

ALMEMO®



Operating Instructions

Multimeter

ALMEMO® 2190-2 VS

V1.0
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ALMEMO[®] 2190-2

For Reference with the ALMEMO[®] Manual

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1. INTRODUCTION

The multimeter ALMEMO® 2190-2 *Version 5* is an instrument from a unique product range of measuring devices that are all equipped with the ALMEMO® connector system, which has been patented by Ahlborn GmbH. The intelligent ALMEMO® connector provides important advantages with regard to the connection of sensors and peripherals as all parameters are stored in an EEPROM within the connector. As a result, the programming that usually has to be performed for the connection is not required.

All sensors and output modules can be connected to all ALMEMO® measuring devices in the same way. The operation and programming is identical with all units. Therefore, all of the ALMEMO® measuring system items listed below are described, in detail, in a separate ALMEMO® manual that is supplied with every device:

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

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

1.1 Function Range

The multimeter ALMEMO® 2190-2 is a simple measuring instrument with one measuring input (4 channels at maximum) without an integrated programming capability. However, it is easily possible to connect any programmed ALMEMO® sensor and read the measured values, including the dimension, from the LCD display. Five keys allow for reading maximum and minimum values and for freezing or setting the measured value to zero.

An analogue output module can be connected to the output socket as required and the measured values can, for example, be evaluated using a recorder.

SENSOR PROGRAMMING

The measuring channels are automatically programmed by the ALMEMO® sensor connectors. It is not possible to alter the programming using the instrument ALMEMO® 2190-2, however, the programming can be changed by means of any other ALMEMO® device that is equipped with an interface for entering data. In any case a programming will be supported without restrictions.

Measuring Ranges

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

Dimension

With any ALMEMO® sensor, two 16-segment elements will always display the correct physical dimension. The conversion from °C to °F is automatically performed according to the dimension.

MEASUREMENT

A maximum of 4 measuring channels is available for each sensor, i.e. it is also possible to evaluate double sensors, sensors with different scaling or sensors with function channels. The selected measuring point can be scanned with a conversion rate of 2.5 measurements/second. The measured value is calculated and indicated on the display or, if available, provided on the analogue output.

Measured Value

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

Measuring Functions

Some sensors require special meas. functions to achieve an optimal acquisition of meas. data. The cold junction compensation is available for thermocouples and a temperature compensation for dynamic pressure and pH and conductivity probes. With infrared sensors the parameters zero point and slope correction are used for background temperature and emissivity factor.

Maximum and Minimum Value

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

Storage for Measured Values

The measured value can be frozen in the display by the push of a button.

Differential Measurement

By setting the measured value to zero it is possible to perform differential measurements related to a reference value or to correct sensor errors.

External Sensor Programming

All sensor programming is supported when they have been programmed in the factory or by using other ALMEMO® devices.

Dimension

The 2-digit dimension can be altered for each measuring channel so that the display will always indicate the correct dimension, for example when a transmitter is connected.

Correction of Measured Values

For correcting meas. values a zero point and slope (gain) correction can be applied to the meas. value of a meas. channel. As a result, sensors can be interchanged that usually, at first, require an adjustment (expansion, force, pH).

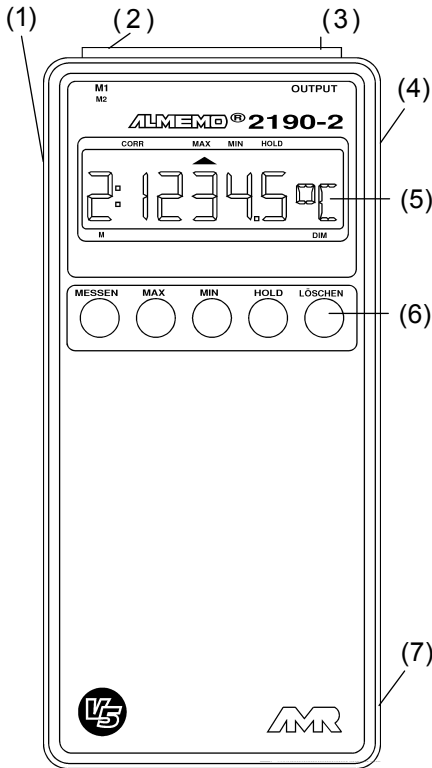
Scaling

The base value and the factor allow for a further scaling of the corrected measured value of each measuring channel for zero point and slope (gain). The decimal point position can be set by the exponent.

