Operating instructions

X6 ALMEMO® 1036-2

High-precision humidity measuring instrument for Pt100 psychrometer

V2.0
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www.ahlborn.com

1. OPERATING CONTROLS

(1) Measuring sockets M0 to M1
M0..M1 ALMEMO® sensors
M10..M31 Additional channels for humidity variables
M02 internal Atmospheric pressure
M12..M32 Additional channels

(2) Sleep-LED

(3) Output socket A2
SD memory connector (ZA1904-SD)

(4) Output socket A1
V24 interface (ZA 1909-DK5)
Optic fiber (ZA 1909-DKL)
USB (ZA 1919-DKU)
Ethernet (ZA 1945-DK)

(5) Power supply, DC 12V
Mains adapter (ZA1312-NA7, 12V, 1A)
Cable, electr. isol. (ZA 2690-UK, 10-30V)

(6) LCD, graphics display
7 rows for function
1 row for softkeys F1, ◀, ▲, ▶, F2
Shown in brackets: **<MEM>** , **<FCT>**

(7) Operating keys

ON	To switch device ON, To switch device OFF press and hold down
F1, **F2**	Function keys (softkeys)
▲, **▼** ...	**M:** measuring channel
▲, **▼**, **▶**	**F:** menu
PROG, **▼** ...	**F:** function
◀ ...	To return to menu
PROG	To program
▲, **▼**, **▶** ...	To enter data
< M◀◀ >	directly to the measuring menu
< P◀◀ >	directly to the programming menu

Rear of device:

(8) Battery compartment
3 AA alkaline-manganese batteries

2. TABLE OF CONTENTS

3. GENERAL

We should like to congratulate you on your purchase of this new and innovative psychrometer; this outstanding instrument provides high-precision measurements for Pt100 sensors at a resolution of 0.001 K; it is thus also ideally suitable for highly accurate humidity measurement..

3.1 Warranty

JEach and every device, before leaving our factory, undergoes numerous quality tests. We provide a guarantee, lasting two years from delivery date, that your device will function trouble-free. Before returning your device to us, please observe the advisory notes in Chapter 17, ´Trouble shooting´. In the unlikely event that a device does prove defective and you need to return it, please wherever possible use the original packaging materials for dispatch and enclose a clear and informative description of the fault and of the conditions in which it occurs.

This guarantee will not apply in the following circumstances :

- Any form of unauthorized tampering or alteration inside the device
- Use of the device in environments or conditions for which it is not suited
- Use of the device with an unsuitable power supply and / or in conjunction with unsuitable peripheral equipment
- Use of the device for any purpose other than that for which it is intended
- Damage caused by electrostatic discharge or lightning
- Failure to properly observe these operating instructions

The manufacturer reserves the right to change the product's characteristics in the light of technical progress or to benefit from the introduction of new components.

3.2 Standard delivery

When you unpack the device please check carefully for any signs of transport damage and ensure that delivery is complete.

Measuring instrument ALMEMO® 1036-2 with 3 AA alkaline batteries,
Mains adapter ZA1312NA7,
Pt100 psychrometer FPA836-3P3
with mains adapter, water bottle, set of wicks,
USB data cable ZA1919DKU
Instrument case,
DKD/DakkS calibration certificate,
Software ALMEMO® View SW5500AV
CD with ALMEMO® Control software and various useful accessories
These operating instructions, ALMEMO® Manual

In the event of transport damage please retain the packaging material and inform your supplier immediately.

3.3 Waste disposal

The pictogram showing a waste bin crossed through means that the product is subject to European Union regulations on segregated waste disposal. This applies both to the product itself and to any accessories marked with the same symbol. Disposal of any such item as unsorted domestic waste is strictly forbidden

- Please dispose of all packaging materials according to the applicable national waste management regulations.
- Please dispose of cardboard boxes, protective plastic packaging materials, and all preservative substances separately and in the proper manner.
- The disposal of the device itself (also of device parts, accessories, and consumables) is subject to the applicable national and local waste management regulations and to the environmental protection legislation in force in the country of use.
- Please dispose of all waste in the proper manner;
  this applies in particular to all parts and substances that constitute a hazard for the environment. This includes inter alia plastics, batteries, and rechargeable battery packs .
- When disposing of goods, please wherever possible use the original packaging materials.

4. SAFETY INSTRUCTIONS

DANGER

Danger to life and limb, risk of damage to equipment
Read the instructions carefully before starting to operate the device. Please ensure that you comply with all general safety advice and the special safety instructions included in other chapters.
Such risks may occur in the following circumstances :

- Failure to heed the operating instructions and all the safety notes these contain
- Any form of unauthorized tampering or alteration inside the device
- Use of the device in environments or conditions for which it is not suited
- Use of the device with an unsuitable power supply and / or in conjunction with unsuitable peripheral equipment
- Use of the device for any purpose other than that for which it is intended
- Damage caused by electrostatic discharge or lightning.

DANGER **Risk of fatal injury caused by dangerously high voltage**

Such risks may occur in the following circumstances :

- Use of the device with an unsuitable power supply and / or in conjunction with unsuitable peripheral equipment
- Damage caused by electrostatic discharge or lightning
- Do not run sensor lines in the vicinity of high-voltage power cables.
- Before you touch any sensor lines, ensure that all static electricity has been discharged.

DANGER **Warning - explosive atmospheres or substances**

In the vicinity of various fuels or chemicals there is a risk of explosion.

Do not use the device in the close vicinity of blasting work or filling stations!

4.1 Handling batteries / rechargeable batteries correctly

When inserting batteries / rechargeable batteries ensure that these are correctly polarized.
If the device will probably not be needed for a relatively long period of time or if the batteries are empty, remove the batteries; this will prevent battery acid leaking onto the device and damaging it.
Rechargeable batteries should be recharged as and when necessary.
You should never attempt to recharge an ordinary (non-rechargeable) battery; it may explode !
Batteries / rechargeable batteries must never be short-circuited or thrown onto the fire.
Batteries / rechargeable batteries are special waste and must not be discarded together with normal domestic waste.

4.2 Special notes on use

- If the device is brought into the work-room from a cold environment there is a risk that condensation might form on the electronics. In measuring operations involving thermocouples pronounced changes in temperature may cause substantial measuring errors. You are advised therefore to wait until the device has adjusted to the ambient temperature before starting to use it.
- Before using the mains adapter make sure that the mains voltage is suitable.
- Be sure to observe the maximum load capacity of the sensor power supply.
- Sensors with their own integrated power supply are not electrically isolated from one another

5. INTRODUCTION

5.1 Measuring humidity, basic principles

Humidity is always present in the atmosphere in the form of water vapor. The percentage of water vapor per volume of air varies. Saturation vapor pressure at any given air temperature is the maximum partial pressure of water vapor (its gas phase) over an even surface of water (its liquid phase). This is temperature-dependent; at each temperature there is a maximum quantity of water vapor that can be contained in a defined quantity of air. Atmospheric humidity can be specified either as **absolute humidity** or as **relative humidity**. In these operating instructions humidity variables will be given first using the new symbols defined in VDI/VDE 3514 and then in brackets using the old abbreviations seen in tables issued by the Deutscher Wetterdienst (German Meteorological Service).

Absolute humidity d_v (AH) is also referred to as water vapor content. This is the weight of water vapor contained in one m3 of a mixture of water vapor and air. Since 1 m3 will, depending on pressure and temperature, contain a different air mass, it is usually easier to refer to absolute humidity per 1 kg of dry air. This variable is known as the **mixture ratio r** (MH).

Relative humidity U_w (RH) is the ratio of the **water vapor's partial pressure e´** (VP) to the saturation vapor pressure ew´ (SVP) in a mixture of water vapor and air at **air temperature t** (TT). The temperature at which saturation occurs (VP=SVP, RH=100%) is known as the **dewpoint temperature t_d** (DT). As soon as the air falls below this dewpoint temperature the water vapor (gas phase) condenses into droplets of water (liquid phase). Enthalpy h (En) is the thermal content in the mixture of water vapor and air.

5.2 Psychrometer

Measuring principle

A psychrometer is a precision measurement instrument incorporating two highly accurate temperature sensors; it is used to determine all the usual humidity variables. One of these sensors is covered in a cotton sheath; this must be kept permanently moist with water from a reservoir and cooled by means of

a current of air. When the power supply is connected and the integrated fan starts operating, the moistened temperature sensor will, depending on air temperature and humidity, cool down by a measurable amount. Based on this psychrometric temperature difference the water vapor's partial pressure e´ and thus all the variables associated with atmospheric humidity can be calculated.

