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Operating instructions

ALMEMO® 1020-2
High-precision temperature measuring instrument for noble-metal thermocouples

V1.1
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www.ahlborn.com

1. OPERATING CONTROLS

(1) Measuring sockets M0, M1
M0..M1 Thermocouple sensor
M10..M11 Additional channels for CJ
M02 Differential

(2) Sleep-LED

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

(4) Output socket A1
V24 interface (ZA 1909-DK5)
Optic fiber (ZA 1909-DKL)
USB (ZA 19019-DKU)
Ethernet (ZA 1945-DK)

(5) Socket DC 12V
Mains adapter (ZA 1312-NA7, 12V, 1A)
Cable, electrically isolated
(ZA 2690-UK, 10-30V)

(6) LCD, graphics display
7 rows for functions
1 row for softkeys F1, ◄, ▲, ►, F2
Shown in brackets **<MEM>** , **<FCT>**

(7) Operating keys
ON To switch device ON
press once and release.
To switch device OFF,
press and hold down.
F1, **F2** Function keys (softkeys)
▲, ▼... **M:** select meas. channel
▲, ▼, ► **F:** select menu
PROG, **▼**... **F:** select function
◄ ... return to menu selection
PROG to program
▲, ▼, ►... enter data
< M◄◄ > go to the meas. menu
< P◄◄ > go to the programming
menu

Rear of device
(8) Battery compartment
3 AA alkaline-manganese batteries

2. CONTENTS

3. GENERAL

We should like to congratulate you on your purchase of this new and innovative high-precision temperature measuring instrument for noble-metal thermocouples (0.01 K resolution).

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 17, ´Trouble shooting´. In the unlikely event that a device does prove defective and you need to return it, please wherever possible use the original packaging materials for dispatch and enclose a clear and informative description of the fault and of the conditions in which it occurs.

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

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

3.2 Standard delivery

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

- Measuring instrument ALMEMO® 1020 with 3 AA alkaline batteries,
    Mains adapter ZA1312NA7,
    Thermocouples sensor type N FTAN926L0500P2 with CJ in the connector,
    USB data cable ZA1919DKU,
    Instrument case,
    DKD/DakkS- calibration certificate,
    Software ALMEMO® View SW5500AV,
    CD with software AMR-Control and accessories,
    These operating instructions, ALMEMO®-Manual

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

3.3 Waste disposal

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

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

4. SAFETY INSTRUCTIONS

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

Read the instructions carefully before starting to operate the device.

Please ensure that you comply with all general safety advice and the special safety instructions included in other chapters.

Such risks may occur in the following circumstances :

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

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

Such risks may occur in the following circumstances :

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

DANGER   **Warning - explosive atmospheres or substances**

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

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

4.1 Special notes on use

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

4.2 Handling batteries / rechargeable batteries correctly

When inserting batteries / rechargeable batteries ensure that these are correctly polarized.

If the device will probably not be needed for a relatively long period of time or if the batteries are empty, remove the batteries; this will prevent battery acid leaking onto the device and damaging it.

Rechargeable batteries should be recharged as and when necessary.

You should never attempt to recharge an ordinary (non-rechargeable) battery; it may explode !

Batteries / rechargeable batteries must never be short-circuited or thrown onto the fire.

Batteries / rechargeable batteries are special waste and must not be discarded together with normal domestic waste.

5. INTRODUCTION

Each ALMEMO® 1020-2 measuring instrument incorporates two electrically isolated high-resolution measuring inputs for thermocouples and NTC. The measured values obtained are larger than the 16-bit numbers provided by other ALMEMO® devices. This device cannot therefore support the standard functions usually provided (limit values, measured value correction, scaling, or analog output).

To facilitate operation the device incorporates an illuminated LCD graphics display and a keypad with softkeys and cursor block. The display can be adapted to any proposed application by means of sensor-specific menus. The device incorporates three output sockets for connecting interface cables, a memory connector, or a mains unit.

5.1 Sensor programming

Measuring ranges

The ALMEMO® 1020-2 high-precision measuring instrument has been designed for noble-metal thermocouples only; the high thermal and mechanical loads involved may make other thermocouple types so instable that accurate and reproducible measuring results are no longer possible. The thermocouple types used (N, S, R, B) provide a resolution of 0.01 K over a maximum measuring range of -200 to +1820 °C. Measured values are no longer determined by means of linearization tables and interpolation; they are calculated using polynomial functions ensuring the highest possible level of accuracy. The ALMEMO® 1020 is thus suitable as reference device and for calibration purposes.

Cold junction compensation

Since using thermocouples it is only possible to acquire temperature differences at the point of transition onto the copper connecting cable, cold junction compensation is critically important for overall accuracy, i.e. for the exact measurement of temperature at the transition from thermocouple to copper wire. The best method has always been to have the transition point immersed in icy water. Cold junction compensation is no longer necessary. The measured value is output on the basis of the thermoelectric voltage, in °C and referred directly to 0 °C. With all other methods the temperature at the transition point has to be separately measured using a 2nd temperature sensor and then set off against the thermoelectric voltage. For this purpose this device incorporates a high-precision NTC sensor, which measures the temperature at a resolution of 0.001 K and accurately adjusted for nominal temperature. Whichever approach is used, it is important that the temperature of the NTC should correspond as closely as possible to that of the transition point in the plug or socket. The device and its connections therefore must not be subject to any major temperature differences and not be exposed to any source of heat radiation on just one side.

Units

The units can be toggled between °C, °F, and K.

Measured channel designation

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

Correction of measured values

The measured value for each measuring channel can be corrected to zero. The sensors can be adjusted in several aspects; i.e. the applicable error curve is saved in the connector. All programmed sensor parameters are saved in the connector and are automatically restored as and when a sensor is plugged in.

