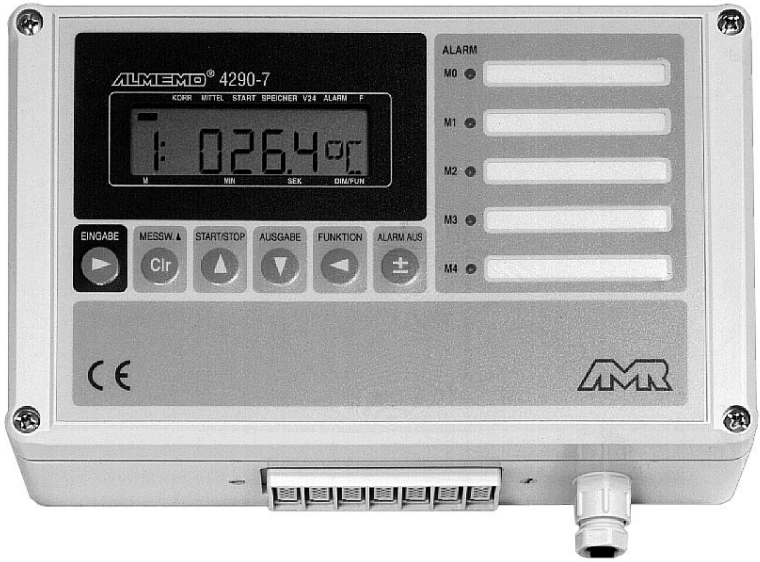
ALMEMO®



Operating Instructions

Data Logger
ALMEMO® 4290-7

V1.0
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Operating Instructions

Data Logger
ALMEMO® 4290-7 V5

For Reference with the ALMEMO® Manual

Table of Contents

1. INTRODUCTION

The data logger ALMEMO® 4290-7 *Version 5* is an instrument from the unique product range of measuring devices that are all equipped with the ALMEMO® connector system, which has been patented by Ahlborn GmbH. The intelligent ALMEMO® connector provides important advantages with regard to the connection of sensors and peripherals as all parameters are stored in an EEPROM within the connector. As a result, the programming that usually has to be performed for the connection is not required.
All sensors and output modules can be connected to all ALMEMO® measuring devices in the same way. The operation and programming is identical with all units. Therefore, all ALMEMO® system items listed below are described, in detail, in a separate ALMEMO® manual that is supplied with every device:

- Detailed description of the ALMEMO® system (manual section 1)
- Overview of the device functions and measuring ranges (manual section 2)
- All sensors with basic principles, operation, technical data (man. section 3)
- The options for connecting existing sensors (manual section 4)
- All analogue and digital output modules (manual section 5.1)
- The interface module RS232, fiber optics, Centronics (manual section 5.2)
- The entire ALMEMO® networking system (manual section 5.3)
- All functions and their control via the interface (manual section 6)
- A complete interface command list with all print outputs (manual section 7)

These operating instructions only cover features and controls that are specific for a certain device. As a result, the sections dealing with the system control via keypad will only often provide a note referring to a more detailed description within the manual (manual section x.x.x).

1.1 Function Range

The data logger ALMEMO® 4290-7 has 5 electrically isolated measuring inputs with up to 20 measuring channels for more than 65 measuring ranges, a real time clock and a 500kB memory for approximately 100,000 measured values. By using external ALMEMO® memory connectors and readout cables it is also possible to evaluate data at another location. The two output sockets allow for connecting any ALMEMO® output modules, for example, the analogue output, digital interface, trigger input or alarm contacts. For easy operation the instrument is equipped with a membrane keypad and an 8½-digit LCD display. The function range can be configured as required by the application. The protected housing for wall mounting, a power failure bypass, five separate alarm lamps for each measuring input, an alarm tone and an alarm relay make the 4290-7 especially suitable for monitoring tasks. By simply connecting devices using network cables, several devices can be networked.

SENSOR PROGRAMMING

The measuring channels are automatically programmed by the ALMEMO® connectors of the sensors. However, the user can easily complete or modify the programming via keypad or via interface.

Measuring Ranges

There are corresponding measuring ranges for sensors with a non-linear characteristic such as 10 thermocouple types, Ntc and Pt100 sensors, infrared sensors, and flow sensors (rotating vanes, thermoanemometers, pitot tubes). Humidity sensors are available with function channels that also calculate humidity data such as dew point, mixture ratio, vapour pressure and enthalpy. Even complex chemical sensors can be used. The acquisition of measured data from other sensors is easily possible by using voltage, current and resistance ranges with individual scaling in the connector. Existing sensors can be used without problems. Only the corresponding ALMEMO® connector has to be connected using its terminals. Furthermore, there are adapter connectors with an own microcontroller for digital signals and for measuring frequencies and pulses. This way, nearly all sensors can be connected to any ALMEMO® measuring instrument and are interchangeable without requiring any settings.

Function Channels

Max, min, average values and differences of certain measuring junctions can be programmed as function channels and can be processed and printed like normal measuring junctions. Furthermore, function channels for special measuring tasks are available to determine the temperature coefficient $Q/\Delta T$ and the wet bulb globe temperature.

Dimension

The 2 digit dimension can be altered for each measuring channel so that the display and the printout will always indicate the correct dimension, for example when a transmitter is connected. The conversion from °C to °F is automatically performed according to the dimension.

Name of Measured Values

Sensors can be identified by a 10 digit alphanumeric designation. It is entered via the interface and appears on the printout or display if the evaluation is done via PC.

Correction of Measured Values

For correcting measured values a zero point and slope (gain) correction can be applied to the measured value of each measuring channel. This also allows for sensors to be interchanged that usually, at first, require an adjustment (expansion, force, pH). The zero point and the slope (gain) correction are virtually performed by the push of a button.

Scaling
The base value and the factor allow for a further scaling of the corrected measured value of each measuring channel for zero point and slope (gain). The decimal point position can be set by the exponent. By setting to zero and entering the nominal value the scaling values can be automatically calculated.

Limit Values and Alarm
Two limit values (1 max and 1 min) can be set for each measuring channel. In case of an exceeding the corresponding alarm lamps will be illuminated and an alarm tone will be activated. By using the optional alarm contact the alarm can also be forwarded. As a standard, the hysteresis is set to 10 digits; however, it can also be adjusted between 0 and 99 digits. By means of relay output modules, alarm contacts are provided that can be individually allocated to limit values. For recording purposes a pure alarm value printout is possible. Furthermore, limit value exceeding can also be used to start or stop a data logging.

Sensor Locking
All sensor data stored in the EEPROM of the connector can be protected against undesired access by means of a graded locking function.

MEASUREMENT
A total of up to 20 measuring channels are available for 5 transducers, i.e. it is also possible to evaluate double sensors, individually scaled sensors, or sensors with function channels. The measuring channels can be successively selected forwards or backwards via keypad. The selected measuring point can be scanned with a conversion rate of 2.5 or 10 measurements/second. The measured value is calculated and indicated on the display or, if available, provided on the analogue output.

Measured Value
A continuous presentation of measuring data from the selected measuring point is provided and also includes automatic zero point correction and optional correction of the measured value or new scaling.
A sensor breakage condition is, with most sensors, automatically detected (exception: connectors with shunts, dividers or additional electronics).

Analogue Output and Scaling
By means of analogue start and analogue end the indicated measured value can be scaled so that the resulting measuring range covers the full analogue output range (2V, 10V or 20mA).

Measuring Functions
Special measuring functions are required for some sensors in order to achieve an optimal acquisition of measuring data. The cold junction compensation is available for thermocouples, a temperature compensation for dynamic pressure and pH and conductivity probes, and an atmospheric air pressure compensation for humidity sensors, dynamic pressure sensors and O_2 sensors. With infrared sensors the parameters zero point and slope correction are used for background temperature and emissivity factor.

Max and Min Value
Each measurement involves an acquisition and storing of the maximum and minimum value. These values can be displayed, printed or cleared.

PROCESS FLOW PROGRAMMING
A cyclic measuring point scan with a time-based process flow control is required to digitally register measuring data of all connected sensors. For this purpose, a real time clock, the print cycle and the measuring cycle are available and, if fast processing is required, the conversion rate is available. The measurement can be started and stopped by using the keypad, the interface, an external trigger signal, the real time clock or an exceeding of limit values.

Time and Date
The real time clock with date function or the pure measuring time is used for the accurate recording of any measurement. For starting or stopping a measurement the time and date of start and stop can be programmed.

Print Cycle
The print cycle is programmable between 1s and 59h/59min/59s. It provides a cyclic output of measured values to the display, interfaces or to the memory as well as a cyclic averaging.

Print Cycle Factor
If necessary, the print cycle factor allows for limiting the data output of particular channels so that an excessive data flow can be limited, especially for the storage of measured values.

Measuring Cycle
The measuring cycle, also programmable between 1s and 59h/59min/59s, is for a cyclic scanning of pulse generators, monitoring of limit values including alarm report and alarm value list, as well as averaging and data storage.

Average Value over Measuring Point Scans
The measured values that result from scanning the measuring junctions can be averaged as desired either over the total measuring time or over the print cycle time. Function channels are provided for a cyclic output of average values.

Conversion Rate
With ALMEMO® *V5* devices, all measuring points can be continuously scanned with the conversion rate (2.5 or 10 meas./s). It is also possible to store all measured values in the memory and/or to perform an output via the interface.

