

### 3. ALMEMO®- Sensors

On ALMEMO® measuring instruments, with some 65 measuring ranges, it is now possible to directly connect an even greater number of sensors / transducers and to read out the exact measured values with immediate effect - without having first to make appropriate settings on the device. All standard sensors with an ALMEMO® connector usually have the measuring range, units, and any necessary scaling already programmed. The associated measuring channels are activated automatically and then appropriately set by the sensor. A mechanical coding system ensures that sensors and output modules can only be connected to the correct sockets and in the correct positions. The following Sections describe in further detail how to use such sensors and how to connect your own sensors.

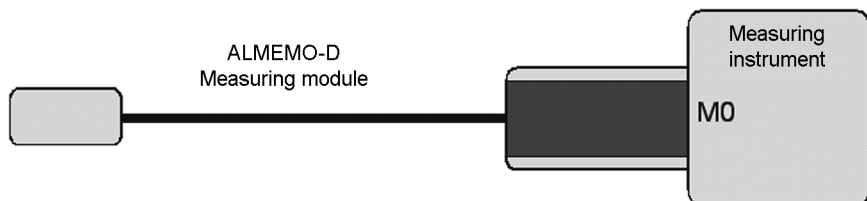
#### 3.0 General

With analog sensors the electrical signal is acquired and evaluated according to the measuring range in the device itself. There are also digital sensors; these are mostly for digital signals and are assigned the measuring range "DIGI". These have their own microcontroller incorporated in the connector; this edits the measured values and sends the results to the measuring instrument in digital form via the I2C bus. A sensor in the new digital ALMEMO® D series has two interfaces and can thus also be operated independently as a stand-alone device in its own right; (see Section 3.0.1).

All ALMEMO® sensors are adjustable; i.e. a sensor's correction values can be permanently stored in the connector itself; (see Section 6.3.10). If your connector has an enlarged EEPROM (E4), multi-point correction is also possible; (see Section 6.3.13). With DKD and factory calibrations such deviations can be stored in the connector as correction values with immediate effect; (DKD = Deutscher Kalibrier-Dienst = German calibration service).

##### 3.0.1 Digital ALMEMO®-D Sensors

In the new ALMEMO® D series of digital sensors and modules the connector incorporates a second serial interface. The D series can thus not only be connected to any ALMEMO® device and operated as a sensor but also, with its own address and standard ALMEMO® protocol, be scanned and networked as a stand-alone device in its own right. Especially suitable as data cable is the new USB cable with its own 9V power supply (order no. ZA1919-DKUV). To extend the operating length of these sensors there is also a range of extension cables (ZAD999-VKxx); these are largely interference-proof and use the serial interface with an RS422 driver and CRC protocol.

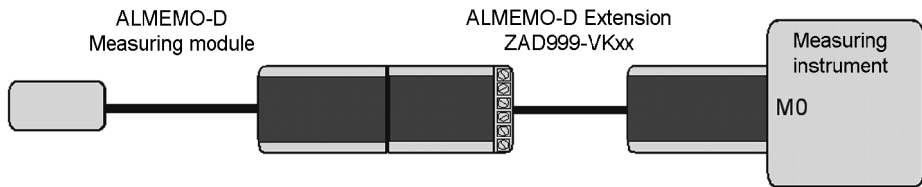


**Uses:****1. Normal digital sensor - on every ALMEMO® device**

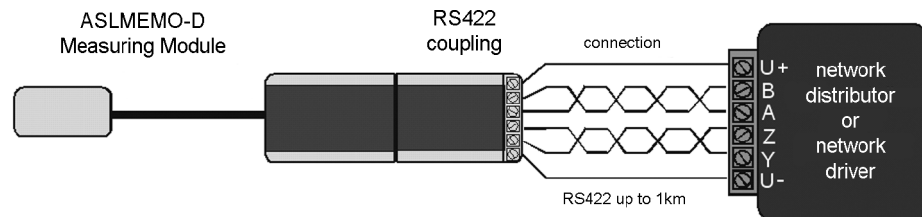
The sensor is powered via the measuring instrument itself; the measuring instrument also processes the sensor data coming from the EEPROM.