5.3 Measuring instrument

The reference measuring instrument ALMEMO® 1036-2 belongs to the new X6 series of high precision measuring instruments featuring very high resolution and linearity. The ALMEMO® 1036-2 provides 2 galvanically isolated measuring inputs for Pt100 sensors with a measuring range from -200 to 400/560°C and a resolution of 0.001K. Since the temperature values can be calculated precisely thanks to appropriate formulas, there will be no linearization errors concerning the resolution. The measurement accuracy of up to 760,000 digits is significantly higher than the usual 16bit numbers (65000) for other ALMEMO® V6 devices. Due to this high measurement accuracy, the standard functions limit values, measured value correction, scaling or analog outputs cannot be supported. Alternatively, the possibility for multi-point adjustment of 24bit basic value interpolation or of the modification of coefficients is offered. Thanks to that, the ALMEMO® 1036-2 is perfectly suited as a precision reference instrument for temperatures as well as – in combination with the psychrometer – for all humidity variables.

The Pt100 psychrometer can be used to measure very accurately both dry temperature and humid temperature and thus calculate all the usual humidity variables on the basis of formulae as per Dr. Sonntag and the enhancement factor as per W. Bögel (correction factor fw(t,p) for real mixed gas systems). These calculations must take account of atmospheric pressure; for this purpose the device incorporates as standard an atmospheric pressure sensor. The measuring range and accuracy of this device are thus much greater than with previous systems. The atmospheric pressure measured can also be used as an additional climate variable.

Device 1036-2 can also have two digital D6 humidity sensors connected, namely NTC psychrometer FNAD36-3, and capacitive humidity sensor FHAD46-RS (for up to maximum 200 °C). Both use exactly the same calculation principles and internal atmospheric pressure compensation as the Pt100 psychrometer.

To facilitate operation the device incorporates an illuminated LCD graphics display and a keypad with softkeys and cursor block. The device incorporates three output sockets for connecting interface cables, a memory connector, or a mains unit.

5.4 Sensor programming

Measuring ranges

For Pt100 sensors, two high resolution measuring ranges exist: -200.000 to 560.000°C and (as an option) -200.00 to 850.00°C. The calculation of the humidity variables relative humidity and dew point is rounded to two decimal places. Additionally, the following humidity variables are available: mixture ratio MH, r [g/kg], absolute humidity AH, dv [g/m3], vapor pressure VP, e [mbar] and enthalpy En, h [kJ/kg]. Differential measurements and monitoring of the supply voltage are possible via further function channels.

Or you can connect and program our latest D6 digital humidity sensors. This device - unlike standard ALMEMO® V6 devices - can even display individual range abbreviations; these would otherwise have to be transferred via interface to the PC.

Measured channel designation

Each sensor is identified by means of a 10-character alphanumeric name. These names are entered via the keypad or the interface and appear in the display, in the printout, and on the computer screen.

Correction of measured values

The standard functions regarding measured value correction and scaling cannot be used due to the considerably expanded measuring range. It is however possible to set the measured value of every measuring channel to zero. Moreover, the sensors are adjustable in several points: either via multi-point linearization i.e. the error curve can be stored in the measurement plug or via modification of the Pt100 coefficients.

For digital D6 sensors the standard correction functions, zero-point and gain, are also provided.

All programmed sensor parameters are saved in the connector and are automatically restored as and when a sensor is plugged in.

5.5 Measuring operation

The user can move forwards or backwards from one measuring channel to the next using the keypad. Data is output on the display at a rate of 1.25 measuring operations per second (mops).

Atmospheric pressure compensation

Humidity variables are heavily dependent on atmospheric pressure. To avoid errors of this nature the device incorporates its own atmospheric pressure sensor for compensating its measured values. All D6 sensors incorporate their own atmospheric pressure sensor.

Measured value smoothing

For both measuring channels measured values of an unstable, fluctuating nature can be smoothed by taking a sliding average over a number of values programmable from 2 to 99. With D6 sensors a separate time constant can be programmed. (see sensor instructions)

Maximum and minimum values

For each measuring operation the maximum value and minimum value are acquired and saved to memory. These values can then be displayed, printed out, or deleted from memory.

Measured value memory

Up to 100 measured values can be saved manually. This data can then be shown on the display or output via the interface.

Operation

All measured values and function values can be displayed in different menus on the dot-matrix LCD screen. Seven keys (four of them softkeys) are available for operating the device. In this way the device and sensors can be programmed.

Output

All data logs, menu functions, saved measured values, and stored program parameters can be output to any peripheral equipment. Using the appropriate interface cable any of interfaces RS232, RS422, USB, or Ethernet can be used. Measured data can be output in list, column, or table format. Files in table format can be processed directly using any standard spreadsheet software. The print header can be programmed to refer specifically to your company or to a specific application.

Data logger

The device can, by fitting an external memory connector with a micro-SD memory card, be upgraded to a high-capacity data logger. Using this external memory connector (available as an accessory) files can be read out very quickly via any standard card reader. As soon as this is connected two additional menus with all the necessary parameters e.g. date, time-of-day, cycle, start time, end time, memory capacity, file name etc. are available.

6. PUTTING INTO SERVICE

Sensor connection Connect sensors to sockets **M0** and **M1** (1) see 8.

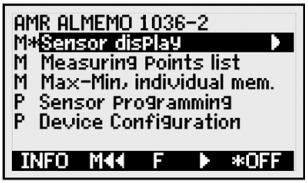
Power supply Via battery or mains adapter connected at socket **DC** (5) see 7.1, 7.2

To switch ON Press once and release key **ON / PROG** (7) see 7.4

Automatic display of the measuring menu see 11,

To call up the menu selection screen press **<MENU>**

To activate / deactivate display illumination press **< ON>**



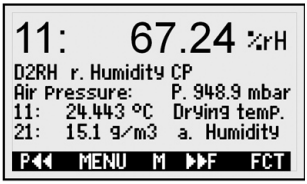
To access the **Sensor display** s. 9.1

press **<F>**: ▲ / ▼ ...

call up the menu press: ▶ or **PROG**

select a measuring channel(s.11.1) **<M>**: ▲ / ▼ ...

The measured values from the sensor are displayed.



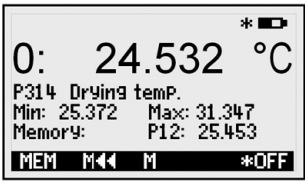
To call up the **functions menu** press **< FCT >** or select it in the **menu** selection screen

Max-Min, Memory: ▲ / ▼ ... , ▶

select a measuring channel(s.11.1) **<M>**: ▲ / ▼ ...

set a measured value to zero **PROG**, **<ZERO>**

save a measured value (s. 13.3) **< MEM>**



To **display saved values** **< LISTM>**

To output memory via an interface to a printer or computer

Connect peripheral equipment via data cable to socket A1 (2). s. 16.3

To output memory see 13.3 **< PRINT>** or command ´**P-04**´ from computer

7. POWER SUPPLY

Power can be supplied to the measuring instrument in any of the following ways :

3 AA alkaline batteries (included in delivery)

Mains adapter, 12 V, 1 A, with ALMEMO® plug ZA 1312-NA7

Power supply cable, electrically isolated (10 to 30 VDC, 0.25 A) ZA 2690-UK

Our product spectrum covers all the appropriate accessories.

7.1 Battery operation and supply voltage monitoring

he device is normally powered by 3 AA alkaline batteries. At a current consumption of on average 25 mA, these last for an operating time of approx. 100 hours. If the display illumination is left switched ON, this operating time will be reduced to approx. 50 hours. The operating voltage can be checked in the ´**Info**´ menu; this gives you a basis for estimating the remaining operating time. (see XREF)

As soon as the remaining battery capacity drops to approx. 10%, the battery symbol in the status bar of the display will start to flash. If the batteries are completely discharged, i.e. down to approx. 3V, the device will switch OFF automatically but measured data already acquired will be saved. (see 7.5)

To replace used batteries first unscrew the battery compartment cover (7) on the rear of the device. When inserting batteries ensure that their polarity is correct.

7.2 Mains operation

To power this device from an external source preferably use mains adapter ZA 1312-NA7 (12 V / 1 A); connect this to the DC socket (3).

Please ensure that the mains voltage is correct.

7.3 External DC voltage supply

The **DC** socket (3) can also be used to connect another DC voltage, 6 to 13 V (minimum 200 mA). ALMEMO® connector ZA1012-FS should be used. If, however, the power supply has to be electrically isolated from the sensors or if a larger input voltage range (10 to 30 V) is required, then electrically isolated supply cable ZA 2690-UK must be used. It will then be possible to use the measuring instrument in a 12-volt or 24-volt on-board supply system.

