

Operating instructions



Universal measuring instrument **ALMEMO® 2390-1**

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Operating instruction

Universal Measuring Instrument ALMEMO® 2390-1

With supplementary reference to the ALMEMO®-Manual

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1. INTRODUCTION

The universal measuring instrument ALMEMO® 2390-1 is member of a truly unique product family

- all equipped with the ALMEMO® connector system, patented by Ahlborn Mess- und Regelungstechnik GmbH. The intelligent ALMEMO® connector offers decisive advantages when connecting sensors and peripherals because all parameters are stored in an EEPROM on the connector itself; repeat programming is thus no longer necessary.

All sensors and output modules can be connected to all ALMEMO® measuring devices - all in the same way. Programming and functioning are identical for all units. The following points apply to all devices in the ALMEMO® measuring system;

they are described in detail in the ALMEMO® Manual supplied with each device

:

- Detailed description of the ALMEMO® system (Manual, Section 1)
- Overview of the device functions and measuring ranges (Manual, Section 2)
- Basic principles, operating instructions, technical data for all sensors (Manual, Section 3)
- Options for connecting your own existing sensors (Manual, Section 4)
- All analog and digital output modules (Manual, Section 5.1)

Universal measuring instrument ALMEMO® 2390-1, unlike the other family members, does not incorporate an interface;

i.e. those sections of the Manual listed below concerning connection to and use of the interface do not apply. However, the sensor functions themselves, providing the sensor connectors have been suitably programmed, do apply.

- *Interface modules RS232, optic fiber, Centronics (Manual, Section 5.2)*
- *The entire ALMEMO® networking system (Manual, Section 5.3)*
- *All functions and their operation via the interface (Manual, Section 6)*
- *Complete list of interface commands with all the print outputs (Manual, Section 7)*

These operating instructions only cover features and controls that are specific to this device.

1.1 Functions

Universal measuring instrument ALMEMO® 2390-1 is a simple measuring instrument with just one measuring input (maximum 2 channels); it does not have its own integrated programming facility. However, any programmed ALMEMO® sensor can easily be connected to it and the measured values plus units can be read out on the LCD.

It is also possible, as and when required, to connect an analog output module to the output socket and evaluate measured values using e.g. a chart recorder or plotter.

SENSOR PROGRAMMING

The measuring channels are automatically and completely programmed by the ALMEMO® sensor connectors. The ALMEMO® 2390-1 cannot be used to modify the programming but it is possible to do so using one of the many other ALMEMO® devices incorporating an input facility. The ALMEMO® 2390-1 does, however, support all sensors programmed in this way without restriction.

Measuring ranges

For all sensors with a non-linear characteristic, e.g. 10 thermocouple types, Ntc and Pt100 sensors, infrared sensors, and flow sensors (rotating vanes, thermoanemometers, Pitot tubes), the appropriate measuring ranges are available. For humidity sensors, additional function channels are available that also calculate humidity variables such as dew point, mixture ratio, vapor pressure, and enthalpy. Even complex chemical sensors are supported. Measured values from other sensors can also be acquired using the voltage, current, and resistance ranges with individual scaling in the connector. Existing sensors can also be used without difficulty - so long as the appropriate ALMEMO® connector is connected via its screw terminals. For digital input signals and frequencies, adapters are available with an integrated microcontroller. It is thus possible to connect virtually any sensor to any ALMEMO® measuring instrument and to interchange these without the need for any extra settings.

Units

There are two 16-segment displays; these always indicate the physically correct units for the ALMEMO® sensor in question. Conversion between °C and °F is performed automatically.

MEASUREMENT

For each transducer up to two measuring channels are available; i.e. it is also possible to evaluate double sensors, individually scaled sensors, and sensors with function channels. The selected measuring point is scanned at a conversion rate of 2.5 measuring operations per second; the measured value is calculated and output to the display and, if available, to an analog output.

Measured value

The measured value for the selected measuring point is shown continuously with auto zero and, as and when necessary, with measured value correction. With most sensors, sensor breakage is detected automatically (except for connectors with shunt, divider, or additional electronics).

Measuring functions

With some sensors, to achieve optimal data acquisition, special measuring functions are required. Cold junction compensation is available for thermocouples; temperature compensation is available for dynamic pressure, pH, and conductivity probes. With infrared sensors the parameters for zero point and slope correction are used as the background temperature and emissivity factor.

