

## Operating instructions

English



## Wireless sensor link MA2790BTFV with ALMEMO® 2790 and sensor module



V1.1  
05.09.2016

# 1. OPERATING CONTROLS



**(1) Measuring inputs**

**M0** Suitable for all ALMEMO® sensors (except D7 sensors)

**(2) M1** Humidity sensor (option RHA)

**(3) DC connector**

5 to 12 V and USB (ZA 19019-DKU5)

**(4) LCD**

- (a) Function
- (b) Measuring point, 2nd measured value Function information
- (c) Units for 2nd measured value
- (d) Units for 1st measured value Abbreviation for function
- (e) 1. Measured value
- (f) Operating states:

**START** Meas. operation started  
**LOBAT** Battery voltage <3.3 V  
**CONNECT** Wireless link established  
**FCT** Programming function

**(5) Operating keys**

**ON OFF** To switch device ON press once and release  
 To switch device OFF press and hold down

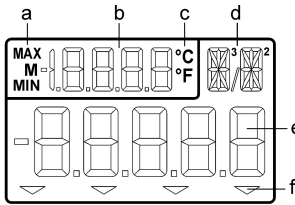
**▲, ▼** Meas. point selection

**F1** To start / stop measuring

**F2** Programming function

**PROG** Program

**▲, ▼, ►** To enter data



START LOBAT CONNECT FCT

Rear of device:

**(6) Battery compartment**

3 rechargeable Ni-MH batteries

**(7) Charge indicator**



**Bluetooth sensor module ZA1729BTFS**

Plug in at an ALMEMO® sensor socket Mxx on any ALMEMO® device

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### 3. GENERAL

We should like to congratulate you on your purchase of this new and innovative ALMEMO® Bluetooth sensor equipment. The wireless system in particular stands out by virtue of its excellent specifications. Thanks to its power amplifier and active antenna it provides an especially wide operating range (up to 1000 meters free field).

Thanks to the patented ALMEMO® plug the sensor device configures itself automatically; its operation should be fairly straightforward.

You are advised to take the time to carefully read these operating instructions and the relevant sections in the ALMEMO® Manual and to properly familiarize yourself with the device's numerous features and with the way the sensors function. This is the best way to avoid operating and measuring errors and prevent damage to the device. To help you find answers to your questions as quickly and easily as possible a comprehensive index is provided at the end of these instructions and at the end of the Manual.

#### 3.1 Warranty

Each 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 XREF, '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.

In folgenden Fällen ist eine Garantieleistung ausgeschlossen:

- 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.

- Wireless measuring instrument ALMEMO® 2790-BTFM with three Ni-MH rechargeable batteries
- Bluetooth sensor module ZA 1729-BTFS
- These operating instructions
- ALMEMO® Manual
- CD with Almemo-Control software and various useful accessories

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 covering 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 in accordance with 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.
- For the dispatch of such goods please wherever possible use the original packaging materials.

## 4. SAFETY INSTRUCTIONS

### DANGER



**Danger to life and limb, risk of damage to equipment**

**Before starting to operate the device, please read the instructions carefully.**

**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 through exposure to 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 vicinity of blasting work or filling stations.

### 4.1 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, before starting to use the device, to wait until it has adjusted to the ambient temperature.
- 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 (s. 9.3).

### 4.2 Handling batteries / rechargeable batteries correctly



When inserting batteries / rechargeable batteries ensure that the polarity is correct.

If the device will probably not be needed for a relatively long period of time or if the batteries are empty, the batteries should be removed; 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 and rechargeable batteries are special waste and must not be discarded as normal domestic waste.



## 5. INTRODUCTION

The ALMEMO® 2790 series is a new member in our family of unique measuring devices - all equipped with Ahlborn's patented ALMEMO® plug system. These systems incorporate a wireless Bluetooth module and, via the Bluetooth sensor module included in delivery, provide a wireless link to a further ALMEMO® measuring instrument or data logger. The intelligent ALMEMO® plug offers decisive advantages when connecting sensors and peripherals because all parameters are stored in an EEPROM located in the plug itself; repeat programming is thus no longer necessary.

All sensors can be connected to all ALMEMO® measuring instruments in the same way (except D7 sensors). Programming and functioning are identical for all units. The following points apply to all devices in the ALMEMO® measuring system; these are described in detail in the ALMEMO® Manual which is included in delivery with each device.

- Detailed explanation of the ALMEMO® system (Man, Chap. 1)

- Overview of the device functions and measuring quantities and ranges (Man., Chap. 2)

- Basic principles, operating instructions, and technical data for all sensors (Man., Chap. 3)

- Options for connecting your own existing sensors (Man., Chap. 4)

- USB interface modules (Man., Sec. 5.2)

- All functions and their operation via the interface (Man., Chap. 6)

- Complete list of interface commands with all the printouts (Man., Chap. 7)

The operating instructions you are now reading cover only those features and controls that are specific to this device. These operating instructions often refer to more detailed descriptions in the Manual.

### 5.1 Functions

Measuring instrument ALMEMO® 2790 has just one measuring input M0 for all ALMEMO® sensors. This is with the exception of D7 sensors, which cannot be used with this measuring instrument. The measuring possibilities are virtually limitless; there are four channels per sensor plug and over 70 measuring ranges. With option RHA the measuring instrument also incorporates a digital sensor for temperature, humidity, and atmospheric pressure, with four channels. To facilitate operation and measured value display on site the device incorporates a keypad and an LCD. At the DC socket it is possible to connect an external power supply source or a USB data cable with integrated power supply. Via this interface both the device and the sensor can also be programmed directly. (see Man. 6) However, the most important innovation on this device is its integrated Bluetooth wireless module, which, in conjunction with the Bluetooth sensor module (included in delivery), makes it possible to transmit measured values over a wireless link to another linked ALMEMO® measuring instrument or data logger. Measured values are collected here together with data from other wireless sensors or standard sensors and then saved - or forwarded online to a computer for further processing. It is also possible to operate multiple wireless sensor links in parallel.