7.4 Switching ON / OFF, reinitialization

To switch the device ON press and release **ON PROG** (6) located in the middle of the cursor block. The first thing to appear in the display is always the measuring menu.
To switch OFF press and hold down the same key(s) **ON PROG**. When the device switches OFF all saved values and settings are retained intact. (see 7.5)
If interference (e.g. electrostatic) or a malfunction (e.g. battery failure) causes the device to behave abnormally, it can be reinitialized. To activate **RESET** press and hold down key **F1** when switching on. To completely reinitialize all device programming (including device designation) to the factory defaults keep key **F2** pressed when switching on. In so doing certain parameters will be lost or be returned to their defaults : Language = German, illumination = OFF.

7.5 Data buffering

The sensor's programming is stored in the EEPROM on the sensor connector; the device's calibration values and programmed parameters are stored in the EEPROM on the instrument itself; in the event of failure both will be retained intact. When the device is simply switched off, the date and time-of-day settings and the individual value memory on the data logger are retained intact; however, if the device is reset or the batteries are replaced, this will all be lost.

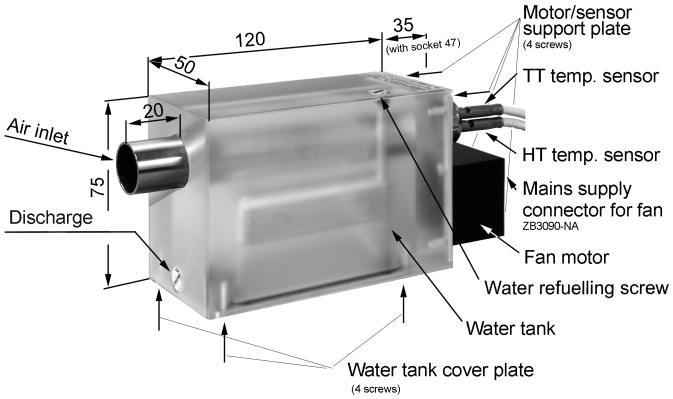
8. CONNECTING SENSORS / TRANSDUCERS

The following special devices can be connected at input sockets M0 and M1 (1) on the measuring instrument :
stationary high-precision psychrometer FPA836-3P3, digital D6 NTC psychrometer FNAD46-3, or D6 humidity sensor FHAD36-RS. Or of course a high-precision Pt100 sensor FPA923-L0250 with range P314 (0.001K) can be used.

8.1 Sensors / transducers

All the afore-mentioned sensors with an ALMEMO® plug have their measuring range and units already programmed and can thus be connected to the measuring sockets without any further adjustment. A mechanical coding system ensures that sensors and output modules can only be connected to the correct sockets. All ALMEMO® plugs incorporate two snap-lock levers; these snap into position as soon as the plug is inserted into the socket, thus preventing unintended disconnection if the cable is pulled accidentally. To withdraw the plug both these levers must first be pressed in at the sides.
Splash-proof variants of devices in the ALMEMO® 1036 series are also available as options. For this purpose new sensors are now available with spray-coated ALMEMO® plugs incorporating a double sealing lip specially designed to protect the socket unit against penetration by splashing water. For any unused sockets protective stoppers are available.

8.2 Stationary high-precision psychrometer FPA 836-3P3



Filling the water reservoir

1. Undo the refill screw
2. Top up the reservoir with distilled water using the squeeze bottle supplied
3. Tighten the refill screw again and perform measuring operation

The water in the reservoir may in certain circumstances become contaminated. The reservoir must be cleaned therefore about every 6 weeks. In the event of long periods of inactivity or for transport purposes the reservoir should be emptied completely.

Changing the wick

If the cotton wick becomes dirty or encrusted it will no longer absorb moisture properly; as a result measured values may be falsified. It should therefore be replaced at regular intervals (depending on how clean the air and water are).

1. Emptying the reservoir (see above)
2. Unscrew the water reservoir lid
3. Unscrew the motor / sensor retaining plate and withdraw the old wick from the humid temperature (HT) sensor
4. From the side of the reservoir insert the new wick into the psychrometer tube and pull over the HT sensor
5. Screw the motor / sensor retaining plate back again
6. From the side of the reservoir adjust the wick, screw the reservoir lid back in position, and refill the reservoir.

Using the psychrometer

To obtain reliable results it is very important that the psychrometer be operated properly. Please ensure therefore that you always comply with all the following advisory notes :

1. After the fan starts up it will take approx. 20 to 30 seconds before the humid temperature sensor is sufficiently cooled. Only after this period will humidity values be stable.

2. Ensure that the humidity sensor is always sufficiently moistened. If you are unsure whether there is sufficient moisture carry out a visual inspection of both the cotton sheath and the wick itself. To moisten the wick use distilled water only. Ordinary water may leave calcified deposits on the wick.
3. If the wick no longer absorbs water properly (through dirt or dryness), replace its cotton sheath.
4. Air velocity at the air intake must be minimum 2 m/s. Ensure therefore that the air intake is always free and unobstructed.
5. Avoid inadvertently warming the probe head from external heat sources or your own body heat.

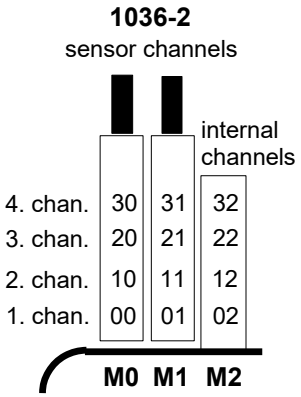
8.3 Measuring sockets, measuring channels

Measuring instrument ALMEMO® 1036 has 2 measuring sockets M0 and M1 (1) and to each of these up to 4 measuring channels can be allocated.

Device-internal channels

This device also provides 4 device-internal additional channels. These can be used, as and when necessary, to program the battery voltage, the device-internal atmospheric pressure, or a function channel Differential . see 14.3, 11.3.

Channel assignment on the 1036-2:

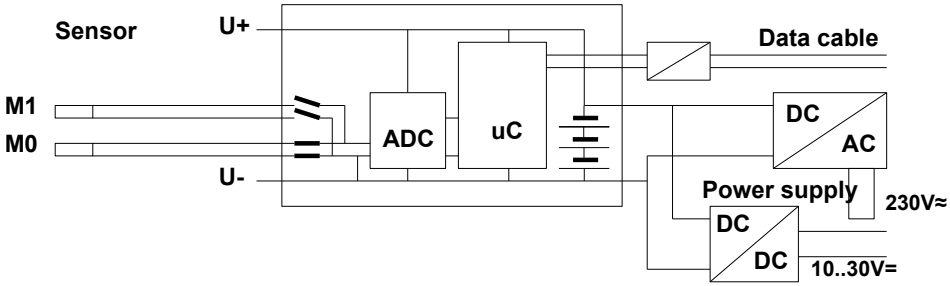


The 3 possible sensors are programmed on leaving our factory with the following ranges (s. 14.3):

	Pt100-Psychrometer FPA836-3P3			Psychrometer FNAD46-3	Humidty sensor FHAD36-Rx
4.		D r		D AP	D AP
3.		P2td		D Uw	D td
2.		P2Uw		D tw	D Uw
1.	P314 HT	P314 TT	AP	D t	D t
	M0	**M1**	**M2**	**M0/M1**	**M0/M1**

8.4 Potential separation

When organizing a properly functioning measuring setup it is very important to ensure that no equalizing current flow between sensors, power supply, and peripherals. All points must therefore lie at the same potential and / or any unequal potentials that do exist must be electrically isolated.



The analog inputs are electrically isolated by means of photovoltaic relays; the maximum potential difference permitted between them is 50 VDC or 60 VAC.
The power supply is isolated by the transformer in the mains adapter or by a DC/DC converter in connecting cable ZA2690-UK.

9. DISPLAY AND KEYPAD

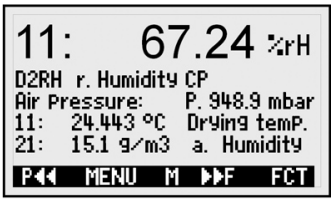
9.1 Display and menu selection

Measuring instrument ALMEMO® 1036 incorporates a display (5) comprising a dot-matrix LCD with 128x64 pixels or 8 rows each 8 pixels high.
The **menu selection** screen offers the following items : (see 10.)
2 measuring menus for measured data acquisition (see 11)
1 function menu for saving values Also accessible from the measuring menu by pressing key **< FCT >** (see 13)
2 programming menus for programming the sensors and the device parameters (see 14, 16)
´Info´ menu for information regarding the device and the sensors (see 10).
The data logger menu appears when you connect of a memory connector (see 16)

To call up **menu selection** (depending on the menu) press ◀ ... or **<MENU>**
To switch **display lighting** (see 16.2) **ON**
To **switch the device OFF** press and hold down key **ON**
To select menus press ▼ or ▲ ...
To call up the selected menu press ▶ or **PROG**
To view the most important device information **< INFO>**

9.2 Measured value display and status symbols

The ´**Sensor display**´ menu will show the selected measuring channels, the measured value, and in some cases the functions of importance for this measured value, plus any further measuring channels assigned to the connector in question. First comes the measuring channel, then measured value, then units.



