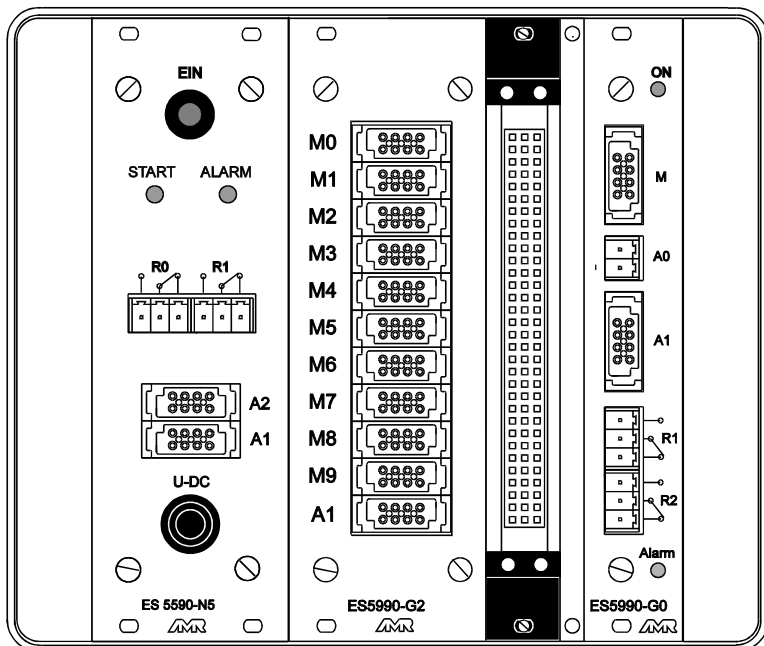


## V5



## Operating Instructions

# Data Acquisition System ALMEMO® 5990-1 V5

V1.0  
17.10.2000

# Operating Instructions

## Data Acquisition System

### ALMEMO 5990-1

For Reference with the ALMEMO® Manual

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# 1. INTRODUCTION

The data acquisition system ALMEMO® 5990-1 *Version 5* is an instrument from the unique product range of measuring devices that are all equipped with the ALMEMO® connector system, which has been patented by Ahlborn GmbH. The intelligent ALMEMO® connector provides important advantages with regard to the connection of sensors and peripherals as all parameters are stored in an EEPROM within the connector. As a result, the programming that usually has to be performed for the connection is not required. All sensors and output modules can be connected to all ALMEMO® measuring devices in the same way. The operation and programming is identical with all units. Therefore, all of the ALMEMO® measuring system items listed below are described, in detail, in a separate ALMEMO® manual that is supplied with every device:

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

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

## 1.1 Function Range

The system ALMEMO® 5990-1 is a modular, universal data acquisition system with a total of up to 100 measuring circuit boards, which can also be housed and networked locally in many individual housings. Each device is, as a minimum, equipped with a power supply, bus board and a master measuring circuit board ES5590-G2/G3 with 10 inputs. Depending on the size of the housing, the measuring circuit board can be extended by up to 8 passive selector switch boards ES 5590-MF or MU or by several active slave meas. circuit boards ES5590-G2/G3 with 10 inputs each. Alternatively, it is also possible to use individual, active meas. circuit boards ES5590-G0 with a measuring input, without selector switch boards. The additional modules can also be externally networkable ALMEMO® devices. The 2 output sockets A1 and A2 of the power supply plug-in module allow for connecting the interface cables with digital interface to the sockets A1 of the measuring modules, cables with analog output or alarm contacts.

## SENSOR PROGRAMMING

The measuring channels are automatically programmed by the ALMEMO® connectors of the sensors. However, the user can easily complete or modify the programming via keyboard or via interface, even without influencing the process of measuring.

### Measuring Ranges

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

### Function Channels

Maximum, minimum, average values and differences of certain measuring junctions can be programmed as function channels and can be processed and printed like normal measuring junctions. Furthermore, function channels for special measuring tasks are provided to determine temperature coefficients  $Q/\Delta t$  and wet bulb globe temperatures.

### Dimension

The 2-digit dimension can be altered for each measuring channel so that the display and the printout will always indicate the correct dimension, for example when a transmitter is connected. The conversion from °C to °F is automatically performed according to the dimension.

### Name of Measured Values

Sensors can be identified by a 10-digit alphanumeric designation. It is entered via the interface and appears on the printout or display if the evaluation is done via PC.

