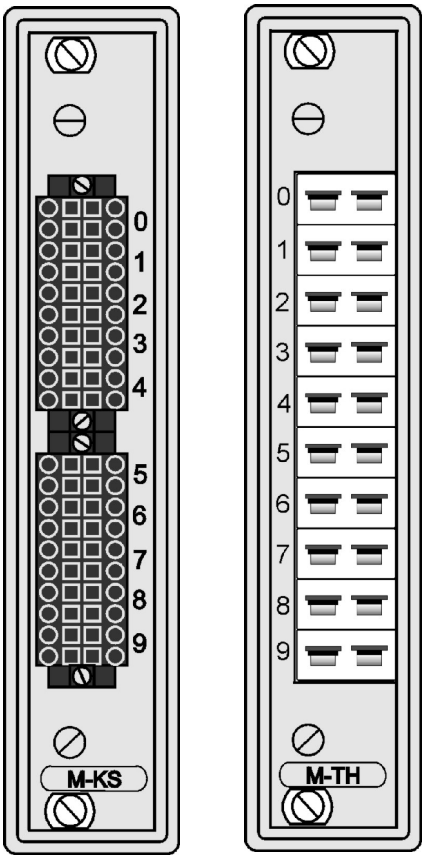
Operating instructions

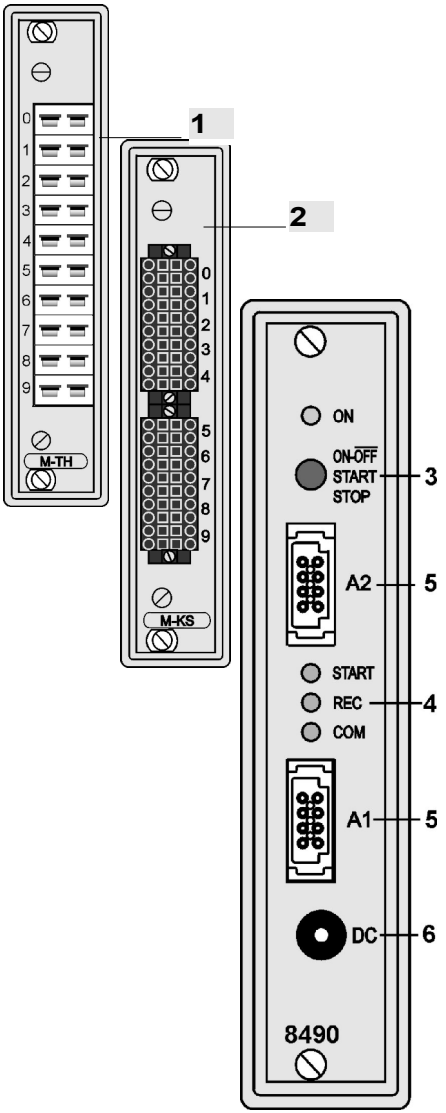


V6

Data acquisition modules ALMEMO® 8490-KS and 8490-TH

V1.0
08.12.2006

1. OPERATING CONTROLS



Front view of 8490-TH

(1) Measuring inputs M0 to M9
M0 ... M9 for thermal sensors
M9 to M39 31 additional channels

Front view of 8490-KS

(2) Measuring inputs M0 to M9
M0 ... M9 for 2 clamp connectors
M9 to M39 31 additional channels

Rear view

(3) Key ON/OFF, START/STOP
ON ON
START Start measuring operation
STOP Stop measuring operation
OFF OFF, Hold key pressed down

4. Status LEDs
ON Device is on.
START Measuring operation started
REC Measuring with results saved
COM Measuring with output

(5) Output sockets A1, A2
A1 Interface/optic fiber (ZA1909-DK5/L)
RS422 (ZA 5099-NVL/NVB)
Ethernet (ZA 1945-DK)
Bluetooth (ZA 1709-BTx)
Trigger input (ZA 1000-ET/EK)
Relay outputs (ZA 1006-EAK)
Analog output 1 (ZA 1601-RK)
A2 Network cable (ZA1999-NK5/NKL)
MMC card connector (ZA1904-MMC)
Trigger input (ZA 1000-ET/EK)
Relay outputs (ZA 1006-EAK)
Analog output 2 (ZA 1601-RK)

(6) Connection socket DC 12V
Mains adapter (ZB 1212-NA4, 12V, 0.6A)
Cable, electrically isolated
(ZB 3090-UK, 10 to 30 V)

Internally on the board

(7) Code switch
G: Device address 00 to 99

2. CONTENTS

3. GENERAL

Congratulations on your purchase of this new, innovative, and highly compact ALMEMO® data acquisition module. This device is available in 2 versions - a special variant designed for standard miniature thermal connectors only and a universal variant with clamp connector for a wide variety of different sensors. On these devices, unlike those with ALMEMO® connectors , all channels must be appropriately programmed. Using the AMR-Control software supplied their operation should be fairly straightforward. The devices can, however, be used with such a wide range of sensors and peripherals and offer many different special functions. You are advised therefore to properly familiarize yourself with the way the sensors function and with the device's numerous possibilities and take the time to carefully read these operating instructions and the appropriate sections in the ALMEMO® Manual. This is absolutely necessary to avoid operating and measuring errors and to prevent damage to the device. To help you find the answers to your questions quickly and easily there is a comprehensive index at the end both of these instructions and of the Manual.

