

# 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, exponent, 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

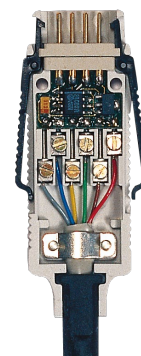
		Measuring inputs	Expansions	Display	Graphics display	Data logger function	Integrated memory	Interface / outputs	Precision class	Measuring rate (mops) max.	Measuring ranges	Multi-point adjustment	Portable device	Desktop device	Fitted device	Catalog page
<b>Compact measuring instrument</b>																
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

<b>Inputs</b> Channel switching between input sockets for analog sensors  Cold junction compensation (CJC) Nominal temperature Sensor power supply Self-calibration Monitoring functions	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 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
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		Basic measuring instruments	Professional measuring instruments	Precision measuring instruments	
Precision class	C	B	A	AA	
ALMEMO® series	2450, 2420	24900	2470, 2790 2590A	4390	500, 710, 809, 2690A, 2890, 5690 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	-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	-1.9 to +2.9 V
Overload	-4 to +5 V	-2 to +5 V	-2 to +5 V	± 12V	± 12V
Input current	< 2nA	< 10nA	100pA	Meas. range 2.6 V: 500 nA in all other meas. ranges 500 pA	100pA
Measuring current		Pt100/1000: 0.3mA	Pt100: 1mA, Pt1000: 0.1mA	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

ALMEMO® socket A1	<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“)
ALMEMO® socket A2	<b>Networking A1/A2</b>	ALMEMO® network cable (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-CO <sub>2</sub> (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

## 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	FWA xxx T	X*	X*	X*	X
Displacement gauge, potentiometric	FWA 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)