuration examples:	Single installation	Parallel working.

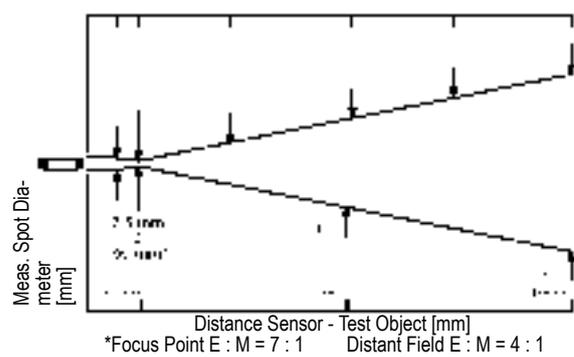
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## Measuring Field Diagrams: AMiR 7838-10(P)



Standard Optics OS1

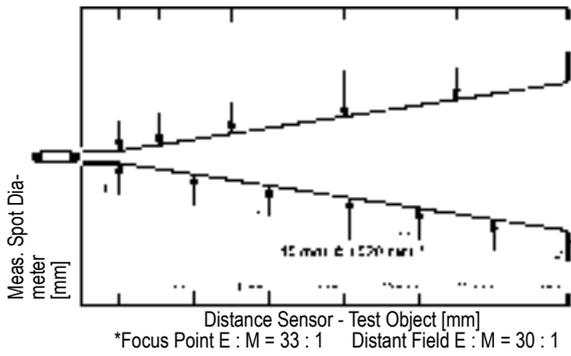


Focal Point Optics OS2

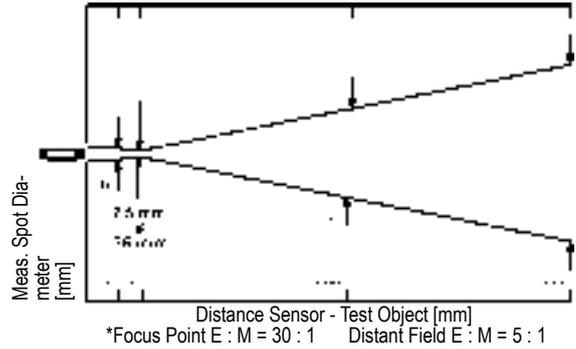
**Order no. OR7838OS2**

# Infrared measuring technology

## Measuring Field Diagrams: AMiR 7838-11(P)/-21(P)/-31(P)/-41(P)

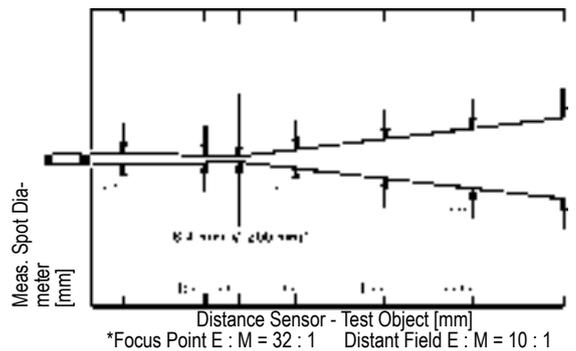


Standard Optics OS3



Focal Point Optics OS4

**Order no. OR7838OS4**

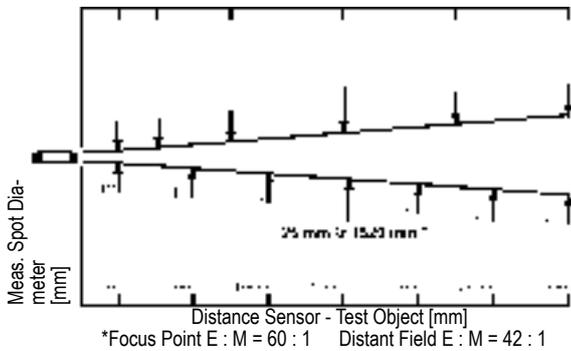


Focal Point Optics OS5

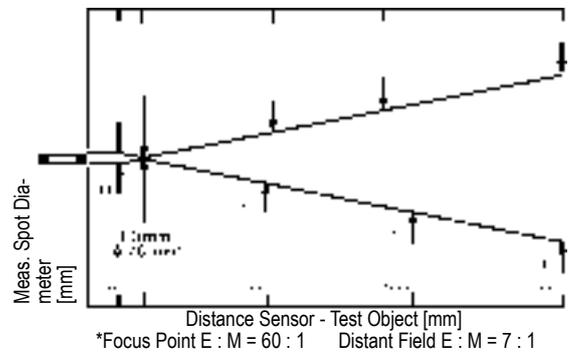
**Order no. OR7838OS5**

! The devices AMiR 7838-31(P) and AMiR 7838-41(P) are only available with standard optics OS3.

## Measuring Field Diagrams: AMiR 7838-51(P)

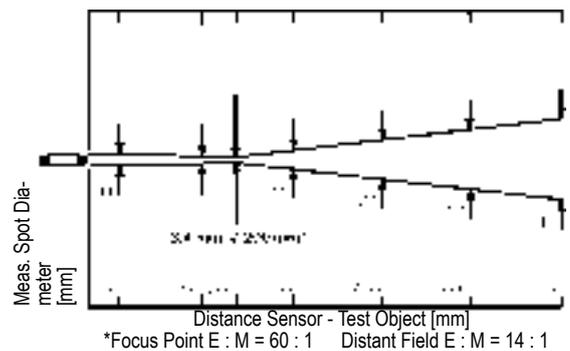


Standard Optics OS6



Focal Point Optics OS7

**Order no. OR7838OS7**



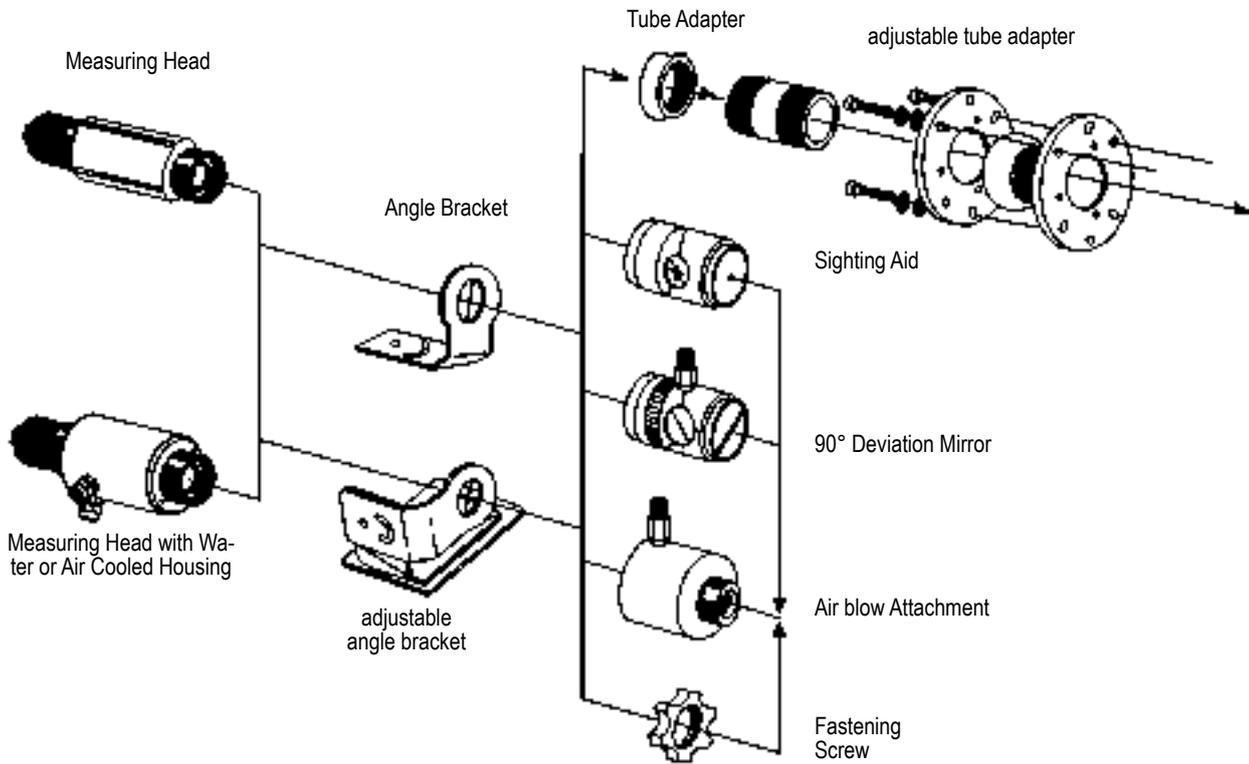
Focal Point Optics OS8

**Order no. OR7838OS8**

# Infrared measuring technology

## Accessories for All Measuring Heads AMiR 7838, 7845, 7850 Without Use of the Thermo jacket Protective Housing

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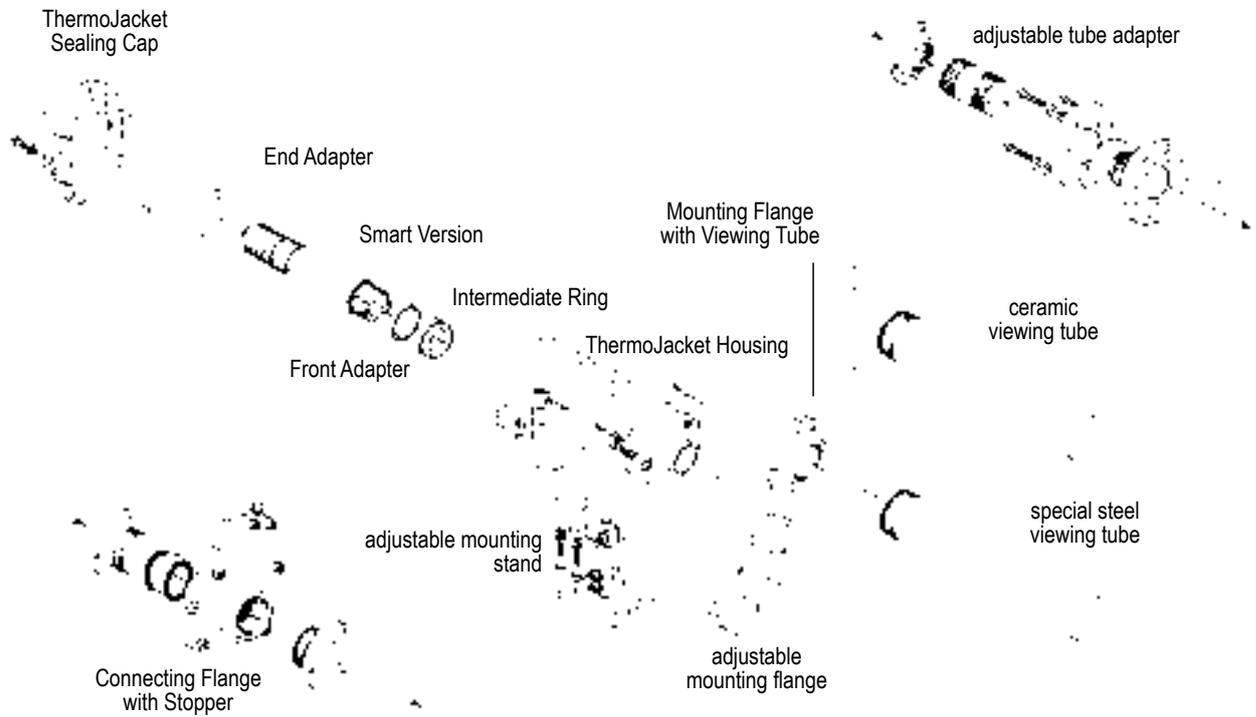
### Accessories

### Order no.

Rigid mounting angle (spare)  
Adjustable mounting angle  
Fastening screw (spare)  
Sighting aid, screw-on  
90° deviation mirror  
Air blow attachment  
Tube adapter onto 1 1/2" NPT

ZR7838H  
ZR7838JH  
ZR7838BM  
ZR7838VS  
ZR7838US  
ZR7838LB  
ZR7838B

## Accessories for All Measuring Heads AMiR 7838, 7845, 7850 With Use of the ThermoJacket Protective Housing



### Accessories

Thermojacket protective housing (3.26kg)	ZR7838SH
Adjustable mounting stand	ZR7838MF
Adjustable mounting flange	ZR7838JM
Mounting flange for anti-reflective tube	ZR7838FR
30cm anti-reflective tube, special steel	ZR7838RE
30cm anti-reflective tube, ceramics	ZR7838RK
Adjustable tube adapter	ZR7838JR
Connecting flange with stopper and Amtir window (from 3.9 to 14 mm)	ZR7838SA
Connecting flange with stopper and quartz window (from 1 to 2.2 mm)	ZR7838SQ
Water quantity regulator	ZR7838WR
Air quantity/pressure regulator	ZR7838WR

### Order no.

ZR7838SH
ZR7838MF
ZR7838JM
ZR7838FR
ZR7838RE
ZR7838RK
ZR7838JR
ZR7838SA
ZR7838SQ
ZR7838WR
ZR7838WR



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Digital sensor for temperature, humidity, and atm. pressure FHAD 46-C2	08.10
High-precision sensor for temperature, humidity, atm. pressure FHAD 36 Rx	08.11
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ALMEMO® dewpoint sensor FHA 646 DTC1, dewpoint transmitter MT 8716 DTC1	08.17
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# Air humidity

## The Right Humidity Sensor for Any Measuring Task

For humidity measurements various methods are used that differ from each other mainly with regard to their accuracy and their suitability for long term measurements and the substance used for the measurement:

- Capacitive Air Humidity Measurement,
- Psychrometric Air Humidity Measurement,
- Hygrometric Air Humidity Measurement,
- Dielectric Measurement of Moisture in Materials,
- Measurement of the Moisture in Ma-

terials According to the Principle of Conductivity,

- Dew Point Determination with CCC Dew Point Probes,
- Dew Point Determination with Dew Point Mirrors.

## Capacitive Air Humidity Measurement

Capacitive sensors contain a glass substrate with a moisture sensitive polymer layer between two metal layers. By absorption of water, corresponding to the relative humidity, the dielectric constant and, as a result, the capacity of the thin-film capacitor are changing. The measuring signal is directly proportional to the relative humidity and does not depend on the atmospheric

pressure.

### Advantage:

- maintenance-free measurement over longer periods,
- can withstand temperatures below 0°C
- atm. pressure-independent, works when pressure is applied
- flexible use of the sensor

### Disadvantage:

- limited long term stability
- sensitive to dewing and certain aggressive substances

## Psychrometric Air Humidity Measurement

Psychrometers are precision devices containing a dry and a moistened temperature sensor. As a result of the evaporation the humidity sensor cools down, with a wind velocity of a minimum of 2m/s being required for the cool down process. The humidity values are calculated from the temperature difference (psychrometric difference). The calculation formulae for AL-MEMO® devices correspond to those used

by the German Weather Authority related to 1013mbar. Differences regarding to the atmospheric pressure can be corrected to achieve precise measurements.

### Advantage:

- no ageing of the sensor - exception: contamination of the wick
- high accuracy
- high quality regarding the measuring technology

- usable without problems up to 100% r.H. in all substances

### Disadvantage:

- long term measurement limited by the required water reserve and wick maintenance
- difficult to use with temperatures below 0°C and with low humidities
- depending on the atmospheric pressure

## Dew Point Determination with Dew Point Mirrors

An optically monitored mirror is mounted on a cascaded Peltier element. The sensor unit is also connected to a control circuit that regulates the operating current of the cooling element so that a defined condensate is established. The dew point temperature will be directly measured within

the sensor and can be output in a format, which allows for an evaluation.

### Advantage:

- high accuracy, reliability and reproducibility
- independent from atmospheric pressure

- wide measuring range
- suitable for temperatures below 0°C

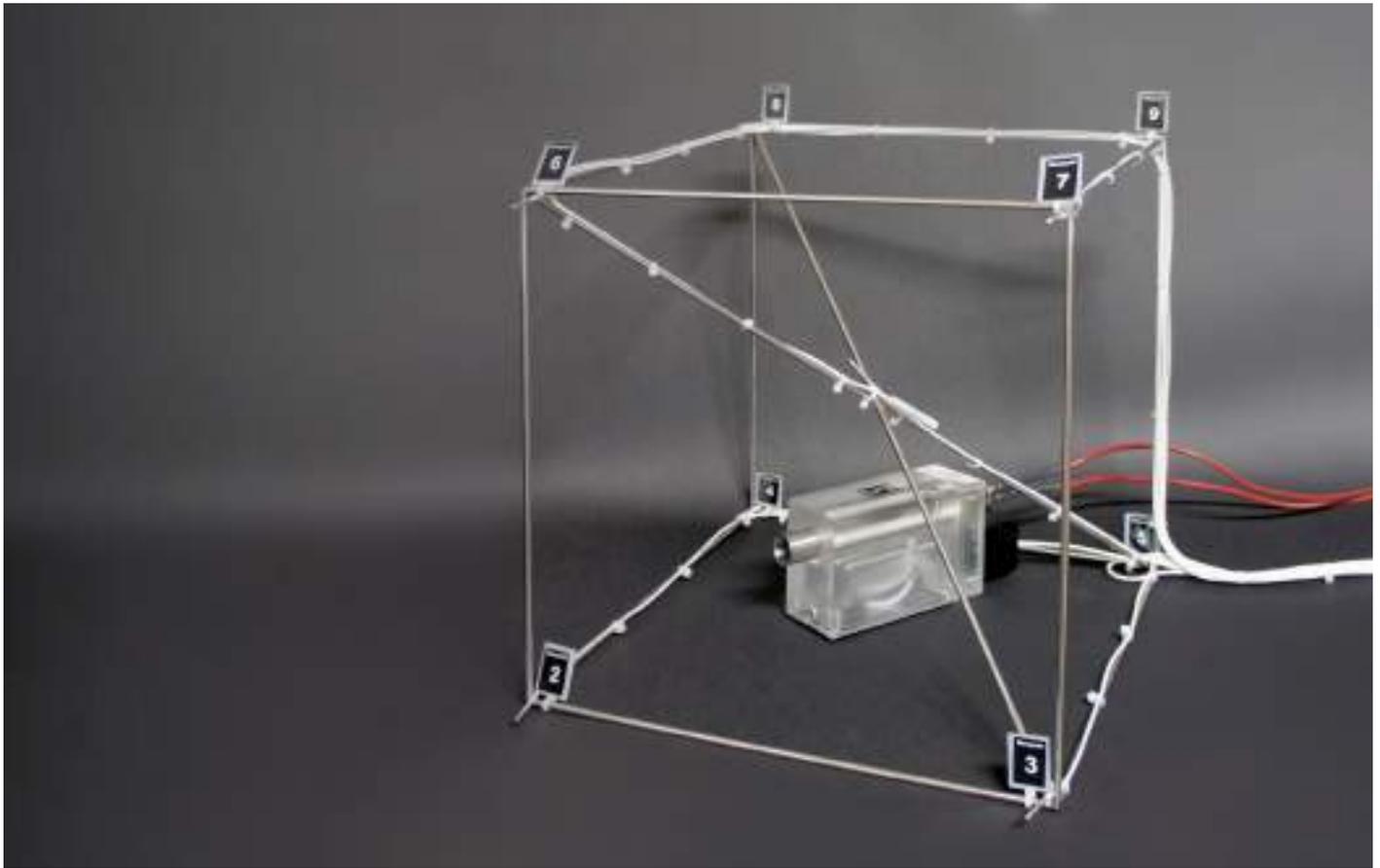
### Disadvantage:

- high sophisticated measuring method
- high current consumption
- risk of contamination

## Small Glossary for Humidity/Moisture Measurement Variables

<b>Absolute Humidity</b>	The absolute humidity indicates the weight of the water vapour contained in one m <sup>3</sup> of a mixture of air and water vapour.
<b>Enthalpy</b>	The enthalpy indicates how much heat is stored within the humid air. This value is important for calculating the cooling and heating performance, e.g. when checking heat exchangers.
<b>Mixture Ratio</b>	The absolute humidity related to 1kg dry air.
<b>Relative Humidity</b>	The relative humidity indicates the percentage of air, which is saturated with water vapour, i.e. how much percent of the maximum possible amount of water vapour is currently contained in the air. Owing to the dependence on temperature the relat. humidity can only ever be indicated for one specific temperature.
<b>Saturation Vap. Pressure</b>	Air can only ever contain a certain maximum amount of water vapour. This is called the saturation vapour pressure, specified as g water vapour per kg of humid air. The saturation vapour pressure strongly depends on the air temperature. At low temperatures it will be low and at high temperatures it will be high. Therefore, warm air can accept large amounts of vapour pressure and cold air only small amounts.
<b>Dew Point</b>	The dew point is the temperature where the relative humidity equals 100%. If the dew point is not reached the water vapour will start condensing.
<b>Water Vap. Partial Press.</b>	The total pressure in the room determined by the water vapour.

## ALMEMO® measuring system for calibrating climatic chambers as per guideline DAkkS-DKD-R 5-7



- Guideline DAkkS-DKD-R 5-7 lays down minimum requirements for the calibration procedure and for the determination of measurement uncertainties when calibrating climatic chambers.
- This guideline describes inter alia the objectives, procedures, and methods of calibration, and the uncertainty components involved.
- The full text of this guideline is available as a PDF document on the home page of the Deutsche Akkreditierungsstelle GmbH ([www.dakks.de](http://www.dakks.de) > Dokumente > Kalibrierlaboratorien) and can be downloaded free-of-charge.

### Calibration of relative atmospheric humidity at nine points in the climatic chamber using precision measuring instrument ALMEMO® 710

The ALMEMO® measuring system, comprising precision measuring instrument ALMEMO® 710, one humidity sensor, and eight temperature sensors, can be used to acquire all relevant measurable variables prevalent in the climatic chamber. The relative atmospheric humidity at the nine points in the climatic chamber is calculated in the ALMEMO® 710 itself. Climatic chambers can thus be calibrated in full and on site quickly and easily.

Humidity is calculated in the ALMEMO® 710 on the basis of formulae as per Dr.

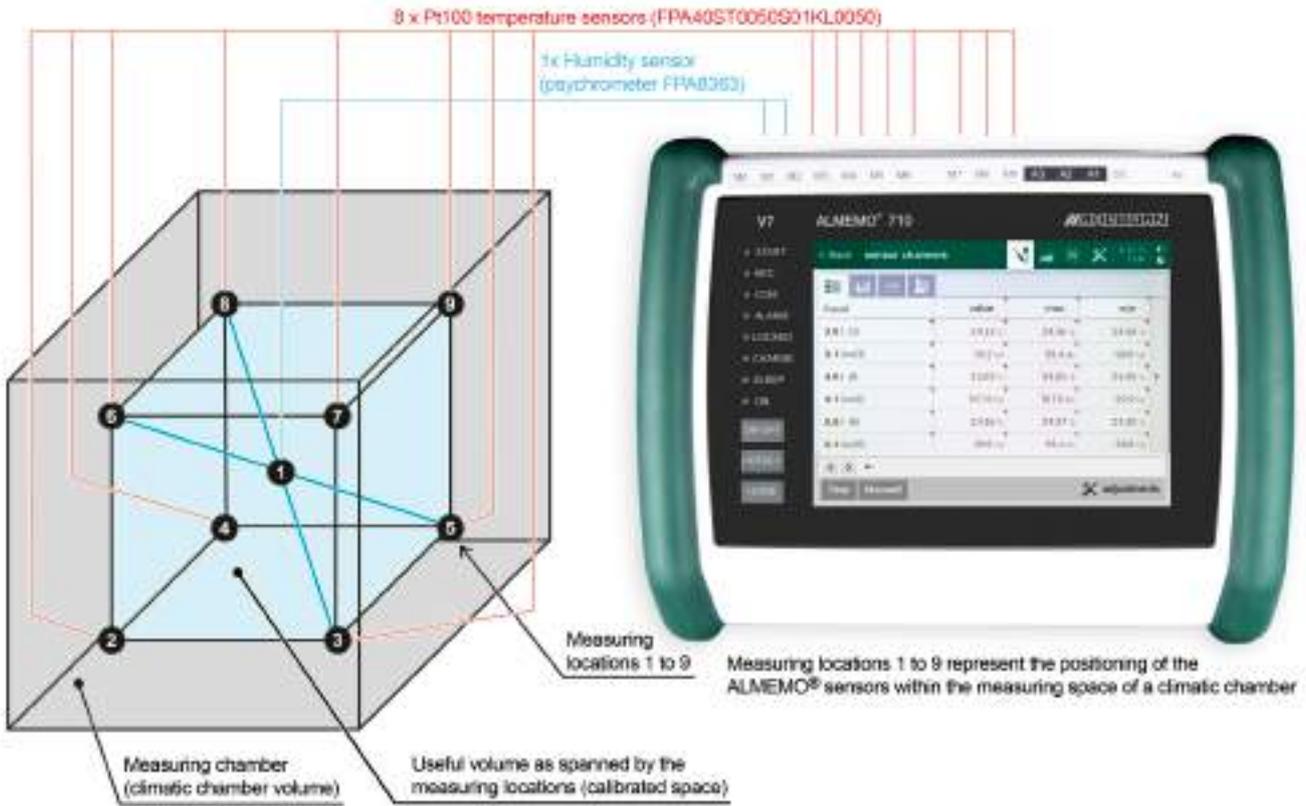
Sonntag and the enhancement factor as per W. Bögel (correction factor  $F_w(t,p)$ ) for real mixed gas systems). This substantially widens the measuring range and improves the accuracy of humidity variable calculations.

All values, both measured and calculated, are shown in a clear and easy-to-understand way on the ALMEMO® 710's large touch display. The ALMEMO® 710 also operates as a data logger. Measuring series can be saved either to the internal memory (capacity for over 400,000

measured values) or via the ALMEMO® memory connector to an SD card (capacity for several millions of measured values).

WinControl can be used to display and document values e.g. as a line graphic - either online those measured values actually being acquired during a measuring operation or offline after a measuring operation those measured values previously saved. It also provides various evaluation and statistical functions.

# Calibrating climatic chambers



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The ALMEMO® measuring system comprises:

## Precision measuring instrument ALMEMO® 710



10 inputs for any ALMEMO® sensors,  
atmospheric pressure sensor integrated in the measuring instrument  
(with DAkkS calibration certificate).

Precision measuring instrument ALMEMO® 710  
including USB cable, mains unit, instrument case, and configuration software ALMEMO® Control  
DAkkS calibration certificate for atm. pressure sensor five points in range 700 to 1100 mbar

**MA710**  
**KD9213D**

## Precision measuring instrument ALMEMO® 500



Data acquisition system, Tablet control via app.  
20 measuring inputs for any ALMEMO® sensors (expandable).

Data logger ALMEMO® 500  
CPU card including interfaces and web service. 4GB SD memory card. 2 active measuring circuit cards MA10 featuring 20  
input sockets for all ALMEMO® sensors (standard, DIGI, D6, D7). Mains adapter  
Control unit with preinstalled app. In desktop housing TG6, 9 free slots  
Digital atm. pressure sensor, built in the ALMEMO® D6 connector  
DAkkS calibration certificate for atm. pressure sensor five points in range 700 to 1100 mbar

**MA500CPUA20TG6B**  
**FDAD12S**  
**KD9213D**

## Pt100 psychrometer with DAkKS calibration certificate

Operative range 0 (not ice) to 90 °C, 10 to 100 % RH

The psychrometer is positioned at the center of the useful volume. From the measured values - dry temperature ( $t$ ) and wet temperature ( $t_w$ ) - and atmospheric pressure ( $p$ ) (atmospheric pressure sensor integrated in the ALMEMO® 710) we can calculate the relative humidity ( $U_w$ ) at the center and the dewpoint ( $t_d$ ).



Pt100 psychrometer FPA836-3 including mains unit, water bottle, one pair of wicks

**FPA8363**

DAkks calibration certificate for atmospheric humidity

**KH9146D**

Two climate points at 25°C, 30%RH and 25°C, 75%RH (other points available on request)

**ZB2490TK2**

Case for psychrometer and accessories

## Eight Pt100 temperature sensors with DAkKS calibration certificate

for operation in the climatic chamber stainless steel protective tube with PFA cable. Operative range -100 to +250 °C, Protective class IP68

The eight temperature sensors are positioned at the corners of the cuboid spanning the useful volume. From the eight measured values for temperature ( $t$ ) and the humidity variables from the psychrometer we can calculate the relative humidity values ( $U_w$ ) at the corners of the cuboid



Eight Pt100 temperature sensors, diameter 4mm, for operation in the climatic chamber, IP68, Cable length = 5 meters

**8 x FPA40ST0050S01KL0050**

DAkks calibration certificate for temperature, three points at 0, 50, 100 °C (other points available on request)

for 1st sensor

**1 x KT9021D**

for 2nd to 8th sensor

**7 x KT9021D2**

Multi-point adjustment for eight sensors

(in certificate, sensor deviation virtually reduced to zero)

**8 x KT9001DW**

Programming for eight Pt100 temperature sensors for calculating humidity using ALMEMO® 710 including labeling of the sensor connector

**OA9000PRKS**

Wire cube, VA wire Ø4 mm, edge length 300 mm, vertices welded.

Including spiral hoses to fix the sensor cables.

**ZB1002Q01**

**Note:** Two temperature sensors with different surfaces (e.g. stainless steel and PTEE) to determine the radiation effects on air temperature measurement operations. In case the two temperatures are measured simultaneously (additionally) with the 8 temperatures of the vertices, an ALMEMO® 500 measuring instrument (20 inputs) is needed; alternatively an ALMEMO® 710 measuring instrument (10 inputs) plus an additional measuring instrument e.g. ALMEMO® 2590-2A (2 inputs) can be used.

cover for Pt100 temperature sensor, diameter 4mm, PTFE, large emissivity factor for determining the radiation effect on air temperature measurement

**ZT9000TS41**

## Measuring software WinControl

WinControl software, for measured value processing and documentation for any number of channels (i.a. arithmetic channels, statistic channels),

all options included (except Data server, Web server, and additional modules)

**SW5600WC3**

Assistant for the calibration of climate cabinets.

Automatic, convenient evaluation with protocol generation. (needed: WC3/WC4)

**SW5600WCZM13**

Additional protocol for direct integration of climate chambers into online measurement

**SW5600WCZM7**

# Calibrating climatic chambers

## Assignment of measuring points, ALMEMO® 710 (example)

Sensor position	Measuring point	Variable	Note
Spatial center	0.0	$t_w$ (wet temperature)	measuring channel -psychrometer
	1.0	$t$ (dry temperature)	measuring channel -psychrometer
	1.1	$U_w$ (humidity)	arithmetic channel (psychrometer)
	1.2	$t_d$ (dewpoint)	arithmetic channel (psychrometer)
	1.3	$p$ (atmospheric pressure)	device-internal atmospheric pressure sensor
Corner 1	2.0	$t$ (temperature Pt100)	measuring channel (Pt100)
	2.1	$U_w$ (humidity)	arithm. channel (humidity from Pt100 and psychrometer)
Corner 2	3.0	$t$ (temperature Pt100)	measuring channel (Pt100)
	3.1	$U_w$ (humidity)	arithm. channel (humidity from Pt100 and psychrometer)
Corner 3	4.0	$t$ (temperature Pt100)	measuring channel (Pt100)
	4.1	$U_w$ (humidity)	arithm. channel (humidity from Pt100 and psychrometer)
Corner 4	5.0	$t$ (temperature Pt100)	measuring channel (Pt100)
	5.1	$U_w$ (humidity)	arithm. channel (humidity from Pt100 and psychrometer)
Corner 5	6.0	$t$ (temperature Pt100)	measuring channel (Pt100)
	6.1	$U_w$ (humidity)	arithm. channel (humidity from Pt100 and psychrometer)
Corner 6	7.0	$t$ (temperature Pt100)	measuring channel (Pt100)
	7.1	$U_w$ (humidity)	arithm. channel (humidity from Pt100 and psychrometer)
Corner 7	8.0	$t$ (temperature Pt100)	measuring channel (Pt100)
	8.1	$U_w$ (humidity)	arithm. channel (humidity from Pt100 and psychrometer)
Corner 8	9.0	$t$ (temperature Pt100)	measuring channel (Pt100)
	9.1	$U_w$ (humidity)	arithm. channel (humidity from Pt100 and psychrometer)

## Guideline DAkks-DKD-R 5-7 *The following section includes extracts from the guideline.*

### Guideline DAkks-DKD-R 5-7 Calibration of climatic chambers

(...)

#### 4 Objectives of calibration

The calibration of a climatic chamber determines any deviation between the values displayed by the chamber indicators and the climatological variables, air temperature and relative humidity, measured in those parts of the chamber volume provided for use or at individual points in the chamber volume. (...)

The objectives of calibration are thus the following :

Calibration of the indicators for temperature and relative humidity by comparison with values for air temperature and atmospheric humidity measured in the useful space using reference equipment (also specifying any such deviation and the necessary corrections. (...)

#### 6 Calibration methods

(...)

(A) Calibration refers to the useful volume as spanned by the measuring locations in the unloaded climatic chamber. (...)

(B) Calibration refers to the useful volume as spanned by the measuring locations in the unloaded climatic chamber. The climatic chamber can be loaded in line with the user's typical application or by filling at least 40 percent of the useful volume with test pieces.

(...)

#### 7 Calibration procedures

##### 7.1 Arrangement of measuring locations

(...) For chamber volumes of up to 2000 liters the requirements regarding the number and spatial positioning of the measuring points are as per DIN EN 60068, 3-5; i.e. the measuring locations are the corner points and the spatial center of the cuboid spanning the useful volume. (...)

The calibration result is only valid for that volume spanned by the measuring points. (...)

##### 7.6 Humidity calibration

For the purpose of calibrating relative humidity in a climatic chamber subject to air circulation the absolute humidity and dew-point  $T_d$  or frost point  $T_f$  can be determined in the center of the useful volume and the spatial distribution of relative humidity be calculated on the basis of the measured air temperature distribution. (...)

## Miniature multi-sensor module for measuring temperature, humidity, and pressure with integrated EEPROM FH0D 46-C



Our new plug-in digital multi-sensor module - with its miniature design and extremely low energy consumption - combines the measurable variables - temperature, atmospheric humidity, and atmospheric pressure. It takes a complete reading of all these ambient parameters and can thus accurately determine all humidity-related and pressure-dependent variables, e.g. the frequently needed mixture ratio ( $r$ ).

It communicates its findings via an I<sup>2</sup>C interface; the user can selectively access individual sensor variables and data saved to the integrated EEPROM.

Before leaving our factory the sensor module is adjusted and assigned an electronic identification code that can be read out on

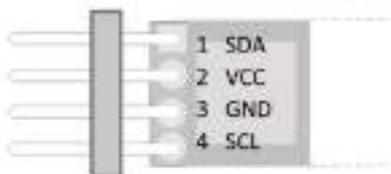
receipt of the appropriate command. The integrated EEPROM can be used to save the user's own adjustment data, fine tuning, or electronic ID data (ID number, comments text, etc.). Since the saved parameters are retained in the EEPROM, a multi-sensor module can only be exchanged or replaced with modules that are identically calibrated and have all the same data.

The module is specially designed with very good thermal isolation to withstand temperature influence / thermal conduction and thus ensure that all variables are measured precisely. This system - unlike analog measured value processing - virtually excludes the risk of varying line lengths or disturbance factors adversely affecting the accuracy of measured results.

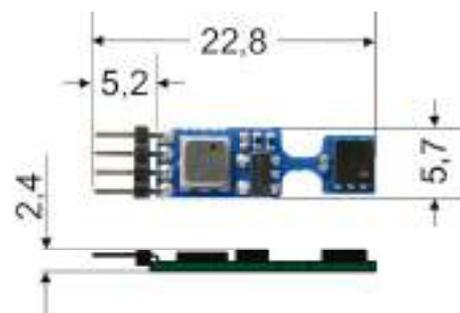
### Technical data

<b>Temperature range</b>	-40 to +85 °C	<b>I<sup>2</sup>C interface</b>	
Accuracy	+5 to +60 °C, typical ±0.2 K +5 to +60 °C, maximum 0.4 K -20 to +85 °C, maximum 0.7 K	Data rate	0 to 400 kHz
Reproducibility	typical ±0.1 K	<b>Sampling rate</b>	2/sec at highest resolution
<b>Humidity range</b>	5.0 to 98.0 % RH	<b>Electrical data</b>	
Accuracy	10 to 90 % RH, maximum ±2 % RH at 23 °C ±5 K 5 to 98 % RH, maximum ±4 % RH at 23 °C ±5 K	Power supply	2.1 to 3.6 V, typical 3.3 V
Hysteresis	typical ±1 % RH	Current consumption	during measuring typical 310 µA in standby typical 0.35 µA
<b>Pressure range</b>	300 to 1100 mbar	Energy consumption	during measuring typical 1.02 mW in standby typical 1.16 µW
Accuracy	700 to 1100 mbar, ±2.5 mbar at 23 °C ±5 K	Connection	male strip connector, 4-pin, spacing 1.27 mm see pin assignment
<b>Internal memory</b>	two-wire serial EEPROM 4 kbit (512 x 8 bit)		lead-free, halogen-free, and RoHS-compliant (restriction of hazardous substances)

### Pin assignment



### Dimensions



### Variants

**Miniature multi-sensor module for, humidity, temperature, and pressure with integrated EEPROM**  
 packaging unit 1 piece  
 packaging unit 10 pieces  
 packaging unit 100 pieces

Order no.

FH0D46C  
 FH0D46C  
 FH0D46C

## Digital sensor for temperature, humidity, and atmospheric pressure FHAD 46-Cx



Example:  
ALMEMO® D6-sensor  
FHAD 46-C41

Digital sensor for temperature, humidity, and atmospheric pressure FHAD46-Cx, with ALMEMO® D6 plug  
**new:** atmospheric pressure sensor integrated in the multi-sensor module, for automatic atmospheric pressure compensation

### Common technical features FHAD 46-Cx

- All sensors in 1 multi-sensor module: capacitive digital sensor for humidity and temperature, digital atmospheric pressure sensor. Additional EEPROM data storage medium in the sensor module.
- The sensor module is thoroughly adjusted. All sensor characteristic and adjustment data are stored on the data storage medium of the sensor module itself. In the process of readjusting the individual sensors the adjustment values are directly saved on the data storage medium of the sensor module.
- **new:** Every sensor module has an unique serial number saved on the humidity sensor. The serial number is either displayed in the sensor menu of the measuring instrument or in the ALMEMO® Control software. Hence, calibrated sensor modules can clearly be assigned to the calibration certificate.
- Replacement sensor modules are inexpensive: The sensor module is pluggable and can simply be exchanged on-site. Full accuracy without any adjustment, especially with calibrated sensors. The ALMEMO® connecting cable and the ALMEMO® measuring instrument have no influence on the calibration.
- **new:** The atmospheric pressure is measured directly at the measuring point in the sensor tip. Hence, the atmospheric pressure dependent humidity variables are automatically pressure compensated.
- All relevant ambient parameters are measured with just one sensor.
- Humidity calculation on the basis of formulae as per Dr. Sonntag and the enhancement factor as per W. Bögel (correction factor fw(t,p) for real mixed gas systems) This substantially widens the measuring range and improves the accuracy of humidity variable calculations.
- **new:** Humidity variable : Absolute humidity in g/m<sup>3</sup>
- The humidity variables are calculated from the three primary measuring channels (real measurable variables). temperature, relative humidity, atmospheric pressure
- Freely selectable measurable variables  
Four measuring channels are programmed (at our factory). temperature (°C, T, t), relative humidity (%H, RH, Uw), dewpoint (°C, DT, td), atmospheric pressure (mbar, AP, p)  
Other humidity variables can also be selected. mixture (g/kg, MH, r), absolute humidity (g/m<sup>3</sup>, AH, dv), vapor pressure (mbar, VP, e), enthalpy (kJ/kg, En, h)  
The configuration is performed on the ALMEMO® V7 measuring instrument or directly on the PC using the USB adapter cable ZA1919AKUV (see chapter “ALMEMO® Network technology”).

### Common technical data FHAD 46-Cx

#### Digital temperature / humidity sensor (including A/D converter)

Operative range depending on sensor type

#### Humidity

Measuring range	0 to 98 % RH
Sensor	CMOSens® technology
Accuracy	±2.0 % RH in range 10 to 90 % RH ±4.0 % RH in range 5 to 98 % RH at nominal temperature
Hysteresis	typical ±1 % RH
Nominal temperature	+23 °C ±5 K
Sensor operating pressure	Atmospheric pressure
Response time T <sub>63</sub>	typical 8 seconds at +25 °C, 1 m/s (without filter)

#### Temperature

Sensor	CMOSens® technology
--------	---------------------

DAkkS or factory calibration KH9xxx temperature, humidity for digital sensor (see chapter „Calibration certificates“).

DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

Accuracy	typical ±0.2 K at 5 to 60 °C maximum ±0.4 K at 5 to 60 °C maximum ±0.7 K at -20 to +80 °C
Reproducibility	typical ±0.1 K
Response time T <sub>63</sub>	typical 20 seconds (without filter)

#### ALMEMO® connecting cable

PVC; Length (see variants) with ALMEMO® D6 plug  
**new** FHAD 46-C4xAx silicone

#### Digital atm. pressure sensor (integrated in the multi-sensor module)

Measuring range	700 to 1100 mbar
Accuracy	±2.5 mbar (at 23 °C ±5 K)

#### ALMEMO® D6 plug

Refresh rate	1 seconds for all four channels
Supply voltage	6 to 13 VDC
Current consumption	3 mA

## Digital sensor for temperature, humidity, and atm. pressure FHAD 46-C4AG in protective all-weather housing cable length up to 100 meters with ALMEMO® D6 plug



Technical data and variants  
(see chapter „Meteorology“)



## Digital sensor for temperature, humidity, and atmospheric pressure FHAD 46-C2 Version in plastic, with slotted sensor cap with ALMEMO® D6 plug



FHAD 46-C2  
Multi-sensor module incorporated  
in slotted sensor cap  
compact design, short response time



FHAD 46-C2 Option with plug-in extension tube



Replacement multi-sensor module FH0D 46-C2



FHAD 46-C2L00



Extension tube

- Four measuring channels are programmed (at our factory).  
Temperature (°C, T, t), Relative humidity (%H, RH, Uw)

- Dewpoint (°C, DT, td)
- Atmospheric pressure (mbar, AP, p).

### Technical data

Operative range	-20 to +60 °C / 5 to 98 % RH	Extension tube	Ø 8 mm, length 97 mm
Mechanical design		General description and common technical data see FHAD 46-Cx	
Sensor cap	Ø 8 mm, length 36 mm		
Plug connection	Ø approx. 9 mm, IP40		

Variants including manufacturer's test certificate	Order no.
Digital sensor for temperature, atmospheric humidity, and atmospheric pressure, with multi-sensor module in slotted sensor cap, plug connector, including ALMEMO® connecting cable with coupling and ALMEMO® D6 plug.	
Connecting cable, length 2 meters	<b>FHAD46C2</b>
Connecting cable, length 5 meters	<b>FHAD46C2L05</b>
Connecting cable, length 10 meters	<b>FHAD46C2L10</b>
Cable stub approx. : 80 mm (incl. multi-sensor module)	<b>FHAD46C2L00</b>
Spare sensor element for FHAD462, digital, enclosed in slotted sensor cover, adjusted	<b>FH0D46C2</b>
Extension tube, Ø 8 mm, length 97 mm, plug-in, for FHAD 46-C2	<b>ZB0D462VR</b>

## Digital sensor for temperature, humidity, and atm. pressure FHAD 46-C0 Uncovered multi-sensor module with ALMEMO® D6 plug



FHAD 46-C0  
Uncovered multi-sensor module  
most compact design, short response time



Replacement multi-sensor module FH0D 46-C

- Four measuring channels are programmed (at our factory).  
Temperature (°C, T, t), Relative humidity (%H, RH, Uw)

- Dewpoint (°C, DT, td),
- Atmospheric pressure (mbar, AP, p).

### Technical data

Operative range	-20 to +80 °C / 5 to 98 % RH	Multi-sensor module (dimensions over all) approx. 6 x 14 x 3 mm
Mechanical design		Plug connection Width approx. 7 mm

Variants including manufacturer's test certificate	Order no.
Digital sensor for temperature, humidity, and atmospheric pressure, with uncovered multi-sensor module, plug connector, including ALMEMO® connecting cable with coupling and ALMEMO® D6 plug.	
Connecting cable, length 2 meters	<b>FHAD46C0</b>
Connecting cable, length 5 meters	<b>FHAD46C0L05</b>
Connecting cable, length 10 meters	<b>FHAD46C0L10</b>
Replacement multi-sensor module, digital, adjusted, plug-in	<b>FH0D46C</b>

## High-precision sensor for temperature, humidity, atmospheric pressure FHAD 36 Rx Wide operating temperature range Automatic atmospheric pressure compensation Digital sensor with ALMEMO® D6 plug



ALMEMO® connecting cable  
with sensor  
(example FHAD 36 RAS)

**General features,  
ALMEMO® D6 sensors**  
see page 01.08

### Common technical features FHAD 36 Rx

- Digital capacitive humidity sensor with integrated signal processor, designed to meet the highest accuracy requirements in humidity measurement
- Unique correction and adjustment process  
All sensor characteristics and adjustment data are saved in the humidity sensor itself.
- A digital atmospheric pressure sensor integrated in the ALMEMO® D6 plug itself provides automatic pressure compensation for all pressure-dependent humidity variables.
- Humidity calculation on the basis of formulae as per Dr. Sonntag and the enhancement factor as per W. Bögel (correction factor  $fw(t,p)$  for real mixed gas systems) This substantially widens the measuring range and improves the accuracy of humidity variable calculations.
- Humidity variable, Absolute humidity in  $g/m^3$
- All relevant ambient parameters are measured with just one sensor.
- The humidity variables are calculated from the three primary measuring channels (real measurable variables). temperature, relative humidity, atmospheric pressure
- Freely selectable measurable variables
- Four measuring channels are programmed (at our factory). temperature ( $^{\circ}C$ , T, t), relative humidity (%H, RH, Uw), dewpoint ( $^{\circ}C$ , DT, td), atmospheric pressure (mbar, AP, p)  
Other humidity variables can also be selected:  
mixture ( $g/kg$ , MH, r), absolute humidity ( $g/m^3$ , AH, dv), vapor pressure (mbar, VP, e), enthalpy ( $kJ/kg$ , En, h)  
This device can be configured directly on a PC using USB adapter cable ZA 1919 AKUV. (see chapter „Networking“).

### Common technical data FHAD 36 Rx

#### Digital temperature / humidity sensor (including A/D converter)

Operative range	depending on sensor type
<b>Humidity</b>	
Sensor	capacitive
Measuring range	0 to 100 % RH
Adjusted	at +23 °C and 10%, 35%, 80% RH
Accuracy	$\pm 1.3$ % RH (at +23°C $\pm 5$ K)
Reproducibility	0.3 % RH
Response time $T_{63}$	<15 seconds at typical 1 m/s (without filter)
<b>Temperature</b>	
Sensor	Pt100 class A
Measuring range	-100 to +170 °C Please observe operative range ! (depending on sensor type)
Accuracy at +23 °C $\pm 5$ K	$\pm 0.2$ K
Reproducibility	0.05 °C

#### Sensor connector on the sensor / sensor cable

Plug connector (Materials : anticorodal aluminum, anodized) IP65

#### Operative range of the electronics

in the connecting cable (coupling) -40 to +90 °C  
in the grip (of hand-held sensors) -40 to +85 °C

#### ALMEMO® connecting cable

Coupling (length = 100 mm) with cable, length = 2 or 5 meters  
(Materials : TPU, -40 to +90 °C) with ALMEMO® D6 plug

#### Digital atm. pressure sensor (integrated in ALMEMO® D6 plug)

Measuring range 700 to 1100 mbar  
Accuracy  $\pm 2.5$  mbar (at 23 °C  $\pm 5$  K)

#### ALMEMO® D6 plug

Refresh rate 1 second for all four channels  
Supply voltage 6 to 13 VDC  
Current consumption 12 mA

**High-precision sensor for temperature, humidity, atmospheric pressure FHAD 36 RAS**  
**Automatic atmospheric pressure compensation. Digital sensor with ALMEMO® D6 plug**

06/2018 • We reserve the right to make technical changes.