External sensor programming

All sensor programming is supported so long as the sensors have been programmed at the factory or using some other suitable ALMEMO® device.

Units

The 2-character units display can be changed for each measuring channel so that the display always indicates the correct units, e.g. when a transmitter is connected.

Correction of measured values

The measured value on each measuring channel can be corrected in terms both of zero point correction and slope (gain) correction; this means that even sensors usually requiring initial adjustment (expansion, force, pH) can be freely interchanged.

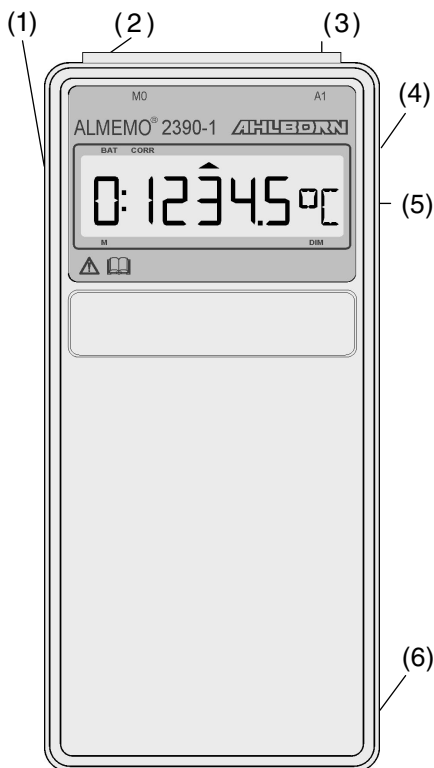
Scaling

The corrected measured value on each measuring channel can also be further scaled in terms of zero point and slope (gain) - using the base value and factor. The decimal point position can be set with the exponent.

Analog output and scaling

The displayed measured value can, by means of analog start and analog end, be scaled in such a way that the associated measuring range covers the full analog output range (2 V, 10 V, or 20 mA).

1.2 Operating controls



(1) ON/OFF switch

up : ON, measuring point M10
middle : ON, measuring point M00
down : OFF

(2) Measuring input M0

for all ALMEMO[®] sensors

M0 1st measuring point
M10 2nd measuring point

(3) Output socket A1

Analog output (ZA 1601-RK)

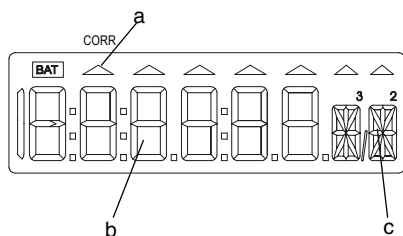
(4) Socket DC

Mains adapter (ZB 2290-NA, 12 V, 200 mA)
Connecting cable (ZB 5090-EK, 7-13 V DC)
Cable, electrically isolated
(ZB 2290-UK, 10-30 V)

(5) LCD display

(6) Battery compartment (rear of device)

9-volt alkaline-manganese battery (6F22)
Space for reserve battery



(5) LCD display

(a) Symbols for operating states

BAT Battery voltage <7 V
▲ CORR Correction of measured values

(b) 6x7 segment display for : measuring point, measured value

(c) 2x16 segment display for : units for measured value

2. PUTTING INTO SERVICE

1. **Connect transducer** to socket M0 (2); (see Section 4).
2. **Provide power supply** via 9-volt battery or mains adapter; (see Section 3.1, 3.2).
3. **To switch on**, push the slide switch (1) located on the left side of the device one position upwards; (see Section 3.3); then read the measured value; (see Section 7.1).
4. **To select** the 2nd measuring channel M10, push the slide switch (1) to its uppermost position, then read the measured value; (see Section 7.1).

3. POWER SUPPLY

As power supply for the measuring instrument there are the following possibilities :

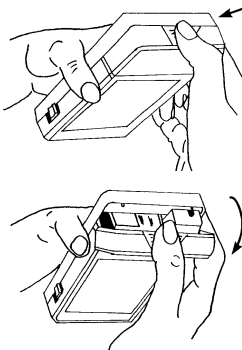
- | | |
|---|------------------------|
| • 9V Batterien IEC 6 F22 | ZB 2000-B9 |
| • 9-volt batteries IEC 6 F22 | ZB 2000-B9 |
| • 9-volt rechargeable battery pack, same with charger integrated in the connector | ZB 2000-A9, ZB 2000-LS |
| • mains adapter 12 V / 200 mA | ZB 2290-NA |
| • external power supply, connecting cable | ZB 2290-UK |

Our product spectrum includes all the appropriate accessories.