3.1 Warranty

Each and every device, before leaving our factory, undergoes numerous quality tests. We provide a guarantee, lasting two years from delivery date, that your device will function trouble-free. Before you send your device to us, please observe the advisory notes in Chapter 11. Trouble-shooting In the unlikely event that the device proves defective and you need to return it please wherever possible use the original packaging material 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 cases :

- The customer attempts any form of unauthorized tampering and alteration inside the device.
- The device is used in environments and conditions for which it is not suited.
- The device is used with unsuitable power supply equipment and peripherals.
- The device is used for any purpose other than that for which it is intended.
- The device is damaged by electrostatic discharge or lightning.
- The user fails to observe and comply with the 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 Scope of delivery

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

Measuring instrument ALMEMO® 8490
Mains adapter
These operating instructions
ALMEMO® Manual
CD with the AMR-Control software and various useful accessories

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

3.3 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.
- 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.

4. INTRODUCTION

The data acquisition modules in the ALMEMO® 8490 series are new members in our family of unique ALMEMO® measuring instruments; these are, however, not for sensors equipped with our patented ALMEMO® connector system but for sensors with standard miniature thermal connectors or universal clamp connectors. On all such sensors used with these devices at least the measuring range must be programmed. All parameters can now be saved in an EEPROM on the device itself in a form completely compatible with the ALMEMO® connector system.

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

Overview of the device functions and measuring ranges (Manual Ch 2)
Basic principles, operation, and technical data for all sensors (Manual Ch 3)
Options for connecting your own existing sensors (Manual Ch 4)
All analog and digital output modules (Manual Section 5.1)
Interface modules RS232, optic fiber, USB, Ethernet (Manual Section 5.2)
The whole ALMEMO® networking system (Manual Section 5.3)
All functions and their operation via the interface (Manual Ch 6)
Complete list of interface commands with all the printouts (Manual Ch 7)

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

4.1 Functions of the ALMEMO 8490

Data acquisition modules in the ALMEMO® 8490 series are housed in compact 4-DU cases; they have 10 electrically isolated measuring inputs. Type TH is suitable for virtually all sensors with a miniature thermal connectors; type KS is suitable for directly clamping a very wide variety of passive sensors. Options U and I are intended for standard 10V and 20mA signals. Thanks to the real-time clock incorporated as standard and the external memory connector with a multimedia card the amount of data you can record is virtually endless. A variant is available with an integrated 512-KB EEPROM memory sufficient for approx. 100,000 measured values. There are two output sockets which can be used to connect any ALMEMO® output modules, e.g. analog output, digital interface, memory connector, trigger input, or alarm contacts. Several devices can be networked by simply connecting them with network cables.

4.1.1 Sensor programming

Module 8490-TH is designed for NiCr-Ni thermocouples and module 8490-KS is designed for Pt100 sensors; option U is preprogrammed for 10V signals and

option I for 20mA signals; all other requirements must be programmed by the user via the interface preferably using the AMR-Control software.

Measuring ranges
Appropriate measuring ranges are available for all sensors with a non-linear characteristic, e.g. 10 thermocouple types, NTC and Pt100 probes. For Pt100 psychrometers additional function channels are available for calculating humidity variables such as dew point, mixture ratio, vapor pressure, and enthalpy. Measured values from other sensors can also be acquired using the voltage, current, and resistance ranges with individual scaling in the connector. Existing sensors and signals can be connected quickly and easily .

Function channels
Maximum, minimum, average values and differences from certain measuring points can be programmed as function channels, also internal channels, and can be processed and printed like normal measuring points. There are also function channels available for special measuring tasks, e.g. to determine the temperature coefficient Q/ΔT and wet bulb globe temperature.

Units
The 2-character units display can be adapted for each measuring channel so that both the display and the printout always indicate the correct units, e.g. when a transmitter is connected. Conversion between °C (Centigrade) and °F (Fahrenheit) is performed automatically.

Measured value designation
Each sensor is identified by means of a 10-character alphanumeric name. This name is entered via the interface and will appear in the printout or on the computer display.

Correction of measured values
The measured value on each measuring channel can be corrected both in terms of zero-point and gain.

Scaling
The corrected measured value on each measuring channel can also be further scaled in terms of zero-point and gain - using the base value and factor. The decimal point position can be set by means of the exponent function. The scaling values can be calculated automatically by setting to zero and entering the nominal setpoint.

Limit values and alarm
Per measuring channel two limit values can be set (1 maximum and 1 minimum). In the event of one of these limit values being exceeded relay output modules actuate the associated alarm contacts; these can be allocated individually to specific limit values. As a standard, the hysteresis is set to 10 digits; however, it can also be adjusted between 0 and 99 digits. The exceeding of a limit value can also be used to automatically start or stop measured value recording.

Sensor locking
All sensor data can be protected by means of a graduated locking function against undesired access.

4.1.2 Measuring operations

Up to 40 measuring channels are available for the 10 transducers; i.e. it is also possible to evaluate double sensors, individually scaled sensors, and sensors with function channels. All activated measuring points are scanned continuously at the selected measuring rate (standard 10 mops, maximum 100 mops). Data is output, if available, to the interface, to a measured value memory, or to an analog output. For analog output of a measuring point in preferred status or smoothing irrespective of measuring point the selected measuring point is scanned in semi-continuous mode, i.e. it is rescanned more frequently, namely every 2nd time.

Measured values
Measured values are acquired automatically with auto-zero and self-calibration; however, they can also be corrected and scaled arbitrarily as required. With most sensors a sensor breakage is detected automatically.

Analog output and scaling
Each measuring point can be scaled by means of analog start and analog end in such a way that the measuring range thus defined covers the full range of the analog output (2 V, 10 V, or 20 mA). At the analog output the device can output the measured value from any measuring point or a programmed value.