**2. Extension**

The operating length of a digital sensor can be extended by means of an intelligent extension cable connected via the serial interface with RS422 drivers. Only the measured data is transferred from the sensor to the measuring instrument; sensor data is processed by the measuring instrument itself.

**3. Direct connection to an ALMEMO® network via the serial interface**

ALMEMO® RS422 network distributors usually have a free slot. Here the ALMEMO® D measuring module can be connected directly using the RS422 coupling (ZA5099-FBV). In this configuration the sensor operates as an ALMEMO® device with its own address and the sensor data is processed by the sensor microcontroller; scaled data is output at the interface using the ALMEMO® protocol.

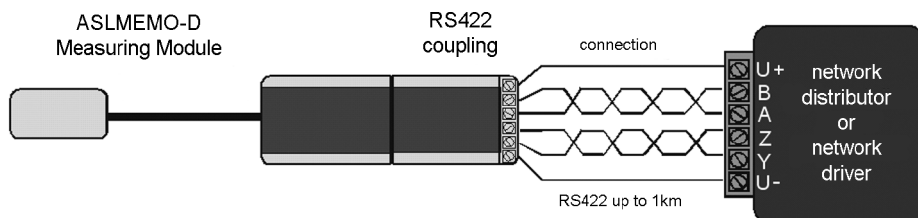


In order to operate in a network all devices must be set to the same baud rate but each be assigned its own unique address xx. This address is programmed in the measuring module using the command f9 Gxx. Only one module must be connected at any one time; several modules together would cause address duplicates.

**4. Direct connection to a PC via the serial interface**

Direct connection to a PC including power supply is possible via the USB data and supply cable ZA1919-DKUV. This requires coupling cable ZA5099-KK with RS422 drivers. Configuration software AMR-Control or data acquisition

software Win-Control can be used; (data can thus be acquired via several interfaces at the same time).



Interface commands supported (see chap. 6):

## Outputs

Individual measured values  
All measured values  
Device version  
Programming

## Commands

p, P01  
s, S1  
t0, f1 t0  
P00, P15, f2 P15 (partial dummy); P19 (dummy)

## Inputs:

Device addressing Gxx  
Programming the device address f9 Gxx Only one device at the interface !  
Baud rate setting f1 bx (x 6 = 9.6, 7 = 57.6, 8 = 115.2 kbaud)  
Output format N0, N2  
Input channel Exx  
Measuring and input channel Mxx  
Base value O(-)xxxxx  
Factor Fxxxxx  
Zero point f1 O(-)xxxxx  
Gain f1 Fxxxxx

## 3.0.2 Sensor overview

Sensor / transducer	Sensor type	ALMEMO connector		Abbreviation Units	
	Order no.	Type	Order no.		
Resistance-based temperature sensors					
Pt100-1, 4 conductors	FP Axxx	Normal	ZA 9030-FS1	P104	°C
Pt100-2, 4 conductors	FP Axxx	Normal	ZA 9030-FS2	P204	°C
Pt1000-1, 4 conductors (with element flag 1)		Normal	ZA 9030-FS4	P104	°C
Pt1000-2, 4 conductors (with element flag 1)		Normal	ZA 9030-FS5	P204	°C
Ni100 4 conductors		Normal	ZA 9030-FS3	N104	°C
Ni1000 4 conductors		Normal	ZA 9030-FS6	N104	°C
Ntc type N	FN Axxx	Normal	ZA 9040-FS	Ntc	°C
2 x NTC type N		Normal	ZA 9040-FS2	Ntc	°C
NTC type N 0,001K*		Normal	ZA 9040-SS3	Ntc3	°C
KTY 84 *		Normal	ZA 9040-SS4	KTY	°C
YSI 400 *			ZA 9641-SS	NtcY	°C
Thermocouples					
NiCr-Ni (K)	FT Axxx	Thermo	ZA 9020-FS	NiCr	°C
NiCr-Ni (K) Measuring module, el. isol., 4 kV <sup>o</sup>		Module	ZA D950-ABK	DIGI	°C
NiCrSi-NiSi (N)		Thermo	ZA 9020-FSN	NiSi	°C

