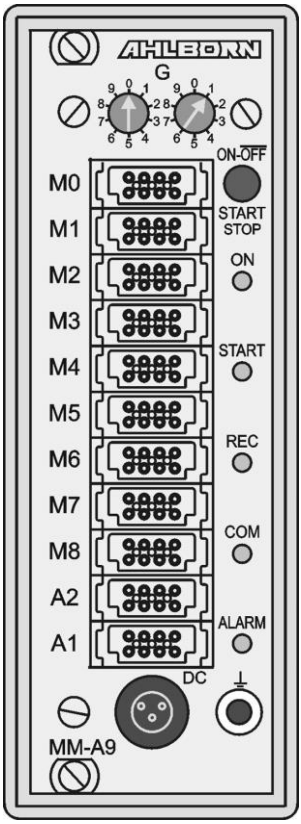
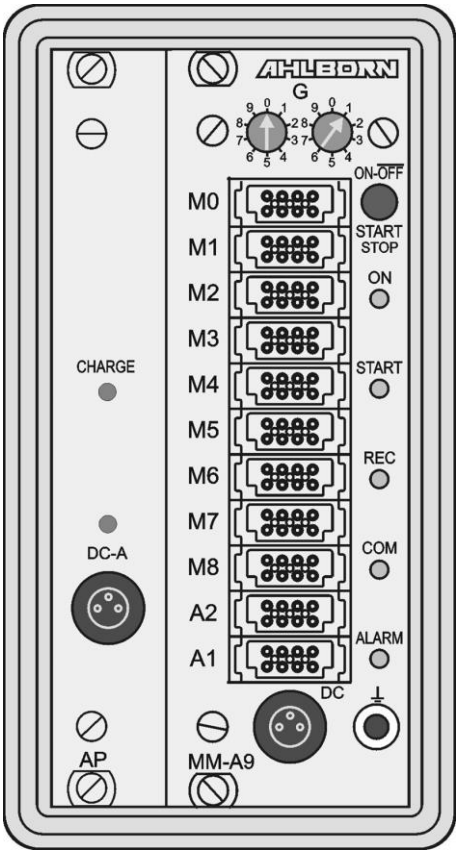
Operating instructions
English



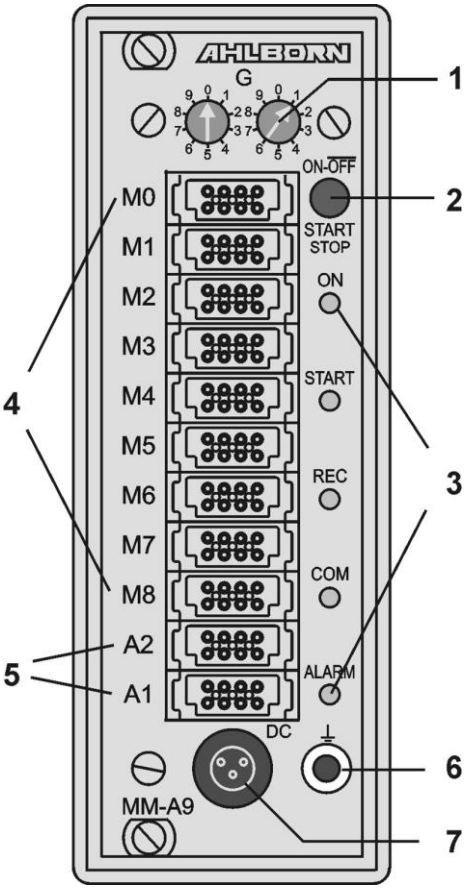


V6

Data acquisition modules ALMEMO® 8590-9 and 8690-9A

V1.6
26.01.2022

1. OPERATING CONTROLS



(1) Code switches
G: Device address 0 to 99

(2) Key ON/OFF, START/STOP
ON ON
START Start meas. operation
STOP Stop meas. operation
OFF OFF, Hold key pressed down

(3) Status LEDs
ON Device is on.
START Meas. operation started
REC Measuring with results saved
COM Measuring with output
ALARM Limit value exceeded
Sensor breakage, LoBat