Analogue Output and Scaling

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

1.2 Operating Controls



(1) ON/OFF Switch

Up: ON
Down: OFF

(2) Meas. Input M1

M1 for all ALMEMO sensors
M2 to M4 add. channels

(3) Output Socket OUTPUT

Analogue output (ZA 1601-RK)

(4) DC Socket

Mains adapter (ZB 2290-NA, 12V, 200mA)
Connect. cable (ZB 5090-EK, 7-13V DC)
Cable, electr. isol. (ZB 2290-UK, 10-30V)

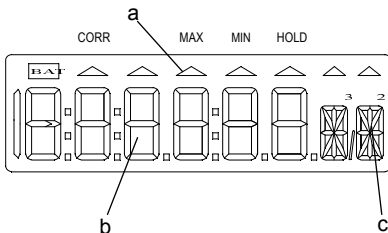
(5) LCD Display

(6) Function Keys

MEASURING meas. val., meas. point
MAX fetch maximum value
MIN fetch minimum value
HOLD freeze meas. value
CLEAR set meas. value to zero
clear max, min, hold

(7) Battery Box (back of unit)

Alkaline mangan. battery 9V (6F22)
Space for spare battery



(5) LCD Display

(a) Symbols for operating modes

BAT U battery < 7 V
▲ CORR correction of meas. val.
flashes differential measurement
▲ MAX max value
▲ MIN min value
▲ HOLD meas. value freezing

(b) 6 x 7-segment display for: meas. point, meas. value

(c) 2 x 16-segment display for: dimension of the meas. value

2. INITIAL OPERATION

1. Connect the **transducers** to socket M1 (2), see 4.
2. Ensure **power supply** with 9V battery or mains adapter, see 3.1, 3.2.
3. **For switching on** move the slide switch (1) on the left side of the unit to the upper position, see 3.3.
4. **For displaying** the measured values:
use key **MEAS.** to select the measuring channels, read the meas. val., s. 7.1.
5. Use the key **HOLD** to perform a **freezing of the measured value**, see 7.3.
6. **Differential measurement** related to a reference value
or **sensor adjustment** with key **CLEAR**, see 7.4.
7. For **evaluating the measurement**:
use the keys **MAX** and **MIN** to recall the max and min values.

3. POWER SUPPLY

The following options are available for the power supply of the instrument:

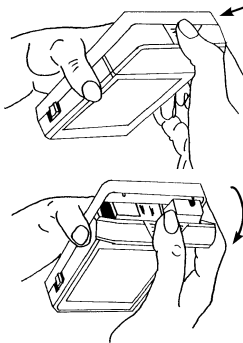
- 9V battery IEC 6 F22 ZB 2000-B9
- 9V rechargeable battery,
as above with charger unit integrated in plug ZB 2000-A9, ZB 2000-LS
- Mains adapter 12V/200mA ZB 2290-NA
- External power supply, connecting cable ZB 2290-UK

Our product line includes corresponding accessories.

3.1 Operation with Battery and Rechargeable Battery

Only use type IEC 6 F22 alkaline manganese batteries. At a current consumption of approximately 6mA, they last for an operating time of 60 hours. The operating time will be shortened if sensors or modules are connected that consume additional current.

Inserting Batteries:



The battery box (7) is located at the underside of the instrument.

1. Press the area that is marked with the arrow and, at the same time, pull as marked by the arrow, as illustrated left.
2. Use the connector clip to connect the battery. The connector shape prevents from confusing the poles.
3. Use the second battery box to store a spare battery.

Battery Control:



If the battery warning symbol is illuminated in the display the battery will still operate for approx. 5 hours. (supply voltage <7V)



If the battery voltage drops below 6 volts 'LobAt' will be indicated on the display.

The battery should be immediately removed. Leakage of the battery and damage to the instrument can then be avoided.



The actual battery voltage can be accurately monitored with an own measuring channel *U_{bat}* and the remaining battery life can be estimated accordingly.

Tips regarding correct handling of batteries:

- Do not leave used batteries in the instrument!
- Remove batteries from the instrument if it is not used for a long period.
- Risk to health and instrument failure can result from leaking batteries! Therefore, only use leak-proof batteries.
- Used batteries are hazardous waste and must be disposed in an environmentally friendly way! Return them to the dealer or dispose of them in a battery storage container.

