

## Operating instructions

### English

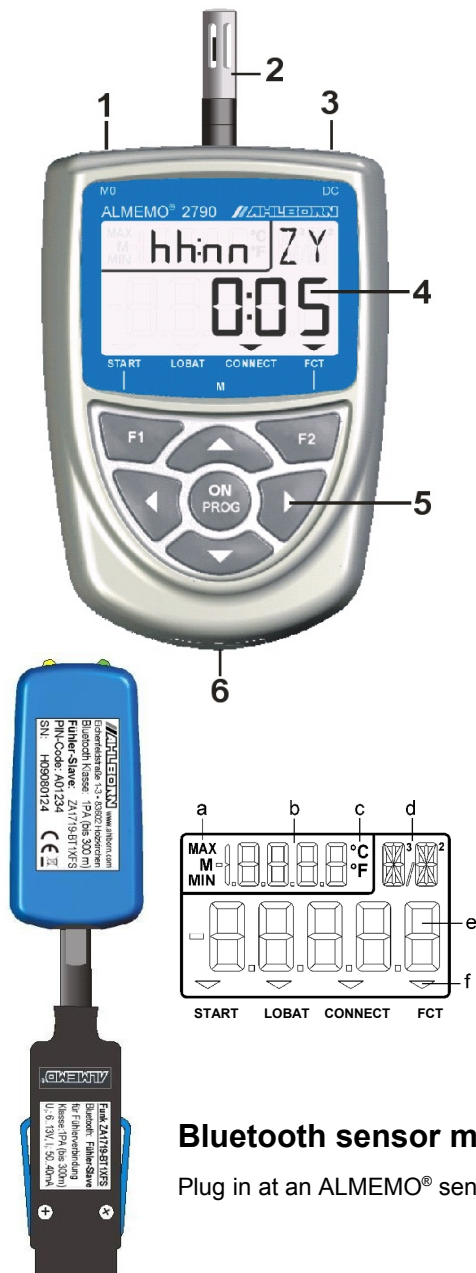


## Wireless sensor link MA2790BT1XFV with ALMEMO® 2790 and sensor module

V6

V1.0  
08.12.2010

# 1. OPERATING CONTROLS



## (1) Measuring inputs

M0 for all ALMEMO® sensors

## (2) M1 Humidity sensor (Option RH) Temperature sensor (Option T)

## (3) DC connector

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

## (4) LCD

- (a) Function
- (b) Meas. 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 < 3.3V  
**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

**F1** Meas. point selection

**F2** To start / stop measuring

**PROG** Programming function

**▲ ▼** Programming

**▲ ▼** To enter data

Rear of device :

## (6) Battery compartment

3 AA alkaline-manganese batteries

## Bluetooth sensor module ZA1719BT1XFS

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

## 2. TABLE OF CONTENTS

1. OPERATING CONTROLS.....	2
3. GENERAL.....	5
3.1 Warranty.....	5
3.2 Standard delivery.....	6
3.3 Waste disposal.....	6
4. SAFETY INSTRUCTIONS.....	7
4.1 Special notes on use.....	8
4.2 Handling batteries / rechargeable batteries correctly.....	8
5. INTRODUCTION.....	9
5.1 Functions.....	9
5.1.1 Sensor programming.....	10
5.1.2 Process control .....	10
6. PUTTING INTO SERVICE.....	11
7. POWER SUPPLY.....	11
7.1 Battery operation and supply voltage monitoring.....	11
7.2 Mains operation .....	12
7.3 External DC voltage supply .....	12
7.4 Sensor supply.....	12
7.5 Switching ON / OFF, reinitialization.....	12
7.6 Data buffering.....	13
8. CONNECTING SENSORS / TRANSDUCERS.....	13
8.1 Sensors / transducers.....	13
8.2 Measuring inputs and additional channels.....	13
8.3 Potential separation.....	14
9. DISPLAY AND KEYPAD.....	15
9.1 Display .....	15
9.2 Keypad .....	16
10. MEASURING OPERATIONS.....	17
10.1 Measured value.....	17
10.1.1 Selecting a measuring point.....	17
10.1.2 Measuring ranges.....	18
10.1.3 Double display.....	20
10.2 Peak value memory .....	20
11. INTERFACE.....	20
12. DEVICE CONFIGURATION.....	20
12.1 Cycle.....	21
12.2 Device locking.....	21
12.3 Pressure compensation.....	22
13. WIRELESS TRANSMISSION TO DATA LOGGER.....	23

<b>14. TROUBLE-SHOOTING.....</b>	<b>23</b>
<b>15. DECLARATION OF CONFORMITY.....</b>	<b>24</b>
<b>16. ANNEX.....</b>	<b>25</b>
<b>16.1 Technical data .....</b>	<b>25</b>
<b>16.2 Product overview .....</b>	<b>26</b>
<b>16.3 Index.....</b>	<b>27</b>
<b>16.4 Your contact partner.....</b>	<b>30</b>

### 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 300 meters free field). Thanks to the patented ALMEMO® connector 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 14, "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.