3.1 Battery / rechargeable battery operation

Use only alkaline-manganese batteries, type IEC 6 F22. At a current consumption of around 4.5 mA, these last for an operating time of approx. 80 hours. If sensors or modules also requiring power are connected, the operating time will be accordingly shorter.

Inserting the batteries :



The battery compartment (6) is located underneath the device.

1. Press on the spot marked with the arrow and at the same time pull in the direction shown by the arrow (as shown in the illustrations).
2. Connect the battery using the clip. Accidental reverse polarity is prevented by the shape of the connections.
3. Use the second battery compartment to store a reserve battery.

Battery check :

If the battery symbol in the display lights up, this means that the battery will last for approximately another 5 hours. (Supply voltage <7 V)



In the event of the battery voltage falling below 6 volts, the display shows the message 'LobAt'. In this event the battery must be removed immediately. This prevents the battery from leaking and thus damaging the device.



The current battery voltage can be checked by removing the sensor or by releasing the 2nd measuring channel.

Tips on the correct handling of batteries:

- Never leave used dead batteries in the device !
- If the device is likely to be unused for a relatively long time, remove the batteries !
- A leaking battery represents a health hazard and may also destroy the device. Use only leak-proof batteries !
- Spent batteries are special waste and must be disposed of in an environmentally acceptable way. Take spent batteries back to your dealer or dispose of them in your local battery collection container !

Rechargeable battery operation:

Instead of the standard batteries you can use rechargeable battery packs. Rechargeable batteries are of lower capacity, and provide an lower operating time. If sensors or modules also requiring power are connected, the operating time will be accordingly shorter. From our range of accessories we recommend the 9-volt rechargeable battery with a charger integrated in the connector, ZB 2000 LS.

Tips on the correct handling of rechargeable batteries:

- The rechargeable batteries supplied are not usually charged when delivered.
- If NiCd cells are only partly discharged, normal recharging will not restore them to full capacity.
- Use the device until the batteries are nearly totally discharged.
- Then recharge the batteries completely.
- This will significantly prolong the life of your rechargeable batteries.
- Even fully charged batteries discharge in storage without being used.

3.2 External voltage supply

On the right side of the device there is a socket (4) for connecting an external power supply. In our range of accessories we offer a mains adapter ZB 2290-NA (12 V / 200 mA). Or, alternatively, you can use some other DC power source (7 to 13 V). The power source is connected by means of a low-voltage connector (NES1 as per DIN 42323), center pin to minus.

If, however, the power supply has to be **electrically isolated** from the transducers or if a larger input voltage range (10 to 36 V DC) is required, electrically isolated supply cable ZB 2290-UK must be used. It will then be possible to operate the measuring instrument using a 12- or 24-volt on-board supply system.



If a battery is connected, this will, in the event of a voltage drop below 9 volts, take over as power supply.

3.3 Switching ON and OFF

The slide switch (1) on the left side of the device has three switch positions :

- up : ON - measuring channel M10
- middle : ON - measuring channel M0
- down : OFF

To switch on, push the slide switch (1) located on the left side of the device upwards.

To switch off, push the slide switch down as far as it will go.

4. CONNECTING THE SENSORS

Virtually any ALMEMO® sensor can be connected to the ALMEMO® input socket M0 (2). To connect your own existing sensors you simply need the appropriate ALMEMO® connector.

4.1 Sensors

The ALMEMO® Manual includes detailed descriptions of the comprehensive ALMEMO® sensor range (see Manual, Section 3) and of how to connect your own existing sensors to ALMEMO® instruments (see Manual, Section 4). All standard sensors with an ALMEMO® connector usually have the measuring range and units already programmed and can thus be immediately connected to any input socket. A mechanical code system ensures that sensors and output modules can only be connected to the correct sockets. Each ALMEMO® connector also incorporates two locking levers; these snap into position as soon as the connector is inserted into the socket, thus preventing disconnection if the cable is pulled. To withdraw the connector, both these levers must be pressed in at the sides.