Data Memory
All measured values or alarm values only can, in the measuring or print cycle, manually or automatically be stored in a buffered RAM. The memory capacity is, as standard, 500kB, which allows for up to 100,000 measured values. The memory organisation can be configured as linear or ring memory. External ALMEMO® connectors with 128kB (25,000 meas. values) or 256kB (50,000 meas. values) EEPROM memory are available as alternative storage options. A selection referring to a time interval or alarm value is possible when data is provided as an output via interface.

Control Outputs
The interface allows to individually trigger up to four external output relays and one analogue output.

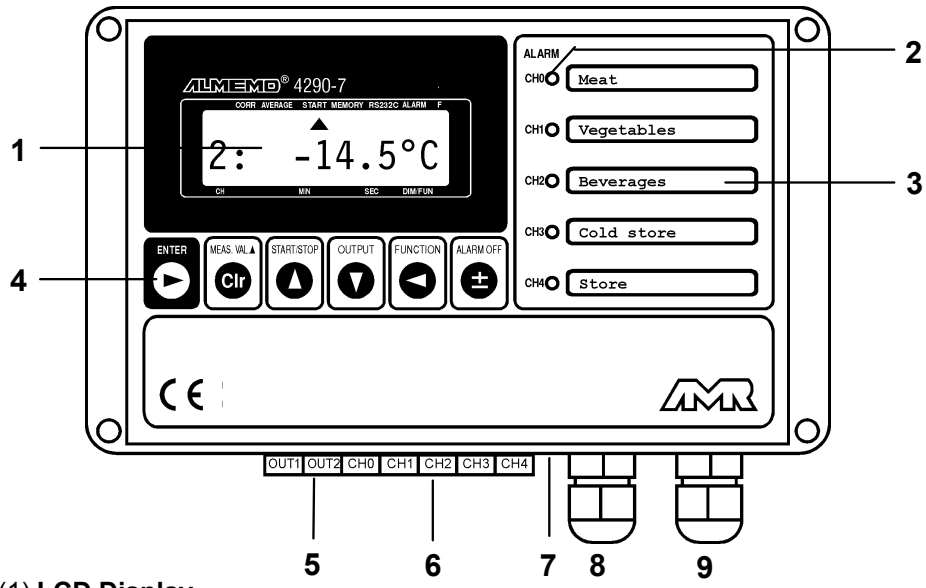
Keypad Lock
The keypad operation can be locked with a password.

Output
All measuring and programming data is accessible by means of the LCD display. RS232, RS422, RS485 and a Centronics interface are available by using different interface cables. All data logs, measured values and programmed parameters can be provided as output to any peripheral equipment. The output of measuring data can be selected in list format, columns or spreadsheet format. Files in spreadsheet format can be processed by each spreadsheet software. The print header can be programmed specifically to the company or application.

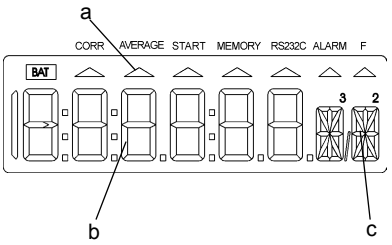
Networking
All ALMEMO® devices can be addressed and can be easily networked by a simple connection with network cables or network junctions for longer distances.

Software
The AMR-Control software, which allows for the entire programming of the sensors, the configuration of the measuring instrument and the read-out of the data memory is supplied with each ALMEMO® manual. The integrated terminal also allows for online measurements with data storage in the computer. The WINDOWS® software packages, Win-Control and DATA-Control, are available for data acquisition of networked devices, graphical presentation and complex data processing.

1.2 Operating Controls



(1) **LCD Display**



(a) Symbols for operating conditions

BAT	batt. soon empty, charge
▲ CORR	correction of meas. value
▲ AVERAGE	averaging
▲ START	measurement in progress
▲ MEMORY	storage of meas. values
▲ V24	output to interface
▲ ALARM	exceeding of limit value
▲ F	function

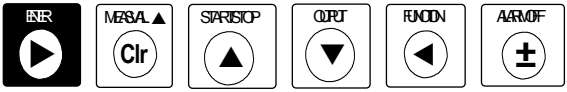
(b) 6½ x 7-segment display for:
meas. point, meas. val., meas. range
measuring/programming values,
cycles, time, date

(c) 2 x 16-segment display for:
dimension of the measured value,
abbreviation for functions

(2) **ALARM LAMPS** for exceeding of limit values from CH0 to CH4

(3) **DESIGNATION SPACE** for measuring points CH0 to CH4

(4) FUNCTION KEYS



ENTER, ±, ▲▼, ◀ ▶	for entering programming values
ENTER, **Clr**	clear data, set meas. value to zero
ENTER, ±	calibrate measured value
MEAS. VAL▲	selection of meas. value and meas. point
START/STOP	start and stop of measurement
OUTPUT	output of selected data via interface
FUNCTION	selecting functions

Activation by:			
		max value (Hi)	MH
		min value (Lo)	ML
		memory	MF
		print cycle	PC
		time	TM
		date	DA
		range	R
		lim. value max	LH
		lim. value min	LL
		locking mode	VM
		base	BA
		factor	FA
		exponent	EX
" pH probes	"	zero point correction	ZC
	"	slope (gain) correction	SC
^ Infrared sensors	^	ambient temperature	AT
	^	emissivity factor	EF
* interface cable	*	baud rate, output mode	BR
	*	device address	A
~ humidity, dyn. pressure, O_2	~	atmospheric pressure	mb

ALARM OFF switch off the alarm tone and alarm relay

(5) ALMEMO® Output Sockets OUT1 and OUT2

OUT1
- V24 interface with cable ZA 1909-DK
- V24 interface with fiber optics (ZA 1909-DKL)
- Centronics interface with cable ZA 1936-DK
- RS 422 interface with network branch box ZA 5099-NVB
- RS 485 interface with network branch box ZA 5085-NV
- analogue output with cable ZA 1601-RK

OUT2
- ext. data storage with memory connector ZA 1904-SS
- networking with network cable ZA1999-NK
- trigger input, relay outputs with cable ZA 1000-EAK
- analogue output with cable ZA 1601-RK

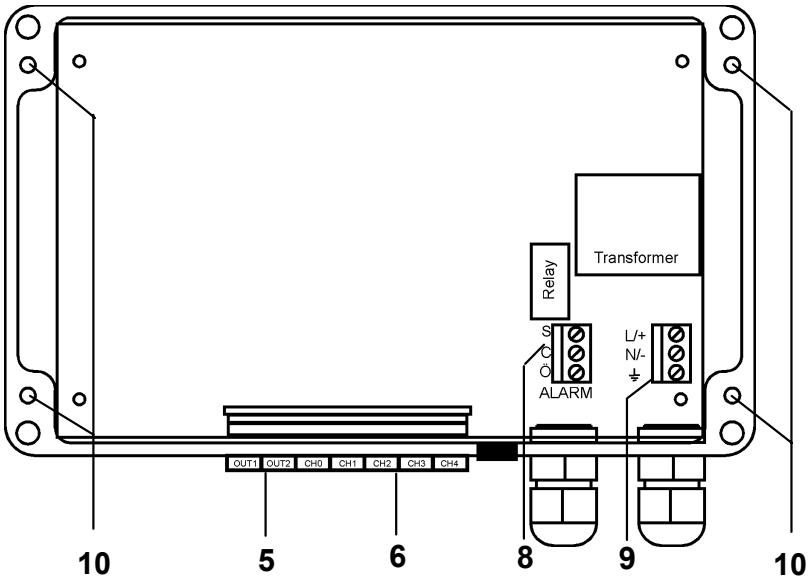
(6) **ALMEMO® Measuring Inputs**
CH0 to CH4 5 ALMEMO® sockets for all ALMEMO® sensors
CH5 to CH19 add. chann. for double sensors and function channels

(7) **ON Switch** for initial operation and reinitialisation

(8) **Relay Contacts**
clamped connection ALARM make and break contacts S-C-Ö
alarm contact for exceeding of limit value
of measuring channels CH0 to CH4

(9) **Power Supply**
clamped connection N / L / ⊥ 230 V AC, 50/60 Hz
Option U + / - 10 to 36 V DC

(10) **Wall Mounting**



2. INITIAL OPERATION

1. **Power Supply**
   Depending on the version (s. type plate) plug in the mains cable, see 3.1 or connect DC voltage supply 9-36 V to clamps (9), see 3.2.
2. Connect the **ALMEMO® sensors** to the sockets CH0 to CH4 (6), see 4. switch the instrument on by using the switch (7), see 3.3.
3. **Displaying the Measured Values**
   Use key **MEAS▲** to select function MEAS.VAL. and measuring channel, read the measured value, see 7.1.
4. **Storing the Measured Values**
   Use the key **FUNCTION** to select the function print cycle ´PC´.
   Enter the print cycle, see 7.3.1.
   Enter the time of day in function ´TM´, see 7.3.2.
   Enter date in function date ´DA´, see 7.3.2.
   Use the key **START/STOP** for starting and stopping the data recording, 7.3.
   Output of Memory Data to Printer or Computer
   Connect peripheral device via interface cable to socket OUT1, see man. 5.2, set 9600 bd, 8 data bits, 1 stop bit, no parity at peripheral device, see 8.1.
   Use the key **MEAS▲** in function baud rate ´BR´ to set the output format columns ´Un´ or spreadsheet table ´Ut´, see 8.2.
   Use function ´MF´ and key **OUTPUT** for the output of meas. values, s. 7.4.3.
5. **Monitoring of Limit Values**
   Use key **FUNCTION** to select function limit value max ´LH´ or limit value min ´LL´, enter the limit values, see 6.4.
6. **Print Alarm Values**
   Programming as described in 4.
   In addition, use key **MEAS▲** to set the output format alarm list ´A´ in function baud rate ´BR´, see 8.
   Connect a Centronics printer using the cable ZA 1936-DK, or a RS232 printer using the cable ZA 1909-DK to socket OUT1 (5).
   Use key **START/STOP** to start or stop a cyclic measuring point scan, s. 7.3.
7. **Evaluating the Measurement**
   Display max and min values in function ´MH´ or ´ML´ (see 7.1.2).