### 5.1.1 Sensor programming

The measuring channels are programmed, completely and automatically, via the ALMEMO® plugs; they are ready-to-operate immediately. However, via interface cable ZA1919-DKUX the user can still add to or modify the programming. (see Man. 6.3) Or, alternatively, the sensors can be programmed on the ALMEMO® data logger.

### 5.1.2 Process control

In order to transmit measured values from all measuring points to the data logger in digital form measuring point scanning must be performed continuously with measured value output according to a time-based process control. A cycle is provided for this purpose.

#### Cycle

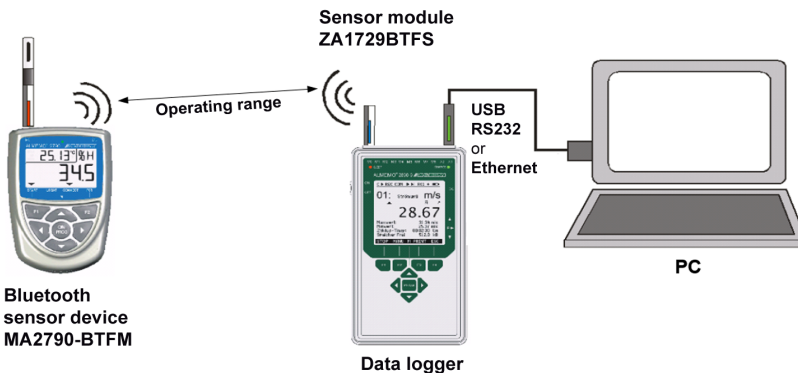
The cycle can be programmed to any value between 0 minutes and 99 hours. This cycle governs the cyclic output of measured values over a wireless link or to the interface. If the cycle is set to 0, data is transmitted continuously; in this case the sensor device should be powered from an external source.

With settings upward of 1 minute the sensor device automatically adopts **sleep mode**; it only resumes normal status when the cycle completes. This ensures a longer battery life if power is being supplied in battery mode.

#### Data transmission

As soon as the cycle starts, measured values from the first four active channels are transmitted from the wireless measuring instrument cyclically via the wireless link to the wireless sensor module plugged in at a sensor socket on the ALMEMO® measuring instrument. The measuring range displayed here is the digital range 'DIGI' with the appropriate units and the original designation. Measured value correction is performed in the wireless measuring instrument;

#### Bluetooth sensor link



parameters are not transmitted to the receiving device (see 14).

## 6. PUTTING INTO SERVICE

1. Plug wireless **sensor module** ZA1729-BTFS into a sensor socket on the ALMEMO® measuring instrument or data logger and switch the device ON.
2. Connect the **sensor** at socket **M0 (1)** on the **2790 device** see 9.
3. Ensure that the correct **power supply** is provided by means of three Ni-MH rechargeable batteries, three AA batteries, or a mains adapter see 7.1, 7.2
4. To **switch device ON** press key **ON** once and release. See 7.5
5. **Select a measuring channel** using key **▲** (5), and read out measured values (4e). see 11.1.1
6. **Program the cycle** in function 'ZY' see 13.1

Start measuring operation in the 'Measured value' function by pressing key **F1**; the 'START' arrow should light up.

As soon as the link is established, the 'CONNECT' arrow on the sensor device and the yellow LED on the wireless sensor module both light up.

Measured values from the first four active measuring channels are transmitted cyclically via the wireless link to the socket on the ALMEMO® measuring instrument to which the wireless sensor module is connected. See 9.2

In the event of failure affecting the wireless measuring instrument, two cycles are left to complete and then sensor breakage is reported. If the cycle is set to more than 0, the device will, after transmission, resume sleep mode (display SLP).

7. To **terminate a measuring** operation press key **F1** or, if in sleep mode, press key **ON**; stop the data logger.

## 7. POWER SUPPLY

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

- Three rechargeable Ni-MH batteries (size AA) (included in delivery)
- Mains adapter, 12 V, 2A, with ALMEMO® plug ZA 1312-NA10
- Power supply cable, electrically isolated (10 to 30 VDC, 0.25 A) ZA 2690-UK
- Power supply and interface via ALMEMO® USB data cable ZA 1919-DKU5

Our product spectrum covers all the appropriate accessories.

### 7.1 Operation using rechargeable batteries / batteries

The device is normally powered by three rechargeable Ni-MH batteries (size AA). Or, alternatively, it can be powered using standard commercially available batteries. The device incorporates for this purpose an intelligent battery recognition system.

#### 7.1.1 Operation using rechargeable batteries

On leaving our factory the device is fitted with three rechargeable Ni-MH batteries. As soon as the mains unit is connected the integrated charge circuitry initiates charging in the device. Operating time in continuous operation with a

current consumption of 8 mA is approx. 230 hours. In sleep mode with a cycle of 1 minute it should be possible per battery charge to perform measuring operations for approx. 390 hours. By extending this cycle to e.g. 1 hour, this time can be increased to approx. 400 days.

Important : The operating time depends very much on the current draw of the sensor being used.