Measuring functions
For the cold junction compensation of the thermocouples in module 8490-TH the temperatures at the outside sockets are measured and interpolated on a linear basis for all the others.

Maximum and minimum values
Each measuring operation acquires and stores the maximum and minimum values with date and time-of-day. Each of these values can be output, used as function channel, or deleted.

Average value
Manual averaging is available per channel over a certain period or cycle or over a series of individual measurements.

4.1.3 Process control

To record the measured values from all connected sensors in digital form measuring point scanning is performed continuously with measured value output according to a time-based process control. This may be per output cycle or, if really rapid results are required, at the measuring rate itself. The measuring operation can be started and stopped by means of a key, the interface, an external trigger signal, the real-time clock, or by a specified limit value being exceeded.

Date and time-of-day
All measuring operations can be accurately logged using the real-time clock with date function or in terms of the pure measuring time. For the purposes of starting / stopping a measuring operation, the start / stop date and time-of-day and / or the actual measuring duration can be programmed.

Cycle
The cycle can be programmed to any value between 00:00:01 (1 second) and 59:59:59 hh:mm:ss. This function permits cyclic output of measured values to the interfaces or to the memory and provides cyclic calculation of the average value.

Print cycle factor
The print cycle factor can be used to limit data output from particular channels; this may be necessary in order to reduce excessive data flow especially while data is being saved.

Averaging over measuring point scans
The measured values from measuring point scans can be averaged either over the whole measuring duration or over the specified cycle. These average values can then be output and saved on a cyclic basis to function channels provided for this purpose.

Measuring rate
The possible measuring rates are 2.5, 10, 50, or 100 mops (measuring operations per second). Recording can be accelerated if all measured values are stored to memory and / or output to the interface at the full measuring rate.

Measured value memory
To save measured values there are two alternative methods. Option S is a 512-KB non-volatile EEPROM, sufficient for up to 100,000 measured values. This memory can be organized and configured in linear or ring form. Output is via the interface. Selection can be specified according to a time interval or number.
New Or alternatively, without option S, an external memory connector with multimedia memory card can be connected at socket A2. This solution, depending on the size of the card, offers a virtually limitless memory capacity. With an external memory connector, available as an accessory, files can be read out very quickly via any standard card reader.

Numbering of measuring operations
By entering a number single scans or entire series of measuring operations can be identified and selectively read out from the memory.

Control outputs
Via the interface up to output relays and analog outputs can be individually addressed.

Output
All data logs, all saved measured values, and all programming parameters can

be output to any peripheral equipment. RS232, RS422, USB, and Ethernet interfaces are available via the appropriate interface cables. Wireless communication is also possible via Bluetooth. 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.

Networking

All ALMEMO® devices can be addressed and can be easily networked by simply linking them together via network cable or for longer distances via RS422 network distributors.

Software

Each ALMEMO® Manual is accompanied by the AMR-Control software package, which can be used to configure the measuring instrument, to program the sensors, and to read out from the measured value memory. Using the integrated terminal, measuring operations can also be performed online. The WINDOWS® software package WIN-Control is provided for the purposes of measured value acquisition via networked devices, for graphical presentation, and for more complex data processing.

5. INITIAL COMMISSIONING

1. Sensor connection

Connect thermal sensors to sockets **M0** to **M9** (1) of module 8490-TH; connect other sensor types to the 2 clamp connectors of module 8490-KS (2); (see 7.2).

2. Power supply Connect the mains adapter to socket **DC** (6); (see 6.1).

3. Switch ON by pressing ON (3); (see 6.3).

4. Device configuration by PC via the interface

Connect the computer via interface cable to socket A1; (see Manual 5.2).
Activate the software, e.g. the supplied AMR-Control.
Identify the device by means of <Search network>.
If the device is not found select <Setup interface>.
Set the appropriate COM interface and baud rate to 9600 baud; (see Manual 6.1.1).
<Update list>
<Program device>
Input "cycle" for automatic measuring point scan; (see Manual 6.5.2).
Activate "With memory" to save (only with option S or memory connector).
If necessary "Accept date and time-of-day from PC"; (see Manual 6.2.8).
Program the output format; (see Manual 6.5.5 and 6.6.1).
"Table" for MS-Excel / "List" or "Columns" for printer or text editor

5. Sensor programming

Call up <Measuring points list>
Click measuring point and <Program measuring point> or
Enter new <Activate measuring point> and if necessary <Program measuring point>

6. Measured data acquisition from PC without saving in device

Call up <File - terminal>; (see Manual 6.1.3).
<Open file - terminal - log>, enter file name, "Save"
Start measuring operation by actuating the "Start" button or pressing the **START/ STOP** key; (see Manual 6.6).
Stop measuring operation by actuating the "Stop" button or pressing the **START/ STOP** key.
<Close file - terminal - log>
Call up file e.g. from MS-Excel and import using ";" as separator; (see Manual 6.1.4).

7. Saving measured values in the device (only with option S or memory connector)

Call up <Devices - Measured value memory>.
If necessary "Clear memory" "Execute"; (see Manual 6.9.3).
For long-term recording (cycle > 2 minutes) Activate sleep mode; (see Section 9.2.1).
"Start saving to memory" immediately or

Start measuring operation on site by pressing **START/ STOP** key.
Or in <Program device> enter measuring operation "Start date / time"´and "End date / time"; (see Manual 6.6.2).
At the end of the measuring operation stop recording again by pressing **START/ STOP**.