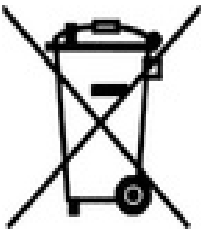
### 3.2 Standard delivery

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

- Wireless measuring instrument ALMEMO® 2790-BT1X with 3 AA alkaline batteries
- Bluetooth sensor module ZA 1719-BT1XFS
- These operating instructions, ALMEMO® Manual
- CD with AMR-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 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.
- 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, 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. 8.3).

### 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, 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 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® connector 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® connector offers decisive advantages when connecting sensors and peripherals because all parameters are stored in an EEPROM located on the connector itself; repeated programming is thus no longer necessary.

All sensors can be connected to all ALMEMO® measuring instruments in the same way. 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 (Manual, Chapter 1)

Overview of the device functions and measuring ranges (Manual, Chapter 2)

Basic principles, operating instructions, and technical data for all sensors (Manual, Chapter 3)

Options for connecting your own existing sensors (Manual, Chapter 4)

USB interface modules (Manual, Section 5.2)

All functions and their operation via the interface (Manual, Chapter 6)

Complete list of interface commands with all the printouts (Manual, Chapter 7)

The operating instructions you are now reading cover only those features and controls that are specific to this device. Many sections refer to more detailed descriptions in the Manual; (see Manual, Section xxx).

### 5.1 Functions

Measuring instrument ALMEMO® 2790-1 has just one measuring input M0 for all ALMEMO® sensors. The measuring possibilities are virtually limitless; there are 4 channels per sensor connector and over 70 measuring ranges. Option RH offers an integrated temperature / humidity sensor with 4 channels; option AP offers an integrated atmospheric pressure sensor. To facilitate operation and measured value display on site the device incorporates a keypad and a large 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. (s.Man. Ch. 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. Several wireless sensor links can be operated simultaneously; they cause no mutual interference.

### 5.1.1 Sensor programming

The measuring channels are programmed, completely and automatically, via the ALMEMO® connectors; they are ready-to-operate immediately. However, via interface cable ZA1919-DKUX the user can still add to or modify the programming. (see Manual, Section 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

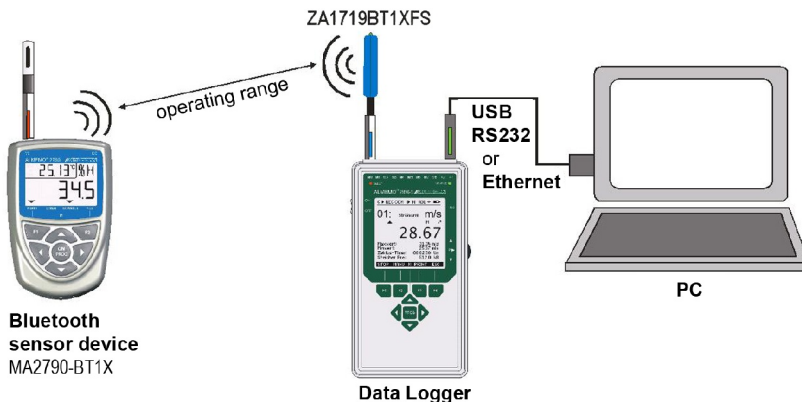
The cycle can be programmed to any value between 0 minutes and 99 hours. This cycle governs the cyclic output of measured values over a wireless link or to the interface. If the cycle is set to 0, data is transmitted continuously; in this case the sensor device should be powered from an external source.

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; parameters are not transmitted to the receiving device (s. 13).

#### Bluetooth sensor link



## 6. PUTTING INTO SERVICE

- 1 Plug **wireless sensor module** ZA1719-BT1XFS 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 8.
- 3 Ensure that the correct **power supply** is provided by means of 3 AA batteries or mains adapter. see 7.1, 7.2
- 4 To switch on press **ON**. see 7.5
- 5 Select a measuring channel using key **▲** (5), and read out measured values (4e). see 10.1.1
- 6 Program the cycle in function 'ZY'. see 12.1  
 Start measuring operation in the "Measured value" function by pressing key **F1**; 'the **START**' arrow should light up.  
 If 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 8.2  
 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:

3 AA batteries (included in delivery)

Mains adapter, 12 V, 1 A, with ALMEMO® connector ZA 1312-NA8

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

Power supply and interface via ALMEMO® USB data cable ZA 1919-DKU5

Our product spectrum includes all the appropriate accessories.