(4) Measuring inputs M0 to M8
M0 to M8 for all ALMEMO® sensors
M9 to M39 31 additional channels

(5) Output sockets A1, A2
A1 USB Interface (ZA1919DKU)
Interface/optic fib. (ZA1909DK5/L)
RS 422 (ZA 5099-NVL/NVB)
Ethernet (ZA 1945-DK)
Bluetooth (ZA 1709-BTx)
Trigger input (ZA 1000-ET/EK)
Relay outputs (ZA 1000-EGK)
Analog output 1 (ZA 1601-RK)
A2 Network cable (ZA1999-NK5/NKL)
SD card connector (ZA1904SD)
Trigger input (ZA 1000-ET/EK)
Relay outputs (ZA 1000-EGK)
Analog output 2 (ZA 1601-RK)

(6) Ground socket

(7) Connection socket DC 12V
Mains adapter (ZB1212NAx, 12V, min. 1 A)
Cable, electr. isol. (ZB3090UK, 10-30V)

8690-9A only, recharg. battery pack AP :

(8) Connection socket DC-A 12V
Mains adapter (ZB 1212-NAx, 12V, min. 1.5 A)

(9) Status LEDs
DC-A Mains supply present
CHARGE Batteries are being charged

2. CONTENTS

3. GENERAL

Congratulations on your purchase of this new and innovative ALMEMO® data acquisition module. Thanks to the patented ALMEMO® connector the device configures itself automatically and thanks to the supplied AMR-Control software its operation should be fairly straightforward. The device can, however, be used with such a wide range of sensors and peripherals and offers 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 respect 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 that delivery is complete.

Measuring instrument ALMEMO® 8590-9 or 8690-9A
Mains adapter
These operating instructions

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

3.3 How to deal with rechargeable batteries

Usually when the device is delivered the batteries have not yet been charged. First of all therefore the batteries should be charged using the mains adapter provided; continue charging until the **CHARGE** lamp goes out.

Rechargeable batteries must never be short-circuited or thrown on the fire.

Rechargeable batteries are special waste and must not be discarded together with normal domestic waste.

3.4 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 temperature changes 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 integrated power supply are not electrically isolated from one another.
- 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

Data acquisition module ALMEMO® 8590-9 is a new member in our family of unique measuring devices - all equipped with Ahlborn's patented ALMEMO® connector system. The intelligent ALMEMO® connector offers decisive advantages when connecting sensors and peripherals because all parameters are stored in an EEPROM located on the connector itself; repeat programming is thus no longer necessary.

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.

Detailed explanation of the ALMEMO® system (Manual Ch 1)
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 RS-232, 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® 8590-9 and 8690-9A

Data acquisition module ALMEMO® 8590-9 is housed in a compact 8 DU case; it has 9 electrically isolated measuring inputs suitable for all ALMEMO® sensors. The measuring possibilities are virtually unlimited; there are 36 channels in the sensor connectors and 4 device-internal function channels - with over 70 measuring ranges. Thanks to the real-time clock incorporated as standard and the external memory connector with a SD 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. The ALMEMO® 8690-9A is housed in a 12 DU case; this contains the same measured data acquisition unit as the 8590-9. The difference is that it is is designed for optional mains-independent operation using a rechargeable battery pack.

4.1.1 Sensor programming

The measuring channels are programmed, completely and automatically, by the ALMEMO® connectors. However, the user can easily supplement or modify this programming via the interface.

Measuring ranges

Appropriate measuring ranges are available for all sensors with a non-linear characteristic, e.g. 10 thermocouple types, NTC and PT100 probes, infrared sensors, and flow transducers (rotating vanes, thermoanemometers, Pitot tubes). For humidity sensors additional function channels are available for calculating humidity variables such as dew point, mixture ratio, vapor pressure, and enthalpy. Even complex chemical sensors are supported. Measured values from other sensors can also be acquired using the voltage, current, and resistance ranges with individual scaling in the connector. Existing sensors can also be used - so long as the appropriate ALMEMO® connector is connected via its screw terminals. For digital input signals, frequencies, and pulses, adapter connectors are available with an integrated microcontroller. It is thus possible to connect virtually any sensor to any ALMEMO® measuring instrument and to change sensors without the need for any extra settings.