The measured value is described by a number of status symbols	**Symbol**
No sensor, measuring channel deactivated	´-----´
Measuring range overshot: Maximum value display	**O** flashes
Measuring range undershot: Minimum value display	**U** flashes
Sensor breakage / sensor voltage low : Display ´-.-.-´	**B / L** flashes

In the measuring menus the **status bar** displays the following states :

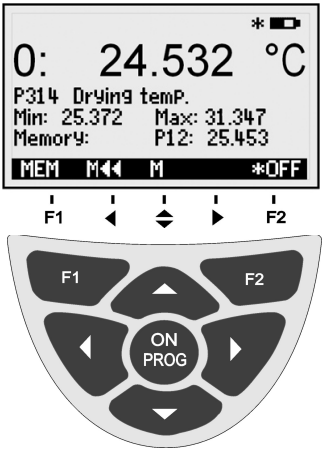
Relative measuring with respect to a reference value	**REL**
Measured value corrected by multi-point adjustment	↗
Smoothing set	**D05**
Display illumination activated or on pause	* or ✱
Battery status: full / half full / almost empty	, ,

Battery voltage <3.8 V, remaining capacity <10% flashes
In the **data logger menu** the top status bar also displays the following symbols for **checking the measuring sequence** :

Measurement stopped or started	ii or ▶
Measuring channel scan started and data being saved	REC
Measuring channel scan started with data output via interface	COM
Start time or end time of measuring operation programmed	i▶ or ▶i

9.3 Function keys

The way in which the function keys **(6)** F1 , F2 and the cursor keys ◀ , ▶ operate may vary from menu to menu. Their function is indicated as an abbreviation in the bottom line of the display (softkeys). In the instructions and documentation these softkey abbreviations are shown in angle brackets. e.g. <MEM>..

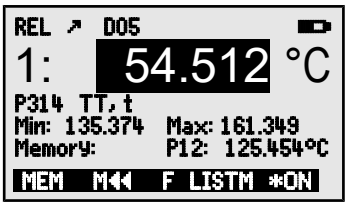


In the measuring menus the following function keys are available :

To select the measuring channel press cursor keys	▲ or ▼ ...
Help is provided in the form of the softkey symbol which lights up in the middle.	<M>
To call up the functions menu for the individual value memory	< FCT > or F2
To call up the data logger menu (with memory connector)	< LOG > or F2
To return to menu selection	< MENU > or ◀
To return to the measuring menu	< M◀◀ >

9.4 Selecting a function

Each menu comprises a number of functions; these may have to be activated or programmed during operation.



To **select a functions** press PROG
The first modifiable parameter is highlighted in inverse font 154.512

Help is provided by the softkey symbol <F> (for function selection) **<F>**
To move forward to the next function press **▲** or **▼** ...
Depending on function the keys **F1** , **F2** ,
and **◄** , **►** are assigned the desired meaning,
e.g.. set measured value to zero. **<ZERO>**
To delete the maximum / minimum value **<CLR>**
To clear the memory **<CMEM>**
To cancel the function **<ESC>**

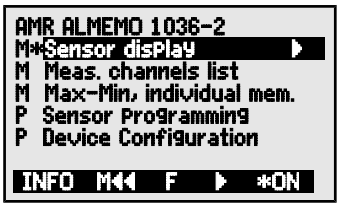
9.5 Entering data

When a programmable parameter is selected its current value can be cleared or reprogrammed directly. (see 9.4)
To **delete a programmed value** press **< CLR >**
To program a value press **PROG**
You should now be in **programming mode**. **<P>** should appear in the middle of the softkey bar.
The cursor appears below the first input position flashing Smoothing 05
To **increment** the selected digit press **▲** ...
To **decrement** the selected digit press **▼** ...
To **change the arithmetic sign** of a numeric value press **< +/- >**
To move forward to the **next position** press **►**
The cursor now appears below the second position flashing. Smoothing 05
To move **back to the previous position** press **◄**
Each position is programmed just like the first. **▲** / **▼** ..., **►**
To **save and exit** press **PROG**
To **cancel** without saving press **<ESC>**
When entering a series of **alphanumeric characters** select the appropriate group.
For upper-case characters press **<ABC>**
For lower-case characters press **< abc >**
For numbers only press **< 123 >**
For arithmetic sign press **< + - >**
When entering certain parameters (e.g. units, baud rate, etc.) this procedure can be used to select and program not just characters but whole designations.

10. MENU SELECTION SCREEN

Via the menu selection screen the following **menus** can be accessed : (see 9.1)

1. **M Sensor display** see 11.
2. **M Measuring channel list** see 12.
3. **M Max./Min. individual memory** see 13
4. **P Sensor Programming** see 14
5. **P Device configuration** see 16



To display the most important data regarding the device press **INFO**

Here, if you have any questions, you can find the exact device type together with its firmware version, options, and serial number.

Here, any sensor can be selected by pressing ▲ / ▼ and identified on the basis of its order number (if available). To assess the available power the remaining battery voltage can be displayed. At our WEB address you can obtain any other help you might need.

11. SENSOR DISPLAY

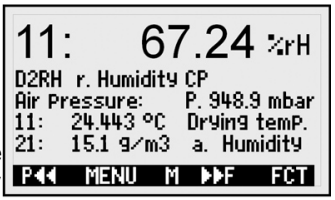
When the device is switched on for the first time it opens with the **Sensor display** menu. In the first line a number of status reports appear. (see 9.2) Below this appear the first measuring channel, the measured value, the units - in large font, and then the range and designation.

Further measuring functions are provided in the functions menu; these can be accessed by pressing key **< FCT >**. (see 13).

11.1 Selecting a measuring channel

To access all measuring channels press ▲
The current measured value is then displayed.
To return to the previous channel press ▼
To increment the meas. channel press ▲
To decrement the meas. channel press ▼

With the psychrometer the humid temperature sensor is on channel 0; this is followed by the dry temperature sensor on channel 1. This connector includes all the humidity function channels too.



11.2 Atmospheric pressure compensation

Certain measured variables are affected by the ambient atmospheric pressure; with a psychrometer all are affected whereas with a capacitive humidity sensor only MH and En; in both cases any pronounced deviation from standard pressure (1013 mbar) may lead to measuring errors.

e.g. Error per 100 mbar		**Compensation range**
Relative humidity, psychrometric	approx. 2%	500 to 1500 mbar
Mixture ratio	approx. 10%	Vapor pressure VP up to 8 bar

To completely avoid errors caused by atmospheric pressure deviations (especially at significant altitudes above sea level), this high-precision instrument incorporates a pressure sensor for use with the Pt100 psychrometer. D6 sensors have their own atmospheric pressure sensors integrated in the ALMEMO® plug. For any measuring channel requiring atmospheric pressure compensation the **Sensor display** menu lists the **Atmospheric Pressure** function.

Active atmospheric pressure compensation **Atm. Pressure P. 1013. mbar**

Active compensation is indicated by the symbol **CP.** with the dot flashing.

In special cases (e.g. when measuring in conduits) the appropriate atmospheric pressure can also be programmed at this juncture. (see 9.5)

To switch back to the measured value the programming value must be deleted again.

11.3 Differential measurement

If two sensors with the same units and same decimal point position are connected at measuring sockets M0 and M1, the difference below device-internal measuring point M02. **M02 = M01 - M00** may be programmed (see 8.3)

12. MEASURING CHANNEL LIST MENU

The best overview of all measuring channels with measured values and function values is obtained via the menu **Measuring channel list**.

This menu cannot be freely configured by the user; it can only be combined with certain selected functions.

When the list is first called up it appears with maximum 12 entries.

Meas. Chan. list
12 measured values
00: 23.12°C ...

To select further measuring channels press **< F ▶>** ...

The measured value can be linked to a series of functions by pressing **<F>**: **▲** or **▼** ...

This reduces the maximum number of channels to 6.

To advance to the next function press **<F>**: **▲**

Measured value with designation **Meas.Chan. list: Designation**

Measured value with maximum value

Measured value with minimum value

Measuring range only (also maximum 12 channels)

```
00: 23.124°C  TemPerature
Meas.Chan. list: Max. value
00: 23.124 °C    32.671 °C
Meas.Chan. list: Min. value
00: 23.124 °C    19.348 °C
Meas.Chan. list: Range
00: P314  °C
```

With more than 6 measuring channels select the next page by pressing: **PROG**, **<M▲>** or **<M▼>** ...