### Charge status indication

The charge status of the rechargeable batteries is indicated by two LED colors (see 1). The following table lists the LED activity and the associated battery charge status.

LED activity	Description
OFF	Mains unit not connected
Green	Mains unit connected, batteries fully charged
Red	Mains unit connected, batteries being charged

Important : Critical battery status is indicated by 'LOBAT' in the 2790's display. (see 7.1.3).

### 7.1.2 Operation using standard batteries

Alternatively, it can be powered using standard commercially available AA batteries. We recommend using such batteries with a high capacity. Using lithium batteries (e.g. Energizer Ultimate Lithium LR91-FR6) the operating time can even be doubled.

### 7.1.3 Supply voltage monitoring

The operating voltage is displayed each time the device is switched on, thus allowing the user to estimate the remaining operating time. In the event of battery voltage falling below 3.4 V (with rechargeable batteries) or 3.2 V (with standard batteries), i.e. approx. 10 percent remaining battery capacity, the **LOBAT** arrow will appear in the display. Now, if rechargeable batteries are being used, the mains unit should be connected in order to recharge them - or, if standard batteries are being used, these should be replaced. Battery status can be monitored on the receiving device; this is activated by programming a measuring channel 'UbAt' on the 2790 within the first four channels transmitted and a limit value on the destination system. Alarm reporting can also be activated. To replace used batteries first unscrew the battery compartment cover (6) on the rear of the device, remove the old batteries, and, observing correct polarity, insert the new.

## 7.2 Mains operation

The ALMEMO® 2790 can be powered from an external source preferably using mains adapter ZA 1312-NA10 (12 V / 2A) connected at the DC socket (3).

### 7.3 External DC voltage supply

The DC socket (3) can also be used to connect another DC voltage, 6 to 30 V (minimum 200 mA). It can be connected using ALMEMO® plug ZA1000-FSV. If, however, the power supply has to be electrically isolated from the transducers, 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 Sensor supply

At the terminals + (plus) and – (minus) in the ALMEMO® plug a sensor supply voltage of 6 to 12 V (maximum 150 mA) is available automatically; this corresponds to the minimum sensor voltage programmed for the measuring channels. (see Man., 6.10.5) Other voltages (15 V or references for a potentiometer and strain gauge) can also be obtained using special plugs. (see Man., 4.2.5 , 4.2.6).

### 7.5 Switching ON / OFF, reinitialization

The **ON PROG** key (5) is located in the middle of the keypad; to **switch the device ON** press once briefly and release; to **switch the device OFF** press and hold down. When the device switches OFF all saved values and settings are retained intact. (see 7.6)

If interference (e.g. electrostatic charge, battery failure) causes the device to behave abnormally, it can be reinitialized. To activate **Reset** press and hold down key **F2** when switching on. This will restore all settings to factory default status - including the configuration of internal measuring channels - but excluding device designation. Sensor programming in the ALMEMO® plugs will remain unaffected.

### 7.6 Data buffering

The sensor's programming is stored in the EEPROM on the sensor plug; the device's calibration and programmed parameters are stored in the EEPROM on the device itself; both are fail-safe.

## 8. PAIRING

On leaving our factory the wireless measuring instrument and the sensor module are paired; i.e. these two components interconnect immediately and automatically as soon as they are switched on. If you wish to have the wireless measuring instrument interconnected with some other sensor module, such pairing can be performed manually in the following way.

1. Switch the wireless measuring instrument OFF.
2. Plug the sensor module into the wireless measuring instrument (socket M0).
3. Switch the wireless measuring instrument ON by pressing the **ON PROG** key (5).
4. These components should now be paired automatically. **PAIR** and **RDY** should

alternate in the wireless measuring instrument display. The components have been successfully paired.

5. Switch the wireless measuring instrument OFF again by pressing and holding down the ON PROG key (5); the sensor module can now be withdrawn from socket M0.

## 9. CONNECTING SENSORS

Virtually any ALMEMO® sensor can be connected at ALMEMO® input socket M0 on the measuring instrument (1) (except D7 sensors).

However, please note, when performing long-term measuring operations under battery power, that sensors with high current consumption may drastically shorten the remaining operating time. To connect your own existing sensors you simply need the appropriate ALMEMO® plug.

### 9.1 Sensors

The ALMEMO® Manual includes detailed descriptions of the comprehensive range of ALMEMO® sensors (see Manual, Chapter 3) and instructions for connecting your own existing sensors to ALMEMO® instruments (see Manual, Chapter 4). All standard sensors with an ALMEMO® plug usually have the measuring quantity, range, and units already programmed and can thus be connected to the input socket without 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 these two levers must first be pressed in at the sides.

For devices with the optional seal (option W) sensors are available with spray-coated ALMEMO® plugs incorporating a double sealing lip to protect the socket unit against the effects of splashing water. For any unused sockets protective stoppers are available.

### 9.2 Measuring inputs und additional channels

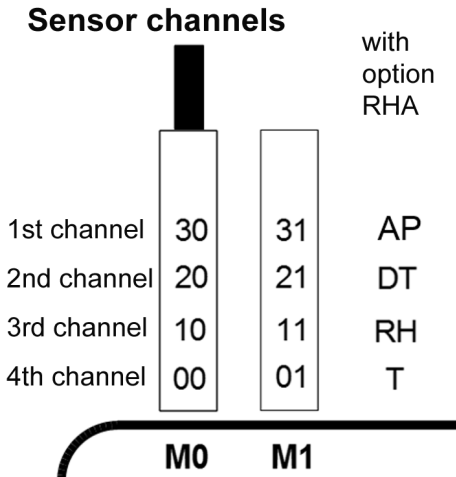
The ALMEMO 2790 measuring instrument has one input socket (1) to which initially measuring channel M0 is assigned. However, ALMEMO® sensors can, if necessary, provide up to four channels. The additional channels can be used in particular for humidity sensors with four measurable variables (temperature / humidity / dewpoint / mixture ratio) or for function channels.