General description and common technical data  
 FHAD 36 Rx (see page 08.11)

## Technical data

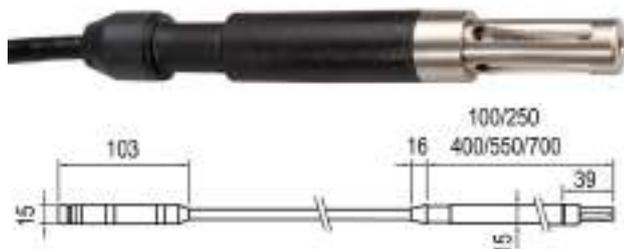
Operative range	-50 to +90 °C	Filter cartridge	Polycarbonate
Sensor materials	Polycarbonate	Filter	Polyethylene

Accessorie	Order no.
Brackets for wall mounting (see page 08.05)	<b>ZB9600W</b>

Variants	Order no.
Including factory test certificate and polyethylene filter	
High-precision digital temperature / humidity sensor, with plug connector, including ALMEMO® connecting cable with coupling and ALMEMO® D6 plug, and integrated digital atmospheric pressure sensor	
Connecting cable, length 2 meters	<b>FHAD36RAS</b>
Same as above Connecting cable, length 5 meters	<b>FHAD36RASL05</b>

Filters	Order no.
	
<b>Variants</b>	
Filter insert made from polyethylene with a polycarbonate filter cartridge for standard applications good response time and good protection against fine particulates	<b>ZB9636APE</b>
Filter insert made from stainless-steel wire fabric with a polycarbonate filter cartridge quickest response time not suitable for environments that are bioactive or contaminated with fine particulates (risk of congestion)	<b>ZB9636AWM</b>
Filter insert made from PTFE (polytetrafluoroethylene) with a polycarbonate filter cartridge good protection against fine particulates and salt (maritime environment) slower response time	<b>ZB9636APTFE</b>

**High-precision sensor for temperature, humidity, atmospheric pressure FHAD 36 RIC**  
**Industrial-standard design for high temperatures up to +170 °C**  
**Automatic atmospheric pressure compensation. Digital sensor with ALMEMO® D6 plug**



Sensor plug, high-temperature cable, sensor

General description  
and common technical data  
FHAD 36 Rx (see page 08.11)

### Technical data

Operative range	-100 to +170 °C *	Filter cartridge	Brass, nickel-plated
Sensor length	100 mm (Other lengths 250 / 400 / 550 / 700 mm are available on request.)	Filter	Stainless-steel wire fabric filter
Sensor materials	PPS (polyphenylene sulfide)	Response time T <sub>63</sub>	<10 seconds at typical 1 m/s, without filter

\* Persistent use in the high-temperature range (>170 °C) may incur a loss in accuracy and / or damage to the measuring cell.

### Accessories

	Order no.
Assembly screw fittings for 15 mm sensor Thread M20x1.5 Viton® seal, up to +200 °C	<b>ZB9636KV</b>
Mounting flange Steel, nickel-plated Diameter 80 mm	<b>ZB9636F</b>



### Variants Including factory test certificate and stainless-steel wire fabric filter

High-precision digital temperature / humidity sensor, industry-standard, with high-temperature sensor cable and plug connector, including ALMEMO® connecting cable with coupling and ALMEMO® D6 plug  
 Integrated digital atmospheric pressure sensor

Sensor cable, length = 2 meters, Connecting cable, length 2 meters

Same as above Sensor cable, length = 5 meters, Connecting cable, length 2 meters

Same as above Sensor cable, length = 2 meters, Connecting cable, length 5 meters

Same as above Sensor cable, length = 5 meters, Connecting cable, length 5 meters

Order no.

**FHAD36RIC102**

**FHAD36RIC105**

**FHAD36RIC102L05**

**FHAD36RIC105L05**

### Filter

for sensors with filter cartridge  
for FHAD 36 RIC and FHAD 36 RHK



### Variants

Stainless-steel wire fabric filter quickest response time

not suitable for environments that are bioactive or contaminated with fine particulates (risk of congestion)

Stainless-steel sinter filter best protection in environments heavily contaminated with particulates

good response time for low humidities (not to be used for high humidities)

PTFE filter good protection against fine particulates and salt (maritime environment) slower response time

Order no.

**ZB9636M15**

**ZB9636S15**

**ZB9636T15**

### Other designs are available on request

FHAD 36-RIMx :

Industry-standard humidity sensor FHAD 36 RIM  
in stainless steel Diameter 15 mm, -100 to +170 °C

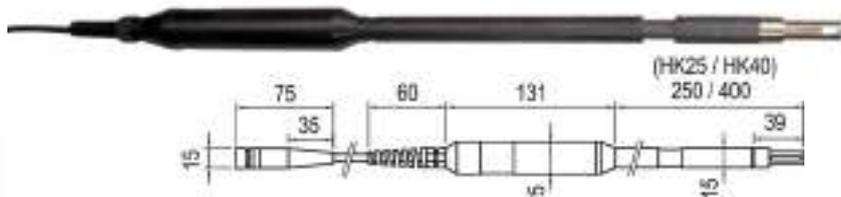
FHAD 36-RIEx :

Screw-fit humidity sensor FHAD 36 RIE, up to 100 bar,  
stainless steel Thread G 1/2-inch, -50 to +170 °C



**High-precision sensor for temperature, humidity, atmospheric pressure FHAD 36 RHK**  
**Hand-held sensor for temperatures up to +170 °C**  
**Automatic atmospheric pressure compensation, Digital sensor with ALMEMO® D6 plug**

06/2018 • We reserve the right to make technical changes.



Sensor plug, cable, sensor with handle

For on-site test measurements,  
not for stationary installation

General description and  
common technical data FHAD 36 Rx  
(see page 08.11)

## Technical data

Operative range	-100 to +150 / +170 °C (see variants)	Filter cartridge	Brass, nickel-plated
Operative range of the electronics in the grip	-40 to +85 °C	Filter	Stainless-steel wire fabric filter
Sensor materials	Shaft PPS (polyphenylene sulfide)	Response time T <sub>63</sub>	<10 seconds at typical 1 m/s, without filter
Grip	POM (polyoxymethylene)		

**Variants** Including factory test certificate and stainless-steel wire fabric filter

**Order no.**

High-precision digital temperature / humidity sensor

Handle with 2-meter sensor cable and plug connector, including ALMEMO® connecting cable, length 0.3 meters, with coupling and ALMEMO® D6 plug Integrated digital atmospheric pressure sensor

Operative range up to +150 °C Sensor length 250 mm

**FHAD36RHK25**

Operative range up to +170 °C Sensor length 400 mm

**FHAD36RHK40**

## Other designs are available on request

FHAD 36-RHPx :

Humidity probe with pointed tip, Diameter 10 mm  
for taking meas. in loose bulk materials, -40 to +85 °C

FHAD 36-RHSx :

Humidity probe with flat blade 18 x 4 mm  
for taking meas. in paper or textile stacks, -40 to +85 °C



## High-humidity sensor FHAD 36-E33x available on request

Digital humidity and temperature sensor for high humidity application. Humidity sensor with heatable monolithic measurement cell for measurement operations in the high-humidity range near condensation.

## Capacitive humidity sensor FHA 646 R, miniature sensor



- Compact sensor, extremely small dimensions
- Wide operating temperature range
- Particularly suitable for measuring operations between PCBs,

inside cases, in walls, ceilings, and insulation layers used in the construction industry, and for the protection of listed historic monuments

### Technical data

Operative range	-30 to +100 °C, 5 to 98 % RH	Temperature measuring circuit	
Humidity measuring circuit		Sensor	NTC type N
Measuring range	0 to 100 % RH	Accuracy	-20 to 0 ±0.4 K, 0 to +70 ±0.2 K +70 to +100 ±0.6 K
Sensor	capacitive	Reproducibility	0.1 K
Accuracy	±2 % RH in the range <90 % RH at nominal temperature	Mechanical design	
Reproducibility	<1% RH at nominal temperature	Sensor tube	nickel-plated, 50 mm long, 5 mm Ø
Nominal temperature	+25 ±3 °C	Protective cap	None
Response time T63	approx. 10 seconds at 1 m/s	Cable	High-temperature cable (up to +100 °C), 2 meters long, with ALMEMO® plug (no other lengths available)

- ! The sensor can only be operated by plugging DIRECTLY onto an ALMEMO® device.  
(NOT with extension cables ZA9060VKx or ZA9090VKCx).  
Or, alternatively, the following sensor types can be used. FHAD36RAS up to +100 °C (see page 08.08)  
FHAD46-C2 or FHAD46-C0 Compact design (see page 08.06)

### Accessories

	Order no.
PTFE filter, inside diameter 5 mm suitable for protection against dust, not water-proof	ZB9646SKR
Clamped screw connection with thread adapter for telescopic extension / extension set (maximum 80 °C)	ZV9915KV
Telescopic extension Ø 15 to 24 mm, 330 / 1010 mm	ZV9915TV
Extension set Ø 15 mm, 4 x 255 mm	ZV9915VR3



### Variants

Miniature sensor for temperature / humidity, with fitted high-temperature cable, length 2 meters, with ALMEMO® plug

Order no.

FHA646R

DAkS or factory calibration KH9xxx temperature, humidity for measuring chain (sensor + device) (see chapter „Calibration certificates“).  
DAkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Digital sensor for measuring temperature and humidity FHAD 46-C7,



Pressure-sealed variant up to 16 bar, with ALMEMO® D6 plug

- Compact sensor made from stainless steel
- Screw thread, for pressure pipes
- Option - adapter for compressed air pipes
- Capacitive digital sensor for humidity and temperature. Additionally EEPROM data storage medium in the multi-sensor module.
- The sensor module is thoroughly adjusted. All sensor characteristic and adjustment data are stored on the data storage medium of the sensor module itself. In the process of readjusting the individual sensors, the adjustment values are directly saved on the data storage medium of the sensor module.
- **new:** Every sensor module has an unique serial number saved on the humidity sensor. The serial number is either displayed in the sensor menu of the measuring instrument or in the ALMEMO® Control software. Hence, calibrated sensor modules can clearly be assigned to the calibration certificate.
- Replacement sensor modules are inexpensive: The sensor

module is pluggable and can simply be exchanged on-site. Full accuracy without any adjustment, especially with calibrated sensors. The ALMEMO® connecting cable and the ALMEMO® measuring instrument have no influence on the calibration.

- The humidity variables are calculated from the two primary measuring channels (real measurable variables): temperature, relative humidity
- Three measuring channels are programmed: temperature (°C, T, t), relative humidity (%H, RH, Uw), dewpoint (°C, DT, td) One further humidity variable can also be selected: mixture(g/kg, MH, r), absolute humidity(g/m³, AH, dv), vapor pressure (mbar, VP, e), enthalpy (kJ/kg, En, h) The configuration of the channels and the input of the system pressure for the automatic pressure compensation of the pressure dependent humidity variables is performed on the ALMEMO® V7 measuring instrument or directly on the PC using the USB adapter cable ZA1919AKUV (see chapter "ALMEMO® Network technology").

### Technical data

<b>Operative range</b>	-20 to +80 °C, 5 to 98 % RH
<b>Digital temperature / humidity sensor (including A/D converter)</b>	
<b>Humidity</b>	
Measuring range	0 to 98 % RH
Sensor	CMOSens® technology
Accuracy	±2.0 % RH in range 10 to 90 % RH ±4.0 % RH in range 5 to to 98 % RH at nominal temperature
Hysteresis	typical ±1 % RH
Nominal temperature	+23 °C ±5 K
Sensor operating pressure	up to 16 bar
<b>Temperature</b>	
Sensor	CMOSens® technology
Accuracy	typical ±0.2 K at 5 to 60 °C maximum ±0.4 K at 5 to 60 °C maximum ±0.7 K at -20 to +80 °C
Reproducibility	typical ±0.1 K

<b>ALMEMO® connecting cable</b>	
PVC Length (see variants) with ALMEMO® D6 plug	
<b>ALMEMO® D6 plug</b>	
Refresh time	1 second for all four channels
Supply voltage	6 to 13 VDC
Current consumption	3 mA
<b>Mechanical design</b>	
Sensor	Stainless steel, diameter 12 mm Overall length approx. 77 mm
Filter cap	PTFE sinter filter SK6
Process connection	Male thread G 1/2-inch Fitted length 48 mm, Width across flats 27
Screw-fit cable gland	Splash-protected



Adapter for compressed air pipes

### Accessories

Adapter for compressed air pipes	ZB96467AP
PTFE sinter filter (spare ) (see page 08.09)	ZB9600SK6
Stainless-steel sinter filter (see page 08.09)	ZB9600SK8

### Variants

Digitaler sensor for temperature and humidity, filter cap PTFE, pressure-sealed variant, with fitted cable and ALMEMO® D6 plug, manufacturer's test certificate

- Connecting cable, length 2 meters
- Connecting cable, length 5 meters
- Connecting cable, length 10 meters
- Replacement sensor element, digital, adjusted, plug-in

### Order no.

**FHAD46C7**  
**FHAD46C7L05**  
**FHAD46C7L10**  
**FH0D46C**

DakKS or factory calibration KH9xxx, temperature, humidity, for digital sensor (see chapter „Calibration certificates“).  
DakKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## ALMEMO® dewpoint sensor FHA 646 DTC1, dewpoint transmitter MT 8716 DTC1



- Especially suitable for monitoring pressurized systems
- Digital transfer of measured values to the ALMEMO® display device (avoids risk of inaccuracy on connecting lines or display section itself)
- High-level accuracy sustained down to -80 °C
- Quick response time
- Displayed variables: temperature, relative humidity, dewpoint
- Process connection for high pressures (option, up to 350 bar).

### Technical data

Measuring range	-80 to +20°C dewpoint temperature (DT)
Measuring accuracy	± 0.5 °C from -10 to +20 °C DT typical ±2 °C DT at -40 °C DT
Measuring channels (FHA646DTC1 only)	
temperature	-20.0 to +70.0 °C
Relative humidity	0 to 98.0 % RH
Dewpoint	-80.0 to +20.0 °C (DT)
Operating temperature	-20 to +70 °C
Process connection	Screw thread G 1/2-inch, stainless steel
Protective cap	Sintered stainless steel filter
Pressure range	-1 to +50 bar standard
Storage temperature	-40 to +80 °C

<b>FHA 646 DTC1</b>	
Output	ALMEMO® digital
Power supply	via ALMEMO® plug, approx. 5 mA
Connection	Cable, 1.5 meters, with ALMEMO® plug
<b>MT 8716 DTC1</b>	
Output	4 to 20 mA / -80 to +20 °C (DT), 2 wires
Power supply	10 to 30 VDC, load <500 ohms
Connection	Transmitter connector
Housing	
Material	Polycarbonate
Protective class	IP65

### Accessories

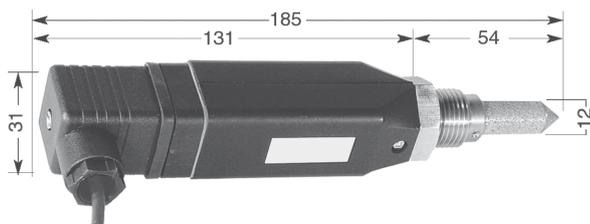
### Order no.

Screw-on measuring chamber for connecting a dewpoint transmitter to compressed air pipes via a ball valve up to maximum 16 bar including perforated protective cap **ZB9646DTCK**  
 Advantage: high-speed measuring without waiting for installation.



### Option

Dewpoint sensor for process pressure up to 350 bar **OA9646DTCP**



### Variants including factory calibration certificate

ALMEMO® dewpoint sensor with connecting cable, 1.5 meters long, and ALMEMO® plug  
 Dewpoint transmitter with current output, including connector  
 Factory calibration KH93xx, dewpoint, for digital sensor (see chapter „Calibration certificates“)

### Order no.

**FHA646DTC1**  
**MT8716DTC1**

## Digital psychrometers, FNAD 46 and FNAD 46-3 with ALMEMO® D6 plug with integrated atmospheric pressure sensor, for automatic pressure compensation



General features,  
ALMEMO® D6 sensors  
see page 01.08

- **new:** A digital atmospheric pressure sensor integrated in the ALMEMO® D6 plug itself provides automatic pressure compensation for all pressure-dependent humidity variables.
- **new:** Humidity calculation on the basis of formulae as per Dr. Sonntag and the enhancement factor as per W. Bögel (correction factor  $f_w(t,p)$  for real mixed gas systems) This substantially widens the measuring range and improves the accuracy of humidity variable calculations.
- **new:** Humidity variable Absolute humidity in  $g/m^3$
- High-precision NTC sensors for dry temperature and wet temperature
- Temperatures are measured using a 24-bit A/D converter incorporated in the ALMEMO® D6 plug.
- The humidity variables are calculated from the three

- primary measuring channels (real measurable variables):  
Dry temperature, wet temperature, atmospheric pressure
- Freely selectable measurable variables  
Four measuring channels are programmed (at our factory):  
dry temperature ( $^{\circ}C$ , TT, t), wet temperature ( $^{\circ}C$ , HT, tw), relative humidity (%H, RH, Uw), atmospheric pressure (mbar, AP, p)
  - Other humidity variables can also be selected:  
dewpoint ( $^{\circ}C$ , DT, td), mixture (g/kg, MH, r), absolute humidity ( $g/m^3$ , AH, dv), vapor pressure (mbar, VP, e), enthalpy (kJ/kg, En, h)
- This device can be configured directly on a PC using USB adapter cable ZA 1919 AKUV. (see chapter „Networking“).

### Technical data, FNAD 46 and FNAD 46-3

#### Digital atmospheric pressure sensor (integrated in ALMEMO® D6 plug)

Measuring range	700 to 1100 mbar
Accuracy	$\pm 2.5$ mbar (at $23^{\circ}C \pm 5$ K)

#### A/D converter incorporated in ALMEMO® D6 plug

Inputs	2 NTC sensors (clamped connection in plug)
Resolution	0.01 K

Linearization	error-free computing method according to Galway Steinhart (no approximations)
Accuracy	$\pm 0.05$ K
Nominal temperature	$23^{\circ}C \pm 2$ K
Temperature drift:	0,004 %/K (40 ppm)
Calculated humidity variables	Analytic equation (not an approximation)
Refresh rate	0.4 seconds for all four channels

**Hand-held digital psychrometer FNAD 46**

For test measurements

General description and common technical data  
FNAD 46 (see page 08.18)

**Technical data**

Operating temperature	0 to +60 °C (no ice)
Humidity measuring range	10 to 100% RH
Measuring system	psychrometric
Accuracy	±1 % RH under nominal conditions
Accuracy in measuring range	10... 100 % r. h.: typ. ±1 % r. h. at 25°C ±3K, 1013 mbar
Nominal conditions	+25 °C ±3 K, 1013 mbar, 50 % RH
Temperature sensors	2 x NTC type N
Accuracy	±0,2 K at 0 to 60 °C
Ventilator power supply	via ALMEMO® D6 plug
Housing	Plastic
Dimensions	Ø 50 mm, length 245 mm
Weight	approx. 300 g
Sensor connector	Built-in plug
ALMEMO® connecting cable	coupling, 1.5 meters, PVC cable with ALMEMO® D6 plug
Supply voltage	9 to 13 VDC
Current consumption	20 mA

**Stationary digital psychrometer FNAD 46-3**

Version optimized for long-term measuring operations  
Automatic humidification of the wick after filling the water  
tank.

General description and common technical data  
FNAD 46-3 (see page 08.18)

**Technical data**

Operating temperature	0 to +90 °C (no ice)
Humidity measuring range	10 to 100% RH
Measuring system	psychrometric
Accuracy	±1 % RH under nominal conditions
Accuracy in measuring range	10... 100 % r. h.: typ. ±1 % r. h. at 25°C ±3K, 1013 mbar
Nominal conditions	+25 °C ±3 K, 1013 mbar, 50 % RH
Temperature sensors	2 x NTC type N
Accuracy	±0,2 K at 0 to 70 °C, ±0,4 K at 70 to 90 °C
Ventilator power supply	12 VDC via mains unit, cable approx. 1.5 meters (included in delivery)
Housing	Plastic PMMA
Dimensions	175 x 50 x 75 mm (LxWxH)
Weight	approx. 890 g
ALMEMO® connecting cable	Cable, FEP / silicone, 5 meters with ALMEMO® D6 plug
Supply voltage	6 to 13 VDC
Current consumption	4 mA

**Accessories****Order no.**

Extension pipe, 200 mm long	<b>ZB9846VR</b>
Plastic suction hose, 300 mm long	<b>ZB9846PS</b>
Spare wicks (2 pieces)	<b>ZB9846ED</b>

**Variants****Order no.**

Hand-held digital psychrometer with NTC sensor	
Hand-held psychrometer, connecting cable with ALMEMO® D6 plug, integrated digital atmospheric pressure sensor, water bottle, two wicks	<b>FNAD46</b>

**Accessories****Order no.**

Extension cable for mains units, 3-pin bayonet coupling, length 5 meters	<b>ZB5090VK05</b>
Spare wicks (2 pieces)	<b>ZB98462ED</b>

**Variants****Order no.**

Digital psychrometer with NTC sensor	
Psychrometer, fitted cable, with ALMEMO® D6 plug, integ- rated digital atmospheric pressure sensor, mains unit, water bottle, two wicks, carry case	<b>FNAD463</b>

DAkS or factory calibration KH91xx, temperature, humidity, for digital sensor (see chapter „Calibration certificates“).  
DAkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

# Air humidity

## Psychrometer FPA 836-3



- Optimized for long-term measuring operations
- Especially suitable for high temperatures

## Recommended for measuring instrument ALMEMO® 710



ALMEMO® 710

When measuring atmospheric humidity the combination of precision measuring instrument ALMEMO® 710 and Pt100 psychrometer FPA 836-3 ensures a substantially higher level of accuracy and a wider measuring range. The measuring instrument incorporates a digital atmospheric pressure sensor for compensation purposes.

On the ALMEMO® 710 atmospheric humidity is calculated on the basis of formulae as per Dr. Sonntag and enhancement factor as per W. Bögel (correction factor  $f_w(t, p)$  for real mixed gas systems). Variables are calculated from the three primary measuring channels (real measurable variables) - dry temperature ( $^{\circ}\text{C}$ , TD, t), wet temperature ( $^{\circ}\text{C}$ , TW, tw), and atmospheric pressure (mbar, AP, p). Humidity variables can be selected: relative humidity (%H, RH, Uw), dewpoint ( $^{\circ}\text{C}$ , DT, td), mixture (g/kg, MH, r), absolute humidity (g/m<sup>3</sup>, AH, dv), vapor pressure (mbar, VP, e), enthalpy (kJ/kg, En, h)

For ALMEMO® 710's general description and technical data see Chapter „ALMEMO® universal measuring instruments“

## Recommendations for calibration laboratories and quality assurance



ALMEMO® 1036-2

Reference measuring instrument ALMEMO® 1036-2 is ideally suited for use in calibration laboratories and quality assurance procedures. When measuring atmospheric humidity the combination of reference measuring instrument ALMEMO® 1036-2 and precision psychrometer FPA-836-3P3 ensures very high levels of resolution, precision, and linearity. Resolution parameters: temperature Pt100 0.001 K, relative humidity 0.01%, dewpoint 0.01K. The measuring instrument incorporates a digital atmospheric pressure sensor for compensation purposes. These devices are offered in a set including the sensor and a DAkkS calibration certificate.

For general description and technical data see Chapter „ALMEMO® reference measuring instruments“.

## Recommendations for measuring operations using other ALMEMO® devices

Digital NTC psychrometer FNAD 46-3 with integrated atmospheric pressure sensor and new humidity calculation procedure. For general description and technical data see Catalog, page 08.14.

## Psychrometer FPA 836-3

## Technical data

Atmospheric humidity		Ventilator power supply	12 VDC via mains unit, cable approx. 1.5 meters (included in delivery)
Operating temperature	0 to 90 °C		
Measuring range	approx. 10 to 100 % RH		
Measuring system		Mechanical design	
Measuring system	psychrometric	Housing	Plastic PMMA (polymethyl methacrylate, acrylic)
Accuracy	±1 % RH under nominal conditions using ALMEMO® 710 (new humidity calculation procedure)	Dimensions	175 x 50 x 75 mm (LxWxH)
Accuracy in measuring range 10... 100 % r. h.: typ. ±1 % r. h. at 25°C ±3K, 1013 mbar		Weight	approx. 890 g
Nominal conditions	+25 ±3 °C, 1013 mbar, 50% RH	Cable	FEP / silicone, 5 meters with ALMEMO® plug 2 cables, 2 plugs
Temperature			
Sensor	2 x Pt100 ilm resistor		
Accuracy	class B, ALMEMO® adjusted		

## Accessories

## Order no.

Automatic compensation of pressure-dependent variables affecting atmospheric humidity  
Psychrometric measurable variables depend on the ambient atmospheric pressure, . ALMEMO® plug-in pressure probe FDAD12SA measures the barometric atmospheric pressure. The ALMEMO® measuring instrument thus compensates pressure-dependent humidity variables.

ALMEMO® plug-in pressure probe for barometric pressure 700 to 1100 mbar, without pressure connection sleeve  
(For version with pressure connection sleeve and technical data, see Catalog, page 10.10).

FDAD12SA

Option with programming for automatic atmospheric pressure compensation (designation \*P)

OA9000PK

Spare wicks (2 pieces)

ZB98462ED

Extension cable for mains units, 3-pin bayonet coupling, length 5 meters

ZB5090VK05

## Variants

## Order no.

(including mains plug, water bottle, two wicks)

Psychrometer with 2 x Pt100 sensors, including connecting cable (two ALMEMO® plugs)

FPA8363

DAkKS or factory calibration KH9xxx, temperature, humidity, for digital sensor (see chapter „Calibration certificates“).  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

# Air humidity

## Digital temperature / humidity transmitter MH8D46 with double analog output V or mA

06/2018 • We reserve the right to make technical changes.



Transmitter with open housing

- Digital sensor element  
All key sensor characteristics, settings, and adjustment data are saved in the sensor element itself.
- Plug-in sensor element  
Spare elements are inexpensive; a replacement can be fitted on site quickly and easily by virtually anyone; it will be fully accurate straight away needing no special adjustment.
- Digital transfer of measured values from the sensor element to the transmitter
- Factory or DAkKS calibration is performed on the sensor element alone. Fully accurate - irrespective of connecting cable and transmitter
- Four climate variables can be measured: Double analog output for temperature and one humidity variable relative humidity / dewpoint / mixture ratio
- Limit value relays available on request
- The transmitters can be configured via the internal display and the keypad.
- The analog output type (10 V or 20 mA) can be selected (via the keypad); the analog output range can be programmed.
- Display of measured value, channel, units, humidity range, analog start, analog end, and analog type
- The sensor tube can be connected either directly by plugging onto the transmitter itself or via a connecting cable.
- Suitable for conduit mounting or wall mounting

### Technical data

Operative range	Sensor -20 to +80 °C, 5 to 98 % RH Electronics -10 to +60 °C, IP65	Output type	0 to 10 V, 0 to 20 / 4 to 20 mA, selectable
Humidity sensor		Resolution	16 bit
Measuring range	0 to 100 % RH	Accuracy	0.1 % of final value
Sensor	CMOSens® technology	Temperature drift	10 ppm / K
Fixed measuring period / output period	approx. 3 seconds	Time constant	100 µs
Accuracy	±1.8 % RH in range 20 to 90 % RH ±2.3 % RH in range 10 to < 20 % RH at nominal temperature	Connection	Cable, via screwless clamp connector, with cable bushing Cable diameter 2 to 5 mm Limit value relays available on request
Hysteresis	typical ±1 % RH	Standard equipment	
Nominal temperature	+25 °C	Display, internal	2-row LCD 7 segments 4 1/2 and 5 characters 2 digits 16 segments
Sensor operating pressure	Atmospheric pressure	Operation, internal	3 keys
Response time T <sub>63</sub>	typical 8 seconds at +25 °C, 1 m/s (without filter)	Power supply	
Temperature sensor		DC voltage	9 to 30 VDC
Sensor	CMOSens® technology	Current consumption	30 mA + 1.2·I <sub>Out</sub>
Fixed measuring period / output period	approx. 3 seconds	Connection	Cable, via screwless clamp connector, with cable bushing Cable diameter 2 to 5 mm
Accuracy	±0.3 K at +25 °C ±0.4 K at +10 to +40 °C ±1.3 K at -20 to +80 °C	Mechanical design	
Reproducibility	typical ±0.1 K	Sensor tube	Stainless steel, diameter 12 mm
Response time T <sub>63</sub>	typical 20 seconds (without filter)	Protective cap	SK7, metal-mesh filter
Outputs		Housing	Die-cast aluminum, closed cover
Double analog output	Digital-to-analog converter (DAC) electr. isol. 0 to 10 V, load >100 kilohms 0 to 20 mA, load <500 ohms	Dimensions	100 x 100 x 60 mm (LxWxH)
		Protective class	IP65 (with sensor tube or connecting cable plugged in)

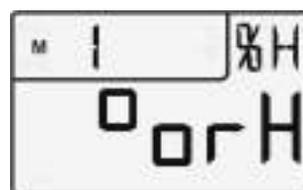
## Display of measured values and programming (housing open)



Measured value display, channel M0, temperature



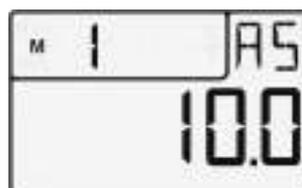
Measured value display, channel M1, humidity variable, e.g. relative humidity



Selecting the humidity variable, e.g. relative humidity, % RH



Selecting the analog output type, e.g. 4 to 20 mA



Programming the analog start



Programming the analog end

Accessories	Order no.		
Angle bracket for wall mounting	<b>ZB8D00W</b>	Connecting cable between sensor tube and transmitter	
Rubber gasket (mat) for mounting the housing directly on a conduit wall (immersion depth = sensor length + approx. 42 mm plug length)	<b>ZB8D00GD</b>	Length = 2 meters	<b>ZH9D46VK02</b>
Movable brass screw with plastic sealing ring (see page 08.09)	<b>ZB9600KV20</b>	Same as above Length = 5 meters	<b>ZH9D46VK05</b>
Connecting flange for screw connection, pitch circle diameter 38 mm (see page 08.09)	<b>ZB9600F20</b>	Same as above Length = 10 meters	<b>ZH9D46VK10</b>
Protective caps (see page 08.09)	<b>ZB1012NA10</b>	Spare sensor, complete Sensor element inside sensor tube including protective cap SK7	
Mains plug, 100 to 240 VAC, 12 VDC, 2 A		Sensor length = 125 mm	<b>FH9D461K1</b>
		Same as above Sensor length = 265 mm	<b>FH9D461K2</b>
		Same as above Sensor length = 525 mm	<b>FH9D461K3</b>
		Replacement sensor element, digital, adjusted, plug-in	<b>FH0D46</b>

### Variants including manufacturer's test certificate

#### Digital transmitter for temperature and humidity

with double analog output, 10 V or 20 mA (selectable via keypad), internal display, 3 keys, aluminum housing, IP65, with plug-in digital sensor, sensor length = 125 mm

Same as above Sensor length = 265 mm

Same as above Sensor length = 525 mm

### Order no.

**MH8D461K1**

**MH8D461K2**

**MH8D461K3**

DAkKS or factory calibration KH9xxx, temperature, humidity, for digital sensor (see chapter „Calibration certificates“).  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.



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## The Right Flow Sensor For Any Measuring Task

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For measuring the flow velocity, typically, three methods are used, which are particularly different from each other with regard

to their measuring range and the operating temperature:

- Pitot tubes
- Rotating vanes
- Thermoanemometer probes

### Pitot Tubes

The air velocity is determined by the dynamic pressure and the static pressure. Pitot tubes are robust and are available in special steel or nickel-plated brass. They connect to ALMEMO® devices by silicone hoses and a differential pressure module.

#### Advantage:

suitable for high flow velocities and harsh operating conditions, high ambient temperatures possible, easy to clean

#### Disadvantage:

strongly directional, low flow velocities are not measurable, temperature-dependent, limited accuracy, sensitive to turbulent flows

### Rotating Vanes

The flow velocity is determined through a frequency measurement. Our rotating vanes are sensitive transducers with diamond bearings that are very precisely adjusted. This ensures high accuracy.

#### Advantage:

high accuracy at medium flow velocities and medium ambient temperatures, insensitive to turbulent flows

#### Disadvantage:

sensitive sensor technology, sensitive to mechanical stress, directional

### Thermoanemometers

Thermistors and hot wire anemometers are highly sensitive sensors. The measuring element is continuously heated up. A control circuit keeps the temperature of the element, which has cooled down by the air flow, on a constant value. The control current is proportional to the flow velocity.

#### Advantage:

even very small air speeds can be measured (e.g. draught measurements), direction-independent measurements are also possible

#### Disadvantage:

sensitive sensor technology, sensitive to mechanical stress and contamination, sensitive to turbulent flows, high current consumption, limited ambient temperature.

## Correction Factors for Exact Measurements of the Air Speed

Air Temperature	940 mbar	960 mbar	980 mbar	1000 mbar	1020 mbar	1040 mbar
-30°C	0.942	0.932	0.922	0.913	0.904	0.895
-20°C	0.961	0.951	0.941	0.932	0.923	0.914
-10°C	0.980	0.970	0.960	0.950	0.941	0.931
0°C	0.998	0.988	0.978	0.968	0.958	0.949
10°C	1.016	1.005	0.995	0.985	0.975	0.966
20°C	1.035	1.024	1.013	1.003	0.993	0.983
30°C	1.051	1.040	1.029	1.019	1.009	0.999
40°C	1.069	1.057	1.047	1.036	1.026	1.016
50°C	1.085	1.074	1.063	1.052	1.042	1.031
60°C	1.102	1.09	1.079	1.068	1.057	1.047
70°C	1.118	1.106	1.095	1.084	1.073	1.063
80°C	1.135	1.123	1.111	1.100	1.089	1.078
90°C	1.151	1.139	1.127	1.116	1.105	1.094
100°C	1.167	1.154	1.142	1.131	1.120	1.109
150°C	1.242	1.229	1.216	1.204	1.192	1.180
200°C	1.314	1.300	1.287	1.274	1.261	1.249
250°C	1.381	1.367	1.353	1.339	1.326	1.313
300°C	1.446	1.431	1.416	1.402	1.388	1.375
400°C	1.567	1.55	1.534	1.519	1.504	1.489
500°C	1.68	1.663	1.646	1.629	1.613	1.597
600°C	1.784	1.766	1.748	1.73	1.713	1.696
700°C	1.884	1.865	1.846	1.827	1.809	1.791

The true air velocity depends on the air temperature and the barometric air pressure. Therefore, the measured value must be corrected according to the above table

to obtain exact measurements of the air speed.

**Example:**

Measured air velocity 50m/s, air tempera-

ture 80°C, atmospheric pressure 960mbar. The measured value must be multiplied with the correction value 1.123. The air velocity is, therefore, 56.1m/s.

## Air Speed For Selected Dynamic Pressures (Prandtl Pitot Tube, T = 22°C)

Dynamic Pressure [Pa]	Dyn. Press. [mm h.o.water]	Air Speed [m/s]
1	0.1	1.29
2	0.2	1.83
3	0.3	2.24
4	0.41	2.59
5	0.51	2.89
10	1.02	4.09
20	2.04	5.78
30	3.06	7.08
40	4.08	8.18
50	5.1	9.14
100	10.2	12.93

**Digital vane anemometer FVAD 15 for air, with ALMEMO® D6 plug****Technical data and functions, FVAD 15 series**

- Measuring air flow velocity
- The vane anemometer is in practice unaffected by environmental variables such as pressure, temperature, density, or humidity.
- The design is compact - especially suitable for mobile measuring operations - heating, ventilating, air-conditioning.
- The probe head has an aero-dynamically optimized shape and protected bearings.
- On those variants with a snap-on head the probe head can be exchanged quickly and easily, e.g. for servicing.
- ALMEMO® D6 plug with high-resolution frequency measurement
- One measuring channel is programmed (at our factory).  
Flow velocity (m/s, v).

**Technical data FVAD15 series**

Operative range	-20 to +140 °C
Maximum resolution	0.01 m/s
Nominal temperature	+22 °C ±2 K
Connecting cables	Fitted cable, 1.8 meters, with LEMO® plug
ALMEMO® adapter cable	LEMO® coupling cable, 0.2 meters with ALMEMO® D6 plug
<b>ALMEMO® D6 plug</b>	
Frequency measurement	resolution 0.01 Hz
Refresh rate	0.5 seconds for all channels
Averaging period	2 seconds
Supply voltage	6 to 13 VDC
Current consumption	4.5 mA

**General features, ALMEMO® D6 sensors**

see page 01.08

Accessories	Order no.
Extension set Ø 15 mm, 4 x 255 mm	ZV9915VR3
Telescopic extension Ø 15 to 24 mm, 330 / 1010 mm	ZV9915TV

DAkkS or factory calibration KV90xx air flow for digital sensor (see chapter „Calibration certificates“).  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

**Digital vane anemometer FVAD 15 S120/S140 with snap-on head, mini****Accessories**

- Spare snap-on head, mini, 20 m/s
- Spare snap-on head, mini, 40 m/s

**Order no.**

- ZV9915S120
- ZV9915S140

**Technical data**

Accuracy	±1 % of final value ±1.5 % of measured value
Probe head	Ø 22 mm, length 28 mm Replaceable snap-on head
Insert opening	from 35 mm
Sensor shaft	Ø 15 mm
Sensor length	175 mm including probe head

**Standard delivery**

- Digital vane anemometer with snap-on head, fitted cable, adapter cable with ALMEMO® D6 plug
- Measuring range 0.4 to 20 m/s
- Measuring range 0.5 to 40 m/s

**Order no.**

- FVAD15S120
- FVAD15S140

### Digital vane anemometer FVAD 15 S220/S240 with snap-on head, micro



#### Accessories

Spare snap-on head, micro, 20 m/s

Spare snap-on head, micro, 40 m/s

#### Order no.

ZV9915S220

ZV9915S240

#### Technical data

Accuracy	±1 % of final value ±3 % of measured value
Probe head	Ø 11 mm, length 15 mm Replaceable snap-on head
Insert opening	from 16 mm
Sensor shaft	Ø 15 mm
Sensor length	165 mm including probe head

#### Standard delivery

Digital vane anemometer with snap-on head fitted cable, adapter cable with ALMEMO® D6 plug

Measuring range 0.6 to 20 m/s

Measuring range 0.7 to 40 m/s

#### Order no.

FVAD15S220

FVAD15S240

### Digital vane anemometer FVAD 15 SMA1 with snap-on head, macro



#### Accessories

Spare snap-on head, macro, 20 m/s

Carry-case

#### Order no.

ZV9915SMA1

ZB9605TK

#### Technical data

Accuracy	±1 % of final value ±1.5 % of measured value
Probe head	Ø 85 mm, length 80 mm Replaceable snap-on head
Insert opening	from 119 mm
Sensor shaft	Ø 15 mm
Sensor length	235 mm including probe head

#### Standard delivery

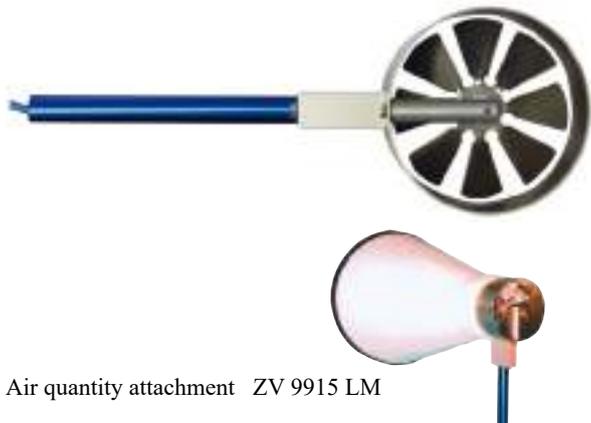
Digital vane anemometer with snap-on head fitted cable, adapter cable with ALMEMO® D6 plug

Measuring range 0.2 to 20 m/s

#### Order no.

FVAD15SMA1

### Digital vane anemometer FVAD 15 MA1 with brass probe head, macro attachment for measuring air quantity



Air quantity attachment ZV 9915 LM

#### Technical data

Accuracy	±0.5 % of final value ±1.5 % of measured value
Probe head	Ø 80 mm, length 70 mm fitted brass probe head
Insert opening	from 108 mm
Sensor shaft	Ø 15 mm
Sensor length	225 mm including probe head

#### Accessories

Carry-case for rotating vane

Air quantity attachment (plug-in)  
Ø 200 mm (up to approx. 275 m³/h)

#### Order no.

ZB9605TK

ZV9915LM

#### Standard delivery

Digital vane anemometer with fitted brass probe head fitted cable adapter cable with ALMEMO® D6 plug

Measuring range 0.2 to 20 m/s

#### Order no.

FVAD15MA1

## Digital vane anemometer FVAD 15-H for special applications, with ALMEMO® D6 plug

### Technical data and functions

- The precision measuring heads and the sensor shaft are made of aluminum or stainless steel.
- The flow velocity is measured with high accuracy.
- In practice, measurements in air and gases are unaffected by environmental variables such as pressure, temperature, or humidity. The low dependence of the measured value on density of the gas can be compensated for. The density can be programmed in the ALMEMO® D6 sensor menu in the ALMEMO® V7 device.
- Several measuring heads can be used for measurements in air and gases as well as in liquids.
- Some variants detect the direction of flows and display the measured value with an algebraic sign.
- The robust type of construction is suitable for mobile measuring operations as well as for stationary measuring operations.
- The ALMEMO® D6 plug measures the frequency signal of the rotating vane with high resolution.
- 1 measuring channel is preprogrammed (ex works): Flow velocity (m/s, v).

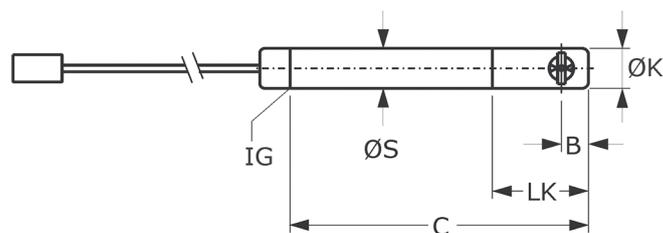
### Technical data

Maximum resolution	0.01 m/s	<b>ALMEMO® D6 plug</b>	
Nominal temperature	22 °C ±2 K	Frequency measurement	resolution 0.01 Hz
Connecting cable	permanently fitted cable, with ALMEMO® D6 plug	Refresh rate	0.5 seconds for all channels
		Averaging period	2 seconds, programmable from 2 to 100 seconds
		Supply voltage	6 to 13 VDC
		Current consumption	8 mA

General features for the ALMEMO® D6 sensors: see page 01.08

Further variants are available upon request!

## Digital vane anemometer FVAD 15-H16GFAMC40



## Technical data

Variant:	Micro, aluminum, suitable also for liquids	Type of rotating vane:	MC40GFA, aluminum
Measured medium:	air and gases or liquids (precondition: no cavitation)	Measuring head: dimension ØK	aluminum, Ø 16 mm
Operative range:	-20 to +100 °C (including cable)	dimension LK	53 mm
Pressure resistance:	up to 3 bar overpressure	dimension B	10.65 mm
Measuring range:	in air: 0.6 to 40 m/s, or in liquids: 0.06 to 10 m/s please specify the desired medium.	Sensor shaft:	Aluminum, Ø 16 mm (dimension ØS)
Accuracy:	± (1.0 % of meas. val. + 0.5 % of final value) for the specified medium.	Sensor length:	163 mm (dimension C) greater lengths are optionally available with an extension bar (only ex works)
		Cable exit:	Thread M 14 x 1.5 (dimension IG)
		Cable length:	2 m

## Option

## Order no.

Extension bar aluminum, Ø 16 mm, length 350 mm, installed on the rotating vane ex works, not removable!

OV9915HVS16A

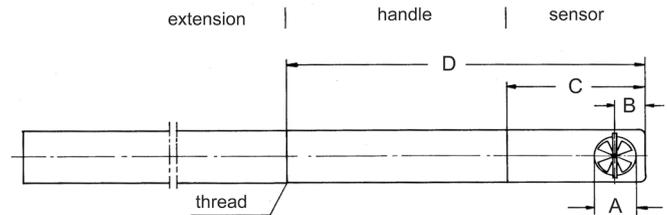
## Variants

## Order no.

Digital vane anemometer for air and gases or for liquids, up to 40 m/s (air and gases), up to 100°C, integrated fixed cable, with ALMEMO® D6 plug. Please indicate the desired medium!

**FVAD15H16GFAMC40**

## Digital vane anemometer series FVAD 15-H25



## Digital vane anemometer FVAD 15-H25GAMN40

## Technical data

Variant:	Mini, aluminum	Sensor shaft:	aluminum, Ø 25 mm
Measured medium:	air and gases	Sensor length:	170 mm (dimension D), greater lengths are optionally available with an extension bar (only ex works)
Operative range:	-20 to +125 °C (including cable)	Cable exit:	Thread M 22 x 1.5
Pressure resistance:	up to 6 bar overpressure	Cable length:	2 m
Measuring range:	0.4 to 40 m/s		
Accuracy:	± (1.0 % of measured value + 0.5 % of final value)		
Type of rotating vane:	MN40GA, aluminum		
Measuring head:	Aluminum, Ø 25 mm dimension C 60 mm dimension A Ø 18.2 mm		

## Option

## Order no.

Extension bar aluminum, Ø 25 mm, length 350 mm, installed on the rotating vane ex works, not removable!

OV9915HVS25A

## Ausführungen

## Order no.

Digital vane anemometer for air and gases, up to 40 m/s, up to 125°C, integrated fixed cable, with ALMEMO® D6 plug.

FVAD15H25GAMN40

## Digital vane anemometer FVAD 15-H25RGAMN40

## Technical data

Variant:	Mini, aluminum, with integrated direction detection	Sensor shaft:	Aluminum, Ø 25 mm
Measured medium:	air and gases	Sensor length:	166 mm (dimension D), greater lengths are optionally available with an extension bar (only ex works)
Operative range:	-20 to +125 °C (including cable)	Cable exit:	Thread M 22 x 1.5
Pressure resistance:	up to 6 bar overpressure	Cable length:	2 m
Measuring range:	± 0.4 to ± 40 m/s with direction detection		
Accuracy:	± ( 1.0 % of measured value + 0.5 % of final value)		
Type of rotating vane:	MN40GA, aluminum		
Measuring head:	Aluminum, Ø 25 mm		

## Option

## Order no.

Extension bar aluminum, Ø 25 mm, length 350 mm, installed on the rotating vane ex works, not removable!

OV9915HVS25A

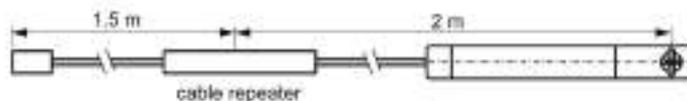
## Ausführungen

## Order no.

Digital vane anemometer for air and gases, up to 40 m/s, with integrated direction detection, up to 125°C, integrated fixed cable, with ALMEMO® D6 plug.