5.2 Measuring operation

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

Measured value smoothing

For both measuring channels measured values of an unstable, fluctuating nature can be smoothed by taking a sliding average over a number of values programmable from 2 to 99.

Maximum and minimum values

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

Measured value memory

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

Operation

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

Output

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

Data logger

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

6. PUTTING INTO SERVICE

Sensor connection Connect sensors to sockets M0 and M1 (1) see 8.1
Power supply Via battery or mains adapter connected at socket DC (5)
      see 7.1, 7.2
To switch ON   Press once and release key ON / PROG (7) see 7.4
Automatic display of the measuring menu see 11.

```
AMR ALMEMO 1020-2
M*Menu Mesure              ▶
M  Liste Points de mesure
M  Max-Min, mémoire unique
P  Programmation du caPteur
P  Device Configuration

 INFO   M◀◀   F   ▶   *OFF
```
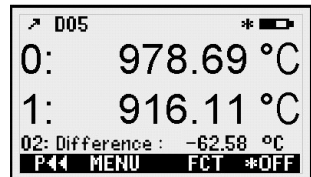
To call up the **menu selection** screen press <MENU>
To activate / deactivate display illumination press <ON>

Measuring menu see 9.1 To access the
measuring menu press: <F> : ▲ / ▼ ...
   To call up the menu press: ► or PROG

The measured values are displayed, including, if
there are two measuring channels, the differential.

```
↗ D05                    * ▪▫
0:      978.69 °C
1:      916.11 °C
02: Difference :   -62.58 °C
 P◀◀   MENU     FCT   *OFF
```

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

Max- Min individual memory :   ▲ / ▼ ... , ►
To select a meas. channel (s. 13.1) <M> : ▲ / ▼ ...
To set a measured value to zero: PROG , <ZERO>
To save a measured value s.13.4: < MEM>

```
↗ D05                    * ▪▫
0:     1124.53 °C
T S2 #J tYPe S
Min: 1125.37   Max: 1131.34°C
MemorY:        P12: 1125.45°C
 MEM   M◀◀  M LISTM *OFF
```

To display saved values: < LISTM>
To output memory via interface to printer or computer:
Connect peripheral equipment via data cable to socket A1 (2). see 16.4
To output memory see 13.4 < PRINT> or command ´P-04´ from computer

7. POWER SUPPLY

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

3 AA alkaline batteries (included in delivery)

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

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

Our product spectrum includes all the appropriate accessories.

7.1 Battery operation and supply voltage monitoring

The device is normally powered by 3 AA alkaline batteries. At a current consumption of on average 25 mA, these last for an operating time of approx. 100 hours. If the display illumination is left switched ON, this operating time will be reduced to approx. 50 hours. The operating voltage can be checked in the **Info** menu (see 10); this gives a basis for estimating the remaining operating time. As soon as the remaining battery capacity drops to approx. 10%, the battery symbol ▭ in the status bar of the display will start to flash. If the batteries are completely discharged, i.e. down to approx. 3V, the device will switch OFF automatically but measured data already acquired will be saved. (see 7.5) To replace used batteries first unscrew the battery compartment cover (7) on the rear of the device. When inserting batteries ensure that their polarity is correct.

7.2 Mains operation

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

Please ensure that the mains voltage is correct

7.3 External DC voltage supply

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

7.4 Switching ON / OFF, reinitialization

To switch the device **ON** press and release `ON PROG` **(6)** located in the middle of the cursor block. The first thing to appear in the display is always the measuring menu.

To switch OFF press and hold down the same key `ON PROG`. When the device switches OFF all saved values and settings are retained intact. (see 7.5)

If interference (e.g. electrostatic) or a malfunction (e.g. battery failure) causes the device to behave abnormally, it can be reinitialized. To activate **RESET** press and hold down key `F1` when switching on. To completely reinitialize all device programming (including device designation) to the factory defaults press and hold down key `F2` when switching on. In so doing certain parameters will be lost or be returned to their defaults : Language = German, illumination = OFF.

7.5 Data buffering

The sensor's programming is stored in the EEPROM on the sensor connector; the device's calibration values and programmed parameters are stored in the EEPROM on the instrument itself; in the event of failure both will be retained intact. Date and time-of-day settings and the individual value memory on the data logger are retained intact when the device is just switched off but will be lost as and when it is reset or the batteries are replaced.

8. SENSORS

At measuring sockets M0, M1 (1) on the measuring instrument only special noble-metal thermocouples with ALMEMO® plugs can be connected. For your own sensors the appropriate plugs are available with or without integrated cold junction sensors. (see 19.2) A mechanical coding system ensures that sensors and output modules can only be connected to the correct sockets. All ALMEMO® plugs incorporate two snap-lock levers; these snap into position as soon as the plug is inserted into the socket, thus preventing unintended disconnection if the cable is accidentally pulled. To withdraw the plug both these levers must first be pressed in at the sides.

## 8.1 Connecting sensors and cold junction compensation

Sensors with an ALMEMO® plug are programmed with special thermocouple measuring ranges (resolution 0.01 K, see 11.) and units; some are also provided with their own cold junction temperature sensor. These can be easily connected at measuring sockets M0 and M1.

The significance of cold junction compensation (CJC) has been explained in 5.1. To ensure the highest level of accuracy possible this device is capable of using two different methods. (see Manual, 6.7.3) And for these purposes either the appropriate sensors or programmed connectors are available.

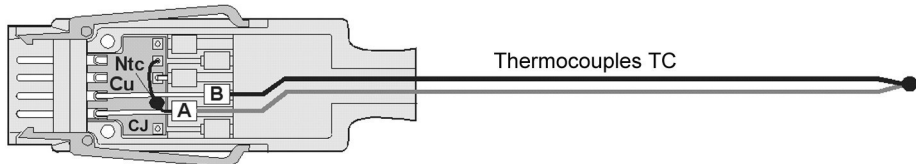## 1. Cold junction compensation integrated in the connector

For all thermocouples there are suitable connectors available with integrated NTC at the terminals. Cold junction compensation requires an additional measuring channel and coding ´#J´ as the first 2 characters of the thermocouple designation. This makes it possible to also acquire 2 thermocouples very accurately.