### 7.1 Battery operation and supply voltage monitoring

The measuring instrument is normally powered by 3 AA batteries. In continuous operation - with current consumption at approx. 19 mA - a battery set should last for approx. 150 hours. In sleep mode (cycle set to 1 minute or above) - with a measuring operation only being performed on completion of the cycle and with current consumption at only 0.1 mA - a battery set will last for approx. 20000 measuring operations. With the cycle set at 15 minutes a battery set would last for approx. 6 months. Using lithium batteries (e.g. Energizer Ultimate Lithium LR91-FR6) this period can even be doubled. The current operating voltage is displayed each time the device is switched on; this provides an

estimate of the remaining operating period. As and when the operating voltage drops below 3.6 V (with alkaline batteries approx. 10 percent remaining battery capacity), the **LOBAT** arrow will appear in the display. Battery status monitoring on the receiving device can be activated by programming a measuring channel 'UBat' on the 2790 within the first 4 channels transmitted and a limit value on the destination system. Alarm reporting is also possible. If the battery voltage drops to 3.3 V the batteries are completely discharged the device itself will switch off. 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-NA8 (12 V / 1 A) 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). This can be via an ALMEMO® connector (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 terminals + (plus) and – (minus) on the ALMEMO® connector a sensor supply voltage of 6 to 12 V (maximum 150 mA) is available automatically (self-healing fuse 500 mA); this corresponds to the minimum sensor voltage programmed for the measuring channels. (see Manual, Section 6.10.5)

Other voltages (15 V) or references for a potentiometer and strain gauge can also be obtained using special connectors. (see Manual Sec. 4.2.5 and 4.2.6).

### 7.5 Switching ON / OFF, reinitialization

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

If interference (e.g. electrostatic) or a malfunction (e.g. battery failure) causes the device to behave abnormally, it can be reinitialized. To activate this **reset** function 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. Programming of sensors in the ALMEMO® connectors will also remain unaffected.

## 7.6 Data buffering

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

## 8. CONNECTING SENSORS / TRANSDUCERS

Any ALMEMO® sensor can be connected at ALMEMO® input socket M0 on the measuring instrument (1). 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® connector.

### 8.1 Sensors / transducers

The ALMEMO® Manual includes detailed descriptions of the comprehensive ALMEMO® range of sensors (Manual, Chapter 3) and instructions for connecting your own existing sensors to ALMEMO® instruments (Manual, Chapter 4). All standard sensors with an ALMEMO® connector usually have the measuring 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® connectors incorporate two snap-lock levers; these snap into position as soon as the connector is inserted into the socket, thus preventing unintended disconnection if the cable is accidentally pulled. To withdraw the connector both these levers must first be pressed in at the sides.

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

### 8.2 Measuring inputs and additional channels

The ALMEMO 2790-1 measuring instrument has one input socket (1) to which initially measuring channel M0 is assigned. However, ALMEMO® sensors can, if necessary, provide up to 4 channels. The additional channels can be used in particular for humidity sensors with 4 measurable variables (temperature / humidity / dew point / 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 measuring ranges or scaling settings; 2 or 3 sensors, if pin assignment so permits, can be combined in a single connector (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.

Option RH is the measuring instrument plus a temperature / humidity sensor

(2) occupying channels M01 to M31.

Option AP offers an integrated atmospheric pressure sensor, which can be used as measured value or for compensation purposes. (see 12.3)

Atmospheric pressure is available - without option RH - on channel M01 or - with option RH - on channel 31. However, in wireless transmission to another 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 10.1.1) On the measuring instruments this gives the following channel assignment:

Sensor channels		with Option AP	with Option RH	with Option RH + AP
4. Chan.	30		AH	AP
3. Chan.	20		DT	DT
2. Chan.	10		RH	RH
1. Chan.	00	AP	T	T

### 8.3 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.

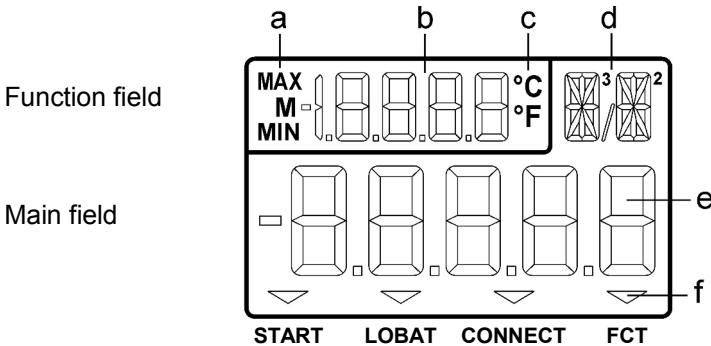
Sensors combined within one connector and sensors with their own power supply are electrically interconnected and must therefore be operated in isolation. The voltage at the measuring inputs themselves (between B, C, D and A or -) must not exceed 5 volts.