3. POWER SUPPLY

Before connecting any supply voltage refer to the type plate to ensure the correct type of power supply! All live cables must be disconnected or the corresponding fuse must be removed before the instrument is opened! Please note that connection to the 230V mains supply network must only be performed by a qualified electrician.

3.1 Mains Connection

The measuring instrument is, as a standard, equipped with a 230VAC+10%-15% / 50-60Hz power supply unit. For mains supply the power supply lead must be connected to a corresponding socket.

3.2 DC Voltage Supply (Option U)

An electrically isolated DC voltage supply 9-36V for the device is available as an option (OA 4290-U). The voltage must be connected to the terminal (9) inside the instrument. The polarity + and - must be considered.

3.3 Data Storage, Switch-On, Reinitialisation

The data logger ALMEMO® 4290-7, as a standard, is equipped with a rechargeable NiCd battery (800mAh) that allows a continuous operation of the instrument for 75 hrs in normal operation (15 hours when the option alarm relay is installed) in case of a power failure. During that time the symbol BAT will be indicated in the display. When the rechargeable battery is completely discharged the recording of measuring data will be stopped. However, the recorded data and the time of day remain stored in the battery buffered memory. The rechargeable battery is recharged by the normal power supply (24 hrs duration at max).

For initial operation the sliding switch (7) on the underside of the device must, by means of a tapered object (screw driver), be moved to the ON position. It has been placed in a hidden position to prevent accidental switch off of the data logger.

If the device is not functioning properly due to disturbances (e.g. electrostatic charging) a complete **reinitialisation** of the instrument may be necessary in some cases. This reset can be achieved if the key **Clr** is pressed during switch-on. The programming of the sensors, the memory, the time of day and date will be cleared by this (standard setting). However, the calibration and the sensor programming within the EEPROM will be maintained.

4. CONNECTION OF THE TRANSDUCERS

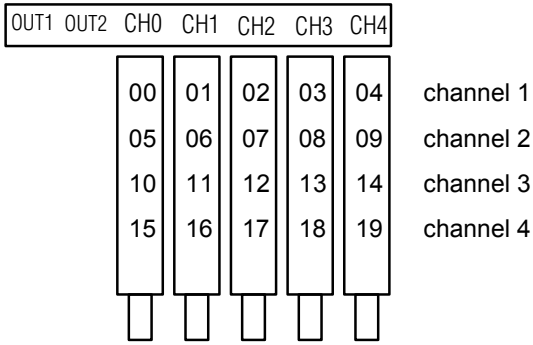
Any ALMEMO® sensors can be connected to the ALMEMO® input sockets (6) CH0 to CH4 of the measuring device (6). For connecting existing sensors it is only necessary to connect a corresponding ALMEMO® connector.

4.1 Transducers

A detailed description of the comprehensive ALMEMO® sensor range (see manual section 3) and the connection of existing sensors (see manual section 4) to the ALMEMO® instruments are provided in the ALMEMO® manual. All standard sensors with ALMEMO® connector usually have the measuring range and dimension already programmed and can be immediately connected to any input socket. A mechanical coding ensures that sensor and output modules can only be connected to the correct sockets. Furthermore, each ALMEMO® connector has two locking levers that snap in when the insertion into the socket is established and that prevent a disconnection caused by pulling the cable. Both levers must be pressed on the sides for disconnecting the connector.

4.2 Measuring Inputs and Additional Channels

The measuring instrument ALMEMO® 4290-7 has 5 input sockets (6) that the measuring channels CH0 to CH4 are initially allocated to. However, ALMEMO® sensors can, if required, provide up to 4 channels so that 20 channels are available with 5 input sockets. The additional channels can be especially used with humidity sensors with 4 measuring variables (temperature/humidity/dew point/mixture ratio) or used for function channels. If required, the sensor can also be programmed with several ranges or different scaling or, depending on the pin assignment, 2 or 3 sensors can be combined in one connector (e.g. rH/Ntc, mV/V, mA/V etc.). The additional measuring channels of a connector are located by 5 higher each (e.g. the first sensor has the channels CH0, CH5, CH10, CH15, the second has the channels CH1, CH6, CH11, CH16 etc.).



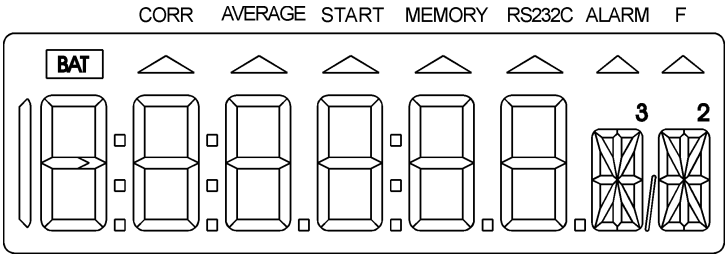
The five analogue inputs are electrically isolated by using photovoltaic relays and a potential difference of 50V DC or 60V AC, at maximum, is permissible between them. However, sensors combined within one connector and sensors with an own power supply are electrically connected to each other and must, therefore, be operated in isolation. The voltage applied to the measuring inputs must not exceed ±5V (between B,C,D and A or - respectively).

The cold junction compensation for thermocouple measurement is integrated in socket CH4 of the device.

5. DISPLAY AND KEYPAD

5.1 Display

The display of the instrument ALMEMO® 4290-7 consists of a LCD module with six and a half 7-segment digits, two 16-segment digits, and a battery symbol and seven arrows for indicating the operating status.



Measuring Data Display

After switching on, the measured value is indicated with the measuring point CH and the dimension DIM of the previously selected channel.

Meas. point, meas. value and dimension: 0: 23.4 °C

Function Display

The key **FUNCTION** can be used to select various function parameters (see 5.2), depending on their activation.

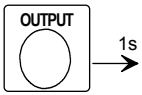
Channel, function value, function: 0: 29.7 MH

Double Display for Temperature and Humidity

If a double sensor for temperature and humidity is connected to socket CH0 the display can be switched to display both variables. To achieve this, the channel M5 for humidity must be selected and key **OUTPUT** must be pressed for longer than one second. The same keys are also used to undo the function again.

Select humidity channel: 

5: 34.5 %H

Double display with key: 

23.4 °C 34.5%

The double display will be maintained when returning to channel CH5 and also when other channels or function parameters are selected in standard format.

Special Operating Conditions

Segment test of the display	automatically after switch-on.
Batt. nearly discharged, printer out of oper.	BAT symbol is illuminated
Battery discharged, device switches off:	1:Lobat
Sensor that are not connected, deactivated measuring points, cleared programming values.	1: ----
Sensor correction or scaling	arrow **CORR** illuminated
Measuring point scan in progress	arrow **START** illuminated
Measuring point scan with storage	arrow **MEMORY** illuminated
Measuring point scan with output	arrow **V24** illuminated
Additional function selected	arrow **F** illuminated

Alarm Conditions

are displayed as follows and cause an alarm (see man. 6.3.9):

Sensor breakage:	1: NiCr °C abbr. flashes
Overshooting of measuring range:	max value flashes
Undershooting of measuring range:	min value flashes
Exceeding of limit value:	arrow **ALARM** illuminated
Undershoot. of meas. range CJ compens.	1: CJ (cold junction)
Meas. without ext. CJC or CJC breakage:	flashes
Exceeding of range of values (>65000):	1:65000 flashes

5.2 Function Selection and Activation

After a reinitialisation (see 3.3) the basic functions for the operation of the data logger are available by using the key **FUNCTION** (bolded text in the table, corresponding to display mode 4). For a correction of measured values and for data transmission further functions are available that can be activated automatically by sensors or output modules (see below) or by selecting a function group in display mode or via the interface. This provides quick access to functions only that are definitely required and reduces the risk of incorrect inputs.

The functions can be selected by operating the key **FUNCTION** several times. If the key is pressed for longer than one second it is possible to switch back to the previous function. The functions can be identified by a 2-digit abbreviation in place of the dimension. Next to the function abbreviation the function value, in case of sensor parameters including the channel number, will be indicated in the display:

Function selection using the key **FUNCTION**:

	Functions	**Abbreviation**	**Function Access**								
	Locking Code	OPEN LC									
↑	Display Mode	1 DM	**0**	**1**	**2**	**4**	**5**	**6**	**7**	**8**	**9**
↓	**Max Value (Hi)**	1: 123.4 MH									
	Min Value (Lo)	1: 023.4 ML									
	Memory Free	126.1 MF									
	Print Cycle	00:15:00 PC									
	Output Format, Baud Rate	Un 9600 BR		*	*	*	*				
	Time	12:34:56 TM									
	Date	31.12.99 DA									
	Locking Mode	1: 0005 LM									
	Range	1: NiCr R									
	Limit Value Max (Hi)	1: 123.0 LH									
	Limit Value Min (Lo)	1:-010.0 LL									
	Base Value	1: ---- BA									
	Factor, Exponent	1: ----+0									
"	Zero Point Correction	1: ---- ZC		"		"					
"	Slope (Gain) Correction	1: ---- SC		"		"					
^	Ambient Temperature	1: 250.0 AT		^	^	^	^		^		^
^	Emissivity Factor	1: 0.950 EF		^	^	^	^		^		^
~	Atmospheric Pressure	1013 mb		~	~	~	~				
	Device Address	00 A		*	*	*	*				

Automatic Activation of Functions via:

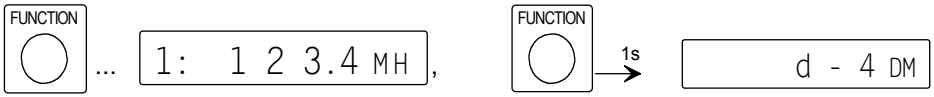
* Interface Modules
" pH Probes
^ Infrared Sensors
~ Humidity, Dyn. Pressure and O_2 Sensors

Activation of Function Groups
As shown in the previous table it is possible via the display mode to set different function groups that release the corresponding functions (grey background). The applications range from an almost entirely locked instrument to the release of all functions.