Transferring data from memory to the computer

If you are using a memory connector remove the multimedia card and transfer via a USB reader to the PC (see Manual 6.9.4.2) or
Reconnect the computer via the interface cable at socket A1; (see above).
In AMR-Control call up <Devices - Measured value memory>.
Click on "Read out complete memory".
Set "Format"; (see above).
Read out "Execute", enter file name, "Save"; (see Manual 6.9.3).
Call up file e.g. from MS-Excel and import using ";" as separator;
(see Manual 6.1.4).

6. POWER SUPPLY

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

Mains adapter 12V / 0.2A (supplied)	ZB 2290-NA1
Electr. isol. power supply cable, 10 to 30 VDC, 0.25 A	ZB 2290-UK

See product overview, Annex 14 and the following chapters.

6.1 Mains operation

To power these devices from the mains preferably use the mains adapter provided ZB 2290-NA1, connect it to the DC socket (6). Please ensure that the mains voltage is correct.

6.2 External DC voltage supply

The **DC** socket (6) can also be used to connect another DC voltage, 9 to 13 V (minimum 200 mA). For this connection use a cable with 2 banana plugs (ZB 5090-EK). If, however, the power supply has to be electrically isolated from the transducers or if a larger input voltage range (10 to 30 V) is required, then electrically isolated supply cable ZB 2290-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.

6.3 Switching ON / OFF, Reinitialization

To **switch the device ON / OFF** press **ON - OFF** (2).

To switch OFF press the **ON - OFF** key and hold down for approx. 1 second. After the device is switched off the real-time clock continues to run and all saved values and settings are retained intact; (see 6.4).

If the device behaves abnormally as the result of interference (e.g. electrostatic or mains failure), you are advised to try clearing the problem first of all by simply reinitializing, i.e. switching off and then on again.

If this does not help then you are advised to restore all device programming to the factory default settings. The device can be **reset** by setting the code switch **G** (7), before switching on, to address 99. This has the effect of also resetting the baud rate setting on the data cable to 9600 baud. However, the programming of the sensors always remains unaffected and intact.

6.4 Data buffering

Sensor programming, calibration data, and programmed device parameters are stored in the EEPROM on the instrument itself, all on a fail-safe basis. The memory data is also saved in non-volatile EEPROMs. The date and time-of-day are buffered by a dedicated lithium battery; this data is retained intact for years - even when the device is switched off and without batteries.

7. CONNECTING THE SENSORS / TRANSDUCERS

At input sockets M0 to M9 of measuring module 8490-TH (1) you can connect 10 thermocouple sensors with miniature thermal connectors. At the 2 clamp connectors of measuring module 8490-KS (2) you can connect a wide variety of standard sensors or electrical signals; (see 8.4.1).

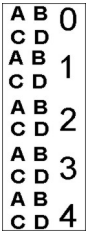
7.1 Sensors / transducers

The two measuring modules in this series, 8490-TH and 8490-KS, are intended primarily for existing standard sensors and transmitters. However, all temperature sensors from the Ahlborn sensor spectrum (see Manual Ch 3) can also be supplied with free ends and all thermocouples can be supplied with thermal connectors. The use of sensors without connectors is described in detail in the ALMEMO® Manual (see Manual Ch 4).

7.2 Measuring inputs

Measuring module ALMEMO 8490-TH incorporates 10 thermal sockets (1) to which initially measuring channels M0 to M9 are assigned.

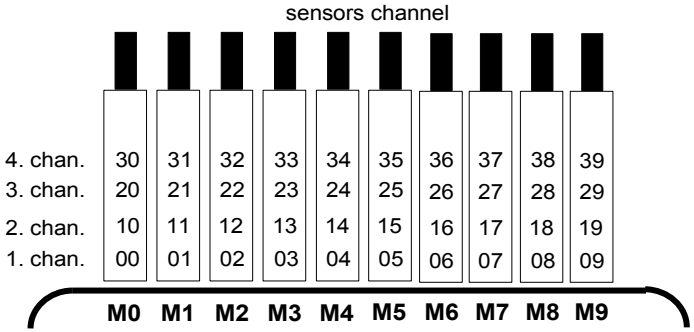
Measuring module ALMEMO 8490-KS also incorporates 10 inputs M0 to M9 but these are wired directly to two 20-contact clamp connectors. Sensors are connected, as with the ALMEMO connector system, via terminals A, B, C, D in the familiar connection pattern (see Manual Ch 4 and the label on the side of the connector, example on the right). In order to feed in the wires the outside connectors must be opened by inserting a narrow screw-driver in the inside holes.



Or alternatively modules are available with shunts for 20-mA signals (terminals A and B, ranges ´mA ´ or ´% ´) or with dividers for 10-V signals (terminals A and C, range ´mV 2´). A module is only suitable for thermocouples if these are connected using copper wires via an isothermal block with integrated cold junction sensors; (see Manual 6.7.3).

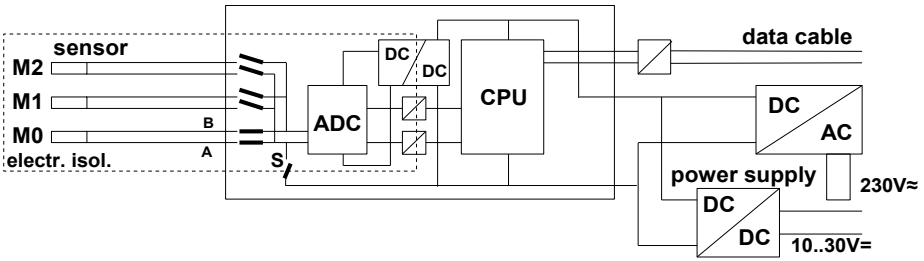
The sensor data for both modules is saved to an EEPROM on the board; automatic sensor recognition is thus not possible. However, it is possible, if required, to provide up to 4 channels per input so that with 10 inputs a total of 40 channels are available. The additional channels are used primarily for function channels. Each sensor can if necessary be programmed with several measuring ranges or scaling settings; and 2 or 3 sensors, if pin assignment so permits, can be combined at just one input (e.g. mV / V, mA / V, etc.) but these will not be electrically isolated. The additional measuring channel numbers per input go up in steps of 10 (e.g. the first input has channels M0, M10, M20, M30, and the second input has channels M1, M11, M21, M31 etc.).