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).

## 9. DISPLAY AND KEYPAD

### 9.1 Display

The display (4) on measuring instruments ALMEMO® 2790 is a 2-row LCD arrangement; this comprises 5x 7-segment digits (e), 2x 16-segment digits (d) depicting the measured value, 4½ x 7-segment digits (b) depicting various measuring functions (a), and 4 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 the cycle function hh:mm:

hh:mm

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: (see 10.1)

Display after segment test

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

Wireless link established :

**CONNECT** arrow lights up

Meas. op. 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 :

**CJ**

(CJ compensation) flashes

Value range overshoot (>65000) :

**65000**

flashes

Measuring range overshoot:

Maximum value flashes

Measuring range undershoot:

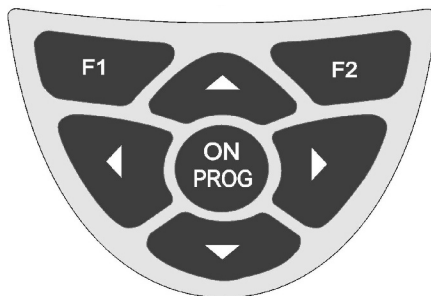
Minimum value flashes

## 9.2 Keypad

To operate the device a keypad with 7 keys is provided.



Operation via the keypad is disabled in sleep mode and in some levels of device locking. (s. 12.2)



### Function:

To switch the device ON: (s. 7.5)

Switch the device OFF:

### Key

**ON PROG**

**ON PROG** press and hold down

**Function:**

To select measuring points: (s.10.1.1)

To start meas. op. and wireless transm.:

To access the programming functions:

To program a function:

To return to the measured value:

To display maximum value: (s. 10.2)

To display minimum value: (s. 10.2)

To display battery voltage:

**Key**

▲ or ▼

F1

F2 ....

ON PROG , ▲ / ▼ , ► ....

▲

► To delete press and hold down

◄ To delete press and hold down

ON PROG

## 10. MEASURING OPERATIONS

With measuring instrument 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 8 measuring channels can be displayed. s. 8.2

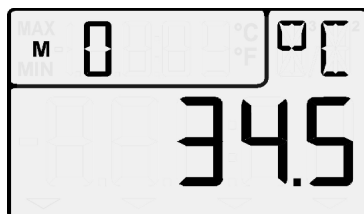
### 10.1 Measured value

After switching ON first of all a segment test is performed; then the battery voltage 'UbAt' appears and if the batteries are almost empty (<3.6 V) the LOBAT arrow also appears.

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



The measured value is then displayed with the appropriate units in the main field and the measuring point displayed in the function field. All special operating states possible for the measured value are explained in Section 9.1.



#### 10.1.1 Selecting a measuring point

To select one after the other all active measuring points and have the current measured value displayed for each of these press ▼. To return to the previous channel press ▲.

To increment the measuring channel

▲

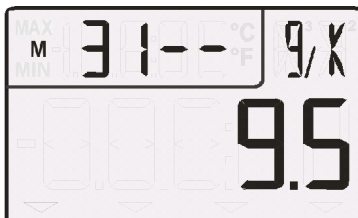
To decrement the measuring channel

▼

With each switchover the measuring range abbreviation appears briefly in the display s. 10.1.2.

## 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. If a channel is thus deactivated it is displayed with 2 lines behind it.



To deactivate / reactivate the selected channel  press and hold down.