### Correction of Measured Values

For correcting measured values a zero point and slope (gain) correction can be applied to the measured value of each measuring channel. This also allows for sensors to be interchanged that usually, at first, require an adjustment (expansion, force, pH).

### Scaling

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

### Limit Values and Alarm

Two limit values (1 max and 1 min) can be set for each measuring channel. An alarm value printout can be performed if a limit value is exceeded and, by means of relay output modules, alarm contacts are provided that can be individually allocated to limit values. As a standard, the hysteresis is set to 10 digits, however, it can also be adjusted.

## Sensor Locking

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

## MEASUREMENT

4 measuring channels are available for each measuring input, i.e. it is also possible to evaluate double sensors, individually scaled sensors, or sensors with function channels. The selected measuring point can be scanned with a conversion rate of 2.5 or 10 measurements/second. The measured value is calculated and, if available, provided on the analogue output.

### Measured Value

A continuous registration of the measured value of the selected measuring point, including an automatic zero point correction and optional correction of the measured value or new scaling. Sensor breakage recognition except with current measurements.

### Analogue Output and Scaling

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

### Measuring Functions

Special measuring functions are required for some sensors in order to achieve an optimal acquisition of measuring data. The cold junction compensation is available for thermocouples, a temperature compensation for dynamic pressure and pH and conductivity probes, and an atmospheric air pressure compensation for humidity sensors and O<sub>2</sub> sensors. With infrared sensors the parameters zero point and slope correction are used for background temperature and emissivity factor.

### Maximum and Minimum Value

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

## PROCESS FLOW PROGRAMMING

A cyclic measuring point scan with a time-based process flow control is required to register the measuring data of all connected sensors. If one active measuring circuit board is available only, it can independently perform the measuring point scan with its own time control, print cycle and measuring cycle and, if fast processing is required, the conversion rate. The measurement can be started and stopped by using the interface, an external trigger signal or an exceeding of limit values. If several active modules or devices are networked an external CPU, either from an ALMEMO® system 5590-3 or a PC with data acquisition software, will be required to perform the process control.

### Time and Date

The time and date or the pure measuring time are used for recording the measurement.

### Print Cycle

The print cycle is programmable between 1s and 59h/59min/59s and allows for a cyclic output of measured values to the interfaces or memories and a cyclic averaging.

### Print Cycle Factor

If necessary, the print cycle factor allows for limiting the data output of particular channels so that an excessive data flow can be limited, especially during data storage.

### Measuring Cycle

The measuring cycle, also programmable between 1s and 59h/59min/59s, is for a cyclic scanning with a display of all measured values, limit value monitoring including alarm message and output of alarm values, averaging and, if necessary, a storage of measured values.

### Average Value

The measured values that result from data scanning can be averaged as desired either over the total measuring time or over the print cycle time. Function channels are provided for a cyclic output of average values.

### Conversion Rate

With ALMEMO® V5 devices, all measuring points can be continuously scanned with the conversion rate (2.5 or 10 meas./s). It is possible to provide an output of all measured values via the interface.

### Output

All data logs, measured values and programmed parameters can, via interface, be provided as output to any peripheral equipment. Interface cables are available for RS232, RS422 or Centronics interfaces. The output of measuring data can be selected in list format, columns or spreadsheet format. Files in spreadsheet format can be processed by each spreadsheet software. The print header can be programmed specifically to the company or application.

### Networking

The data acquisition system ALMEMO® 5990-1 can be extended by up to 99 internal measuring modules, further systems or other ALMEMO® devices, either by simply connecting them with network cables or, in case of longer distances, by using RS422 network distributors.