Display Mode	**Application MEASUREMENT:**
0	Locked: no input, only single measuring point scan, no output, no clearing of Min and Max values, range indication
1	Minimum: Start/Stop, Max-Min, range normally locked, memory, print cycle
2	Man. meas., as above, with zero-setting and sensor adjustment
4	**Standard: Cyclic measurement with limit value monitoring**
5	as above, with sensor adjustment
6	only functions that have been defined by the user via interface
	Application PROGRAMMING:
7	Sensor/connector programming
8	Device programming
9	All functions

After a reinitialisation (key **CLR** must be pressed when switching on) the function group 4 is selected. The selection of another function group can be performed in the function display mode. The (slightly difficult to access) DISPLAYMODE ´DM´ can be accessed by using the key **FUNCTION** to select the function MAX.VAL. ´MH´ and once again by pressing and holding the key **FUNCTION** for a longer period.

Function DISPLAY MODE ´DM´



Example: German-FunctionGrp.4

For entering the display mode, see 5.4.

The letter that precedes the function group indicates the language setting:
d = **G**erman, E = **E**nglish, F = **F**rench

Activation via Interface
In function group 6, it is possible to use the interface (e.g. AMR-Control) for allocating the required functions, as required, and without an automatic activation. As a result, the key assignment can be completely configured (see man. 6.10.13.3). The key **FUNCTION** corresponds to the key **F2**.

5.3 Keypad

The keypad (4) has the following functions that are displayed above the keys:

Function	Normal	Input
Programming of parameters	ENTER	▸
Selection of meas.value and meas.points	**MEAS▲**	**Clr**
Start and stop of measurements	**START/STOP**	▲
Data output via interface	**OUTPUT**	▼
Selection of the functions	**FUNCTION**	◂
Alarm switch off	**ALARM OFF**	±

If the key **ENTER** is pressed a digit or an abbreviation will flash in the display, i.e. the device is in edit mode and the **white** designations on the keys are valid. Then, the keys ±, ▲ and ▼ can be used to change the input digit, ▸ and ◂ are available as cursor keys and the key **Clr** for clearing the parameter. The data input is finished when the last digit has been confirmed by operating the key ▸ .

5.4 Data Entry

The programming of numeric parameters is performed as follows

Selection of the function by using the key **FUNCTION...**

The programming can be started by operating the key ENTER.
The first programmable digit flashes
and can be altered.

The digit can be **increased** using the key ▲.
After exceeding the maximum value the cycle restarts from zero.

The digit can be **decreased** using the key ▼.
After falling below zero the maximum value follows (9 or 5).

The sign can be changed using the key ±.

A switch to the next digit is performed using the key ▸ .

A switch to the previous digit is performed using the key ◂ .

The programming process is complete
after setting the last digit and again operating the key ▸

Programming and measured values can be cleared using

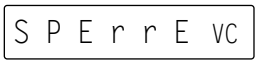
,

5.5 Keypad Locking

When all parameters are programmed and, possibly, the data recording has been started with the key **START/STOP**, the keypad can be locked to protect against unintentional modifications. For this purpose the (slightly hidden) function locking code ´LC´ must be selected by operating and holding (approx. 1 second) the key **FUNCTION** twice in function MaxValue ´MH´.

When the locking is switched off,
the following message will be displayed:

To block the access, a 4-digit number
can be entered (see 5.4), the display will indicate:



The easiest and fastest locking (code 0000) can be activated by operating the key **ENTER** five times. By entering the same locking code again, the locking can be released. The functions **INPUT** and **START/STOP** are no longer accessible in locked mode. However, reading the measured values and the programming will still be possible. When selecting measuring points manually only activated sensors will be indicated.

5.6 Alarm Lamps and Name of Measuring Point

On the right side of the operating panel the 5 measuring points CH0 to CH4 are separately listed with their channel numbers, alarm lamps (2) (see 7.4) and designation fields (3). A ´draw/pull´ labelling option can be used for a quick identification of measuring points in case of alarm conditions. For this purpose, the covering foil is cut on the right-hand side so that the end can be lifted by using a tapered tool and a paper strip with the measuring point designation can be inserted.

6. SENSOR PROGRAMMING

As all ALMEMO® instruments contain the whole sensor programming stored in the ALMEMO® connector plug, the user does not usually need to perform any programming. Only if, for example, sensor errors must be corrected or existing sensors must be scaled or limit values need to be specified the comprehensive programming options have to be used. It must be considered that standard sensors are, by a locking mode, protected against unintentional modification and that the locking level must first be reduced before desired changes can be performed (see 6.7). All parameters can easily be entered or changed via keypad if the corresponding sensor connector is connected and the function is activated (see 5.2).

6.1 Selecting the Measuring Point

For querying or programming the parameters of a sensor it is necessary to select the corresponding measuring point by using the key **MEAS▲** and then to select the required function by using the key **FUNCTION**.

Increase the input channel by: 

(programmed channels only)

Decrease the input channel by: 

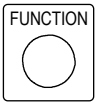
press and hold (approx. 1 sec.)

6.2 Selecting the Measuring Range

If users want to program the connectors on their own or frequently change the measuring range, it is necessary that the locking of the connectors is cleared (see 6.7) and special connectors may be required for some transducers (e.g. thermo, shunt, divider etc., see table).

The selection of the measuring range is performed within the function RANGE ´ R´. For activating a channel that has not yet been programmed the locking of the 1st channel must be 0 for the corresponding sensor (see 6.7). After selecting the measuring point and pressing the key **ENTER** the abbreviation of the measuring range will flash in the display. The keys ▲ and ▼ can be used to select all available ranges in the sequence given below. If the desired range is displayed the programming can be completed by pressing the key **ENTER** once again and the data is transmitted to the connector. All programming values of the measuring point, except the calibration values (shunt, divider, humidity), are cleared by this.

Function RANGE ´ R´

Selection with key: 

... 1: N i C r °C

Example : channel CH1, range NiCr, dimension °C

Change meas. range: 

,  ... or  ... , 

Transducer	Conn./Cable/ Sensor	Meas. Range	Dim	Display
Pt100-1	ZA 9000-FS	-200.0... +850.0	°C	P104
Pt100-2	ZA 9000-FS	-200.00...+200.00	°C	P204
Ni100	ZA 9000-FS	-60.0... +240.0	°C	N104
NiCr-Ni (K)	ZA 9020-FS	-200.0...+1370.0	°C	NiCr
NiCroSil-NiSil (N)	ZA 9020-FS	-200.0...+1300.0	°C	NiSil
Fe-CuNi (L)	ZA 9000-FS	-200.0... +900.0	°C	FECO
Fe-CuNi (J)	ZA 9000-FS	-200.0...+1000.0	°C	IrCo
Cu-CuNi (U)	ZA 9000-FS	-200.0... +600.0	°C	CUCO
Cu-CuNi (T)	ZA 9000-FS	-200.0... +400.0	°C	CoCo
PtRh10-Pt (S)	ZA 9000-FS	0.0...+1760.0	°C	Pt10
PtRh13-Pt (R)	ZA 9000-FS	0.0...+1760.0	°C	Pt13
PtRh30-PtRh6 (B)	ZA 9000-FS	+400.0...+1800.0	°C	EL18
Au-FeCr	ZA 9000-FS	-270.0... +60.0	°C	AUFE
Ntc type N	ZA 9000-FS	-30.00...+125.00	°C	Ntc
Millivolt 1	**ZA 9000-FS**	**-26.000...+26.000**	**mV**	U 26
Millivolt	ZA 9000-FS	-10.000...+55.000	mV	U 55
Millivolt 2	ZA 9000-FS	-260.00...+260.00	mV	U260
Volt	ZA 9000-FS	-2.6000...+2.6000	V	U2.60
Differential Millivolt 1	ZA 9050-FS	-26.000...+26.000	mV	d 26
Differential Millivolt	ZA 9050-FS	-10.000...+55.000	mV	d 55
Differential Millivolt 2	ZA 9050-FS	-260.00...+260.00	mV	d260
Differential Volt	ZA 9050-FS	-2.6000...+2.6000	V	d2.60
Sensor Voltage	ZA 9000-FS	0.00...20.00	V	UbAt
Milliampere	ZA 9601-FS	-32.000...+32.000	mA	I032
Percent (4-20mA)	ZA 9000-FS	0.00... 100.00	%	P420
Ohm	ZA 9000-FS	0.00... 400.00	Ω	Ohn
Frequency	ZA 9909-AK	0... 25000	Hz	FrEq
Pulses	ZA 9909-AK	0... 65000		PULS
Digital Input	ZA 9000-EK2	0.0... 100.0	%	Inp
Digital Interface	ZA 9919-AKxx	-65000... +65000		diGi
Infrared 1	ZA 9000-FS	0.0... +200.0	°C	Ir 1
Infrared 2	ZA 9000-FS	0.0... +800.0	°C	Ir 2