### 10.1.2 Measuring 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 / transducers	Connector / cable / sensor	Measuring range	Units	Display
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-NiSil (N)	ZA 9020-FSN	-200.0...+1300.0	°C	NiSi
Fe-CuNi (L)	ZA 9021-FSL	-200.0...+900.0	°C	FEC0
Fe-CuNi (J)	ZA 9021-FSJ	-200.0...+1000.0	°C	IrCo
Cu-CuNi (U)	ZA 9000-FSU	-200.0...+600.0	°C	CUC0
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 Typ 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
Volt	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 (4-20mA)	ZA 9601-FS2	0.00... 100.00	%	P420
Ohms	ZA 9003-FS	0.0... 500.0	Ω	0hn
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

Sensors / transducers	Connector / cable / sensor	Measuring range	Units	Display
Digital Interface	ZA 9919-AKxx	-65000... +65000		diGi
Rotating vane, normal 20	FV A915-S120	0.30... 20.00	m/s	S120
Rotating vane, normal 40	FV A915-S140	0.40... 40.00	m/s	S140
Rotating vane, micro 20	FV A915-S220	0.50... 20.00	m/s	S220
Rotating vane, micro 40	FV A915-S240	0.60... 40.00	m/s	S240
Macro	FV A915-MA1	0.10... 20.00	m/s	L420
Water turbine mikro	FV A915-WM1	0.00... 5.00	m/s	L605
Dyn. press. 40m/s with TC and PC	FD A612-M1	0.50... 40.00	m/s	L840
Dyn. press. 90m/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 cap. with PC	FH A646	0.0 ... 500.0	g/k	H AH
Dew point temperature cap.	FH A646	-25.0... 100.0	°C	H dt
Partial vapor pressure cap.	FH A646	0.0 ... 1050.0	mb	H UP
Enthalpy cap. with PC	FH A646	0.0 ... 400.0	kJ	H En
Humid temperature	FN A846	-30.00 ... +125.00	°C	P Ht
Rel. humidity psychr. with PC	FN A846	0.0 ... 100.0	%H	P RH
Mixture ratio psychr. with PC	FN A846	0.0 ... 500.0	g/k	P AH
Dew point temp. psychr. w. PC	FN A846	-25.0 ... +100.0	°C	P dt
Partial vapor press. psychr. PC	FN A846	0.0 ... 1050.0	mb	P UP
Enthalpy psychr. 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	%	CO2
O <sub>2</sub> Saturation with TC a. PC	FY A640-O2	0 ... 260	%	O2-S
O <sub>2</sub> 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


Difference Mb1-Mb2	any			diFF
Maximum value Mb1	any			Hi
Minimum value Mb1	any			Lo
Average value over time (Mb1)	any			A[t]
Avg.val. over meas.pts (Mb2..Mb1)	any			A[n]
Sum over meas. pts (Mb2..Mb1)	any			S[n]
Total pulse count (Mb1)	ZA 9909-AK2	0... 65000		S[t]
Pulse count/print cycle (Mb1)	ZA 9909-AK2	0... 65000		S[P]
Alarm value (Mb1)	any			Alrn
Measuring value (Mb1)	any			MESS
Cold junction temperature	any		°C	CJ
Nuber of averag. values (Mb1)	any			n(t)
Timer	any		s	tinE
Atm. pressure ° (B86) s. 12.3	any	300...1100	mb	AP


TC=Temperature Compensation, PC= Atm. Pressure Compensation, \*Only Option 2790-RH, °only Option AP

### 10.1.3 Double display

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

Select 2nd channel



To activate temperature display press and hold down 

To return to the channel display press and hold down 



### 10.2 Peak value memory

From the measured values acquired for each measuring point the highest and the lowest values are continuously recorded. To display these high / low peak values first the desired channel must be set. (see Section 7.1)

Then press  or . The display also includes the associated symbol.

To display maximum value press:

To display minimum value press :

To delete maximum value:

To delete minimum value:

To return to the measuring point display :



press and hold down

press and hold down

Whenever this memory is cleared, the current measured value will appear (because measuring is continuous).

## 11. 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 Manual, Chapter 6)

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

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

## 12. DEVICE CONFIGURATION

On measuring instrument ALMEMO® 2790 a number of parameters can be configured. To access configuration press **FCT**. The function field should then show - instead of the units - the abbreviations for the various parameters one after the other; the main field should show the value currently set.

**To select from all possible parameters**

one after the other press:

Cycle:

Time format hh:mm

Keypad locking (locking code): s. 12.2

Atmospheric pressure for measured value com s.12.3

**FCT** ...

hh:nn	ZY
00:05	

	VC
0000	

	mb
1013	

**To enter a value** first press:

The value can be changed by means of keys:

To select next digit press:

To delete the value press:

To save and exit press:

To cancel without saving press:

**To return** to the measured value display press :

**PROG** value flashes

▲ or ▼

▶

**FCT**

**PROG**

◀, ▶ ...