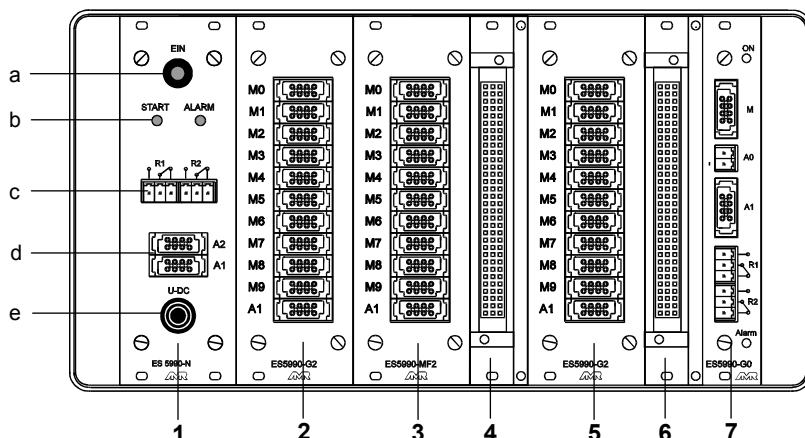
### OPTION Data Memory

Each active measuring circuit board can optionally be equipped with real time clock and 500 kB (100,000 measured values) or 2MB (400,000 measured values) of buffered data memory. Depending on the programming the measured values of all possible measuring point scans or just alarm values can be stored. The memory organisation can be configured as linear or ring memory. The output can optionally be performed via the interface, or, if available, via the analog output. In case of a digital output it is possible to select by a certain time interval, number or alarm value.

### SOFTWARE

The AMR-Control software, which allows for the entire programming of the sensors, the configuration of the measuring instrument and, if available, the read-out of the data memory is supplied with each ALMEMO® manual. The integrated terminal also allows for online measurements by using a measuring circuit board. The WINDOWS® software packages, Win-Control and DATA-Control, are available for data acquisition of networked devices and modules, graphical presentation and complex data processing.

## 1.2 Operating Controls



### Standard Equipment:

#### (1) Plug-In Module ES 5990-N: Power Supply and Outputs

- (a) **ON Switch:**
- |                           | Device | Control Lamp          |
|---------------------------|--------|-----------------------|
| not depressed:            | OFF    | off                   |
| depressed:                | ON     | on                    |
| Option rech. batt.:       | ON     | on (recharging)       |
|                           | ON     | flashing (recharged)  |
| without pow. supply unit: | ON     | off (batt. operation) |
- (b) **Control Lamps:** **START** green meas. point scan in progress  
**ALARM** red limit value exceeding or sensor breakage
- (c) **Alarm Relay:** 2 relay outputs **R0** and **R1** with make and break contacts
- (d) **Interface:**
- A1 V24 interface to PC with cable ZA1909-DK  
V24 interface with fiber optics ZA1909-DKL  
RS422 with network distributor ZA 5099-NV  
Networking with network cable ZA1999-NK  
Triggering with cable ZA 1000-EK/ET  
Trigger and 2 relay outputs with cable ZA 1000-EGK
- A2
- (e) **Socket U-DC:** 12VDC  $\pm 5\%$  for netw. adapter ZB 5090-NA2, 12V, 0.8A  
Option U: 10..36VDC electr. isol. with DC/DC converter, 12V, 1A  
Option A: 12VDC for recharg. batt. f. mains adapter ZB 5090-NA2

**Option Master Meas. Circ. Bd. ES 5590-G2, ES 5590-G3 or ES 5590-G0**  
 extendible with passive selector switch boards (not applic. for ES5590-G0)

- (2) **Plug-In Module ES 5590-G2: Active Master Meas. Circ. Bd. ALMEMO®**  
 M00 to M09 10 meas. inputs for all sensors with ALMEMO® conn.  
 M10 to M39 max. 30 add. chann. f. double sensors and arithm. chann.  
 A1 analogue output with cable ZA 1601-RK  
 2 alarm outputs with cable ZA 1000-EGK  
 2 CODE SWITCHES modul address 00 to 99 internally on-board

### **Extension with Passive Selector Switch Boards:**

- (3) **Plug-In Modul ES 5590-MF: Passive Selector Switch Board ALMEMO®**  
 Mx0 - Mx9 10 measuring inputs for all sensors with ALMEMO® conn.  
 Mx0+10-Mx0+39 max. 30 add. chann. f. double sensors and arithm. chann.  
 A1 2 alarm outputs with cable ZA 1000-EGK  
 1 CODE SWITCH board number 0 to 7 internally on-board
- (4) **Plug-In Module ES 5590-MU: Passive Selector Switch Board MU**  
 Mx0 to Mx9 10 meas. inputs for analogue sensors without power  
 supply with 10-fold connector ZA 5590-MU  
 LV max, LV min 2 alarm outputs f. all meas. points of the plug-in module  
 1 CODE SWITCH board number 0 to 7 internally on-board