On the measuring instruments this gives the following channel assignment :



7.3 Potential separation

When organizing a properly functioning measuring setup it is very important to ensure that no equalizing current can flow between sensors, power supply, and peripherals. This will be the case so long as all points lie at the same potential or any unequal potentials are electrically isolated.



The 10 analog inputs are electrically isolated from one another by means of photovoltaic relays. A new feature on this device is the additional separation of the measuring inputs from CPU and power supply. Between all inputs and outputs (even the analog output cables which are not electrically isolated) the maximum potential difference permitted is 50 V. The voltage at the measuring inputs themselves must not exceed 12 V (between B, C, D, and A).

Sensors combined within one connector, however, are not electrically isolated.

Data and trigger cables are also isolated by means of optocouplers.

8. OPERATION AND CONFIGURATION

Data acquisition modules in the ALMEMO 8490 series have only a few operating controls; they are operated mainly via a PC.

8.1 Combination key

The first function of the key **ON/OFF - START/STOP** (3) has already been described.

Press to switch the device ON; press and hold down to switch the device OFF.

If the device is on and a cycle has been programmed the same key can be used to **start** and **stop** a measuring operation.

The current operating status is clearly shown by the status LEDs.

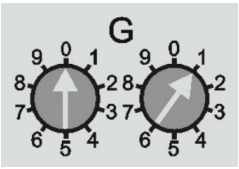
8.2 Status LEDs

The following status LEDs (4) report the current device status :

ON	Device is on.
ON flashes briefly	Device is in sleep mode.
START Measuring operation is started.	
COM continuous	Measured value transmission to the PC - cyclic
COM flashes	Meas. val. transmission to the PC-at the conversion rate
REC continuous	Data saving on the device - cyclic Also lights up during memory output
REC flashes	Data saving on the device - at the conversion rate
START flashes briefly	Once-only measuring point scan from PC
COM flashes briefly	Once-only measuring point scan transfers data to PC
REC flashes briefly	Once-only meas. point scan saves data on the device

8.3 Device address and networking

ALMEMO 8490 data loggers, like all ALMEMO devices, can also be networked. To communicate with networked devices it is absolutely indispensable that each device should have its own dedicated address; this is because only one device should respond per command. Before each network operation therefore those measuring instruments involved must be opened and set by means of their code switches (7) to different device numbers.



Example: Module address 01 0 1

In network operation consecutive numbers between 01 and 99

should be used; this ensures that device 00 is not addressed unnecessarily in the event of interruption to the power supply.

8.4 Configuration

For the purposes of programming and configuration the supplied AMR-Control software is ideally suited. This can be used to program the sensors and to configure the process control. The various possibilities are explained in detail in the Manual Ch 6. This Chapter also describes how all functions can be accessed via a terminal by means of ASCII commands.

8.4.1 Sensor programming

All sensors to be used on those 8490 measuring modules without ALMEMO connectors must be programmed; this is the exception. The most important thing in so doing is to set the measuring range; this ensures that the channel is activated and if necessary linearization is performed. For the passive sensors and measuring signals to be connected the following measuring ranges are available :

Range		Command	Pressure	Units
On measuring modules 8490-TH and 8490-KS				
* NiCr-Ni (K) ITS 90	-200..1370 °C	B04	NiCr	°C
* NiCrSil-NiSil (N) ITS 90	-200..1300 °C	B34	NiSi	°C
* Fe-CuNi (L)	-200.. 900 °C	B05	FeCo	°C
* Fe-CuNi (J) ITS 90	-200..1000 °C	B35	IrCo	°C
* Cu-CuNi (U)	-200.. 600 °C	B06	CuCo	°C
* Cu-CuNi (T) ITS 90	-200.. 400 °C	B36	CoCo	°C
* PtRh10-Pt (S) ITS 90	0..1760 °C	B07	Pt10	°C
* PtRh13-Pt (R) ITS 90	0..1760 °C	B37	Pt13	°C
* PtRh30-PtRh6 (B) ITS 90	+400..1800 °C	B08	El18	°C
* AuFe-Cr	-270.. 60 °C	B38	AuFe	°C
Millivolt	-10.. +55mV	B10	mV	mV
Millivolt 1	-26.. +26mV	B27	mV 1	mV
Millivolt 2	-260..+260mV	B28	mV 2	mV
Volt	-2.6.. +2.6 V	B11	Volts	V
Battery	0..25 V	B14	Battery	V
Function channels				
Difference	(Mb1-Mb2)	B71	Diff	f(Mb1)
Maximum value	(Mb1)	B72	Max	f(Mb1)
Minimum value	(Mb1)	B73	Min	f(Mb1)
Average value over time M(t)	(Mb1)	B74	M(t)	f(Mb1)
Average value over measuring points	(Mb2..Mb1)	B75	M(n)	f(Mb1)
Total from measuring points	(Mb2..Mb1)	B76	S(n)	f(Mb1)
Alarm value	(Mb1)	B80	Alrm	%
Measured value	(Mb1)	B81	Meas	f(Mb1)
Cold junction temperature		B82	CJ	°C
Number of averaged values	(Mb1)	B83	n(t)	