Transducer	Conn./Cable	Meas. Range	Dim	Display
Infrared 3	ZA 9000-FS	-30.0... +70.0	°C	Ir 3
Infrared 4	ZA 9000-FS	-30.0... +100.0	°C	Ir 4
Infrared 6	ZA 9000-FS	0.0... +500.0	°C	Ir 6
Snap-on head Normal 20	FV A915-S120	0.30... 20.00	m/s	S120
Snap-on head Normal 40	FV A915-S140	0.40... 40.00	m/s	S140
Snap-on head Micro 20	FV A915-S220	0.50... 20.00	m/s	S220
Snap-on head Micro 40	FV A915-S240	0.60... 40.00	m/s	S240
Macro	FV A915-MA1	0.10... 20.00	m/s	L420
Water-Micro	FV A915-WM1	0.00... 5.00	m/s	L605
Dyn.Press. 40m/s w. TC a. PC	FD A612-M1	0.50... 40.00	m/s	L840
Dyn.Press. 90m/s w. TC a. PC	FD A612-M6	1.00... 90.00	m/s	L890
Rel. Humidity cap.	FH A646	0.0... 100.0	%H	°orH
Rel. Humidity cap. w. TC	FH A646-R	0.0... 100.0	%H	H rH
Mixture Ratio w. PC	FH A646	0.0 ... 500.0	g/kg	H AH
Dew Point Temperature	FH A646	-25.0... 100.0	°C	H dt
Partial Vapour Pressure	FH A646	0.0 ...1050.0	mbar	H UP
Enthalpy w. PC	FH A646	0.0 ... 400.0	kJ/kg	H En
Humid Temperature	ZA 9000-FS	-30.00 ... +125.00	°C	P Ht
Rel. Humidity psychr. w. PC	ZA 9000-FS	0.0 ... 100.0	%H	P rH
Mixture Ratio w. PC	ZA 9000-FS	0.0 ... 500.0	g/kg	P AH
Dew Point Temperature w. PC	ZA 9000-FS	-25.0 ... +100.0	°C	P dt
Partial Vapour Pressure w. PC	ZA 9000-FS	0.0 ...1050.0	mbar	P UP
Enthalpy w. PC	ZA 9000-FS	0.0 ... 400.0	kJ/kg	P En
Conductivity Probe w. TC	FY A641-LF	0.0 ... 20.000	mS	LF
CO_2 Sensor	FY A600-CO2	0.0 ... 2.500	%	CO2
O_2 Saturation w. TC a. PC	FY A640-O2	0 ... 260	%	O2-S
O_2 Concentration w. TC	FY A640-O2	0 ... 40.0	mg/l	O2-C
Function Channels				
Difference B1-B2	any			diFF
Maximum Value of B1	any			Hi
Minimum Value of B1	any			Lo
Avg. Value over Time of B1	any			A[t]
Avg. Val. over Meas.Pt. B2..B1	any			A[n]
Sum over Meas.Pt. B2..B1	any			S[n]
Total number of pulses of B1	ZA 9909-AK2	0... 65000		S[t]
Pulses/Print Cycle of B1	ZA 9909-AK2	0... 65000		S[P]
Alarm Value of B1	any			Alrm
Temperature Coefficient	ZA 9000-FS		W/m^2K	q:dt
Wet Bulb Globe Temperature	ZA 9000-FS		°C	UbGt

TC=Temperature Compensation, PC=Atm. Press. Compensation, B1/B2=Ref.Chann.

The **use of the function channels** for the output of meas. and calculated variables with the corresponding ref. channels is described in man. sect. 6.3.4.

Switch-off, i.e. deactivation of a programmed measuring channel

Function: RANGE ´ R´ **Keys:** 

After switch-off the measured value is no longer indicated, queried or provided as output. However, the programming is still maintained.

Re-activation of the measuring channel:

Function: RANGE ´ R´ **Keys:** 

If the channel was previously deactivated, it will be re-activated with all programmed values. However, if the channel is already active then all programming values will be cleared by operating the above key combination (corresponds to selecting a measuring range).

6.3 Changing the Dimension

Each measuring channel allows replacing the standard dimension of the measuring range by any other dimension that has two digits (see manual 6.3.5). In addition to all capital and normal letters, the characters □, □, Ω, %, [,], *, -, =, ~ and the space `_´ are available. The dimension is indicated by two 16-segment characters next to the measured value.

The **change of the dimension** can be performed within the function MEAS. VALUE by pressing the key **ENTER**. The first character of the dimension will flash in the display. It can then be changed by using the keys ▲ and ▼. When the first character is selected the key **ENTER** should be pressed again and the same procedure will be performed for the second character. When the desired dimension has been set the programming can be completed by the key **ENTER**.

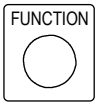
Function: MEAS.VALUE 

When the dimension °F is entered a temperature value in degrees Celsius will be converted into degrees Fahrenheit.
The cold junction compensation can be switched off by using the characters □C or □F.
The dimension ms is indicated on the display as m/s, and mh as m^3/h.

6.4 Limit Values

For monitoring measured values 2 limit values (MAX and MIN) can be programmed for each measuring point. If limit values are exceeded the arrow ´ALARM´ will be indicated in the display, the corresponding control lamp will be on and the alarm tone will be activated. If the optionally available limit value relay (option G) has been integrated, the corresponding contacts (8) that can be used for activating an alarm circuitry will be responding as well. The alarm remains activated until the measured value has fallen below the limit value by the hysteresis (see man. 6.2.7) or until the key **ALARM OFF** is operated. If the limit value is still being exceeded when the instrument is switched off, the alarm LED will stay on; only the tone signal and relays will be switched off.
An exceeding of a limit value can also be used to start or stop a measuring point scan (see man. 6.6.3).

Function LIMIT VALUE MAX ´LH´ and **LIMIT VALUE MIN** ´LL´

Selection with key: 

... 1: 1 2 3.0 GH

Programming: input, see 5.4

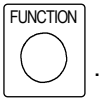
Switching off: 

, Clr 1: - - - - GH

6.5 Correction Values

The correction values ZERO POINT and SLOPE allow for correcting sensors with regard to zero point and slope (gain) (see manual 6.3.10).

Corrected Meas. Value = (Meas. Value - ZERO POINT) x SLOPE
Function ZERO POINT CORRECTION ´ZC´

Selection with key: 

... 1: 0 0 3.2 NK

Programming: input, see 5.4

Clear: 

, Clr 1: - - - - NK

Function SLOPE (GAIN) CORRECTION ´SC´

Selection with key **FUNCTION**... 1:1.5 0 0 0 SK

Programming: input, see 5.4

If correction values are programmed and, as a result, the measured value is corrected, the arrow ´CORR´ will be indicated in the display.

Sensor Adjustment

To simplify the correction of sensors for the zero point and, possibly, also the slope (gain), a key combination for an automatic adjustment is available in the function **MEAS.VAL.** (see 7.1.3). The corrected measured value will be stored as zero point correction and, as a result, set to zero. The base value will be maintained.

Function MEAS.VALUE: Adjustment with keys: 

6.6 Scaling, Decimal Point Setting

For indicating the electrical signal of a sensor as a measured value of a physical variable it is, in most cases, necessary to set a decimal point shift, a zero point shift and to perform a multiplication with a factor. The functions FACTOR with EXPONENT and BASE are available for this. A detailed description of the scaling, including an example, can be found in the manual section 6.3.11.

Inidcated Value = (corrected meas. value - BASE) x FACTOR.

Decimal Point Setting

At first, the position of the decimal point should be checked and, by using the EXPONENT, be adjusted to the required resolution and dimensioning of the sensor, as required. The EXPONENT allows for shifting the decimal point as far to the left (-) or right (+) as it can be indicated on the display.
EXPONENT and FACTOR will appear in a function, which is characterised by the exponent as an abbreviation, e.g. ´+0´.

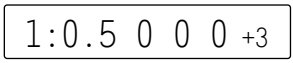
Function FACTOR and EXPONENT ´+0´

Selection with key **FUNCTION...** 1: - - - - +0

For **entering the exponent** the keys **ENTER**, ◀ must be pressed so that the exponent flashes and then the value must be entered by using the keys ▲ and ▼. The key ± can be used to change the sign and the key **ENTER** can be used to finish the programming.

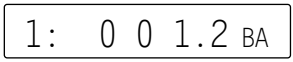
Example: A force transducer with a 2.0000 V output should indicate 1000.0 N. The decimal point must, via exponent 3, be shifted by 3 digits to the right. The additionally required factor 0.5 can easily be calculated from the new actual values 0.0 N and 2000.0 N. In this case, the base value might only be required for a zero point correction.

Input of the FACTOR, see 5.4

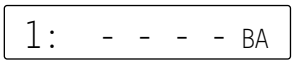


Function BASE VALUE ´BA´

Selection with key **FUNCTION...** input, see 5.4



Clear with keys: 



The arrow ´**CORR**´ will be indicated in the display if scaling values are programmed and if the actual measured value is modified.

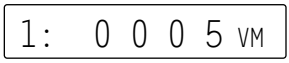
6.7 Locking the Programming of the Sensor (s.man. 6.3.12)

The function parameters of each measuring point are protected by the locking mode up to an adjustable locking level. Before any programming is performed the locking mode must be correspondingly lowered. If a dot is indicated following the locking mode on the display then a modification is not possible.