FVAD15H25RGAMN40

## Digital vane anemometer FVAD 15-H25GEMN40T2



## Technical data

Variant:	Mini, stainless steel, for high-temperature up to 260 °C	Sensor shaft:	dimension A Ø 18.2 mm dimension B 14 mm
Measured medium:	air and gases	Sensor length:	stainless steel, Ø 25 mm
Operative range:	-40 to +260 °C (including high- temperature cable)	Cable exit:	170 mm (dimension D), greater lengths are optionally available with an extension bar (only ex works)
Pressure resistance:	up to 10 bar overpressure	Cable length:	Thread M 22 x 1.5
Measuring range:	0.5 to 40 m/s		2 m high-temperature cable (up to 260 °C), cable repeater (-30 to 125 °C), 1.5 m cable (up to 125 °C)
Accuracy:	± (1,0 % of measured value + 0.5 % of final value)		
Type of rotating vane:	MN40GE, stainless steel		
Measuring head:	stainless steel, Ø 25 mm dimension C 81 mm		

## Option

## Order no.

Extension bar stainless steel, Ø 25 mm, length 350 mm, temperature-resistant from -20 to +240 °C (VITON O-ring), installed on the rotating vane ex works, not removable!

OV9915HVS25E

## Ausführungen

## Order no.

Digital vane anemometer for air and gases, up to 40 m/s, up to 260 °C, integrated fixed cable, with ALMEMO® D6 plug.

FVAD15H25GEMN40T2

## Differential pressure and Pitot tube measurement Measuring connector FDA 602 S1K / S6K



Measuring connector FDA602S1K / S6K

- Pressure measuring connector in compact design for flow measurement with Pitot tubes
- Fitting for connecting hose between Pitot tube and pressure measuring connector
- Pressure measuring connector can be plugged directly onto the measuring instrument.

### Technical data

Overload capacity	Maximum three times final value	Operating range	-10 to +60 °C, 10 to 90% RH, non-condensing
Max. common mode pressure	700 mbar	Dimensions	74 x 20 x 8.8 mm
Accuracy (zero-pt adjusted)	±0.5% of final value in range 0 to positive final value	Hose terminals	Ø 5 mm, 12 mm long
Nominal temperature	25 °C	Sensor material	aluminum, nylon, silicone, silica gel, brass
Temperature drift	< ±1.5 % of final value		
Compensated temp. range	0 to +70 °C		

! Advisory note when used in conjunction with ALMEMO® 2890, 5690, 5790, 8590, 8690, 500, 809: The new ALMEMO® pressure measuring connector is very slightly higher (8.8 mm). As a result adjacent input sockets on the ALMEMO® device may be partly covered. However, the 1st input socket can always be used without restriction. Or, alternatively, the ALMEMO® pressure measuring connector can be plugged in at any input socket using connecting cable ZA9060AK1.

! On ALMEMO® devices to obtain precise measured results in m/s the wind tunnel temperature can be entered in the -50 to +700 °C range for compensation purposes.

### Accessories

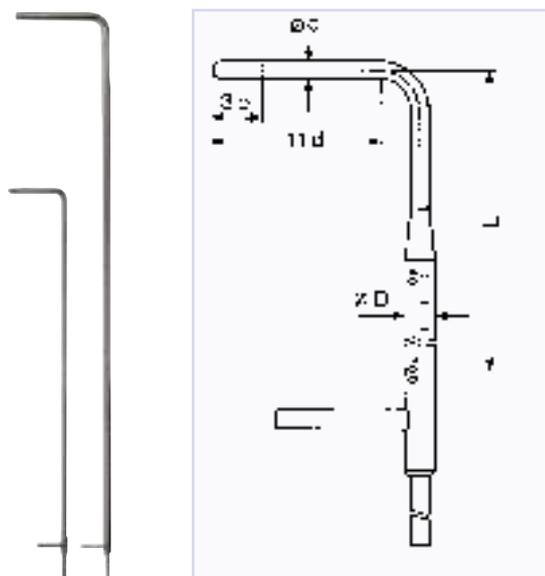
	Order no.
ALMEMO® pressure measuring connector for barometric pressure 700 to 1100 mbar, without pressure terminal sleeve Technical data see page 11.12	<b>FDAD12SA</b>
including programming for automatic atmospheric pressure compensation (comment *P) (variant with pressure terminal sleeve, see page 10.10)	<b>OA9000PK</b>
Connecting cable, 0.2 meters	<b>ZA9060AK1</b>
Extension cable, 2 meters	<b>ZA9060VK2</b>
1 set of silicone hoses black / colorless, 2 meters	<b>ZB2295S</b>
Silicone hose, black, per meter	<b>ZB2295SSL</b>
Silicone hose, colorless, per meter	<b>ZB2295SFL</b>

### Variants (including manufacturer's test certificate)

	Order no.
(including one set of silicone hoses, 2 meters) Measuring ranges ±1250 Pa, Differential pressure (1 to 40 m/s), Measured variables: m/s, Pa, Measuring connector, independent of position	<b>FDA602S1K</b>
Measuring ranges ±6800 Pa Differential pressure (2 to 90 m/s) Measured variables m/s, Pa, Measuring connector, independent of position	<b>FDA602S6K</b>

DAkKS or factory calibration KV90xx, air flow, and KD90xx, pressure, for sensor or measuring chain (sensor + device) (see chapter „Calibration certificates“). DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Pitot Tubes for Differential Pressure Sensors FDA602



- Prandtl Pitot tubes with hemispheric head.
- For measuring the dynamic pressure, the tip of the Pitot tube has an opening of  $0.3d$ .
- For measuring the static pressure, a total of 12 holes with  $0.1d$   $\varnothing$  have been arranged at a distance of  $3d$ .



Mit ALMEMO® devices that have an option for entering factors can also be used to perform wind velocity measurements with cylindrical probes, according to VDEH. The cylindrical Pitot tubes have a probe-related coefficient of 1.7. By entering a factor of 0.767 in the range m/s this coefficient will be considered during the measurement.

### Option

Movable screw connection for brass Pitot tubes with shaft diameter x (6; 8; 10; 20mm)  
for steel Pitot tubes with shaft diameter x (6; 8; 10; 20mm)

### Order no.

ZB9912KMx  
ZB9912KVx

### Types and Technical Data:

Head Diameter (d)	Shaft Diameter (D)	Length	Tmax	Permiss. Dust	Material	Order no.
3 mm	6 mm	300 mm	150°C	none	Nickel-plated brass	FD991233MS
3 mm	6 mm	300 mm	300°C	none	Chrome-nickel steel	FD991233VA
5 mm	8 mm	400 mm	350°C	none	Nickel-plated brass	FD991254MS
5 mm	8 mm	400 mm	500°C	none	Chrome-nickel steel	FD991254VA
5 mm	8 mm	600 mm	350°C	none	Nickel-plated brass	FD991256MS
5 mm	8 mm	600 mm	500°C	none	Chrome-nickel steel	FD991256VA
8 mm	8 mm	400 mm	350°C	low	Nickel-plated brass	FD991284MS
8 mm	8 mm	400 mm	500°C	low	Chrome-nickel steel	FD991284VA
8 mm	8 mm	800 mm	350°C	low	Nickel-plated brass	FD991288MS
8 mm	8 mm	800 mm	600°C	low	Chrome-nickel steel	FD991288VA
10 mm	10 mm	800 mm	350°C	some	Nickel-plated brass	FD991296MS
10 mm	10 mm	800 mm	600°C	some	Chrome-nickel steel	FD991296VA*
10 mm	10 mm	1000 mm	350°C	some	Nickel-plated brass	FD991297MS
10 mm	10 mm	1000 mm	600°C	some	Chrome-nickel steel	FD991297VA*
10 mm	20 mm	1500 mm	350°C	some	Nickel-plated brass	FD991298MS
10 mm	20 mm	1500 mm	600°C	some	Chrome-nickel steel	FD991298VA*
20 mm	20 mm	2000 mm	350°C	more	Nickel-plated brass	FD991299MS
20 mm	20 mm	2000 mm	600°C	more	Chrome-nickel steel	FD991299VA*

□\*) all VA Pitot tubes can be operated up to 700°C for a short period

## Digital thermoanemometer FVAD 35 THx with ALMEMO® D6 plug with integrated atmospheric pressure sensor, for automatic pressure compensation



- Automatic atmospheric pressure compensation is provided for pressure-dependent flow velocity by means of a digital atmospheric pressure sensor integrated in the ALMEMO® D6 plug itself.
- Digital thermoanemometer with A/D converter in the grip or integrated in the cable
- The probe tube has a small diameter, only 6 mm.
- All relevant measurable variables can be measured using just one sensor.
- Three measuring channels are programmed (at our factory): Temperature (°C, t), Flow velocity (m/s, v), Atmospheric pressure (mbar, AP, p)

**General features and accessories, ALMEMO® D6 sensors:** see page 01.08

DAkkS or factory calibration KV90xx air flow for digital sensor (see chapter „Calibration certificates“). DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

### Technical data

#### Digital thermoanemometer (Sensor including A/D converter)

Flow	
Measuring range	
FVAD 35 TH4 / TH4Kx	0.08 to 2 m/s
FVAD 35 TH5 / TH5Kx	0.2 to 20 m/s
Resolution	
FVAD 35 TH4 / TH4Kx	0.001 m/s
FVAD 35 TH5 / TH5Kx	0.01 m/s
Response time	<1.5 seconds
Accuracy	
FVAD 35 TH4 / TH4Kx	± (0.04 m/s +1% of meas. val.)
FVAD 35 TH5 / TH5Kx	± (0.2 m/s +2% of meas. val.)
Nominal conditions	22 °C ±2 K, 45 % RH ±10 % RH 1013 mbar
Temperature compensation	0 to +50 °C
Influence of temperature	
FVAD 35 TH4 / TH4Kx	±0.5 % of measured value /°C at 0.3 to 2 m/s
FVAD 35 TH5 / TH5Kx	±0.3% of measured value /°C at 0.3 to 20 m/s
Incidental flow	bidirectional
Angle dependence	<3% of measured value with deviation <15°
Pressure range	Ambient pressure
Pressure compensation	automatic in range 700 to 1100mbar

Temperature	
Measuring range	-20 to +70 °C
Resolution	0.1 °C
Accuracy	±0.7 °C at 0 to 50 °C and >0.5 m/s
Response time T <sub>90</sub>	typical 10 seconds

#### Digital atmospheric pressure sensor

(integrated in ALMEMO® D6 plug)	
Measuring range	700 to 1100 mbar
Accuracy	±2.5 mbar (at 23 °C ±5 K)

#### ALMEMO® D6 plug

Refresh rate	0.5 seconds for all 3 channels
Supply voltage	6 to 13 VDC
Current consumption	40 mA

#### Dimensions

Probe diameter	6 mm
Flow aperture	approx. 10 x 3 mm
FVAD 35 TH4 / TH5	
Probe with grip, probe lengths 210 mm (plus grip) ALMEMO® cable 1.5 meters	
FVAD 35 TH4Kx / TH5Kx	
Probe with detached electronics unit integrated in the cable, Probe lengths THxK1, 80 mm / THxK2, 300 mm	
Probe cable 5 meters to the electronics	
ALMEMO® cable 1.5 m	

#### Accessories (for FVAD 35 THxK1 / K2 only)



	Order no.
Clamped screw connection with thread adapter for telescopic extension / extension set (maximum 80 °C)	ZV9915KV
Telescope extension Ø 15 to 24 mm 330 / 1010 mm	ZV9915TV
Extension set Ø 15 mm 4 x 255 mm	ZV9915VR3

#### Variants (including works certificate)

Digital thermoanemometer, fitted cable with ALMEMO® D6 plug and integrated digital atmospheric pressure sensor

Sensor 2 m/s, length = 210 mm, (with grip)	<b>FVAD35TH4</b>
Sensor 2 m/s, length = 80 mm, (detached electronics unit)	<b>FVAD35TH4K1</b>
Sensor 2 m/s, length = 300 mm, (detached electronics unit)	<b>FVAD35TH4K2</b>
Sensor 20 m/s, length = 210 mm, (with grip)	<b>FVAD35TH5</b>
Sensor 20 m/s, length = 80 mm, (detached electronics unit)	<b>FVAD35TH5K1</b>
Sensor 20 m/s, length = 300 mm, (detached electronics unit)	<b>FVAD35TH5K2</b>

#### Order no.

#### Other designs are available on request

High-temperature thermoanemometer MT8635THx  
Operative range -40 to +120 °C, up to 40 m/s  
Probe with detached electronics unit integrated in the cable



## Thermoelectric Flow Sensor FV A605 TA



- Probe tube with heated miniature thermistor for flow measurement and precision NTC resistance for automatic compensation.
- Evaluation electronics are located in a separate sensor transmitter module.
- High accuracy as a result of integrated temperature compensation and individual calibration in wind tunnel, with laser Doppler anemometer as reference system.
- Response time only 2s for smoothing the measured value indicated, optionally without smoothing with 100ms response time.
- Suitable for measuring small flow velocities in gaseous substances, particularly for control systems and monitoring.
- Typical applications include comfort index measurements, HEVAC applications, environmental technology, clean room technology and process measuring and control technology.

### Technical Data

Electronics Box with Sensor		Sensor length:	
Measuring range:		FV A605 TAx:	300mm
FV A605 TA1(O)	0.01 to 1m/s	FV A605 TAxO	310mm
FV A605 TA5(O)	0.15 to 5m/s	Sensor cable length:	1.5m
Resolution:		Storage temperature:	-30 to +90°C
FV A605 TA1(O)	0.001m/s	<b>General Technical Specifications</b>	
FV A605 TA5(O)	0.01m/s	Measurement medium:	dry air or inert gases
Accuracy:		Response time:	
FV A605 TA1(O)	±1.0% of final value and ±1.5% of meas. value	FVA605TAxD	smoothened, 1 $\tau$ = 2s
FV A605 TA5(O)	±0.5% of final value and ±1.5% of meas. value	FVA605TAxU	not smoothened, 1 $\tau$ = 100ms
Nominal conditions:	22°C, 960hPa Flow in the marked direction	Power supply:	through ALMEMO® device (approx. 7... 12V)
Automatic temperature compensation:	effective in range 0 to 40°C	Current consumption:	approx. 70mA
Temperature influence:	±0.5% of fin. value/°C	Output signal:	0 ... 1V, linearised, load resistance min. 10kohms
<b>Sensor</b>		Housing:	
Head size:	Ø 8mm	Dimensions:	100 x 60 x 35mm (L x W x H)
Shaft:	Ø 15mm	Protection system:	IP 40 (aluminium housing)
Operative range:	0 to 40°C	Weight:	approx. 250g
Angle of attack:		Operating temperature:	0 to 40°C
FV A605 TA1/TA5	±30°	Storage temperature:	-30 to 90°C
FV A605 TA10/TA50	±180°	Air humidity:	0 ... 90% r.H., non-condensing
Inlet opening:		Adjusting reference:	laser Doppler wind tunnel, adjustment at 22°C/approx. 960hPa, (certificate according to SN EN 45001)
FV A605 TAx:	9mm		
FV A605 TAxO:	protecting cage 110mm		

### Types (incl. clamping holder and ALMEMO® connecting cable 1.5m long)

Unidirectional (sensitive in one direction) with protected measuring tip  
 Measuring range up to 1m/s, smoothened  
 Measuring range up to 5m/s, smoothened  
 Measuring range up to 1m/s, not smoothened  
 Measuring range up to 5m/s, not smoothened

Omnidirectional sensitive tip with protecting cage (Ø110mm) including carry-case  
 Measuring range up to 1m/s, smoothened  
 Measuring range up to 5m/s, smoothened  
 Measuring range up to 1m/s, not smoothened  
 Measuring range up to 5m/s, not smoothened

### Order no.

**FVA605TA1D**  
**FVA605TA5D**  
**FVA605TA1U**  
**FVA605TA5U**

**FVA605TA10D**  
**FVA605TA50D**  
**FVA605TA10U**  
**FVA605TA50U**

DAkKS or factory calibration KV90xx, air flow, for sensor or measuring chain (sensor + device) (see chapter „Calibration certificates“).  
 DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.



# Pressure, force, displacement, speed, flow

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Pressure

force, displacement, flow

# Pressure



## The Right Pressure Sensor For Any Measuring Task

Different methods are usually used for manufacturing pressure sensors that have been adapted to the corresponding application.

- Thick-Film Sensors
- Thin-Film Sensors
- Piezo-Resistive Sensors

Pressure transducers are principally available with 4 pressure calibrations:

- Relative pressure: Pressure related to the environmental pressure
- Absolute pressure: Pressure related to vacuum (0bar)
- Overpressure: Pressure related to atm.

pressure at manufacturing (approx. 1bar)

- Differential press.: Pressure related to a second, variable pressure

## Piezo-Resistive Sensors

A silicone membrane with diffused expansion-sensitive resistors is used as the pressure-sensitive element. Due to its compatibility with many substances silicone would limit the use of the sensor. Therefore, a pressure transmission system, consisting of a filling liquid and a special steel membrane has been integrated. The pressure measuring cell is temperature-compensated and is manufactured in demanding vacuum processes.

### Advantage:

High accuracy within a wide temperature range, particularly suitable for use in high sophisticated measurement and control

tasks, especially for measurement of absolute pressure and low to medium relative pressure.

### Disadvantage:

Generally, an expensive manufacturing process, however, cost-efficient when produced in large quantities.

Two mechanical designs are available in the ALMEMO® sensor range:

- Pressure sensors for hose connection: The measuring cell is housed in a compact plastic housing with two connecting fittings. The pressure sensors are available for wall mounting or as pressure modules that can be directly

plugged into measuring instruments, with measuring ranges for relative or differential pressure measurement in gases, and also for atmospheric pressure measurements.

- Built-In Pressure Transducers: The measuring cell is suspended in an oil-filled, all-welded special steel enclosure. All parts that come into contact with a substance are made from special steel. Therefore, these transducers are also suitable for use in chemically aggressive substances in various industrial applications.

## ALMEMO® pressure measurement

Every ALMEMO® sensor can be adjusted, i.e. correction values of the sensor can be stored in the connector. Thus, the measuring accuracy can be significantly increased.

During DAkKS/DKD or factory

calibrations performed by the Ahlborn Company, the correction values are recorded, stored in the sensor plug and locked. The adjustment can be realized in 2 points (zero, gradient) or in over 30 points as multi-point adjustment. Thanks

to this procedure minimal deviations are achieved on the calibrated temperature points.

The multi-point adjustment is described in detail in chapter "Input connectors" and in chapter "Calibration certificates".

## Temperature Measurement with Pressure Sensors for Refrigerants

### Option SB000R

All ALMEMO® Version V5/V6 devices, including ALMEMO® data loggers and

data acquisition systems, can be used for continuous temperature measurement (resolution 0.1K) with absolute pressure sensors (resolution 0.001 bar compulsory!).

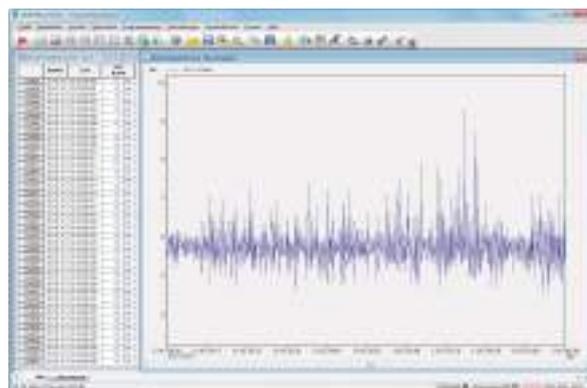
Both, pressure and temperature can be selected or continuously indicated and recorded.

## Measurement of pressure peaks and fast pressure changes with digital ALMEMO® D7 sensors

The new ALMEMO® V7 measuring system makes it possible to measure pressure peaks and pressure changes with a temporal resolution of up to 1ms. The analog pressure sensor measures the pressure change with a short response time.

The ALMEMO® D7 Measurement plug ZED7 00-FS works with a A/D converter integrated in the plug and with a measuring rate of up to 1000 measuring operations per second (1ms per measuring operation). In combination with the ALMEMO® V7 measuring instrument, e.g. ALMEMO®

710 it is therefore possible to record pressure peaks and pressure changes. The measured values are evaluated in the WinControl software as table or line diagram (see chapter “Software”).



The overall accuracy of the measurement is determined only by the pressure sensor with the connected ALMEMO® D7 measuring plug, and is unaffected by the

ALMEMO® display device / data logger and extension cables used.

The complete measuring chain, consisting of pressure sensor and the connected

ALMEMO® D7 measuring plug can be calibrated. An increased accuracy can be achieved by a multi-point adjustment of the sensor during the calibration process.

## High resolution measurement with digital ALMEMO® D7 sensor

The ALMEMO® D7 measuring plug not only enables fast measurements but also high resolution measurements. Thereby, the measuring plug works with reduced

conversion rate. Thus, stable measured values with high resolution can be achieved by using high-precision sensors. The user can easily configure the

ALMEMO® plug on the ALMEMO® V7 measuring instrument.

### Digital ALMEMO® D7sensor for pressure, consisting of

Order no.

#### Pressure transducer series FDA 602-L



Pressure sensor FD 0602-Lx without connecting cable

**FD0602Lx**

Variants, Technical data and Accessories, see catalog page 10.04

ALMEMO® D7 connecting cable for FD 0602-Lx: cable box for sensor, with 2 meters cable, with ALMEMO® D7 measuring plug ZED7 00-FS, up to 1000 mops, including scaling to the measuring range of the pressure sensor.

**ZDD702AKL**

For technical data of ZED7 00-FS, see chapter “Input connector”.

#### Pressure transducer series FD 8214



Pressure sensor FD 8214-x without connecting cable

**FD8214x**

Variants, Technical data and Accessories, see catalog page 10.07

ALMEMO® D7 connecting cable for FD 8214-x: cable box for sensor, with 2 meters cable, with ALMEMO® D7 measuring plug ZED7 00-FS, up to 1000 mops including scaling to the measuring range of the pressure sensor.

**ZDD714AKL**

For technical data of ZED7 00-FS, see chapter “Input connector”.

# Pressure

## Pressure Transducer FDA 602 L



- Compact pressure sensors for industrial applications in liquid and gaseous substances.
- Piezo-resistive, flexibly suspended silicone measuring cell in an oil-filled, all-welded special steel enclosure.
- The stable mechanical construction provides a reliable protection for the measuring cell against the test substance and immunizes it against pressure peaks and vibrations.
- Available with three calibrations. Relative pressure: Pressure related to the environmental press. Absolute pressure: Pressure related to vacuum (0 bar) Overpressure: Pressure related to atm. pressure at manufacturing (approx. 1bar).

### Technical Data:

Overload	Two times final value
Output signal	0.2 to 2.2 V
Accuracy class (linearity + hysteresis + reproducibility)	±0.5 % of final value
Total error range	
0 to +50 °C	±1.0 % of final value
-10 to +80 °C	±1.5 % of final value
(linearity + hysteresis + reproducibility + temperature coefficients + zero-point + range tolerance)	
Response time (0 to 99 %)	<5 ms
Nominal conditions	22°C ±2 K, 10 to 90 % RH, non-condensing

Power supply	6.5 to 15 VDC, consumption <4 mA via ALMEMO® connector
Operating temperature	-40 to +100 °C
Pressure terminal	male thread G1/4" membrane not flush with front
Material in contact with medium	Stainless steel DIN 1.4404/1.1135 External seal Viton
Weight	approx. 50 g
Protective class	IP 65



Quick-release coupling

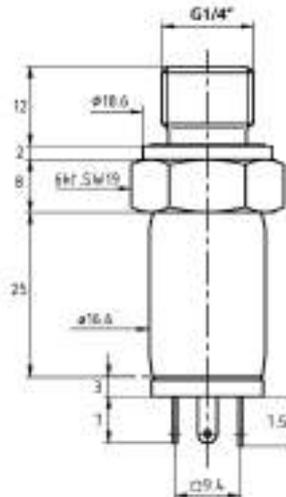
nominal width 5

internal thread G1/4"

nominal width 7,2

internal thread G1/4"

**New:** Measurement of pressure peaks and fast pressure changes with digital ALMEMO® D7 measuring plugs, see page 10.03.



### Accessories

PTFE sealing tape, -200 to +260 °C, width 10 mm, thickness 0.1 mm, roll of 12 meters  
 Quick-release coupling, nominal width 5, up to 35 bar Connection internal thread G1/4", brass  
 Quick-release coupling, nominal width 7.2, up to 35 bar connection internal thread G1/4", brass

### Order no.

ZB9000TB  
 ZB9602N5  
 ZB9602N7

**Types:** including ALMEMO® cable 1.5m long

#### Measuring ranges relative pressure:

up to 2.5 bar      **FDA602L3R**  
 up to 5 bar        **FDA602L4R**  
 up to 10 bar       **FDA602L5R**

#### Measuring ranges absolute pressure:

up to 2.5 bar      **FDA602L3A**  
 up to 5 bar        **FDA602L4A**  
 up to 10 bar       **FDA602L5A**

#### Measuring ranges overpressure:

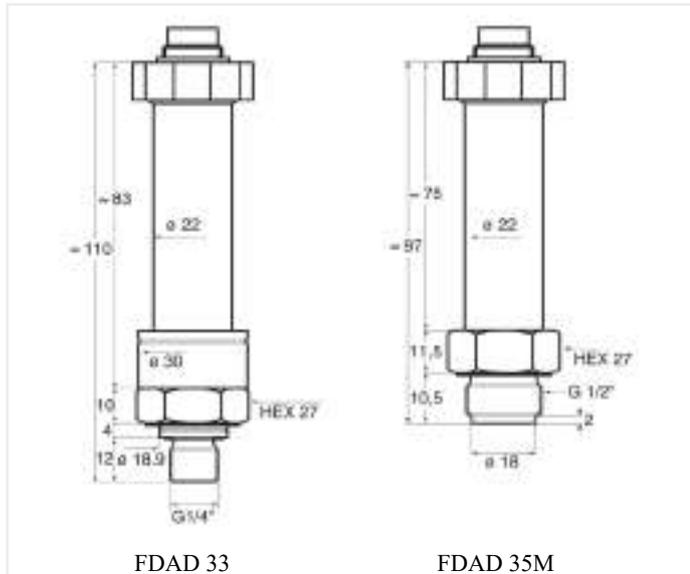
up to 25 bar        **FDA602L2U**  
 up to 50 bar       **FDA602L3U**  
 up to 100 bar      **FDA602L4U**  
 up to 500 bar      **FDA602L6U**

Pressure transducer for measuring the temperature of refrigerants see page 10.08.

DAkkS or factory calibration KD9xxx pressure for sensor or measuring chain (sensor + device) (see chapter Calibration certificates).  
 DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## High-precision pressure sensor FDAD33/35M

Very accurate over a wide temperature range, digital sensor with ALMEMO® D6 plug



- Stable piezo-resistive transducer with integrated A/D converter and signal processor
- Temperature-dependence and non-linearity are eliminated by means of mathematical compensation; this ensures a high level of accuracy.
- Digital output of measured value
- The current value is measured at the sensor's high sampling rate.
- To acquire transitory pressure fluctuations and pressure peaks the maximum value, minimum value, and average value are calculated from the current values in the ALMEMO® D6 plug and output in three function channels.
- One measuring channel is programmed (at our factory) : Pressure (bar,p) Upto three function channels can also be activated (via LMEMO® device V6) : Maximum value, minimum value, average value. A complete configuration can be carried out either on the ALMEMO® V7 measuring instrument or directly on the PC with the USB adapter cable ZA 1919 AKUV (see chapter ALMEMO® "Network technology").

**General features and accessories, ALMEMO® D6 sensors:**  
see page 01.08

## Technical data

Digital pressure sensor (including A/D converter)		Sampling rate, internal	200 Hz
Pressure range	1 to 1000 bar see under variants	Material in contact with medium	Stainless steel, AISI 316L, Viton
Relative pressure	Zero-point at ambient atmospheric pressure, current	Protection	IP65
Overpressure	Zero-point at ambient atmosph. pressure, production	Dimensions	see dimensional drawings
Absolute pressure	Zero-point, vacuum	Sensor connector	Built-in plug
Pressure connection		ALMEMO® connecting cable	Coupling, 2-meter PVC cable, ALMEMO® D6 plug
FDAD33	Outside thread G 1/4" Diaphragm, internal	<b>ALMEMO® D6 plug</b>	
FDAD35M	Diaphragm, flush with front Outside thread G 1/2" In pressure range 700/1000 bar Outside thread G 3/4"	Refresh time	0.005 seconds for all channels
Storage / operating temperature	-40 to +120 °C	Output to the ALMEMO® device	With the conversion rate of the ALMEMO® device: max. 10 ... 100 Hz depending on the device and configuration
Accuracy		Delay after sleep mode	1 second
Error margin* at +10 to +40 °C	0.05 % of final value	Supply voltage	6 to 13 VDC
Error margin* at -10 to +80 °C	0.1 % of final value	Current consumption	approx. 11 mA
*Linearity, hysteresis, reproducibility, temperature coefficients, zero-point			

Options	Order no.
Connecting cable Total length = 5 m	OD0D33L05
Connecting cable Total length = 10 m	OD0D33L10
Greater lengths up to 100 meters on request..	

## Variants

Digital pressure sensor, plug connection, 2-meter connecting cable with ALMEMO® D6 plug, factory test certificate

Pressure range	Resolution	Overload	Order no. Diaphragm, internal	Order no. Diaphragm, flush with front
<b>Relative pressure</b>				
0 to 1 bar	0.0001 bar	2 bar	<b>FDAD3301R</b>	<b>FDAD35M01R</b>
0 to 3 bar	0.0001 bar	5 bar	<b>FDAD3302R</b>	<b>FDAD35M02R</b>
0 to 10 bar	0.001 bar	20 bar	<b>FDAD3303R</b>	<b>FDAD35M03R</b>
0 to 30 bar	0.001 bar	60 bar	<b>FDAD3304R</b>	<b>FDAD35M04R</b>
Special ranges -1 ... 1 / 3 / 10 bar on request				
<b>Overpressure</b>				
0 to 100 bar	0.01 bar	200 bar	<b>FDAD3305U</b>	<b>FDAD35M05U</b>
0 to 300 bar	0.01 bar	400 bar	<b>FDAD3306U</b>	<b>FDAD35M06U</b>
0 to 700 bar	0.1 bar	1000 bar	<b>FDAD3307U</b>	<b>FDAD35M07U</b>
0 to 1000 bar	0.1 bar	1000 bar	<b>FDAD3308U</b>	<b>FDAD35M08U</b>
<b>Absolute pressure</b>				
0,8 to 1,2 bar	0.0001 bar	2 bar	<b>FDAD3300A</b>	<b>FDAD35M00A</b>
0 to 1 bar	0.0001 bar	2 bar	<b>FDAD3301A</b>	<b>FDAD35M01A</b>
0 to 3 bar	0.0001 bar	5 bar	<b>FDAD3302A</b>	<b>FDAD35M02A</b>
0 to 10 bar	0.001 bar	20 bar	<b>FDAD3303A</b>	<b>FDAD35M03A</b>
0 to 30 bar	0.001 bar	60 bar	<b>FDAD3304A</b>	<b>FDAD35M04A</b>

DAkkS or factory calibration KD9xxx pressure for digital sensor (see chapter Calibration certificates).

DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Pressure Sensors FD 8214



- Compact pressure sensors for liquid and gaseous substances.
- Piezo-resistive measuring cell with temperature compensation.
- Pressure membrane and enclosure made from special steel.
- As the pressure is transmitted to the pressure membrane through a small hole in the thread part, the liquids should not be prone to crystallise and gases should not be heavily contaminated with dust. There are sensors with front-flush membranes for critical applications
- Available with three calibrations. Relative pressure: Pressure related to the environmental pressure, Absolute pressure: Pressure related to vacuum (0bar). Overpressure: Pressure related to atm. pressure at manufacturing (approx. 1bar).

**New:** Measurement of pressure peaks and fast pressure changes or high resolution measurement with digital ALMEMO® D7 measuring plug, see page 10.03.

Options	Order no.	Order no.	Order no.
Linearity 0.1% (for ranges 1 bar to 600 bar)	OR8214G1	KF25	OR8214KF25
Substance temperature -25 to +100°C	OR8214T1	Food compliant version	
Substance temperature -25 to +150°C (version with cooling fins)	OR8214T2	with vegetable oil ASEOL Food	OR8214ML
Process connection, small flange (for FD8214xxA absolute pressure)		Throttle against excess pressure	OR8214DS
KF16	OR8214KF16	Output 0 to 10V	OR8214V
		Output 0 to 20mA	OR8214A
		Output 4 to 20mA	OR8214R4

Accessories	Order no.	Order no.	Order no.
Coupler socket with 2m cable and ALMEMO® connector	ZA8214AK	Coupler socket 6-pin Straight version	ZB9030RB
		Coupler socket 6-pin Angled version	ZB9030RBW

### Types

#### Order no.

FD 8214:

Standard version, inside membrane with G $\frac{1}{4}$ " internal thread. External thread G $\frac{1}{2}$ " available on request

FD 8214 M:

Membrane (welded with end of thread) flush with front, external thread G $\frac{1}{2}$ ", can be sterilised (important for food and pharmaceutical industry)

inside membrane

front flush membrane

#### Measuring ranges relative pressure:

0 to 100 mbar	<b>FD821401R</b>	<b>FD8214M01R</b>
0 to 160 mbar	<b>FD821402R</b>	<b>FD8214M02R</b>
0 to 250 mbar	<b>FD821403R</b>	<b>FD8214M03R</b>
0 to 400 mbar	<b>FD821404R</b>	<b>FD8214M04R</b>
0 to 600 mbar	<b>FD821405R</b>	<b>FD8214M05R</b>
0 to 800 mbar	<b>FD821406R</b>	<b>FD8214M06R</b>
0 to 1 bar	<b>FD821407R</b>	<b>FD8214M07R</b>
0 to 1.6 bar	<b>FD821408R</b>	<b>FD8214M08R</b>
0 to 2.5 bar	<b>FD821409R</b>	<b>FD8214M09R</b>
0 to 4 bar	<b>FD821410R</b>	<b>FD8214M10R</b>
0 to 6 bar	<b>FD821411R</b>	<b>FD8214M11R</b>
0 to 10 bar	<b>FD821412R</b>	<b>FD8214M12R</b>

### Types

#### Order no.

internal membrane

front flush membrane

#### Measuring ranges absolute pressure:

Option: Process connection. small flange (see under Options)

0 to 1 bar	<b>FD821407A</b>	<b>FD8214M07A</b>
0 to 1.6 bar	<b>FD821408A</b>	<b>FD8214M08A</b>
0 to 2.5 bar	<b>FD821409A</b>	<b>FD8214M09A</b>
0 to 4 bar	<b>FD821410A</b>	<b>FD8214M10A</b>
0 to 6 bar	<b>FD821411A</b>	<b>FD8214M11A</b>
0 to 10 bar	<b>FD821412A</b>	<b>FD8214M12A</b>

#### Measuring ranges overpressure:

0 to 10 bar	<b>FD821412U</b>	<b>FD8214M12U</b>
0 to 16 bar	<b>FD821413U</b>	<b>FD8214M13U</b>
0 to 25 bar	<b>FD821414U</b>	<b>FD8214M14U</b>
0 to 40 bar	<b>FD821415U</b>	<b>FD8214M15U</b>
0 to 60 bar	<b>FD821416U</b>	<b>FD8214M16U</b>
0 to 100 bar	<b>FD821417U</b>	<b>FD8214M17U</b>
0 to 160 bar	<b>FD821418U</b>	<b>FD8214M18U</b>
0 to 250 bar	<b>FD821419U</b>	<b>FD8214M19U</b>
0 to 400 bar	<b>FD821420U</b>	<b>FD8214M20U</b>
0 to 600 bar	<b>FD821421U</b>	<b>FD8214M21U</b>
0 to 1000 bar	<b>FD821422U</b>	<b>FD8214M22U</b>

other measuring ranges on request

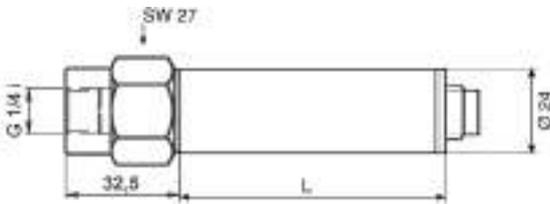
DAkS or factory calibration KD9xxx pressure for sensor or measuring chain (sensor + device) (see chapter Calibration certificates).  
DAkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

# Pressure

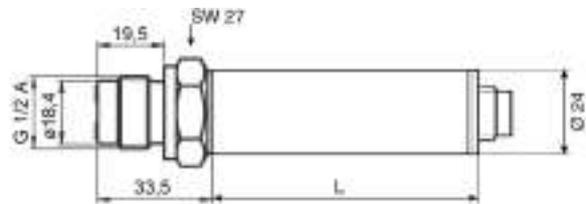
## Technical Data

Measuring cell:	piezo-resistive
Overload	Ranges 600 bar, i.e. 1.5 times the final value (minimum 3 bar, maximum 850 bar) Ranges >600 bar, 1500 bar
Output signal, power supply :	Standard 0 to 2 volts, feed 6.5 to 13 volts (from ALMEMO® device), current <4 mA Option : 0 to 10 volts, feed 15 to 30 volts, load >10 kilohms, current <4 mA Option : 0 to 20 mA, feed 9 to 33 volts, (>18 volts at load 500 ohms), current <25 mA Option : 4 to 20 mA, 2 conductors, feed 9 to 33 volts, (>18 volts at load 500 ohms), current <25 mA
Response time:	<1.5 ms / 10 to 90 % nominal pressure
Linearity:	Standard $\pm 0.25$ % of final value Option : $\pm 0.1$ % of final value for ranges 1 bar and up to 600 bar
Media temperature:	0 to +80°C, temperature comp.: 0 to +70°C option: -25 to +100°C, temperature comp.: -25 to +85°C -25 to +150°C, temperature comp.: -25 to +85°C
Temperature drift:	Zero-point $<\pm 0.04$ % of final value / °C for ranges >0.5 bar span $<\pm 0.02$ % of final value / °C for all ranges
Nominal temperature:	22°C $\pm 2$ K, 10 to 90% rH non-condensing
Material:	housing, pressure connector, membrane: special steel 1.4435
Operat. environment/Sealing:	IP 67
Dimensions:	see drawing
Connecting threads:	Type 8214: internal thread G1/4", wrench SW 27 Option for absolute pressure: small flange KF16 or KF21 Type 8214 M: external thread G1/2", wrench SW 27
Electrical connection	Flush-mounting connector, binder coupling 723, 5-pin
Weight:	approx.. 180 g

06/2018 • We reserve the right to make technical changes.



Type **FD 8214** standard version, inside membrane with internal thread G1/4"  
L = 45 mm (L = 72 mm with option of medium temperature up to 150 °C with cooling ribs)



Type **FD8214M** membrane flush with front (welded with end of thread), external thread G1/2" can be easily sterilized  
L = 45mm  
(L = 72 mm with option of medium temperature up to 150 °C with cooling ribs)

Accessories	Order no.	Order no.
PTFE sealing tape, -200 to +260 °C, width 10 mm, thickness 0.1 mm, roll of 12 meters	ZB9000TB	
Quick-release coupling, nominal width 5, up to 35 bar Connection G1/4" external thread, brass	ZB8214N5	Quick-release coupling, nominal width 7.2, up to 35 bar Connection 1/4" external thread, brass
		ZB8214N7

Quick-release coupling nominal width 5 external thread G1/4"

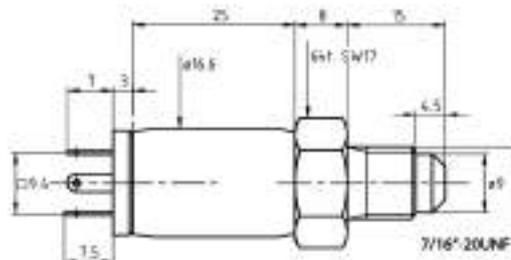


Quick-release coupling nominal width 7.2 external thread G1/4"

## Pressure transducer for measuring the temperature of refrigerants FDA 602 LxAK



- Compact pressure sensors for industrial applications in liquid and gaseous substances.
- Piezo-resistive, flexibly suspended silicone measuring cell in an oil-filled, all-welded special steel enclosure.
- The stable mechanical construction provides a reliable protection for the measuring cell against the test substance and immunizes it against pressure peaks and vibrations.
- Absolute pressure: pressure related to vacuum (0 bar).



### Technical Data:

Overload	Two times final value	Power supply	6.5 to 15 VDC, consumption <4 mA via ALMEMO® connector
Output signal	0.2 to 2.2 V	Operating temperature	-40 to +100 °C
Accuracy class (linearity + hysteresis + reproducibility)	±0.5 % of final value	Pressure terminal	male thread 7/16" membrane not flush with front
Total error range 0 to +50 °C -10 to +80 °C (linearity + hysteresis + reproducibility + temperature coefficients + zero-point + range tolerance)	±1.0 % of final value ±1.5 % of final value	Material in contact with medium	Stainless steel DIN 1.4404/1.1135 External seal, Viton
Response time (0 to 99 %)	<5 ms	Weight	approx. 50 g
Nominal conditions	22°C ±2 K, 10 to 90 % RH, non-condensing	Protective class	IP 65

### Calculation of the refrigerant temperature with device special version SB0000R2

The ALMEMO® Version V6 devices, (2590-2/-3S/-4S, 2690, 2890, 8590, 8690, 5690) can be used for continuous temperature measurement (resolution 0.1K) with absolute pressure sensors (resolution 0.001 bar compulsory !). Both, pressure and temperature can be selected or continuously indicated and recorded.

**Technical data for ALMEMO® option SB0000R2:**

Refrigerant:	R22	R23	R134a	R404a	R404a
Pressure Range:	0 to 36 bar	0 to 49 bar	0 to 40,5 bar	0 to 32 bar	0 to 32 bar
Temperature Range:	-90°C to +79°C *	-100°C to +26°C *	-75°C to +101°C *	-60°C to +65°C *	-60°C to +65°C *
Operation point	dew-point	dew-point	dew-point	dew-point	boiling point
Refrigerant:	R407C	R407C	R410A	R417A	R507
Pressure Range:	0 to 46 bar	0 to 46 bar	0 to 49 bar	0 to 27 bar	0 bis 37 bar
Temperature Range:	-50°C to +86°C *	-50°C to +86°C *	-70°C to +70°C *	-50°C to +70°C *	-70°C to +70°C *
Operating point	dew-point	boiling point	dew-point	dew-point	dew-point

\*) The final temperature is obtained from the data of the refrigerant.

For pressure transducer with smaller pressure ranges, the specified final temperature changes. (Linearizations for other refrigerants on request)

Special design refrigerant temperature for ALMEMO® devices V6  
(Please order when buying new devices or send it to upgrade existing device)

**Order no. SB0000R2**

### Types

including ALMEMO® connecting cable, 1.5 m, and programming of a refrigerant measuring channel

**Measuring ranges Absolute pressure** (resolution 0.001 bar)

up to 10bar

up to 30bar

up to 50bar

**Order no.**

**FDA602L5AK**

**FDA602L6AK**

**FDA602L7AK**

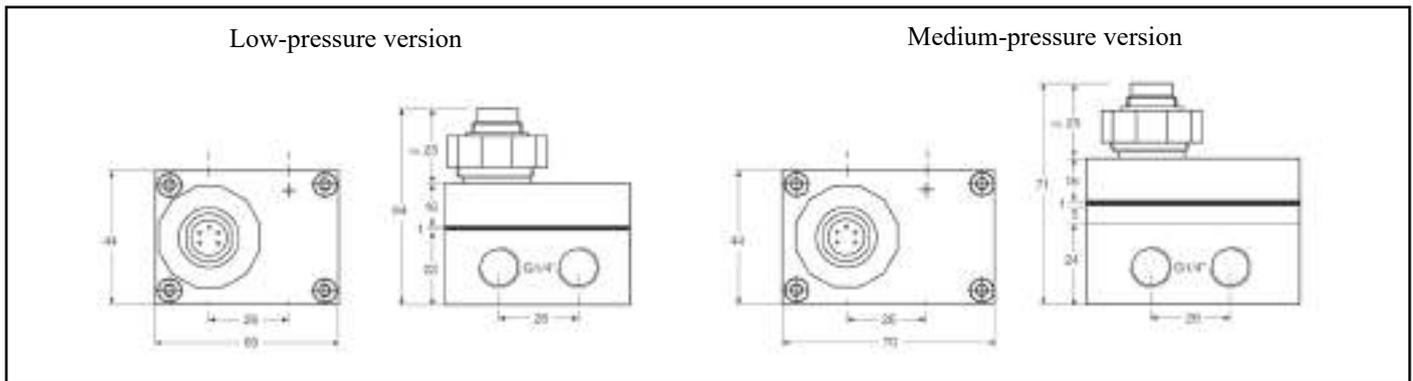
DAkKS or factory calibration KD9xxx pressure for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

# Pressure

## Differential pressure transmitter FDA 602 D



- This measures the differential pressure in liquid and gaseous media indirectly using two absolute pressure sensors.
- This makes it less expensive but more robust with respect to asymmetrical overload.
- The differential pressure range should be at least 5% of the standard pressure range.
- Each side of the sensor incorporates two pressure connections. The transmitters can thus be used easily and conveniently in pressure pipes.
- It incorporates a high-speed, high-precision microprocessor.
- All reproducible errors affecting the pressure sensors, i.e. involving non-linearity and temperature dependency, can be completely eliminated by means of mathematical error compensation.



### Technical Data:

Standard pressure range (maximum measurable pressure per pressure connection), overload, differential pressure range.	See versions listed below.	Power supply	6 to 15 VDC via ALMEMO® connector
Storage / operating temperature	-40 to +100 °C	Output	0 to 2 V
Compensated standard range	-10 to +80 °C	Electrical connection	Binder plug, including ALMEMO® connecting cable, 2 meters
Error margin	≤0.05% typical, ≤0.1% max. of final value to standard pressure range	CE conformance	EN61000-6-1 to 4 with shielded cable
(linearity + hysteresis + reproducibility + temperature error)		Protective class	IP 65
Pressure connections	G1/4" thread, female (2 per side)	Weight	
Material in contact with medium	Stainless steel, 316L, DIN 1.4435	Low-pressure version	475 grams
		Medium-pressure version	750 grams

### Types

Differential pressure transmitter, including ALMEMO® cable, 2 meters

Standard pressure range Absolute pressure	Overload	Differential pressure range Please indicate final value	Order no.
<b>Low-pressure version</b>			
0 to 3 bar	10 bar	0 to 0.2 to 3 bar	<b>FDA602D01</b>
0 to 10 bar	20 bar	0 to 0.5 to 10 bar	<b>FDA602D02</b>
0 to 25 bar	30 bar	0 to 1.25 to 25 bar	<b>FDA602D03</b>
<b>Medium-pressure version</b>			
0 to 100 bar	200 bar	0 to 5 to 100 bar	<b>FDA602D10</b>
0 to 300 bar	450 bar	0 to 15 to 300 bar	<b>FDA602D11</b>

DAkkS or factory calibration KD9xxx pressure for sensor or measuring chain (sensor + device) (see chapter Calibration certificates).  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Digital atmospheric pressure sensor FDAD 12 SA, for barometric pressure Integrated in ALMEMO® D6 plug



**General features and accessories, ALMEMO® D6 sensors**  
see page 01.08

### Special features

- Digital atmospheric pressure sensor with temperature compensation
- Very accurate over a wide temperature range
- The value measured for atmospheric pressure can also be used to compensate other sensors on the ALMEMO® device (programming comment \*P).
- Compact design, without pressure connection sleeve
- Can be connected directly to the measuring instrument.
- One measuring channel is programmed (at our factory).
- Atmospheric pressure (mbar, AP, p)

### Technical Data

Digital atm. pressure sensor (integrated in ALMEMO® D6 plug)		ALMEMO® D6 plug	
Measuring range	300 to 1100 mbar	Refresh rate	1 second for all channels
Accuracy	±2.5 mbar in the range 700 to 1100 mbar at 23 °C ±5 K	Supply voltage	6 to 13 VDC
Operating range	-10 to +60 °C 10 to 90 % RH non-condensing	Current consumption	4 mA
Dimensions	62 x 20 x 7.6 mm		

### Variants (including manufacturer's test certificate)

Digital atmospheric pressure sensor for barometric pressure, integrated in ALMEMO® D6 plug

**Order no.**  
**FDAD12SA**

DAkKS or factory calibration KD92xx atmospheric pressure for digital sensor (see chapter Calibration certificates).  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Pressure measuring connector for barometric pressure FDA 612 SA



- Compact design - can be plugged directly onto measuring instrument.
- Piezo-resistive pressure sensor - ensures high measuring accuracy.