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 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 via interface 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 via interface and in the software.

Correction of measured values

The measured value on each measuring channel can be corrected both in terms of zero-point and gain; this means that even sensors usually requiring initial adjustment (e.g. expansion, force, pH) can be freely interchanged. Zero-point correction and, partly at least, gain adjustment can be performed at the touch of a button.

A **new** feature is the possibility of user-defined linearization or multi-point calibration.

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 value.

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. Hysteresis is set by default to 10 digits but this can be adjusted to any number between 0 and 99. The exceeding of a limit value can also be used to start or stop measured value recording automatically.

Sensor locking
All sensor data stored in the connector EEPROM can be protected by means of a graduated locking function against undesired access.

4.1.2 Measuring operations

A total of up to 36 measuring channels are available for 9 transducers; i.e. it is also possible to evaluate double sensors, individually scaled sensors, and sensors with function channels. All activated measuring points are continuously scanned at a rate of 10 mops (measuring operations per second). If there are a lot of measuring points involved the response time can be shortened by increasing the measuring rate accordingly. If the selected measuring point (M0) needs to be smoothed or output at an analog output, it can be assigned preferred status; it will then be rescanned with each 2nd cycle (semi-continuous mode).

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
With some sensors, to achieve optimal measured value acquisition, certain special measuring functions are required. Cold junction compensation is provided for thermocouples; temperature compensation is provided for dynamic pressure, pH, and conductivity probes; and atmospheric pressure compensation is provided for humidity sensors, dynamic pressure sensors, and O_2 sensors. On infrared sensors the parameters for zero-point correction and gain correction

are used as the background temperature and the emissivity factor.

Maximum and minimum values
Each measuring operation acquires and stores the maximum and minimum values with da

Measured value smoothing
Measured values of an unstable or strongly fluctuating nature can be smoothed by taking a sliding average over a number of values programmable from 2 to 99.

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 24 h. 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. Function channels are available for the cyclic output and storage of these average values.

Measuring rate
The available measuring rates are 2.5, 10, 50 or 10 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 micro SD card can simply 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 keypad and interface 4 analog outputs (ZA8006-RTA3) and up to four output relays 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 specifically for the company or 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 RS-422 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 : Plug in sensor at sockets **M0** to **M8** (4); see Ch 7.

2. Power supply : Connect mains adapter at socket **DC** (7); see Section 6.1.

3. Switching on : Press the **ON** key (2); see Section 6.5-

4. Device configuration by PC via the interface :

Connect 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; Man 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 text editor

5. Measured data acquisition from PC without saving in device :

Activate <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>
Activate file e.g. from MS-Excel and import using ";" as separator; Man. 6.1.4.

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

Activate <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 the **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 the **START/ STOP** key.

Transferring data from memory to the computer

If you are using a memory connector remove the micro SD 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 activate <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.
Activate file e.g. from MS-Excel and import using ";" as separator; s. Man 6.1.4.

6. POWER SUPPLY

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

Mains adapter 12V / min. 1 A (ALMEMO 8590-9)	ZB 1212-NAx
Mains adapter 12V / min. 1.5 A (ALMEMO 8690-9A)	ZB 1212-NAx
Rechargeable batteries NiMH 9.6V / 1600mAh (ALMEMO 8690-9A only)	MA 8690-9A
Electrically isolated power supply cable, 10 to 30 VDC, 0.25 A	(ZB 3090-UK)
Electrically isolated power supply cable, 10 to 30 VDC, 1.25 A	(ZB 3090-UK2)

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 (for type see above); connect it to the socket DC (7). Please ensure the mains voltage is correct !

6.2 External DC voltage supply

The **DC** socket (7) 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 an electrically isolated supply cable must be used, either the ZB 3090-UK or, for the ALMEMO® 8690-9A because of the battery charging current at socket DC-A, the ZB 3090-UK2 (1.25 A). It will then be possible to use the measuring instrument in a 12-volt or 24-volt on-board supply system.