13. FUNCTIONS MENU

It is possible, via the functions menu, to acquire maximum and minimum values over specifiable periods of time or to save measured values for specifiable locations or points in time. Measured values can also be set to zero.

The functions menu can be accessed via the menu selection screen. see 9.1

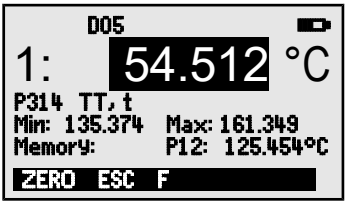
To access the functions menu press **▼** and **►** or **PROG**

or in the measuring menu press **<FCT>**

To return to the measuring menu press **<M◄◄>**

Symbol **<M>** in the middle of the softkey bar indicates that the measuring channel can be selected by pressing ▲ / ▼.

13.1 Setting a measured value to zero



One very useful function is to zero the measured value at certain locations or points in time as a reference value from which to observe subsequent deviations. Having selected the measured value the softkey **<ZERO>** will appear. Pressing this key sets the displayed measured value to zero.

Pressing this key sets the displayed measured value to zero.

Select the ´**Measured value**´ function (see 9.4) **00: 54.512 °C**

To **zero the measured value** press **<ZERO>**

The measured value should then show **00: 0.000 °C** with the symbol **REL**

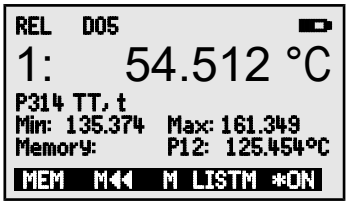
To cancel zero-setting, after selecting this function, press and hold down **<ZERO>**

The offset is saved **temporarily** in RAM only. After switching OFF

the normal measured value is displayed again.

13.2 Maximum / minimum memory

The **Functions menu** shows not only the measured value with designation but also the continuously acquired maximum and minimum values for the measuring channel selected.



Maximum value, minimum value

Function - Min / Max — Min: 135.374 Max: 161.341

To clear the memory select the function (see 9.4) — Min: 135.374 Max: 161.341 °C

To then delete maximum and minimum values for all channels press **<CLRA>**

Whenever this memory is cleared, the current measured value will appear (because measuring is continuous). These maximum / minimum values are also cleared automatically whenever the device is switched on or the measured value is set to zero.

13.3 Individual value memory

Each measured value can be saved at the touch of a button. The measured value is displayed in the **Memory** function together with its units and position number. The user can choose whether to clear the whole memory or just the last value. All data thus saved can be shown in the display or output in list form via the interface..

To continuously save the measured value press **<MEM>**

To display a memory position — Memory P12: 25.451 °C

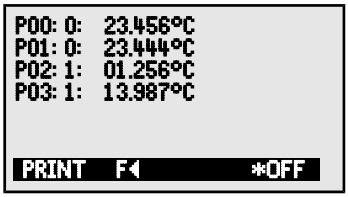
Measuring channel change — **▼** and **►**

After selecting this function, to clear the last position press **<CLRP>**

To clear all saved values press **<CLRM>**

To display all saved values press — **<LISTM>** and **<F►>** ...

To display memory list



To output all saved values press (see 16.3) **<PRINT>**

To return to the functions menu press **<F◄>**

14. SENSOR PROGRAMMING

Since on ALMEMO® devices all sensor programming is stored in the ALMEMO® connector itself, the user will not normally need to reprogram each time. However, with humidity sensors it is necessary sometimes to program other humidity ranges than those provided as standard. Each channel can also be assigned a designation or smoothing.

In the **Sensor Programming** menu these channel parameters can (so long as the appropriate sensor connector is plugged in) be entered, viewed, checked, and modified via the keypad.

14.1 Measuring channel designation

Each measuring channel can be assigned a 10-character alphanumerical designation denoting as clearly as possible the type of sensor, measuring location, and / or purpose. This designation is displayed in the functions menu. In outputs via the interface the measuring channel designation appears in the program header as **Designation**.

To enter name in **Designation** function see 9.5 **Designation: Humid temP**

14.2 Locking the sensor programming

The functional parameters for each measuring channel are protected by means of the locking mode; this can be set to the desired locking level (see Manual, 6.3.12) Before programming you must lower the locking mode to an appropriate level.

Locking level	**Locked functions**
0	none
1	range
3	+ Units
4	+ zero-point and gain (D6 only)
5	+ base value, factor, exponential (D6 only)

Function **Locking level** : **Locking: 5**

For the measuring channel M01 of a psychrometer (TT), the psychrometer constant will be displayed instead of the locking function:

Function psychrometer constant: **Psychr.Const.: 0.000640**

With D6 sensors the measuring channel is locked again automatically at level 5 as soon as programming is finished.

14.3 Selecting a measuring range

If you want to change a measuring range you must first clear the locking mode for the connectors concerned, i.e. set to 0. (see 14.2) To activate a new measuring channel you must first activate all channels by pressing **<MALL>**, then

select the required input channel, and then enter the range. (see 11.1) When the input for the new measuring range is confirmed all programming values for that input channel will be deleted.

Function range selection RANGE: D dv

To accept the selection of all possible measuring channels press <MALL>

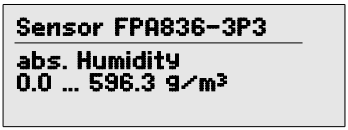
To deactivate a channel press <CLR>

To reactivate a channel press PROG , PROG

Programming the range is as for data input s.9.5 PROG , ▲... , PROG

In the input window all possible abbreviations appear one after the other, as listed in the following table : RANGE: D dv

And a help window for identifying the sensors



14.4 Functions of the Pt100 psychrometer FPA8363P3

14.4.1 Measuring ranges

The following table lists the measuring ranges available on Pt100 psychrometer FPA8363P3. Factory default settings are marked with an asterisk '*'. Humidity variables must be programmed in sensor M1 to channels M11, M21, M31 and atmospheric pressure, differential, or supply voltage to channels M02 to M32. (see 8.3) Commands for entering this via an interface using a terminal are also listed.

Measuring function	Sensor	Meas. Range	Unit	Display	Command
Pt100-3 ITS90 0.001°C	FPA903L0250	-200.000...+400.000	°C	P314	B96
*Pt100-3 ITS90 HT	FPA8363P3 M0	-200.000...+400.000	°C	P314	B96
*Pt100-3 ITS90 TT	FPA8363P3 M1	-200.000...+400.000	°C	P314	B96
*Atmospheric pressure AP int.	Device channel M2	300.0... 1100.0	mbar	AP	B86
*Rel. Humidity 0.01%H	FPA8363P3 M1	0.00... 100.00	%H	P2RH	B-10
Dew-point temp. 0.01°C	FPA8363P3 M1	-64.80... 100.00	°C	P2DT	B-11
Mixture MH, r	FPA8363P3 M1	0.0... 6500.0	g/kg	D MH	B-04
Abs. Humidity AH, dv	FPA8363P3 M1	0.0... 596.3	g/m³	D AH	B-05
Vapor pressure VP, e	FPA8363P3 M1	300... 1100.0	mbar	D VP	B-06
Enthalpy En, h	FPA8363P3 M1	0.0... 6500.0	kJ/kg	D En	B-07
Differential	Device channel M2			Diff	B71
Supply voltage	Device channel M2	0.0... 26.0	V	Batt	B14

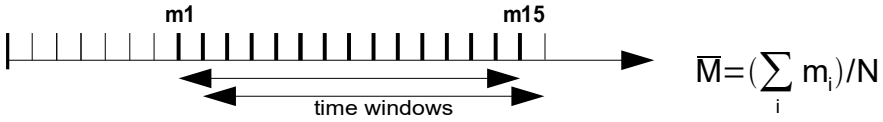
14.4.2 Multi-point adjustment

The sensor's measuring accuracy can be optimized by storing in the connector EEPROM a correction curve for the Pt100 dry temperature and humid temperature sensors. In a calibration laboratory any deviations from the ideal setpoint can be measured at various points; then, with the AMR-Control, this informa-

tion can be stored in the sensor and interpolated on a linear basis for subsequent measuring operations.

14.4.3 Smoothing by means of a sliding average

When measuring temperature at a resolution of 1/1 000 °C - especially if using sensors in air - the measured value display may be unstable. In this case the measured value can be smoothed in the form of a sliding average over a specified time frame. The **level of smoothing** can be set in the **Smoothing** function by specifying the number of measured values to be averaged (range 0 to 99); this is for both Pt100 channels.