Fe-CuNi (L)		Thermo	ZA 9000-FSL	FeCo	°C
Fe-CuNi (J)		Thermo	ZA 9000-FSJ	IrCo	°C
Cu-CuNi (U)		Thermo	ZA 9000-FSU	CuCo	°C
Cu-CuNi (T)		Thermo	ZA 9000-FST	CoCo	°C
PtRh10-Pt (S)	FS Axxx	Normal	ZA 9000-FSS	Pt10	°C
PtRh13-Pt (R)		Normal	ZA 9000-FSR	Pt13	°C
PtRh30-PtRh6 (B)		Normal	ZA 9000-FSB	EL18	°C
AuFe-Cr		Normal	ZA 9000-FSA	AuFe	°C
W5Re - W26Re (C)*		Normal	ZA 9000-SSC	Wr26	
Heat flow W/m²	FQ Axxx	Normal	ZA 9007-FS	mV 2	Wm
DC Voltage					
55 millivolts DC		Normal	ZA 9000-FS0	mV	mV
26 millivolts DC		Normal	ZA 9000-FS1	mV 1	mV
260 millivolts DC		Normal	ZA 9000-FS2	mV 2	mV
2.6 volts DC		Normal	ZA 9000-FS3	VoIt	V
26 volts DC		Divider	ZA 9602-FS	VoIt	V
2 x 26 volts DC (without el. isol.)		Divider	ZA 9602-FS2	VoIt	V
Differential measurement, sensor supply voltage 7..9V					
Difference 55 millivolts DC		Normal	ZA 9000-FS0D	D 55	mV
Difference 26 millivolts DC		Normal	ZA 9000-FS1D	D 26	mV
Difference 260 millivolts DC		Normal	ZA 9000-FS2D	D260	mV
Difference 2.6 volts DC		Normal	ZA 9000-FS3D	D2.6	V
Differential amplifier for measuring bridges Sensor supply 5 V stable					
Difference 55 millivolts DC		Bridge	ZA 9650-FS0	D 55	mV
Difference 26 millivolts DC Amplification=10		Bridge	ZA 9650-FS1V	D260	mV
Difference 260 millivolts DC Amplification=10		Bridge	ZA 9650-FS2V	D2.6	mV
Difference 2.6 Volt DC		Bridge	ZA 9650-FS3	D2.6	V
Differential measurement Sensor supply voltage with DC/DC 12 V					
Difference 55 millivolts DC		V12	ZA 9600-FS0V12	D 55	mV
Difference 26 millivolts DC		V12	ZA 9600-FS1V12	D 26	mV
Difference 260 millivolts DC		V12	ZA 9600-FS2V12	D260	mV
Difference 2.6 volts DC		V12	ZA 9600-FS3V12	D2.6	V
Difference 26 volts DC		V12divider	ZA 9602-FS3V12	D2.6	V
Quick-action, overload-proof DC measuring module, electr. isolated , 4 kV					
2.0 volts DC 1kHz		Module	ZA 9900-AB2	DIGI	V
20 volts DC 1kHz		Module	ZA 9900-AB3	DIGI	V
200 volts DC 1kHz		Module	ZA 9900-AB4	DIGI	V
400 volts DC 1kHz		Module	ZA 9900-AB5	DIGI	V
DC					
32 milliamperes DC		Shunt	ZA 9601-FS1	mA	mA
Percent (4-20mA DC)		Shunt	ZA 9601-FS2	%	%
2 x 32 milliamperes DC (without electr. isolation)		Shunt	ZA 9601-FS3	mA	mA
2 x Percent (4-20mA DC) (without electr. isolation)		Shunt	ZA 9601-FS4	%	%
Differential measurement, sensor supply voltage 7 to 9 V					
Difference 32mA		Shunt	ZA 9601-FS5	mA	mA
Difference Percent		Shunt	ZA 9601-FS6	%	%
Differential measurement Sensor supply voltage with DC/DC 12 V					
Difference 32mA		V12Shunt	ZA 9601-FS5V12	mA	mA
Difference % (4 - 20%)		V12Shunt	ZA 9601-FS6V12	%	%
Quick-action, overload-proof DC measuring module, electr. isolated , 4 kV					
20 mA DC 1kHz		Module	ZA 9901-AB1	DIGI	mA
200 mA DC 1kHz		Module	ZA 9901-AB2	DIGI	mA
2 Amp. DC 1kHz		Module	ZA 9901-AB3	DIGI	A