Range		Command	Pressure	Units
Timer	0..60000/6000.0s	B85	Time	s
Measuring module 8490-KS only				
Pt100-1 4 liters ITS 90	-200.. 850 °C	B01	P104	°C
Pt100-2 4 liters ITS 90	-200.. 400 °C	B03	P204	°C
Pt100-3 4 liters ITS 90	0.. 65.000 °C	B00	P304	°C
Pt1000-1 4 liters with element flag 1	-200.. 850 °C	B01	P104	°C
Pt1000-2 4 liters with element flag 1	-200.. 400 °C	B03	P204	°C
Ni100 4 liters	-60.. 240 °C	B63	N104	°C
Ni1000 4 liters with element flag 1	-60.. 240 °C	B63	N104	°C
NTC type N	-50..125 °C	B09	NTC	°C
Difference - millivolt	-10.. +55mV	B50	D 55	mV
Difference - millivolt 1	-26.. +26mV	B51	D 26	mV
Difference - millivolt 2	-260..+260mV	B52	D260	mV
Difference - volt	-2.6.. +2.6 V	B53	D2.6	V
Milliampere	-32.. +32mA	B12	mA	mA
Percent	4-20 mA	B13	%	%
Ohms	0..500 Ω	B15	Ohms	Ω
Ohms with element flag 1	0..5000 Ω	B15	Ohms	Ω
Function channels				
Relative humidity, psychrometric, with PC	0..100 %	B46	P RH	%H
Absolute humidity, psychrometric, with PC	0..500g/kg	B47	P AH	gK
Dew point, psychrometric, with PC	-25..100°C	B48	P DT	°C
Vapor pressure, psychrometric, with PC	0..1050 mbar	B49	P VP	mb
Enthalpy, psychrometric, with PC	0..400 kJ/kg	B57	P En	kJ
Thermal coefficient	$\overline{M}$ (q)/ $\overline{M}$ (M01-M00)	B79	q/dt	Wm
Wet bulb globe temperature	0.1TT+0.7HT+0.2GT	B02	WBGT	°C
Volume flow m^3/h	$\overline{M}$ (Mb1) * Q	B84	Flow	mh
Measuring module 8490-KS with option U only :				
Volts with internal 100:1 divider and decimal point in range 3	-26.. +26 V	B28	mV 2	V
Measuring module 8490-KS with option I only :				
Milliampere with internal shunt, 2 ohms	-32.. +32mA	B12	mA	mA
Percent with internal shunt, 2 ohms	4-20 mA	B13	%	%

► PC = atmospheric pressure compensation, b1/b2 =reference channels 1 and 2

* On 8490-KS, external cold junction compensation only (see Manual 6.7.3)

° With external shunt 2 ohms only

" With flow transmitter in m/s 2 decimal points only

Transmitters usually also require **scaling** with base value and factor and a **change of units**. This and many other functions can be performed quickly and easily using the AMR-Control software; (see Manual Ch. 6).

9. MEASURED DATA ACQUISITION

Measured data acquisition can be performed in basically two ways :

1. Perform measurement online and transfer data to the PC immediately (no device-internal memory required).
2. Perform measurement offline, i.e. the data is first saved to the device memory (option S) or to an external memory connector with multimedia card and then transferred to the PC later.

9.1 Online measurement with PC

For conveniently recording measured data on the PC the measured data acquisition software Win-Control is ideally suited. This software is unique in that it can scan one stand-alone or several internetworked measuring modules at its own measuring cycle, then save the measured data on the PC, and output it online in a clearly understandable form as a line diagram, table, or list; thus for process control purposes you need simply to program the measuring cycle in Win-Control. There are numerous other possibilities using formula channels, control and regulation functions, alarm reports via SMS and e-mail, etc. but it would be going too far to describe all these here in detail.

9.2 Offline measurement

To perform offline measuring operations, i.e. data logging in the device itself, you need either option S with a 500-KB EEPROM on the device or an external memory connector with a multimedia card (ZA 1904-MMC).
The following parameters must be configured :

1. Date, time-of-day
2. Cycle with saving to memory activated
3. Sleep mode, possibly

The easiest way to do this is by means of the AMR-Control software, in menu <Program device> and <Measured value memory - Recording to memory>.

To start and stop a measuring operation on site there are numerous methods available; (see Manual 6.6).

1. Press the **START / STOP** key (2) on the device.
2. Program the start date and time-of-day and then either the end date and time-of-day or the measuring duration (see Manual 6.6.2).
3. Reaction to overshooting / undershooting a limit value (see Manual 6.6.3).
4. Triggering in response to electrical signals (see Manual 6.6.4).

The status of a measuring operation and of data recording can easily be traced by watching the LEDs (see 8.2).

To **read out the measured data** (see Manual 6.9.3) select AMR-Control menu item <Devices - Measured value memory>. Here you can transfer to a file on the PC either the complete memory or parts of it selected according to date and time-of-day or by number; the device memory can then be cleared.

9.2.1 Sleep mode

For long-term monitoring involving large measuring cycles where power is supplied by rechargeable or normal battery the measuring instrument can also be operated in sleep mode. In energy-saving sleep mode the measuring instrument switches off after each measuring point scan and switches on again automatically after the cycle expires ready for the next measuring point scan. In this way with just one battery recharge up to 30000 measuring point scans can be performed; for a cycle lasting 5 minutes this represents a measuring capability of over 100 days.