Operation with Rechargeable Batteries

Rechargeable batteries can be used instead of normal batteries. Due to their smaller capacity of 110mAh they only reach an operating time of 20 hours. The operating time will be shortened if sensors or modules are connected that consume additional current. It is recommended to use the 9V rechargeable battery with plug-integrated charger unit ZB 2000 LS, which is included in the range of accessories.

Tips regarding correct handling of rechargeable batteries:

- The rechargeable batteries supplied are not charged when delivered!
- If NiCd cells are only partly discharged, the full capacity cannot be reached by a normal recharging.
- Therefore, use the instrument until the rechargeable batteries are completely discharged.
- Completely recharge the rechargeable batteries afterwards.
- As a result, the life of the rechargeable batteries is significantly increased.
- Completely recharged batteries will slowly discharge during storage.

3.2 External Voltage Supply

For an external voltage supply the connector socket (4) is located at the right side of the device. The range of accessories includes the mains adapter ZB 2290-NA (12V/200mA). However, any other DC voltage source (7 to 13V) can also be used. The connection is performed by a low-voltage connector (NES1 according to DIN 42323, centre pin to negative).

The electrically isolated supply cable ZB 2290-UK must be used if an **electrical isolation** between power supply and transducers is required or if a larger input voltage range (10...36V DC) is required. It allows to operate the measuring instrument with 12V or 24V mains supply.



If a battery is used in addition it will take over the power supply if the voltage drops under 9V.

3.3 Switch On/Off

The ON/OFF switch (1) on the left side of the device has two positions:

- up: ON
- down: OFF

For **switch-on** the slide switch (1) on the left side must be moved upwards.

The device is **switched off** when the slide switch is moved to the lower position.

Measuring data will be lost; however, the sensor programming in the ALMEMO® connectors will not be affected.

4. CONNECTION OF THE TRANSDUCERS

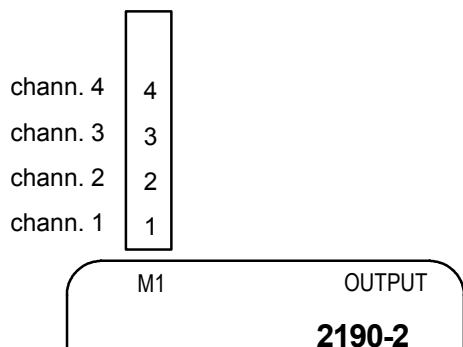
Any ALMEMO® sensors can be connected to the ALMEMO® input socket M1 (2). For connecting existing sensors it is only necessary to connect a corresponding ALMEMO® connector.

4.1 Transducers

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

4.2 Measuring Inputs and Additional Channels

The measuring instrument ALMEMO® 2190-2 has 1 input socket M1 (2), the ALMEMO® 2290-3 has 2 input sockets M1 and M2, and additionally a differential channel M3 (M1-M2). However, ALMEMO® sensors can, if required, provide up to 4 channels. The additional channels can be especially used with humidity sensors with 4 measuring variables (temperature/humidity/dew point/mixture ratio) or used for function channels. If required, a sensor can also be programmed with several ranges or scaling or, depending on the pin assignment, 2 or 3 sensors can be combined in one connector (e.g. rH/Ntc, mV/V, mA/V etc.). The additional measuring channels of the connector are located next to the first channel. The following channel occupancy is valid for both measuring instruments.

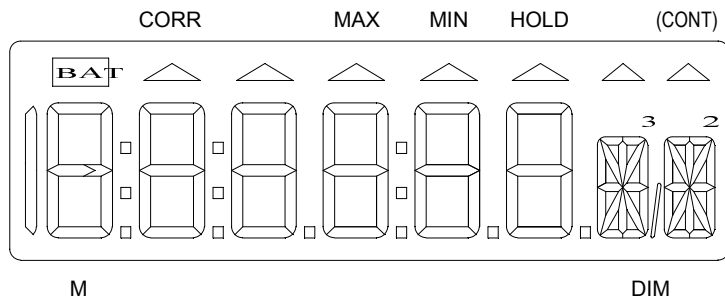


Combined sensors within one connector are electrically connected to each other and must, therefore, be operated in isolation. The voltage applied to the measuring inputs must not exceed $\pm 5V$ (between B,C,D and A or - respectively).

The cold junction compensation for thermocouple measurement is integrated in socket M1 of the device.