It may be advisable to program one channel for monitoring the battery voltage so that this value is also available in the evaluation system.(see 7.1) Each sensor can if necessary be programmed with several quantities or scaling settings; and two or three sensors, if pin assignment so allows, can be combined in a single plug (e.g. RH / NTC, mV / V, mA / V, etc.). The additional measuring channel numbers per connector go up in steps of 10; e.g. the first sensor has channels M0, M10, M20, M30 maximum.

With option RHA the measuring instrument also incorporates a digital sensor for temperature, humidity, and atmospheric pressure (2), occupying channels M01 to M31.

However, in wireless transmission to a subsequent linked device, only four channels can be transmitted, normally the first four (M00 to M30 or M00 to M11). If channels are deleted or deactivated other configurations are also possible. (see 11.1.1).

On the measuring instruments this gives the following channel assignment:



### 9.3 Potential separation

When organizing a properly functioning measuring setup it is very important to ensure that no equalizing current can 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.

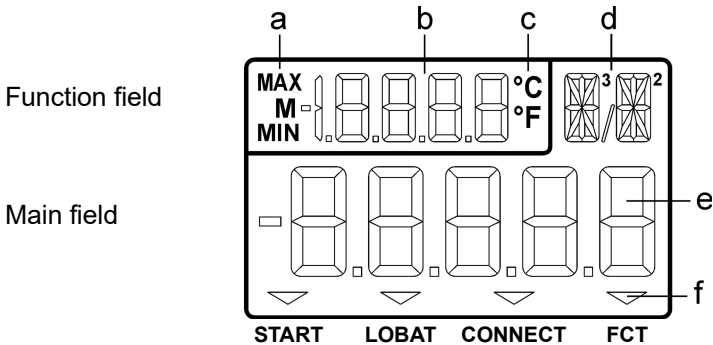
Sensors combined within one connector and sensors with their own power supply are electrically interconnected and must therefore be operated in isolation. The voltage at the measuring inputs themselves (between B, C, D and A or - ) must not exceed 5 volts.

The power supply is isolated by means of the transformer in the mains adapter or, for DC operation, by means of a DC/DC converter (OA2490-U or ZA2690-UK).

## 10. DISPLAY AND KEYPAD

### 10.1 Display

The display (4) on measuring instruments ALMEMO® 2790 is a two-row LCD arrangement; this comprises 5 x 7-segment digits (e), 2 x 16-segment digits (d) depicting the measured value, 4½ x 7-segment digits (b) depicting various measuring functions (a), and four arrows (f) depicting the operating status.



Function field - **display of measuring functions:**

Measuring point:

M	0
---	---

Maximum value:

MAX	36.5
-----	------

Minimum value:

MIN	17.3
-----	------

Temperature value from double sensors:

26.57 °C
----------

Time format in cycle function hh:mm:

hh:nn
-------

Device is in sleep mode:

SLP
-----



## Special operating states and faults

Segment test for display:

This is performed automatically each time the device is switched on.

Supply voltage: (s. 11.1)

Display after segment test

Below 3.6 V: **LOBAT** arrow lights up

Wireless link established:

**CONNECT** arrow lights up

Measuring with wireless transmission:

**START** arrow lights up

Programming function selected:

**FCT** arrow lights up

Checksum error during device calibration:

CALEr

Non-connected sensors, deactivated measuring points:

-----

Measuring range / function not permitted:

Err

Sensor breakage:

NiCr

Abbreviation flashes

Measuring range undershot, CJ or CJ breakage (cold junction)

CJ

flashes

Value range overshoot (>65000):

65000

flashes

Measuring range overshoot:

Maximum value flashes

Measuring range undershot:

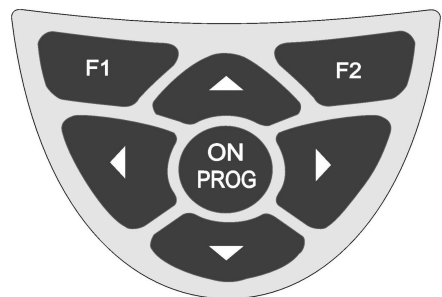
Minimum value flashes

## 10.2 Keypad

To operate the device a keypad with seven keys is provided.



Operation via the keypad is disabled in sleep mode and in some levels of device locking. (see 13.2).



**Function:**

To switch the device ON: (s. 7.5)

To switch the device OFF

To select measuring points: (s. 11.1.1)

To start measuring operation and wireless transmission **F1**

To access the programming functions

To program a function

To return to the measured value

To display maximum value (s. 11.2)

To display minimum value (s. 11.2)

To display battery voltage

**Key**

**ON PROG**

**ON PROG** press and hold down

**▲** or **▼**

**F2** . . . .

**ON PROG** , **▲** / **▼** , **▶** . . . .

**▲**

**▶** To delete, press and hold down

**◀** To delete, press and hold down

**ON PROG**

## 11. MEASURING OPERATIONS

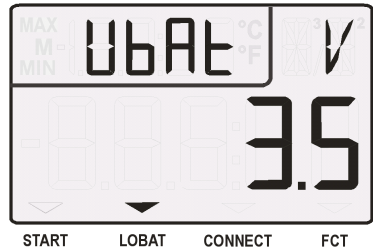
With the ALMEMO® 2790 all available measuring channels are scanned continuously; this ensures continuous temperature compensation for dynamic pressure probes or chemical probes. (see Manual, 6.5.1.3)

Up to eight measuring channels can be displayed. See 9.2

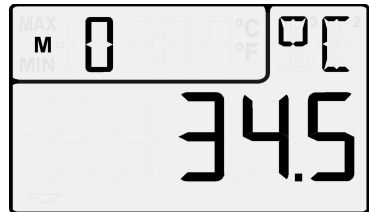
### 11.1 Measured value

After switching ON first of all a segment test is performed; then the battery voltage 'UbAt' appears and if the rechargeable batteries are almost empty (<3.4V) the LOBAT arrow also appears.