For **data recording in sleep mode** go to AMR-Control <Device programming> and take the following steps :

1. Enter a cycle lasting at least two minutes.
2. Activate saving to memory in the cycle.
3. Activate sleep mode.
4. Start measuring operation as normal; the device should then switch off automatically; as a check the LED ´**ON**´ (3) should flash rhythmically on and off.
6. In the specified cycle the instrument switches on automatically, performs one measuring point scan, and then switches off again.
7. To stop the measuring operation twice press key (2e), Function ´**ON**´ and ´**STOP**´.

In this way any number of measuring operations can be performed in sleep mode up until when sleep mode is deactivated again. With cycles shorter than 2 minutes measuring operations are performed automatically in normal mode.

9.2.2 Device-internal measured value memory (option S)

With option S data acquisition module ALMEMO 8490 incorporates a memory with a 512-KB EEPROM, sufficient for 64000 to 100000 measured values (depending on the number of channels). This memory is non-volatile; i.e. it retains data intact even in the event of a failure affecting the lithium battery used to buffer the real-time clock. How this measured value memory is organized and how data is recorded to it and output from it are described in the Manual, Section 6.9. It can be configured either as linear memory or ring memory; (see Manual 6.10.13.2).

As on all other ALMEMO data loggers the internal memory supports the following functions :

However, only one sensor configuration is possible.
Recording to ring memory
Sleep mode
Data output in any normal format
Selective data output according to date and time
Selective data output by number

9.2.3 Memory connector with multimedia card

Another convenient feature for data recording without option S is provided by the newly developed memory connector (ZA 1904-MMC) with a conventional multimedia flash memory card. The memory card should preferably be RS form (reduced size), half size, 32 to 512 MB; measured data is written to it via the memory connector in table mode and in standard FAT16 format. The MMC card can be formatted and its contents can be read and deleted via any normal PC using any card reader; (see Manual 6.9.4.2). Measured data can be imported into MS-Excel or into Win-Control (the accompanying measured value software). The memory connector works in a completely different way to the device-internal memory; this brings both restrictions and advantages.

Functions of the MMC memory connector

Virtually unlimited memory capacity
With each new connector configuration a new file is created.
No ring memory recording
Sleep mode
Data can be evaluated using any reader on site and elsewhere.
Very high-speed data transfer via the reader
Data recording and output in table format only
Via the device itself only the last file can be read.
No selective data output according to date and time or by number

The memory connector with the additional memory card can be connected at socket A2; it is recognized automatically. If the external memory is connected at the start of any measuring operation, it will be used. However, in the course of the measuring operation it must not be unplugged; this would cause temporarily buffered measured values to be lost.

Before starting any measuring operation you can enter an 8-character file name (see Ch 11). In the absence of a user-assigned file name, the default name ´ALMEMO.001´ or the name most recently used will be suggested automatically. So long as the connector configuration is not altered, you can save several measuring operations, either manually or cyclically, also with numerical assignment, all in the same file.

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

10. NEW INTERFACE COMMANDS

For new functions the latest V6 device generation incorporates a series of new interface commands; most of these were in fact already supported by the last version of AMR-Control; however, they are often also needed in terminal mode.

Measuring point

Activate, i.e. restore old range,
To delete without further programming `o00`

Process control

Switch saving per cycle on / off `I(-)hhmmss` or `f1 A(-)4`
Switch sleep mode on / off `o(-)11`
Switch monitor mode on / off `f1 A(-)1`
Switch fail-safe mode on / off `f2 A(-)1`
Scan process mode per cycle `P11`
Switch saving on / off : `S/U`, Output format : `-/n/t` `PRINT CYCLE : 00:05:00 Sn s`
Process mode : Normal : Sleep: **s**, Monitor: M, Fail-safe: F
Measured value output (not) allowed more frequently than measuring rate `f6 k(-)5`
Input measuring duration `f2 I hhmmss`
Output measuring duration `P47 MEASURING DURATION : 12:00:00`
Zero-set timer 1s `f3 C01`
Zero-set timer 0.1s `f4 C01`
Enter macro 5 to 9 from V24 commands (<30Z) `f-5 to f-9 $xx|xxx|xxCR`
Output macro 5 to 9 `f-5 to f-9 P20`
Set macro 5 to 9 as trigger function `f9 k5 to k9`
Limit value action, maximum, manual `h3`
Limit value action, maximum, zero-set timer 0.1s `h4`
Limit value action, maximum, macro 5 to 9 `h5 to h9`
Limit value action, minimum, manual `l3`
Limit value action, minimum, zero-set timer 0.1s `l4`
Limit value action, minimum, macro 5 to 9 `l5 to l9`

Saving

Output version MMC connector : `f4 t0 MMC1.01`
Format MMC connector (All files will be deleted !) : `C04`
Input file name (maximum 8 characters) `$Name`
Table header in MMC memory : `P04`

```
"ALMEMO";"RANGE:";"NiCr";
"MMC1.01";"DESIGNATION:";"Oil";
"ALMEMO.001";"LIMIT-MAX:";123,4;
;"LIMIT - MIN:";;12,;;;;;;;
```

Connector version:
File name of last measuring operation :

11. TROUBLE-SHOOTING

The ALMEMO® 8490 data acquisition module can be configured and programmed in many versatile ways. Each one is suitable for connecting a wide variety of very different sensors, additional measuring instruments, alarm signaling devices, and peripheral equipment. 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 invalid setting, or unsuitable cabling. In such event try to pinpoint and clear the problem with the aid of the following tests.

Error: No or all LEDs light up; keys do not react.

Remedy: Check the power supply, switch off and then on again.
If necessary, re-initialize; (see 6.3).