6.3 Battery operation (8690-9A only)

To permit mains-independent operation the ALMEMO® 8690-9A has a larger housing containing module AP with eight NiMH rechargeable batteries (9.6 V / 1600 mAh). At a current consumption of approx. 25 mA this will give an operating time of approx. 60 hours. To prolong the operating time for the purposes of long-term recording the device can be left in SLEEP mode; (see 9.2.1). When the remaining capacity of the rechargeable batteries drops to approx. 10%, the **ALARM** LED in the display will start flashing; as soon as this happens the batteries must be recharged. If the batteries are completely discharged the device will switch off to avoid the risk of critically low discharge. The measured data and time-of-day will, however, be retained; see 6.6. The NiMH rechargeable batteries can in fact be recharged at any time and in any charge status using the

intelligent charge circuitry. To charge the batteries the mains adapter ZB 1212-NA9 (12 V / 2.5 A) must be connected to socket DC-A on the battery module. The "**CHARGE**" lamp should then light up indicating that the batteries are being recharged. After approx. 2.5 hours the batteries should be fully recharged and the lamp switches off; the charge circuitry has switched over to trickle charge. The mains adapter can thus be left permanently connected to the measuring instrument in buffer mode without risk of overcharging the batteries. If you prefer not to recharge the batteries at the moment, e.g. to prevent the device from warming up during thermocouple measurement, you can connect the mains unit to the DC socket (7).

6.4 Sensor supply

At the terminals + (plus) and – (minus) in the ALMEMO® connector there is, for mains operation, a sensor supply voltage, 12 V, 400 mA, available (self-healing fuse, 500 mA). During battery operation the battery voltage is available, 9 to 11.5 V. Other voltages (12, 15, or 24 V or references for a potentiometer and strain gauge) can be obtained using special connectors; (see Manual 4.2.5 and 4.2.6).

6.5 Switching ON / OFF,

To switch the device **ON / OFF** the **ON - OFF key** (2) must be pressed.
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 6.6).

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** (1), 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 in the ALMEMO® connectors always remains intact.

6.6 Data buffering

The sensor's programming is stored in the EEPROM on the sensor connector and the device's calibration and programmed parameters are stored in the EEPROM on the instrument itself, both 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 TRANSDUCERS

Virtually any ALMEMO® sensor can be connected to any of the ALMEMO® input sockets M0 to M8 on the measuring instrument (4). To connect your own existing sensors you simply need the appropriate ALMEMO® connector.

7.1 Transducer

The ALMEMO® Manual includes detailed descriptions of the comprehensive ALMEMO® range of sensors (see Manual Ch 3) and instructions for connecting your own existing sensors to ALMEMO® instruments (see Manual Ch 4). All standard sensors with an ALMEMO® connector usually have the measuring range and units already programmed and can thus be connected to any input socket without further adjustment. A mechanical coding system ensures that sensors and output modules can only be connected to the correct sockets. All ALMEMO® connectors incorporate two snap-lock levers; these snap into position as soon as the connector is inserted into the socket, thus preventing unintended disconnection if the cable is accidentally pulled. To withdraw the connector, both these levers must be pressed in at the sides.