5. DISPLAY

The display (5) of the measuring instrument ALMEMO® 2190-2 consists of an LCD module with six 7-segment digits, two 16-segment digits, and a battery symbol and seven arrows for indicating the operating status.



Special Operating Conditions

Segment test of the display

Supply voltage:

lower than 7 V:

automatically after switch-on.

BAT symbol illuminated

lower than 6 V:

1: L o b A t

Sensors that are not connected,
deactivated measuring points,
cleared programming values.

1: - - - - X X

Sensor correction or scaling:

arrow **CORR** illuminated

Measurement in differential mode:

arrow **CORR** flashes

Display max value:

arrow **MAX** illuminated

Display min value:

arrow **MIN** illuminated

Measured value frozen:

arrow **HOLD** illuminated

Continuous measuring point scan:

arrow (CONT) illuminated

Alarm Conditions

Sensor breakage:

1: N i C r °C abbr. flashes

Overshooting of measuring range:

maximum value flashes

Undershooting of measuring range:

minimum values flashes

Undershoot of meas. range CJ compens.
or CJC breakage:

1: C J (cold junction)
flashes

Exceeding of range of values (>65000):

1: 6 5 0 0 0 flashes

6. SENSOR PROGRAMMING

As all ALMEMO® instruments contain the whole sensor programming stored in the ALMEMO® connector, it is possible to connect all ALMEMO® sensors with no programming being required. The instrument ALMEMO® 2190-2 does not offer any programming facility. To connect existing sensors it is necessary to order an ALMEMO® connector including the corresponding programming. However, if sensors must be scaled or if sensor errors must be reliably corrected, it is also possible to perform the programming (s. man. 6.3) using other ALMEMO® instruments that provide input capabilities.

6.1 Measuring Ranges

With each channel switching or in case of a sensor breakage the abbreviation of the measuring range is indicated in the display. For easy identification the following table provides all possible measuring ranges.

| Transducer | Sensor/Cable | Meas. Range | Dim | Display |
|--------------------------|--------------|-------------------|-----|---------|
| Pt100-1 | FP Axxx | -200.0... +850.0 | °C | P104 |
| Pt100-2 | FP Axxx | -200.00...+200.00 | °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 9000-FSL | -200.0... +900.0 | °C | FECO |
| Fe-CuNi (J) | ZA 9000-FSJ | -200.0...+1000.0 | °C | IrCo |
| Cu-CuNi (U) | ZA 9000-FSU | -200.0... +600.0 | °C | CUCO |
| Cu-CuNi (T) | ZA 9000-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 | -30.00...+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 | -2.6000...+2.6000 | V | U2.60 |
| Differential Millivolt | ZA 9050-FS0 | -10.000...+55.000 | mV | d 55 |
| Differential Millivolt 1 | ZA 9050-FS1 | -26.000...+26.000 | mV | d 26 |
| Differential Millivolt 2 | ZA 9050-FS2 | -260.00...+260.00 | mV | d260 |
| Differential Volt | ZA 9050-FS3 | -2.6000...+2.6000 | V | d2.60 |
| Sensor Voltage | any | 0.00...20.00 | V | UbAt |
| Milliampere | ZA 9601-FS1 | -32.000...+32.000 | mA | I032 |
| Percent (4-20mA) | ZA 9601-FS2 | 0.00... 100.00 | % | P420 |
| Ohm | ZA 9003-FS | 0.00... 400.00 | Ω | Ohn |
| Frequency | ZA 9909-AK1 | 0... 25000 | Hz | FrEq |
| Pulses | ZA 9909-AK2 | 0... 65000 | | PULS |