### Technical Data:

Measuring range	700 to 1050 mbar (total range 0 to 1050 mbar)	Sensor material	aluminum, nylon, silicone, silica gel, brass
Overload capacity	Maximum 1.5 times final value	Operating range	-10 to +60 °C, 10 to 90% RH, non-condensing
Accuracy	±0.5 % of final value	Dimensions	90 x 20 x 7,6 mm
Nominal temperature	25 °C		
Temperature drift	<±1 % final value at 0 to +70 °C		
Hose terminals	Ø 5 mm, 12 mm long		

### Accessories

	Order no.	Order no.
Connecting cable, 0.2 meters	ZA9060AK1	Extension cable, 4 meters
Extension cable, 2 meters	ZA9060VK2	ZA9060VK4

### Variants (including manufacturer's test certificate)

Pressure measuring connector for barometric pressure with pressure terminal sleeve

**Order no.**  
**FDA612SA**

DAkKS or factory calibration KD9xxx pressure for sensor or measuring chain (sensor + device) (see chapter Calibration certificates).  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

# Pressure

## Pressure measuring connector for differential pressure FDA 612 SR, FDA 602 S2K



- New compact design - can be plugged directly onto measuring instrument.
- Piezo-resistive pressure sensor - ensures high meas. accuracy.

! Advisory note when used in conjunction with ALMEMO® 2890, 5690, 5790, 8590, 8690: The new ALMEMO® pressure measuring connector is very slightly higher (8.8 mm). As a result adjacent input sockets on the ALMEMO® device may be partly covered. However, the 1st input socket can always be used without restriction. Or, alternatively, the ALMEMO® pressure measuring connector can be plugged in at any input socket using connecting cable ZA9060AK1.

### Technical Data

Overload capacity	FDA612SR FDA602S2K	max. 1.5 times final value maximum 250 mbar	FDA602S2K	< ±2 % of final value compensated temperature range -25 to +85 °C
Accuracy (zero-pt adjusted)		±0.5% of final value in range 0 to positive final value	Operating range	-10 to +60 °C, 10 to 90% RH, non-condensing
Common mode pressure		FDA602S2K max. 700 mbar FDA612SR max. 3 bar	Dimensions	74 x 20 x 8.8 mm
Nominal temperature		25 °C	Hose terminals	Ø 5 mm, 12 mm long
Temperature drift	FDA612SR	< ±1.5 % of final value compensated temperature range 0 to +70 °C	Sensor material	aluminum, nylon, silicone, silica gel, brass

Accessories	Order no.	Order no.
Connecting cable, 0.2 meters	ZA9060AK1	Extension cable, 4 meters
Extension cable, 2 meters	ZA9060VK2	ZA9060VK4

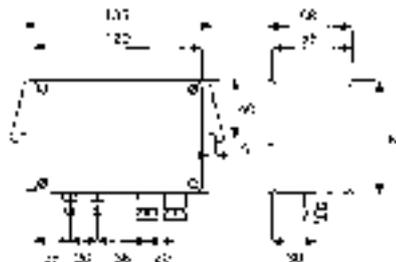
Variants (including manufacturer's test certificate)	Order no.
(including one set of silicone hoses, 2 meters) Pressure measuring connector for differential pressure Range ±1000 mbar	FDA612SR
Range ±250 Pa (independent of position)	FDA602S2K
Range ±1250 Pa or ±6800 Pa see page 09.06	

DAkkS or factory calibration KD9xxx pressure for sensor or measuring chain (sensor + device) (see chapter Calibration certificates).  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Pressure Sensors for Wall Mounting FD 8612 DPS / APS



- Suitable for use in the laboratory, as well as for use in harsh industrial environments, e.g. HEVAC applications, clean room technology, medical technology, filter technology and finishing pass technology.
- The robust mechanics guarantees long term stability, linearity and good reproducibility.
- Temperature drift reduced to a minimum by specific compensation of the sensors.
- Operation is almost maintenance-free, as a result of the free-from-wear inductive measuring system.
- As standard, the integrated electronics provide a pressure proportional voltage signal from 0 to 2V as output.



### Technical Data:

Linearity:	±1% of final value, option: ±0.2% or ±0.5%	Rise time:	T <sub>90</sub> approx. 0.02s
Hysteresis:	±0.1% of final value	Temperature drift: Zero point range	0.03% of final value / K, 0.03% of final value / K
Nominal temperature:	23°C	Operative range:	+10 to +50°C, air humidity 10 to 90% non-condensing
Overload capacity:	up to 400 mb: 5-fold, from 500 mb: 2-fold	Storage temperature:	-10 to +70°C
Max. common mode pressure:	1 bar (at differential measurement)	Housing:	material ABS 120 x 80 x 55mm (L x H x D) Safety class: 0
Power supply:	6 ... 12 VDC, option: 230V 50/60Hz	Protection system:	IP 54
Power consumption:	approx. 3.5mA	Weight:	approx. 300g
Output:	0 to 2V, option: 0 to 10V/0(4) to 20mA	Sensor capacity:	approx. 3ml
Connection:	electrical: screw terminals, screwed cable gland PG 7, pressure: 6.5mm hose connection	Volume increase:	approx. 0.2ml at nom. press.k

Optionen	Order no.	Order no.
Linearity 0.2% (DPS from final value / APS from range) with DPS only in ranges ≥ 2.5 mbar with APS only in range ≤ 100 mbar	OD8612L2	Power supply : 230 V OD8612N Output 0 to 10 V OD8612R2 (voltage supply 19 to 31 V DC)
Linearity 0.5% (DPS from final value / APS from range) with DPS only in ranges ≥ 1 mbar with APS only in range ≤ 200 mbar	OD8612L5	Output 0 to 20 mA OD8612R3 (voltage supply 19 to 31 V DC) Output 4 to 20 mA OD8612R4 (voltage supply 19 to 31 V DC)

Accessories	Order no.	Order no.
Connecting cable 2m long mounted with connector for connection to ALMEMO® devices	ZA8612AK2	Silicone hose black per m ZB2295SSL
1 set silicone hoses 2m long black/colourless	ZB2295S	Silicone hose colourless per m ZB2295SFL

Types	Order no.	Order no.
<b>Measuring ranges relative and differential pressure:</b> Pressure transducer type DPS 0 to 2.5 mbar ... 1000 mbar Please specify measuring range	<b>FD8612DPS</b>	<b>Measuring ranges absolute pressure:</b> Pressure transducer type APS 0 to 1000 mbar, 900 to 1100 mbar, 800 to 1200 mbar Please specify measuring range
Range 1 mbar (100 Pa), additional charge	<b>OD8612P10</b>	<b>FD8612APS</b>
Range 0.5 mbar (50 Pa), additional charge	<b>OD8612P05</b>	

DAkKS or factory calibration KD9xxx pressure for sensor or measuring chain (sensor + device) (see chapter Calibration certificates).  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.



## Technical Features of Force Transducers

The technical features of the force transducers are substantially fixed by VDI/VDE guideline 2637. The most important terms are described below:

### Measuring range:

The load range, for which the guaranteed error limits will not be exceeded.

### Nominal load:

The nominal load is the upper limit of the measuring range. Depending on the sensor, the nominal load can be a tension or compression load.

### Working load:

The working load is the load that can be applied to the sensor, as well as the nominal load, without affecting the specified characteristics. The working load range should only be used in exceptional cases.

### Load limit:

The load limit is the maximum permissible load that can be applied to the measuring cell without expecting a destruction of the measuring system. At this load the specific error limits are no longer applicable.

### Breaking load:

The breaking load is the load where a permanent change or destruction occurs.

### Maximum dynamic load:

Rated force related oscillation amplitude of a sinusoidally changing force in direction of the measuring axis of the sensor. At a load of 107 cycles the sensor, when being repeatedly used up to the rated force, is not subject to significant changes regarding the metrology characteristics.

### Drift error:

The drift error is the maximum permissible change of the output signal of the sensor over the specified time at constant load and stable environmental conditions.

## ALMEMO® Force Measurement

ALMEMO® force transducers allow to adjust the constant load (tare) to zero and to enter the final value as nominal value.

The correction value will be automatically calculated from this by the measuring instrument. An ALMEMO® connector that

switches on this resistor for the adjustment is available for force transducers with integrated reference resistor.

## Measurement of fast changes in force and force peaks with digital ALMEMO® D7 sensors

The new ALMEMO® V7 measuring system makes it possible to measure fast changes in force and force peaks with a temporal resolution of up to 1ms.

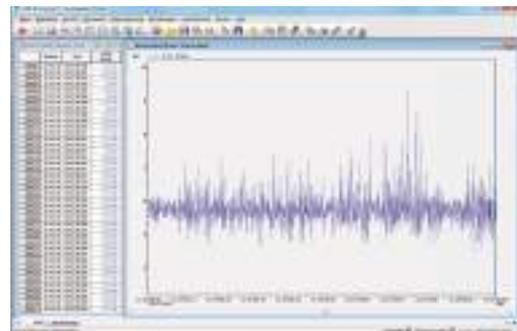
The (passive) measuring bridge of the force transducer measures the change in force without (electrical) delay.

The digital ALMEMO® D7 measuring plug ZKD7 00-FS works with an A/D converter integrated in the plug and with a measuring rate of up to 1000 measuring operations per second (1ms per measuring operation).

In combination with the ALMEMO® V7

measuring instrument, e.g. ALMEMO® 710, it is therefore possible to record fast changes in force and force peaks.

The measured values are evaluated in the WinControl software as table or line diagram (see chapter “Software”).



The overall accuracy of the measurement is determined only by the force transducer with the connected ALMEMO® D7

measuring plug, and is unaffected by the ALMEMO® display device / data logger and extension cables used. The complete

measuring chain, consisting of force transducer and connected ALMEMO® D7 measuring plug, can be calibrated.

## High resolution measurement with digital ALMEMO® D7 sensors

The digital ALMEMO® D7 measuring plug not only enables fast measurements but also high resolution measurements. Thereby, the measuring plug works with

reduced conversion rate. Thus, stable measured values with high resolution can be achieved by using high-precision sensors. The user can easily configure the

ALMEMO® plug on the ALMEMO® V7 measuring instrument.

# Force, Displacement

## Force transducers with digital ALMEMO® D7 measuring plug

For force transducers (compression / tension), torque transducer or strain gauges.  
Fast measurement with 1000 measuring operations per second, resolution of 50 000 digits or high resolution of up to 200 000 digits, 10 measuring operations per second.



With digital ALMEMO® sensors, forces are measured with high measuring rates or high resolution.

Any force transducer with measuring chain becomes a digital sensor with the appropriate ALMEMO® measuring plug.

For technical data of the ALMEMO® D7 measuring plug ZKD7 00-FS, see chapter "Input connector".

## Displacement transducer

Depending on the boundary and environmental conditions of the measuring task, different measuring methods can be used:

Linear inductive displacement transducer and displacement sensor:

**Advantages:** high accuracy, high resolution, robust, acceleration resistant, inexpensive, resistant to interference, very long-term stable, environmentally stable (dirt, humidity), spot measurement combined with basically non-contact measurement, easy assembly and handling

Conductive plastic potentiometers:

**Advantages:** high resolution, good linearity, inexpensive, good temperature and humidity coefficients, extensive application temperature range.

## ALMEMO® Displacement Measurement

Our Potentiometric displacement sensors have been pre-aligned in the factory by storing the correction values in the

ALMEMO® connector before delivery. The precise adjustment can be locally performed by the user with final measures

after the installation

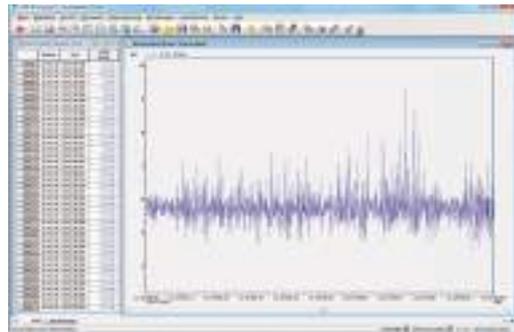
## Measurement of fast changes in displacement with digital ALMEMO® D7 sensors

The new ALMEMO® V7 measuring system makes it possible to measure fast changes in displacement with a temporal resolution of up to 10ms. The potentiometric displacement transducer measures changes in displacement without (electrical) delay. The digital ALMEMO® D7 measuring

plug ZKD7 00-FS works with an A/D converter integrated in the plug and with a measuring rate of up to 100 measuring operations per second (10ms per measuring operation). In combination with the ALMEMO® V7 measuring instrument, e.g. ALMEMO® 710, it is therefore

possible to record fast changes in displacement.

The measured values are evaluated in the WinControl software as table or line diagram.



The overall accuracy of the measurement is determined only by the displacement transducer with the connected ALMEMO® D7 measuring plug, and is unaffected by

the ALMEMO® display device / data logger and the extension cables used.

The complete measuring chain, consisting

of displacement transducer and connected ALMEMO® D7 measuring plug, can be adjusted.

## Displacement transducer with digital ALMEMO® D7 measuring plug

For displacement transducers and other potentiometric sensors.

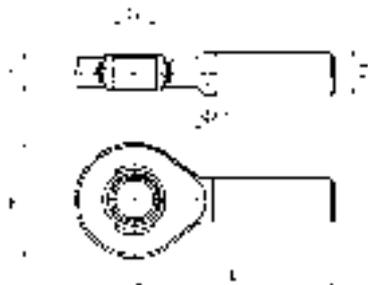
Fast measurement with 100 measurement operations per second, resolution of 10 000 digits



With digital ALMEMO® sensors, changes in displacement are measured with high measuring rate. Any potentiometric displacement transducer becomes a digital sensor with the appropriate ALMEMO® measuring plug.

For technical data of the ALMEMO® D7 measuring plug ZKD7 00-FS see chapter "Input connector".

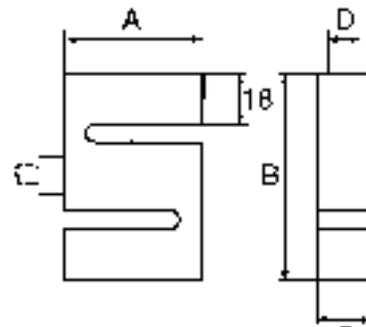
## Tension and Compression Sensor K25



- Wire strain gauges in four-conductor full-bridge circuit.
- Control resistance for final adjustment of the measuring range.
- All measuring ranges that are specified in Newton can also be supplied in kg ranges

! All ALMEMO® devices provide easy push-button adjustment of no-load and final value.

**New:** Measurement of fast changes in force and force peaks or high resolution measurement with digital ALMEMO® D7 measuring plugs, see page 10.15.



### Technical Data:

Max. load limit:	150% of final value	Drift error at permanent load:	<0.07% per 30min
Maximum dynamic load:	70% of final value	Permissible lateral forces:	±60% of fin. val.
Reference temperature:	23°C	Protection system:	up to 1kN: IP 65, from 2kN: IP 67
Cable:	3m long, with axial ALMEMO® connector	Material:	up to 1kN: aluminium 2 to 50kN: stainless steel
Accuracy for tension:	<±0.1% of fin. val.	Dimensions in mm	up to 10kN: A=50, B=75, C=20, D=M12 20kN, 50kN: A=65, B=85, C=40, D=M24 x2
Accuracy for tension and compression:	<±0.2% of fin. val.		
Nominal measuring path:	<0.15mm		
Operative range:	-10 to +70°C		

### Options for all Force Transducers

Options for all Force Transducers	Order no.	Options for all Force Transducers	Order no.
Indication of measured values with ALMEMO® devices in kg	OK9000K	Indication of measured values with ALMEMO® devices in N and kg	OK9000NK

### Accessories

Accessories	Order no.	Accessories	Order no.
Knuckle eyes with external thread M 12 (2 pcs) (dimensions in mm: D = M 12, E = 16, F = 32, G = 12, L = 54)	ZB902512	Knuckle eyes with external thread M 24 x 2 (2 pcs) (dimensions in mm: D = M 24 x 2, E = 26, F = 62, G = 25, L = 94)	ZB902524

### Types (including test certificate)

Types (including test certificate)	Order no.
Measuring range 0.02kN 0.05kN, 0.1kN, 0.2kN, 0.5kN, 1kN, 2kN, 5kN or 10kN please specify	<b>FKA0251</b>
Measuring range 20kN	<b>FKA0252</b>
Measuring range 50kN	<b>FKA0255</b>
Factory calibration KK9xxx force (traction / thrust) for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)	

### Other designs are available on request

Tension and compression sensor FKA 012 with male thread terminal up to 1000 kN

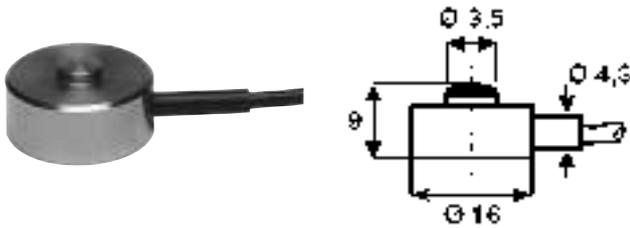


Tension and compression sensor FKA 1563 low height, with male thread terminal up to 2 kN



# Force

## Compression Sensor K 22



- Wire strain gauges in four-conductor full-bridge circuit.
- Control resistance for final adjustment of the measuring range.
- All measuring ranges that are specified in Newton can also be supplied in kg ranges.

! All ALMEMO® devices provide easy push-button adjustment of no-load and final value.

**New:** Measurement of fast changes in force and force peaks or high resolution measurement with digital ALMEMO® D7 measuring plugs, see page 10.15.

### Technical Data:

Max. load limit:	150% of final value
Maximum dynamic load:	70% of final value
Reference temperature:	23°C
Cable:	radial, 3m long with ALMEMO® connector
Accuracy:	<±0.5% of final value

Nominal measuring path:	<0.2mm
Operative range:	-10 to +50°C
Drift error at permanent load:	0.1% per 30min
Protection system:	IP 65
Material:	stainless steel

### Type (including test certificate)

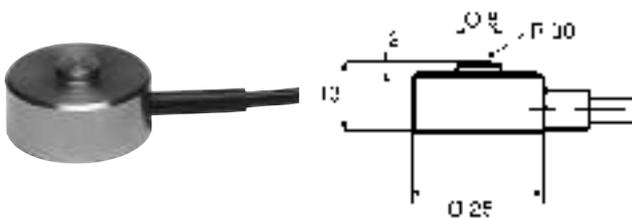
Measuring range 100 N, 200N, 500N, 1000N or 2000N please specify

Factory calibration KK9xxx force (tension or compression) for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)

**Order no.**

**Order no. FKA022**

## Compression Sensor K 1613



- Wire strain gauges in 4-conductor full-bridge circuit.
- Control resistance for final adjustment of the measuring range.
- All measuring ranges that are specified in Newton can also be supplied in kg ranges.

! All ALMEMO® devices provide easy push-button adjustment of no-load and final value.

**New:** Measurement of fast changes in force and force peaks or high resolution measurement with digital ALMEMO® D7 measuring plugs, see page 10.15.

### Technical Data:

Max. load limit:	150% of final value
Maximum dynamic load:	70% of final value
Reference temperature:	23°C
Cable:	radial, 3m long with ALMEMO® connector
Accuracy:	<±0.5% of final value

Nominal measuring path:	<0.2mm
Operative range:	-10 to +50°C
Drift error at permanent load:	0.1% per 30min
Protection system:	IP 65
Material:	stainless steel

### Type (including test certificate)

Measuring range 0.5kN, 1kN, 2kN, 5kN, 10kN or 20kN (50 kN on request) please specify

Factory calibration KK9xxx force (tension or compression) for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)

**Order no.**

**FKA613**

**Compression Sensor**

Other designs are available on request



Compression sensor FKA 2528  
inexpensive Protective class IP60  
0.2 to 10 kN



Compression sensor FKA 013  
other measuring ranges  
from 10 N up to 100 kN

**Torque sensor**

Other designs are available on request



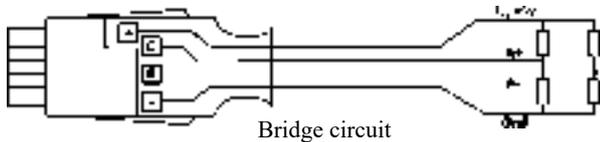
Static torque sensor  
e.g. with square terminal 2 to 5000 Nm



Rotating torque sensor (slip ring)  
e.g. with square terminal 1 to 5000 Nm

**ALMEMO® input connector for measuring bridges, millivolt / volt differential**

Full bridges are measured in four-conductor circuits. The power supply for the bridges is provided by the ALMEMO® plug.



Bridge circuit

For technical data, see chapter "Input connectors".

**Types**

Model	Meas. Range	Resolution
55mV DC	-10.0 to +55.0	1 µV
26mV DC	-26.0 to +26.0	1 µV

**Order no.**

ZA9105FS0
ZA9105FS1

**Digital ALMEMO® D7 measuring plug for bridge differential mV**

For force transducers (compression / tension), torque transducer or strain gauges.

Fast measurement with 1000 measurement operations per second, resolution of 50 000 digits or high resolution of 200 000 digits, 10 measuring operations per second. Only for current ALMEMO® V7 measuring instruments, i.a. precision measuring instrument ALMEMO® 710 or ALMEMO® 202.

Full bridges are measured in four-conductor circuits. The power supply for the bridges is provided by the ALMEMO® D7 plug..

For technical data, see chapter "Input connectors".

**Types:**

Range	Display range	Conversion rate
DMS2*	±50 000 digits	1000 mops
or: DMS1	±200 000 digits	10 mops

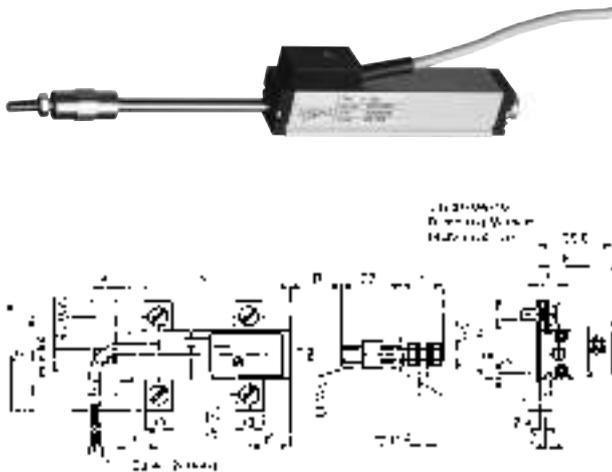
**Order no.**

ZKD700FS

\* Factory setting : The desired measuring range can be programmed on the ALMEMO® V7 device itself.

# Displacement

## Displacement Sensor, Potentiometric FWA xxx T



- Displacement transducers are suitable for direct, accurate measurement of displacements in automatic control and metrology.
- The pickup of the displacement is performed by using a pull rod with a universal joint. This allows for an actuation that is free from backlash and transverse forces, even in case of parallel and angular displacements of transducer and measuring direction.
- Elastomer-damped, independently resilient multi-finger noble metal sliding contact for reliable contact, even at high adjustment speed, shock or vibration.
- Long life, extraordinary linearity, pull rod running on two exact bearings, very high adjustment speed of up to 10m/s, shock and vibration resistant.

! Pre-adjusted in the factory by storing the correction values in the ALMEMO® connector. The precise adjustment can be locally performed by the user with final measures after the installation.

**New:** Measurement of fast changes in displacement with digital ALMEMO® D7 measuring plugs, see page 10.16.

### Technical Data:

Independent linearity:	T25: ±0.2%; T50: ±0.15% T75: ±0.1%; T100: ±0.075% T150: ±0.075%	Movability, ball-shaped coupling	±1mm parallel displacement, ±2.5° angular displacement
Housing length (meas. A+1mm):	T25: 63mm; T50: 88mm T75: 113mm; T100: 138mm T150: 188mm	Operating force (horizontal):	≤ 0.30N
Mech. stroke (meas. B ±1.5mm):	T25: 30mm; T50: 55mm T75: 80mm; T100: 105mm T150: 155mm	Reproducibility:	0.002mm
Total weight (with 2m cable):	T25: 140g; T50: 160g T75: 170g; T100: 190g T150: 220g	Insulation resistance:	≥ 10MW, (500VDC, 1 bar, 2s)
Weight of the pull rod incl. coupling and sliding contact block:	T25: 35g; T50: 43g T75: 52g; T100: 58g T150: 74g	Dielectric strength:	≤ 1mA, (50Hz, 2s, 1 bar, 500VAC)
		Max. permissible torque:	140Ncm
		Temperature range:	-30 to +100°C
		Temperature coefficient:	typ. 5ppm/°C
		Vibrations:	5 to 2000Hz/Amax = 0.75mm/amax = 20g
		Shock:	50g/11ms
		Life span:	> 100 x 106 strokes
		Protection system:	IP 40

### Option

Plug connection (instead of fixed connected cable), including 3m cable with screwed round socket and ALMEMO® connector

**Order no.**

OWA071AK

### Types

Working length/resolution, incl. ALMEMO® cable 2m long	Order no.	Order no.
25 mm / 0,001 mm	<b>FWA025T</b>	<b>FWA100T</b>
50 mm / 0,01 mm	<b>FWA050T</b>	<b>FWA150T</b>
75 mm / 0,01 mm	<b>FWA075T</b>	

included with delivery 2 tensioning clamps Z3-31 including 4 cap screws M4x10, 1 ball-shaped coupling

### Other designs are available on request

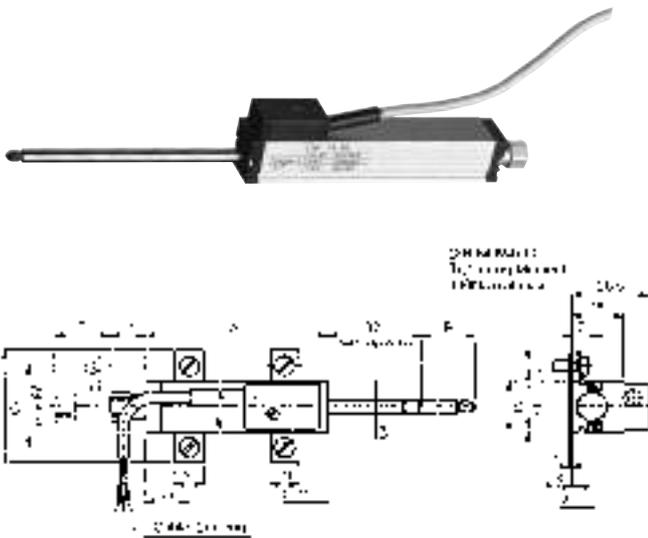


Displacement transducers FWA xxx TEX with pivot joint Protective class IP54, 10 to 300 mm



Displacement transducers FWA xxx TX2 Protective class IP67 with pivot joint, 25 to 300 mm

## Displacement Tracer, Potentiometric FWA xxx TR



- Resistor and collector paths made from conducting plastic.
- Suitable for direct measurements of displacement without a form-locking connection, position detection at stationary measuring objects, tolerance measurements and for continuous contour measurement.
- The pull rod, which is supported on both sides, allows for accepting transverse forces that, for example, occur during a continuous scan of curves or spline parts.
- Rear limit stop is used to provide a simple mechanical coupling of automatic retraction systems, such as pneumatic cylinders or electromagnets.
- Long life, extraordinary linearity, tracer pin running on two exact bearings, DIN compliant standard measuring inserts can be used, shock and vibration resistant.

! Pre-adjusted in the factory by storing the correction values in the ALMEMO® connector. The precise adjustment can be locally performed by the user with final measures after the installation.

**New:** Measurement of fast changes in displacement with digital ALMEMO® D7 measuring plugs, see page 10.16.

### Technical Data:

Independent linearity:	TR25: ±0.2%; TR50: ±0.15% TR75: ±0.1%; TR100: ±0.075%	Operating force (horizontal):	≤ 5 N
Housing length (meas. A+1mm):	TR25: 63mm; TR50: 94.4mm; TR75: 134.4mm; TR100: 166mm	Reproducibility:	0.002mm
Mech. stroke (meas. B ±1.5mm):	TR25: 30mm; TR50: 55mm TR75: 80mm; TR100: 105mm	Insulation resistance:	≥ 10MW (500VDC, 1 bar, 2s)
Total weight (with 2m cable):	TR25: 120g; TR50: 150g TR75: 180g; TR100: 200g	Dielectric strength:	≤ 1mA (50Hz, 2s, 1 bar, 500VAC)
Weight of the pull rod incl. coupling and sliding contact block:	TR25: 25g; TR50: 36g TR75: 48g; TR100: 57g	Max. permissible torque:	140Ncm
Max. operating frequency: (for most critical application 'probe tip upright')	TR25: 18Hz; TR50: 14 TR75: 11Hz; TR100: 10Hz	Temperature range:	-30 to +100°C
		Temperature coefficient:	typ. 5ppm/°C
		Vibrations:	5 to 2000Hz/Amax = 0.75mm/amax = 20g
		Shock:	50g/11ms
		Life span:	> 100 x 106 strokes
		Protection system:	IP 40

### Option

Plug connection (instead of fixed connected cable), including 3m cable with screwed round socket and ALMEMO® connector

Order no.

OWA071AK

### Types

Working length/resolution, incl. ALMEMO® cable 2m long  
25 mm / 0,001 mm  
50 mm / 0,01 mm  
75 mm / 0,01 mm

Order no.

**FWA025TR**  
**FWA050TR**  
**FWA075TR**

Order no.

**FWA100TR**

100 mm / 0,01 mm

included with delivery

2 tensioning clamps Z3-31 including 4 cap screws M4x10

1 probe tip with hard-metal ball

## Optical Rotational Speed Meters

The optical reflection method has become the most accepted method for the measurement of revolutions of shafts, wheels, fans etc.

With single unit retroreflective photoelectric sensors the transmitters and receivers form one single unit. The light sent by the transmitter is, by an opposite located object, reflected to the receiver. The sensor performs a switch when the reflected amount of light exceeds a specific, adjustable limit value at the receiver. This quantity of light depends on the size and the reflection properties of the object. Special reflective tapes are used to increase the sensing range and to improve

the signal-to-noise ratio.

ALMEMO® rotational speed sensors can be used in two measurement setups:

- Retroreflective photoelectric sensor (DIN EN 60947: Type D) Detects only opaque objects. The sensing range depends on the reflectivity of the object, i.e. on the surface quality and colour. Sensitive with regard to contamination and against changes of the reflective properties of the object. These influences can (within limits) be compensated by means of a sensitivity adjustment control

Only small mounting efforts are required as the sensor is a single unit device and a rough alignment is sufficient in most cases.

- Retroreflective light barrier (DIN EN 60947: Type R) Retroreflectors allow for long sensing ranges and an improved signal-to-noise ratio. Low susceptibility to interferences, therefore, highly suitable for use under harsh conditions, e.g. outdoor applications or dirty environments

## Turbine Flowmeters

The sensor contains a vane or paddle that starts rotating when a flow is present. Unlike the optical method, this method also allows for measurements in cloudy and non-transparent liquids. The rotational speed is proportional to the corresponding quantity of flow. The electrical output signal can be generated by two different methods:

- Inductive Proximity Switch: The rotor blades are provided with

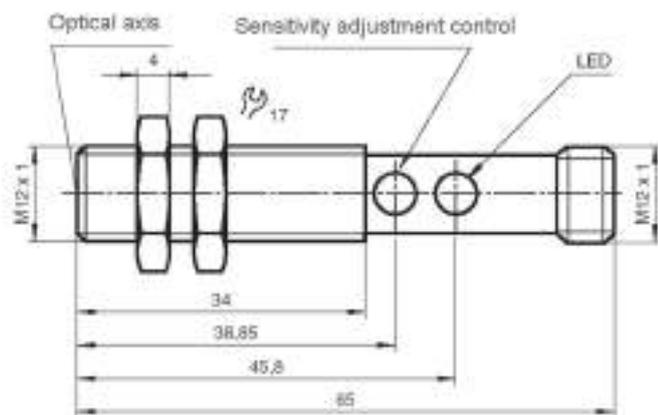
special steel caps, therefore, the rotor blades approaching the transducer cause a change of the inductance and the generation of a pulse type output signal.

- Hall Sensor: The rotor is provided with permanent magnets that affect a Hall sensor, which is located on the transducer. The transducer electronics transforms the Hall signal into a pulse type electrical output signal.

For measuring the volume flow rate or for dosing tasks, the ALMEMO® sensor range includes turbine flowmeters for different measuring ranges and operating conditions:

- Radial turbine flowmeters for large flow quantities.
- Axial turbine flowmeters with rotating vane for small flow quantities

## Rotational Speed Sensor FUA 9192



- Optical probe for measurements of rotational speed, designed as retroreflective photoelectric sensor for photoelectric detection of rotational speeds.
- For evaluation of the pulses, the tachometer probe is equipped with a specific frequency meter module that calculates the number of revolutions per minute from the time period between two pulses. A stable read-out is achieved by averaging over a minimum of 500 ms.
- Easy application: A reflective adhesive tape is attached to the moving part and the probe is aligned with it. For function control purposes a yellow signal lamp at the rear side of the probe will be on when the reflective adhesive tape is recognised.
- To increase the operation reliability the sensitivity can be adjusted through a potentiometer.

## Technical Data:

Measuring range:	8 to 30000rpm (maximum)	Optics:	2-lens system PC
Bright-up pulse time:	> 1ms	Permissible shock load:	$b \leq 30g$ , $T \leq 1ms$
Resolution:	1rpm	Permissible vibrational load:	$f \leq 55Hz$ , $a \leq 1mm$
Accuracy:	up to 15000rpm: $\pm 0.02\%$ of m.v. $\pm 1$ digit up to 30000rpm: $\pm 0.05\%$ of m.v. $\pm 1$ digit	No-load current:	$\leq 20mA$
Detection range:	20 to 200mm (depending on the reflector)	Supply voltage:	> 8.5VDC via instrument, mains adapter recommended
Sensitivity:	adjustable with potentiometers	Connection:	Device connector M12x1 including socket M12x1, angled, with 1.5 meters cable and ALMEMO® connector
Detectable object:	opaque or reflector	Material:	housing: brass, nickel plated, lens opening: PMMA
Distance hysteresis:	$\leq 10\%$	Dimensions:	diameter: M12 x 1mm, length: 55mm
Indication of switching status:	LED yellow	Weight:	15g
Type of light:	red light 660nm	Meets standards:	EN 60 947-5-2
Limit for foreign light:	sun light: $\leq 20000lux$ halogen light: $\leq 5000lux$		
Ambient/storage temperature:	-25/-40°C to +55/+70°C		
Protection system:	IP 67 (accord. to EN 60529)		

## Accessories

	Order no.
Extension cable, 1 meter long	ZA9060VK1
Extension cable, 2 meters long	ZA9060VK2

## Types

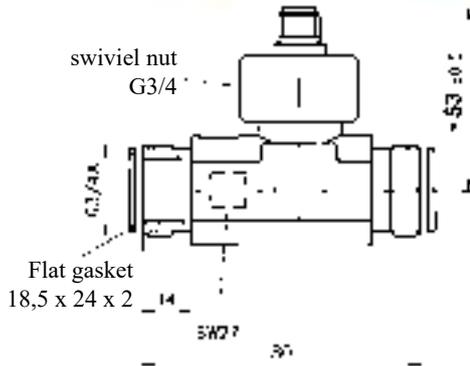
For rotational speeds up to 30000rpm max., incl. 5 reflective adhesive tapes  
Connecting cable 1.5m long with ALMEMO® connector

Order no.

FUA9192

DAkKS / DKD or factory calibration KU90xx rotational speed for digital sensor (see chapter Calibration certificates).  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Axial turbine flowmeter for liquids FVA 915 VTHM



- For measuring the volume flow rate or for dosing tasks with small flow rates.
- Extraordinary compact design.
- Wide, usable measuring range.
- Various options for operation: Cooling water flow, medical technology, plastics industry, solar systems, baker's equipment, machine tools, catering equipment, photographic laboratory equipment, dispensers, dosing equipment, cooling equipment, heating applications, calorimetry.

### Technical Data:

Nominal diameter	DN 15
Measuring range	2 to 40 l / min continuous load max. 20 l/min
Measuring accuracy	±1% of finale value
Reproducibility :	± 0,2 %
Signal output	from 0.3 l/min
maximum size of particles in medium	0.5 mm
maximum temperature of medium	85°C
Nominal pressure	PN10
Process connection	G 3/4" external thread and union nuts
Pressure loss in bar	$\Delta p = 0.00145 \times Q^2$ (Q in l/min) approx. 0.6 bar at 20 l / min approx. 2.3 bar at 40 l / min
Protection system	IP 54
Output signal	
Pulse rate / K factor	940 pulses / liter
Resolution	1.1 ml / pulse
Signal form	rectangular signal, NPN, open collector
Measuring transducer	Hall sensor
Supply voltage	4,5 ... 24 V DC

Electrical connection	(from ALMEMO® device) 4-pin connector M12x1 including PVC line (Tmax =70 °C) with ALMEMO® connector
-----------------------	--

### Materials

pipe section	brassCuZn36Pb2As
Flat gasket	NBR
Turbine cage	PEI ULTEM
Rotating vane	PEI ULTEM
Rotor complements	hard ferrite magnets
Axle / bearing	axle Arcap AP1D with hard metal pins in saphire bearings
Bearing support	Arcap AP1D
Sensor	PPO Noryl GFN3
O-ring	NBR
Knurled swivel nut *	PA GF 30

\* not coming into contact with the medium

### Types

incl. connecting cable, 6m long with ALMEMO® connector, turbine body made of brass  
Factory calibration KV91xx flow for digital sensor (see chapter Calibration certificates)

**Order no.**  
**FVA915VTHM**

### Other designs are available on request

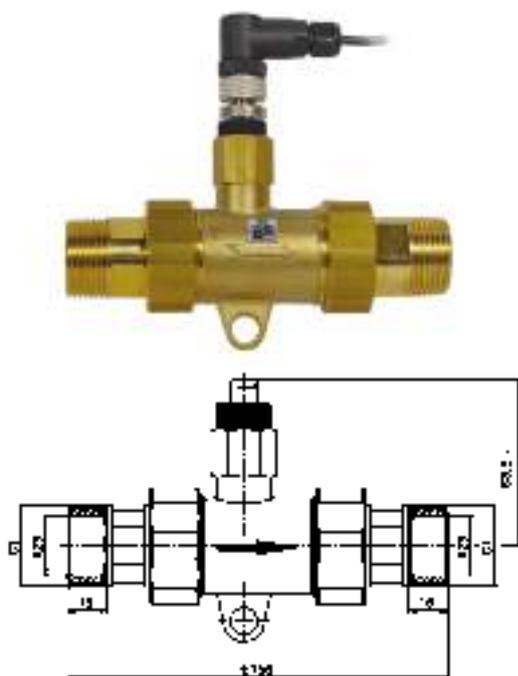
Axial turbine flowmeters FVA915VTPx for water up to 150 °C, 300 bar,  
2 to 40 l/min Figure - similar to above

Magnetic-inductive flowmeters FVA 915 VMZx without moving parts,  
for small flow rates from 0.1 l / min and high flow rates up to 250 l / min



FVA 915 VMZ

## Axial turbine flowmeter for liquids FVA 915 VTH25M



- For measuring the volume flow rate or for dosing tasks with large flow rates.
- Compact design.
- Wide useful operating range.
- Wide variety of applications :
  - Cooling water flow, medical technology, plastics industry, solar systems, baker's equipment, machine tools, catering equipment, photographic laboratory equipment, dispensers, dosing equipment, cooling equipment, heating applications, calorimetry.

### Technical Data

Nominal diameter	DN 25
Measuring range	4 to 160 l/min
Continuous load	max. 80 l/min
Measuring accuracy	±5% of measured value up to 5l/min ±7% of measured value
Reproducibility :	±0.5%
Signal output	from < 1 l/min
maximum size of particles in medium	0.63 mm
maximum temperature of medium	85°C
Nominal pressure	PN10
Process connection	G 1¼" external thread including adapter for R 1" (absolutely necessary)
Pressure loss	approx. 0.1 bar at 80 l / min approx. 0.45 bar at 160 l / min
Protection system	IP 54
Output signal	
Pulse rate / K factor	65 pulses / liter

Resolution	15 ml / pulse
Signal form	NPN, open collector
Measuring transducer	Hall sensor
Supply voltage	4,5 ... 24 V DC (from ALMEMO® device)
Electrical connection	4-pin connector M12x1 including PVC line (Tmax =70 °C) with ALMEMO® connector

#### Materials

Pipe section	brass, CW602N
Turbine cage	PPO Noryl GFN 1630V
Rotation vane	PPO Noryl GFN 1520V
Rotor complements	Hard Ferrite Magnets
Axle / bearing	stainless steel 1.4539 / sapphire, PA
Sensor socket	PPO Noryl GFN 1630V
O-ring	EPDM

### Type

incl. connecting cable, 6 m long, with ALMEMO® connector, turbine body made of brass  
Factory calibration KV91xx flow for digital sensor (see chapter Calibration certificates)

**Order no.**  
**FVA915VTH25M**

### Other designs are available on request

Axial turbine flowmeters FVA 915 VTH40 6.7 to 417 l/min, DN40  
Figure - similar to above

Turbine flowmeters FVA 915 VTRx  
Stainless steel, up to 120 °C, up to 250 bar for different flow rates  
from 1.8 l/min to 1133 l/min



# Flow

## Flow sensors for liquids FVA 645 GVx

### Variant in stainless steel without any moving parts, with integrated temperature measuring



- Measuring section in stainless steel
- Application in systems with laminar flow, no pressure surges, no air pockets, no suspended solids
- Without any moving parts
- Integrated temperature measuring
- Low pressure loss
- Wide temperature range
- High-speed reaction time
- Using with water and water-glycol mixture
- For heat output measurement in heating systems and cooling plant

### Technical Data:

Flow		Suitable conditions	
Measuring principle	Pressure pulsation Kármán vortex street	Media	Water, water-glycol ( max. 42 % glycol)
Measuring range	see variants	FVA645GV12QT/40QT	Viscosity < 4 mm <sup>2</sup> /s,
Accuracy	using water as medium at 0 to +100°C ±1.5 % of final value	FVA645GV100QT/200QT	Viscosity < 2 mm <sup>2</sup> /s)
FVA645GV12QT/40QT:	by water-glycol ( 42 % ) 30 to +100°C (Viscosity < 4 mm <sup>2</sup> /s) ±5 % of final value	Temp. of medium	0 to +100 °C
Resolution	see variants	Ambient temperature	-25 to +60 °C
Reaction time (63 %)	< 1 s ( < 3 s for FVA645GV12QT)	Ambient humidity	up to 95 % RH, non-condensing
Temperature		Electrical connections	
Measuring range	0 to +100 °C	Output signal	2x 0.5 to 3.5 V
Accuracy	±1 K at +25 to +80 °C ±2 K at 0 to +100 °C	Power supply	5 VDC (±5 %), <10 mA via ALMEMO® connector
Resolution	0.5 K	Connection	Sensor with 2.9-meter connecting cable and ALMEMO® connector
Reaction time (63 %)	<1 second under flow conditions 50% of final value	Fitting length	
Process connection	2x male thread see variants	see variants	
Pressure	10 bar (bursting pressure >16 bar)	Materials (in contact with media)	
Pressure loss	0.1 bar, typical under flow conditions, 50 % of final value	Corrosion-resistant coating EPDM, PPS, PPA 40-GF	
		Pipe piece	Stainless steel 1.4408; (inside pipe PPA 40-GF)

### Variants

Sensor for flow rate and temperature over a measured section, including ALMEMO® connecting cable, 2.9 meters

Measuring range	Resolution	Process connection	Fitting length	Order no.
1 to 12 l/min	0.06 l/min	G 3/4" male thread	ca. 110 mm	<b>FVA645GV12QT</b>
2 to 40 l/min	0.2 l/min	G 3/4" male thread	ca. 110 mm	<b>FVA645GV40QT</b>
5 to 100 l/min	0.5 l/min	G 1" male thread	ca. 129 mm	<b>FVA645GV100QT</b>
10 to 200 l/min	1.0 l/min	G 1 1/4" male thread	ca. 137.5 mm	<b>FVA645GV200QT</b>

Factory calibration KV91xx flow for sensor (see chapter Calibration certificates)

## Content

How split-core type transformers work	
Split-core type transformer for AC currents Chauvin Arnoux types Mini 09, MN 88, Y4N	11.03
Measuring module for DC voltages and DC currents ZA9900AB / ZA9901AB	11.05
True / effective measuring module for AC voltages and AC currents ZA9903AB / ZA9904AB	11.06

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ALMEMO® input connectors and adapter cables  
for all sizes see Chapter Input connectors

# Electrical variables

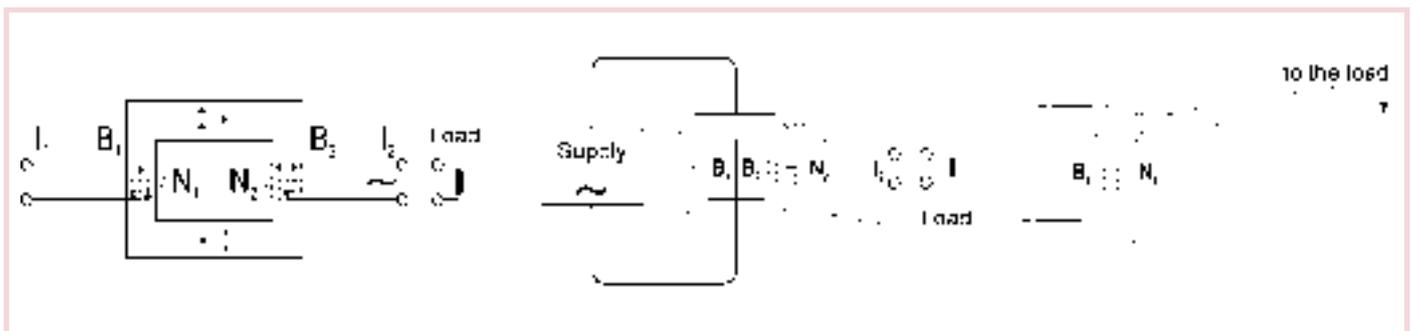


## How Split-Core Type Transformers Work

Current transformers are used to acquire high alternating currents without contact and without interrupting the circuit. In principle, they consist of 2 separate transformer windings ( $B_1$  = primary winding with  $N_1$  windings,  $B_2$  = secondary winding with  $N_2$  windings) on one common iron core (closed magnetic circuit).