Type N: Sensor FTAN926L0500P2, Connector ZA9421FSNP2, Design. = #J

Thermocouples TC
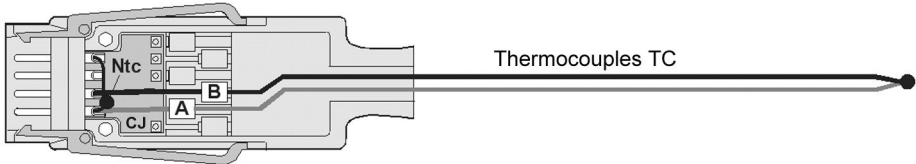
Type S: Sensor FTAS918L0500P2
Type S, R, B: Connector ZA9400FSSP2,-FSRP2,-FSBP2, Designation = #J

Thermocouples TC

2. Cold junction compensation using icy water

The most accurate method is to have the transition point immersed in a bath of icy water. For this purpose standard connector ZA9000FSxP2 is used.
Cold junction compensation is disabled by programming the units to ´!C´.

Type S: Sensor FTAS908L0500P2
Type S: Connector ZA9000FSSP2, Designation = !C

copper   TC

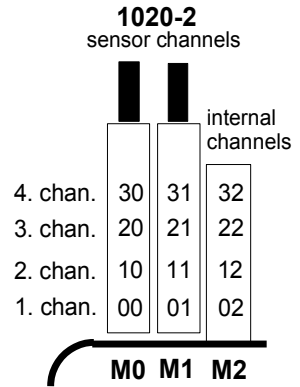icy water
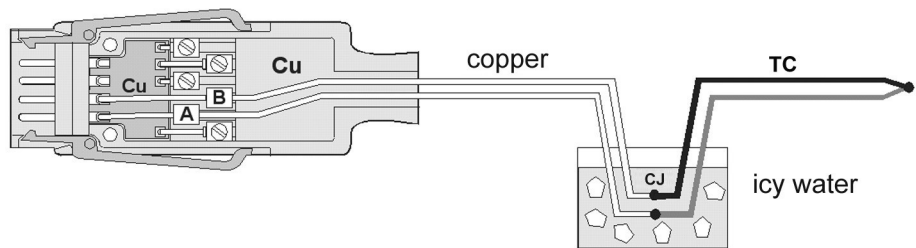
8.2 Measuring sockets and measuring channels

Measuring instrument ALMEMO® 1020-2 incorporates 2 measuring sockets (1), to which initially measuring channels M00 and M01 are assigned. Of the maximum 3 additional channels normally available per sensor special connectors ZA9400FSxP2 and the integrated NTC cold junction sensors occupy only channels M10 and M11.

Internal device channels:
This unit also has 4 additional internal channels, are available. On the canal M02 automatically appears the difference M01 - M00, if two identical sensor to the measuring sockets M0 and M1 are present (see 12.2). If necessary, can be programmed here and the battery voltage.

Device-internal channels:
This device also incorporates additional internal channel M02, which is programmed as differential channel M01 – M00. However, this will only appear if two identical sensors are present at measuring sockets M0 and M1 (see 11.2).

1020-2
sensor channels

internal channels

	M0	M1	M2
4. chan.	30	31	32
3. chan.	20	21	22
2. chan.	10	11	12
1. chan.	00	01	02

M0 M1 M2

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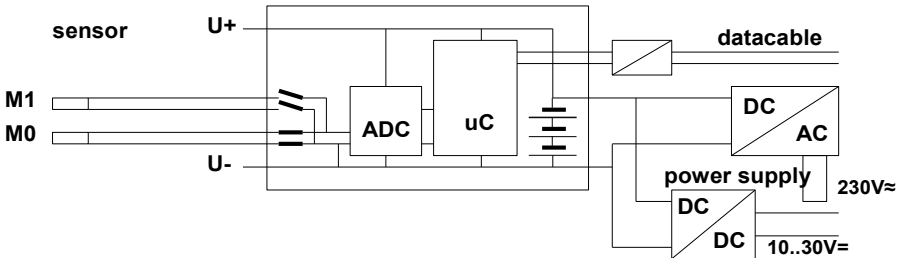
he analog inputs are electrically isolated by means of photovoltaic relays; the maximum potential difference permitted between them is 50 VDC or 60 VAC.
The power supply is isolated by the transformer in the mains adapter or by a DC/DC converter in connecting cable ZA2690-UK.

9. DISPLAY AND KEYPAD

9.1 Display and menu selection

Measuring instrument ALMEMO® 1020 incorporates a display (5) comprising a dot-matrix LCD with 128x64 pixels or 8 rows each 8 pixels high.

The **menu selection** screen offers the following items : (see **10**) **M**easuring menu for acquiring measured values (see **11**) Memory functions menu (see **13**) Also accessible from the measuring menu by pressing key `<FCT>`

```
AMR ALMEMO 1020-2
M*Meas. menu           ▶
M  Measuring Points list
M  Max-Min. individual mem.
P  Sensor Programming
P  Device Configuration

INFO   M◀◀   F   ▶   *OFF
```

2 programming menus for programming the sensors and the device parameters (see **14**, **16**).
Info menu for information regarding the device and the sensors (see **10**)

The data logger menu appears when you connect of a memory connector s 16

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

9.2 Measured value display and status symbols

The **Measuring menu** displays the measured values from the connected sensor and, if there are two sensors, also the differential. First comes the measuring channel, then measured value, then units.

```
↗ D05              *▪▫
0:   1124.53 °C
T S2 #J type S
Min: 1125.37  Max: 1131.34°C
Memory:       P12: 1125.45°C
MEM   M◀◀   M LISTM  *OFF
```