7.2 Measuring inputs and additional channels

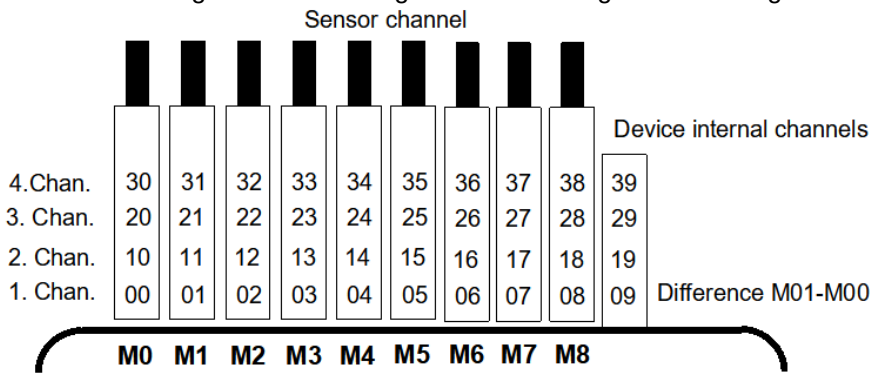
Measuring instrument ALMEMO® 8590-9 has 9 input sockets (4) to which initially measuring channels M0 to M8 are allocated. However, ALMEMO® sensors can, if required, provide up to 4 channels with 9 input sockets each so that altogether 36 channels are available. The additional channels can be used in particular for humidity sensors with four measuring variables (temperature / humidity / dew point / mixture ratio) or for function channels. Each sensor can if necessary be programmed with several measuring ranges or scaling settings; and two or three sensors, if pin assignment so permits, can be combined in a single connector (e.g. rH / NTC, mV / V, mA / V, etc.). The additional measuring channel numbers per connector go up in steps of 10 (e.g. the first sensor has channels M0, M10, M20, M30, the second sensor has channels M1, M11, M21, M31 etc.).

Device-internal channels

A further innovation on this device is its four additional device-internal channels. The first of these M9 is programmed by default as differential channel M1 – M0. This only applies, however, if there are two sensors with the same units and same decimal point position connected at measuring points M0 and M1. However, all four channels can be programmed with any other function channels (e.g. U-Bat, cold junction compensation, average, volume flow, etc.); (see Manual 6.3.4). The reference channels used are by default Mb1 = M1 and Mb2 = M0.

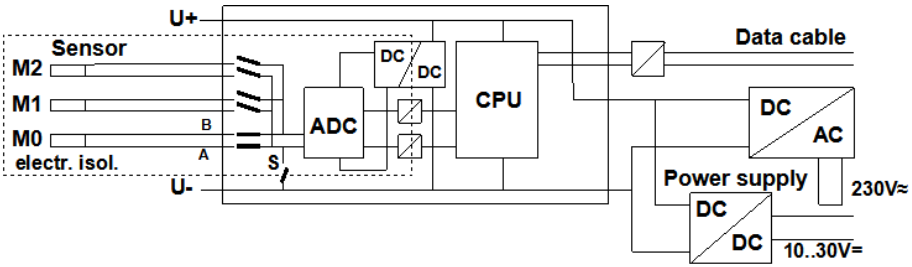
The **advantage** of device-internal channels is that when using several sensors for the same application these sensors do not have to be reprogrammed and

can be exchanged without losing the function channels. However, if the whole application operates with just one sensor, then programming on the sensor itself makes more sense.
On the measuring instrument 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 unequal potentials are electrically isolated.



The 9 analog inputs are electrically isolated from one another by means photo-voltaic 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).

However, some components are not electrically isolated**,** namely all sensors connected to the same common internal power supply ±U or combined sensors within one connector. For these sensors the electrical isolation usually has to be disabled by means of relay S (see above) or by wire jumper; some inputs would otherwise be left without reference potential. The relay is set automatically by

element flag 5 ´**ISO OFF**´ the first time it is connected; (see Manual 6.10.3). However, with certain connectors (especially divider connectors without power supply) element flag 5 should be checked and if necessary corrected. These sensors must themselves be isolated or the device must be operated with an electrically isolated power supply (mains adapter or connecting cable ZA2690-UK with DC/DC converter).

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

8. OPERATION AND CONFIGURATION

Data acquisition module ALMEMO® 8590-9 has only a few operating controls; it is operated mainly via a PC.

8.1 Combination key

The first function of the one and only key **ON/OFF - START/STOP** (2) has already been described in Section 6.5.

Press to switch ON and press and hold down **to switch OFF again**.

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 (3) report the current device status :

ON Device is on.

ON flashes once briefly Device is in sleep mode.

START Measuring operation is started.