▲

**12.1 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.

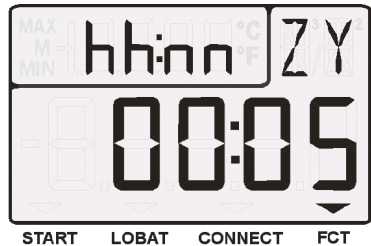
To access cycle function 'ZY' press

To return to the measured value display press

To start / stop a measuring operation press

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



**FCT**

▲

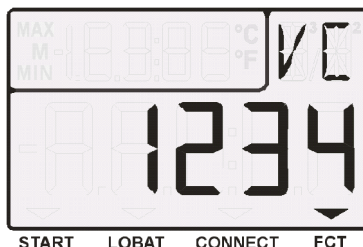
**F1**

**12.2 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 - select the locking code function 'VC' and enter a 4-digital number as password (display 'Loc'). (see 12.1)

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



### 12.3 Pressure compensation

Certain measured variables depend on the ambient atmospheric pressure; in such cases large deviations from standard pressure (1013 mbar) may lead to measuring errors (see Measuring range list 'with PC') :

#### e.g. error per 100 mbar

Relative humidity, psychr.

Mixture ratio

Dynamic pressure

O<sub>2</sub> saturation

#### Compensation range:

approx. 2% 500 to 1500 mbar

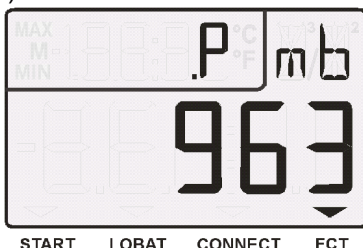
approx. 10% Vapor pressure VP up to 8 bar

approx. 5% 800 to 1250 mbar (error <2%)

approx. 10% 500 to 1500 mbar

It is advisable therefore, especially when working at appreciable 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 12)

With option AP (integrated atmospheric pressure sensor) the current atmospheric pressure is already 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 8.2)



This can be programmed to any measuring channel (command B86 see Manual, 6.3.3)

and, with abbreviation '\*P' in the designation, can even be forwarded for compensation purposes to the next device. (see Manual 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 10.1.2)

To display the programmed atmospheric pressure (not 1013) 'P'

To display the measured atmospheric pressure 'P' The dot flashes.

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

**PROG** , **FCT**

### 13. WIRELESS TRANSMISSION TO DATA LOGGER

Cyclic wireless transmission of maximum 4 channels to wireless sensor module ZA1719-BT1XFS on an ALMEMO® device begins with the cycle start. (see 12.1) 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 8 channels possible with option RH only the first 4 are transmitted. Those channels not required can be deactivated. (see 10.1.1) 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; they cause no mutual interference. Data from all channels is transmitted in its original format via a USB interface cable.

### 14. 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.

- |               |   |
|---------------|---|
| <b>Error</b>  | No display, display malfunction   |
| <b>Remedy</b> | Check the power supply; use fresh batteries; switch OFF and then ON again; if necessary re-initialize (see 7.5)   |
| <b>Error</b>  | Data transmission over the wireless link does not function. Does the symbol 'CONNECT' light up on the device, does the yellow LED light up on the module ?  |
| <b>Remedy</b> | Start measuring operation by pressing <b>F1</b> , 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. |
| <b>Error</b>  | Keys do not react.  |
| <b>Remedy</b> | Terminate sleep mode and / or device locking by pressing ON.(see 12.1)  |
| <b>Error</b>  | Measured values are not found in the data logger.   |
| <b>Remedy</b> | The measuring point numbers and measuring ranges may have changed; only 4 channels can be transmitted; try reconfiguring.(s 10.1.1, 13)   |
| <b>Error</b>  | Measured values are incorrect.  |
| <b>Remedy</b> | Switch the device OFF and then ON again; check all channel programming very carefully via the interface, especially the base value and zero-point .   |
| <b>Error</b>  | Measured values fluctuate unexpectedly or the system hangs in mid-  |

operation.

**Remedy** Check the cabling for any inadmissible electrical connections.  
Unplug the sensor. Connect a hand-held sensor in air or a phantom sensor (for thermocouples short-circuit A-B, for Pt100 sensors use 100  $\Omega$ ) and check. Reconnect the sensor and recheck.  
If necessary insulate the sensor or power the device using an electrically isolated supply.

**Error** 'CALEr' is displayed when the 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) ?  
Is the correct COM interface on the computer being addressed ?  
Test data transmission by means of a terminal (AMR-Control, WIN-Control, WINDOWS-Terminal). Check the programming by means of command 'P15'. (see Manual 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 AMR-Control software you can print out screenshots showing the relevant programming and save and / or print out a comprehensive "Function test" in the device list or terminal mode.