The measured value is described by a number of status symbols: **Symbol**

No sensor, measuring channel deactivated	´– – – – –´
Measuring range overshot, Maximum value display	**O** flashes
Measuring range undershot, Minimum value display	**U** flashes
Sensor breakage / sensor voltage low Display ´-.-.-´	**B** flashes / **L** flashes

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

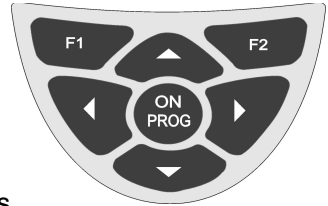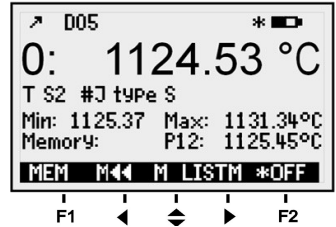|	
Relative measuring with respect to a reference value	**REL**
Measured value corrected by multi-point adjustment	↗
Smoothing set	**D05**
Display illumination activated or on pause	* or ▓
Battery status, full, half full, almost empty	▬▬ , ▭▬ , ▭▬¶
Battery voltage <3.8 V, remaining capacity <10%	▭▬ flashes

In the first **data logger menu** the top status bar also displays the following

symbols for **checking the measuring sequence** :   ii or ▶
Measuring channel scan started and data being saved   REC
Measuring channel scan started with data output via interface   COM
Start time or end time of measuring operation programmed   i▶ or ▶i

9.3 Function keys

The way in which the function keys **(6)** F1 , F2
and the cursor keys ◄ , ► operate may vary
from menu to menu. Their function is indicated
as an abbreviation in the bottom line of the dis-
play (softkeys). In the instructions and documen-
tation these softkeys abbreviations are shown in
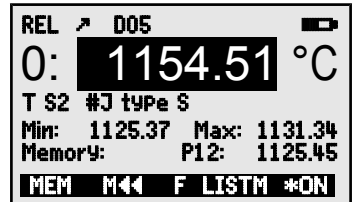angle brackets. e.g. <MEM>.

```
↗ D05                    * ▬
0:    1124.53 °C
T S2 #J tyPe S
Min: 1125.37  Max: 1131.34°C
Memory:       P12: 1125.45°C
MEM   M◄◄  M LISTM *OFF
```
        F1   ◄   ⬍   ►   F2

In the measuring menus the following function keys
are available :
To **select the measuring channel** press cursor keys   ▲ oder ▼ ...
Help is provided in the form of the softkey symbol which lights up in the middle. <M>
To call up the functions menu for the individual value memory   < FCT > or F2
To call up the data logger menus (with memory connector)   < LOG > or F2
To return to menu selection   < MENU > or ◄
To return to the measuring menu   < M◄◄ >
To return to the programming menu   < P◄◄ >

9.4 Selecting a function

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

```
REL ↗  D05               ▬
0:   1154.51 °C
T S2 #J tyPe S
Min:  1125.37  Max: 1131.34
Memory:        P12: 1125.45
MEM   M◄◄   F LISTM *ON
```

To **select a functions** press: PROG
The first modifiable parameter is highlighted in inverse font   1154.51
Help is provided in the form of the softkey symbol   <F> for function selection

To move forward to the next function press   ▲ or ▼ ...

Depending on function the keys F1 , F2
or ◀ , ▶ are assigned the desired meaning. e.g.

To set the measured value to zero   \<ZERO\>

To delete the maximum / minimum value   \<CLR\>

To clear the memory   \<CMEM\>

To cancel the function   \<ESC\>

9.5 Entering data

When a programmable parameter is selected (see 9.4) its current value can be cleared or reprogrammed directly.

To **delete a programmed value** press   \< CLR \>

To **program a value** press   PROG

  You should now be in **programming mode** \<P\> appears in the middle of the softkey bar.

  The cursor appears below the first input position flashing. **Smoothing** 05

  To **increment** the selected digit press   ▲ ...

  To **decrement** the selected digit press   ▼ ...

  To **change the arithmetic sign** of a numeric value press   \< +/- \>

To move **forward to the next** position press   ▶

  The cursor now appears below the second position flashing. **Smoothing** 05

  To move back to the previous position press   ◀

Each position is programmed just like the first.   ▲ / ▼ ..., ▶

To save and exit press   PROG

To cancel without saving press   \<ESC\>

When entering a series of alphanumeric characters select the appropriate group.

For upper-case characters press   \<ABC\>

For lower-case characters press   \< abc \>

For numbers only press   \< 123 \>

For arithmetic signs press   \< + - \>

When entering certain parameters (e.g. units, baud rate, etc.) this procedure can be used to select and program not just characters but whole designations.

10. MENU SELECTION SCREEN

Via the menu selection screen the following **menus** can be accessed : (see 9.1)
1. `M  Measuring menu` see 11
2. `M  Meas. channels list` see 12
3. `M  Max. Min. indiv. memory` see 13
3. `P  Sensor Programming` see 14
4. `P  Device configuration` see 16

```
AMR ALMEMO 1020-2
M*Meas. menu           ▶
M  Meas. channels list
M  Max-Min. individual mem.
P  Sensor Programming
P  Device Configuration

 INFO  M◀◀  F  ▶  *OFF
```

To display the most important data regarding the device press ` INFO ` Here, if you have any questions, you can find the exact device type together with its firmware version, options, and serial number. Here, any sensor can be selected by pressing ` ▲ ` / ` ▼ ` and identified on the basis of its order number (if available). To assess the available power the remaining battery voltage can be displayed. At our WEB address you can obtain any other help you might need.

```
ALMEMO 1020
V: 2-6.12 Option:
Serial-No.: 12345607
Sensor-No.: 0: ZA9020-FS
UBat: 4.1 V  Us: 9.1 V
www.ahlborn.de

 M◀◀  MENU  M
```