Measured value smoothing over e.g. 15 values **Smoothing : 15**

Time constant t_{100} (s) = smoothing / (conversion rate * 2) = 15 / (1.25 * 2) = 6 seconds

14.5 Functions of D6 sensors

Normally the functions and ranges of digital D6 sensors can only be configured on a PC connected via an interface cable. However, with this special device - an exception - the measuring ranges and their abbreviations and the atmospheric pressure compensation can also be programmed in the sensor itself; it can subsequently be used in the modified form in other devices too. However, multi-point calibration and time constant can only be entered via a PC. (see D6 instructions).

14.5.1 Measuring ranges of the NTC psychrometer FNAD46-3

Measuring function	Sensor	Meas. Range	Unit	Display	Command
*Ntc-Dry Temperature TT	FNAD46-3	-50.00...+125.00	°C	D TT	B-01
*Ntc-Humid Temperature HT	FNAD46-3	-50.00...+125.00	°C	D HT	B-09
*Rel. Atm. Humidity 0.1%H	FNAD46-3	0.0... 100.0	%H	D rH	B-02
*Atm. Pressure AP in sensor	FNAD46-3	300.0... 1100.0	mbar	D AP	B-08
Dew-point Temperature 0.1°C	FNAD46-3	-64.80... 100.00	°C	D DT	B-03
Mixture MH, r	FNAD46-3	0.0... 6500.0	g/kg	D MH	B-04
Abs. Humidity AH, dv	FNAD46-3	0.0... 596.3	g/m³	D AH	B-05
Vapor pressure VP, e	FNAD46-3	300... 1100.0	mbar	D VP	B-06
Enthalpy En, h	FNAD46-3	0.0... 6500.0	kJ/kg	D En	B-07

14.5.2 Meas. ranges of the capacitive humidity sensor FHAD36-RS

Measuring function	Sensor	Meas. Range	Unit	Display	Command
*Air temperature	FHAD36-RS	-50.00...+125.00	°C	D °C	B-01
* Rel. Atm. Humidity 0.1%H	FHAD36-RS	0.0... 100.0	%H	D rH	B-02
*Dew-point Temperature 0.1°C	FHAD36-RS	-64.80... 100.00	°C	D DT	B-03

*Atm. Pressure AP in sensor	FHAD36-RS	300.0... 1100.0	mbar	D AP	B-08
Mixture MH, r	FHAD36-RS	0.0... 6500.0	g/kg	D MH	B-04
Abs. Humidity AH, dv	FHAD36-RS	0.0... 596.3	g/m³	D AH	B-05
Vapor pressure VP, e	FHAD36-RS	300... 1100.0	mbar	D VP	B-06
Enthalpy En, h	FHAD36-RS	0.0... 6500.0	kJ/kg	D En	B-07

14.5.3 Correction values

In the **Sensor Programming 2** menu D6 digital sensors - like all V6 devices - provide functions ´Zero-point´ and ´Gain´ for the purpose of measured value correction and functions ´Base value´ and ´Factor´ for the purpose of scaling. (see Manual, 6.3.11).

To access these functions press <▶P>
To return to **Sensor Programming** press <P◀> ...

Sensors can be corrected in terms of zero-point and gain by means of the correction values ´Zero-point´ and ´Gain´. (see Manual, 6.3.10)

Corrected measured value = (measured value - zero-point) x gain

Function

Zero-point correction **4 Zero Point : ------°C**
Gain correction **4 Gain : ------°C**
To switch on and off press <OFF> or <ON>

Once the correction values have been programmed and the actual measured value thus modified, the correction arrow ↗ appears indicating the measured value status. (see 9.2).

14.5.4 Scaling, decimal point setting

Normally for the physical variables concerned here scaling would not be necessary or advisable. However, with these digital sensors the exponential will set the decimal point.

Displayed value = (corrected measured value – base value) x factor

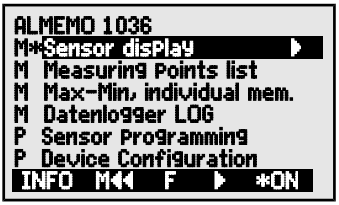
The ´Factor´ can be programmed within the range -2.0000 to +2.0000. For factors below 0.2 or above 2.0 the decimal point setting should be specified by entering the ´Exponent´. Using the ´Exponent´ function the decimal point can be shifted as far to the left (-) or to the right (+) as the display permits.

Function:

Base value: **5 Base value: ------**
Factor and Exponent: **5 Factor,ExP: ------ E0**

Once the scaling values have been programmed and the actual measured value thus modified, the correction arrow ↗ appears indicating the measured value status. (see 9.2).

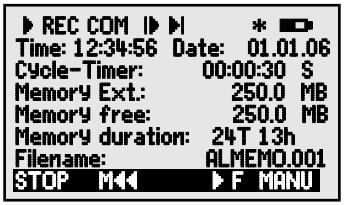
15. DATA LOGGER



Measuring instrument ALMEMO® 1036 can be made into a data logger - by fitting memory connector ZA1904SD with a micro-SD memory card (available as an accessory). In the main menu an additional menu item **Data logger LOG** should then appear automatically; with this you can call up two further sub-menus offering a comprehensive range of data logger functions. These can be used to acquire measured values either manually at specifiable points in time or cyclically over a specifiable period and record these on the memory card.

15.1 Memory connector with memory card

Measured data is written to this memory card via the memory connector; this data is in table mode and standard FAT16 format. The memory card can be formatted and its contents can be read out and / or deleted on any normal PC using any standard card reader. This data can also be imported into MS-Excel or into Win-Control.



The memory connector fitted with a memory card can be plugged in at socket A2; it will be recognized automatically. The first data logger menu should then be accessible - with date, time-of-day, cycle, and file name. It should also be possible to view the memory properties - its total memory capacity, memory still free, and memory time available.

Card memory - total capacity
Card memory - still free
File name (maximum 8 characters)

The **device status can be checked** by means of the symbols appearing in the top status bar of the menu. (see 9.2)

Before starting any measuring operation you can, in the **File name** function, enter an 8-character file name. In the absence of a user-defined file name, the default ´ALMEMO.001´ or the name most recently used will be suggested automatically. So long as the connector configuration is not altered, any number of measuring operations can be saved - either manually or cyclically - all in the same file.

If, however, the **connector configuration** has been **changed** since the last measuring operation, a new file will be created; and, if no new file name has been programmed, the index in the file name extension will be incremented automatically by 1, e.g. ´.002´. Similarly, if the file name now entered already exists, a new file will be created with the same file name prefix but with a new index.

15.2 Date and time-of-day

For logging data recordings a real-time clock with date and time-of-day is provided. This real-time clock is buffered by means of the device battery; in the event of battery replacement date and time-of-day are lost. The first line contains the time-of-day on the left and the date on the right; by selecting this function these can be programmed in the format indicated. (see 9.4, 9.5)

Function Date and time-of-day **Time: 12:34:56 Date: 01.05.07**
Format of time-of-day and date hh:mm:ss dd.mm.yy

15.3 Once-only output / saving of all meas. channels

Once-only manual measuring channel scans for acquiring the current measured values from all active measuring channels can be initiated by pressing **<MANU>**.

Once-only manual measuring channel scan **<MANU>**

The following symbols will be highlighted briefly in the status bar as verification : (see 9.2)

While data is being output via the interface ´COM´
While measured values are being saved ´REC´

Each time the key is pressed again the measured values will be processed in the same way with the associated measuring time.

15.4 Cyclic output / saving of all measuring channels

For cyclic recording and output of measured values the cycle must be programmed accordingly. The measuring operation can be **started** by pressing **<START>** and stopped by pressing **<STOP>**. Whenever a measuring operation is started the maximum and minimum values from all measuring channels are deleted.

In the course of a measuring operation the external memory must not be unplugged; this would cause all temporarily buffered measured values to be lost.

So long as no measuring operation has been started the **Cycle timer** function displays the cycle previously set. Having selected this function you can specify the cycle directly. (see 9.4, 9.5)

As soon as an operation is started the timer can be seen counting down to the next cycle.

Function **Cycle timer** **Cycle timer 00:02:00 S**
Cycle (hh:mm:ss max. 24h), saving ON
To enable / disable memory activation ´S´ press **<M-ON / M-OFF>**

To start a cyclic measuring channel scan press **<START>**

The following symbols will now be highlighted in the **status bar** as verification :

While a measuring operation is running ´▶´
While data is being output via the interface ´COM´
While measured values are being saved ´REC´

To stop a cyclic measuring channel scan press **<STOP>** ´▮▮´

15.5 Memory capacity, memory output, clearing the memory

While measured values are being recorded the **Memory free** function continuously displays the memory capacity still available. Selecting this function enables two softkeys, one for direct memory output and one for memory clearing.