4.2 Measuring inputs and additional channels

Measuring instrument ALMEMO® 2390-1 incorporates one input socket M0 (2). Of the maximum four channels that an ALMEMO® sensor may have this device can use only two. Additional channels are available primarily for humidity sensors (temperature / humidity / dew point / mixture ratio) or flow probes and chemical probes incorporating a temperature sensor. A single sensor can be programmed, if necessary, with several ranges or scaling processes; similarly, if pin assignment permits, two sensors can be combined on one connector (e.g. rH/Ntc, mV/V, mA/V, etc.). If the 2nd channel is not programmed, the battery voltage is displayed. The additional measuring channel is located in the connector on the next level, number 10.

On the measuring instrument this gives the following channel assignment :

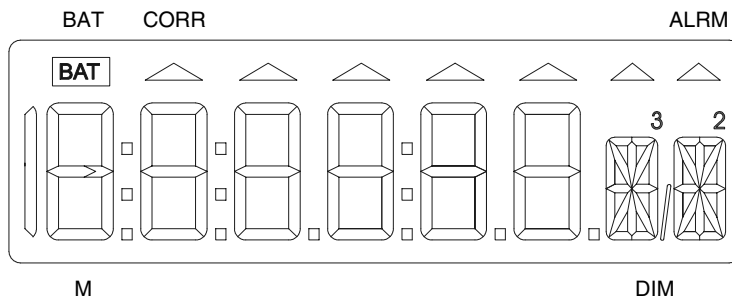


Sensors combined within one connector are electrically inter-connected and must therefore be operated in isolation. The voltage applied to the measuring inputs themselves must not exceed ± 5 volts (between B, C, D, and A or -).

The cold junction compensation for thermocouple measurement is integrated in socket M0 on the device.

5. DISPLAY

The display (5) on measuring instrument ALMEMO® 2390-1 comprises an LCD with six 7-segment digits, two 16-segment characters, a battery symbol, and arrows to indicate the operating status.



Special operating states and faults

Segment test for display :

switched on Voltage supply : below 7 V :

automatic - each time the device is

BAT - symbol lights up

below 6 V :

L o b A t

Checksum error during
device calibration

C A L E r r

Non-connected sensors,
deactivated measuring points

0: - - - -

Non-permitted measuring range

0: E r r

Sensor correction or scaling
Limit value exceeded

CORR arrow lights up

ALRM arrow lights up

Sensor breakage:

0: 'N i C r' °C

abbreviation
flashes

Measuring range overshoot :

Maximum value flashes

Measuring range undershot :

Minimum value flashes

Measuring range undershot for
cold junction compensation
or breakage:

0: 'C J' °C

(Cold junction)
flashes

Values range overshoot (>65000):

0: 6 5 0 0 0 ' x x

flashes

6. SENSOR PROGRAMMING

Since on ALMEMO® devices all sensor programming is stored in the ALMEMO® connector, you can connect any ALMEMO® sensor without needing to re-program. Measuring instrument ALMEMO® 2390-1 does not have its own integrated programming facility. To connect certain sensors you must order ALMEMO® connectors that have already been appropriately programmed. If, however, you wish to scale your own sensors or if sensor errors have to be continually corrected, you can do the programming using one of the many other ALMEMO® devices incorporating an integrated input facility; (see Manual, Section 6.3).

6.1 Measuring ranges

With each channel switchover or sensor breakage the abbreviation for the measuring range appears in the display. The following table lists all possible measuring ranges for identification purposes.

Sensors	Sensor/connector	Meas. range	Units	Display
Pt100-1	FP Axxx	-200.0...+850.0	°C	P104
Pt100-2	FP Axxx	-200.00...+300.00	°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	FEC0
Fe-CuNi (J)	ZA 9000-FSJ	-200.0...+1000.0	°C	IrCo
Cu-CuNi (U)	ZA 9000-FSU	-200.0...+600.0	°C	CUC0
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	-260.0...+260.0	mV	U260
Volt	ZA 9000-FS3	-2.0000...+2.6000	V	U2.60
Difference millivolt	ZA 9050-FS0	-10.000...+55.000	mV	d 55
Difference millivolt 1	ZA 9050-FS1	-26.000...+26.000	mV	d 26
Difference millivolt 2	ZA 9050-FS2	-260.0...+260.0	mV	d260
Difference volt	ZA 9050-FS3	-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	Ohn
Frequency	ZA 9909-AK1	0... 32000	Hz	FrEq