Battery voltage can also be viewed at any time by pressing key **ON PROG**.



The measured value and its appropriate units are displayed in the main field and the measuring point is displayed in the function field. All the special operating states the measured value may possibly attain are explained in 10.1.



#### 11.1.1 Selecting a measuring point

By means of key **▲** all active measuring points can be selected one after the other; the current measured value of each of these is shown in the display. By means of key **▼** the display returns to the previous channel.

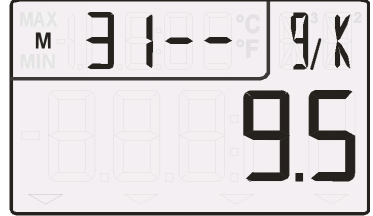
To increment the measuring channel press key **▲**

To decrement the measuring channel press key **▼**

With each change the measuring range abbreviation appears briefly in the display. See 11.1.2.

## Deactivating and reactivating measuring channels

Since only 4 of the maximum 8 measuring channels (option RH) can be transmitted over a wireless link, individual channels can be excluded from data transmission in order to prioritize those further back in the queue. In the display a channel thus deactivated is followed by two dashes. In the display a channel thus deactivated is followed by two dashes.



The following table lists the steps needed to activate or deactivate a channel.

- |                |                                     |  |
|----------------|-------------------------------------|--|
| <b>Step 1:</b> | Selecting a channel                 | Using key ▲ select the desired channel.  |
| <b>Step 2:</b> | Activating the settings menu        | <p>Press and hold down key ▼ .</p> <p>In the menu the channel's current status is displayed.</p> <p>Display <b>ChAct</b> The channel is activated.</p> <p>Display <b>ChOFF</b> The channel is deactivated.</p> <p>To leave the settings menu without saving any changes briefly press any key (except key ▼ ).</p> |
| <b>Step 3:</b> | Activating / deactivating a channel | <p>Press briefly and release key ▼ .</p> <p>This activates / deactivates the selected channel. After approx. 3 seconds the display returns automatically to the measured value.</p>  |

### 11.1.2 Measuring quantities and ranges

Whenever there is a channel switchover or sensor breakage the measuring range abbreviation appears in the display. The following table lists all the measuring ranges possible.

Sensors	Sensor / plug	Measuring range	Unit	Abbreviation
Pt100-1	FP Axxx	-200.0... +850.0	°C	P104
Pt100-2	FP Axxx	-200.00...+400.00	°C	P204
Ni100	ZA 9030-FS3	-60.0... +240.0	°C	N104
NiCr-Ni (K)	FT Axxx	-200.0...+1370.0	°C	NiCr
NiCroSil-NiSiil (N)	ZA 9020-FSN	-200.0...+1300.0	°C	NiSi
Fe-CuNi (L)	ZA 9021-FSL	-200.0... +900.0	°C	FECo
Fe-CuNi (J)	ZA 9021-FSJ	-200.0...+1000.0	°C	IrCo
Cu-CuNi (U)	ZA 9000-FSU	-200.0... +600.0	°C	CUCO
Cu-CuNi (T)	ZA 9021-FST	-200.0... +400.0	°C	CoCo
PtRh10-Pt (S)	FS Axxx	0.0...+1760.0	°C	Pt10
PtRh13-Pt (R)	ZA 9000-FSR	0.0...+1760.0	°C	Pt13
PtRh30-PtRh6 (B)	ZA 9000-FSB	+400.0...+1800.0	°C	EL18
Au-FeCr	ZA 9000-FSA	-270.0... +60.0	°C	AUFE
Ntc type N	FN Axxx	-50.00...+125.00	°C	Ntc
Millivolt	ZA 9000-FS0	-10.000...+55.000	mV	U 55
Millivolt 1	ZA 9000-FS1	-26.000...+26.000	mV	U 26
Millivolt 2	ZA 9000-FS2	-260.00...+260.00	mV	U260
Volts	ZA 9000-FS3	-2.0000...+2.6000	V	U2.60
Difference - millivolt	ZA 9000-FS0D	-10.000...+55.000	mV	d 55
Difference - millivolt 1	ZA 9000-FS1D	-26.000...+26.000	mV	d 26
Difference - millivolt 2	ZA 9000-FS2D	-260.00...+260.00	mV	d260
Difference - volt	ZA 9000-FS3D	-2.0000...+2.6000	V	d2.60
Sensor voltage	any	0.00...20.00	V	UbAt
Milliampere	ZA 9601-FS1	-26.000...+26.000	mA	I032
Percent (4 to 20 mA)	ZA 9601-FS2	0.00... 100.00	%	P420
Ohms	ZA 9003-FS	0.0... 500.0	Ω	Ohn
Frequency	ZA 9909-AK1	0... 32000	Hz	FrEq
Pulses	ZA 9909-AK2	0... 65000		PULS
Digital input	ZA 9000-EK2	0.0... 100.0	%	Inp
Digital interface	ZA 9919-AKxx	-65000... +65000		diGi
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