## 15. DECLARATION OF CONFORMITY

Ahlborn Mess- und Regelungstechnik GmbH declares herewith that measuring instrument ALMEMO® 2790 and the associated sensor modules carry the CE label and comply in full with the requirements of EU directives relating to low voltage and to electromagnetic compatibility (EMC) (89/336/EWG).

The following standards have been applied in evaluating these products :

Safety / security  
EMC

EN 61010-1: 2001  
EN 61326: 2006



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

When using the sensor with an extension care must be taken to ensure that wiring is not laid alongside or close to high-voltage power cables and that it is, if necessary, properly shielded so as to prevent spurious interference being induced in the system.

## 16. ANNEX

### 16.1 Technical data (see Manual 2.3)

<b>Measuring inputs</b>	1 ALMEMO® socket suitable for all ALMEMO® sensors
Measuring channels	4 channels for double sensors, function channels
A/D converter	Delta - sigma, 16-bit, 2.5 / 10 mops, adjustable 1 to 100
Sensor power supply	6 / 9 / 12 V as required, max 150 mA
<b>Option OA2790-RH</b>	Integrated temperature / humidity sensor
Measuring channels	4 additional humidity sensor channels (T, RH, DT, MH)
Measuring ranges	Temperature -20.00 to +80.00 °C
	Accuracy ±0.3 K at +25 °C, otherwise max. ±1.2 K
	Rel. humidity 5.0 to 98.0 % RH
	Accuracy ±1.8 % RH at +25 °C
	within range 20 to 80 % RH
	Hysteresis ±1.0 % RH
	Humidity variables
<b>Option OA2790-AP</b>	Integrated absolute pressure sensor
	Range 300 to 1100 mbar, Accuracy ±2.5 mbar
<b>Outputs</b>	
Interfaces	USB with cable ZA1919-DKU5 at ALMEMO® DC socket
Wireless link	Bluetooth class 1PA with internal active antenna
<b>Standard equipment</b>	
LCD	Measured value 5x 7-segment, 15 mm, 2x 16-segment, 9 mm Function 4½ x 7-segment 9 mm, 9 symbols 7 silicone keys
Operation	
<b>Power supply</b>	
Batteries	3 AA alkaline batteries
Current consumption	approx. 19 mA (with wireless but without input and output modules)
<b>External</b>	ALMEMO® DC socket
Mains adapter	ZA 1312-NA8 230 VAC to 12 VDC, 1 A
Adapter cable, el. isol.	ZA 2690-UK 10 - 30 VDC to 12 VDC, 0.25 A
<b>Housing</b>	(LxWxH) 127 x 83 x 42 mm ABS Weight approx. 260 g
<b>Suitable 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 ZA1719-BT1XFS</b>	
Power supply	via ALMEMO® device
Current consumption	approx. 35 mA (9 V)
Module housing	(LxWxH) 61 x 30 x 12 mm ABS PC GF (-10 to +70 °C)
Cable length	only with type K approx. 1 meter
Suitable conditions	
Operating temperature	-10 to +50 °C Storage temperature -20 to +60 °C
Ambient atm. humidity	10 to 90 % RH (non-condensing)

**Wireless link**

Wireless standard	Bluetooth V2.0, class 1PA with active antenna
Protocol	SPP (sequence packet protocol) (128-bit encryption)
Operating range	approx. 300 meters free field, in buildings much less

**16.2 Product overview**

Wireless sensor link - comprising :

**Wireless measuring instrument ALMEMO® 2790-1****Order no.**

1 measuring input, 2-row LCD, 7 keys, Bluetooth module  
Battery supply, DC socket for mains adapter