11. MEASURING MENU

When the device is switched on for the first time it opens with the `measuring  menu`. In the first line a number of status reports appear. (see 9.2) Below this appear the first measuring channel, the measured value, and the units - in upper-case format, plus the range and designation. This is followed, if a second sensor is connected, by the second measured value and below this the differential. (see 11.2)

```
↗ D05          *▪□

0:  1278.69 °C
T S2  #J type S


       MENU   FCT  *ON
```
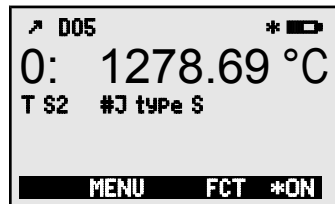
To measuring instrument ALMEMO® 1020 four accurate and stable thermocouples of different types (N, S, R, B) can be connected. Resolution for all these is 0.01 K. The following table lists all the measuring ranges and their abbreviations and the commands for programming the associated sensors or connectors via the terminal. (see Manual, 6.3.3).

Sensors / transducers	Designation	Measuring range	Units	Display	Command
Thermocouple Type N	FTAN30L0500P2 ZA9421FSNP2	-200.00...+1300.00	°C	T N2	B92
Thermocouple Type S	ZA9400FSSP2	-50.00...+1768.00	°C	T S2	B93
Thermocouple Type R	ZA9400FSRP2	-50.00...+1768.00	°C	T R2	B94
Thermocouple Type B	ZA9400FSBP2	+250.00...+1820.00	°C	T B2	B95
NTC	ZA9040FS	0.000...70.000	°C	Ntc	B09
Differential			°C	Diff	B71

11.1 Cold junction compensation

Measuring range NTC, with a resolution of 0.001 K, is for measuring the cold junction temperature. Cold junction compensation for the thermocouples can be performed in two different ways. The appropriate sensors or connectors are available. (see 8.1) .
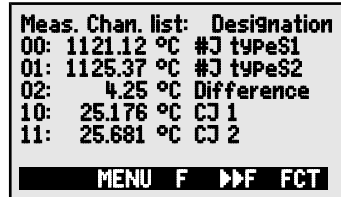
11.2 Differential measurement

If two sensors with the same units and same decimal point position are connected at measuring channels M00 and M01, the difference appears automatically below device-internal measuring channel M02. (see 8.2):**M02 = M01 - M00**

```
REL ↗ D05              *  ▄▄
0:        978.69 °C
1:        916.11 °C
2: Difference:    -62.58 °C
        MENU     FCT  *ON
```
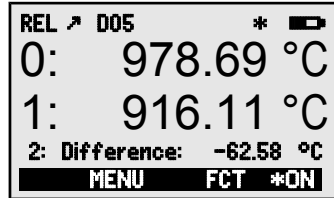
12. MEASURING CHANNELS LIST MENU

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

```
Meas. Chan. list:  Designation
00: 1121.12 °C  #J typeS1
01: 1125.37 °C  #J typeS2
02:     4.25 °C  Difference
10:   25.176 °C  CJ 1
11:   25.681 °C  CJ 2

        MENU  F   ▶▶F  FCT
```

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

Meas. Chan. list
12 measured values
00: **1123.12°C** ...

The measured value can be linked to a series of functions by
pressing
This reduces the maximum number of meas. channels to 6.
To advance to the next function press

<F>: **▲** or **▼** ...

<F>: **▲**

Measured value with **designation**

Meas.chan. list Designation
00: **123.12°C   Temperature**

Measured value with **maximum value**

Meas.chan. list   Max.
00: **123.12 °C   132.67 °C**

Measured value with **minimum value**

Meas.chan. list Mini.
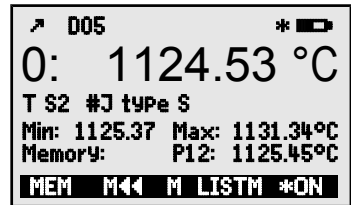00: **123.12 °C   119.34 °C**

Measuring range only (also maximum 12 meas. channels)

Meas.chan. list Range
00: **T S2 °C**

With more than 6 meas. channels select the next page by
pressing
To call up the functions menu press (see 13)

PROG, **<M▲>** or **<M▼>** ...
< ▶▶F > ...

13. FUNCTIONS MENU

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

```
↗  D05                    * ▬
0:   1124.53 °C
T S2  #J tYPe S
Min: 1125.37 Max: 1131.34°C
MemorY:        P12: 1125.45°C
 MEM   M◀◀  M LISTM *ON
```

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

To access the functions menu press   ▼ and ▶ or PROG
or in the measuring menu press   < FCT >
To return to the measuring menu press   < M◀◀ >
Symbol <M> in the middle of the softkey bar indicates that the measuring channel can be selected by pressing ▲ / ▼.

13.1 Selecting a measuring channel

To select all measuring channels and the current measured value press ▲.
To return to the previous measuring channel press ▼
To increment the measuring channel press ▲
To decrement the measuring channel press ▼

## 13.2 Setting a measured value to zero

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

```
↗  D05                    ▬
0:   1154.51 °C
T S2  #J tYPe S
Min: 1135.37 Max: 1161.34°C
MemorY:        P12: 1125.45°C
 ZERO  ESC  F
```
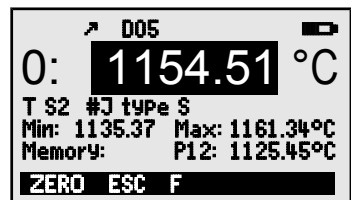
Select the ´**Measured value**´ function (see 9.4)   00: 1154.51 °C
To **zero the measured value** press   <ZERO>
The measured value should then show   00: 0.000 °C with the symbol REL
To cancel zero-setting, after selecting this function, press and hold down <ZERO>

☞   The offset is saved **temporarily** in RAM only. After switching OFF the normal measured value is displayed again.