Sensors	Sensor/connector	Meas. range	Units	Display
Digital input	ZA 9000-EK2	0.0... 100.0	%	Inp
Digitale interface	ZA 9919-AKxx	-65000... +65000		diGi
Infrared 1	FI A628-1/5	0.0... +200.0	°C	Ir 1
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	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.pressure 40m/s w. TC	FD A612-M1	0.50... 40.00	m/s	L840
Dyn.pressure 90m/s w. TC	FD A612-M6	1.00... 90.00	m/s	L890
Relative air humidity, cap	FH A646	0.0... 100.0	%H	°orH
Relative air humidity, w. TC	FH A646-R	0.0... 100.0	%H	H rH
Humid temperature	FN A846	-30.00 ... +125.00	°C	P Ht
Rel. air humidity psychr.	FN A846	0.0 ... 100.0	%H	P RH
Mixture ratio pschr.	FN A846	0.0 ... 500.0	g/k	P AH
Dew-point temp. pschr.	FN A846	-25.0 ... +100.0	°C	P dt
Partial vapor press. psychr	FN A846	0.0 ... 1050.0	mb	P UP
Enthalpy, psychr	FN A846	0.0 ... 400.0	kJ	P En
Conductivity probe, with TC	FY A641-LF	0.0 ... 20.000	mS	LF
CO ₂ -sensor	FY A600-CO2	0.0 ... 2.500	%	CO2
O ₂ saturation, with TC	FY A640-O2	0 ... 260	%	O2-S

Function channels

Maximum value	any		Hi
Minimum value	any		Lo
Alarm value of	any	%	Alrm

Given its limited operating functions, the ALMEMO® 2390-1 cannot be used to measure the following values

Pulses	ZA 9909-AK2	0... 65000		PULS
Mixture ratio, cap	FH A646	0.0 ... 500.0	g/k	H AH
Dew-point temp. 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	FH A646	0.0 ... 400.0	kJ	H En
O ₂ concentration, with TC	FY A640-O2	0 ... 40.0	mg	O2-C
Average value over time	any			A[t]
Av. value of meas. points	any			A[n]
Sum of measuring points	any			S[n]
Total number of pulses	ZA 9909-AK2	0... 65000		S[t]
Pulses / print cycle	ZA 9909-AK2	0... 65000		S[P]
Wet bulb globe temp. meas.	ZA 9000-FS		°C	UbGt

TC = Temperature compensation

6.2 Dimension

The units are shown after the measured value as two 16-segment characters. Depending on the programming (see Manual, Sec. 6.3.5) units other than the standard units can be stipulated per measuring range; (see Manual, Sec. 6.1).



For degrees Fahrenheit (°F) the temperature value is converted from degrees Celsius

With the character $\square C$ or $\square F$ cold junction compensation is disabled. The units ms are displayed as m/s and mh as m³/h.

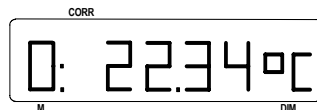
7. MEASURING OPERATIONS

With measuring instrument ALMEMO® 2390-1 both measuring channels are scanned continuously; this ensures continuous temperature compensation for dynamic pressure probes or chemical probes; (see Manual, Section 6.5.1.3). Two measuring points can be displayed; (see Section 7.1). A measured value can be sent to an analog output; (see Manual, Section 5.1.1).

7.1 Measured values and selection of measuring point

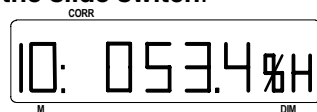
When the device is switched on (1st position) the display first of all shows the current measured value for measuring point M0.

Measure - measuring point M0.



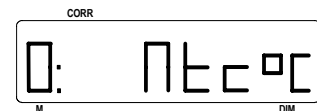
If the connected sensor is programmed for more than one measuring point (e.g. a humidity sensor), you can select the second measuring point M10 by means of the slide switch (1).

To select the 2nd measuring point by means of the slide switch:



If, when switching measuring points, the measuring range changes, the abbreviation for the measuring range is displayed for a moment first; (see Section 6.1). This abbreviation also flashes in the event of sensor breakage - instead of the measured value:

Display of the measuring range:



If the actual measured value changes as a result of programmed scaling or correction values (see Manual, Sec. 6.3.10/11), then the 'CORR' arrow lights up in the display

8. TROUBLE-SHOOTING

Measuring instrument ALMEMO® 2390-1 can have a great many different sensors and peripherals connected to it. 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; more usually it is incorrect operation by the user, an incorrect setting, or incorrect cabling. In such event try to pinpoint and clear the problem with the aid of the following tests.