**Bluetooth wireless sensor module**

for ALMEMO® measuring instruments

ZA2790-BT1XFV

Same as above Wireless sensor module with 1-meter cable

ZA2790-BT1XFVK

**Options**

Integrated humidity sensor

OA2790-RH

Integrated temperature sensor

OA2790-T

Integrated atmospheric pressure sensor

OA2790-AP

Housing with protective class IP54

OA2790-W

**Accessories**

Set of 3 lithium batteries

ZB2000-BSL1

ALMEMO® USB data cable,  
with 5 V power supply, maximum 115.2 kbaud

ZA1919-DKU5

DIN top hat rail mounting

ZB2490-HS

Rubber guard, gray

ZB2490-GS2

Mains adapter with ALMEMO® connector, 12 V, 1 A

ZA1312-NA8

DC adapter cable, 10 to 30 VDC, 12 V / 0.25 A, electr. isolated

ZA2690-UK

## 16.3 Index

Accessories	16.2	26
Accuracy	16.1	25
additional channels	8.2	13
Ambient atm. humidity	16.1	25
Atm. Pressure Compensation	10.1.2	19
atmospheric pressure sensor	16.2	14, 22, 26
batteries	4.2	8
Battery operation	7.1	11
battery voltage	10.1	17
Bluetooth sensor module	16.1	25
channel assignment	8.2	14
channel number in	13	23
Checksum error	9.1	16
CONNECT	9.1	2, 16
Connecting sensors	8	13
current consumption	7.1	11
Current consumption	16.1	25
Cycle	5.1.2	10, 21
Data buffering	7.6	13
Data transmission	5.1.2	10
DC adapter cable	16.2	26
Deactivating and reactivating measuring channels	10.1.1	18
Declaration of conformity	15	24
Device configuration	12	20
device locking	9.2	16
Device locking	12.2	21
DIN top hat rail mounting	16.2	26
Display	9.1	15
Double display	10.1.3	20
double sensor	9.1	15
double-function sensors	10.1.3	20
Dynamic pressure	12.3	22
electrically isolated	7.3	12
electromagnetic compatibility	15	24
External DC voltage supply	7.3	12
factory default status	7.5	12
faults	9.1	16
FCT	9.1	2, 16
Function channels	10.1.2	19
Function field	9.1	15
Functions	5.1	9
Hotline	16.4	30
Housing	16.1	25

humidity sensor	16.2	25f.
Humidity sensor	1	2
Interface	11	20
Introduction	5	9
keypad	9	15
Keypad	9.2	16
Kundendienst	16.4	30
lithium batterie	16.2	11, 26
LOBAT	7.1	2, 12, 16
locking code	12.2	22
Main field	9.1	15
mains adapter	7.2	12
Mains adapter	16.2	11, 25f.
Mains operation	7.2	12
maximum value	10.2	20
Measured value	10.1	17
Measuring	10	17
measuring functions	9.1	15
Measuring inputs	16.1	13, 25
measuring range abbreviation	10.1.2	18
Measuring range overshoot	9.1	16
Measuring ranges	10.1.2	18
minimum value	10.2	20
Mixture ratio	12.3	22
notes on use	4.1	8
O2 saturation	12.3	22
ON PROG	10.1	17
Operating controls	1	2
operating range	3	5
Operating range	16.1	26
operating states	9.1	16
Operating states	1	2
Operating temperature	16.1	25
option AP	12.3	22
Option AP	8.2	14
option RH	13	23
Option RH	8.2	13
Options	16.2	26
Outputs	16.1	25
password	12.2	21
Peak value memory	10.2	20
polarity	4.2	8
Potential separation	8.3	14
Power supply	16.1	11, 25
Pressure compensation	12.3	22

Process control	5.1.2	10
Product overview	16.2	26
Protocol	16.1	26
Putting into service	6	11
rechargeable batterie	4.2	8
reinitialization	7.5	12
replace used batteries	7.1	12
Rubber guard	16.2	26
Safety instructions	4	7
segment test	10.1	17
Selecting a measuring point	10.1.1	17
Sensor breakage	9.1	16
sensor module	1	2
Sensor power supply	16.1	25
Sensor programming	5.1.1	10
Sensor supply	7.4	12
Sensors	8.1	13
sleep mode	12.1	15, 21
Standard delivery	3.2	6
Standard equipment	16.1	25
START	1	2, 16
start / stop a measuring operation	12.1	21
Suitable conditions	16.1	25
Supply voltage	9.1	16
supply voltage monitoring	7.1	11
switch the device OFF	7.5	12
Switch the device OFF	9.2	16
Switching ON / OFF	7.5	12
Technical data	16.1	25
temperature / humidity sensor	8.2	13
Temperature Compensation	10.1.2	19
Time format	9.1	15
To switch the device ON	9.2	16
USB data cable	16.2	20, 26
Vapor pressure	12.3	22
Warranty	3.1	5
Waste disposal	3.3	6
Wireless link	16.1	26
wireless sensor module	13	10f., 23
Wireless standard	16.1	26
Wireless transmission to data logger	13	23

## 16.4 Your contact partner

AHLBORN Mess- und Regelungstechnik GmbH  
Eichenfeldstraße 1  
83607 Holzkirchen  
Germany

internet : <http://www.ahlborn.com>  
e-mail : [amr@ahlborn.com](mailto:amr@ahlborn.com)

**Even the greatest possible care cannot exclude the possibility of inaccuracies.  
We reserve the right to make technical changes without advance notice.**