Sensors	Sensor / plug	Measuring range	Unit	Abbreviation
Dynamic pressure, 40 m/s with TC and PC	FD A612-M1	0.50... 40.00	m/s	L840
Dynamic pressure, 90 m/s with TC and PC	FD A612-M6	1.00... 90.00	m/s	L890
Rel. atm. humidity, capacitive	FH A646	0.0... 100.0	%H	°orH
Rel. atm. humidity, cap. with TC	FH A646-C	0.0... 100.0	%H	HcrH
Rel. atm. humidity, cap. with TC	FH A646-R	0.0... 100.0	%H	H rH
Mixture ratio, capacitive with PC	FH A646	0.0 ... 500.0	g/k	H AH
Dew-point temp., capacitive	FH A646	-25.0... 100.0	°C	H dt
Partial vapor pressure, cap.	FH A646	0.0 ...1050.0	mb	H UP
Enthalpy, capacitive with PC	FH A646	0.0 ... 400.0	kJ	H En
Temperature, wet	FN A846	-30.00 ... +125.00	°C	P Ht
RH, psychrometric with PC	FN A846	0.0 ... 100.0	%H	P RH
Mixture, psychrometric with PC	FN A846	0.0 ... 500.0	g/k	P AH
TD, psychrometric with PC	FN A846	-25.0 ... +100.0	°C	P dt
Partial vapor pressure, psychrometric with PC	FN A846	0.0 ...1050.0	mb	P UP
Enthalpy, psychrometric with PC	FN A846	0.0 ... 400.0	kJ	P En
Conductivity probe with TC	FY A641-LF	0.0 ... 20.000	mS	LF
CO <sub>2</sub> sensor	FY A600-CO2	0.0 ... 2.500	%	C02
O <sub>2</sub> saturation with TC and PC	FY A640-O2	0 ... 260	%	O2-S
O2 concentration with TC	FY A640-O2	0 ... 40.0	mg	O2-C
Temperature, digital * (B68)	FH0D46-2	-20.00 ... +80.00	°C	d °C
Humidity, digital * (B69)	FH0D46-2	0.0 ... 100.0	%H	d %H

### Function channels

Differential channels Mb1 - Mb2	any			diFF
Maximum value of channel Mb1	any			Hi
Minimum value of channel Mb1	any			Lo
Av. val. over time, M(t) of Mb1	any			A[t]
Average value M(n) Mb2 to Mb1	any			A[n]
Sum S(n) Mb2 to Mb1	any			S[n]
Total pulses S(t) of Mb1	ZA 9909-AK2	0... 65000		S[t]
Pulses / print cycle of Mb1	ZA 9909-AK2	0... 65000		S[P]
Alarm value of channel Mb1	any			Alrn
Measured value of Mb1	any			MESS
Cold junction temperature	any		°C	CJ
Number of av. values of Mb1	any			n(t)
Timer	any		s	tinE
Atm. pressure ° (B86) see 13.3	any	300...1100	mb	AP

TC=Temperature compensation, PC=Atmospheric pressure compensation,

\* Only with option 2790-RH, ° Only with option AP

### 11.1.3 Dual display

On all double-function sensors incorporating a temperature sensor on the first channel the temperature value can be displayed at the same time in the function field.

Select 2nd channel,

To activate the temperature display  
press and hold down key **▲**.

To return to the channel display  
press and hold down key **▲**.



### 11.2 Peak values memory

From all the measured values acquired for each measuring point the highest and the lowest values are continuously recorded. To display these high / low peak values the desired channel must be set (see 7.1) and then key **◀** or **▶** must be pressed.

The display also includes the associated symbol.



To display the maximum value briefly press key

To display the minimum value briefly press key

To delete the maximum value press and hold down key

To delete the minimum value press and hold down key

To return to the measuring point display briefly press key



Whenever this data is deleted, the current measured value will, since measuring is a continuous process, appear again immediately.

## 12. INTERFACE

If measuring instrument ALMEMO® 2790 is connected to a computer via USB data cable ZA1919-DKU5, this interface is used not only to power the device but also to program it and output all its data. (see Man. 6.)

The data cable must be plugged in at the DC socket (3). The baud rate is programmed on leaving our factory to 9600 baud; this setting should not be altered. (see Man. 5.2)

So long as a data cable is connected, wireless transmission remains disabled.

## 13. DEVICE CONFIGURATION

On measuring instrument ALMEMO® 2790 a number of parameters can be configured. To access configuration press **FCT**. The display should then show - instead of the units - the abbreviations for the various parameters, one

after the other; the main field should show the respective value currently set. To switch through the possible parameters one after the other press key:

Cycle

Time Format hh:mm

Keypad locking (locking code): s. 13.2

Atmospheric pressure for measured: s. 13.3

**FCT** . . .

hh:nn	ZY
00:05	

	VC
0000	

	mb
1013	

To enter a value first press key

The value can be changed by pressing keys

To select the next digit press key

To delete the value press key

To save and exit press key

To quit without saving press key

**PROG** The value flashes.

▲ or ▼

▶

**FCT**

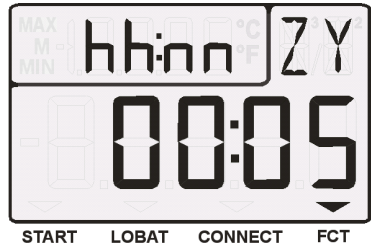
**PROG**

◀, ◀ ...