COM continuous Measured value transmission to the PC - cyclic

COM flashes Measured value 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 once briefly Once-only measuring point scan from PC

COM flashes once briefly Once-only measuring point scan transfers data to PC

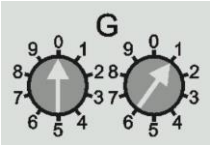
REC flashes once briefly Once-only meas. point scan saves data on the device

ALARM Limit value exceeded or sensor breakage

ALARM flashes once briefly Device supply voltage too low

8.3 Device address and networking

ALMEMO® 8590-9 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 all measuring instruments must be set, by means of their code switches (1), 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 modify the programming of 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 programmed via a terminal by means of ASCII commands.

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 micro SD 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 in the device or an external memory connector with a micro SD card (ZA 1904-MMC); in either case 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 - Record 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 - Data 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; 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. The measuring operation can be stopped by twice pressing 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® 8590-9 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 connector 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 Micro SD card

Another convenient feature for data recording without option S is provided by the newly developed memory connector (ZA 1904-SD) with a conventional SD memory card. The memory card is written to it via the memory connector in table mode and in standard FAT16 format. The SD 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 SD memory connector :

Virtually unlimited memory capacity
With each new sensor 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 ALMEMO® 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. OPTION KL

Special measuring ranges linearization, multi-point calibration, calibration data management

Thanks to the new ALMEMO® special connectors with extra memory for additional data (bigger EEPROM, code E4) the following tasks can now be performed for the first time with great elegance :

1. Provision of special measuring ranges with internal characteristic
2. User-defined linearization of signals for voltage, current, resistance, or frequency
3. Multi-point calibration of all sensors
4. Serial number and calibration data management in the sensor

The ALMEMO® 8590-9 can as standard evaluate all appropriately programmed special connectors. With option KL you can also convert measuring signals into equivalent display values based on a characteristic of up to 35 support points. These support points can be programmed to the EEPROM in the ALMEMO® connector using the AMR-Control software (menu <Measuring points> list <Program measuring point>, <Measuring point>, multi-point calibration / special linearization). During a measuring operation the measured values between these points are interpolated on a linear basis. When correcting non-linear sensors (e.g. with PT100 or thermocouple sensors) initially the original characteristics are considered; then only the deviations are interpolated on a linear basis and inserted.

If a channel with a characteristic is deactivated or programmed with a different range, the characteristic can subsequently be reactivated by restoring the special range using command ´B99´.

Other information that can be entered in the extended connector includes the order number, the serial number, the date of the next calibration, and the calibration interval. In internetworked systems this permits automatic monitoring of the calibration intervals; (for commands see Ch 11).

11. TROUBLE-SHOOTING

Data acquisition modules ALMEMO® 8590-9 and 8690-9A can both 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, no reaction from the keys
Remedy Check the power supply, charge the battery, switch off and then on again.
If necessary, re-initialize; (see 6.5).

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 Fluctuating measured values 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, isolate 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 6.5) with the interface module connected, the baud rate will be set to 9600 baud.
Is the correct COM interface on the computer being addressed ?
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 approx. +9V positive voltage and the LEDs light up red; for the duration of data transmission the data LEDs must 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´ (s. Man. 6.2.1).
Enter <ctrl Q> for XON, if the device is in the XOFF status.
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 with 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. DECLARATION OF CONFORMITY

AHLBORN

Doc-Nr. CE_MA85909_001_20181005_R1.doc

EU-Konformitätserklärung

EU-Declaration of Conformity

nach/*according to* EN 17050-1

Hersteller: *Manufacturer:*	**Ahlborn Mess- und Regelungstechnik GmbH**
Adresse: *Address:*	Eichenfeldstrasse 1 83607 Holzkirchen Germany

bestätigt, dass das Produkt
declares, that the product

Produktbezeichnung: *Product Name:*	Präzisionsmessgerät Almemo® 8590-9
Produkt Typ: *Product Type:*	MA85909
Produkt Optionen: *Product Options:*	Alle/*all*

den nachfolgenden Europäischen Anforderungen und Richtlinien entspricht und folglich das CE Zeichen trägt.
conforms to following European Product Specifications and Regulations and carries the CE marking accordingly.