## Sensor overview

10 Amp. DC 1kHz	Module	ZA 9901-AB4	DIG I	A
<b>Resistance</b>				
500 ohms	Normal	ZA 9003-FS	Ohm	Ω
5000 ohms (with element flag 1)	Normal	ZA 9003-FS2	Ohm	Ω
50 ohms *	Normal	ZA 9003-SS3	Ohm1	Ω
110 kohms *	Normal	ZA 9003-SS4	Ohm4	Ω
<b>AC Voltage</b>				
260 millivolts AC (without electrical isolation)	Cable	ZA 9603-AK1	mV 2	mV
2.6 volts AC (without electrical isolation)	Cable	ZA 9603-AK2	VoIt	V
26 volts AC (without electrical isolation)	Cable	ZA 9603-AK3	VoIt	V
<b>Quick-action, overload-proof AC measuring module, electr. isolated , 4 kV</b>				
130 millivolts AC TRMS	Module	ZA 9903-AB1	DIG I	mV
1.3 volts AC TRMS	Module	ZA 9903-AB2	DIG I	V
13 volts AC TRMS	Module	ZA 9903-AB3	DIG I	V
130 volts AC TRMS	Module	ZA 9903-AB4	DIG I	V
400 volts AC TRMS	Module	ZA 9903-AB5	DIG I	V
<b>Bestell-Nr.</b>	<b>Typ</b>	<b>Bestell-Nr.</b>		
<b>AC: Quick-action, overload-proof AC measuring module, electr. isolated , 4 kV</b>				
1 A AC TRMS	Module	ZA 9904-AB1	DIG I	A
10 A AC TRMS	Module	ZA 9904-AB2	DIG I	A
<b>Digital signals</b>				
Frequency	Cable	ZA 9909-AK1U	Freq	Hz
rpm	Cable	ZA 9909-AK4U	Freq	Um
Pulses / measuring cycle	Cable	ZA 9909-AK2U	PULS	
Digital inputs	Cable	ZA 9000-EK2	In p	%
Digital interface	Cable	ZA 9919-AKxx	DIG I	%
<b>Infrared sensors</b>				
Infrared 4      -30 to +100 °C	FI A628-4	Normal	ZA 9008-FS4	Ir 4 °C
Infrared 6      0 to 500 °C	FI A628-6	Normal	ZA 9008-FS6	Ir 6 °C
<b>Capacitive humidity sensor with NTC</b>				
1. Temperature NTC type N	FH A646	Normal	ZA 9046-FS	Ntc °C
2. Relative humidity			% rH	%H
x Dew-point temperature			H DT	°C
x Mixture ratio			H AH	gk
with pressure compensation (PC)				
x Partial vapor pressure			H VP	mb
x Enthalpy with PC			H En	kJ
1. Temperature NTC type N	FH A646-C		Ntc	°C
2. Relative humidity with TC			HcrH	%H
1. Temperature NTC type N	FH A646-R		Ntc	°C
2. Relative humidity with TC			H rH	%H
Diameter 5 mm				
<b>Capacitive humidity sensor with NiCr-Ni</b>				
1. NiCr-Ni (K)		Thermo	ZA 9026-FS	NiCr °C
2. Relative humidity			% rH	%H
<b>Psychrometers</b>				
1. NTC type N	FN A846	Cable	ZA 9846-AK	Ntc °C
2. Relative humidity with PC			P RH	%H
x Dew-point temperature with PC			P DT	°C
x Mixture ratio with PC			P AH	gk
x Enthalpy with PC			P En	kJ
x Partial vapor pressure with PC			P VP	mb
x Humid temperature			P HT	°C