To return to the measured value display press key ▲

### 13.1 Cycle

The cycle with abbreviation 'ZY' is for acquiring measured values at certain intervals and then transmitting these over a wireless link to a data logger. If the cycle is set to longer than one minute, the wireless measuring instrument will between such actions adopt sleep mode to save energy. With longer cycles, e.g. 15 minutes, one battery set may last for more than a year.



To access the cycle function 'ZY' press key

To return to the measured value display press key

To start / stop a measuring operation press key

**FCT**

▲

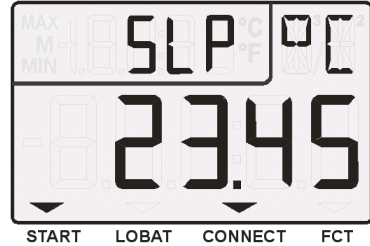
**F 1**

As soon as the measuring operation starts the 'START' arrow appears.

## 13. Device configuration

In sleep mode the function field displays abbreviation 'SLP'; in this status the device can no longer be operated.

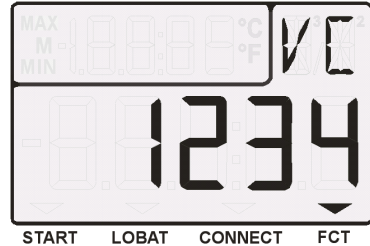
To quit sleep mode and terminate a measuring operation the device must be switched ON again by pressing key **ON**.



### 13.2 Device locking

Measured data acquisition can be locked by means of a password and thus protected against unauthorized manipulation. To do so - before starting a measuring operation (see 13.1) - select the locking code function 'VC' and enter a 4-digit number as password (display 'Loc').

When the measuring operation is started all keys are locked - except 'ON'. If key **ON** is pressed the 'VC' function will reappear and, as soon as the appropriate number is entered, all keys will be unlocked again. Otherwise the measuring operation is simply continued.



### 13.3 Atmospheric pressure compensation

Some measured variables depend on the ambient atmospheric pressure (see 11.1.2, measuring range list 'with PC') - with the effect that large deviations from normal pressure (1013 mbar) may lead to measuring errors.

#### e.g. Error per 100 mbar

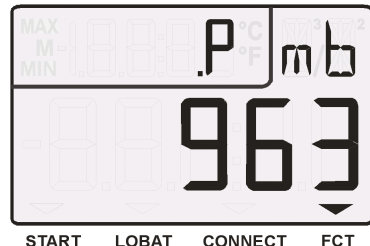
RH, psychrometric	approx. 2%
Mixture ratio	approx. 10 %
Dynamic pressure	approx. 5%
O <sub>2</sub> saturation	approx. 10%

#### Compensation range

500 to 1500 mbar
Vapor pressure VP up to 8 bar
800 to 1250 mbar (error <2%)
500 to 1500 mbar

It is important therefore, especially when working at significant altitudes above sea level, to take due account of atmospheric pressure (approx. -11 mbar / 100 meters above mean sea level, MSL).

The atmospheric pressure can be entered as a parameter in function 'mb'. (see 13) With option RHA (integrated atmospheric pressure sensor) the current atmospheric pressure is displayed in this function and used automatically for all compensation procedures. There is also already a function channel 'AP' with the appropriate measured value. (see 9.2)





This can be programmed to any measuring channel (command B86, see Man. 6.3.3) and, with abbreviation '\*P' in the designation, can even be forwarded for compensation purposes to the next device. (see Man. 6.3.6) The status of atmospheric pressure compensation is displayed both in the atmospheric pressure function and, for appropriate measured values, in the function field. (see 11.1.2).

Display indicating that atmospheric pressure (not 1013) is programmed 'P'

Display indicating that atmospheric pressure is being measured'.P' The dot flashes

To toggle from programmed value to measured value in function 'mb' press keys

**PROG**

**FCT**

## 14. WIRELESS TRANSMISSION TO DATA LOGGER

Cyclic wireless transmission of maximum four channels to wireless sensor module ZA1729-BTFS on an ALMEMO® device begins when the cycle starts. (see 13.1)

Data from the sensor is modified as follows :

The original measuring ranges are replaced by the 'DIGI' range; only the units and designation remain unaffected.

The parameters for measured value correction are already applied in the sensor device and therefore do not need to be transmitted.

Of the maximum eight channels possible with option RHA only the first four are transmitted. Those channels not required can be deactivated. (see 11.1.1)

If the sensor module is connected at socket M04, channel numbering changes from e.g. M00, M01, M10, M11 to M04, M14, M24, M34.

In the event of failure affecting the wireless measuring instrument, two cycles are left to complete and then sensor breakage is reported. Several wireless sensor links can be operated simultaneously; there is no mutual interference.

Data from all channels is transmitted in its original format via a USB interface cable.

## 15. TROUBLE-SHOOTING

The ALMEMO® 2790 measuring instrument can be configured and programmed in many different ways. It is suitable for connecting a wide variety of different sensors. Given these numerous possibilities the device may in certain circumstances not 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

**Remedy:** Check the power supply; use fresh batteries or connect mains unit (using rechargeable batteries); switch OFF and then ON again; if necessary re-initialize.(see 7.5)

**Error:** Data transmission over the wireless link does not function.

Does the symbol 'CONNECT' on the device light up ?

Does the yellow LED on the module light up ?

**Remedy:** Start measuring operation by pressing key **F1**.

Inside a building attenuation may be too high; try reducing the distance; try using a cable to connect the sensor module, and then re-align the wireless module.