If an alternating current  $I_1$  flows through the winding  $B_1$ , a current  $I_2$  is induced in the winding  $B_2$ , which depends on the winding ratio  $N_1/N_2$ . In comparison with stationary-installed panel transformers, split-core type transformers must be able to embrace a conductor within a magnetic circuit that is split open.

In practice, the primary winding  $B_1$  consists of only one winding that carries the current to be measured. The transformation ratio of a current transformer is:  
 $I_1 \times N_1 = I_2 \times N_2$



### ! IMPORTANT !

ALMEMO® measuring instruments generally allow the connection of sensors of other manufactures. We will gladly adapt your current clamp to ALMEMO®. Please contact us.

## Split-Core Type Transformer for AC Currents Chauvin Arnoux type Mini 09



- Perfectly suitable for use in maintenance and monitoring of electrical systems without interrupting their current supply.
- Application oriented design, particularly suitable for measurement in dense wiring.
- Ideal for non-contact control measurements with ALMEMO® hand-held devices, e.g. for fault currents or at devices with low current consumption.

### Technical Data

Measuring range:	1A to 150A AC	Admissible voltage	300 V category IV or 600 V category III
Accuracy of meas. at 50/60Hz:	40 to 150A: ± 4% 15 to 40A: ± 3% ± 0.2A 5 to 15A: ± 6% ± 0.2A 1 to 5A: ± 10% ± 0.2A	Operating frequency	48 to 500 Hz
Encompassing capacity:	cable Ø 10mm	Operating conditions	-10 to +50°C, 10 to 85% RH
Transformation ratio:	100mVDC/1A AC	Dimensions	130 x 37 x 25 mm
Output signal:	15VDC	Weight	approx. 180 grams
Nominal conditions	23°C ±3K, 1013 mbar, 20 to 75% RH	Storage temperature	-40 to +80°C
Electrical safety	EN 61010-2-032 (issue 2/2003)	Connecting cable	Cable, 1.5 meters, with safety laboratory connectors, including safety coupling and 1.5-meter ALMEMO® connecting cable with banana plugs

### Types (including manufacturer's test certificate)

Single-range split-core type transformer with integrated rectifying for small AC currents incl. ALMEMO® connecting cable (±26VDC)

### Order no.

**FEA6049**

With test certificate of the manufacturer Chauvin Arnoux. Delivery in original packaging, adapted with ALMEMO® plug

## Split-Core Type Transformer for AC Currents Chauvin Arnoux type MN 88



- Perfectly suitable for use in maintenance and monitoring of electrical systems without interrupting their current supply.
- Asymmetric shape of the jaw of tongs, particularly suitable for encompassing cables and rails.
- With polarity indicator for power measurements.
- Ideal for non-contact control measurements with ALMEMO® handheld devices, e.g. at low power systems.

### Technical Data

Measuring range:	0.5A to 200A AC (the higher value corresponds to 120% of the max. nominal value)	Dimensions:	135 x 50 x 30mm
Accuracy of meas. at 50Hz:	± 3% of meas. val. ±0.5A	Weight:	approx. 180g
Encompassing capacity:	cable Ø 20mm rail 20 x 5mm	Nominal conditions:	25°C ±3°C/1013mbar
Transformation ratio:	100mVDC/1A AC	Operating temperature:	-10 to +55°C
Output signal:	20VDC	Relative humidity:	0% to 90% at 40°C max.
Operating frequency:	40Hz to 10kHz	Storage temperature:	-40 to +70°C
Safety standards:	IEC 1010-1	Connecting cable:	Connecting cable Integrated banana sockets, including 1.5-meter ALMEMO connecting cable with banana plugs
Overvoltage protection:	category III		

### Types (including manufacturer's test certificate)

Single-range split-core type transformer with integrated rectifying for small AC currents incl. ALMEMO® connecting cable (±26VDC)

### Order no.

**FEA604MN**

With test certificate of the manufacturer Chauvin Arnoux. Delivery in original packaging, adapted with ALMEMO® plug

# Electrical variables

## Split-Core Type Transformer for AC Currents Chauvin Arnoux type Y4N



- Perfectly suitable for use in maintenance and monitoring of electrical systems without interrupting their current supply.
- Asymmetric shape of the jaw of tongs, particularly suitable for encompassing cables and rails.
- With polarity indicator for power measurements.
- Ideal for non-contact control measurements with ALMEMO® handheld devices, e.g. at low power systems.

### Technical Data

Measuring range:	2A to 500A AC (the higher value corresponds to 120% of the max. nominal value)	Weight:	approx. 420g
Accuracy of meas. at 50Hz:	$\pm 3\%$ of meas. val. $\pm 0.5A$	Nominal conditions:	25°C $\pm 3^\circ C$ /1013mbar
Encompassing capacity:	cable $\varnothing$ 30mm rail 30 x 63mm	Operating temperature:	-10 to +55°C
Transformation ratio:	1mVDC/1A AC	Relative humidity:	0% to 90% at 40°C max.
Output signal:	0.5VDC	Storage temperature:	-40 to +70°C
Operating frequency:	40Hz to 1kHz	Connecting cable:	Cable, 1.5 meters, with safety laboratory connectors, including safety coupling and 1.5-meter ALMEMO® connecting cable with banana plugs
Safety standards:	IEC 348, IEC 1010-2-032		
Overvoltage protection:	no		
Dimensions:	215 x 66 x 34mm		

### Types (including manufacturer's test certificate)

Single-range split-core type transformer with integrated rectifying for small and medium AC currents incl. ALMEMO® connecting cable ( $\pm 2.6VDC$ )

### Order no.

**FEA6044N**

With test certificate of the manufacturer Chauvin Arnoux. Delivery in original packaging, adapted with ALMEMO® plug

## ALMEMO® Measuring Modules for DC Voltage and DC Current ZA 9900 AB / ZA 9901 AB



- Acquisition of the momentary, maximum, minimum and average value, plus transferring data of each measuring point scan to the ALMEMO® device.
- DC voltage or DC current signal are scanned with 1kHz.
- Pure digital data transmission to the measuring instrument.
- Connector sockets electrically isolated and overvoltage-protected.

### Technical Data

Accuracy:	0.1% of fin. val. ±2 digits for DC Current 20 A: ± 4 digits	Housing:	polystyrene, dimensions L100 x W54 x H31mm
Sampling rate:	1kHz	Sockets:	touchproof, Ø 4mm
Resolution:	12bit, ±2048 digits	Operating voltage:	6 ... 14V through ALMEMO® device
Meas. period/transient time:	0.1s	Current consumption:	< 40mA (connector and module)
Meas. cycle, maximum:	14h		
Electrical isolation:	1kV permanent, 4kV for 1s		
Nominal conditions	23 °C ±2 K, 10 to 90 % r.H. (non-condensing)		

- New:** Digital ALMEMO® D7 measuring plug with galvanic isolation up to 50 V, see chapter “Input connectors”  
Dynamic measurement of DC voltage up to 20 V or DC up to 20 mA.
- Fast measurement with up to 1000 mops.
  - Or high resolution of up to 200 000 digits.
  - Accuracy independent from the measuring instrument.

### Types (incl. touchproof connecting cable)

### Order no.

#### DC Voltage:

Measuring range	Resolution	Overload	Internal resistance	
±2.000 V*	0.001V	±400 V	800 kΩ	<b>ZA9900AB2</b>
±20.0 V	0.01V	±500 V	1 MΩ	<b>ZA9900AB3</b>
±200.0 V	0.1V	±500 V	1 MΩ	<b>ZA9900AB4</b>
±400 V	1V	±1000 V	4 MΩ	<b>ZA9900AB5</b>

#### DC Current:

Measuring range	Resolution	Overload	Internal resistance	
±20.00 mA	0.01mA	±0.1 A*	10 Ω	<b>ZA9901AB1</b>
±200.0 mA	0.1mA	±1 A*	1 Ω	<b>ZA9901AB2</b>
±2.000 A	0.001A	±10 A*	0.1 Ω	<b>ZA9901AB3</b>
±10.00 A	0.01A	±20 A*	0.01 Ω	<b>ZA9901AB4</b>
±20.0 A	0.1 A	±30 A*	0.002 Ω	<b>ZA9901AB5</b>

\*Without fuse. overload condition only up to 1 minute maximum

#### DC via external shunt:

±200.0 mV	0.1mV	±40 V	50 kΩ	<b>ZA9900AB1</b>
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DAkks or factory calibration KE90xx electrical for digital measuring module (see chapter Calibration certificates).  
DAkks calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

# Electrical variables

## True/Effective Measuring Modules for AC Voltages and AC Current ZA 9903 AB / ZA 9904 AB



- Independent, full digital acquisition of the true/effective values of an AC variable.
- Measuring signals with any course of a curve are digitised with 1kHz.
- Pure digital data transmission to the measuring instrument.
- Acquisition of the frequency through a second measuring channel.
- Connector sockets electrically isolated and overvoltage-protected.

06/2018 • We reserve the right to make technical changes.

### Technical Data

TRMS		Frequency range:	20.0 ... 250Hz
Accuracy:	0.1% of fin. val. ± 2 digits for AC Current 20 A: ± 4 digits	Meas. period/transient time:	0.5s
Sampling rate:	1kHz	Electrical isolation:	1kV permanent, 4kV for 1s
Resolution:	12 bit, ± 2048 digits for U <sub>ss</sub>	Nominal conditions	23 °C ±2 K, 10 to 90 % r.H. (non-condensing)
Frequency range:	20.0 ... 250Hz	Housing:	polystyrene, dim. L 100 x W 54 x H 31mm
Meas. period/transient time:	0.5s	Sockets:	touchproof, Ø 4mm
Frequency		Operating voltage:	6 ... 14V through ALMEMO® device
Accuracy:	± 0.1Hz	Current consumption:	< 40mA (connector and module)
Sampling rate:	1kHz		
Resolution:	0.1Hz		
Sensitivity:	10% of final value		

### Types (incl. touchproof connecting cable)

### Order no.

#### AC Voltage

Meas. range	Resolution	Peak	Overload	Internal resistance	
130.0mV <sub>eff</sub> <sup>1)</sup>	0.1mV	±0.2V	±400V	0.5MΩ	<b>ZA9903AB1</b>
1.300V <sub>eff</sub>	1mV	±2V	±400V	0.8MΩ	<b>ZA9903AB2</b>
13.00V <sub>eff</sub>	10mV	±20V	±500V	1MΩ	<b>ZA9903AB3</b>
130.0V <sub>eff</sub>	0.1V	±200V	±500V	1MΩ	<b>ZA9903AB4</b>
400V <sub>eff</sub>	1V	±1000V	±1000V	4MΩ	<b>ZA9903AB5</b>

<sup>1)</sup> When using the measuring module for the purposes of current measurement with an external shunt. the shunt must be looped into the neutral conductor (not into the phase).

#### AC Current

Meas. range	Resolution	Peak	Overload	Internal resistance	
1.000A <sub>eff</sub>	1mA	±2A	±10A <sup>2)</sup>	0.10Ω	<b>ZA9904AB1</b>
10.00A <sub>eff</sub>	10mA	±20A	±20A <sup>2)</sup>	0.01Ω	<b>ZA9904AB2</b>
20.0 A <sub>eff</sub>	0.1 A	±30 A	±30 A <sup>2)</sup>	0.002 Ω	<b>ZA9904AB3</b>

<sup>2)</sup> Without fuse, overload condition only up to 1 minute maximum

DAkKS or factory calibration KE90xx electrical for digital measuring module (see chapter Calibration certificates).  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

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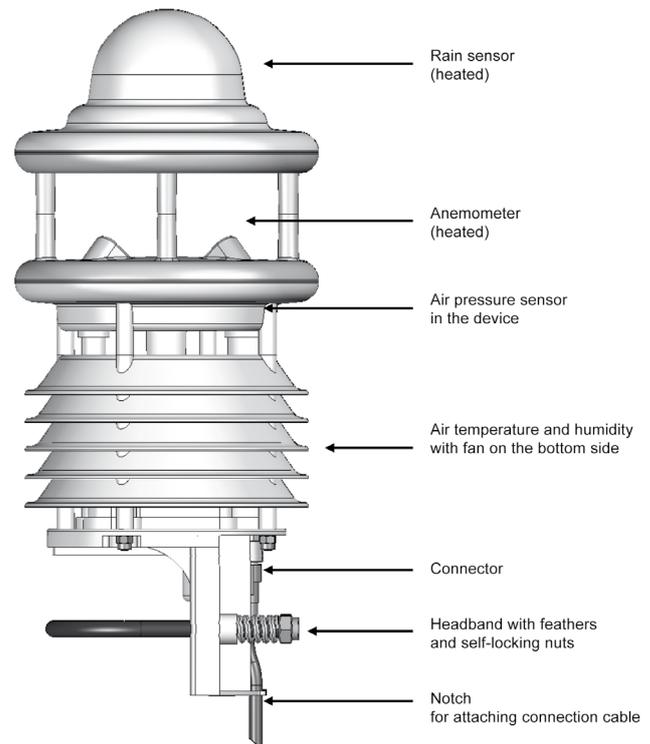


## Compact Glossary of Meteorological Terms

Response value	The wind velocity at which the cup or the wind vane starts to move.																																																
Barometer	General term for the device measuring the atmospheric pressure.																																																
Barometric pressure	Pascal [Pa] = Newton per square meter [N/m <sup>2</sup> ]; 1hPa=1mbar; 1 bar=10 <sup>5</sup> Pa																																																
Beaufort	Classification for certain wind velocity ranges: <table border="1"> <thead> <tr> <th>bft</th> <th>m/s</th> <th>bft</th> <th>m/s</th> <th>bft</th> <th>m/s</th> <th>bft</th> <th>m/s</th> <th>bft</th> <th>m/s</th> <th>bft</th> <th>m/s</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0 - 0.2</td> <td>1</td> <td>0.3- 1.5</td> <td>2</td> <td>1.6- 3.3</td> <td>3</td> <td>3.4- 5.4</td> <td>4</td> <td>5.5- 7.9</td> <td>5</td> <td>8.0-10.7</td> </tr> <tr> <td>6</td> <td>10.8-13.8</td> <td>7</td> <td>13.9-17.1</td> <td>8</td> <td>17.2-20.7</td> <td>9</td> <td>20.8-24.4</td> <td>10</td> <td>24.5-28.4</td> <td>11</td> <td>28.5-32.6</td> </tr> <tr> <td>12</td> <td>32.7-36.9</td> <td>13</td> <td>37.0-41.4</td> <td>14</td> <td>41.5-46.1</td> <td>15</td> <td>46.2-50.9</td> <td>16</td> <td>51.0-56.0</td> <td>17</td> <td>56.1-61.2</td> </tr> </tbody> </table>	bft	m/s	bft	m/s	0	0 - 0.2	1	0.3- 1.5	2	1.6- 3.3	3	3.4- 5.4	4	5.5- 7.9	5	8.0-10.7	6	10.8-13.8	7	13.9-17.1	8	17.2-20.7	9	20.8-24.4	10	24.5-28.4	11	28.5-32.6	12	32.7-36.9	13	37.0-41.4	14	41.5-46.1	15	46.2-50.9	16	51.0-56.0	17	56.1-61.2								
bft	m/s	bft	m/s	bft	m/s	bft	m/s	bft	m/s	bft	m/s																																						
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6	10.8-13.8	7	13.9-17.1	8	17.2-20.7	9	20.8-24.4	10	24.5-28.4	11	28.5-32.6																																						
12	32.7-36.9	13	37.0-41.4	14	41.5-46.1	15	46.2-50.9	16	51.0-56.0	17	56.1-61.2																																						
Damping ratio	Measure for the damping of wind vanes. It is the ratio of successive damped deflection amplitudes (e.g. 3rd to 1st amplitude) in one direction.																																																
Distance constant	Is the distance that has been passed by the wind and which is reached when, after a sudden change of the wind velocity, the velocity has reached 63% of the final value.																																																
Gray code	One step digital code used for the wind direction.																																																
Altitude formula	Mathematical reduction of the barometric air pressure to a reference altitude, at minimum to sea level (QFF). Example: with each altitude increase of 8m the pressure decreases by approximately 1hPa.																																																
Detection limit	The lowest value of the wind velocity and wind direction where a stable measured value is established.																																																
Normal pressure	The barometric normal pressure (1013.25hPa) that, according to DIN ISO 2533, serves as base value for the 'high pressure' and 'low pressure' data.																																																
QFE	The atmospheric pressure that has been reduced to the elevation of an airport runway.																																																
QFF	Designation used in aviation for the barometric air pressure that has been reduced to sea level (0m). Also serves as a common base for the barometric air pressure comparison of different weather stations with different elevations of the stations and it is the base for the presentation of the isobars in weather maps.																																																
QNH	Designation commonly used in aviation for the barometric air pressure, which has to be entered into an altimeter as an initial value so the altimeter can indicate the altitude above sea level.																																																
Altitude of station	The local elevation regarding the installation of the measuring station incl. the barometer above sea level.																																																
Variation	The range in which the wind direction has been changing within the preceding 10 minutes (acc. to ICAO).																																																
Wind velocity	Usual practical units: 1m/s = 3.6km/h = 1.9455knots																																																
Wind direction	Specification of which direction the wind comes from. The specification is based on a clockwise setup starting from North to East (90°), South (180°) and West (270°) to North (360°).																																																
Wind travel	Is the distance travelled by the wind during a certain period.																																																

**Compact meteorological transducer for professional use - FMD760**

**Digital sensors for measuring wind, precipitation, air temperature, atmospheric humidity, atmospheric pressure. Maintenance-free measuring procedures for wind and precipitation  
Forced-ventilated radiation-protected housing**

**Technical data and functions****Digital meteorological transducer for operating with ALMEMO® V7 devices**

This digital meteorological transducer, with its integrated signal processor or A/D converter, can acquire all important weather variables in one device (over 20 different measurable variables). Up to 10 measuring channels can be evaluated simultaneously via the ALMEMO® D7 plug.

On leaving our factory the following variables are programmed : wind velocity (m/s), wind direction (°), precipitation quantity (mm), precipitation intensity (mm/h), air temperature (°C), relative atmospheric humidity (% RH), barometric atmospheric pressure (hPa).

The meteorological transducer operates with current ALMEMO® V7 devices, including precision measuring instrument ALMEMO® 710 and professional measuring instrument ALMEMO® 202.

**For professional applications**

The meteorological transducer complies in essence with all specifications laid down by the WMO (world meteorological organization) and is used in a wide variety of areas, e.g. weather services, water management, transport technology (roads, rail), agriculture, renewable energy technology, and the monitoring of air quality and atmospheric emissions.

The transducer can be fitted quickly and easily, e.g. on a mast or pole, using the supplied bracket.

The connection cable can be plugged onto the transducer. In the small connection box the signal cables are clamped and the mains unit 24V for the heating system supply are plugged. In mobile use (without mains unit 24V) heating and fan (see below) are deactivated, and the rainfall radar (see below) can be operated in Energy Saver mode. 1

**Wind**

Wind is measured by means of four ultrasonic sensors (the four main compass points). From the runtime differences the wind velocity is calculated in m/s and the wind direction in °.

This measuring procedure is maintenance-free (no moving parts). For operation in winter the ultrasonic sensors can if so required be heated.

**Precipitation, rainfall**

Precipitation is acquired using tried and tested radar technology. A Doppler radar measures the velocity of individual drops of rain / snow. Precipitation quantity (in mm) and precipitation intensity (in mm/h) can be calculated on the basis of the correlation of drop size and drop velocity. The type of precipitation (rain / snow) is determined on the basis of the different velocity of descent.

This measuring procedure is maintenance-free (no moving parts). For operation in winter the precipitation sensor can if so required be heated.

**Air temperature and atmospheric humidity**

Air temperature is measured (in °C) by means of a high-precision NTC resistance sensor; relative atmospheric humidity is measured (in % RH) by means of a capacitive humidity sensor. These sensors are enclosed in a forced-ventilated radiation-protected housing in order to minimize external influences (e.g. solar radiation, etc.). This ensures that in spite of high solar radiation accurate measuring results can still be achieved. The forced ventilation, similarly, improves responsiveness in the event of condensation.

**Atmospheric pressure**

Absolute atmospheric pressure is measured (in hPa) by means of an integrated sensor.

**Measured values**

The sensors in the meteorological transducer measure the current measured values continuously and at their internal sampling rate. In the ALMEMO® D7 plug the minimum / maximum average values and quantities are calculated (at the output cycle of the ALMEMO® V7 device); this is for the purpose of measuring a large number of measurable variables.

## Technical data

<b>Wind velocity</b>		Measuring range	300 to 1200 hPa
Measuring method	Ultrasonic	Resolution	0.1 hPa
Measuring range	0 to 75 m/s	Accuracy sensor	±0.5 hPa (0 to +40 °C)
Resolution	0.1 m/s	Sampling rate	1 minute
Accuracy	±0.3 m/s or ±3 % (0 to 35 m/s) ±5 % (>35 m/s) RMS	ALMEMO® D7 quantities	Current momentary value
Response threshold	0.3 m/s	<b>Operating conditions</b>	
Sampling rate	10 seconds	Temperature	-50 to +60 °C (with heating)
ALMEMO® D7 quantities	Average value, minimum value, maximum value (at output cycle)	Relative humidity	0 to 100 % RH
<b>Wind direction</b>		<b>Dimensions</b> (including fixture)	
Measuring method	Ultrasonic	Height	343 mm
Measuring range	0 to 359.9 °	Diameter	150 mm
Resolution	0.1 degrees	Weight	approx. 1.5 kg (including fixture, excluding connection cables)
Accuracy	<3 ° (>1 m/s)	<b>Housing</b>	
Response threshold	0.3 m/s	Plastic Protective class IP66	
Sampling rate	10 seconds	Fixture	Mast fixture, stainless steel, for Ø 60 to 76 mm
ALMEMO® D7 quantities	Average value, minimum value, maximum value, average value as text (at output cycle)	Sensor connector	Built-in plug
<b>Precipitation, rainfall</b>		Sensor connection cable	fitted in connection box Length (see variants, accessories)
Measuring method	Radar sensor	<b>Connection box</b>	
Measuring range	Drop size 0.3 to 5.0 mm	Clamp fitting the sensor connection cable and the ALMEMO® connection cable	
Resolution	Precipitation, liquid 0.01 mm	Plug fitting the mains unit cable for the heating system supply	
Precipitation types	rain, snow	Dimensions 80 x 82 x 55 mm	
Reproducibility	typical >90 %	3 cable glands	
Response threshold	0.002 mm	<b>Heating</b>	
Sampling rate	On reaching the response threshold, event-dependent	Supply voltage	24 VDC
Rainfall intensity	0 to 200 mm/h; Sampling rate 1 minute	Current consumption	1.7 A (40 W)
ALMEMO® D7 quantities	Rainfall quantity or snow quantity (at the output cycle) Rainfall intensity or snow intensity, current momentary value	via external mains unit ZB1024NA2 (in delivery), 100 to 240 V AC / 24 V DC, 4,17 A with hollow connector, fitted in the connection box	
<b>Air temperature</b>		ALMEMO® connection cable	fitted in connection box Length = 2 meters
Measuring method	NTC	<b>ALMEMO® D7 plug</b>	
Measuring range	-50 to +60 °C	Refresh rate 2 seconds for all current momentary values	
Resolution	0.1 K (-20 to +50 °C), otherwise 0.2 K	Average value, maximum value, minimum value and quantities - at the output cycle (minimum 2 sec. up to 24 hours)	
Accuracy sensor	±0.2 K (-20 to +50 °C), otherwise ±0.5 K (>-30 °C)	of the ALMEMO® V7 device	
Sampling rate	1 minute	<b>Supply with mains unit 24V (default):</b>	
ALMEMO® D7 quantities	Current momentary value, average value, minimum value, maximum value (at output cycle)	All functions available. 24 V from the mains unit, max. 1,8 A. 12 V from ALMEMO® device, typ. 10 mA.	
<b>Atmospheric humidity</b>		<b>Supply without mains unit 24V (mobile operation):</b>	
Measuring method	capacitive	Fan and heating deactivated. 12 V from ALMEMO® device, typ. 130 mA with rainfall radar in continuous operation.	
Measuring range	0 to 100 % RH	Operating in Energy Saver mode 1: typ. 25 mA, no rain test / no rain, typ. 130 mA for 2 s / Min in the rain test, typ. 130 mA continuously, in the rain	
Resolution	0.1 % RH		
Accuracy sensor	±2 % RH		
Sampling rate	1 minute		
ALMEMO® D7 quantities	Current momentary value		
<b>Atmospheric pressure</b>			
Measuring method	MEMS sensor, capacitive		

## Accessories

Sensor connection cable, free ends	Length = 20 meters	<b>Order no.</b>	<b>ZB9760AK20</b>
Sensor connection cable, free ends	Length = 100 meters		<b>ZB9760AK100</b>
Overvoltage arrester (for stationary operation)			<b>ZB9760USP</b>

## Variants

Digital meteorological transducer for measuring wind, precipitation, air temperature, atmospheric humidity, atmospheric pressure. Forced-ventilated radiation-protected housing, integrated heating, bracket for mast fitting. Sensor with built-in plug, including sensor connection cable Length = 10 meters fitted in connection box, external mains unit ZB1024NA2, fitted in the connection box, ALMEMO® connection cable fitted in connection box Length = 2 meters with ALMEMO® D7 plug	<b>Order no.</b>	<b>FMD760</b>
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DAkKS / DKD or factory calibration for digital sensors, see chapter "Calibration certificates".  
The DAkKS / DKD calibration meets the requirements of DIN EN ISO/IEC 17025 for test equipment.

**Mobile weather station****Meteorological sensor FMD7-60 with ALMEMO® data logger**

Universal mobile weather station for measuring a wide range of meteorological data, e.g. wind direction, wind velocity, temperature, atmospheric humidity, atmospheric pressure, rainfall quantity and intensity, and global radiation. Quick and easy to install, robust design, compatible with various ALMEMO® V7 data loggers.

**Applications**

- Building automation (heating, ventilation, shading)
- Photovoltaic monitoring
- Industrial emissions tracing
- Disaster control (tracing clouds of poisonous gas, etc.)
- Sporting events
- Agricultural trials
- Road weather information systems (RWIS)
- Icy roads warning systems
- Vehicle test circuits

**The mobile weather station comprises :**

- Meteorological sensor FMD7-60 including mobile tripod
- Probe head for measuring optical radiation
- ALMEMO® data logger choice of ALMEMO® 202 / 710 / 809

**Digital meteorological sensor**

Sensor with built-in plug, including sensor connection cable length = 10 meters fitted in junction box, mains adapter unit (24 V) ZB 1024 NA2 fitted in junction box, ALMEMO® connection cable fitted in junction box, length = 2 meters, with ALMEMO® D7 plug **FMD760**

**Mobile tripod**, extendable up to approx. 4.4 meters

including set of anchoring fixtures, comprising three karabiners, three guy lines (4 meters long), three ground pegs **ZB9760ST**

**Carry-bag**, space for one tripod including accessories and two probe head holders **ZB9510TT**

**Further variants on request:**

Digital transducer FMD7 20 for wind velocity, wind direction **FMD720**

**Probe head for measuring global radiation, illuminance, photosynthesis, and UVA or UVB radiation, including probe head holder**

Probe head with cable, 1.5 meters long

**Measuring of global radiation** up to 1200 W/m<sup>2</sup>, **FLA613GS**

**Measuring of illuminance** up to 170 kLux, **FLA613VLM**

**Measuring of photosynthetically active radiation** up to 3000 μmol/m<sup>2</sup>s, **FLA613PSM**

**Measuring of UVA radiation** up to 3 mW/cm<sup>2</sup>, **FLA613UVA**

**Measuring of UVB radiation** up to 50 μW/cm<sup>2</sup>, **FLA613UVB**

Option of probe head with longer cable Total length = 5 meters **OA9613K05**

**Probe head holder** to tripod Length = approx. 0.5 meters, for one radiation probe head FLA613-GS / -VLM / -PSM / -UVA / -UVB **ZB9510MH**

**Advisory note**

To connect these radiation probe heads to data logger ALMEMO® 202 a digital ALMEMO® D7 measuring connector is required.

This variant is offered on request.



## Weather-proof housing for ALMEMO® 202 / 710 / 809 devices with meteorological sensor FMD7 60

### Technical data and functions

The sensor connection cable, mains unit ZB 1024 NA2 (for heating, ventilation, and sensor supply), the junction box, and the sensor's ALMEMO® connection cable are all permanently fitted in the weather-proof housing. (Sensor FMD7-60 should be ordered separately.)

The ALMEMO® measuring instrument is integrated in the DIN rail mounting. The mains unit for the device supply (mains plug assembly, NA9 design) is plugged into the integrated socket. (The measuring instrument should be ordered separately.)

The device receives its continuous 110 / 230 V supply via the mains connection cable. Length = 2 meters (Connection is on the rear of the housing.)

When using devices ALMEMO® 202 / 710, any short-term failures to the supply voltage are bridged; in the case of ALMEMO® 202, this is by means of batteries and in the case of ALMEMO® 710, by means of the integrated rechargeable battery. The ALMEMO® device cannot be operated in sleep mode.

### Further variants on request:

For information on protective housing ZB9015AGU for various ALMEMO® measuring instruments performing general applications without meteorological sensor FMD7-60.



## Weather-proof housing AG2 for ALMEMO® 202 with meteorological sensor

### Weather-proof housing for ALMEMO® 202,

lockable transparent door, mast fixture

integrated rail for fastening ALMEMO® 202 device

including mains unit ZA 1312 NA9 for supplying the device

permanently fitted sensor connection cable for sensor FMD7-60

integrated mains unit for supplying sensor heating and sensor ventilation

Option of weather-proof housing for sensor FMD7 60

**OM9760AG2**

## Data logger ALMEMO® 202 with accessories

### ALMEMO® 202 professional measuring instrument

2 measuring inputs, graphics display, keypad controls, batteries

**MA202**

DIN rail holder for the measuring instrument

**ZB2490HS**

Memory connector with micro SD

**ZA1904SD**

USB data cable

**ZA1919DKU**



### Weather-proof housing AG7 for ALMEMO® 710 with meteorological sensor

**Weather-proof housing for ALMEMO® 710,**  
lockable transparent door, mast fixture  
integrated rail for fastening ALMEMO® 710WG device  
including mains unit ZA 1312 NA9 for supplying the device  
permanently fitted sensor connection cable for sensor FMD7-60  
integrated mains unit for supplying sensor heating and sensor ventilation  
Option of weather-proof housing for sensor FMD7 60 **OM9760AG7**

### Data logger ALMEMO® 710 with accessories

**ALMEMO® 710WG precision measuring instrument in wall-mounted housing,**  
10 measuring inputs, display and operation via touch screen  
internal measured value memory, integrated rechargeable battery  
including mains unit NA10 (100 to 240 VAC / 12 VDC)  
and USB data cable **MA710WG**

Option of external memory  
**Memory connector with micro SD** **ZA1904SD**



### Weather-proof housing AG8 for ALMEMO® 809 with meteorological sensor

**Weather-proof housing for ALMEMO® 809,**  
lockable transparent door, mast fixture  
integrated rail for fastening ALMEMO® 809 device  
including mains unit ZB 1212 NA9 for supplying the device  
permanently fitted sensor connection cable for sensor FMD7-60  
integrated mains unit for supplying sensor heating and sensor ventilation  
Option of weather-proof housing for sensor FMD7 60 **OM9760AG8**

### Data logger ALMEMO® 809 with accessories

**ALMEMO® 809 precision measuring instrument**  
9 measuring inputs  
operation via ALMEMO® Control software  
internal measured value memory  
including mains unit NA10 (100 to 240 VAC / 12 VDC)  
**DIN rail holder for the measuring instrument** **MA809**  
**USB data cable** **OA2290HS**  
**ZA1919DKU**

Option of external memory  
**Memory connector with micro SD** **ZA1904SD**

## Wind Direction Sensor FVA 614



- Wind direction sensor for measuring the horizontal wind direction.
- Wind vane made from robust plastic, electronics in weather-resistant aluminum housing, rotating mechanism on friction bearings.
- A special labyrinth reliably protects without friction and guards against water penetrating into the housing.
- Electronically controlled heating for operation in winter conditions to prevent bearings and external rotating parts from freezing.

### Technical Data

Measuring range:	0 to 360°	Connection:	Adapter cable with ALMEMO® connector including supply cable for heating (length 1.5 m, free ends) A mains supply unit must be provided by the user on site.
Accuracy:	±5°	Installation:	e.g. pole tube with holding thread PG21 / drilling 29mm Ø
Resolution:	11.25° (5 bit Gray code)	Weight:	1100 g
Measuring principle:	optoelectronically (slotted disk)		
Sensor power supply:	9–30VDC through ALMEMO® device		
Heating:	24VAC/DC max. 20W		
Operative range:	-30 to +70 °C, with heating		
Cable:	12m long, LiYCY 6 x 0.25mm <sup>2</sup>		

### Type

Wind vane including ALMEMO® connector (0–2V) with 12m cable

### Order no.

FVA614

### Accessories for wind direction and wind velocity sensors

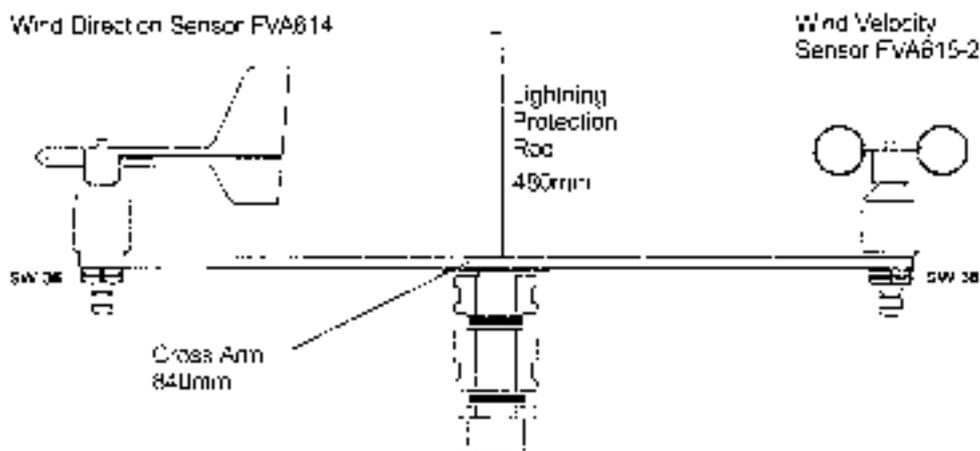
### Order no.

Cross-arm for separate wind direction and wind velocity sensors inclusive assembly utilities for mast Ø 48 to 102 mm

ZB9015TC

Lightning protection rod

ZB9015BS



## Wind Velocity Sensor FVA 615 2



- Wind velocity sensor for measuring the horizontal wind velocity.
- Cup-type made from robust plastic, electronics in weather-resistant aluminum housing, rotating mechanism on friction bearings.
- A special labyrinth reliably protects without friction and guards against water penetrating into the housing.
- Electronically controlled heating for operation in winter conditions to prevent bearings and external rotating parts from freezing.

### Technical Data

Measuring range:	0.5 to 50m/s	Connection:	Adapter cable with ALMEMO® connector including supply cable for heating (length 1.5 m, free ends) A mains supply unit must be provided by the user on site.
Accuracy:	±0.5m/s ±3% of meas. value	Installation:	e.g. pole tube with holding thread PG21 / drilling 29mm Ø
Resolution:	0.1m/s	Weight	750 g
Measuring principle:	optoelectronically (slotted disk)		
Sensor power supply:	9–30VDC through ALMEMO® device		
Heating:	24VAC/DC max. 20W		
Operative range:	-30 to +70 °C, with heating		
Cable:	12m long, LiYCY 6 x 0.25mm <sup>2</sup>		

### Type

Cup-type anemometer including ALMEMO® connector (0–2V) with 12m cable

### Order no.

FVA6152

## Global Radiation Probe Head FLA 613 GS



- Measuring head in anodized aluminium housing with a plastic dome that is transparent to UV light.
- Rain and splash-proof system, additionally with desiccant to prevent dome from inside condensation.
- Particularly suitable for outdoor measurements, e.g. in medical and biological research, weather information and forecast systems, climatology, agriculture and for general public information.

### Technical Data

Measuring range:	0 to approx. 1200W/m <sup>2</sup>	Cos correction:	error f2 < 3%
Spectral sensitivity:	400nm to 1100nm	Linearity:	< 1%
Maximum spectral sensitivity:	780nm	Absolute error:	< 10%
Signal output:	0V to 2V	Residual voltage: (E = 0)	< 10mV
Power supply:	+5V to +15V	Nominal temperature:	22°C ±2°C
Mounting:	2 screws M4, in base plate	Operating temperature:	-20°C to +60°C
Cable passage:	downwards	Dimensions:	housing: 55 mm high dome 40 mm high diameter: 80 mm
Housing:	anodized aluminium	Weight:	approx. 300 g
Diffusor:	PTFE		
Dome:	PMMA		

Option	Order no.
Longer cable Total length = 5 meters	OA9613K05
<b>Type (including test protocol)</b>	<b>Order no.</b>
Weather-proof measuring head for measuring the global radiation, incl. ALMEMO® connector with 1.5m cable	<b>FLA613GS</b>
Factory calibration KL90xx radiation for sensor (see chapter Calibration certificates)	

## Illuminance measuring head FLA 613 VLM



- Measuring head in anodized aluminum housing, with UV-transparent plastic dome.
- Rain-proof, splash-protected system, with desiccant to prevent condensation forming on the inside of the dome.
- Especially suitable for measuring operations outdoors, e.g. in medical, biological, and climate research, in weather information forecast systems, in agriculture, and for the purposes of general information for the public.
- The spectral sensitivity of the receiver corresponds approximately to that of the human eye.

### Technical Data

Measuring range :	0 to 170 klux (approx. 250 W/m <sup>2</sup> )	Cos correction :	error f2 <3%
Spectral sensitivity :	360 to 760 nm	Linearity :	<1%
Max. spectral sensitivity :	550 nm	Absolute error :	< 10 %
Signal output	0 to 2 V	Residual voltage (E = 0) :	<10 mV
Power supply :	+5 to +15 V	Nominal temperature :	22 ± 2 °C
Mounting :	2 screws, M4, in base plate	Operating temperature :	-20 to +60 °C
Cable passage :	downwards	Dimensions :	Housing : 55 mm high Dome : 40 mm high Diameter : 80 mm
Housing :	anodized aluminum	Weight :	approx. 300 g
Diffusor :	PTFE		
Dome :	PMMA		

Type (including test protocol)	Order no.
Weather-resistant measuring head for measuring the illuminance including cable, 1.5 m, and ALMEMO® connector	<b>FLA613VLM</b>
Factory calibration KL90xx radiation for sensor (see chapter Calibration certificates)	

## UVA Radiation Probe Head FLA 613 UVA



- Measuring head in anodized aluminium housing with a plastic dome that is transparent to UV light.
- Rain and splash-proof system, additionally with desiccant to prevent dome from inside condensation.
- Particularly suitable for outdoor measurements, e.g. in medical and biological research, weather information and forecast systems, climatology, agriculture and for general public information.

### Technical Data

Measuring range:	0 to approx. 3mW/cm <sup>2</sup>	Cos correction:	error f2 < 3%
Spectral sensitivity:	310 to 400nm	Linearity:	< 1%
Maximum spectral sensitivity:	335nm	Absolute error:	< 10%
Signal output:	0V to 2V	Residual voltage: (E = 0)	< 10mV
Power supply:	+5V to +15V	Nominal temperature:	22°C ±2°C
Mounting:	2 screws M4, in base plate	Operating temperature:	-20°C to +60°C
Cable passage:	downwards	Dimensions:	housing: 55 mm high dome 40 mm high diameter: 80 mm
Housing:	anodized aluminium	Weight:	approx. 300 g
Diffusor:	PTFE		
Dome:	PMMA (transparent to UV)		

### Type (including test protocol)

Weather-proof measuring head for measuring the UVA radiation including cable, 1.5 m, and ALMEMO® connector

Factory calibration KL90xx radiation for sensor (see chapter Calibration certificates)

### Order no.

**FLA613UVA**

## UVB Radiation Probe Head FLA 613 UVB



- Measuring head in anodized aluminium housing with a plastic dome that is transparent to UV light.
- Rain and splash-proof system, additionally with desiccant to prevent dome from inside condensation.
- Particularly suitable for outdoor measurements, e.g. in medical and biological research, weather information and forecast systems, climatology, agriculture and for general public information.

### Technical Data

Measuring range:	0 to approx. 50mW/cm <sup>2</sup>	Cos correction:	error f2 < 3%
Spectral sensitivity:	265 to 315nm	Linearity:	< 1%
Maximum spectral sensitivity:	297nm	Absolute error:	< 10%
Signal output:	0V to 2V	Residual voltage: (E = 0)	< 10mV
Power supply:	+5V to +15V	Nominal temperature:	22°C ±2°C
Mounting:	2 screws M4, in base plate	Operating temperature:	-20°C to +60°C
Cable passage:	downwards	Dimensions:	housing: 55 mm high dome 40 mm high diameter: 80 mm
Housing:	anodized aluminium	Weight:	approx. 300 g
Diffusor:	PTFE		
Dome:	PMMA (transparent to UV)		

### Type (including test protocol)

Weather-proof measuring head for measuring the UVB radiation including cable, 1.5 m, and ALMEMO® connector

Factory calibration KL90xx radiation for sensor (see chapter Calibration certificates)

### Order no.

**FLA613UVB**

## Star Pyranometer FLA 628 S



- Star pyranometer, according to Dirmhirm, for measuring the global radiation, the sky radiation and the short-wave radiation.
- Independent from ambient temperature through differential temperature measurement.
- Cut precision glass cupola for shielding from external environmental effects.
- Levelling by 3 setting screws and an integrated bubble

### Technical Data

Measuring range:	0 to 1500W/m <sup>2</sup>	Nominal temperature:	22°C ±2°C
Resolution:	0.1W/m <sup>2</sup>	Linearity:	<0.5% (0.5 to 1330W/m <sup>2</sup> )
Spectral range:	0.3 to 3µm	Stability:	<1% of the meas. range per year
Output:	approx. 15mV/Wm <sup>-2</sup>	Settling time:	25s (t <sub>95</sub> )
Impedance:	approx. 35ohms	Dimensions:	160mm Ø, 75mm high, hole circle: 134mm Ø, holes: 8mm Ø
Operative range:	-40 to +60°C	Weight:	1 kg
Accuracy:	cosine effect + azimuth effect + temperature influence		
Cosine effect:	<3% of measured value (0 to 80° inclination)		
Inclination azimuth effect:	< 3% of meas. val.		
Temperature influence:	< 1% of meas. val. (-20 to +40°C)		

### Accessories

Shadow belt with stand

### Order no.

ZB9628SB

### Type (including test protocol)

Star pyranometer including 3m cable with ALMEMO® connector and programmed calibration value  
Factory calibration KL90xx radiation for sensor (see chapter Calibration certificates)

### Order no.

FLA628S

### Other variants are available on request



Probe for measuring global radiation FLA 613 T1B11,  
3-mode sensor : It measures UVA, VIS, IRA radiation.  
Spectral sensitivity from 315 to 1100 nm



Probe for measuring global radiation FLA 613 GS-SDEK,  
This measures the global, direct, and diffused solar radiation  
(integrated shadow bar).  
Spectral sensitivity from 380 to 1100 nm

## Digital sensor for temperature, humidity, atmospheric pressure FHAD 46-C4AG in protective all-weather housing with ALMEMO® D6 plug



### On request

Temperature sensor Pt100  
in protective all-weather housing

FPA930AG

- All relevant ambient parameters are measured with one sensor.
- Suitable for mounting on a wall or a mast
- Sensor cable up to 100 meters long, clamped in terminal box
- All sensors in 1 multi-sensor module: capacitive digital sensor for humidity and temperature, digital atmospheric pressure sensor. Additional EEPROM data storage medium in the sensor module
- The sensor module is thoroughly adjusted. All sensor characteristic and adjustment data are stored in the data storage medium of the sensor module itself. In the process of readjusting the individual sensors, the adjustment values are directly saved in the data storage medium of the sensor module.
- Replacement sensor modules are inexpensive: The sensor module is pluggable and can be simply exchanged on-site. Full accuracy without any adjustment, especially with calibrated sensors. The ALMEMO® connecting cable and the ALMEMO® measuring instrument have no influence on the calibration.
- **new:** The atmospheric pressure is measured directly at the measuring point in the sensor tip. Hence, the atmospheric pressure dependent humidity variables are automatically pressure compensated.
- Humidity calculation on the basis of formulae as per Dr. Sonntag and the enhancement factor as per W. Bögel (correction factor fw(t,p) for real mixed gas systems). This substantially widens the measuring range and improves the accuracy of humidity variable calculations.
- Humidity variables: Absolute humidity in g/m<sup>3</sup>.
- The humidity variables are calculated from the three primary measuring channels (real measurable variables): temperature, humidity and atmospheric pressure.
- Four measuring channels are programmed (ex factory): temperature (°C, T, t), relative humidity (%H, RH, Uw), dew point (°C, DT, td), atmospheric pressure (mbar, AP, p). Alternatively further humidity variables are selectable. Mixture (g/kg, MH, r), absolute humidity (g/m<sup>3</sup>, AH, dv), vapor pressure (mbar, VP, e), enthalpy (kJ/kg, En, h). The configuration is performed on the ALMEMO® V7 measuring instrument or directly on the PC using the USB adapter cable ZA1919AKUV (Chapter "Network technology").

## Technical Data

<b>Operative range</b>	-30 to +60 °C, 5 to 98 % RH	<b>Digital atm. pressure sensor</b> (integrated in the multi-sensor module)	Measuring range	700 to 1100 mbar
<b>Digital temperature / humidity sensor</b> (including A/D converter)			Accuracy	±2.5 mbar (at 23 °C ±5 K)
<b>Humidity</b>		<b>ALMEMO® connecting cable</b>	PVC, for available lengths see variants with ALMEMO® D6 plug	
Measuring range	0 to 98 % RH	<b>ALMEMO® D6 plug</b>	Refresh time	1 second for all four channels
Sensor	CMOSens® technology		Supply voltage	6 to 13 VDC
Accuracy	±2.0 % RH in range 10 to 90 % RH ±4.0 % RH in range 5 to 98 % RH at nominal temperature		Current consumption	12 mA
Hysteresis	typical ±1 % RH	<b>Mechanical design</b>	Sensor tube	Plastic, diameter 12 mm
Nominal temperature	+23 °C ±5 K		Filter cap	PTFE-Sinterfilter, SK6
Sensor operating pressure	Atmospheric pressure		All-weather protection	Ø 105 mm, height approx. 110 mm
<b>Temperature</b>			Terminal box	51 x 53 x 36 mm
Sensor	CMOSens® technology		Screw-fit cable gland	Splash-protected
Accuracy	typical ±0.2 K at 5 to 60 °C maximum ±0.4 K at 5 to 60 °C maximum ±0.7 K at -20 to +80 °C			
Reproducibility	typical ±0.1 K			

<b>Accessories</b>	<b>Order no.</b>
ALMEMO® transmitter 2450-1 with double analog output 10 V or 20 mA (For other data, options, accessories, see page 01.50)	MA24501R02

<b>Standard delivery</b>	<b>Order no.</b>
Digital sensor for temperature, humidity, atmospheric pressure in protective all-weather housing with connecting cable and ALMEMO® D6 plug, manufacturer's test certificate, 2 fixtures for mounting on a mast	
Connecting cable	
Length = 5 meters	<b>FHAD46C4AGL05</b>
Length = 10 meters	<b>FHAD46C4AGL10</b>
Length = 20 meters	<b>FHAD46C4AGL20</b>
Length = 40 meters	<b>FHAD46C4AGL40</b>
Length = 100 meters	<b>FHAD46C4AGL100</b>
Replacement multi-sensor module, digital, adjusted, plug-in	<b>FH0D46C</b>

DAkkS or factory calibration KH9xxx, temperature, humidity, and KD92xx, atmospheric pressure, for digital sensor (see chapter Calibration certificates).

DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Comfort Index Measurement



### Operative range

It is possible with this measuring setup to measure all the physical parameters needed for assessing and evaluating thermal comfort simultaneously on three levels. It reliably evaluates the performance of heating and ventilating systems. The data acquired from the series of measuring operations for operative temperature (globe temperature), room temperature, and room air flow and humidity, and the necessary input parameters (e.g. clothing factor, activity level, mechanical output) is used together to calculate the PMV (predicted mean vote) and PPD (predicted percent dissatisfied) values (as per DIN ISO 7730) and the degree of turbulence (as per DIN EN 13779, formerly DIN 1946 Part 2); these values are calculated either online or offline using the AMR WinControl software in conjunction with the add-on module for comfort index measurement.

### The software

The averaging number is preset at 200 measuring points but this is variable and can be modified. The PMV and PPD values and the degree of turbulence can be displayed and documented in y/t or x/y diagrams either each one separately or together with other measurable variables. A software wizard is available to guide the user step-by-step through the various settings. If measuring is started online, the first value is indicated after completion of the first 200 measuring operations (as per DIN ISO 7730). These values continue to be calculated, updated, and displayed, and - optionally - also saved and / or exported. (see Chapter 05)

### Technical features

- Thermal comfort and air-conditioning calculations using WinControl software with add-on module for comfort index measurement as per DIN ISO 7730 and DIN EN 13779 (formerly DIN 1946)
- Independent measuring sequence in real-time mode
- Various display and output options Real-time mode, memory access to offline measuring operations
- Graphical presentation of measured data and calculated data in a format with data export options
- Comprehensive, clear, meaningful evaluation.

### Types (sensor set for one level)

Globe thermometer

Digital sensors for humidity, temperature, atmospheric Pressure

Thermo-anemometer, up to 1 m/s, without smoothing, response time 100 ms, including carry case

Stand for measuring operations at heights of 0.1 to 1.7 meters, including 1 set of instrument holders for 1 level (traverse including traverse holder and sensor fastening), including carry case

Set of instrument holders for extra levels (as above)

optional for assessing air quality Digital carbon dioxide sensor to 10.000 ppm, with handle

### Device selection

ALMEMO® 2690-8A (new variant) hand-held data logger, 5 inputs, including mains unit and data cable, USB can be used for 1 measuring level (see page 01.22)

ALMEMO® 2890-9 hand-held data logger, 9 inputs, including mains unit, USB data cable can be used for 3 measuring levels (see page 01.24)

PC link via Ethernet, RS232, or wireless with Bluetooth see Chapter 04, ALMEMO® networking technology.

### Software:

WinControl for 20 measuring points / 1 device including additional module for comfort index measurement

### Accessories:

Carry case, universal, spacious, robust, for globe thermometer, humidity sensor, and data logger Exterior dimensions (WxHxD) approx. 51 x 35 x 30 cm

### Order no.

FPA805GTS

FHAD46C41

FVA605TA10U

ZB1001PPD

ZB1001MH

FYAD00CO2B10

MA26908AKSU

MA28909

SW5600WC1

SW5600WCZM1

ZB5600TK3

DAkKS or factory calibration temperature, humidity, air flow, carbon dioxide for sensor (see chapter Calibration certificates).  
DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

# Room air conditions

## WGBT Measurement



### Application Range

The wet bulb globe temperature (WGBT) is the decisive parameter for evaluating the work stress at heat-exposed working places and the operation and cool-off times involved. Temperature, radiation and relative humidity are determined by measuring the dry temperature, the natural humid temperature of a psychrometer and the globe temperature of a globe thermometer. These are all combined as WGBT.

### Note:

For WGBT measurements the use of a psychrometer with a disengageable ventilator is compulsory

## Technical Data

Accuracy:	Class B	Diameter:	approx. 150mm
Sensor:	Pt100 4-conductor, arranged in the center	Operating temperature:	-50 to 200°C
Globe thermometer:	matt black copper globe with suspension	Cable length	3 m

## Types

Globe thermometer (Pt100 4L)

Psychrometer with disengageable ventilator

## Order no.

FPA805GTS

FNA846WB

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates).  
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.



On request:

Sound Level Meter MA 86193  
with ALMEMO®- cable for  
measured value recording

## NTC-sensor FNA 305



Accuracy: NTC, see page 07.04  
Measuring tip: Operative range -10 to +60 °C  
(non-condensing)  
Protective tube in stainless steel  
Diameter = 3.0mm, length = 50 mm  
mounted directly on ALMEMO® connector  
8 s

T<sub>90</sub>

L = 50 mm      **Order no. FNA305**  
(No variants available)

For Indoor air measurements

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# Building physics, Moisture in materials



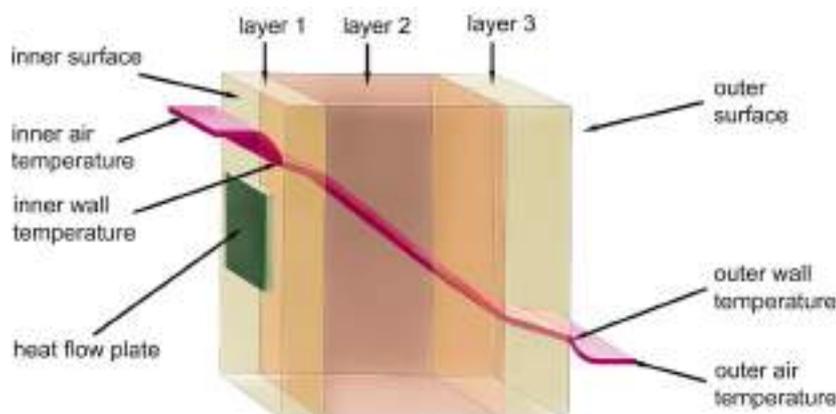
## Measuring thermal transmittance (U) and heat flow

The heat transfer characteristics of any structural element depend on the thermal conductivity of the materials used, on the

thickness of its various component layers, on its structural geometry (e.g. flat or cylindrically curved walls, etc.), and on the

ambient conditions at the structure's surfaces inside and outside.

## Presentation of the temperature behavior



The thermal transmittance coefficient (U value) of a structural element describes the quantity of heat that passes through it from one side to the other (no matter how many layers) per second and per square meter surface at a constant difference in ambient temperature inside / outside of 1K. This thermal transmittance coefficient (U) thus also includes the surface heat transfer coefficients, i.e. the thermal energy transferred at the boundary surfaces, interior air - structure - exterior air. The thermal transmittance coefficient (U) is measured in  $(\text{W}/\text{m}^2\text{K})$  and is internationally defined in standard ISO 6946.

A structure's thermal transmittance coefficient (U) is the reciprocal of its total thermal resistance coefficient (R); R is the sum of the thermal transmission resistances between the structure's various contiguous layers and also the surface heat transfer resistances between the structure and the ambient media on either side (e.g. air).

Total thermal resistance (R) = thermal transmission resistances through the material + surface heat transfer resistances, inside and out

The thermal transmittance coefficient (U value) is an important rating in civil engineering and the construction industry

where it is used to define a building's transmission heat loss through its various structural elements. Transmission heat loss is the term used to describe the energy-saving qualities of a building's shell (i.e. the thermal insulation of its roof, outside walls, windows, and floors). In Germany each residential structure is assigned a permissible maximum U value (depending on its external surface area and its internal volume); this is based on the most recently amended version of the Energieeinsparverordnung (EnEV) (German energy-saving legislation)

# Building physics, Moisture in materials

## ALMEMO® Measuring system for Measuring thermal transmittance (U) and heat flow

The thermal transmittance coefficient (U value) is an important rating in civil engineering and the construction industry where it is used to define a building's transmission heat loss through its various structural elements. It is now possible, with the ALMEMO® measuring system, to measure and record all the physical parameters for the component parts of existing buildings (e.g. walls, etc.) in order to calculate their U value and other relevant thermal energy coefficients.

### Measuring principle:

The measuring principle involved in quantifying heat loss at partition elements, e.g. walls, heating systems, etc., is based on the method which uses a heat flow plate (sensor) fitted on the surface of the structural element and thus incorporated directly in the heat flow. Using the known thermal characteristics of the heat flow plate and the thermo-electrically measured

temperature gradient inside the heat flow plate the ALMEMO® measuring system can thus measure the heat flow density  $q$  in  $W/m^2$ .

The ALMEMO® measuring system can also be used to measure the surface temperatures on either side the structural element and the respective air temperatures immediately inside and outside; based on these results it is then possible to calculate all the relevant thermal coefficients.

The temperatures and heat flow density data on which these calculations are based are acquired cyclically as average values. Any influence that the structure's own thermal capacity may have on these calculations (e.g. time shifts between temperature and heat flow, affecting calculation of the U value) will, given a sufficiently long measuring period, become negligible and the calculated average value will certainly be very close

to the structure's actual U value.

### Operative range:

To ensure a stable and meaningful U value calculation it is possible to stipulate that measuring operations only be performed subject to certain specified conditions.

- The temperature difference between interior and exterior ambient air must be sufficiently large (typically 20 K, e.g. inside temperature 20°C and outside temperature 0°C).
- Any fluctuations in these temperatures (e.g. day / night) must throughout the measuring period be as small as possible.
- The measured values must be acquired and recorded on-site over a sufficiently long period (e.g. one whole day or even several days) and the parameters must be calculated on the basis of average values

### Ordering information

**ALMEMO® measuring system - with 2 temperature sensors and 1 heat flow plate - for determining the U value - with straightforward calculation in the ALMEMO® measuring instrument:**

ALMEMO® data logger 2590-4AS, 4 inputs, including mains unit and USB data cable	MA25904ASKSU
Outside air temperature Thermo-wire sensor, with glass-fiber insulation, 5 meters long	FTA3900L05
Inside air temperature Thermo-wire sensor, with glass-fiber insulation, 1.5 meters long	FTA3900
Programming for inside sensor Differential channel and average value	OA9000PRUT
Heat flow plate, including installation materials see page 13.04 / 13.05 e.g. type 118, approx. 120 x 120 mm, cable 2 meters	FQA018C
Programming for Heat flow plate, Average value and U-value channel	OA9000PRUQ

**ALMEMO® measuring system - with 4 temperature sensors and 1 heat flow plate - for determining the U value - using WinControl software (possible both online and offline) :**

ALMEMO® data logger 2690-8A, 5 inputs, including mains unit and data cable, USB	MA26908AKSU
Outside air temperature Thermo-wire sensor, with glass-fiber insulation, 5 meters long	FTA3900L05
Outside surface temperature Thermo-wire sensor, with glass-fiber insulation, 5 meters long	FTA3900L05
Inside air temperature Thermo-wire sensor, with glass-fiber insulation, 1.5 meters long	FTA3900
Inside surface temperature Thermo-wire sensor, with glass-fiber insulation, 1.5 meters long	FTA3900
Heat flow plate, including installation materials see page 13.04 e.g. type 118, approx. 120 x 120 mm, cable 2 meters	FQA018C
WinControl software for 20 measuring points, 1 device	SW5600WC1
Additional module U-value wizard	SW5600WCZM4
Hardlock USB dongle	SW5600HL

### Accessories

Carry case, large	ZB2590TK2
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# Heat flow

## Heat Flow Plates FQAx



- For determining the heat flow density up to max. 150°C.
- Application-oriented designs, consisting of a meander of opposing thermocouples that are embedded in a substrate.
- In case of thick substrates no lateral circulation of the heat flow because of sufficient meander shell zone.
- Software for k value measurement, see chapter Software



Each heat flow plate has been assigned a calibration value, which corresponds to the heat flow density in  $W/m^2$  when the plate provides an output of 1mV. The calibration value will be stored as factory-setting in the ALMEMO® connector so that ALMEMO® devices will immediately indicate the current heat flow density in  $W/m^2$ .

### Technical Data:

Type	Dimensions (mm)	Meander Size (mm)	Substrate	Temperature Stability	Calibr. Val. appr. ( $W/m^2 \approx mV$ )	Accuracy of Calibr. Value
117	100 x 30 x 1.5	80 x 20	epoxy resin	-40 ... 80°C	< 50	5% at 23°C
118	120 x 120 x 1.5	90 x 90	epoxy resin	-40 ... 80°C	< 15	5% at 23°C
119	250 x 250 x 1.5	180 x 180	epoxy resin	-40 ... 80°C	< 8	5% at 23°C
120	33 Ø x 1.5	20 Ø	epoxy resin	-40 ... 80°C	< 150	6% at 23°C
117SI	100 x 30 x 3	80 x 20	silikone	-40 ... 80°C	< 50	5% at 23°C
118SI	120 x 120 x 3	90 x 90	silikone	-40 ... 80°C	< 15	5% at 23°C
150-1	180 x 100 x 0.6	170 x 90	PTFE	150°C	< 80	5% at 25°C
150-2	500 x 500 x 0.6	490 x 490	PTFE	150°C	< 10	5% at 25°C

### Accessories

Adhesive tape for room temperature  
Self-adhesive film 24 x 100cm for room temperature

### Order no.

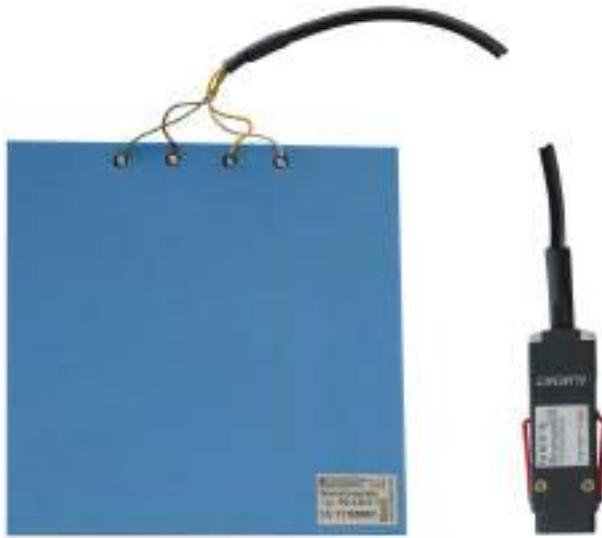
ZQ9017KB  
ZQ9017KF

### Types incl. connecting cable, 2 m, with ALMEMO® connector and manufacturer's test certificate

### Order no.

Model	Application	Order no.
117	for even surfaces, e.g. casement sections	FQA017C
118	for universal applications, e.g. solar-electric systems and insulating plates	FQA018C
119	especially for constructional industry, brickwork insulating plates, old buildings	FQA019C
120	small heat flow plate, e.g. for medicine, veterinary medicine, small components etc.	FQA020C
117 SI	flexible heat flow plate, suitable for even surfaces, e.g. casement sections	FQA017CSI
118 SI	flexible heat flow plate, suitable for even surfaces, e.g. solar-electric systems and insulating plates	FQA018CSI
150-1	flexible heat flow plate, particularly suitable for high temperatures e.g. for brickwork, insulated boilers and pipes	FQA0801H
150-2	particularly suitable for high temperatures, especially for the construction industry, masoned walls and insulating plates	FQA0802H

## Digital heat flow plate FQADx, with integrated temperature sensor for automatically correcting the heat flow plate's temperature coefficient, with ALMEMO® D6 plug



- This automatically corrects the heat flow plate's temperature coefficient using a miniature NTC sensor integrated in the heat flow plate for the purpose of measuring the plate's mean temperature.
- It measures heat flows and temperatures using a A/D converter incorporated in the ALMEMO® D6 plug.
- Two measuring channels are programmed (at our factory).
- Plate's mean temperature (°C, t) Heat flow, temperature-compensated (W/m<sup>2</sup>, fq)



model 117, 118, 119

### Technical Data

#### Heat flow sensor (see table on page 13.04)

Accuracy of calibration value at nominal temperature	5 %
Nominal temperature	23 °C
Temperature coefficient	-0.12 % / K (epoxide plate) or -0.17 % / K (silicone plates)

#### Temperature sensor

Sensor element	Miniature NTC type N
Accuracy	±0.5 K at 0 to +80 °C

#### A/D converter incorporated in ALMEMO® D6 plug

Input 1	NTC sensor (clamp connector in plug)
Resolution	0.01 K
Linearization	error-free computing method according to Galway Steinhart (no approximations)
Accuracy	±0.05 K
Nominal temperature	23 °C ±2 K
Temperature drift:	0.004 %/K (40 ppm)
Input 2	Voltage mV (clamp connector in plug)
Measuring range	0 to 26 mV, 0 to 260 mV
Precision class	AA see page 01.05
Refresh rate	0.4 seconds for both channels
Supply voltage	6 to 13 VDC
Current consumption	4 mA

### Accessories

see page 13.03

General features and accessories, ALMEMO® D6 sensors see page 01.08

### Order no.

#### Variants including manufacturer's test certificate

Heat flow plate with integrated temperature sensor cable permanently fitted, PVC, length 2 meters with ALMEMO® D6 plug.		<b>Order no.</b>
Type 117	Substrate Epoxy resin, Dimensions 100 x 30 x 1.5 mm	<b>FQAD17T</b>
Type 118	Substrate Epoxy resin, Dimensions 120 x 120 x 1.5 mm	<b>FQAD18T</b>
Type 119	Substrate Epoxy resin, Dimensions 250 x 250 x 1.5 mm	<b>FQAD19T</b>
Type 117SI	Substrate Silicone, Dimensions 100 x 30 x 3 mm	<b>FQAD17TSL</b>
Type 118SI	Substrate Silicone, Dimensions 120 x 120 x 3 mm	<b>FQAD18TSL</b>

## Digital sensors for humidity, temperature, dew point FHAD 46-Cx for measuring the equilibrium moisture content in building materials

06/2018 • We reserve the right to make technical changes.

### Measuring the equilibrium moisture content

A material's equilibrium moisture content is that level of relative humidity prevailing in the ambient atmosphere at which the material neither gains nor loses moisture.

All construction materials may - to a greater or lesser degree - attract water vapor from or emit water vapor to the ambient air. They are hygroscopic; i.e. they attempt to establish an equilibrium in terms of moisture content with respect to the ambient air. The construction material and the ambient air, depending on their

respective temperatures, establish an interactive balance between the adsorption of and the emission of water vapor from / to one another. Each material thus has, depending on temperature and on atmospheric humidity, a certain moisture content level (measured in water as a percentage of overall weight).

In the state of equilibrium the relationship between the water content and the equilibrium humidity of a material can be displayed graphically as a curve, the so

called moisture sorption isotherm. The sorption isotherm for the material in question indicates per atmospheric humidity value the corresponding water content value at a given constant temperature. If the composition or quality of the material changes then its sorption behavior - and thus its sorption isotherm - also changes. Given the great complexity of sorption processes these isotherms cannot be determined by calculation; they have to be recorded experimentally.

### Digital sensors for humidity, temperature, air pressure FHAD 46-C0, uncovered sensor element, with ALMEMO® D6 plug.



FHAD 46-C0

Uncovered sensor element: Smallest design, short response time

Description and technical data see page 08.06

### Digital sensor for temperature, atmospheric humidity, and atmospheric pressure FHAD 46-C2 Version in plastic, with slotted sensor cap with ALMEMO® D6 plug



FHAD 46-C2

Sensor element enclosed in slotted sensor cover, compact design, short response time

## Measurement of Moisture in Materials

### Dielectric Measurement of Moisture in Materials

The measurement of the moisture in materials is performed indirectly via the determination of the dielectric constant. This is performed by using a capacity measurement via a high-frequency electrical field,

which penetrates the material without disturbances.

**Advantage:**

- simple and fast measuring technology
- non-destructive contact measurement

- long term use is possible

**Disadvantage:**

- limited accuracy

### Measurement of the Moisture in Materials according to the Principle of Conductivity

The measurement of the moisture in materials is performed indirectly via the determination of the electrical resistance, which depends on the moisture content of the material.

**Advantage:**

- simple and fast measuring technology

**Disadvantage:**

- limited accuracy
- probe insertions

- only for short term control measurements
- measured values depend on various material parameters

DAkKS or factory calibration KH9xxx, temperature, humidity, and KD92xx, atmospheric pressure, for digital sensor (see chapter Calibration certificates).

DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Moisture Sensor FHA 696 MF



- Moisture sensor for determination of the moisture content in mineral construction materials, wood and cardboard.
- Indirect measurement of the moisture through the determination of the dielectric constant.
- Capacity measurement through a high frequency electromagnetic field, which penetrates the material in a non-destructive way.

### Technical Data

Measuring method:	capacitive	Measuring comb:	stainless spring steel 0.5mm, 70 x 35mm
Resolution:	0.1%	Weight:	260g
Measuring range (moisture):	0 to 50% moisture, referenced to mass	Nominal temperature:	15 to 25°C
Measuring range (material):		Operative range:	0 to +60°C
mineral construction materials	0 to 20%, moisture	Storage temperature:	-20 to +80°C
woods	0 to 50%, moisture	Signal output:	0 to 2V
paper and cardboard	0 to 20% moisture	Power supply:	+8 to +12V
Housing:	plastic handle with integrated electronics 40mm Ø, 130mm long	Current consumption	approx. 7 mA
Terminal block:	aluminium/plastic 20 x 25 x 70mm		

### Accessories

Test block for min. construct. materials	<b>Order no.</b> ZB9696PE05
Test block for wood, paper, cardboard	ZB9696PE30

### Type

Moisture sensor	<b>Order no.</b> FHA696MF
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## Wood moisture probe FHA 636 MF Hand-held probe for mobile test measurements



- Moisture sensor for determination of the moisture content in wood.
- Indirect moisture measurement according to the principle of conductivity.
- Determination of the moisture content in the material through the dependence of the electrical resistance on the moisture.

### Technical Data

Measuring method:	principle of conductivity	Reproducibility:	± 1%
Measuring range:	7 to 30 % moisture, referenced to mass	Nominal temperature:	23°C ±2°C
Housing:	plastic handle 40mm Ø, 130mm long	Operating temperature:	0 to +60°C
Measuring tips:	stainless steel, uninsulated 3mm Ø, 50mm long	Storage temperature:	-20 to +80°C
Weight:	260g	Signal output:	0 to 2V
		Power supply:	7.5 to +12V
		Current consumption	max. 10 mA

### Accessories

PTFE-insulated measuring tip - helps avoid measuring errors in the event of surface moisture, 1 piece (2 pieces are needed per probe)	<b>Order no.</b> ZB9636MFST
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### Type

Wood moisture probe	<b>Order no.</b> FHA636MF
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# Moisture in materials

## Moisture content sensor - for wood, for stationary measuring operations FHA696MFS1 Capacitive sensor for applying onto the wood's surface



- Moisture content sensor for comparative measurement of moisture in wood materials
- The capacitive sensor with the measuring electronics is completely integrated in the damp-proof sensor housing. Plug-in ALMEMO® connecting cable
- This device is designed for stationary installation and long-term monitoring e.g. of wooden parts of buildings, roof structures (with laminated beams).
- It is also suitable for data logger operation in energy-saving sleep mode (intermittent mode).
- The sensor housing is quick and easy to install on the wooden surface in question.
- The material's moisture content is measured indirectly by determining its dielectric constant, which is moisture-dependent (but not temperature-dependent).
- Its capacity is measured via a high-frequency electrical field which penetrates the wood without destroying it.
- The ALMEMO® device acquires the material's moisture content based on the linearization curve stored in the ALMEMO® plug.
- This measuring operation can be performed using any current ALMEMO® device (version 6 and above).

06/2018 • We reserve the right to make technical changes.

### Technical Data

Measuring method	capacitive	Housing	Plastic 51 x 53 x 36 mm (LxWxH)
Measuring range	0 to 50 % moisture percentage in wood with respect to total mass (at 23 °C)	Signal connection	Built-in plug
Resolution	0.1 % moisture content	Protection	Housing and plug connection IP64
Reproducibility	±1 % moisture content	ALMEMO® connecting cable	Coupling, PVC cable, 5 meters
Nominal temperature	23 °C ±2 K	ALMEMO® plug	Linearization for wood, stored in the ALMEMO® plug (for ALMEMO® devices version 6 and above)
Suitable conditions	0 to +80 °C Air humidity 0 to 90 % RH (no dew formation, no ice)	Supply voltage	via ALMEMO® plug (5 V)
Storage temperature	-20 to +80 °C	Current consumption	approx. 7 mA

### Variants

Moisture content sensor for wood, sensor integrated in the sensor housing, with built-in plug, connecting cable 5 meters, ALMEMO® plug for current ALMEMO® devices, version 6 and above

### Order no.

FHA696MFS1

## Moisture content sensor - for wood, for stationary measuring operations FHA636MFS1 Conductivity measurement with measuring tips that can be screwed into the wood Sensor with integrated temperature sensor for automatic temperature compensation



- Moisture content sensor for comparative measurement of moisture in wood materials
- Two hanger bolts are screwed into the wood surface and connected via measuring lines to the measuring electronics in the damp-proof sensor housing.
- The sensor housing with the integrated temperature sensor is also fixed in position on the wood surface.
- Plug-in ALMEMO® connecting cable
- This device is designed for stationary installation and long-term monitoring e.g. of wooden parts of buildings, roof structures (with laminated beams).
- Data logger operation in sleep mode (intermittent mode) is required in order to protect the wood from salinization or drying out.
- The material's moisture content is measured indirectly by determining its electrical conductivity, which is moisture-dependent.
- It is also temperature-dependent. However, the displayed moisture value is automatically temperature-compensated by means of an integrated temperature sensor.
- The ALMEMO® device acquires the material's moisture content based on the linearization curve stored in the ALMEMO® plug.
- This measuring operation can be performed using any current ALMEMO® device (version 6 and above).

### Technical Data

Measuring method	Electrical conductivity	Measuring lines	2 lines, PTFE-insulated, length = 0.5 meters with circular cable lugs 4 mm
Measuring range	5 to 50 % moisture percentage in wood with respect to total mass (at 23 °C)	Measuring tips	2 stainless-steel M4 hanger bolts Total length = 60 mm including 4 stainless-steel nuts, 4 stainless-steel lock washers
Resolution	0.2 % moisture content	Clearance	2.5 cm at right angles to the grain
Reproducibility	±1 % moisture content	Signal connection	Built-in plug
Nominal temperature	23 °C ±2 K	Protection	Housing, including connectors IP63
Temperature sensor	NTC, integrated in sensor housing	ALMEMO® connecting cable	Coupling, PVC cable, 5 meters
Temperature compensation	in range 0 to +80 °C	ALMEMO® plug	Linearization for wood, stored in the ALMEMO® plug (for ALMEMO® devices version 6 and above)
Suitable conditions	0 to +80 °C Air humidity 0 to 90 % RH (no dew formation, no ice)	Supply voltage	via ALMEMO® plug (5 V)
Storage temperature	-20 to +80 °C	Current consumption	approx. 5 mA
Housing	Plastic 51 x 53 x 36 mm (LxWxH)		
Measuring connection	2 built-in sockets, 4 mm, with transverse hole		

### Variants

Moisture content sensor for wood, with measuring tips, measuring line, sensor housing, connecting cable, 5 meters ALMEMO® plug, for current ALMEMO® devices, version 6 and above

Order no.

FHA636MFS1

# Moisture in materials

## Sensor for measuring the moisture in materials FHA 696 GF1

For determining the moisture content in granulated materials such as wood chips, wood pellets, and sawdust



- The sensor operates on the principle of an open plate capacitor. The moisture contained in a material can be measured in terms of that material's dielectric constants.
- Moisture content can be determined in a matter of seconds - in wood chips or wood pellets, and sawdust, in grain and cereals, and other granulated materials.
- The characteristics of the materials to be measured can be specified on a highly customized basis; a wide variety of granulates, e.g. various cereal types, can thus be measured

### Technical Data

Measuring principle	capacitive
Measuring range	0 to 99.9 % water content as a weight percentage H <sub>2</sub> O
Resolution	0.1%
Measuring radius / penetration depth	approx. 10 cm around the sensor
Temp. range of material	+5 to +40 °C
Operating temp. range	+5 to +40 °C
Storage temp. range	-20 to +70 °C
Signal output	ALMEMO® (voltage)
Power supply	5 V from ALMEMO® measuring instrument
Current consumption	approx. 5 mA

Dimensions	
Sensor head	Ø = 22 mm, length = 200 mm Rounded tip
Extensions	3 pieces, screw-on Ø = 18 mm, length = 300 mm
End piece	Plastic Ø = 22 mm, length = 30 mm
Cable terminal	Mountable male connector on sensor head
Cable	PVC, length = 2 meters with ALMEMO® connector The cable is led through the extension tubes and end piece.

### Option

Determining characteristics for special customer-specific materials

1. We need a sample of approx. 10 liters of your granulate (e.g. wood, cereal, plastic). This sample should be sealed in an air-tight package, e.g. shrink-wrapped in plastic film.
2. We use various dried samples to determine the characteristics of your particular material.
3. We then program these characteristics in the ALMEMO® connector for the moisture content probe..

Pro rata processing costs per material sample, net (service)

Advisory note:

If the material cannot absorb water (not hygroscopic), it will not be possible to measure its moisture content.

In this case the processing fee we charge will be reduced.

**Order no.**

Order no. OA9696GFK



### Variants

Sensor for measuring moisture in granulated wood chips and pellets comprising :

Sensor head, 3 screw-on extensions, end piece, connecting cable 2 meters, with ALMEMO® connector programmed for wood chips (also programmable for wood pellets; if required, please indicate) including carry case

Test block for FHA696GF for wood chips and wood pellets

**Order no.**

**FHA696GF1**

**ZB9696PE22**

## Water Detection Probe FHA 936 WD



- Water detection probe for instant detection of uncombined water.
- Particularly suitable for construction applications, especially in locations that are difficult to check visually, e.g. at sealing joints, under cement floors etc.
- Indirect moisture measurement according to the principle of conductivity.
- Probe with two collets for easy electrode replacements.
- Electrodes in three different designs for matching any required application.

### Technical Data

Measuring method:	detection of water	Weight:	260g
Meas. values:	<10% no water >10% water	Nominal temperature:	23°C ±2°C
Housing:	plastic handle 40mm Ø, 130mm long	Operating temperature:	0 to +60°C
Electrodes:	stainless steel	Storage temperature:	-20 to +80°C
Electrode types:	uninsulated with rounded tip: 200mm long, 3mm Ø uninsulated with sharp-edged tip: 50mm long, 3mm Ø spring steel strap: 200mm long, 6mm wide, 0.5mm high	Signal output:	ALMEMO® (approx. 0 to 2V)
		Power supply:	7.5 to 15V
		Current consumption	max. 10 mA

### Type

Water detection probe

### Order no.

FHA936WD

# Moisture in materials

## Tensiometer FDA 602 TM2

- Measurement of soil moisture through the identification of suction pressure. The suction pressure is the force with which water is being held in the soil or is available for absorption. This is the force that must be produced by the plant roots in order for water to be absorbed.
- The porous, clay tip of the tensiometer transfers water from within to the drier outer surroundings by means of capillarity, thereby, creating a sub-pressure within the sealed tensiometer tube. This sub-pressure is a measure of the moisture level and can be determined as a value or used directly to activate an electrical switch. The customary unit of measurement is hPa.
- However, a tensiometer also functions in dry air as long as evaporation can take place over the porous, clay chamber. Therefore, moisture levels can be measured even in coarse-grained or very loose substrate.
- Suction pressure measurements are largely independent of the salt concentration of the substrate or soil.

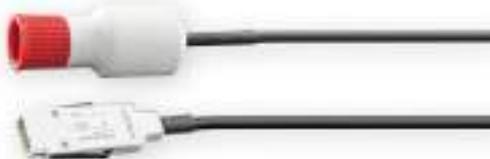
### Typical Suction Pressure at Peat Substrates

30 - 40 hPa	very moist
50 - 120 hPa	moist
150 - 200 hPa	dried
>200 hPa	dry

### Typical Suction Pressure at Open fields (intermediate grade soil)

< 50 hPa	saturated
100 - 150 hPa	wet to moist
>200 hPa	start drying
200 - 500 hPa	Irrigation

### Moisture tension meter, electronics



### Technical Data

Measurement:	Measurement of soil moisture through the identification of suction pressure.
Measure range:	0 to -1000 hPa relative (negative pressure)
Output	0,5 to 4,5 V
Power supply	5 V via ALMEMO® connector
Cable	Sensor with cable, length = 5m, with ALMEMO® connector

### Type

Tensiometer electronics  
for screwing onto the tensiometer  
with cable and ALMEMO® connector

### Order no.

**FDA602TM2**

### Types

### Order no.

#### Insertion Tensiometer L2

**ZB9602TML2**



Ceramic cell	Cylindrical, with tip, Ø 20 x 65 mm
Overall length	approx. 340 mm
Insertion depth	typical 250 mm

#### Insertion Tensiometer LKV2

**ZB9602TMKV2**



Ceramic cell	Cylindrical, with tip, Ø 15 x 40 mm
Overall length	approx. 160 mm
Insertion depth	typical 70 mm

#### Surface Tensiometer FO

**ZB9602TMFO**



Sensor completely porous for measuring in thin layers of substrate.

Dimensions:	65 mm, Ø 70 mm
Sink deep:	approx. 30 - 60 mm

#### Surface Tensiometer FV

**ZB9602TMFV**



Standard model for use on capillary matting, for moist to moderately moist cultivation or for general measurement on moist surfaces.

Dimensions:	65 mm, Ø 70 mm
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Probe Heads for Outdoor Operation see Chapter Meteorology

# Optical radiation

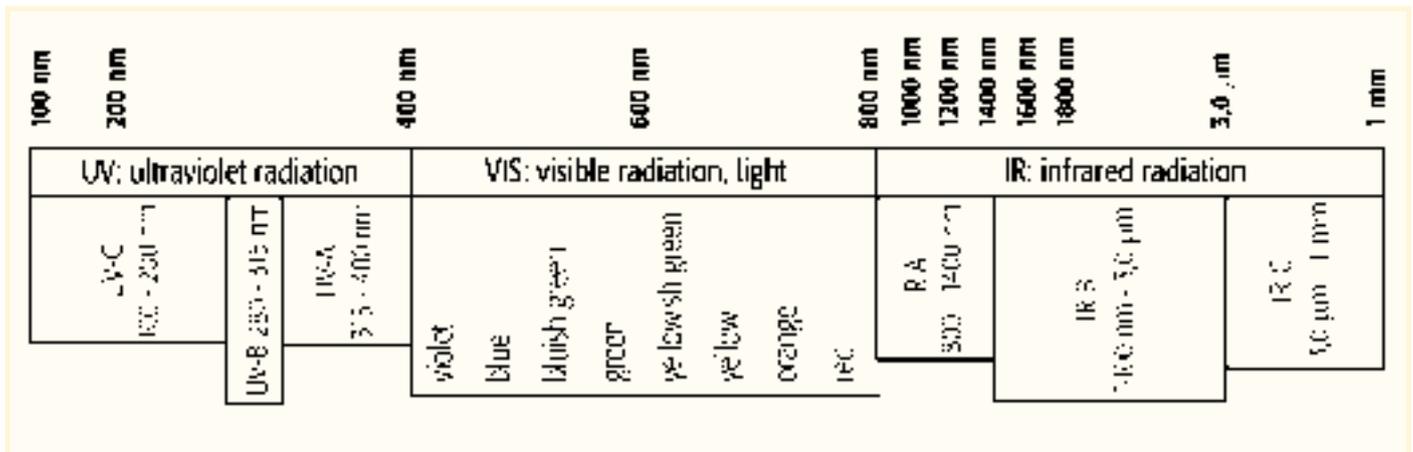


## What is 'Optical Radiation'?

Optical radiation covers the wave length range from 100nm to 1mm of the electromagnetic radiation spectrum.

It must be considered that, with regard to the range limits, they do not present a sharp separation, which is compulsory for all applications.

The detection of optical radiation can, for example, be measured by means of radiometric, photometric, photobiological or plant-physiological measurable variables.



## Definition of Photometric and Radiometric Measurable Variables

### Photometry

Limited to the range of the optical spectrum (light) that is visible to the human eye. Photometric measurable variables include: Light flux, illuminance, luminance and luminous intensity. The main characteristics of photometry is the evaluation of the brightness perception by the spectral luminosity function of the eye for photopic vision or, in rare cases, for scotopic vision (DIN 5031). Radiation detectors for photometric measuring tasks must, therefore, provide one of these spectral response characteristics.

### Light Flux

The luminous power of a light source (lamp, LED etc.). As lamps do not generally emit a completely parallel luminous beam, the light flux measurement is performed by using measurement geometries, which

detect the light flux independent from its geometric distribution. In most cases Ulbricht globe photometers or goniometers will be used.

### Luminous Intensity

The part of a light flux, which radiates in one specific direction. The luminous intensity is an important variable for calculating the efficiency and quality of lighting equipment. The measurement is performed by detectors with a defined field of view and placed at distances that allow to consider the light source as a point light source.

### Luminance

The brightness sensation provided by an illuminated or luminous surface to the eye. In many cases the luminance data will provide significantly better information regarding the quality of a light than the

illuminance. For measuring the luminance, measuring heads with a defined measuring field angle are used.

### Illuminance

The light flux of one or several light sources striking a certain surface horizontally or vertically. In case of a non-parallel incidence (which is the typical case in practical photometry) a cosine diffusor must be used as measurement geometries.

### Radiometry

Metrological evaluation of optical radiation using the radiometric variables „Radiation Capacity“, „Radiant Intensity“, „Radiancy“ and „Intensity of Irradiation“. The main characteristic of radiometry is the wavelength-independent examination of the intensity of radiation. This is the significant difference between radiometry and actively weighted

# Optical radiation

measurable variables, such as variables used in photometry, photobiology, plant physiology etc.

## Radiation Capacity

The overall power provided by radiation.

## Radiant Intensity

The quotient from the radiation capacity emitted by the light source into a certain direction and the solid angle being covered. The radiant intensity is used for the measurement of the geometric distribution of the radiation capacity.

## Radiancy

The quotient from the radiation capacity passing through (striking) a plane in a certain direction and the product of the passed solid angle and the projection of the plane to a plane surface, which is perpendicular to the examined direction. The radiancy is used for the evaluation of aperture radiators. Steradian or telescopic adapters can be used as measurement geometries.

## Intensity of Irradiation

The quotient of the radiation capacity striking a plane and the illuminated plane. For measuring the intensity of irradiation the spacial examination of the incident radiation is very important; therefore, a cosine-corrected field view function has been preset.

## Comparison of Photometric and Radiometric Variables

Every photometric variable corresponds to a radiometric variable and involves the

same interrelationships between them. The variables can be distinguished by

their index v (visual) and index e (energetic).

Lighting Engineering			Radiation Physics		
Variable	Symbol	Unit	Variable	Symbol	Unit
Light Flux	$\Phi_v$	lm	Radiation Capacity	$\Phi_e$	W
Luminous Intensity	$I_v$	cd	Radiant Intensity	$I_e$	$\frac{W}{sr}$
Luminance	$L_v$	$\frac{cd}{m^2}$	Radiance	$L_e$	$\frac{W}{m^2 \cdot sr}$
Illuminance	$E_v$	$\frac{lm}{m^2}$	Intensity of Irradiation	$E_e$	$\frac{W}{m^2}$
Light Quantity	$Q_v$	lm·s	Radiation energy	$Q_e$	J
Luminous Flux	$\Phi_v$	lm	Radiation Flux	$\Phi_e$	$\frac{W}{m^2}$

## Spectral Valuation Function

The relative spectral sensitivity of the human eye is specified with different functions for the light-adapted eye (photopic vision) or for the dark-adapted eye (scotopic vision). Due to the individual differences this data can only be considered for average values but is sufficient for most technical purposes. The detailed data

of the spectral sensitivity curve are given in table format in the DIN 5031 standard. The two different spectral action functions result from the different „sensor types“ of the eye.

The relative luminous efficiency for photopic vision (rods,  $> 10cd/m^2$ ) is described with the function  $V(\lambda)$ , which is

the function used in most cases. The spectral luminous efficiency for the scotopic vision (cones,  $< 0.001cd/m^2$ ) is described with the function  $V'(\lambda)$  and can, with regard to the practical use, only be rarely found.

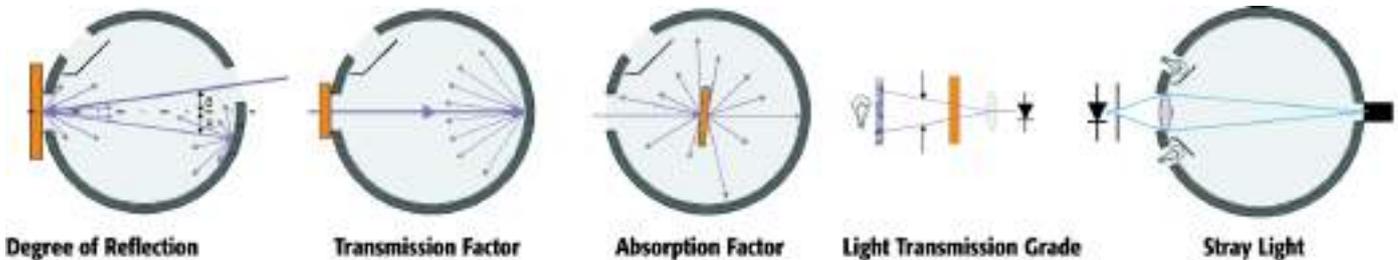
# Optical radiation

## Determination of Photometric Characteristic Factors

The metrological evaluation of the properties of materials regarding their reflection, transmission and absorption, as well as the stray light of objectives, is based on internationally accepted

recommendations. These mainly include the CIE 130-1998 „Practical methods for the measurements of reflectance and transmittance“, DIN 5036 Part 3 „Radiometric and photometric

characteristics of materials“, DIN 67507 „Light transmission factor of glazing“, DIN 58186 „Stray light determination of optically image-forming systems“.



## Why Measure Optical Radiation?

A large part of the human sense impression is of an optical nature. Light is the only visible part of the electromagnetic spectrum. The human eye perceives different wave lengths of the light as colours. The spectral response of the eye, with regard to different colours, depends on the wave length. Furthermore, the human system is also influenced by ultraviolet radiation in a short-wave range and the infrared radiation in a long-wave range of the electromagnetic spectrum.

### Illumination:

People are used to daylight illumination. This can be approximately 5000 lux on a dull winter day, while on a sunny summer day approximately 100000 lux are reached. In contrast, only between 100 and 1000 lux are reached with artificial illumination. However, sufficient light is an essential factor for the well-being of people. Symptoms of tiredness, caused by insufficient light, do not generally occur at the eye but affect the whole body.

The standard DIN 5035/2, therefore, contains illumination standard values for health protection at work places.

These are legally bound in the guideline ASR 7/3 and it is imperative that this is observed.

The following nominal illuminations are valid for inside:

Offices:	office rooms	300 lux
	work places for writing and drawing	750 lux
Factories:	visual works within the production process	1000 lux
Hotels:	recreation rooms, reception, counter (cash)	200 lux
Shops:	front side of show windows	1500–2500 lux
Hospitals:	patients' rooms,	100–150 lux
	emergencies	500 lux
Schools:	lecture rooms, gymnasiums	300 Lux

### Global Radiation:

The global radiation is a measuring variable that is especially important for environmental research. It represents the entire diffuse and direct sun radiation that strikes the surface of the earth. The spectral range covers wavelengths from the short-wave range, at 300nm (UV-B), to the long-wave range, at 5000nm (IR).

### UVA Radiation:

The long-wave UV radiation (more than 313nm) reaches the surface of the earth

almost unfiltered and tans the human skin and strengthens the immune system. In solariums the biological effect of the UVA spectrum is used, combined with other spectral ranges, to trigger the direct pigmentation (melanin colouring). Damages to the connective tissue and premature skin ageing are promoted by too much radiation.

### UVB Radiation:

The short-wave UV range (less than 313nm) can cause irreversible damages.

All spectral characteristic functions that can have unfavourable effects on the human skin are summarised in the CIE recommendation. This recommendation is described in DIN 5050 and regarded as a guideline. A popular measure for the 'sunburn sensitivity' is, for example, the UV index 'UVI' provided by the German Weather Service. The measuring results provide, directly or in comparison with other spectral ranges, information that is of medical or biological relevance.

## Radiation probe FLA 623 x

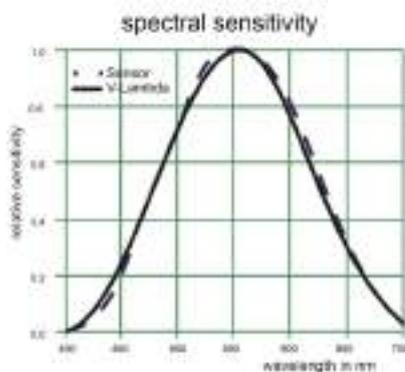


- Probes for various spectral ranges:
- Illuminance ( $V_{\lambda}$ ), UVA, UVB, UVC, global radiation, IR, quantum (photosynthesis)
- Sturdy aluminum housing
- ALMEMO® connecting cable, plug-in
- For indoor applications

### Common technical data

Diffuser	PTFE	Electrical connection	Mountable male connector, lateral
Cosine correction	Error f2 <3 %	Connecting cable	PVC cable, plug-in, with ALMEMO® connector
Linearity	<1 %	Housing	Aluminum, black anodized
Absolute error	<10 % (<5 % for FLA623VL)	Fixture	2 screws M2 in base plate
V lambda adapter	<3 % (for FLA623VL only)	Dimensions	Diameter 33 mm, height approx. 29 mm
Nominal temperature	22 °C ±2 K	Weight	approx. 50 g (without cable)
Operating temperature	-20 to +60 °C		
Signal output	0 to +2 V		
Duty cycle	<1 second		
Power supply	via ALMEMO® connector (5 to 15 VDC)		

## Probe for measuring illuminance FLA 623 VL



- This measures the  $V_{\lambda}$  radiation (visible light, equivalent to sensitivity of the human eye).
- For evaluating lighting conditions, e.g. in the workplace
- The sensor complies with device class B as per DIN 5032.

### Technical data:

Measuring range $V_{\lambda}$	0 to approx. 170 klx
Measuring channels	1st channel up to approx. 20,000 lx 2nd channel up to approx. 170.00 klx
Spectral sensitivity	380 to 720 nm, max. at 555 nm

Common technical data and image see page 14.05

### Variants (including factory test certificate)

Illuminance probe with ALMEMO® connecting cable, length = 2 meters

#### Options

ALMEMO® connecting cable, length = 5 meters  
ALMEMO® connecting cable, length = 10 meters

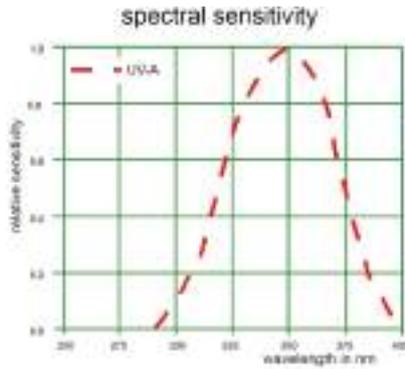
**Order no.**  
**FLA623VL**

**OA9623L05**  
**OA9623L10**

Factory calibration KL90xx radiation for sensor (see chapter Calibration certificates)

# Optical radiation

## Probe for UVA radiation FLA 623 UVA



- This measures long-wave UV radiation (bronzing effect on human skin).
- Its spectral sensitivity is weighted towards global solar radiation.