Locking Level	Locked Functions
0	none
1	measuring range + element flags
2	measuring range + zero point and slope correction
3	measuring range + dimension
4	+ zero point and slope correction
5	+ base value, factor, exponent
6	+ analogue output, start and end
7	+ limit values, max and min

Function LOCKING MODE ´LM´

Selection with key **FUNCTION...** input, see 5.4



If programmed, the output function, element flags and multiplexer setting will be indicated next to the locking mode (see man. 6.10.2/3/4).

To protect also the rest of the programming and the process flow control from unauthorised modification during a measurement, the keypad locking must be used along with a locking code (see 5.5).

7. MEASUREMENT

The data logger ALMEMO® 4290-7 provides the following options for the acquisition of measuring data:

1. Continuous measurement of a selectable meas. point, see 7.1 and man. 6.4. Output of measuring data to the analogue output, see man. 5.1.1.
2. Single measuring point scan, see 7.2 and manual 6.5.1.1.
3. Cyclic measuring point scan, see 7.3 and manual 6.5.1.2.
4. Continuous measuring point scan, see 7.3.1 and manual 6.5.1.3.

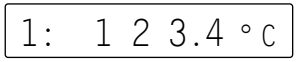
7.1 Continuous Measurement of a Measuring Point

As long as no cycle and no continuous measuring point scan have been programmed (e.g. after a reinitialisation, see 3.4) only the measured value of a selected measuring point, which is at first CH0, is continuously acquired with the specified conversion rate (see man. 6.5.4) (ideal for analogue output).

7.1.1 Selecting the Measuring Point

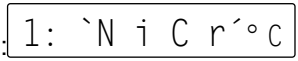
In function MEAS. VALUE, the key **MEAS▲** allows to successively select all active measuring points and indicate the actual measured value. If the key **MEAS▲** is pressed and held longer (approx. 1s) the previous channel is again indicated. If the measuring range changes when switching over, the abbreviation of the measuring range is indicated first.

Increase measuring channel with key: 



Decrease measuring channel with key: 

press and hold longer (ca. 1s)

In case of a sensor breakage the short name of the meas.range will flash instead of the meas.value(s.6.2): 

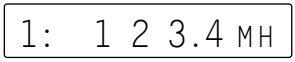
If the actual measured value is changed by scaling or correction values the arrow ´CORR´ will be indicated in the display (see 5.1).

7.1.2 Memory for Peak Values

From the acquired measured values of each measuring point the highest and lowest value is determined and stored. For indicating the peak values the function MAX VALUE or MIN VALUE must be selected with the key **MEAS** and the desired channel must be set.

Function MAX VALUE ´MH´ and **MIN VALUE** ´ML´

Selection with key **FUNCTION...**



Clearing of max and min values: ENTER , Clr

Furthermore, the peak values are also cleared if a change of the measuring range (see 6.2) is carried out.

7.1.3 Setting the Measured Value to Zero, Zero Point Correct.

Setting Measured Value to Zero

The user can zero the measured value at certain locations or at certain times in order to check the deviation from this reference value. The indicated measured value is, by the following key combination, stored as base value and, as a result, set to zero.

Function MEAS.VALUE: MEAS.V ▲ Zero setting with keys: ENTER , Clr

Please note that this function is only available if the locking code is set below 5 (see 6.7).

If function ´BA´ is activated the new base value will be stored in the EEPROM of the connector (see 6.6). If not activated, the original value will be inserted again after switching off and on.

The arrow CORR. appears in the display as long as the deviation from the base value is indicated, but not the actual measured value.

To return to the original value again, the base value must be cleared (s. 6.6). If the function BASE ´BA´ is not activated a switch-off of the instrument is sufficient (see above). However, if the function is available, it can be selected with the key **FUNCTION** and the base value can be cleared with the keys **ENTER**, **Clr**.

Function BASE: FUNCTION ... Clear base value: ENTER , Clr

Zero Point Adjustment

Many sensors must be adjusted at least once or at regular intervals to compensate for instabilities. For this purpose and in addition to the ´Set Measured Value to Zero´ mentioned above, a specific **zero point adjustment** is available because many sensors require an additional scaling (e.g. pH probes). In this function the zero point error is not stored as base value but as zero point correction. In this case the locking mode must be set to lower than 4 (see 6.7). The zero point correction is performed with the following keys:

Function MEAS.VALUE: 

Zero point adjustment: 

, 

If a base value is programmed the measured value is not indicated as zero but as the negative base value after the adjustment.

For some sensors **special functions** are available in this context:

1. **Dynamic pressure probes** are very delicate and should be adjusted in an unpressurized state before each use (i.e. disconnected hoses or Pitot tube out of flow). The correction value must be entered before the conversion 'pressure-to-velocity' is performed. For the ranges L840 and L890 an adjustment is possible even if the channel is locked. The zero point error is temporarily being written into the calibration offset until the switch-off is performed.
2. With the following sensors the same key combination as for the zero point adjustment can be used to automatically perform a **slope adjustment** if not the zero value but the calibration value mentioned below is present:

pH probe:	ZA 9610-AKY	pH4 or pH10
Conductivity:	FY A641-LF:	2.77 mS/cm,
	FY A641-LF2:	147 µS/cm
	FY A641-LF3:	111.8 mS/cm
O_2 saturation:	FY A640-O2:	101 %

7.1.4 Atmospheric Pressure Compensation

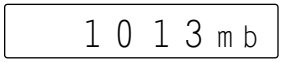
Some measuring variables depend on the environmental atmospheric pressure (see 6.2 measuring range list ´w. PC´). As a result, higher deviations from the normal pressure of 1013mbar can cause corresponding measuring errors:

e.g. Error per 100 mbar:		**Compensation Range:**
Rel. humidity psychrometer	approx. 2%	500 to 1500 mbar
Mixture ratio, cap.	approx. 10 %	vapour pressure VP up to 8 bar
Dynamic pressure	approx. 5%	800 to 1250 mbar (error < 2%)
O_2 saturation	approx. 10%	500 to 1500 mbar

Therefore, the atmospheric pressure should be considered (approx. -11mb/100m over mean sea level, MSL) especially during use in a corresponding height above sea level. It can be programmed or measured with a sensor (s. man. 6.7.2). The function ATM.PRESS. ´mb´ will be automatically activated under the key **FUNCTION** for the sensors mentioned (see 5.2).

Function ATM.PRESS. ´mb´

Selection with key: 

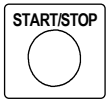
... Input mbar, see 5.4 

With each reset the atmospheric pressure is set to 1013mb. It can be set to the actual value by the usual data entry.

7.2 Single Measuring Point Scan (see also man. 6.5.1.1)

Measuring point scans can be used to acquire, indicate and, in most cases, to document data from the selected measuring point and also from other measuring points. During a measuring point scan the measuring inputs of the active measuring points are, via photovoltaic relays and with the conversion rate, switched to the measuring circuit. The measured values are acquired, monitored with regard to an exceeding of limit values and successively indicated in the display for 1.5 seconds. Furthermore, the maximum and minimum values are updated.

Single measuring point scans for acquiring the momentary measured values of all active measuring points are triggered by the key **START/STOP** as long as no print cycle has been programmed.

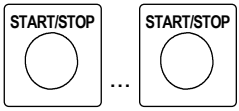
Single Meas. Point Scan: key: 

(cycle 00:00:00)

The measured values are sequentially indicated in the display for approx. 1.5 sec while the arrow ´START´ is on and then disappears again. The time is started if it has been previously cleared. If the memory is active the arrow ´MEMORY´ will be on during the scan. If a peripheral device (e.g. a printer) is connected the measured values are provided one time as an output via interface (printout s. man. 6.6.1) and the arrow ´V24´ will also be displayed. The output format can be set in function BAUD RATE (see 8.2). With each further pressing of the key the measured values are equally processed with the corresponding measuring time. If true time has to be indicated it must be set beforehand (see 7.3.2).

7.3 Cyclic Measuring Point Scan (see also manual 6.5.1.2)

For cyclic measuring point scans the measuring cycle or print cycle must be programmed (see 7.3.1/2). The measurement is started with the key **START/STOP** and the arrow ´START´ will be continuously on. If the measured value is also stored, the arrow ´MEMORY´ will be on. If a peripheral device is connected, the measured values are provided as a cyclic output and, in addition, the arrow ´V24´ is indicated. Different output formats are available (see 8.2). The measurement must be started in the function RANGE if the programming is to be indicated before the measured values. The corresponding print outputs can be found in manual section 6.6.1.

Start/stop cyclic measuring point scans: 

Stopping of the automatic measuring point scan can be achieved by operating the key **START/STOP** once again. The arrows will turn off again.

7.3.1 Print Cycle, Continuous Measuring Point Scan

With all measurements the print cycle will cause a cyclic measuring point scan of all active measuring points including an output of measured values to the display, printer, memory or interface. The time can range from 1s and 24h.

Function PRINT CYCLE ´PC´

Selection with key: 

... 00:30:00.DZ

Example: print cycle 30min, cont. scan

The print cycle is programmed with 6 digits in the format hh:mm:ss (see 5.4).

Clear print cycle: 

00:00:00 DZ

A running cyclic scan is terminated by this.

The **continuous measuring point scan** can be switched on and off using the keys **ENTER**, **±** (see man. 6.5.1.3), for control purposes a dot will be indicated next to the print cycle.