| Transducer | Sensor/Cable | Meas. Range | Dim | Display |
|---------------------------------------|--------------|--------------------|-----|---------|
| Digital Input | ZA 9000-EK2 | 0.0... 100.0 | % | Inp |
| Digital Interface | ZA 9919-AKxx | -65000... +65000 | | diGi |
| Infrared 1 | FI A628-1/5 | 0.0... +200.0 | °C | Ir 1 |
| Infrared 2 | FI A628-2 | 0.0... +800.0 | °C | Ir 2 |
| Infrared 3 | FI A628-3 | -30.0... +70.0 | °C | Ir 3 |
| Infrared 4 | FI A628-4 | -30.0... +100.0 | °C | Ir 4 |
| Infrared 6 | FI A628-6 | 0.0... +500.0 | °C | Ir 6 |
| Snap-on head Normal 20 | FV A915-S120 | 0.30... 20.00 | m/s | S120 |
| Snap-on head Normal 40 | FV A915-S140 | 0.40... 40.00 | m/s | S140 |
| Snap-on head Micro 20 | FV A915-S220 | 0.50... 20.00 | m/s | S220 |
| Snap-on head Micro 40 | FV A915-S240 | 0.60... 40.00 | m/s | S240 |
| Macro | FV A915-MA1 | 0.10... 20.00 | m/s | L420 |
| Water-Micro | FV A915-WM1 | 0.00... 5.00 | m/s | L605 |
| Dyn.press. 40m/s w. TC a. PC | FD A612-M1 | 0.50... 40.00 | m/s | L840 |
| Dyn.press. 90 m/s w. TC a. PC | FD A612-M6 | 1.00... 90.00 | m/s | L890 |
| Rel. air humidity cap. | FH A646 | 0.0... 100.0 | %H | °orH |
| Rel. air humidity cap. w. TC | FH A646-R | 0.0... 100.0 | %H | H rH |
| Mixture ratio w. PC | FH A646 | 0.0 ... 500.0 | g/k | H AH |
| Dew point temperature | FH A646 | -25.0... 100.0 | °C | H dt |
| Partial vapour pressure | FH A646 | 0.0 ... 1050.0 | mb | H UP |
| Enthalpy w. PC | FH A646 | 0.0 ... 400.0 | kJ | H En |
| Humid temperature | FN A846 | -30.00 ... +125.00 | °C | P Ht |
| Rel. humidity psychr. w. PC | FN A846 | 0.0 ... 100.0 | %H | P RH |
| Mixture ratio w. PC | FN A846 | 0.0 ... 500.0 | g/k | P AH |
| Dew point temperature w. PC | FN A846 | -25.0 ... +100.0 | °C | P dt |
| Partial vapour press. w. PC | FN A846 | 0.0 ... 1050.0 | mb | P UP |
| Enthalpy w. PC | FN A846 | 0.0 ... 400.0 | kJ | P En |
| Conductivity probe w. TC | FY A641-LF | 0.0 ... 20.000 | mS | LF |
| CO ₂ sensor | FY A600-CO2 | 0.0 ... 2.500 | % | CO2 |
| O ₂ saturation w. TC a. PC | FY A640-O2 | 0 ... 260 | % | O2-S |
| O ₂ concentration w. TC | FY A640-O2 | 0 ... 40.0 | mg | O2-C |

Function channels:

| | | | |
|------------------------------|-------------|------------|--------|
| Difference | any | | diff |
| Maximum value | any | | Hi |
| Minimum value | any | | Lo |
| Average value over time | any | | A[t] |
| Average value over junctions | any | | A[n] |
| Sum over junctions | any | | S[n] |
| Total number of pulses | ZA 9909-AK2 | 0... 65000 | S[t] |
| Pulses/print cycle | ZA 9909-AK2 | 0... 65000 | S[P] |
| Alarm value | any | | % Alrm |

TC=Temperature Compensation, PC=Atmospheric Pressure Compensation

6.2 Dimension

The dimension is indicated by two 16-segment digits next to the measured value. Depending on the programming (see also manual 6.3.5) the dimension can be different from the standard dimensions of the measuring range (see 6.1).



When the dimension °F is selected a temperature value in degrees Celsius will be converted into degrees Fahrenheit.

The cold junction compensation can be switched off by using the character □C or □F. The dimension ms is indicated in the display as m/s, and mh as m³/h.

7. MEASUREMENT

The instrument ALMEMO® 2190-2 provides the following options for the acquisition of measuring data:

1. Continuous measurement of a selectable measuring point, see man. 6.4
Output of measuring data to the analogue output, see manual 5.1.1.
2. Single measuring point scan, see manual 6.5.1.3.

The following functions are available for the data processing:

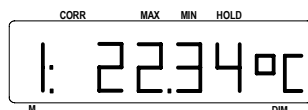
1. Storage of maximum and minimum value.
2. Freezing of the measured value.
3. Differential measurement based on a reference value.

7.1 Measured Value and Selection of a Meas. Point

If no continuous measuring point scan has been programmed, only the measured value of the selected measuring point will be continuously acquired. This is the standard operating mode and is most suitable for recording with an analogue output.

After switching on, the display will immediately indicate the actual measured value of measuring point 1 (M1).