13.3 Maximum / minimum memory

The **functions menu** shows not only the mea-
sured value with designation but also the contin-
uously acquired maximum and minimum values
for the measuring channel selected.

```
↗  D05                    * ▬▬
0:    1124.53 °C
T S2 #J tyPe S
Min: 1125.37  Max: 1131.34°C
MemorY:      P12: 1125.45°C
 MEM   M◄◄  M LISTM *ON
```

Maximum value, minimum value

Function - **Min** / **Max**   Min: 1125.37   Max: 1131.34°C

To clear the memory select the function (see 9.4) **Min: 1125.37   Max: 1131.34°C**

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

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

13.4 Individual value memory

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

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

To display a memory position   Memory P12: 1125.45 °C

Change measuring channel   **▼** and **►**

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

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

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

To display memory list

To output all saved values
press s. 16.4 **<PRINT>**

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

```
P00: 0: 1123.45°C
P01: 0: 1123.44°C
P02: 1: 1101.25°C
P03: 1: 1113.98°C



 PRINT  F◄
```

14. SENSOR PROGRAMMING

Since on ALMEMO® devices all sensor programming is stored in the ALMEMO® connector itself, the user will not normally need to reprogram each time. It is pos-

sible, however, to program certain parameters (e.g. assign the sensor a name, change the units, or, with a view to stabilizing the display, set a smoothing factor). In the ´Sensor Programming´ menu these measuring channel parameters can (so long as the appropriate sensor connector is plugged in) be entered, viewed, checked, and modified via the keypad.

```
SENSOR PROGRAMMING
Sensor:      0
Designation:      #J Type N
Multi-Point calibration:    ✔
Unit                     °C
Smoothing:               05

M◀◀   MENU   M        *ON
```

Accessing the ´**Sensor programming**´ menu (see 9.1)

14.1 Measuring channel designation

Each measuring channel can be assigned a 10-character alphanumerical designation denoting as clearly as possible the type of sensor, measuring location, and / or purpose. This designation is displayed in the functions menu. In outputs via the interface the measuring channel designation appears in the program header as ´Designation´. The configuration for cold junction compensation has an appropriate abbreviation (#J) as the first two characters. This abbreviation must not be deleted or overwritten; the user may use only the following 8 characters.

To enter name in ´Designation´ function see 9.5 Designation #J Type N

14.2 Multi-point adjustment

The EEPROM in the sensor can be used to store a correction curve that will help optimize its measuring accuracy. In a calibration laboratory any deviations from the ideal setpoint can be measured at various points; with the AMR-Control, this information can be stored in the sensor and interpolated on a linear basis for subsequent measuring operations.

14.3 Units

Sensors leave our factory with default resolution 0.01 K and default units °C. In the ´Sensor Programming´ menu you can if so required select other units such as °F or K. (see 9.5) For cold junction compensation using icy water special units ´!C´ ensures that external compensation is disabled.

14.4 Smoothing by means of a sliding average

When measuring temperature at a resolution of 1/100 °C - especially if using sensors in air - the measured value display may be unstable. In this case the measured value can be smoothed in the form of a sliding average over a spec-ified time frame. The **level of smoothing** can be set in the ´Smoothing´ func-tion by specifying the number of measured values to be averaged (range 0 to 99); this is also possible for two sensors.

$$\overline{M}=(\sum_i m_i)/N$$
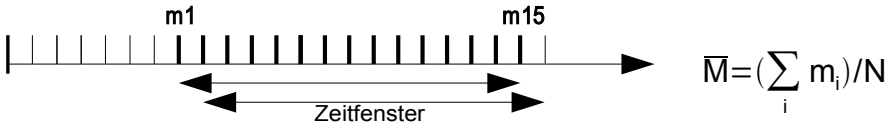
Measured value smoothing over e.g. 15 values   Smoothing: 15

Time constant t_{100} (s) = smoothing / (conversion rate $\cdot$ 2) = 15 / (1.25 $\cdot$ 2) = 6s

15. DATA LOGGER

Measuring instrument ALMEMO® 1020 can be made into a data logger - by fitting memory connector ZA1904SD with a micro-SD memory card (available as an accessory).

```
AMR ALMEMO 1020-2
M*Meas. menu           ▶
M  Measuring Points list
M  Max-Min. individual mem.
M  Datenlogger LOG
P  Sensor Programming
P  Device Configuration
INFO   M◀◀   F   ▶   *OFF
```

In the main menu an additional menu item ´Data logger LOG´ should then appear automatically; with this you can call up two further menus offering a comprehensive range of data logger functions. These can be used to acquire measured values either manually at specifiable points in time or cyclically over a specifiable period and record these on the memory card.
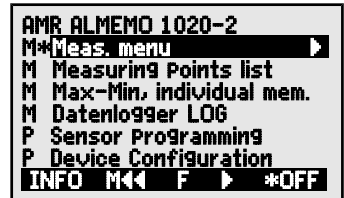
15.1 Memory connector with memory card

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

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

```
▶ REC COM I▶ ▶I      * ▬▬
Time: 12:34:56  Date: 01.01.06
Cycle-Timer:      00:00:30  S
Memory External:      250.0  MB
Memory free:          250.0  MB
Memorytime:        24T 13h
File name:              .001
STOP   M◀◀        ▶ F  MANU
```

Card memory - total capacity

Card memory - still free

File name (maximum 8 characters)

```
External memory  128.00 MB
Memory capacity free 21.75 MB
File name  .001
```

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

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

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

15.2 Date and time-of-day

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

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

15.3 Once-only output / saving of all measuring channels

Once-only manual measuring channel scans for acquiring the current measured values from all active measuring channels can be initiated by pressing `<MANU>` .
Once-only manual measuring channel scan `<MANU>` The following symbols will be highlighted briefly in the status bar as verification : (see 9.2)
While data is being output via the interface `´COM´`
While measured values are being saved `´REC´`
Each time the key is pressed again the measured values will be processed in the same way with the associated measuring time.