### Technical data:

Measuring range	0 to approx. 50 W/m <sup>2</sup>
Spectral sensitivity	310 to 400 nm, maximum at 335 nm

Common technical data and image see page 14.05

### Variants (including factory test certificate)

UVA probe with ALMEMO® connecting cable, length = 2 meters

#### Options:

ALMEMO® connecting cable, length = 5 meters

ALMEMO® connecting cable, length = 10 meters

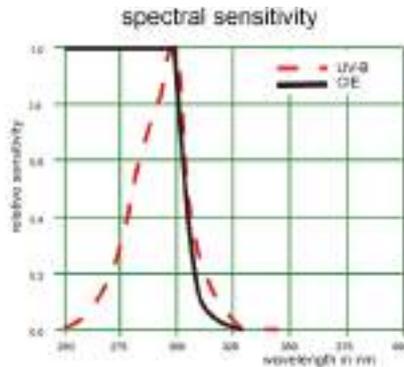
### Order no.

FLA623UVA

OA9623L05

OA9623L10

## Probe for UVB radiation FLA 623 UVB



- This measures short-wave UVB radiation.
- Its spectral sensitivity is weighted towards global solar radiation likely to cause erythema (sunburn) as per CIE recommendation (Commission Internationale de l'Eclairage). The UV index can be calculated.

### Technical data:

Measuring range	0 to approx. 5 W/m <sup>2</sup>
Spectral sensitivity	265 to 315 nm, maximum at 297 nm

Common technical data and image see page 14.05

### Variants (including factory test certificate)

UVB probe with ALMEMO® connecting cable, length = 2 meters

#### Options

ALMEMO® connecting cable, length = 5 meters

ALMEMO® connecting cable, length = 10 meters

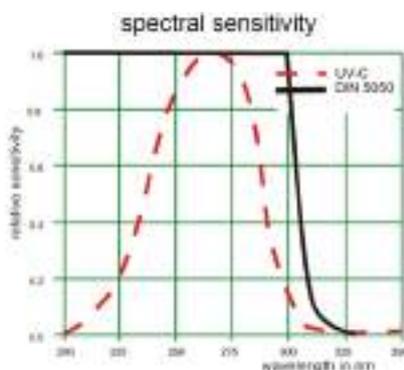
### Order no.

FLA623UVB

OA9623L05

OA9623L10

## Probe for UVC radiation FLA 623 UVC



- This measures UVC radiation, e.g. Hg line at 256 nm.
- This probe can be used inter alia in water disinfection units.

### Technical data:

Measuring range	0 to approx. 1990 mW/m <sup>2</sup>
Spectral sensitivity	220 to 280 nm, maximum at 265 nm

Common technical data and image see page 14.05

### Variants (including factory test certificate)

UVC probe with ALMEMO® connecting cable, length = 2 meters

#### Options:

ALMEMO® connecting cable, length = 5 meters

ALMEMO® connecting cable, length = 10 meters

### Order no.

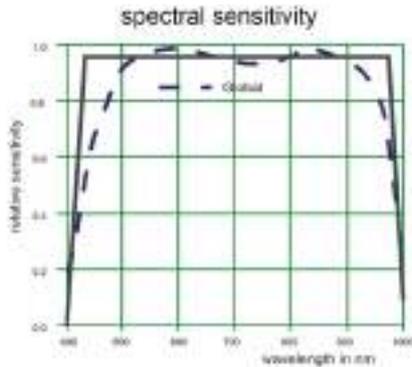
FLA623UVC

OA9623L05

OA9623L10

Factory calibration KL90xx radiation for sensor (see chapter Calibration certificates)

## Probe for global radiation FLA 623 GS



- This measures the solar spectrum in the visible range and in the short-wave IR range.
- Global radiation comprises both direct and diffused solar radiation.

### Technical data:

Measuring range	0 to approx. 1300 W/m <sup>2</sup>
Spectral sensitivity	400 to 1100 nm, maximum at 780 nm

Common technical data and image see page 14.05

### Variants (including factory test certificate)

Global radiation probe with ALMEMO® connecting cable, length = 2 meters

#### Options:

- ALMEMO® connecting cable, length = 5 meters
- ALMEMO® connecting cable, length = 10 meters

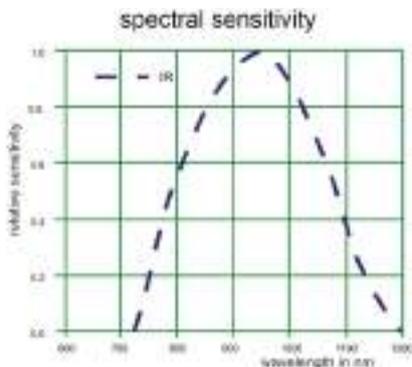
### Order no.

FLA623GS

OA9623L05

OA9623L10

## Probe for infra-red radiation FLA 623 IR



- This measures the solar spectrum in the short-wave IR range (excluding the visible range).

### Technical data:

Measuring range	0 to approx. 400 W/m <sup>2</sup>
Spectral sensitivity	800 to 1100 nm, maximum at 950 nm

Common technical data and image see page 14.05

### Variants (including factory test certificate)

IR probe with ALMEMO® connecting cable, length = 2 meters

#### Options:

- ALMEMO® connecting cable, length = 5 meters
- ALMEMO® connecting cable, length = 10 meters

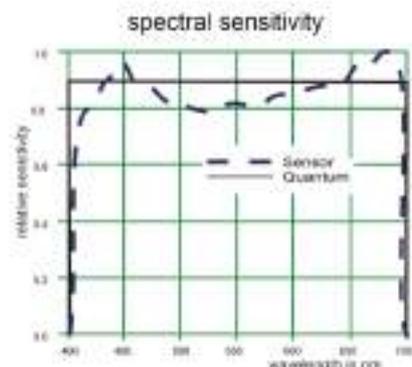
### Order no.

FLA623IR

OA9623L05

OA9623L10

## Probe for quantum radiation FLA 623 PS



- This measures the visible light absorbed by the chlorophyll in plants during photosynthesis.
- It determines the level of quantum radiation in the spectral range specified.
- It is used to assess the conditions in which plants develop in open field and greenhouse cultivation.

### Technical data:

Measuring range	0 to approx. 3000 μmol/m <sup>2</sup> s
Spectral sensitivity	380 to 720 nm, maximum at 420 and 700 nm

Common technical data and image see page 14.05

### Variants (including factory test certificate)

Quantum probe with ALMEMO® connecting cable, length = 2 meters

#### Options:

- ALMEMO® connecting cable, length = 5 meters
- ALMEMO® connecting cable, length = 10 meters

### Order no.

FLA623PS

OA9623L05

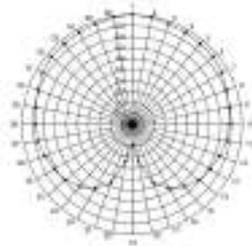
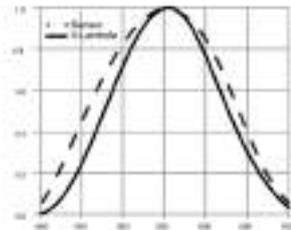
OA9623L10

# Optical radiation

## Illuminance measuring head FLA 613 VLK



- Measuring independent of direction - thanks to the probe head's spherical characteristics
- Weather-proof aluminum housing, with plastic globe
- Suitable for universal use, inter alia for measuring in photo-stability tests according to various international standards and ICH guidelines (International Conference on Harmonization)
- Spectral range of the probe head corresponds to the sensitivity of the human eye (V-lambda radiation).



### Technical data:

Measuring range	0 to 50 klux
Spectral sensitivity	360 to 760 nm
Maximum spectral sensitivity	555 nm
Signal output	0 to 2 V
Duty cycle	<1 second
Power supply	via ALMEMO® connector +5 to +15 V
Fastening	2 screws, M4, in base plate
Cable passage	at side
Housing	anodized aluminum
Diffuser	Plastic
Ball	Plastic
Directional characteristic	see diagram
Linearity	<1%
Absolute error	<10%
Nominal temperature	22 ± 2 °C
Operating temperature	-20 to +60 °C
Dimensions	Ball diameter : 40 mm Overall height : 76 mm
Weight	approx. 100 grams

### Type (including test protocol)

Lux probe head for measuring illuminance, with spherical characteristic, including 1.5-meter cable and ALMEMO® connector

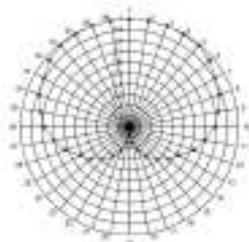
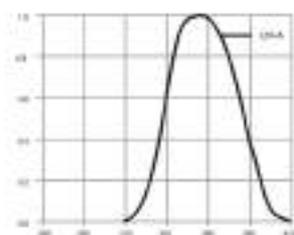
### Order no.

**FLA613VLK**

## UVA probe head FLA 613 UVAK



- Measuring independent of direction - thanks to the probe head's spherical characteristics
- Weather-proof aluminum housing, with plastic globe
- Suitable for universal use, inter alia for measuring in photo-stability tests according to various international standards and ICH guidelines (International Conference on Harmonization)
- Measuring head for measuring the UVA



### Technical data:

Measuring range	0 to approx. 50 W/m <sup>2</sup>
Spectral sensitivity	310 to 400 nm
Maximum spectral sensitivity	355 nm
Signal output	0 to 2 V
Duty cycle	<1 second
Power supply	via ALMEMO® connector +5 to +15 V
Fastening	2 screws M4, in base plate
Cable passage	at side
Housing	anodized aluminum
Diffuser	PMMA (polymethyl methacrylate, acrylic)
Ball	PMMA (transparent to UV)
Directional characteristic	see diagram
Linearity	< 1%
Absolute error	< 10%
Nominal temperature	22 ± 2 °C
Operating temperature	-20 to +60 °C
Dimensions	Ball diameter : 40 mm Overall height: 76 mm
Weight	approx. 100 grams

### Type (including test protocol)

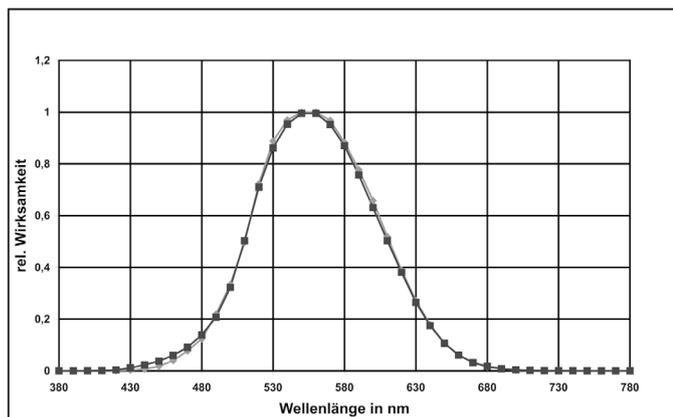
UVA probe head, with spherical characteristic, including 1.5-meter cable and ALMEMO® connector

### Order no.

**FLA613UVAK**

Factory calibration KL90xx radiation for sensor (see chapter Calibration certificates)

## V-lambda radiation sensor FLAD 03 VL1



## V-lambda radiation

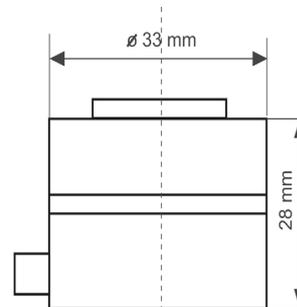
The spectral range of the visible light is referred to as V-lambda radiation and corresponds to the sensitivity of the human eye. The measured value is a measure for the perceived brightness. The wavelength range extends from the end of the UV spectrum at 400 nm to the beginning of the IR range at 720 nm with a maximum at 555 nm. The determined illuminance in "LUX" can directly be converted into the irradiance "W/ m<sup>2</sup>". Measurements in this particular range have a great importance for the workplace design and lighting projects.

## V-lambda radiation sensor FLAD 03 VL1

V-lambda sensors are used in the field of medical and/or biological research, for weather information and forecasting systems, for climate research, for agriculture, and for the automobile industry respectively for measuring artificial lighting. The spectral sensitivity of the receiver is extremely well adapted to the sensitivity of the human eye and complies with the device class B as per DIN 5032. The measuring head FLAD 03 VL1 has a black, anodized aluminum housing. The measurement is cos corrected. The measuring head is only suitable for indoor usage.

## Technical data

Measuring range V-lambda	0.02 lx to 200 klx
ALMEMO® measuring ranges	0 to 650.00 lx 0 to 6500.0 lx 0 to 65000 lx 0 to 200.00 klx
Sensor system	Si / interf. filter
Spectral sensitivity	380 nm to 720 nm
Maximum spectral sensitivity	555 nm
Operating temperature	-20°C to +60°C
Signal output	I <sup>2</sup> C
Minimum resolution	0.02 lx
Power supply	from ALMEMO® measuring instrument
Switch-on time (Duty cycle)	< 1 s
Switch-off time	< 1 s
Mounting	2 screws M3
Cable passage	at side / socket
Diffuser	PTFE
Dome	PMMA
V-Lambda adaption	<3%
Cos-correction	error f2 < 2.0%
Linearity	< 1 %
Absolute error	< 5 %
Weight	approx. 50 g



## Variants

V-lambda radiation sensor with a 1.5 m long ALMEMO® connection cable

Order no.  
FLAD03VL1

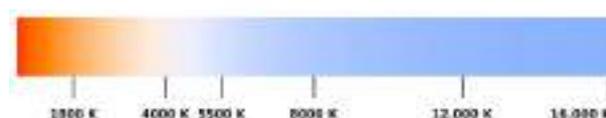
## Digital sensor for color temperature and illuminance FLAD23CCT with ALMEMO® D6 plug



- Color temperature and illuminance are determined as a means to plot and evaluate lighting systems.
- Compact sensor, particularly suitable for mobile applications
- Continuous measuring and updating of measured values
- Digital color temperature sensor with „TrueColorSensorchip“ and integrated signal processor. The TrueColorSensorchip (3 sensors on 1 chip) detects - separately - each of the three colors - red, green, blue (RGB). The respective sensitivities of these 3 color sensors are adapted to the standard spectral curves as per CIE and DIN. (see Figure) On the basis of these RGB values the computer calculates the color point within the RGB range in terms of coordinates X and Y and determines the correlated color temperature (CCT) in Kelvin.
- The display shows simultaneously both this color data and the illuminance in lux (lx) or kilolux (klx).
- Freely selectable measurable variables  
Two measuring channels are programmed (at our factory): Color temperature (CCT, K), Illuminance (Ev, lx)  
Other measurable variable can also be selected: Illuminance (Ev, klx), X-value, Y-value  
The configuration is performed on the ALMEMO® V7 measuring instrument or directly on the PC using the USB adapter cable ZA1919AKUV (see chapter “ALMEMO® Network technology”).

### Technical data:

Spectral sensitivity	380 to 720 nm
Sensor system	TrueColor, 3 sensors on 1 chip
Measuring ranges	
Correlated color temperature (CCT)	54 to 30,000 K (at 120 lx to 170 klx)
Accuracy	< 10% in range 1600 to 17000 K
Coordinates resolution (dx, dy)	< 0.005
Illuminance (V-lambda)	0 to 65,000 lx (factory setting) or 0.00 to 170.00 klx
Accuracy	< 10% in range 120 lx to 170 klx
Cosine correction	8 mm diffuser plate
Cosine error	< 3%
Measuring duration	< 3 seconds
Nominal conditions	23 °C ± 3 K, 0 to 90 % RH (non-condensing)
Operating temperature	-10 to +40 °C
Dimensions	Diameter 25 mm, length 134 mm
ALMEMO® connecting cable	Fixed cable, 1.5 meters, with ALMEMO® D6 plug
ALMEMO® D6 plug	
Refresh rate	1.5 seconds for all channels
Setting time	3 seconds (In order to run the data logger in sleep mode a wakeup delay of 3 seconds must be programmed.)
Supply voltage	6 to 13 VDC
Current consumption	approx.. 4 mA



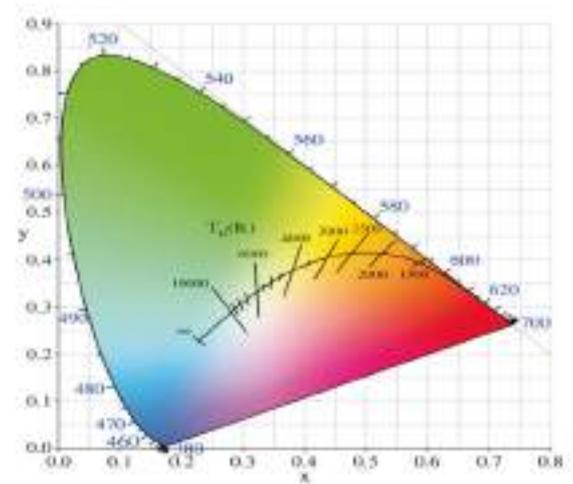
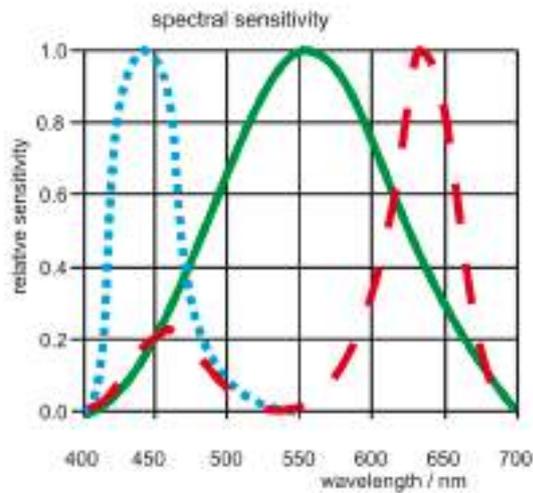
Color temperature sensor with ALMEMO® 2590-2 (example)

### Variants

Digital sensor for color temperature and illuminance, fitted cable, 1.5 meters with ALMEMO® D6 plug

### Order no.

FLAD23CCT



## Accessories

Ulbricht integrating sphere



- Ulbricht integrating sphere, for measuring total radiation from any light source
- Especially suitable for measuring operations on site for light sources that have already been installed. This minimizes interference from extraneous light in the environment.
- Dimensions
 

Measuring aperture	13.5 mm
Sphere diameter	40 mm
Housing diameter	44.5 mm, length 44 mm

## Accessories

An Ulbricht integrating sphere can be attached to color temperature sensor FLAD23CCT

Order no.

ZB9623KU

# Optical radiation

## Luminance Probe Head FLA 603 LDM2



- Luminance measuring head, equipped with achromatically corrected, low stray light optics and high quality V(l) detector according to DIN class B.
- The external sighting device allows, at a working distance of 1m, to exactly locate the measuring point, therefore, it is particularly suitable for evaluating the luminance for service and constancy tests.
- Three measuring channels with different sensitivity.
- Typical applications: Luminescent surfaces such as colour monitors, alphanumeric displays, sign plates and light panels, and reflecting surfaces, such as walls and equipment at work places, projecting screens, traffic and sign plates, guided paths and roadway lines.

### Technical data:

Measuring range:	0.04 cd/m <sup>2</sup> to appr. 6400 cd/m <sup>2</sup>
Smallest resolution:	10 mcd/m <sup>2</sup>
Field of view:	1°
Sensitivity:	approx. 30 pA/(cd/m <sup>2</sup> )
Spectral adaptation:	approxim. to photometric valuat. function V(l) for photopic vision, class B, better than 6%
Field of view diameter :	approx. 30 mm at a distance of 0.5 m approx. 40 mm at a distance of 1 m approx. 120 mm at a distance of 5 m
Nominal temperature:	24°C ±2K
Operat./storage temperature:	0 to 60°C/-10 to +80°C
Humidity range:	10 to 90% (non-condensing)
Measuring surface:	21mm x 21mm at 1m operating distance
Meets standards:	IEC 61223-2-5, DIN 5032-T.7
Dimensions:	diameter 30mm, length 150 mm

### Variants

Luminance probe head with 1° field of view and external sighting device, DIN quality class B, with ALMEMO® connecting cable 1.5m long, incl. factory calibration certificate calibration in cd/m<sup>2</sup>

### Order no.

**FLA603LDM2**

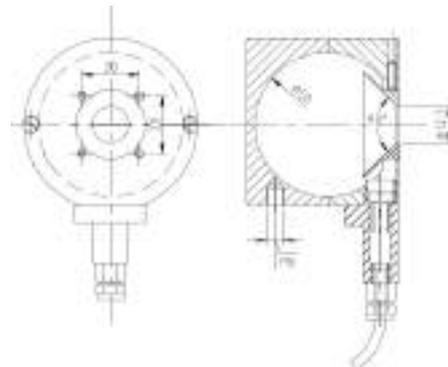
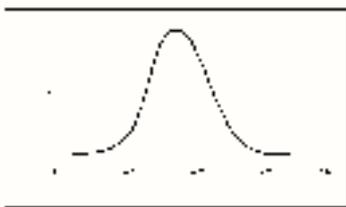
## Light Flux Probe Head FLA 603 LSM4



- High quality measuring head, DIN class B for light flux measurement with Ulbricht globe photometer.
- Perfect coating of the globe with BaSO<sub>4</sub> for diffuse reflectivity and spectrally neutral reflection quality.
- Suitable for cold light sources, and lamps with high colour temperature and almost monochromatic radiation (as in LEDs).
- Examples for applications: Endoscopes, fiber optic bunches, light emitting diodes.

### Technical data:

Measuring range:	0.0002 lm to appr. 38 lm
Smallest resolution:	0.001 lm
Sensitivity:	20nA/lm
Acceptance angle:	up to 90°
Accuracy:	DIN quality class B
Nominal temperature:	24°C ±2K
Humidity range:	10 to 90 % non-condensing
Operating temperature:	max. 100°C inside globe
Inner diameter of globe:	50mm
Test opening:	12,7 mm



### Type

Light flux probe head with ALMEMO® connecting cable 2m long and factory calibration certificate

### Order no.

**FLA603LSM4**

Factory calibration KL90xx radiation for sensor (see chapter Calibration certificates)

## Content

pH value, Redox potential, Conductivity	15.02
The Electrical Conductivity	15.03
Solute oxygen in liquids	15.03
pH one-bar measuring chains FY 96 PHEK, FY 96 PHER, FY 96 PHEN	15.04
pH insertion electrode FY 96 PHEE	15.05
Redox one-bar measuring chains FY 96 RXEN	15.05
Accessories for pH and redox probes	15.05
ALMEMO® connecting cable for pH and redox probes	15.06
Conductivity probes FYA 641 LFP1 / LFL1	15.07
Conductivity probes FYA 641 LFP2 / LFL2, FYA 641 LFP3	15.08
Digital probes for measuring conductivity FYD 741 LFE01 and FYD 741 LFP	15.09

# Water analysis



## The pH Value



The pH value is a logarithmic measure for the concentration of the H ions in a hydrous solution and indicates, by a numerical value, whether the solution has an acid, neutral or alkaline reaction.

The pH scale ranges from pH0 to pH14, pH7 is neutral.

The further the pH value deviates from 7, the more aggressive the sample is. The acidic or alkaline effect will increase by the factor 10 per pH unit.

The illustration on the left shows some examples for pH values of typical substances

## The Redox Potential

The level of the Redox potential (measured in mV) indicates the strength of an oxidising or reducing reaction of a measuring solution. A negative voltage value means that the solution has reducing properties compared to a standard hydrogen electrode. A positive value indicates that the solution has an oxidising

effect.

As the extermination of microorganisms (disinfection) is directly related to the strength of the oxidation (e.g. of chlorine) the Redox potential is successfully being used for monitoring disinfection processes, e.g. in swimming baths. However, redox measurements are also performed for

controlling the denitrification of waste waters (redox break point determination) at the detoxification in galvanic plants and for monitoring multiple chemical processes (e.g. cyanide oxidation or chromate reduction).

## ALMEMO® pH and Redox Measurement

By using reference solutions the calibration of pH and redox probes can be started with the push of a button. As the adjustment is stored in the ALMEMO® connector, the probe can also be used with other devices.

If ALMEMO® devices with several input sockets are used, it is even possible to connect more probes with individual adjustments. The calculation of the pH value is based on the electrode steepness at

25°C. If the temperature of the measuring medium largely deviates from the reference temperature, it is possible for all ALMEMO® devices to perform a temperature compensation.

## The Electrical Conductivity

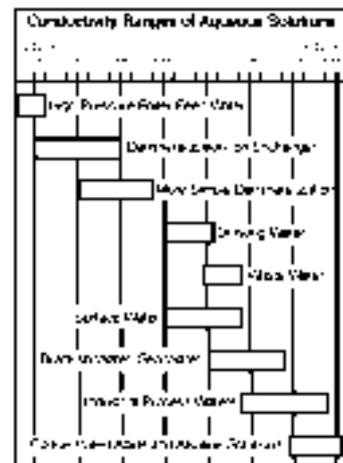
The conductivity (unit S/m = Siemens/meter) is a measure for the ion concentration in a measuring solution.

It is proportional to the salt, acid or base content in the measuring solution. High-purity waters have a conductivity of approx. 0.05 μS/cm (at 25°C), natural waters approx. 100 to 1000 μS/m, some bases (e.g. potassium hydroxide solutions)

up to slightly more than 1000 mS/cm.

The diagram shows further examples of hydrous solutions relevant for measurements.

In practice, the conductivity measurement is used for monitoring plants, for producing of high-purity waters or for determining the salinity of sea water.



## Solute Oxygen

Oxygen is not only a component of the air but it is also contained dissolved in water and, practically, in every liquid. For example, water contains approximately 9 mg/l oxygen in saturated compound at a temperature of 20°C and an atmospheric pressure of 1019 mbar.

Every liquid accepts as much oxygen until the oxygen partial vapour pressure in the liquid is in a balance with the 'contacting' air or gas phase. The saturation state (air-saturated water) is reached when the

partial pressure of the physically dissolved oxygen in the liquid equals the partial pressure of the oxygen in the air.

The current oxygen concentration increases with atmospheric pressures and with decreasing temperatures. Relevant for metrology are processes, such as the oxygen consumption involved with microbiological decomposition processes or an oxygen production, e.g. due to the growth of algae.

The oxygen concentration is very important for animals and organisms living in water and for the biological treatment of municipal and industrial waste water. Additionally, corrosion processes in lines and keeping the quality of beverages depend on the solute oxygen in the liquid.

## This is only possible with ALMEMO® Devices

Through the complete electrical isolation of the measuring inputs it is possible to use only one single ALMEMO® device to simultaneously measure various chemical

variables, and use several probes in one sampling vessel without having any mutual influences of the probes! Through pre-programmed ALMEMO® connectors

it is possible to connect any environmental sensor technology.

## ALMEMO® system with data logger and comprehensive sensor equipment

Order no.

For exploring abandoned polluted areas and their environments or for performing groundwater quality tests

### ALMEMO® data logger including sensor equipment and accessories

- ALMEMO® 2690-8A with 5 measuring inputs, including PC data cable
- Temperature sensor -70 to +400 °C
- pH electrode 1 to 12 pH including connecting cable and buffer solutions pH 4/7/10
- Redox electrode including connecting cable and buffer solution 220 mV and KCl solution
- Conductivity probe 0.01 to 20.00 mS/cm including reference solution 2.77 mS/cm
- Probe for measuring solute oxygen 0 to 40 mg/l or 0 to 260 % saturation including filling solution
- Adjustment set for the oxygen probe, saturation and zero point adjustment

MA2690AKSU

FPA30L0250 + OFS0008

FY96PHEK + ZA9610AKY4  
+ ZB98PHPL4 + ZB98PHPL7  
+ ZB98PHPL10 + ZB98PHNL

FY96RXEK + ZA9610AKY5  
+ ZB98RXPL2

FYA641LFP1 + ZB96LFRL

FYA64002

ZB9640AS

# Water analysis

## pH One-Bar Measuring Chain FY96PHEK



### Applications:

manual measurements e.g. swimming pools, drinking water ...

### Technical Data

pH range:	1 ... 12	Reference:	Ag / AgCl (3mol KCl / gel)
Operating range	0 ... 13pH / 0 ... 60°C	Shaft length:	125 ±3mm
Operating pressure:	unpressurised	Shaft diameter:	12mm (polycarbon)
Conductivity:	> 150 µS / cm	Electrode head:	plug head SN6
Diaphragm type:	glass fiber		

### Type

pH-one-bar measuring chain pH 1 ... 12, 0 ... 60°C for unpressurised operating

### Order no.

FY96PHEK

## pH One-Bar Measuring Chain FY96PHER



### Applications:

Waste water, drinking water, industrial water, chemical industry, paper industry, food industry ...  
(not media contained for chlorine and fluoride, for not frequent temperature fluctuations).

### Technical Data

pH range:	1 ... 12	Shaft diameter:	12mm (glass)
Operating range	0 ... 13pH / 0 ... 80°C	screw connection	thread PG13.5
max. pressure:	6 bar	Shaft length:	120 ±3mm
Conductivity:	> 50 µS / cm	Electrode head:	plug head SN6
Diaphragm type:	PTFE ring diaphragm		
Reference:	Ag mit AgCl stock (3mol KCl / polymer)		

### Type

pH-one-bar measuring chain pH 1 ... 12; 0 ... 80°C

### Order no.

FY96PHER

## pH One-Bar Measuring Chain FY96PHEN



### Applications:

manual measurements in the laboratory.

### Technical Data

pH range:	0 ... 12		KCl-elektrolyt refillable
Operating range	0 ... 13pH / 0 ... 80°C	Shaft length:	160 ±3mm
Operating pressure:	unpressurised	Shaft diameter:	12mm (material: glass)
Conductivity:	> 150 µS / cm,	Electrode head:	plug head SN6
Diaphragm type:	ceramik diaphragm		
Reference:	Ag / AgCl stock (3mol KCl / liquid)		

### Type

pH-one-bar measuring chain pH 0 ... 12, 0 ... 80°C for unpressurised operating

### Order no.

FY96PHEN

## pH Insertion Electrode FY96PHEE



### Applications:

pH-measurements in semi-solid or pasty media,  
e.g. foods like meat, cheese ...

### Technical Data

pH range:	1 ... 12		KCl-elektrolyt refillable
Operating range	0 ... 13pH / 0 ... 60°C	Shaft length:	120 ±3mm (glass)
Operating pressure:	unpressurised	Penetrating tip	approx. 45 mm, Ø 6 to 8 mm
Diaphragm type:	3 ceramic diaphragms	Electrode head:	plug head SN6
Reference:	Ag / AgCl (3mol KCl / liquid)		

### Type

pH-insertion electrode pH 1 ... 12, 0 ... 60°C for unpressurised operating

### Order no.

FY96PHEE

## Redox-One-Bar Measuring Chain FY96RXEK



### Applications:

manual measurements e.g. swimming pools, drinking water ...

### Technical Data

Operating temperature	0 ... 60°C	Metal electrode :	platinum
Operating pressure:	unpressurised	Shaft length:	125 ±3mm
Conductivity:	> 150 µS / cm	Shaft diameter:	12 mm (material: plastic)
Diaphragm type:	glass fiber	Electrode head:	plug head SN6

### Type

Redox-one-bar measuring chain 0 ... 60°C for unpressurised operating

### Order no.

FY96RXEK

## Accessories for pH-One-Bar Meas. Chains and Redox-One-Bar Meas. Chain

pH-One-Bar Measuring Chains	Order no.	Redox-One-Bar Measuring Chain	Order no.
ALMEMO® transducer cable for pH probes, 2 m	ZA9610AKY4	ALMEMO® transducer cable for redox probes, 2 m	ZA9610AKY5
5 m	ZA9610AKY4L05	5 m	ZA9610AKY5L05
ALMEMO® transducer cable for pH and redox probes, 2 m	ZA9610AKY6	ALMEMO® transducer cable for pH and redox probes, 2 m	ZA9610AKY6
5 m	ZA9610AKY6L05	5 m	ZA9610AKY6L05
Buffer solution pH 4.0 50 ml	ZB98PHPL4	Redox buffer solution 220 mV	ZB98RXPL2
Buffer solution pH 7.0 50 ml	ZB98PHPL7	KCl solution, 3-molar for refilling and storage, 50ml	ZB98PHNL
Buffer solution pH 10.0 50 ml	ZB98PHPL10		
KCl solution, 3-molar, 50ml for refilling and storage	ZB98PHNL		

# Water analysis

## ALMEMO® connecting cable for pH and redox probes



Transducer cable with various electrodes

### Applications:

Transducer cables are available for all popular electrodes with a coaxial connector. To avoid the measuring signal being corrupted by the measuring instrument itself an extremely high-impedance amplifier is integrated in the ALMEMO® connector on the connecting cable.

### Technical Data

Transducer	High-impedance measuring amplifier (>500 Gohm), integrated in the ALMEMO® connector	Electrode terminal	For plug-on head S7/SN6 or SMEK (see variants)
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#### Type

ALMEMO® connecting cable with transducer (ALMEMO® connector, spray-coated)  
For probes with plug-on head S7/SN6 (coaxial connector, screw-fit):

Programming for pH probe

Cable length 2 meters

Cable length 5 meters

Programming for redox probes

Cable length 2 meters

Cable length 5 meters

Programming for pH or redox probe (1 probe connectable at a time)

Cable length 2 meters

Cable length 5 meters

#### Order no.

ZA9610AKY4  
 ZA9610AKY4L05

ZA9610AKY5  
 ZA9610AKY5L05

ZA9610AKY6  
 ZA9610AKY6L05



#### Type

ALMEMO® connecting cable with transducer  
For probes with SMEK plug-on head

Cable length 2 meters

Programming for pH probe with integrated temperature sensor NTC (30 kohm at 25 °C), linearization saved in ALMEMO® connector (only for current V6 ALMEMO® devices)

Programming for pH probe

Programming for redox probe

#### Order no.

ZA9640AKY8  
 ZA9610AKY8  
 ZA9610AKY9

## NTC temperature sensor for automatic temperature compensation when measuring pH



Connector programming designation \*T for ALMEMO® 2490 and 2590-2/-3S/-4S and (with effect from 07/2006) for ALMEMO® 2690/ 2890/ 5690/ 8590/ 8690

#### Type

Stainless-steel sheathed sensor (see page 07.06) Diameter 3.0 mm, length 250 mm, Hexagonal cable sleeve with 1.5 meters PVC cable and ALMEMO® connector

Safety hose made from PTFE (for aggressive media) Hermetically sealed on one side, inside diameter 3.0 mm, outside diameter 4.0 mm, length 700 mm

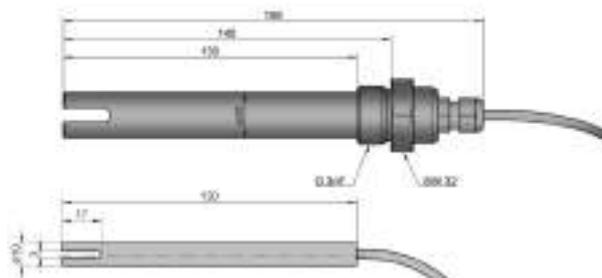
#### Order no.

FNA30L0250T  
 ZT9000000

## On request: Sensor for dissolved oxygen FYA 640-O2



## Conductivity Probe FYA641LFP1 / LFL1



### Applications:

Concentrated waste water, aggressive waters, general aqueous and partly aqueous solutions, beer, emulsions, electroplating, waters, concentrated acidic and alkaline solutions, corrosive acids and alkaline solutions, lacquers and paints, substances containing protein, soaps, detergents, suspensions, titrations in organic substances, environmental analysis.

### Technical Data

Measuring range:	0.01 to 20mS/cm LFL1 up to 10mS/cm	Shaft material:	PVC - C
Temperature sensor:	NTC, type N (10k at 25°C)	Shaft length/shaft diameter:	LFP1: 130mm/20mm LFL1: 130mm/10mm
Temperature compensation:	0 to +70°C, automatic	Fitting length / thread	only LFP1 145 mm / G $\frac{3}{4}$ "
Compensation coefficient:	1.9 linear	Maximum pressure	LFP1: 16 bar at 25 °C LFL1: not suitable for use under pressure
Cell constant:	approx. 1cm <sup>-1</sup>	Cable length:	1.5m
Electrode material:	special coal	Power supply:	8 to 12V through meas. instr.
Accuracy:	± 3% of meas. val. ± 0.1mS/cm	Current consumption:	approx ca. 3 mA
Nominal temperature:	25°C ± 3°C		
Operating temperature:	-5 to 70°C		
Minimum insertion depth:	30mm		

### Accessories

Reference solution 2.77mS/cm at 25°C 0.02mol KCl, 250ml

**Order no.**

**ZB96LFRL**

### Type (including manufacturer's test certificate)

Active conductivity probe with automatic temperature compensation, Built-in probe, G 3/4" thread, suitable for use under pressure up to 20mS/cm

Laboratory probe, not suitable for use under pressure up to 10mS/cm

Factory calibration KY90xx conductivity for measuring chain (sensor + device) (see chapter Calibration certificates)

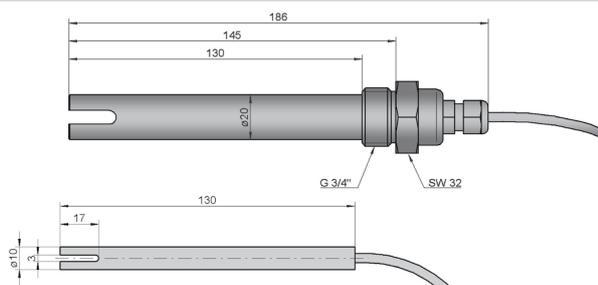
**Order no.**

**FYA641LFP1**

**FYA641LFL1**

# Water analysis

## Conductivity Probe FYA641LFP2 / LFL2



### Applications:

Low-salt waste water, general aqueous and partly aqueous solutions, fish tanks, emulsions, desalting/ion exchanger, beverages, waters, cold/boiler feed water, lacquers and paints, milk, samples with low ionic strength, substances containing protein, purest water, soaps, detergents, suspensions, drinking water, environmental analysis.

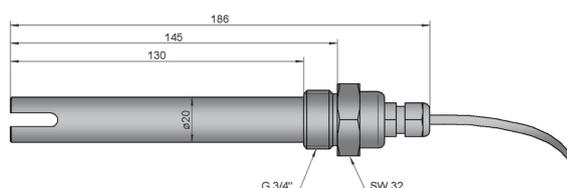
### Technical Data

Measuring range:	10 to 200 $\mu\text{S}/\text{cm}$	Shaft material:	PVC - C
Temperature sensor:	NTC, type N (10k at 25°C)	Shaft length/Shaft diameter:	LFP2: 130mm/20mm LFL2: 130mm/10mm
Temperature compensation:	0 to +70°C, automatic	Fitting length / thread	only LFP2 145 mm / G $\frac{3}{4}$ \"
Compensation coefficient:	1.9 linear	Maximum pressure	LFP2: 16 bar at 25 °C LFL2: not suitable for use under pressure
Cell constant:	approx. 1 $\text{cm}^{-1}$	Cable length:	1.5m
Electrode material:	special coal	Power supply:	8 to 12V through meas. instr.
Accuracy:	$\pm 3\%$ of meas. val. $\pm 1 \mu\text{S}/\text{cm}$	Current consumption:	approx. 3 mA
Nominal temperature:	25°C $\pm 3^\circ\text{C}$		
Operating temperature:	-5 to 70°C		
Minimum insertion depth:	30mm		

Zubehör	Order no.
Reference solution 147 $\mu\text{S}/\text{cm}$ at 25°C 0.001mol KCl, 250ml	ZB96LFRL2

Type (including manufacturer's test certificate)	Order no.
Active conductivity probe 0 ... 200 $\mu\text{S}/\text{cm}$ with automatic temperature compensation, Built-in probe, G $\frac{3}{4}$ \" thread, suitable for use under pressure Laboratory probe, not suitable for use under pressure Factory calibration KY90xx conductivity for measuring chain (sensor + device) (see chapter Calibration certificates)	FYA641LFP2 FYA641LFL2

## Conductivity Probe FYA641LFP3



### Applications:

Concentrated waste water, aggressive waters, general aqueous and partly aqueous solutions, beer, emulsions, electroplating, waters, concentrated acid and alkaline solutions, corrosive acids and alkaline solutions, lacquers and paints, substances containing protein, soaps, detergents, suspensions, titrations in organic substances, environmental analysis.

### Technical Data

Measuring range:	0 to 200 $\text{mS}/\text{cm}$	Shaft material:	PVC - C
Temperature sensor:	NTC, type N (10k at 25°C)	Shaft length:	145mm
Cell constant:	approx. 1 $\text{cm}^{-1}$	Shaft diameter:	20mm
Electrode:	4 electrodes, special coal	Fitting length / thread	130 mm / G $\frac{3}{4}$ \"
Accuracy:	$\pm 3\%$ of meas. val. $\pm 1 \text{mS}/\text{cm}$	Maximum pressure	16 bar at 25 °C
Nominal temperature:	25°C $\pm 3^\circ\text{C}$	Cable length:	1.5m
Operating temperature:	0 to 70°C	Power supply:	8 to 12V through meas. instr.
Minimum insertion depth:	30mm	Current consumption:	approx. 15 mA

Accessories	Order no.
Reference solution 111.8 $\text{mS}/\text{cm}$ at 25°C 1mol KCl, 250ml	ZB96LFRL3

Type (including manufacturer's test certificate)	Order no.
Conductivity probe 0 ... 200 $\text{mS}/\text{cm}$ without temp. compensation Factory calibration KY90xx conductivity for measuring chain (sensor + device) (see chapter Calibration certificates)	FYA641LFP3

## Digital probes for measuring conductivity FYD 741 LFE01 and FYD 741 LFP with ALMEMO® D7 plug



ALMEMO® 202

Just one single probe for measuring conductivity from very low (10  $\mu\text{S}/\text{cm}$ ) up to very high levels (500  $\text{mS}/\text{cm}$ )

4-contact graphite electrode with high linearity across the whole measuring range

Integrated NTC sensor for temperature compensation of measured conductivity values

Suitable for the latest ALMEMO® V7 devices, including professional measuring instrument ALMEMO® 202 and precision measuring instrument ALMEMO® 710.

### Technical data and functions

The digital conductivity probe provides this high level of precision irrespective of any extension cables used and of any processing in the ALMEMO® V7 display device / data logger.

Overall accuracy is determined exclusively by the conductivity electrode and the ALMEMO® D7 plug.

All parameters for the sensor can be programmed end-to-end via the programming menu on the ALMEMO® V7 measuring instrument. The desired measuring range can be selected and

temperature compensation can be activated or deactivated. The temperature coefficient of the solution to be measured, if known, can also be programmed.

The probe is delivered already adjusted and ready-to-use. The electrode's measured cell constant can also be entered, if so required, and / or the probe can be adjusted using a reference solution.

### Common technical data FYD 741 LFE01 and FYD 741 LFP ALMEMO® D7 plug with A/D converter

Measuring method	Electrical conductivity measurement with AC voltage (approx. 1 kHz)	Temperature coefficient	Natural surface water or linear in range 0.00 to 9,99
Measuring ranges		Linearization NTC	Calculated error-free (not an approximation)
Range DLF1	up to maximum 500.00 $\mu\text{S}/\text{cm}$ Resolution 0.01 $\mu\text{S}/\text{cm}$	Nominal temperature	+23 °C $\pm$ 2 K
Range DLF2	up to 50.000 $\text{mS}/\text{cm}$ Resolution 0.001 $\text{mS}/\text{cm}$ (factory default settings)	Temperature drift	0.004 % / K (40 ppm)
Range DLF3	with FYD 741 LFE01 up to 500.00 $\text{mS}/\text{cm}$ with FYD 741 LFP up to 200.00 $\text{mS}/\text{cm}$ Resolution 0.01 $\text{mS}/\text{cm}$	Refresh time	2.5 seconds
Range NTC	Resolution 0.01 K	Sleep mode on the device	possible with wakeup delay of 5 seconds
Temperature compensation	either automatic or non-compensated	Supply voltage	6 to 13 VDC, from ALMEMO® device (sensor supply voltage)
		Current consumption	approx. 10 mA

### Accessories

Reference solution for monitoring / calibration  
 Conductivity 147  $\mu\text{S}/\text{cm}$ , Container 250 ml  
 Conductivity 2.77  $\text{mS}/\text{cm}$ , Container 250 ml  
 Conductivity 12.88  $\text{mS}/\text{cm}$ , Container 250 ml  
 Conductivity 111.8  $\text{mS}/\text{cm}$ , Container 250 ml

### Order no.

ZB96LFR12  
 ZB96LFR14  
 ZB96LFR17  
 ZB96LFR13

## Digital probe for measuring conductivity FYD 741 LFP



Probe for process applications

General description and common technical data  
see previous page

### Technical data FYD 741 LFP

Uses	Process applications
Conductivity	10 µS/cm up to 200 mS/cm
Temperature	0 to +70 °C
Pressure	up to 16 bar under nominal conditions
Process connection	Thread G ¼-inch Fitted length 145 mm
Electrode type	4-contact graphite electrode electrically connected to the power supply (ALMEMO® device ground)
Cell constant	approx. 0.5 cm <sup>-1</sup>
Temperature sensor	NTC 10 kilohms, integrated
Accuracy	
Conductivity	±3% of meas. value ±0.2% of final value under nominal conditions
Temperature	±0.2 K under nominal conditions
Nominal conditions	+25 °C ±2 K
Minimum immersion depth	30 mm
Electrode shaft	Material PVC-C diameter 20 mm, length 130 mm
Connecting cable	length = 1.5 meters, permanently fitted, with ALMEMO® D7 plug

## Digital probe for measuring conductivity FYD 741 LFE01



Probe for laboratory applications

General description and common technical data  
see previous page

### Technical data FYD 741 LFE01

Uses	Laboratory applications
Conductivity	10 µS/cm up to 200 mS/cm, on demand up to 500 mS/cm
Temperature	0 to +80 °C
Pressure	Ambient pressure (unpressurized)
Electrode type	4-contact graphite electrode electrically connected to the power supply (ALMEMO® device ground)
Cell constant	approx. 0.5 cm <sup>-1</sup>
Temperature sensor	NTC 30 kilohms, integrated
Accuracy	
Conductivity	±2% of meas. value ±0.2% of final value under nominal conditions
Temperature	±0.2 K under nominal conditions
Nominal conditions	+25 °C ±2 K
Minimum immersion depth	30 mm
Electrode shaft	Material PC (+ABS) diameter 12 mm, length 120 mm
Connecting cable	length = 1 meter, permanently fitted, with ALMEMO® D7 plug

#### Variants

Digital probe for measuring conductivity, integrated temperature sensor, with process connection G ¼-inch, permanently fitted cable with ALMEMO® D7 plug,  
**probe for process applications**

#### Order no.

**FYD741LFP**

#### Variants

Digital probe for measuring conductivity, integrated temperature sensor, with permanently fitted cable with ALMEMO® D7 plug,  
**probe for laboratory applications**

#### Order no.

**FYD741LFE01**

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# Gas concentrations in the air



## Why is the Measurement of Room Air Quality So Important?

An unsatisfactory room air quality of indoor rooms (e.g. in offices) can easily cause tiredness, poor powers of concentration and even diseases to people. Indicator for the room air quality is the concentration

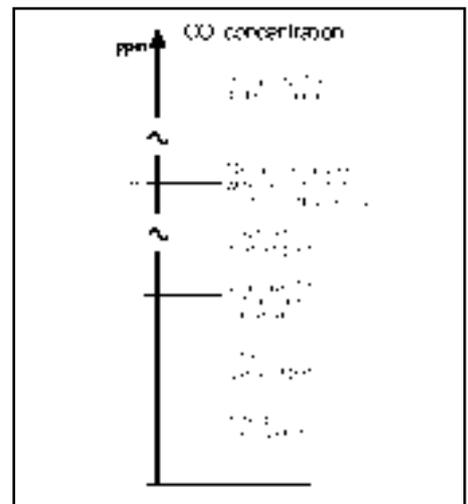
of specific gases in air. The most important ones include:

- Carbon dioxide (CO<sub>2</sub>)
- Carbon monoxide (CO)
- Oxygen (O<sub>2</sub>)
- Ozone (O<sub>3</sub>)

## CO<sub>2</sub>-Concentration

An important criterion for the evaluation of the room air quality is the CO<sub>2</sub> concentration. A CO<sub>2</sub> concentration, which is too high due to insufficient ventilation,

is experienced as stale or stagnant air. The illustration above shows the range of CO<sub>2</sub> concentrations that are relevant to a human.