2014/35/EU	Niederspannungsrichtlinie *Low Voltage Directive*
2014/30/EU	EMV Richtlinie *EMC Directive*
2014/53/EU	R&TTE Richtlinie *R&TTE Directive*
Angewandte harmonisierte Normen und technische Spezifikationen: *Applied harmonised standards and technical specifications:*	Sicherheit *(Safety)* EN 61010-1: 2010+A1 EMV *(EMC)* EN 61326-2-3: 2013 Tabelle 2

Holzkirchen, 05.10.2018
Ort, Datum der Ausstellung
Place, date of issue

Schmidt

Entwicklungsleitung

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EU-Konformitätserklärung

EU-Declaration of Conformity

nach/*according to* EN 17050-1

Hersteller: *Manufacturer:*	**Ahlborn Mess- und Regelungstechnik GmbH**
Adresse: *Address:*	Eichenfeldstrasse 1 83607 Holzkirchen Germany

bestätigt, dass das Produkt
declares, that the product

Produktbezeichnung: *Product Name:*	Präzisionsmessgerät Almemo® 8690-9A
Produkt Typ: *Product Type:*	MA86909A
Produkt Optionen: *Product Options:*	Alle/*all*

den nachfolgenden Europäischen Anforderungen und Richtlinien entspricht und folglich das CE Zeichen trägt.
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13. APPENDIX

13.1 Technical data

Measuring inputs : 9 ALMEMO® sockets, suitable for ALMEMO® flat connectors
Measuring channels : 9 primary channels, electr. isol., max. 31 additional channels for double sensors and function channels
A/D converter : Delta - sigma, 24-bit, 2.5 / 10 / 50 / 10 mops, adjustable 1 to 100
Sensor voltage supply : With mains adapter : 12 V, 0.4 A, with rechargeable battery : 9 to 11.5 V, 0.2 A

Outputs : 2 ALMEMO® sockets for all output modules

Standard equipment :
Operation : 1 key
Date and time-of-day : Real-time clock buffered (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 8590-9 : ZB 1212-NAx, 230 VAC to 12 VDC, min. 1 A
Mains adapter 8690-9A : ZB 1212-NAx, 230 VAC to 12 VDC, min. 1.5 A
Rechargeable battery in the 8690-9A : 8 NiMH cells, AA, 9 to 11.5 V, 1600 mAh
Current consumption without active mode : approx. 25 mA
Input and output modules : Sleep mode : approx. 0.05 mA

Housing : 8590-9 : Polystyrene, LxWxH 180x49x137 mm , weight: 490 g
8690-9A : Polystyrene, LxWxH 218x77x145 mm

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

13.2 Product overview

	Order no.
Data acquisition module ALMEMO® 8590-9	
9 inputs, maximum 40 channels, 2 outputs, cascadable interface, 1 key, real-time clock, in 8 DU housing, mains unit 12 V, 0.6 A	MA 8590-9
Data acquisition module ALMEMO® 8690-9A	
ditto except 12 DU housing with bus and rechargeable battery pack (8 NiMH cells, 1600 mAh), mains unit 12 V, 2 A	MA 8690-9A
Options	
S: integrated 512-KB EEPROM	OA 8590-S
Q4: Conversion rate of 400 mops for a measuring point with MMC	SA 0000-Q4
R: Measuring ranges for temperature display of 8 refrigerants	SB 0000-R
KL: Linearization, multi-point calibration, calibration data management	OA 8590-KL
Accessories	
Memory connector including micro SD card, minimum 128 MB	ZA 1904-SD
DC power cable, 10 to 30 VDC, 12 V / 0.25 A, electrically isolated	ZB 3090-UK
ALMEMO® data cable with USB interface, electr. isol., max.115.2 kbaud	ZA 1919-DKU
ALMEMO® data cable with V24 interface, electr. isol., max. 115.2 kbaud	ZA 1909-DK5
ALMEMO® network cable, electrically isolated, maximum 115.2 kbaud	ZA 1999-NK5
ALMEMO® cable with Ethernet interface, electr. isol., max. 115.2 kbaud	ZA 1945-DK
ALMEMO® input / output cable for triggering and limit value alarms	ZA 1000-EGK
ALMEMO® recording cable, -1.25 to 2.00 V	ZA 1601-RK

13.3 Index

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