The function **measuring cycle** is, for an easier operation, no longer activated as standard. However, it is still available via the interface and can also be activated in display mode 6. The continuous measuring point scan provides a higher resolution for averaging. For an alarm output the output format ´ALARM´ is available (see 8.2). The measuring cycle is only required for pulse measurements with a cyclic summation.

7.3.2 Time and Date

For recording the measuring time a real time clock with date function has been integrated into the ALMEMO® 4290-7. It has a lithium battery so the time and date are maintained after a switch-off.

Function TIME ´TM´

Selection with key FUNCTION... 12:34:56 ZT

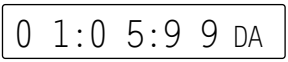
Input of the time in format hh:mm:ss (see 5.4).

Stopping and zero setting of the clock with the keys **ENTER**, **Clr** .

Operate the key **START/STOP** to start the clock in any switch setting.

Function DATE ´DA´

Selection with key FUNCTION...



Example: date 1 May 1999

Enter the date in format dd.mm.yy (see 5.4).

Clear the date with operating the keys **ENTER**, **Clr** .

The year number can also be provided with 4 digits via interface (see manual 6.10.13).

7.3.3 Alarm Processing

If limit values are programmed and exceeded or if a sensor breakage or mains interruption occurs, an alarm will be triggered, i.e. the built-in alarm tone starts and the alarm relay (option G) will respond. To ensure that the relay also responds with an alarm when a mains interruption occurs, the relay is picked up during normal operation. The symbol BAT will be indicated in the display if a mains interruption occurs. In case of a sensor disturbance the arrow ALARM will be indicated and the alarm LED that corresponds to the sensor will be illuminated. For checking whether an error has occurred while the system was not directly monitored, the control lamps will stay on until they are cleared by operating the key ALARM OFF. However, this is only possible if the disturbance has been cleared. The alarm tone and relay can be switched off immediately after a disturbance has occurred, by operating the key ALARM OFF. If a second error occurs, a new alarm will be triggered.

The alarm relay (option G) with make and break contact has a switch capacity of 230V / 1A. The connection is a 3-pole connector block (8), which is located inside the instrument (see 1.3).

The mains plug must be disconnected before the housing is opened. The connection of mains-operated alarm generators must only be performed by a qualified electrician!

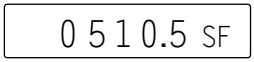
7.4 Data Memory

The basic principles for data storage in ALMEMO® devices are described in the manual section 6.9. The memory organisation can be reconfigured from linear to ring memory (see man. 6.10.13.2). The stored data can, completely or as an extract, later be displayed offline in different output formats (see 8.2).

Display of Memory Capacity

The key **F1** can be used to select the function **Memory Free** ´MF´ and monitor the free memory space in Kbytes. If the **memory is full** the display turns to 0.0 and no further meas. values will be stored if linear memory has been selected. If ring memory has been selected old meas. values will be overwritten.

Function MEMORY FREE ´MF´

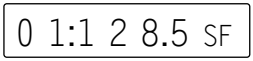


7.4.1 Memory Connector

The ALMEMO® 4290-7 is the first device that allows connecting external ALMEMO® EEPROM memory connectors ZA 1904-SS with capacities of 128kB or 256kB (25,000 or 50,000 measured values) alternatively. These memories do not require a battery to keep stored data available. They can be removed, sent away and, independent from the device they can be evaluated on a computer by means of a readout interface (ZA 1409-SLK). The baud rate for the readout of data using the readout interface can be set via the measuring instrument (see 8.1). The operating mode ring memory is not available when external memories are used.

The memory connector is plugged into socket OUT2 and will be automatically identified and, as long as it is connected, will be used in place of the internal memory. This will also be visible at the display of the memory capacity. Next to the memory space a 2-digit connector number will be indicated. For identification of the connector it can be programmed from 00 to 99 as follows. After operating the key **ENTER** the message ´SCLr´ will start flashing and when the key **ENTER** is operated again, the first digit of the number will flash and can be edited as described in 5.4.

Input of the connector number:



If the internal data memory contains data when connecting the memory connector the message ´SCLr´ will flash in the display and prompt the user to delete the memory by using the key **Clr** (see 7.4.3). If the data needs to be rescued the connector must be removed again and the data must first be read out.

7.4.2 Data Acquisition

All single measuring point scans and all measuring point scans that are performed in the print cycle are generally stored in the memory. If only alarm values (e.g. exceeding of limit values) should be stored, the output format alarm must be set in function (see 8.2).

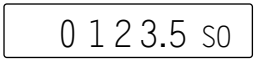
For **starting the cyclic storage** the key **START/STOP** must be operated. For control purposes the arrow ´MEMORY´ will be on and indicate that measured values are being continuously stored during automatic scans (see 7.3) or only during the scan when a manual scan is performed (see 7.2).
The storage can be stopped by operating the key **START/STOP** again.

More methods to start and stop a record using time of day, limit values, external triggering or the interface are described in the manual section 6.6.

7.4.3 Output of Measuring Data

The content of the memory can, as with the online data output, be provided as often as desired and in all output formats (see 8.2) to a printer or PC (see also man. 6.6.1). The output can be started by operating the key **OUTPUT** in function Memory Free ´MF´. During the data output the display will firstly indicate ´S Out´ and then the function abbreviation ´SO´ is used to continuously indicate the remaining memory content in Kbytes to be provided as output.

Function MEMORY OUT ´SO´



Printout:

```
MEMORY:
DATE:       12.03.90
12:30:00 01: +0012.0 °C NiCr designation
         02:!+0008.8 °C NiCr water
         03:>+125.00 °C Ntc  motor oil
```

List format

The following key functions are available during the output:

stop automatic output	**START/STOP**
display meas. values individually	**F**
restart automatic output	**OUTPUT**
cancel automatic output	**Clr**

Clear Memory

After pressing the key **ENTER** the message ´SClr´ will flash in the display. Only if the key **Clr** is then pressed the memory will be deleted, otherwise not.

Clear memory using the keys: 

, 

8. DIGITAL DATA OUTPUT

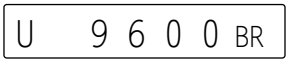
The serial interface can be used to completely program the instrument and sensors or to query the programming (see man. 6.). Furthermore, it is possible, as described in sections 7.2 and 7.3, to provide outputs of manual and cyclic measurements online, or offline after a recording (see 7.4), to a printer or computer. The various interface modules can be connected to socket OUT1 (3). The connection to the devices is described in the manual section 5.2. Modules for networking the devices follow in section 5.3.

8.1 Baud Rate, Data Format

All interface modules are factory-set and programmed to 9600 baud. To avoid unnecessary problems when networking several devices the baud rate should not be modified but the computer or printer should be set up accordingly. If this is not possible the values 150, 300, 600, 1200, 2400, 4800, 9600 bd and 57.60 Kbd can via keypad be entered in function BAUD RATE ´BR´ (maximum baud rate of the interface module must be considered!).

The input can, as usual, be started by operating the key **ENTER** and then setting the baud rate by using the keys ▲ and ▼ and, by once more operating the key **ENTER**, performing the programming. The baud rate is stored in the EEPROM of the interface module and, as a result, is also valid for use with all other ALMEMO® devices.

Function BAUD RATE ´BR´

Selection with key **FUNCTION**... *Example:* 9600 bd 

Data format: unchangeable 8 data bits, no parity, 1 stop bit

To change the baud rate for the readout of a memory connector via readout cable ZA 1409-SLK, the memory connector must be plugged into socket OUT1 and the baud rate must be programmed as shown above.

8.2 Output Formats for Lists of Measuring Data

For measuring point scans (s. 7.2, 7.3) the measured values can be provided as lists of measured values in different output formats (s. man. 6.5.5, 6.6.1). Apart from the standard list format, with all measured values given in a **list**, the column output format allows for a clear and space-saving printout in **columns**. For this purpose, a printer will automatically switch to the condensed character mode. The **spreadsheet format** is available to further process measuring data by means of spreadsheet applications (s. man. 6.1).

If only alarm values shall be printed during a cyclic measuring point scan, the format **Alarm** must be set.

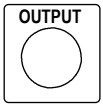
If the function RANGE ´ R´ is selected when starting, a header containing the programming will be printed at first. It is also possible to print out an individual designation within the header (see man. 6.2.4).

The **output format** can also be set in function BAUD RATE ´BR´. The four options can be selected via the keys **ENTER**, ◀ , ▲▼. For identification the following abbreviations will be displayed next to the baud rate:

Format	**Printout**	**Display**
u **l**ist	meas. values in list format	U u 9 6 0 0 BR
n **c**olumn	meas. values in column format	U n 9 6 0 0 BR
t **s**preadheet	meas. values in spreadsheet format	U t 9 6 0 0 BR
A **a**larm	alarm values only, in list format	U A 9 6 0 0 BR
as above without data cable:	storage of alarm values only	S A - - - - BR

8.3 Manual Data Output

In addition to the lists of measured values it is also possible, by using the key **OUTPUT**, to provide a print output (as given below) of all other function values that have been selected by using the key **FUNCTION**.