<b>Material moisture sensor</b>					
1. Humidity in construction materials	FH A696-MF	Normal		D 2 . 6	B %
2. Humidity in wood				D 2 . 6	H %
x Humidity in paper				D 2 . 6	P %
<b>Rotating vanes</b>					
Snap-on head, normal, 20 m/s	FV A915-S120	Cable	ZA 9915-AKS1	S 1 2 0	m / s
Snap-on head, normal, 40 m/s	FV A915-S140	Cable	ZA 9915-AKS2	S 1 4 0	m / s
Snap-on head, micro, 20 m/s	FV A915-S220	Cable	ZA 9915-AKS3	S 2 2 0	m / s
Snap-on head, micro, 40 m/s	FV A915-S240	Cable	ZA 9915-AKS4	S 2 4 0	m / s
Macro, 20 m/s	FV A915-SMA1	Cable	ZA 9915-AK5	L 4 2 0	m / s
Water micro, 5 m/s	FV A915-WM1	Cable	ZA 9915-AK6	L 6 0 5	m / s
<b>Turbine flow meter</b>	FV A915-VR	Counter	ZA 9909-AK1	F r e q	m / s
<b>Thermoanemometer</b>					
1. Temperature	FV A645-THx	Normal		D 2 . 6	° C
2. Flow				D 2 . 6	m / s
1. Flow, 40 m/s with TC and PC	FD A602-M1K	Modul		L 8 4 0	m / s
2. Dynamic pressure, 2000 Pa				V o l t	P a
1. Flow, 90 m/s with TC and PC	FD A602-M6	Modul		L 8 9 0	m / s
2. Dynamic pressure, 6800 Pa				V o l t	P a
pressure transducers Barometer	FD A612-MA	Modul		V o l t	m b
Pressure transducer, 0.1 to 1000 bar, 0.5%	FD 8214	Cable	ZA8214-AK	D 2 . 6	b r
Pressure transducer, 2.5 to 100 bar, 1%	FD A602-L	Cable		D 2 . 6	b r
1. Pressure transducer, 10 to 30 bar, 1%	FD A602-LxAK	Cable		D 2 . 6	b r
2. Temperature, refrigerant, R22, R23, R134a, R404a, R407c, R410, R417a, R507*				R 2 2	° C
<b>Tachometer probes</b>					
Tachometer probe, analog	FU A619	Divider	ZA 9019-FS	V o l t	U m
Tachometer probe, digital	FU A919-2	Counter		F r e q	U m
<b>Light sensors</b>					
1. 26000 lux	FL A613-VL	Normal		m V 2	L x
2. 260 kLux				m V 2	k L
<b>pH probes</b>					
pH probe	FY A8PH-xx	Cable	ZA 9610-AKY4	D 2 . 6	p H
1. Temperature NTC type N	FY A8PH-xx	Cable	ZA 9640-AKY4	N t c	° C
2. pH probe with TC				D 2 . 6	p H
Redox probe	FY A8RX-xx	Cable	ZA 9610-AKY5	D 2 . 6	m V
<b>Conductivity probe</b>					
1. NTC type N	FY A641-LF	Normal		N t c	° C
2. Conductivity, with TC				L F	m S
<b>O<sub>2</sub> probe for solute oxygen in water</b>					
1. NTC type N	FY A640-O2	Normal		N t c	° C
2. O <sub>2</sub> saturation, with TC and PC				O 2 - S	%
3. O <sub>2</sub> concentration, with TC				O 2 - C	m g
<b>O<sub>2</sub> sensor for gases</b>	FY A600-O2	Normal		m V 2	%
<b>CO<sub>2</sub> sensor for gases</b>	FY A600-CO2	Normal		C O 2	%

TC = Temperature compensation PC = Atmospheric pressure compensation

\* Special measuring ranges see 2.2.

D ALMEMO D sensor see 3.0.1