## CO-Concentration

CO is produced when carbon is only partially combusted (fuel). CO is very dangerous for humans because it is at the

same time highly toxic - but invisible and odorless. Reasons for the production of CO in various combustion processes:

- deficiency of air
- too high excess of air
- too early cooling down of flame

### Effects of CO in the ambient air on the human body

CO concentration	Inhalation period and consequences
30 ppm 0.0003%	Maximum concentration in the workplace per 8-hour shift (German MAK value)
200 ppm 0.02%	Slight headache within 2 to 3 hours
400 ppm 0.04%	Headache within 1 to 2 hours, first in the forehead and temples, then spreading to the whole head
800 ppm 0.08%	Dizziness, nausea, and twitching limbs within 45 minutes, unconsciousness within 2 hours
1600 ppm 0.16%	Headache, dizziness, nausea within 20 minutes, death within 2 hours
3200 ppm 0.32%	Headache, dizziness, nausea within 5 to 10 minutes, death within 30 minutes
6400 ppm 0.64%	Headache and dizziness within 1 to 2 minutes, death within 10 to 15 minutes
12800 ppm 1.28%	Death within 1 to 3 minutes

### Applications

- measurement, control, and warning system in garages,
- monitoring of room air quality with respect to maximum permissible workplace concentration (MAK value)
- monitoring of outside air or of protected air systems in domestic and large public shelters.

# Gas concentrations in the air

## O<sub>2</sub>-Concentration

The inhaled air consists of vital oxygen at a ratio of 1:5. Oxygen is required for all oxidation processes; for combustion processes, as well as for silent oxidations. Examples include the rusting of iron, oxidations, which occur in living processes, or the decomposition of organic material. Additionally, all combustion processes that release energy require this gas, for example, heating systems or

aircraft engines. However, oxygen is also bound with any type of noxious fires such as forest and heath fires. Due to the permanent cycle of assimilation and photosynthesis in green plants when they are subject to sunshine, oxygen is continuously re-formed from carbon dioxide. The balance between oxygen consumption and oxygen production is disturbed by the continuously increasing

combustion of fossil combustibles. Therefore, many areas require control measurements of the oxygen content in the air, e.g. in air condition systems, air purifiers, oxygen rectifiers, greenhouses and oxygen incubators, as well as for exhaust emission tests, e.g. in the automotive industry.

## O<sub>3</sub>-Concentration

The ozone contained in the earth's atmosphere forms at altitudes of approximately 30km. It provides a protective shield around the earth and filters out approximately 50% of the solar UV radiation, particularly the short-wave range, which is dangerous for living organisms. However, ozone is toxic and an extremely aggressive trace gas that can cause major burns in human mucous

membranes when breathed in high concentrations. Therefore, control measurements for the ozone content in air must be performed in many areas, e.g. leakage tests in industry, protection of health and safety standards at work, mobile-based air quality measurements or for providing environmental data on advertising displays etc.

### Calculation Formulae

The following formulae are used for converting the O<sub>3</sub> measured value from ppb to µg/m<sup>3</sup>, depending on the current atm. pressure and the temperature.

Example:

20°C and 1013 hPa = factor 2

Ozone (µg/m<sup>3</sup>) = 2 x Ozone (ppb)

This is the nominal value for conversion from ppb to µg/m<sup>3</sup>.

$$\text{Ozone}(\mu\text{g}/\text{m}^3) = \frac{0,57 \times \text{Atm. Press. [hPa]}}{\text{Temperature [K]}} \times \text{Ozone (ppb)}$$

## Digital carbon dioxide sensor FYAD 00 CO2 with grip, integrated atmospheric pressure sensor for automatic atmospheric pressure compensation, and ALMEMO® D6 plug



- Digital CO<sub>2</sub> sensor with integrated signal processor
  - All sensor characteristics and adjustment data are stored in the CO<sub>2</sub> sensor itself.
  - The unique automatic calibration procedure (without fresh air intake) automatically compensates any natural ageing effects.
  - The sensor is very well protected against the effects of pollution by means of replaceable PTFE filter caps. Long-term stability is outstanding.
  - Automatic atmospheric pressure compensation is provided for pressure-dependent CO<sub>2</sub> concentrations by means of a digital atmospheric pressure sensor integrated in the grip.
  - The relevant ambient parameter, atmospheric pressure, is measured using the same sensor.
  - Long-term measuring operations can be performed with an ALMEMO® data logger in sleep mode; this applies only to current device types with sleep delay (180 seconds).
  - 2 primary measuring channels (real measurable variables) CO<sub>2</sub> concentration and atmospheric pressure
  - Freely selectable measurable variables Two measuring channels are programmed (at our factory). CO<sub>2</sub> concentration, average value (ppm), Atmospheric pressure (mbar, AP, p). Alternatively a further variable can be selected. CO<sub>2</sub> concentration, current value (ppm)
- The configuration is performed on the ALMEMO® V7 measuring instrument or directly on the PC using the USB adapter cable ZA1919AKUV (see chapter "ALMEMO® Network technology").

**General features and accessories, ALMEMO® D6 sensors:**  
see page 01.08

### Technical Data

Digital carbon dioxide (CO <sub>2</sub> ) sensor (including A/D converter)		Filter cap	PTFE Diameter 18 mm Length appr. 41 mm
Measuring principle	non-dispersive infrared (NDIR) technology	Sensor connector	Plug connection
Sensor	2-beam infrared measuring cell	Grip	with socket, integrated electronics
Measuring range		Dimensions:	Diameter 20 mm Total length including the sensor 245 mm
FYAD00CO2B10	0 to 10,000 ppm	ALMEMO® connecting cable	fitted cable, 2 meters With ALMEMO® D6 plug
FYAD00CO2B05	0 to 5,000 ppm	<b>Digital atmospheric pressure sensor (integrated in grip)</b>	
Accuracy		Measuring range	700 to 1100 mbar
FYAD 00-CO2B10	±(100 ppm +5 % of measured value)	Accuracy	±2.5 mbar (at 23 °C ±5 K)
FYAD 00-CO2B05	±(50 ppm +3 % of measured value)	<b>ALMEMO® D6 plug</b>	
Nominal conditions	+25 °C, 1013 mbar	Refresh rate	1 second for all four channels
Temperature dependence	typical 2 ppm CO <sub>2</sub> / K in range 0 to +50 °C	Supply voltage	6 to 13 VDC
Response time	<195 seconds	Current consumption	25 mA
Operative range	-40 to +60 °C / 0 to 95 % RH (non-condensing)		
Measuring interval	Moving average 165 seconds (= 11 current values of 15 sec.)		

### Type (including factory test certificate)

Digital CO<sub>2</sub> sensor with grip, fitted cable with ALMEMO® D6 plug, and integrated digital atmospheric pressure sensor

Measuring range 10 000 ppm

Measuring range 5 000 ppm

**FYAD00CO2B10**

Factory calibration KY96xx carbon dioxide concentration for digital sensor (see chapter Calibration certificates)

### Order no.

**FYAD00CO2B10**

**FYAD00CO2B05**

## Carbon Dioxide Probe FYA600CO2



- Since the gas is supplied by means of free convection, this is especially suitable for climatology measurements.
- Various measuring ranges up to 25%.

### Technical Data

Gas:	CO <sub>2</sub>	Power supply:	6.5 to 12VDC from the ALMEMO® device Operation with mains supply unit recommended !
Measuring principle:	IR optics	Current consumpt.	eff. 50mA/ max. 70mA
Measuring ranges:	nominal (% CO <sub>2</sub> ): 0 ... 2.5%, 0 ... 10%, 0 ... 25%	Settling time t90:	< 60s
Accuracy:	±2% of final value	Temperature coefficient:	typical -0.4% signal/K
Reproducibility:	±1% of final value	Temperature range:	5 to +40°C
Resolution:	(depending on measuring range) <200ppm at 2.5%	Relative humidity:	0 to 95%, noncondensing
Output:	0 ... 2V on ALMEMO® connector Linearization in ALMEMO® device	Dimensions:	W 96mm x H 36mm x D 64mm
Current output:	referred to GND	Weight:	241g
max. burden (load resist.):	400W	Connecting cable:	1.5m long, ALMEMO® connector

! Operation with the device in SLEEP mode is not possible!  
When operating more than one CO<sub>2</sub> probe on a single ALMEMO® device, these CO<sub>2</sub> probes will need their own external power supply ! On request we can offer a wide variety of power supply options to suit your particular measuring setup.

### Type

Carbon dioxide sensor including connecting cable 1.5m long for CO<sub>2</sub> measurements in air  
(Please specify measuring range !)

Factory calibration KY96xx carbon dioxide concentration for measuring chain (sensor + device) (see chapter Calibration certificates)

**Order no.**  
**FYA600CO2**

# Gas concentrations in the air

## Carbon Monoxide Probe ADOS 592 TOX



- Applications: For measurement, control and warnings in garages, for monitoring the air quality with respect to the maximum allowable concentration at work places (MAC value, e.g. in laboratories and engine test benches)

! Operation with the device in SLEEP mode is not possible!

### Technical Data

Gas:	CO	Transverse sensitivity:	< 2% by integrated filter
Measuring principle:	electrochemical reaction	Output:	4 ... 20 mA on ALMEMO® connector
Measuring range:	see types	Supply voltage:	from the ALMEMO® measuring instrument
Zero point error:	< 10 ppm CO	Ambient temperature:	-10 to +40°C, sensor temperature compensated in range
Gauge reading balance:	< 3 ppm CO	Air humidity:	0 to 90% non-condensing
Error of meas. value:	±3% of full scale value	Life span of the meas. cell:	approx. 2 years typical
Zero point drift:	< 2% (1 year)	Dimensions of meas. head:	Ø 80mm, height 80mm
Reproducibility:	< 2% (1 year)	Weight:	600g
Linearity:	< 2% of full scale value	Connecting cable:	1.5m, with ALMEMO® connector
Settling time $t_{90}$ :	< 60s		

### Ausführung (incl. factory test certificate) Order no.

Carbon monoxide sensor including connecting cable 1.5m long for CO measurements in air  
range: 0 ... 150 ppm

**FYA600COB1**

range: 0 ... 300 ppm  
range: 0 ... 5000 ppm  
range: 0 ... 5 Vol.%

**FYA600COB2**  
**FYA600COB3**  
**FYA600COB4**

## Oxygen Probe FYA600O2



- Examples from the range of applications: Measurements in air conditioning systems, air purifiers, oxygen rectifiers, greenhouses and oxygen incubators.
- Approved by PTB and approved for exhaust emission measurements in the automotive industry.

! A correction value can be stored in the ALMEMO® connector plug to compensate for the natural ageing of the probes, so optimum output characteristics can be ensured for the whole operating life.

### Technical Data

Gas:	O <sub>2</sub>	Operating life:	2 years, if operated in 20.9% O <sub>2</sub>
Measuring principle:	electrochemical cell	Nominal conditions:	20°C, 50% rH, 1013mbar
Measuring range:	1 ... 100% O <sub>2</sub> , linear	Temperature range:	-20 to +50°C
Accuracy :	1% O <sub>2</sub>	Temperature compensation:	effective in range -10 to +40°C
Resolution :	0.01% O <sub>2</sub>	Pressure range:	atm. pressure ±10%
Response time:	< 40s	Relative humidity:	0 to 99% non-condensing
Signal drift:	< 2% signal/month (typ. < 5% over operating life)	Connecting cable:	adapter cable 1.5m long
Offset voltage at 20°C:	< 20mV	Dimensions:	H 43 mm x Ø 29,3 mm

### Types

Oxygen sensor including connecting cable 1.5m long for O<sub>2</sub> measurements in air

### Order no.

**FYA600O2**

### For Reordering:

Oxygen sensor  
ALMEMO® connecting cable

**FY9600O2**  
**ZA9600A**

## Ozone Measuring Transducer FYA600O3



- Suitable for many measuring tasks where ozone measurements for control purposes were too expensive to date, e.g. for leakage tests in industry, for protection of health and safety standards at work, for mobile air quality measurements etc.
- Each ozone sensor is supplied with a manufacturer's test certificate.
- As a result of the high long-term stability, only small maintenance costs.

### Technical Data

Gas:	O <sub>3</sub> (ozone)	Power supply:	6 to 14V, stable
Measuring principle:	electrochemical three-electrode sensor	Current consumption:	pump on : 50 mA, typical pump off : 25 mA, typical pump blocked : 180 mA, typical
Measuring range:	0 ... 300 ppb	Overload capacity:	1 ppm
Detection limit	20 ppb	Expected useful life :	Sensor, typically 24 months (at 20 °C) pump, typically 6000 hours
Accuracy:	typically 5% of final value under nominal conditions (for intermittent operation)	Nominal conditions:	20°C, 30% r.H., 1013 mbar, no contaminations of the contact surfaces
Long term accuracy:	after 12 months under nominal conditions typically 5% of final value (for intermittent operation)	Operating range :	-20 to +40 °C / 30 to 80 % RH
Exposure period :	until specification is reached, at least 2 hours (at 200 ppb); for a prolonged period the device was in an ozone-free environment	Storage temperature:	0 to 20°C, at 30 to 80% RH non-condensing
Meas. interval:	pump on: 5min pump off: 10min	Dimensions:	L 180mm x W 125mm x H 90mm
Pump flow rate:	500ml/min	Connecting cable:	1.5m long with ALMEMO® connector programmed in ppb
Signal output:	0 ... 2V, load resistance > 100kΩ		

#### Type (including manufacturer's test certificate)

Ozone sensor including connecting cable 1.5m long for O<sub>3</sub> measurements in air

#### Order no.

FYA600O3

#### Option:

Pump in continuous operation (fixed factory setting)

OY9600O3D

Maintenance set :

new electro-chemical measuring cell, pump replacement, readjustment, including calibration certificate

ZB9600O3

# Gas concentrations in the air

## Gas probe for various gases ADOS 592 TOX



- Range:  
Measurement of gas concentration in air
- multiple ranges / Modelvariants

! Operation with the device in SLEEP mode is not possible!

### Technical Data

Gas:	see model variants	Output:	4 ... 20 mA on ALMEMO® connector
Measuring principle:	electrochemical reaction	Supply voltage:	from the ALMEMO® measuring instrument
Measuring range:	see model variants	Ambient temperature:	-10 to +40°C, sensor temperature compensated in range
Error of meas. value:	±3% of full scale value	Air humidity:	0 to 90% non-condensing
Zero point drift:	< 2% (1 year)	Life span of the meas. cell:	approx. 2 years typical
Reproducibility:	< 2% (1 year)	Dimensions of meas. head:	Ø 80mm, height 80mm
Linearity:	< 2% of full scale value	Weight:	600g
Settling time $t_{90}$ :	< 60s	Connecting cable:	1.5m, with ALMEMO® connector
Transverse sensitivity:	< 2% by integrated filter		

### Model variants (including factory test certificate)

### Order no.

Gas probe, including connecting cable, 1.5 meters, for measuring gas in air

#### Ammonia $\text{NH}_3$

Range: 0 ... 250 ppm

FYA600ANH3

#### Nitrogen dioxide $\text{NO}_2$

Range: 0 ... 30 ppm

FYA600ANO2

#### Nitrogen oxide $\text{NO}$

Range: 0 ... 50 ppm

FYA600ANO

#### Chlorine gas $\text{Cl}_2$

Range: 0 ... 50 ppm

FYA600ACL2

#### Sulfur dioxide $\text{SO}_2$

Range: 0 ... 20 ppm

FYA600ASO2B1

Range: 0 ... 50 ppm

FYA600ASO2B2

Range: 0 ... 250 ppm

FYA600ASO2B3

#### Hydrogen sulfide $\text{H}_2\text{S}$

Range: 0 ... 50 ppm

FYA600AH2SB2

Range: 0 ... 250 ppm

FYA600AH2SB3

#### Ethylene oxide $\text{C}_2\text{H}_4\text{O}$

Range: 0 ... 20 ppm

FYA600AC2H4OB1

Range: 0 ... 50 ppm

FYA600AC2H4OB2

Range: 0 ... 100 ppm

FYA600AC2H4OB3

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# Calibration certificates

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## What You Should Know About Calibration

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With the introduction of quality management standards all over the world, the requirements for measuring and test devices have become significantly more demanding. For example, the certification according to DIN EN ISO 9000+ requires an active quality management involving regular calibrations. With consideration of the specific environment this ensures a high reliability regarding the measuring results and the traceability of the measured values to the national standard.

## The Result of a Calibration

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1. The result of a calibration allows the evaluation of errors of dimension of the measuring instrument, measuring equipment or the setup of measuring instruments or the allocation of values to any scaled graduation marks.
2. The result of a calibration can be fixed in a document, which is often called a 'calibration report' or a 'calibration certificate'.
3. In many cases, the result of a calibration is specified as correction or 'calibration factor' or as 'calibration curve'.

## DAkKS Calibration

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- The calibration must only be performed within the range of those measurable variables, measuring ranges and measuring uncertainties, which are specified in the accreditation document. The customer receives a DAkKS Calibration certificate specifying the measured values, the corresponding measuring uncertainty, the designation of the calibration method, the environmental conditions and, as required, information on special measurement conditions. The calibrated object will be identified by a label (blue). DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025 (inter alia for the monitoring of production processes and the quality assurance applied to products).



DAkKS-calibrations outside the range of accreditation services provided by the DAkKS calibration laboratory at Ahlborn Mess- und Regelungstechnik GmbH are performed by DAkKS laboratories run by our various partners.

# Calibration certificates

## Factory Calibration

The calibration is performed according to comparison measurements with factory standards. Factory standards are (as far as possible) PTB or DAkkS / DKD calibrated measuring instruments, sensors or

measuring systems. The customer receives a factory calibration certificate specifying the measured values, the corresponding measuring uncertainty, the designation of the calibration method, the

environmental conditions and, as required, information on special measurement conditions. The calibrated object will be identified by a label.

! Factory calibrations outside the range of accreditation services provided by the calibration laboratory at Ahlborn Mess- und Regelungstechnik GmbH are performed by laboratories run by our various partners.

## How Often To Calibrate?

The time interval between calibrations highly depends on the specific application and is influenced by the following parameters:

- Permissible measuring tolerances
- Results of previous calibrations
- Environmental conditions
- Customer-specific requirements and definitions
- Application frequency
- Application conditions

## Calibration certificates - temperature and pressure - sensor deviation reduced to zero

The ALMEMO® measuring system of the AHLBORN Company has already repeatedly proven itself in a wide variety of application areas such as research and development. However, also quality audits, monitoring of measuring equipment and the system of calibration are other areas of application for the ALMEMO® measuring system. Whenever the traceability of measured values is indispensable, ALMEMO® is firmly established – whether as a reference

measuring instrument in calibration laboratories or as a traceable customer device.

The correction of a measuring chain is performed via a multi-point adjustment function.

During the calibration of the ALMEMO® measuring system, the sensor deviation is determined in every calibration point and then saved as correction value for that calibration point to the ALMEMO® plug.

The measured values for such multi-point adjusted sensors are then listed in the calibration certificate. This means that the identified sensor deviations are close to zero.

The measured value displayed on the ALMEMO® measuring instrument is the already corrected value and can be used further. It is not necessary to correct the measured value afterwards with the correction function that was established during the calibration.

Result	Anzeige Indication °C	Abweichung Deviation K	Messunsicherheit Uncertainty K
620,00	620,00	0,00	0,25
600,00	600,00	0,00	0,25
550,00	550,00	0,00	0,15
500,00	500,00	0,00	0,10
450,00	450,00	0,00	0,08
400,00	400,00	0,00	0,07
350,00	350,00	0,00	0,06
300,00	300,00	0,00	0,06
250,00	250,00	0,00	0,05
200,00	200,00	0,00	0,05
150,00	150,00	0,00	0,04
100,00	100,00	0,00	0,04
50,00	50,00	0,00	0,03

## Simulator KA 7531-1



**Simulator  
for Pt100, thermocouples,  
mV, V, mA, Hz  
Option PC interface**

### Technical features

- Universal manual simulator for simulating temperature sensors and process variables when testing measuring instruments, regulators, and other equipment
- Pt100 simulation with 5 fixed resistors in 4-conductor technology  
Voltage and thermocouples simulation with 15-bit D/A converter  
Current simulation with 15-bit D/A converter  
Frequency and pulse generator with quartz-crystal oscillator  
Continuity check with settable threshold
- All signals are available at the same time.
- Signals can be set either manually or automatically, in step or ramp form.
- All signals and all the programming can be shown on the illuminated graphics display.
- Connection of peripherals via ALMEMO® clamp connectors, cable with anti-kink protective sleeve and strain relief
- Power supply via battery or mains unit
- Modern, compact housing - also suitable for DIN top-hat rail mounting
- Option of PC-controlled operation via all ALMEMO® data cables.

### Technical data

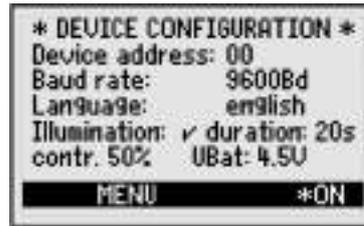
Signal Pt100	5 discrete resistance values in 4-conductor technology 0 / 50 / 100 / 200 / 300 °C
Accuracy	±0.1°C
Temperature drift	0.01°C / K
Signal voltage	15-bit DAC electr. isolated load > 1 MΩ
-10 to +60.000 mV	load > 100 kΩ
-3 to 10.000 V	Accuracy ± 0.05% of measured value ± 0.05% of final value
Accuracy	Temperature drift 20 ppm / K
Time constant	100 μs
Thermocouples	type K, N, T, J (ITS90) resolution: 0.1K type S, R, B (ITS90) resolution: 1K
Accuracy:	± 0.05% of measured value ± 0.05% final value
CJ - temperature:	-30..100°C
Signal current	15-bit DAC electr. isolated load < 500 Ω
0 to 20.0 mA	Accuracy ± 0.05% of measured value ± 0.05% of final value
Accuracy	Temperature drift 20 ppm / K
Time constant	100 μs

signal frequency	1..4000Hz, 0.01..10.00kHz, 0.1..40.0kHz, 1..100kHz
Pulse width	1 to 99 %
Accuracy	corresponds to the resolution
Pulse range	Period 2μs...99.999 ms, 2ms...99.999 s Pulse 1μs...99.998 ms, 1ms...99.998 s
Accuracy	0.01 %
Continuity	current approx. 1 mA
Threshold	0 to 1000 mV
Power supply:	10..12V DC
Battery:	3 Mignon Alcaline
Current consumption	(Battery): approx. 30 mA
Voltage and Current output: with illumination:	approx. 80mA + 4 x IOUT, approx. 40mA additional
Display	graphics 128 x 64 (55 x 30 mm)
Illumination	2 white LEDs
Keypad	7 silicone keys (4 soft-keys)
Housing	(LxWxH) 127 x 83 x 42 mm ABS (-10 to +70 °C), 290 g
Operating range:	
Operating temperature:	-10 ... +50 °C
(Storage temperature:	-20 ... +60 °C)
Ambient humidity:	10 ... 90 % rH (noncondensing)

## Displays (examples)



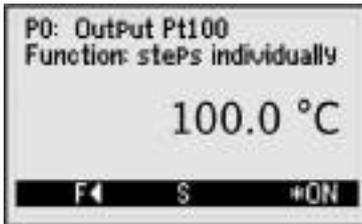
Main menu



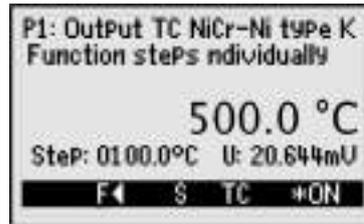
Device configuration



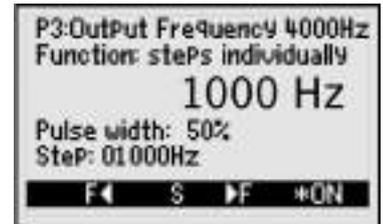
Continuity tester



Pt100 resistance values



NiCr-Ni step generator



Frequency pulse generator



0 to 10 V step generator



0 to 20 mA ramp generator

## Accessories

ALMEMO® clamp connector (for Pt100 or universal use)  
 ALMEMO® connecting cable with 2 banana plugs and 2 test probes  
 Mains adapter 12 V / 2 A  
 USB data cable, electrically isolated  
 V24 data cable, electrically isolated  
 Fixture for top-hat rail mounting  
 Rubber guard, gray

## Order no.

ZA1000TS  
 ZA1000TK  
 ZA1312NA10  
 ZA1919DKU  
 ZA1909DK5  
 ZB2490HS  
 ZB2490GS2

## Options

Factory calibration certificate for Simulator KA7531:  
 Electrical Calibration compared reference standards that are traceable to national standards.  
 Calibration in 6 ranges: Pt100 (5 points), and (3 points each) voltage 10 V, voltage 50 mV, current 20 mA, thermocouple type K, frequency Hz,  
 Package Offer  
 addressable PC interface

## Order no.

KE9006W  
 OA7531I

## Included as standard

Simulator, 5 sockets for Pt100, thermocouples or -4 to 10 V, 0 to 20 mA, frequency, continuity tester,  
 Graphics display and keypad, sockets DC, A1, batteries, including manufacturer's test certificate,  
 1 ALMEMO® clamp connector (for Pt100) and ALMEMO® and ALMEMO® connecting cable  
 with 2 banana plugs and 2 test probes

## Order no.

KA7531I

# Test instrument

## Adjustment Set for ALMEMO® Devices



### Type

#### Adjustment Set for ALMEMO® Devices

Input connector with 1.5 m cable and 4 banana plug (for connection to the calibrator of the customer) including ALMEMO® Adjustment instructions and software AMR-Control (CD)

### Order no.

ZA9090AKA

## Temperature

Calibration certificate for temperature measuring chains consisting of a contact temperature sensor and an instrument (also individual sensors). The calibration of the sensors or sensor + measuring instrument (measuring chain) is performed in a liquid bath, in a dry-well calibrator or in a climatic chamber.

### DAkkS Calibration Certificate

**Order no.**

DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025 (inter alia for the monitoring of production processes and the quality assurance applied to products).

Calibration is performed by a DAkkS authorized office which compares measured values against reference values based on national standards. .

Package offer (basic rate + 3 points 0°C, 50°C, 100°C)

**KT9021D**

#### Measuring points, freely selectable

Basic fee per certificate

**KT9001D**

Measuring point fee per sensor, one measuring point, temperature range up -100 to +1300 °C

**KT9011D**

Measuring point fee per sensor, one measuring point -196 °C

**KT9012D**

### Factory Calibration Certificate

Calibration compares measured values against reference values based on national standards.

Package offer (basic rate + 3 points 0°C, 50°C, 100°C)

**KT9021W**

#### Measuring points, freely selectable

Basic fee per certificate

**KT9001W**

Measuring point fee per sensor, one measuring point, temperature range up -100 to +1300 °C

**KT9011W**

Measuring point fee per sensor, one measuring point -196 °C

**KT9012W**

For first-time deliveries of temperature sensors of the ALMEMO® series, the identified sensor deviations are stored in form of correction values for zero point and slope in the sensor connecting plug in order to increase the accuracy in case of a calibration with 2 or more points. The measured values specified in the calibration certificate correspond to the corrected values. The correction is performed with DAkkS and factory calibrations.

## Calibration certificate - temperature - sensor deviation reduced to zero (see page 17.03)

### Multi-point adjustment for ALMEMO® measuring chains (preferably using Pt100 and NTC sensors)

**Order no.**

For the measurable variable temperature, for calibration packages and for single points (at least 2 temperature points, temperature point 0 °C obligatory), additional charge per sensor for factory / DAkkS calibration (German calibration service)

**KT9001DW**

Calibration and adjustment of the ALMEMO® measuring chain are performed for the whole of the sensors measuring range at the points in the calibration package.

Calibration and adjustment of the ALMEMO® measuring chain (preferable using Pt100 and NTC sensors) are performed on the selected temperature points (temperature point 0°C obligatory). Outside the calibrated range (below the lowest and above the highest calibration points) linear interpolation is performed up to the limits of the device's measuring range (e.g. Pt100 0.01 K from -200 to +400°C).

During the calibration of the ALMEMO® measuring system, the sensor deviation is determined in every calibration point and then saved as correction value for that calibration point to the patented ALMEMO® plug. The measured values for such multi-point adjusted sensors are then listed in the calibration certificate. This means that the identified sensor deviations are close to zero.

With thermocouples, as is generally the case, the indicated (adjusted) values in the calibration certificate are only valid if the device is in a stationary, thermally steady-state condition.

Only for device types ALMEMO® 2450 (not -L), 2490 (not -L), 2470, 2590-2/-3S/-4S/-2A/-4AS, 2690, 2890, 4390, 8590, 8690, 5690, 5790, ALMEMO® V7-Measuring instruments und ALMEMO® X6-Reference measuring instrument

These device types as of serial number H0802xxxx incorporate this function as standard; for device types of serial number H0801 and below a device firmware update is possible (noted at incoming inspection as part of the calibration service).

**OA0006U**

#### Advisory note :

On temperature sensors with special linearization or special measuring ranges saved to the ALMEMO® connector (e.g. ALMEMO® connector ZA9040SS3 NTC 0.001K or ALMEMO® connectors with KTY84, YSI400, or customized NTC) multi-point adjustment is not possible..

# Calibration certificates

## Infrared Temperature Measurement

Calibration certificate for temperature measuring chains consisting of an IR temperature sensor and an instrument (also individual sensors).

### DAkkS-Calibration Certificate

Order no.

DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025 (inter alia for the monitoring of production processes and the quality assurance applied to products).

Calibration is performed by a DAkkS authorized office which compares measured values against reference values based on national standards.

For IR transmitters MR7838, MR7842, MR78434, Hand-held IR devices MR7811, MR7814, ALMEMO® IR sensor FIAD43

Package offer: 3 temperature points, 25, 100, 200 °C

KI9201D

Calibration in the range -20°C to +550°C in 3 individually selectable measuring points

KI9168D

Calibration in the range +550°C to +1600°C in 3 individually selectable measuring points

KI9178D

1 additional measuring point, freely selectable, in the range -20 to +1600 °C

KI9168DP

### Factory Calibration Certificate

Calibration compares measured values against reference values based on national standards.

For IR transmitters MR7838, MR7842, MR7843, Hand-held IR devices MR7811, MR7814, ALMEMO® IR sensors FIA844, FIAD43

Package offer 3 temperature points, 25, 100, 200 °C

KI9201W

Calibration in the range -20°C to +550°C in 3 individually selectable measuring points

KI9168W

Calibration in the range +550°C to +1600°C in 3 individually selectable measuring points

KI9178W

1 additional measuring point, freely selectable, in the range -20 to +1600 °C

(but not between 550 and 600 °C)

KI9168WP

## Calibration certificates for meteorological transducers FMD7 60

### DAkkS/DKD calibration certificate

Order no.

The DAkkS/DKD calibration meets the requirements of DIN EN ISO/IEC 17025 for test equipment (i.a. for monitoring production processes or qualification assurance of products).

Calibration is performed by a DAkkS/DKD authorized office which compares measured values against reference values based on national standards.

Temperature and Relative Air Humidity (description, see further below)

KH9046D

Absolute pressure (description, see further below)

KD9214D

Wind velocity (also for FMD7 20)

Package offer (calibration in the range 4 to 16 m/s for a wind direction of approx. 0 °)

KV9225D

Wind direction (also for FMD7 20)

Package offer (calibration in the range 5 ° to 355 ° for a wind velocity of approx. 10 m/s)

KV9324D

### Factory Calibration Certificate

Calibration compares measured values against reference values based on national standards.

Temperature and Relative Air Humidity (description, see further below)

KH9156W

Absolute pressure (description, see further below)

KD9213W

Wind velocity and wind direction (also for FMD7 20)

Package offer (calibration in the range 2 to 50 m/s. For wind velocities in the range of 2 to 50 m/s

the deviations of the wind velocity and the wind direction are calculated from the root-mean-square of the measured values taken from different directions.)

KV9425W

## Relative Air Humidity for Capacitive Humidity Sensors

Calibration certificate for humidity measuring chains consisting of a capacitive humidity sensor and measuring instrument (also individual sensors).

### Factory Calibration Certificate

Order no.

Calibration compares measured values against reference values based on national standards.

Calibration is performed in a humidity generator / climate chamber at an ambient temperature of approx. 25° C.

Package offer

(Basic rate + 3 humidity points 11% / 53% / 75% r.H. + 1 temperature point at approx. 25°C)

KH9046 W

For calibration at other temperatures, see below !

## Relative Air Humidity for capacitive humidity sensors / psychrometer

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Calibration certificate for humidity measuring chains consisting of capacitive humidity sensor / psychrometer and measuring instrument.

### DAkkS Calibration Certificate

**Order no.**

The DAkkS/DKD calibration meets the requirements of DIN EN ISO/IEC 17025 for test equipment (i.a. for monitoring production processes or qualification assurance of products).

Calibration is performed by a DAkkS/DKD authorized office which compares measured values against reference values based on national standards.

Calibration is performed in a humidity generator / climate chamber at an ambient temperature of approx. 25 °C.

Package offer (Basic rate + 3 humidity points 20%/53%/75% r.H. + 1 temperature point at approx. 25 °C) **KH9046D**

Package offer (Basic rate + 2 humidity points 30% / 75% r.H. + 1 temperature point at approx. 25°C) **KH9146D**

### Factory Calibration Certificate

Calibration compares measured values against reference values based on national standards.

Calibration is performed in a humidity generator / climate chamber at an ambient temperature of approx. 25 °C.

Package offer (Basic rate + 3 humidity points 20%/53%/75% r.H. + 1 temperature point at approx. 25 °C) **KH9156W**

Package offer (Basic rate + 2 humidity points 30 % / 75 % r.H. + 1 temperature point at approx. 25 °C) **KH9146W**

## Relative air humidity at temperatures up to +95 °C

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### DAkkS calibration certificate for temperatures up to +95° C

**Order no.**

DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025 (inter alia for the monitoring of production processes and the quality assurance applied to products).

For capacitive humidity sensors and psychrometers. Calibration is performed by a DAkkS authorized office which compares measured values against reference values based on national standards. Calibration is performed in a humidity generator / climate chamber by a DAkkS authorized office.

#### Measuring points, freely selectable

Basic rate **KH9166D**

Points rate per sensor for 1 climate point  
Temperature in the range +10 to +95 °C and humidity in the range 10% to 95% RH **KH9166DP**

Measuring points rate per sensor for 1 temperature point:  
Temperature in the range +0 to +95 °C **KH9166DT**

### Factory calibration certificate for temperatures up to +95 °C

For capacitive humidity sensors and psychrometers. Calibration compares measured values against reference values based on national standards. Calibration is performed in a humidity generator / climate chamber.

#### Measuring points, freely selectable

Basic rate **KH9166W**

Points rate per sensor for 1 climate point  
Temperature in the range +10 to +95 °C and humidity in the range 10% to 95% RH **KH9166WP**

Measuring points rate per sensor for 1 temperature point:  
Temperature in the range +0 to +95 °C **KH9166WT**

## Dew point

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Calibration certificate - for dewpoint sensor only FHA646DTC1 / MT8716DTC1.

### Factory Calibration Certificate

**Order no.**

Factory calibration certificate

Calibration is performed based on measurement comparison at an ambient temperature of approx. 25 °C.

basic rate + 1 dew point in the range -60 to +20 °C dew point **KH9316W**

Supplement for KH9316W  
1 additional dew point in the range -60 to +20 °C dew point **KH9316WP**

# Calibration certificates

## Pressure

Calibration according to DIN 16005/16086.

This calibration can be performed in 5 or 10 measuring points with pressure transducers or transducer + measuring instrument (measuring chain): to 100bar, medium: gas to 700bar, medium: oil

### DAkKS Calibration Certificate

**Order no.**

DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025 (inter alia for the monitoring of production processes and the quality assurance applied to products).

Calibration is performed by a DAkKS authorized office which compares measured values against reference values based on national standards.

Positive overpressure in the range 0 to 700 bar, 10 points

**KD9012D**

Positive and negative overpressure for pressure sensors in the range -1 to 700 bar, 10 points

**KD9014D**

Absolute pressure in the range from 0.03bar to 700bar, 10 points

**KD9112D**

### Factory Calibration Certificate

Calibration compares measured values against reference values based on national standards.

Positive overpressure in the range 0 to 700 bar, 10 points

**KD9012W**

Positive overpressure in the range 0 to 700 bar, 5 points

**KD9013W**

Positive and negative overpressure for pressure sensors in the range -1 to 700 bar, 10 points

**KD9014W**

Absolute pressure in the range from 0.03bar to 700bar, 10 points

**KD9113W**

Absolute pressure in the range from 0.03bar to 700bar, 5 points

**KD9112W**

## Calibration certificate - pressure - sensor deviation reduced to zero (see page 17.06)

### Multi-point adjustment for ALMEMO® measuring chains

**Order no.**

For the measurable variable pressure, for calibration packages, additional charge per sensor for factory / DAkKS calibration

**KD9001DW**

For the ALMEMO® measuring chain, calibration and adjustment are carried out in the entire measuring range of the sensor at the points of the calibration package.

During the calibration of the ALMEMO® measuring system, the sensor deviation is determined in every calibration point and then saved as correction value for that calibration point to the ALMEMO® plug. The measured values for such multi-point adjusted sensors are then listed in the calibration certificate. This means that the identified sensor deviations are close to zero.

Only for device types ALMEMO® 2450 (not -L), 2490 (not -L), 2470, 2590-2/-3S/-4S/-2A/-4AS, 2690, 2890, 4390, 8590, 8690, 5690, 5790, ALMEMO® V7 measuring instruments and ALMEMO X6 reference measuring instrument.

These device types as of serial number H0802xxxx incorporate this function as standard; for device types of serial number. H0801 and below, a device firmware update is possible (noted at incoming inspection as part of the calibration service). **OA0006U**

## Absolute pressure for digital atmospheric pressure sensor FDAD12SA

Calibration certificate for barometric pressure sensors integrated in the ALMEMO® device or in the ALMEMO® D6 plug

### DAkKS Calibration Certificate

**Order no.**

DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025 (inter alia for the monitoring of production processes and the quality assurance applied to products).

Calibration is performed by a DAkKS authorized office which compares measured values against reference values based on national standards.

Absolute pressure 5 points in the range 700 to 1100 mbar

**KD9213D**

Absolute pressure 10 points in the range 700 to 1100 mbar

**KD9214D**

### Factory Calibration Certificate

Calibration compares measured values against reference values based on national standards.

Absolute pressure 5 points in the range 700 to 1100 mbar

**KD9213W**

Absolute pressure 10 points in the range 700 to 1100 mbar

**KD9214W**

## Air Flow

Calibration certificate for rotating vanes, Pitot tubes and thermoanemometers.

### DAkkS Calibration Certificate

**Order no.**

DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025 (inter alia for the monitoring of production processes and the quality assurance applied to products).

Calibration is performed in a wind tunnel based on measurement comparison against a laser Doppler anemometer by a DAkkS authorized office.

Package offer (Basic rate + 5 points in the range 0,2 m/s to 50 m/s)

**KV9075D**

Supplement to KV9075D: 1 additional measuring point

**KV9075DP**

### Factory Calibration Certificate

The calibration can be performed with the sensor and the meas. instrument (meas. chain). Calibration in a wind tunnel.

Reference standards: Wind tunnel and reference rotating vanes (calibrated acc. to the laser-Doppler method).

Package offer (basic rate + 3 points 0.5m/s / 5m/s / 10m/s)

**KV9025W**

Package offer (basic rate + 3 points 5m/s / 10m/s / 19m/s) FVA645TH3: 15m/s

**KV9035W**

Package offer (basic rate + 3 points 7m/s / 20m/s / 30m/s)

**KV9045W**

Package offer (basic rate + 3 points 0.5m/s / 1m/s / 1,75m/s)

**KV9055W**

Package offer (basic rate + 3 points 0.5m/s / 0.8m/s / 1m/s)

**KV9065W**

### Measuring points, freely selectable

Basic rate

**KV9005W**

Per measuring point and sensor Meas. range 0.5m/s to 40m/s.

**KV9015W**

## Flow measurement in liquids

Calibration certificate for turbine flow meters or flow sensors

### DAkkS Calibration Certificate

**new**

**Order no.**

DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025 (inter alia for the monitoring of production processes and the quality assurance applied to products).

Calibration is performed by a DAkkS authorized office which compares measured values against reference values based on national standards.

Calibration of the volume flow rate in l/min (up to maximum 200 l/min) in the flow test bench.

Measuring medium: Water

Calibration at 5 measuring points, logarithmically distributed within the measuring range of the sensor.

For recalibration:

calibration of the current state. Package offer

**KV9145D**

linked to the new delivery of the flowmeter for liquids:

determination of the K factor, programming of the ALMEMO plug, calibration of the original state.

Package offer

**KV9145DE**

### Factory Calibration Certificate

**Order no.**

Calibration compares measured values against reference values based on national standards.

Calibration of the volume flow rate in l/min (up to maximum 200 l/min) in the test chamber

Measuring medium: Water

Calibration at 3 measuring points 1 point each at start / middle / end of sensor range

Package offer

**KV9115W**

Supplement to KV9115W 1 additional measuring point in the sensor's measuring range

**KV9115WP**

# Calibration certificates

## Conductivity

Calibration certificate for conductivity measuring chains.

### Factory Calibration Certificate

Order no.

Calibration compares measured values against reference values based on national standards.

Package offer for conductivity probe FYA641LF /LFP1  
(Basic rate + 3 points 0.5mS / 2.77mS / 10mS)  
(Basic rate + 2 points 2.77mS / 12.8mS)

KY9041W  
KY9044W

Package offer for conductivity probe FYA641LF2 /LFP2  
(Basic rate + 3 points 10µS / 147µS / 190µS)

KY9042W

Package offer for conductivity probe FYA641LF3 /LFP3  
(Basic rate + 3 points 5mS / 50mS / 111,8mS)

KY9043W

Package offer for digital conductivity probe FYD7 41-LF  
(Basic rate + 3 points 147 µS / 12,8 mS / 111,8 mS)

KY9045W

## Gas Concentration

Calibration certificate for CO<sub>2</sub>

### ÖKD Calibration Certificate

Order no.

ÖKD calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025 (inter alia for the monitoring of production processes and the quality assurance applied to products).

Calibration is performed by a ÖKD authorized office which compares measured values against reference values based on national standards.

Package offer for CO<sub>2</sub> probe FYAD00CO2B10 (3 measuring points at approx. 1000 / 4000 / 7000 ppm)

KY9626D

Package offer for CO<sub>2</sub> probe FYAD00CO2B05 (3 measuring points at approx. 500 / 2500 / 4500 ppm)

KY9627D

### Factory Calibration Certificate

Order no.

Calibration is performed based on measurement comparison against a reference gas specified by the manufacturer.

Package offer for CO<sub>2</sub> probe FYA600CO2 (approx. 10 measuring points)

KY9620W

## Measurable Variables for Optical Radiation

Calibration certificate for broad-band light detectors

### Factory Calibration Certificate

single point calibration of absolute size  
(not for probes FLA613GS / UVA / UVB / VLM / VLK / UVAK, FLA623x)

KL9033W

Calibration of absolute variable in 3 points  
(only for probes FLA613GS / UVA / UVB / VLM / VLK / UVAK, FLA623x)

KL9034W

## Optical Speed Sensors

Calibration certificate for contactless tachometers.

### DAkKS Calibration Certificate

Order no.

DAkKS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025 (inter alia for the monitoring of production processes and the quality assurance applied to products).

Calibration is performed by a DAkKS authorized office which compares measured values against reference values based on national standards.

Calibration of the optical transducer at 8 measuring points  
(not applicable for the tachometer probe FUA919-MF)

KU9029D

### Factory Calibration Certificate

Calibration compares measured values against reference values based on national standards.

Calibration of the optical transducer at 8 measuring points  
(not applicable for the tachometer probe FUA919-MF)

KU9029W

## Force

Calibration for tension and compression sensors

### Factory calibration certificate

Order no.

Calibration is performed based on the measurement comparison method for Ahlborn force transducers;

4 series of measuring operations upwards and 2 series downwards

3 steps (0%, 20%, 60%, 100% of final value) Tension or compression (indicate direction), up to 1 kN

KK9021W

3 steps (0%, 20%, 60%, 100% of final value) Tension or compression (indicate direction), up to 10 kN

KK9031W

3 steps (0%, 20%, 60%, 100% of final value) Tension or compression (indicate direction), up to 100 kN

KK9041W

3 steps (0%, 20%, 60%, 100% of final value) Tension or compression (indicate direction), up to 1000 kN

KK9051W

## Electrical Calibration for all ALMEMO® measuring instruments with interface

### DAkkS calibration certificate

Order no.

DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025 (inter alia for the monitoring of production processes and the quality assurance applied to products).

Calibration is performed by a DAkkS authorized office which compares measured values against reference values based on national standards.

Full calibration of ALMEMO device in 9 measuring ranges

2.6 V (volt), 55 mV (mV), 26 mV (mV1), 260 mV (mV2), NiCr-Ni (NiCr), Pt100 0.1 K (P104), Pt100 0.01 K (P204), NTC type N (NTC), relative humidity, capacitive (% RH)

Package offer

KE9005D

### Factory calibration certificate

Calibration compares measured values against reference values based on national standards.

Full calibration of ALMEMO device in 9 measuring ranges

2.6 V (volt), 55 mV (mV), 26 mV (mV1), 260 mV (mV2), NiCr-Ni (NiCr), Pt100 0.1 K (P104), Pt100 0.01 K (P204), NTC type N (NTC), relative humidity, capacitive (% RH)

Package offer

KE9005W

## Electrical Calibration of Measuring and Indicating Devices

Calibration certificate for all devices of the THERM and ALMEMO® series.

### DAkkS Calibration Certificate

Order no.

DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025 (inter alia for the monitoring of production processes and the quality assurance applied to products).

Calibration is performed by a DAkkS authorized office which compares measured values against reference values based on national standards.

The calibration is performed at approx. 10 measuring points.

Calibration for one measuring range

KE9010D

Each further measuring range

KE9020D

Calibration of a measuring chain using ALMEMO® adapter cable ZA9603AKx, AC voltage or ALMEMO® measuring module ZA990xABx, AC / DC voltage, up to 400 V (50 Hz), or AC / DC current, up to 10 A (50 Hz) Package offer, approx. 10 points

KE9030D

### Factory Calibration Certificate

Calibration compares measured values against reference values based on national standards.

The calibration is performed at approx. 10 measuring points.

Calibration for one measuring range

KE9010W

Each further measuring range

KE9020W

Calibration of a measuring chain using ALMEMO® adapter cable ZA9603AKx, AC voltage or ALMEMO® measuring module ZA990xABx, AC / DC voltage, up to 400 V (50 Hz), or AC / DC current, up to 10 A (50 Hz) Package offer, approx. 10 points

KE9030W