Function

Memory capacity free e.g. **Memory free 108.4 MB**

To output memory content via interface **<PMEM>**

To clear memory (i.e. reformat the memory card) **<CMEM>**

If a **memory card** is being used the device itself can only read out (in table mode) the measured data contained in the file most recently used.

The most sensible approach is to remove the memory card and copy the files via a USB card reader directly onto a PC. These can then be imported either into MS-Excel or into Win-Control.

During memory output the **Output Remaining** function continuously updates and displays the amount still to be output.

Memory output, remaining **Output Remaining 12.5 MB**

15.6 Memory time available

An important parameter for data recording is the memory time available. This depends on the memory still free, cycle and the number of active measuring channels.

Memory time available in days (D) and hours (h) **Memory time 24 D 13 h**

15.7 Sleep mode

For long-term monitoring involving long measuring cycles the device can also be operated in sleep mode. In energy-saving sleep mode the measuring instrument switches off completely after each measuring channel scan (sensors with their own power supply) and switches on again automatically after the cycle expires - ready for the next measuring channel scan. In this way with just one set of batteries or one battery recharge over 15000 measuring channel scans can be performed. For a cycle lasting 10 minutes this represents an available measuring duration of over 100 days.

For **data recording in sleep mode** the following parameters must be set :

1. Enter a cycle lasting at least two minutes **Cycle 00:05:00**
2. Enable memory activation by pressing **<M-ON>** **Cycle 00:05:00 S**

In the following menu accessible by pressing **< ▶ F >**

3. Program sleep mode by pressing **<ON>**: **SleePmode: ✓**
4. In the measuring menu start measuring operation by pressing **<START>**
   The device should then display **SleeP On**
   The device then switches off and the only visible activity is the flashing red LED ´**SLEEP**´ at the top of the display. LED ´**SLEEP**´ (4) flashes
5. The device switches on automatically as per the specified cycle, performs one measuring channel scan, and then switches off again.
6. To quit sleep mode press **<ON>**
7. To terminate the measuring operation press **<STOP>**

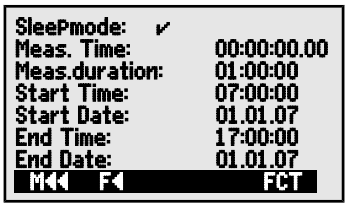
When sleep mode is selected (subject to a check window being confirmed), all necessary parameters may be configured.

15.8 Starting and stopping measuring operations

A measuring operation can be started / stopped not only by pressing the appropriate keys but also automatically by means of start time / end time or a specified measuring duration.

Start date and time-of-day, end date and time-of-day

A measuring series can be started / stopped automatically at specified times. For this purpose the start date and time-of-day and the end date and time-of-day must be programmed. If no date has been programmed, the measuring operation will be performed every day within the set period.



Or, alternatively, instead of specifying the end time the measuring duration itself can be programmed. (maximum 59h 59m 59s)

The total measuring time since starting can be seen in the ´Measuring time´ function.

This is assuming of course that the current time-of-day has been programmed. Please note that start date / time, end date / time, and measuring duration are not supported in sleep mode.

To access the menu press **< ▶F >**

Function Measuring duration (format hh:mm:ss) Meas. duration: 00:10:00
Function Start time-of-day (format hh:mm:ss) Start time : 07:00:00
Function End time-of-day(format hh:mm:ss) End time : ------
Function Start date (format dd:mm:yy) Start date: 01.05.07
Function End date (format dd:mm:yy) End date : ------
Measuring duration start (format hh:mm:ss.hh) Meas.duration: 00:01:23.45

To clear these values, after selecting this function, press **<OFF>**

If the start time-of-day for a measuring operation has been programmed, the following symbol appears in the status bar : ´▮▶´ (see 9.2)

If the end time-of-day or the measuring duration for a measuring operation has been programmed, the following symbol appears in the status bar : ´▶▮´

16. DEVICE CONFIGURATION

In the **Device configuration** menu certain basic settings can be made, e.g. language and illumination. The device designation can be used as print header in log printouts. The baud rate can be adapted for operation with external devices.

16.1 Language

The user can choose between German / English / French as the language for function labeling and printouts; (other languages are available on request). The softkeys are international; these cannot be changed.

To select desired language press <SET> in the function. **Language: English**

16.2 Illumination and contrast

Display illumination can be enabled / disabled in all menus by pressing <* ON> or in the function ´Device configuration´ - **Illumination**; (please note that enabling will double current consumption). If illumination is enabled but no mains adapter is connected, it will switch off again automatically as soon as a settable illumination duration expires; this starts with each pause in key operation and restarts as soon as any key is pressed. The display contrast can be set in the **Contrast** function to any one of 10 levels.

To enable illumination press <* ON>
or in the **Illumination** function **Illumination ✓**
To set the illumination duration (20 s to 10 min) press <SET> **Duration 20sec**
If display illumination is enabled,
the following symbol appears in the status bar * Illumination ON
If illumination has temporarily switched off,
the following will light up * Pause
To switch ON again **without** this function press ◄
To set the contrast (5 to 100 %) press <-> and <+> **Contrast : 50%**

16.3 Interface, baud rate, data format

Via the serial interface you can output measured data online or saved measured values to a printer or computer. For connecting to the various interfaces we have a series of data cables available. The data cables should be plugged in at socket A1 (2); in ´Device configuration´ the programmed baud rate then appears.

On leaving our factory the baud rate for all interface modules is programmed to 9600 baud. In order to avoid unnecessary problems when networking several devices together the baud rate should not be altered; rather the computer or printer should be set to match. If this is for some reason not possible you can, in the **Baud rate** function, choose from the values 1200, 2400, 4800, 9600 baud

or 57.6, 115.2 kbaud (taking care not to exceed the maximum baud rate for the interface module). The baud rate setting is saved to the EEPROM on the interface module and thus applies when any other ALMEMO® device is used.
To set the baud rate, function (see 9.5) **Baud rate 9600 baud**
Data format: 8 data bits, 1 stop bit, no parity (cannot be changed)

16.4 Device Address and Networking

All ALMEMO® devices can also be networked together very easily thus enabling the user to centrally acquire and record measured values from several measuring instruments - even if these are located far apart. (see Manual, 5.3)
To communicate with networked devices it is absolutely essential that all the devices concerned should have the same baud rate setting but that each should have its own dedicated address; this ensures that only one device responds per command. Before starting network operation ensure therefore that all the measuring instruments involved are assigned different device addresses. For this purpose use the **Device address** function. On leaving the factory address 00 is normally set.
To set the device address (see 9.5) **Device address: 00**

16.5 Data communications

For data retrieval and programming we provide a comprehensive ALMEMO® protocol (described in the Manual, chapters 6 and 7).
Since this high-precision instrument exceeds the standard ±16-bit range limits (65000), certain sensor parameters (e.g. base value, factor, zero-point, gain, limit values, analog scaling) are not available. Measured value correction is performed using just one 24-bit multi-point correction system. Data retrieval should be performed using the table format; this is also supported by the WinControl data acquisition program.
To display measured values in list format - together with channel, overflow indication, range, and comments text - a new command is provided in the table format.

```
f1 P35  (individual channels with Mxx P35)
00;;20,044;°C;P314;HT
01;;26,962;°C;P314;TT
02;;942,6;mb;AP  ;air pressure
11;;54,27;%H;P2Uw;r. humidity
21;;17,06;°C;P2td;dewpoint
```

The command ´f1 P18´ previously used for maximum / minimum / average values with date and time-of-day has been converted for use in the table format.

```
f1 P18  (individual channels with Mxx P18)
MS;MEAS.Val;MAXVAL.;MINVAL.;AVERAGE;NUMBER;MAX-TIME;MAX-DATE;MIN-TIME;MIN-DATE
00;20,044;150,007;20,038;-;0;02:31;05.01;02:32;05.01
01;26,961;27,017;26,952;-;0;02:33;05.01;02:45;05.01
02;942,6;942,7;942,5;-;0;02:43;05.01;02:46;05.01
11;54,28;54,32;53,99;-;0;02:45;05.01;02:33;05.01
21;17,06;17,06;17,02;-;0;02:46;05.01;02:32;05.01
```

Certain measured value outputs in list format (commands p, P01..P03, P-04, Sx) are still available but are now output with an additional decimal place.