15.4 Cyclic output / saving of all measuring channels

For cyclic recording and output of measured values the cycle must be programmed accordingly. The measuring operation can be **started** by pressing `<START>` and **stopped** by pressing `<STOP>` Whenever a measuring operation is started the maximum and minimum values from all measuring channels are deleted.
In the course of a measuring operation the external memory must not be unplugged; this would cause all temporarily buffered measured values to be lost.
So long as no measuring operation has been started the `´Cycle timer´` function displays the cycle previously set. Having selected this function you can specify the cycle directly. (see 9.5, 9.5) Once an operation is started the timer can be seen counting down to the next cycle.

Function `Cycle-timer` :   `Cycle-timer:  00:02:00 S`
    Cycle (hh:mm:ss max. 24h), Saving ON
To enable / disable **memory activation** ´S´ press   `<M-ON / M-OFF>`
To start a cyclic measuring channel scan press   `<START>`
The following symbols will now be highlighted in the **status bar** as verification :
While a measuring operation is running   `´▶´`
While data is being output via the interface   `´COM´`
While measured values are being saved   `´REC´`
To stop a cyclic measuring channel scan press   `<STOP>`   `´ll´`

15.5 Memory capacity, memory output, clearing the memory

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

Function - Memory free e.g.   Memoryfree   108.4 MB

To output memory content via interface (s. 16.4)   <PMEM>

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

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

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

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

Memory output, remaining   Output-remaining 12.5 MB

15.6 Memory time available

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

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

15.7 Sleep mode

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

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

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

In the following menu accessible by pressing   < ►F >

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

☞ When sleep mode is selected, subject to a check window being con-firmed, all necessary parameters may be configured.

15.8 Starting and stopping measuring operations

A measuring operation can be started / stopped not only by pressing the appro-priate keys but also automatically by means of start time / end time or a speci-fied measuring duration.

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

A measuring series can be started / stopped automatically at specified times. For this pur-pose the start date and time-of-day and the end date and time-of-day must be pro-grammed. If no date has been programmed, the measuring operation will be performed ev-ery day within the set period. Or, alternatively, instead of specifying the end time the **measur-**

```
SleePmode:   ✔
Meas time:      00:00:00.00
Meas. duration: 01:00:00
Start time:     07:00:00
Start date:     01.01.07
End time:       17:00:00
End date:       01.01.07
M◀◀   F◀              FCT
```

ing duration itself can be programmed. (maximum 59h 59m 59s) The total measuring time since starting can be seen in the ´**Measuring time**´ function.

☞ This is assuming of course that the current time-of-day has been pro-grammed. Sleep mode does not support start time, end time, or measuring duration.

To **access the menu** press
Function - Measuring duration (format hh:mm:ss)
Function - Start time-of-day (format hh:mm:ss)
Function - End time-of-day (format hh:mm:ss)
Function - Start date (format dd:mm:yy)
Function - End date (format dd:mm:yy)
Measuring duration since start (hh:mm:ss.hh)

```
< ►F >
Meas. duration  00:10:00
Start time-of-day 07:00:00
End time-of-day ------
Start date 01.05.07
End date  ------
Meas. duration 00:01:23.45
```

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

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

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

16. DEVICE CONFIGURATION

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

```
DEVICE CONFIGURATION
Device Dresign ALMEMO 1020
Language:      English
Illumination: ✓ Duration: 20 s
Contrast:            50 %
Baud rate:         9600 Bd

 M◄◄  MENU            *ON
```

16.1 Device designation

In the ´Device designation´ function you can enter any text up to maximum 40 characters in length. (see Manual, 6.2.4) This text will then appear in the ´Info´ menu, in the print header for measuring operations, and in device lists (software).

Function - Device designation   Device designation Owner

16.2 Language

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

To select desired language press ◄SET► in the ´Language´ function: English

16.3 Illumination and contrast

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

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

16.4 Interface, Baud rate

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

On leaving our factory the baud rate for all interface modules is programmed to 9600 baud. If this needs to be changed you can, in the ´**Baud rate**´ function, choose from 1200, 2400, 4800, 9600 baud or 57.6, 115.2 kbaud (taking care not to exceed the maximum for the interface module). The baud rate setting is saved to the EEPROM on the interface module and applies when any other device is used.

To set the baud rate, ´**Baud rate**´ function **Baud rate 9600 baud**

Data format 8 data bits, 1 stop bit, no parity (cannot be changed)

16.5 Device Address and Networking

All ALMEMO® devices can also be networked together very easily thus enabling the user to centrally acquire and record measured values from several measuring instruments - even if these are located far apart. (see Manual, 5.3)

To communicate with networked devices it is absolutely essential that all the devices concerned should have the same baud rate setting but that each should have its own dedicated address; this ensures that only one device responds per command. Before starting network operation ensure therefore that all the measuring instruments involved are assigned different device addresses. For this purpose use the ´**Device address**´ function. On leaving the factory address 00 is normally set.

To set the device address   **Device address: 00**

16.6 Data Communication

For data retrieval and programming we provide a comprehensive ALMEMO® protocol (described in the Manual, chapters 6 and 7).

Since this high-precision instrument exceeds the standard ±16-bit range limits (65000), certain sensor parameters (e.g. base value, factor, zero-point, gain, limit values, analog scaling) are not available. Measured value correction is performed using just one 24-bit multi-point correction system. Data retrieval should be performed using the table format; this is also supported by the Win-Control data acquisition program.