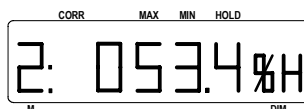
Function MEASUREMENT



If more than one measuring point has been programmed in the connected sensor (e.g. humidity sensor), the remaining (2 to 4 at max.) measuring points can be selected using the key **MEAS.** If the key **MEAS.** is pressed longer (approx. 1s) the previous channel will be indicated again.

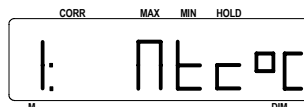
Selection of further meas. points with key:

MESSEN



If the measuring range changes when switching over, the abbreviation of the measuring range is indicated for a short time (s. 6.1). In case of a sensor breakage the abbreviation flashes instead of the measured value:

Display measuring range:



If the actual measured value has been changed by scaling or correction values (see man. 6.3.10/11) the arrow 'CORR' will be indicated on the display.

If the difference to a reference value is indicated for a short time, the arrow 'CORR' will flash (see 7.4).

7.2 Maximum and Minimum Values

The maximum and the minimum value are always determined among the current measured values of a measuring point and are stored. For displaying the peak values the required channel must be selected (see 7.1) and the key **MAX** or **MIN** must be pressed. For control purposes an arrow will be indicated under the corresponding symbols.

Function MAX VALUE

Selection of max value with key:

MAX



Function MIN VALUE

Selection of min value with key:

MIN



Clear max/min values with key:

LÖSCHEN



Return to the meas. value with key:

MESSEN

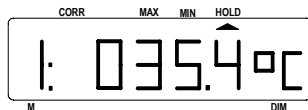


7.3 Memory for Momentary Values

If a measured value, e.g. for easier evaluation, is frozen at a certain point in time, the key **HOLD** must be operated. The hold mode is indicated in the display by an arrow under the 'HOLD' symbol.

Function HOLD

Freezing of measured value with key:



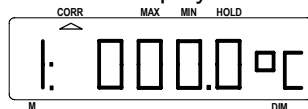
With each additional operation of the key **HOLD**, the momentary measured value will be taken over and displayed.

To return to a continuous display of the current measured value, the key **CLEAR** or **MEAS.** must be pressed. The arrow 'HOLD' will turn off.

7.4 Differential Meas. and Correction of Meas. Values

In the function **MEASUREMENT** the key **CLEAR** can be used to set the current measured value to zero, i.e. the current measured value will be stored as reference value and the difference to this reference value will be displayed. To indicate the differential mode the arrow 'CORR' will flash in the display.

Set measured value to zero with key:



When a zero setting is performed, the max and min values of this channel will be automatically cleared.



If a base value has been programmed (see man. 6.3.11) the measured value will not be zero but the negative base value after the adjustment.

For example, if the temperature is set to zero at a certain point, the differences to the reference point can be read at any point. The **MAX**, **MIN** and **HOLD** functions are also available when difference measurements are performed.

The reference value will only be cleared when the key **MEAS.** is operated again in the function **MEASUREMENT** or when the instrument is being switched off. In this case the max and min values will also be cleared and the arrow 'CORR' will stop flashing.

Sensor Adjustment

The function differential measurement is also suitable for the correction of measured values of a sensor. Many sensors must be adjusted more frequently to compensate for instabilities.

In most cases, a temporary **zero point correction** will be sufficient.

Firstly, the measured value must be brought to zero, i.e.:

- Temperature sensors must be put into ice water
- Pressure and force transducers must be released
- Hoses of dynamic pressure probes must be removed or
- Pitot tube must be removed from the flow channel
- pH probe must be placed in pH 7 buffer solution
- Conductivity probe must be taken out of the substance and dried

Afterwards, the display of the measured value can be set to zero by operating the key **CLEAR**. This procedure corresponds to a zero point adjustment, as described in the manual section 6.3.10. For probes with a scaling the base value will be maintained, i.e. a pH probe will not indicate pH 0.00 but pH 7.00 after the adjustment.



Unlike other ALMEMO® instruments, the correction values will not be stored in an EEPROM of the sensor but will be lost when switching over in function MEASUREMENT or when switching the instrument off.