Manual data output in any function by using the key: 

Switch	**Fun**	**Printout**
MEAS.VALUE		12:34:00 01: +0023.5 °C
MAX / MIN VALUE	MH/ ML	MS MEASVAL MAXVAL MINVAL AVG VAL COUNT 01:+0023.0 +0025.0 +0019.0 +0022.0 99999
MEMORY	MF	MEMORY: - - - - see 7.4.3
PRINT CYCLE	PC	PRINT CYCLE: 00:06:00
TIME	TM	TIME: 12:34:00
DATE	DA	DATE: 01.02.99
LOCKING MODE extended software routine	L	MS ZEROPT SLOPE VM K FUNC EOFSET EFACT ANA-STR ANA-END B1 MX EF AH AL ZF RPM 01:+0000.0 +1.0000 5. 1 MEAS +00000 32000 +0000.0 +1000.0-01 M1 -- S- E2 05 12.0 see man. 6.10.1
RANGE	R	01:NiCr +0123.4 -0012.0 +0000.0 °C 1.0000 E+0 - - -
LV MAX	LH	LIM VAL MAX: 01: -0100.0 °C
LV MIN	LL	LIM VAL MIN: 01: +0020.0 °C
BASE	BA	BASE VALUE: 01: -0273.0 °C
FACTOR	FA	FACTOR: 01: +1.0350E-1
ZERO PT CORR.	ZC	ZEROPOINT: 01: -0000.7 °C
SLOPE (GAIN) CORR.	SC	SLOPE: 01: +1.0013

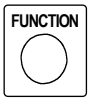
Switch	Fun	Printout
BAUD RATE Sensor Programming	BR	AMR ALMEMO 4290-7 RANGE. LV-MAX LV-MIN BASE V D FACTOR EXP AVG COMMENT 01:NiCr +0123.4 - - - - - - °C 1.0350 E+0 - - - Designation 02:NiCr - - - +0012.0 - - - °C - - - E+0 CONT Water MEAS.CYCLE: 00:00:00 S0501.9 F0304.7 A W010 C-SU-
if programmed		PRINT CYCLE: 00:10:00 Sn 9600 bd START TIME: 00:07:00 START DATE:02.01.99 END TIME: 18:30:00 END DATE: 03.01.99
		see man. 6.2.3
ATM. PRESSURE Device Programming	mb	DEVICE: G00 M20 A08 P05/20/00 ATM.PRESS: +01013. mb CJ-TEMP: +0023.5 °C U-SENSOR: ! 12.5 V HYSTERESIS: 10 CONFIG: FCRDAS-- -L-- ALARM: -1-3 A1: DK0 Un A2: AK1
		see man. 6.2.5

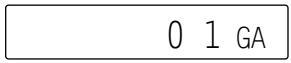
8.4 Device Address and Networking

All ALMEMO® instruments can be very easily networked to centrally acquire the measured values of several instruments that are located at different places (s. man. 5.3). For communicating with networked devices it is mandatory that each device has its own address as only one device is allowed to respond to each command. Therefore, before any network operation it is necessary that all connected devices are set to different device numbers. The function DEVICE ADDRESS ´ A´ is used for this purpose. It can be selected with the key **FUNCTION** and, at first, and the currently set device number is displayed, which is usually factory-set to 00. It can then be modified by the usual data entry (s. 5.4).

Function DEVICE ADDRESS ´ A´

Selection with key:





Example: address 01:

Only successive numbers between 01 and 99 should be entered for network operation so that the device 00 cannot be falsely addressed in case of a power supply failure.

9. TROUBLESHOOTING

The data logger ALMEMO® 4290-7 can be configured and programmed in many different ways. They allow for a connection of many different sensors, additional measuring instruments, alarm signalisers and peripheral devices. Due to the large variety of options it is possible that, under certain conditions, they do not perform as the user would expect. In most cases this will not be related to a defective device but to operating errors such as wrong settings or an inadmissible wiring. The following tests should be performed to correct or to correctly identify the error.

Error: No display data or all display segments are permanently illuminated.
Remedy: Check power supply, recharge battery, switch off and on again, reinitialise (see 3.3).

Error: False measured values.
Remedy: Thoroughly check the programming of the channel (especially base and zero point), query the entire programming by means of the software AMR-Control or the terminal and command `P15` (see manual 6.2.3) and `f1 P15` (see manual 6.10.1).

Error: Varying meas. values, segment test or blockage during operation.
Remedy: Check cabling for inadmissible electrical connection,
Disconnect external power supply and output modules,
disconnect suspicious sensors and replace them by hand-held sensors in air or connect dummies and check (short circuit AB at thermocouples, 100Ω at Pt100 sensors).
If the error is corrected by this, check the wiring,
isolate the sensor if necessary, use electrically isolated power supply, prevent influences from disturbances by shielding or twisting.

Error: Data transmission via interface does not function.
Remedy: Check interface module, connections and settings:
Are both devices set to the same baud rate and transmission mode (see 8.1)?
Is the correct COM interface addressed at the computer?
Is the printer set to ONLINE mode?
Are the handshake lines DTR and DSR active?

A small interface tester with LEDs is very useful for checking the data flow and the handshake lines (during standby mode the data lines TXD and RXD are on a negative potential of approximately -9V and the diodes are illuminated green. The handshake lines DSR, DTR, RTS and CTS have a positive voltage of approximately +9V and the LEDs are illuminated red. During the data transmission the data lines must flash red).

Test the data transmission by using a terminal (AMR-Control, WIN-Control, DATA-Control, WINDOWS Terminal):
Address the device with its device number Gxy (see manual 6.2.1),
query the programming by P15 (see manual 6.2.3),
only check the sending line by cycle input via command Z123456 and control in the display.
Test the receiving line by using the key **OUTPUT** and monitor control.

Error: Data transmission within network does not function

Remedy: Check that all devices are set to different addresses,
address devices individually via terminal and command Gxy,
addressed device is OK when the feedback is at least y CR LF.
If data transmission is still not possible, disconnect networked devices, check devices separately at data cable of the computer (see above),
check the wiring regarding short circuit or twisting.
Are all network distributors supplied with power?
Network and check the devices successively again (see above).

If the device is, after the above inspections, still not performing as specified in the operating instructions, it must be sent to the factory in Holzkirchen, Germany, including a short report and possibly control printouts. The software AMR-Control allows to print the monitor pages including the programming and also to save the terminal operation and to print it out.

10. ELECTROMAGNETIC COMPATIBILITY

The data logger ALMEMO® 4290-7 meets the electromagnetic compatibility (EMC) safety requirements specified in the relevant CE directive issued by the council for the alignment of legal regulations of the member states (89/336/EWG).

The following standards have been applied for the evaluation of the product:

EN 50081-1:1992	
EN 50082-1:1992	IEC 801-2 8kV, IEC 801-4 1kV
	IEC 801-3 3V/m: deviation<100µV

The following notes must be observed when operating the instrument:

1. If the standard sensor cables (1.5m) are extended it must be considered that the measuring lines are not guided together with power mains and that they are appropriately shielded to protect against any coupling of disturbance signals.
2. If the instrument is operated within strong electromagnetic fields an additional measuring error must be expected (<50µV at 3V/m and 1.5m thermocouple transducers). After the irradiation the device operates again within the specified technical data.

Technical Data (see also man. 2.2)

Measuring Inputs:	5 ALMEMO® sockets for ALMEMO® flat connectors
Measuring Channels:	5 prim. channels electr. isol., max. 15 add. channels for double sensors and function channels
Sensor Voltage Supply:	ca. 9V (operation with recharg. batt. 6V) , max. 70mA
Equipment:	
Display:	6½ digits 7-segment, 2 digits 16-segment, 12mm
Keypad:	6 membrane keys
Memory:	500 kB (100,000 meas. val.) buffered with Li battery
Time and Date:	real time clock buffered with Li battery
Microprocessor:	HD 6303 Y
Outputs:	2 ALMEMO® sockets for all output modules
Voltage Supply:	
Mains:	230V AC, 50Hz
Option U (OA 4290-U):	9 ... 36V DC electrically isolated
Rechargeable Battery:	NiCd 6 V, 800 mAh, charg. time: approx. 24h
Current Consumption:	12 mA without option G, 50 mA with option G
Supply Voltage Control:	automatic with visual and tone alarm
Housing:	plastic ABS: L 200 x W 120 x H 57 mm, IP 51
Operating Conditions:	
Operating Temperature:	-10 ... +60 °C
Storage Temperature:	-30 ... +60 °C
Humidity of Ambient Air:	10 ... 75 % rH non-condensing
Extent of the Delivery:	Measuring Instrument ALMEMO® 4290-7 Operating Instructions ALMEMO® 4290-7 ALMEMO® Manual incl. software AMR-Control

Product Overview

	Order No.
Data Logger ALMEMO® 4290-7	
5 inputs, max. 20 channels, 500 kB memory, real time clock, 6 keys, serial interface that can be cascaded, rech. batt. 6V/0.8Ah, mains conn.	MA 4290-7
Option U Voltage Supply, 9-36V DC, electrically isolated	OA 4290-U
Option G Limit Value Relay with make and break contact, 250V/1A	OA 4290-G
ALMEMO® Memory Connector, 128kB EEPROM (ca. 25000 meas.val.)	ZA 1904-SS4
ALMEMO® Memory Connector, 256kB EEPROM (ca. 50000 meas.val.)	ZA 1904-SS8
V24 Adapter Cable for direct readout of memory connector via PC, max. 115200 baud	ZA 1409-SLK
ALMEMO® Recording Cable -1.25 to 2.00 V, 0.1 mV/digit	ZA 1601-RK
ALMEMO® Data Cable V24 interface, electr. isol, max. 9600 bd, 1-4mA	ZA 1909-DK
ALMEMO® Data Cable Centronics Interface, electr. isolated	ZA 1936-DK
ALMEMO® Network Cable Current Loop, electr. isolated	ZA 1999-NK
ALMEMO® I/O Cable for Triggering and Limit Value Alarm	ZA 1000-EGK