Error: Either no display or all display segments light up continuously

Remedy: Check the power supply, switch off and then on again

Error: Measured values are incorrect

Remedy: Check the position of the slide switch (used for switching on and selecting measuring channels). If the 'CORR' arrow lights up, this may indicate that the measured value has been falsified by correction values; in this event have the programming checked at the factory or try in conjunction with another ALMEMO® device.

Error: Fluctuating measured values or segment test or the system hangs in mid-operation,

Remedy: Check the cabling for inadmissible electrical connections, disconnect the external power supply and the analog output, unplug the sensor and replace with a hand-held sensor and operate them in air or dummies (for thermocouples short-circuit A-B, for Pt100 sensors, 100-Ω resistor); if these steps succeed in clearing the error, then check all wiring, if necessary, insulate the sensor, use an electrically isolated power supply, eliminate interference by using shielded or twisted wiring

Error: 'CALErr' is displayed when device is switched on

Remedy: The calibration of a measuring range may have become misadjusted; the device must be recalibrated at the factory

If, after performing the above-listed checks and remedial steps, the device still fails to behave as described in the instructions, it must be returned to our factory in Holzkirchen, accompanied by a explanatory note and error description. Complaints not accompanied by explanation and error description cannot be processed.

9. ELECTROMAGNETIC COMPATIBILITY

ALMEMO® measuring instrument 2390-1 complies in full with the safety requirements specified in the EU directive on the approximation of Member States' laws relating to electromagnetic compatibility (EMC) (89/336/EEC).

The following standards have been applied in evaluating the product :

IEC 61326:1997+A1:1998+A2:2000

IEC 61000-6-1:1997

IEC 61000-6-3:1996

IEC 61000-4-2: 1995+A1:1998+A2:2000 8kV

IEC 61000-4-4: 1995+A1:2000 2kV

IEC 61000-4-3: 1995+A1:1998+A2:2000 3V/m

The following advisory notes must be observed when operating the device :

1. If the standard sensor is extended (1.5 meters) care must be taken to ensure that the measuring lines are not laid together with high-voltage power cables or that they are properly shielded so as to prevent spurious interference from being induced in the system.
2. Using the device in strong electromagnetic fields may aggravate measuring errors (<50 μ V at 3 V/m and 1.5 meters thermocouple sensor). After exposure to such irradiation ceases, the device will again operate within its technical specifications

Technical data (see also Manual, Section 2.2)

Measuring inputs:	one ALMEMO® socket for ALMEMO® sensors
Channels :	2 measuring or function channels, depending on sensor type-
Sensor power supply :	Battery : 7 to 9 V, max. 100 mA Mains adapter : approx. 12 V, max. 100 mA
Measuring rate :	2.5 measuring operations per second
System accuracy :	$\pm 0.05\%$ of measured value ± 3 digits
Temperature drift :	0.01% / K
Cold junction compens. :	$\pm 0.2 \text{ K} \pm 0.01 \text{ K /}^\circ\text{C}$ (-30 to +80 °C)
Outputs :	1 ALMEMO® socket for analog output module
Equipment :	
Display :	6-digit 7-segment, 2-digit 16-segment, 12 mm
A/D converter :	delta-Sigma ± 16 bit
Microprocessor :	NEC 78F0078
Power supply :	7 to 13 V DC, not electrically isolated
Mains adapter :	ZB 2290-NA, 230 V AC to 12 V DC, 200 mA, electrically isolated
Adapter cable, el. isol. :	ZB 2290-UK, 10 - 30 V DC. to 12 V DC, 250 mA
Current consumption :	approx. 5 mA (without input and output modules)
Housing :	180 x 85 x 33 mm, ABS (acrylonitrile butadiene styrene) high impact resistance (max. 70 °C)
Operating temperature :	-10 ... +60 °C
Storage temperature :	-30 ... +60 °C
Ambient rel. humidity :	10 to 90 % (non-condensing)
Delivery includes :	Measuring instrument ALMEMO® 2390-1 Operating instructions ALMEMO® 2390-1 ALMEMO® Manual

Product overview

Universal measuring instrument ALMEMO® 2390-1

1 input, 2 channels, connection for analog output	MA 2390-1
Mains adapter, 12 V DC, 200 mA	ZB 2290-NA
DC adapter cable, 10 to 30 V DC, 12 V / 250 mA, electrically isolated	ZB 2290-UK
ALMEMO® analog output module	ZA 1601-RK
- 1.25 to 2.00 V, 0.1 mV / digit	

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