With the following sensors a **slope correction** can be performed in addition, when a corresponding calibration value is provided at the sensor:

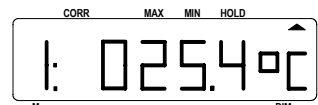
| | | |
|---------------------------|--------------|-------------------|
| pH probe | FY A8PH-xx: | pH 4.0 or pH 10.0 |
| Conductivity | FY A641-LF: | 2.77 mS/cm |
| or | FY A641-LF2: | 147 µS/cm |
| O ₂ saturation | FY A640-O2: | 101 % |

7.5 Continuous Measuring Point Scan

To also obtain the max and min values of those measuring points that are not indicated and to ensure a continuous temperature compensation of probes for pH and dynamic pressure, it is possible to set a continuous measuring point scan for sensors with several channels (see man. 6.5.1.3).

The continuous measuring point scan can be activated by pressing the key **MEASUREMENT** during switching on the instrument. For control purposes an arrow will be indicated in the display on the right above the dimension. When switching off, the instrument will return to the standard setting.

Press key  when switching on the instrument:



8. TROUBLESHOOTING

The measuring instrument ALMEMO® 2190-2 allows for a connection of many different sensors and peripheral devices. Due to the large variety of options it is possible that, under certain conditions, it does not perform as the user would expect. In most cases this will not be related to a defective device but to operating errors such as wrong settings or an inadmissible wiring. The following tests should be performed to correct or to correctly identify the error.

Error: No display data or all display segments are permanently illuminated.

Remedy: Check power supply, switch off and on again.

Error: False measured values.

Remedy: Press key **MEAS.VALUE** to clear a reference value that might exist.

Error: Varying meas. values, segment test or blockage during operation.

Remedy: Check cabling for inadmissible electrical connection.

Disconnect external power supply and output modules.

Disconnect all suspicious sensors and replace them by hand-held sensors operated in air or by dummies (short circuit AB at thermocouples, 100Ω at Pt100 sensors).

If this corrects the error, check the wiring, isolate the sensor if necessary, and prevent influences from disturbances by shielding or twisting.

If the device is, after the above inspections, still not performing as specified in the operating instructions, it must be sent to the factory in Holzkirchen, Germany, including a short report and possibly control printouts.

9. ELECTROMAGNETIC COMPATIBILITY

The measuring instrument ALMEMO® 2190-2 meets the electromagnetic compatibility (EMC) safety requirements specified in the relevant CE directive issued by the council for the alignment of legal regulations of the member states (89/336/EWG).

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

EN 50081-1:1992

EN 50082-1:1992

IEC 801-2 8kV, IEC 801-4 1kV

IEC 801-3 3V/m: deviation < 100 µV

The following notes must be observed when operating the instruments:

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

Technical Data (see also manual 2.2)

| | |
|----------------------------------|--|
| Measuring Inputs: | 1 ALMEMO® socket for ALMEMO® flat connector |
| Measuring channels: | 1 primary channel, 3 add. chann. f. double sensors and function chann. |
| Sensor voltage supply: | battery: 7...9V, max. 100mA mains adapter: approx. 12V, max. 100mA |
| Output: | 1 ALMEMO® socket for analogue output module |
| Equipment: | |
| Display: | 6 digits 7-segment, 2 digits 16-segment, 12mm |
| Keypad: | 5 keys |
| Microprocessor: | HD 6303 Y |
| Voltage Supply: | 7 to 13V DC, not electrically isolated |
| Mains adapter: | ZB 2290-NA 230V AC to 12V DC, 200mA electr. isol. |
| Adapter cable, electr. isolated: | ZB 2290-UK 10...30V DC to 12V DC, 250mA |
| Current consumption: | approx. 5.5 mA (without I/O modules) |
| Housing: | 180x85x33mm, ABS high impact strength (70°C max) |
| Operating temperature: | -10 ... +60 °C |
| Storage temperature: | -30 ... +60 °C |
| Humidity of ambient air: | 10 ... 90 % rH (non-condensing) |
| Extent of the Delivery: | Measuring Instrument ALMEMO® 2190-2 Operating Instructions ALMEMO® 2190-2 ALMEMO® Manual |

Product Overview

Multimeter ALMEMO® 2190-2

1 input, 4 channels at max., connector for analogue output
 Mains Adapter, 12V DC, 200mA
 DC Adapter Cable, 9 to 30V DC, 12V/250mA electrically isolated
 ALMEMO® Recording Cable, -1.25 to 2.00 V, 0.1 mV/digit

Order No.

MA 2190-2
 ZB 2290-NA
 ZB 2290-UK
 ZA 1601-RK

Your Contacts