Error: Measured values are incorrect.

Remedy: Check all the channel programming very carefully, especially the base value and zero-point (sensor programming and special functions).

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

Remedy: Check the cabling for any inadmissible electrical connections. For sensors with their own power supply check element flag 5; (see 7.3).
Unplug any suspicious sensors.
Connect hand-held sensors in air or phantoms (for thermocouples short-circuit AB, for PT100 sensors use 100Ω) and check.
Connect the sensors again one at a time and check successively.
If a fault persists for any one connection, then 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 interface module, connections, and settings.
Are both devices set to the same baud rate and transmission mode ? (see Manual 6.10.12).
In the event of a reset (see 6.3) with the interface module connected, the baud rate will be set to 9600 baud.
Is the correct COM interface on the computer being addressed ?
Is a printer in the ONLINE status ?
Are the handshake lines DTR and DSR active ?
To check the data flow and the handshake lines a small interface tester with LEDs comes in very handy; (in ready-to-operate status the data lines TXD, RXD carry negative potential of approx. -9V and the LEDs light up green, whereas the handshake lines DSR, DTR, RTS, CTS carry positive voltage of approx. +9V and the LEDs light up red. For the duration of data transmission the data LEDs should flash red. Check data transmission by means of a terminal (AMR-

Control, WIN-Control, WINDOWS-Terminal). Address the device using its assigned device number´Gxy´ (see Manual 6.2.1). If the device is in the XOFF status, enter <ctrl Q> for XON. Check the programming by means of ´P15´ (see Manual 6.2.3). Test only the transmit line by entering the start command ´S2´; LED **START** should light up. Test only the receive line by pressing the **START / STOP** key.

Error: Data transmission in the network does not function.

Remedy: Check to ensure that all devices are set to different addresses.
Address all devices individually via the terminal using command´Gxy´.
Addressed device is OK if at least ´y CR LF´ is returned as echo.
If transmission is still not possible, unplug the networked devices.
Check all devices individually on the data cable to the computer; (see above). Check the wiring for short-circuit or crossed wires.
Are all network distributors supplied with power? Network the devices again one at a time and check successively; (see above).

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

12. ELECTROMAGNETIC COMPATIBILITY (EMC)

The ALMEMO® 8490 data acquisition module complies in full with the safety requirements specified in the EU directive relating to electromagnetic compatibility (EMC) (89/336/EWG).

The following standards have been applied in evaluating the product.

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

IEC 61000-6-1:1997	IEC 61000-4-2: 1995+A1:1998+A2:2000 8kV
IEC 61000-6-3:1996	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 and that, if necessary, they are properly shielded so as to prevent spurious interference being induced in the system.
2. Using the device in strong electromagnetic fields may aggravate measuring errors. After exposure to such irradiation ceases, the device will again operate within its technical specifications.

13. APPENDIX

13.1 Technical data (see Manual 2.3)

Measuring inputs : **8490-TS** 10 sockets for miniature thermal connectors
8490-KS 10 inputs via 2 clamp connectors
Option U: 10 inputs, A - C, with 100:1 divider Accuracy 0.1 % (22 °C), drift 0.003 % / K
Option I: 10 inputs, A - B, with shunt, 2 ohms Accuracy 0.1 % (22 °C), drift 0.005 % / K
Measuring channels 10 primary channels, electrically isolated, maximum 30 additional channels for double sensors and function channels

Outputs : 2 ALMEMO® sockets for all output modules

Standard equipment
Operation 1 key
Date and time-of-day Real-time clock, buffered with lithium battery
Memory (option S) 512-KB EEPROM (64,000 to 100,000 meas. values)
Microprocessor : M16C62P

Power supply external 9 to 13 VDC
Mains adapter : ZB 2290-NA1, 230 VAC to 12 VDC, 0.2 A
Current consumption without input and output modules : active mode approx. 25 mA
Sleep mode approx. 0.05 mA

Housing Polystyrene 174x29x137 mm, Weight : approx. 435 g

Suitable conditions
Operating temperature -10 to +50 °C (storage temperature -20 to +60 °C)
Ambient relative humidity : 10 to 90 % rH (non-condensing)

Product overview

	Order no.
Data acquisition module ALMEMO 8490-TH	
10 inputs for miniature thermal connectors, maximum 40 channels 2 outputs, cascadable interface 1 key Real-time clock, 4-DU housing, mains unit 12V, 0.2A	MA 8490-TH
Data acquisition module ALMEMO 8490-KS	
same but 10 inputs with clamp connectors (included) for all analog sensors without power supply, and thermocouples with external cold junction compensation only	MA 8490-KS
same 10 inputs with 100:1 divider, only for 10V (0-26V)	MA 8490-KSU
same 10 inputs with shunt, only for 20mA (0..32mA)	MA 8490-KSI
Options S: integrated 512-KB EEPROM	OA 8490-S
Accessories	
Memory connector including multimedia card, minimum 32 MB (RS)	ZA 1904-MMC
DC power cable, 10 to 30 VDC, 12 V / 0.25 A, electrically isolated	ZB 2290-UK
ALMEMO® data cable with V24 interface, electr. isol., max. 115.2 kbaud	ZA 1909-DK5
ALMEMO® network cable, electrically isolated, maximum 115.2 KB	ZA 1999-NK5
ALMEMO® data cable with V24 interface, electr. isol., max.115.2 kbaud	ZA 1945-DK
ALMEMO® V6 input / output cable with trigger input and relays	ZA 1006-EAK
ALMEMO® recording cable, -1.25 to 2.00 V	ZA 1601-RK

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13.3 your contact