**Error:** Keys do not react

**Remedy:** Terminate sleep mode and / or device locking by pressing ON.

(see 13.1, 13.2)

**Error:** Measured values are not found in the data logger

**Remedy:** The measuring point numbers and measuring ranges may have changed; only four channels can be transmitted; try reconfiguring. (see 11.1.1)

**Error:** Measured values are incorrect

**Remedy:** Switch the device OFF and then ON again; check all channel programming very carefully via the interface, especially the base value and zero-point.

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

**Remedy:** Check the cabling for any inadmissible electrical connections.

Unplug sensor, connect a hand-held sensor in air or a phantom sensor (for thermocouples short-circuit A-B, for Pt100 sensors use 100 Ω) and check; then reconnect sensor and recheck. If necessary insulate the sensor or power the device using an electrically isolated supply.

**Error:** Error message 'CALER' is displayed when device is switched on

**Remedy:** The calibration of a measuring range may have become misadjusted. The device must be recalibrated at our factory.

**Error:** Data transmission via the interface does not function

**Remedy:** This device accepts USB data cable DKU5/V only,

Has the correct baud rate been set on the computer (standard 9600 baud) ?

Ensure that the correct COM port on the computer is being addressed.

Test the data transmission by means of a terminal (Almemo-Control, Win-Control, WINDOWS Terminal). Check the programming by means of command 'P15'. (see Man. 6.2.3).

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. (see 16.4) With the Almemo-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.

## 16. ANNEX

### 16.1 Technical data

<b>Measuring inputs</b>	one ALMEMO® socket for all ALMEMO® sensors
Measuring channels	4 channels for double sensors, function channels
A/D converter	Delta - sigma, 16-bit, 2.5 / 10 mops, amplification 1 to 100
Sensor power supply	6 / 9 / 12 V as required, max 150 mA
<b>Option OA2790-RHA</b>	Integrated temperature / humidity sensor
Measuring channels	4 additional humidity sensor channels (T, RH, TD, AP)
Measuring ranges	Temperature -20 to +80 °C
	Accuracy +5 to +60 °C typical ±0.2 K
	+5 to +60 °C maximum ±0.4 K
	-20 to +80 °C maximum ±0.7 K
	Reproducibility typical ±0.1 K
	Humidity 5.0 to 98.0 % RH
	Accuracy 10 to 90 % RH max. ±2.0 % RH at 23 °C ±5 K
	5 to 98 % RH max. ±4 % RH at 23 °C ±5 K
	Hysteresis typical ±1 % RH
<b>Outputs</b>	
Interfaces	USB with cable ZA1919-DKU5 at ALMEMO® DC socket
Wireless link	Bluetooth, class 1, with internal antenna
<b>Standard equipment</b>	
LCD	Meas. value 5x 7-segment, 15 mm 2x 16-segment, 9 mm
	Function 4½ x 7-segment, 9 mm, 9 symbols
	Operation 7 silicone keys
<b>Power supply</b>	
Batteries	3 Ni-MH rechargeable batteries (AA size)
Current consumption	approx. 14 mA (with wireless connection, without input and output modules)
<b>External</b>	ALMEMO® DC socket
Mains adapter	ZA 1312-NA10 230 VAC to 12 VDC, 2A
Adapter cable, el. isolated:	ZA 2690-UK 10...30 VDC to 12 VDC, 0.25 A
<b>Housing</b>	127 x 83 x 42 mm (LxWxH), ABS, Weight approx. 260 g
<b>Operating conditions</b>	
Operating temperature	-10 to +50 °C (storage temperature -20 to +60 °C)
Ambient atm. humidity	10 to 90 % RH (non-condensing)
<b>Bluetooth sensor module ZA1729-BTFS</b>	
Power supply	via ALMEMO device
Current consumption	approx. 25 mA (9 V) (with wireless connection)
Module housing	61 x 20 x 8 mm (LxWxH), ABS
Operating conditions	
Operating temperature	-10 to +50 °C (storage temperature -20 to +60 °C)
Ambient atmospheric humidity	10 to 90 % RH (non-condensing)

**Wireless link**

Wireless standard	Bluetooth V2.0, class 1, with internal antenna
Protocol	SPP (sequence packet protocol)
Operating range	up to 1000 meters free field, in buildings much less

**16.2 Product overview**

	<b>Order no.</b>
<b>Wireless sensor link</b> - comprising :	
<b>Wireless measuring instrument ALMEMO® 2790-BTFM</b> 1 measuring input , 2-row LCD, 7 keys, Bluetooth module, rechargeable batteries, DC socket for mains adapter	MA2790BTFV
<b>Bluetooth wireless sensor module ZA1729BTFS</b> for ALMEMO® measuring instruments	
<b>Options</b>	
Integrated digital sensor for temp., humidity, and atm. pressure	OA2790RHA
<b>Accessories</b>	
Three rechargeable Ni-MH batteries (nickel – metal hydride)	ZB2000A1NM
ALMEMO® USB cable, with 5V power supply, up to 115.2 kbaud	ZA1919DKU5
DIN rail mounting	ZB2490HS
Rubber guard, gray	ZB2490GS2
Mains adapter with ALMEMO® plug, 12 V, 2 A	ZA1312NA10
DC adapter cable 10 to 30 VDC, 12 V / 0.25 A, electr. isolated	ZA2690UK

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## 16.4 Your contact partners

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**We take every possible care but the risk of inaccuracy  
can never be altogether excluded.  
We reserve the right to make technical changes without advance notice.**