16.6 Atmospheric pressure

The atmospheric pressure needed to compensate the Pt100 psychrometer is measured internally. (see 11.2) If it is being used, this is indicated by symbol **P.** with the dot flashing. As and when necessary (e.g. when measuring in conduits) the atmospheric pressure can also be programmed. (see 9.5)
To monitor, check, or enter atmospheric pressure **Atm. Pressure P. 947 mbar**
To return from programmed to measured value press **<CLR>**

17. OPTION FE - FUNCTION EXTENSION

Measuring range ´P314´ (B96) has been extended to:
Measuring range -200.000 to +560.000 °C
Accuracy: ± 0.010 K ± 1 digit (in range -50 to +560°C)

There is also an additional **measuring range ´P214´** (B69):
Measuring range -200.00 to +850.00 °C
Accuracy: ± 0.05 K ± 1 digit (in range -100 to +850°C)

Measured value correction by modifying the coefficients of Pt100 sensors.
When calibrating a Pt100 sensor in a calibration laboratory any deviation detected can be managed by adjusting the sensor on the basis of the four real coefficients in the Van Dusen equation.
The easiest way is to use the ALMEMO®-Control software package.
This incorporates the following terminal commands :
Determine the four coefficients of a Pt100 sensor using command P27.

Select the input channel	E00	
Determine the coefficients	P27	Pt100 COEFFICIENTS: 00: A = 3.90830E-3 00: B = -5.77500E-7 00: C = -4.18300E-12 00: R0 = 100.01234

To enter coefficients A, B, C and resistance R0 (at 0 °C) in the Pt100 formula, first select the input channel and then determine the associated coefficients.

Select the input channel	E00	
		Input range
Enter coefficient A	f1 ax.xxxxx	3.7 ... 4.1
Enter coefficient B	f2 ax.xxxxx	5.6 ... 6.0
Enter coefficient C	f3 ax.xxxxx	4.0 ... 4.4
Enter resistance R0	f2 exxx.xxxxx	95.0 ... 105.0

The input format is one integer digit before the decimal point (three integer digits for R0) and up to five decimal places. If fewer decimal places are entered, the input must be completed with CR. There is no need to enter the arithmetic sign or exponent - just the mantissa.

To denote measured value correction ´!´ appears at the end of the comments text.

To delete all coefficients : C27 or to delete individually enter ´0´.

18. TROUBLE-SHOOTING

This measuring instrument can be configured and programmed in many different ways. It is suitable for connecting a wide variety of different sensors and peripheral equipment. Given these numerous possibilities the device may in certain circumstances not always behave quite as expected. The cause of such unexpected behavior is only very rarely a device defect; usually the cause is incorrect operation by the user, an invalid setting, or unsuitable cabling. In such event try to pinpoint and clear the problem with the aid of the following tests.

Error No display, display malfunction, keys do not react.

Remedy Check the power supply; replace the batteries; switch off and then on again; if necessary re-initialize. (see 7.4)

Error Measured values are incorrect.

Remedy Check the status of the measuring channel, in particular the offset. (REL)

Error Measured values fluctuate unexpectedly or the system hangs in mid-operation.

Remedy Check the cabling for any inadmissible electrical connections; unplug all sensors and replace with hand-held sensors in air or phantoms (for Pt100 sensors, 100 ohms) and test again; then reconnect the sensors one after the other and test again. If a fault persists for any one connection, check all wiring; if necessary, insulate the sensor and eliminate interference by using shielded or twisted wiring.

Error Data transmission via the interface does not function.

Remedy Check the interface module, connections, and settings. Ensure that both devices are set to the same baud rate and transmission mode. (see 16.4) Test data transmission by means of a terminal.
If the computer is in XOFF status. enter <ctrl Q> for XON.
Check the programming by means of ´P15´. (see Manual, 6.2.3)
Test the transmit line by entering a smoothing factor using command ´f1 z10´ and check in ´Sensor programming´. Test the receive line by a memory output in the ´Functions´ menu by pressing **<LISTM>** and **<PRINT>** and check the display.

If, after performing the above-listed checks and remedial steps, a device still fails to behave as described in the operating instructions, it must be returned to our factory in Holzkirchen, accompanied by a brief explanatory note, error description, and if available test printouts. With the AMR-Control software you can print out screenshots showing the relevant programming details and save and / or print out a comprehensive ´Function test´ in the device list or terminal mode.

19. DECLARATION OF CONFORMITY

Ahlborn Mess- und Regelungstechnik GmbH declares herewith that the ALMEMO® 1036-2 device carries the CE label and complies in full with the requirements of EU directives relating to low voltage and to electromagnetic compatibility (EMC) (89/336/EWG).

The device is designed specifically for use in laboratories or test and measurement areas in a controlled electromagnetic environment.

The following standards have been applied in evaluating this product.

Safety	EN 61010-1: 2001
EMC:	EN 61326: 2013

CE

If a product is modified in any manner not agreed with us in advance, this declaration becomes void.

20. ANNEX

20.1 Technical data

Measuring inputs	2 ALMEMO® sockets, for Pt100 psychrometer FPA836-3P3, D6 precision humidity/temperature Sensor FHAD36-Rx, D6 Ntc psychrometer FNAD36-3
Measuring channels	12 maximum
Galv. separation	Solid state relays (50V)
Measuring range	Pt100, -200 to +400 °C
Resolution	0.001K
Measuring current	1 mA
A/D converter	Delta - sigma 24 bit, 1.25 mops, amplification 5
Accuracy	±0.01 K ±1 digit (at 50 °C to 400 °C)
Nominal conditions	23°C ± 2K, 1013mbar, Battery operation without display illumination
Temperature drift	2 ppm / K
Atm. pressure sensor	integrated in the device
Measuring range	300 to 1100 mbar
Accuracy	±2.5 mbar (700 to 1100 mbar, 0 to +65 °C)
Humidity variables	Measuring ranges, calculated
Rel. atmospheric humidity	RH, Uw 0.00 to 100.00 %H
Dew-point temperature	DT, td -64.80 to +100.00 °C
Mixture MH, r	0.0 to 6500.0 g/kg
Absolute humidity AH, dv	0.0 to 596.3 g/m3
Vapor pressure VP, e	300 to 1100.0 mbar
Enthalpy En, h	0.0 to 6500.0 kJ/kg
Outputs	1 ALMEMO® socket for data cable

	1 ALMEMO® socket for memory connector
Standard equipment	
Display	Graphics, 128 x 64 pixels, 8 rows of 4 mm
Illumination	2 white LED's
Operation	7 keys (4 softkeys)
Memory	100 measured values in RAM, SD memory card connector
Date and time-of-day	Real-time clock, buffered by device battery
Power supply	External ALMEMO® DC socket, 9 to 13 VDC
Batteries	3 AA alkaline batteries
Mains adapter	ZA 1312-NA7, 100-230 VAC to 12 VDC, 1 A
Adapter cable, electr. isol.	ZA 2690-UK, 10-30 VDC to 12 VDC, 0.25 A
Current consumption without	Input and output modules
active mode	approx. 20 mA (at 4.5 V)
With illumination	approx. 40 mA (at 4.5 V)
Housing	127 x 83 x 42 mm (LxWxH)
	ABS (acrylonitrile butadiene styrene)
	Weight approx. 290 g
Suitable conditions	
Operating temperature	-10 to +50 °C Storage temperature -20 to +60 °C
Ambient atmospheric humidity	10 to 90 % RH (non-condensing)

20.2 Product overview

	Order no.
High-precision humidity measuring instrument with atm. pressure sensor, 3 AA alkaline batteries, mains unit ZA1312NA7, USB data cable ZA1919DKU, instrument case, evaluation software ALMEMO® View SW5500AV and Pt100 psychrometer FPA8363P3 with mains unit, water bottle, wicks including DKD / DAkkS calibration certificate	**SP10362D**
Option FE: Erweiterte Messbereiche P314, P214, Koeffizienteneingabe	OA1036FE
Sensor	
ALMEMO® Pt100 psychrometer (included)	FPA8363P3
ALMEMO® Pt100 temperature sensor	FPA923L0250
ALMEMO® D6 digital humidity sensor with atmospheric pressure compensation	FHAD46RS
ALMEMO® D6 digital psychrometer with atmospheric pressure compensation	FNAD363
Accessories	
Mains adapter with ALMEMO® plug, 12 V, 1 A (included)	ZA1312NA7
DC adapter cable 10 to 30 VDC, 12 V / 0.25 A, electrically isolated	ZA2690UK
ALMEMO® memory connector with micro-SD	ZA1904SD
Data cable, USB interface electrically isolated maximum 115.2 kbaud (included)	ZA1919DKU
Data cable, V24 interface electrically isolated maximum 115.2 kbaud	ZA1909DK5
Ethernet data cable	ZA1945DK
Rubberized impact protection, gray	ZB2490GS2
DIN rail mounting	ZB2490HS

20.3 Index

20.4 Your contact partner

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