To display measured values in list format - together with channel, overflow indication, range, and comments text - a new command is provided in the table format.

```
f1 P35        (Individual channels with Mxx P35)
00;;1234,64;°C;T N2;#J Nisil
10;;26,962;°C;Ntc ;VK-sensor
```

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

f1 P18   (Individual channels with Mxx P18)
MS;MEAS.Val;MAXVAL.;MINVAL.;AVERAGE;NUMBER;MAX-TIME;MAX-DATE;MIN-TIME;MIN-DATE
00;1234,64;1289,38;987,07;-;0;02:31;05.01;02:32;05.01
10;26,961;27,017;21,952;-;0;02:33;05.01;02:45;05.01

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

17. TROUBLE-SHOOTING

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

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

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

Error   Measured values are incorrect.

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

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

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

Error   Data transmission via the interface does not function.

Remedy   Check the interface module, connections, and settings. Ensure that both devices are set to the same baud rate and transmission mode. (see 16.5) Is the correct COM port on the computer being addressed Test data transmission by means of a terminal. If the computer is in XOFF status. enter <ctrl Q> for XON. Check the programming by means of ´P15´. (see Manual, 6.2.3) Test the transmit line by entering a smoothing factor using comman ´f1 z10´ and check in ´Sensor programming´. Test the receive line by a memory output in the ´Functions´ menu by pressing **<LISTM>** and **<PRINT>** and check the display.

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

18. DECLARATION OF CONFORMITY

Ahlborn Mess- und Regelungstechnik GmbH declares herewith that the ALMEMO® 1020 device carries the CE label and complies in full with the requirements of EU directives relating to low voltage and to electromagnetic compatibility (EMC) (89/336/EWG).

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

The following standards have been applied in evaluating this product.

Safety   EN 61010-1: 2001

Electromagnetic compatibility (EMC)   EN 61326: 2006

$$\mathsf{C}\,\mathsf{E}$$

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

19. ANNEX
19.1 Technical data

Measuring inputs	2 ALMEMO® sockets, for thermocouples
Measuringl channels	12 maximum
Measuring ranges	
NiCrSi-NiSi, Typ N	-200.00...+1300.00 °C
PtRh10-Pt, Typ S	-50.00...+1768.00 °C
PtRh13-Pt, Typ R	-50.00...+1768.00 °C
PtRh30-PRh6t, Typ B	+250.00...+1820.00 °C
Resolution:	0.01K
Accuracy:	0.1K ± 1 digit in the range
	Type N: -200.00...+1300.00 °C
	Type S: +50.00...+1760.00 °C
	Type R: +100.00...+1760.00 °C
	Type B: +500.00...+1800.00 °C
Cold junction compensation	
Measuring range NTC	0.000 to +70000 °C
Resolution	0.001K
Accuracy	0.1 K ±0.01 K / °C (0 to 30 °C)
Nominal conditions	23 ±2 °C, 1013 mbar,
	battery operation without display illumination
Temperature drift	10 ppm / K
A/D converter	Delta - sigma 24 bit, 1.25 mops, amplification 64
Outputs	1 ALMEMO® socket A1 for data cable
	1 ALMEMO® socket A2 for memory connector
Standard equipment	
Display	Graphics, 128 x 64 pixels, 8 rows of 4 mm
Operation	7 keys (4 softkeys)
Memory	100 measured values in RAM, SD memory connector
Date and time-of-day	Real-time clock, buffered by device battery
Power supply	External ALMEMO® DC socket, 9 to 13 VDC
Batteries	3 AA alkaline batteries
Mains adapter	ZA 1312-NA7
	100 - 230 VAC to 12 VDC, 1 A
Adapter cable, electr. isolated	ZA 2690-UK
	10 - 30 VDC to 12 VDC, 0.25 A
Current consumption without Input and output modules:	
	active mode: approx. 20 mA (at 4.5 V)
	With illumination: approx. 40 mA (at 4.5 V)
Housing	127 x 83 x 42 mm (LxWxH)
	ABS (acrylonitrile butadiene styrene)
	Weight approx. 260 g
Suitable conditions	
Operating temperature	-10 to +50 °C
Storage temperature	-20 to +60 °C
Ambient atmospheric humidity	10 to 90 % RH (non-condensing)

19.2 Product overview   Order no.

High-precision temperature measuring instrument ALMEMO® 1020
for noble-metal thermocouples with with 3 AA alkaline batteries,
mains unit ZA1312NA7, USB-data cable ZA1919DKU , carry-case
evaluation software ALMEMO® View SW5500AV,
and thermocouple sensor type N,
with cold junction compensation in the connector,
including DKD / DAkkS calibration certificate   SP10202ND
Same as above
with thermocouple sensor type S, with cold junction compensation
integrated in the connector   SP10202S1D
Same as above
with thermocouple sensor type S,
with external cold junction compensation   SP10202S2D

Accessories

Mains adapter with ALMEMO® connector 12V, 1A (incl.)	ZA1312NA7
DC adapter cable 10 to 30 VDC, 12 V / 0.25 A, electr. isolated	ZA2690UK
ALMEMO® memory connector with micro-SD card	ZA1904SD
Data cable USB-Interface, electr. isolated, max. 115.2kB (incl.)	ZA1919DKU
Data cable V24-Interface, electr. isolated, max. 115.2kB	ZA1909DK5
Ethernet data cable	ZA1945DK
Rubberized impact protection, gray	ZB2490GS2
DIN rail mounting	ZB2490HS

19.3 Index

19.4 Your contact partner

Ahlborn Mess- und Regelungstechnik GmbH,
Eichenfeldstraße 1, 83607 Holzkirchen, Germany
Tel. +49(0)8024/3007-0, Fax +49(0)8024/300710
Internet: http://www.ahlborn.com, email: amr@ahlborn.com

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

19. Annex