### **Extension with Active Meas. Circ. Boards (passive not extendible)**

- (5) **Plug-In Module ES 5590-G2: Active Meas. Circuit Board ALMEMO®**  
 M00 to M09 10 measuring inputs for all sensors with ALMEMO® conn.  
 M10 to M39 max. 30 add. chann. f. double sensors and arithm. chann.  
 A1 analogue output with cable ZA 1601-RK  
 2 alarm outputs with cable ZA 1000-EGK  
 2 CODE SWITCHES module address 00 to 99 internally on-board
- (6) **Plug-In Module ES 5590-G3: Active Measuring Circuit Board MU**  
 M00 to M09 10 meas. inputs for analogue sensors without power  
 supply with 10-fold connector ZA 5590-MU  
 2 CODE SWITCHES module address 00 to 99 internally on-board
- (7) **Plug-In Mod. ES5590-G0: Active Meas.Circ. Bd with 1 ALMEMO® Input**  
 M00 1 measuring input for all sensors with ALMEMO® conn.  
 M01 to M03 3 addit. channels f. double sensors and arithm. chann.  
 AA analogue output internally electrically isolated  
 (option R1:2V, R2:10V, R3:20mA)  
 A1 analogue output not electr. isol. with cable ZA 1601-RK  
 R1 alarm contact alarm contact 1 lim. val. Max, make and break contact (50V, 300mA)  
 R2 alarm contact alarm contact 2 lim. val. Min, make and break contact (50V, 300mA)  
 2 CODE SWITCHES module address 00 to 99 internally on-board



## 2. INITIAL OPERATION

1. Connect the **transducers** to the sockets Mxx (2), see 4.
2. **For power supply** connect mains adapter to socket **U-DC** (1e), see 3.1.
3. **For switch-on** operate the push button (1a), see 3.4.
4. **Data output** to printer or computer  
Connect peripheral device via data cable to socket **A1** (1d), see man. 5.2.  
Set 9600 bd, 8 data bits, 1 stop bit, no parity at peripheral device.  
Enter time and date as required, see manual 6.2.8.  
Program print cycle and output format, see manual 6.5.2/6.5.5.  
Start and stop the automatic measuring point scan, see manual 6.6.  
If a meas. point scan or a cycle is running, the LED **START** (1b) will be on.
5. **Data acquisition** via computer  
Connect the computer via data cable to socket **A1** (1d), see man. 5.2.1.  
Set 9600 bd, 8 data bits, 1 stop bit, no parity at peripheral device.  
Activate and start the data acquisition software.
6. **Monitoring of limit values**  
Enter the limit values, see manual 6.3.9.  
Program the measuring cycle, see manual 6.5.3.  
For alarm value outputs connect printer via data cable to socket **A1** (1d), see manual 5.2.  
Connect the alarm device to socket **R0** or **R1** (1c), see manual 5.1.2.  
Start and stop the automatic measuring point scan, see manual 6.6.  
If a meas. point scan or a cycle is running, the LED **START** (1b) will be on.  
If an alarm occurred the red LED **ALARM** (1b) will be on.

### 3. POWER SUPPLY

#### 3.1 Mains Operation

The mains adapter ZB 5090-NA2 for 230VAC to 12VDC, 0.8A, is used for the power supply of the measuring instrument. It is connected to the socket U-DC (1e) and is locked by turning it to the right.

#### 3.2 Operation with Rechargeable Battery (Option OA 5590-A)

With the option A, a rechargeable NiCd battery with 1.5 Ah will be installed, which allows, in case of one measuring circuit board with a power consumption of approximately 30 mA, an uninterrupted operating time of 50 hours. In case of several measuring circuit boards and sensors that require additional current (e.g. humidity sensors FH A646 2mA or rotating vanes approximately 3mA) the operating time will be shorter. An exact determination of the voltage of the rechargeable battery and an estimation of the remaining operating time are available with the measuring channel 'Batt'.

The ZB 5090-NA2 mains adapter supplied allows for fully recharging a discharged battery within 2 h. During this process the green lamp in the ON switch (1) will be continuously on. (*Attention: During this time, due to the heat build-up in the device, it is possible that thermocouple measurements with internal cold junction compensation might be badly influenced!*). When the green lamp flashes, the rechargeable battery is fully recharged and the charge circuitry switches to trickle charge. As a result, the power supply can, during buffer operation, remain connected to the measuring instrument.

#### 3.3 External Power Supply (Option OA 5590-U)

If the instrument is intended to have an external voltage supply the power supply plug-in module with option U (OA 5590-U) is required. It has a wide input voltage range from 10 to 36V DC and an electrical isolation allowing that the instrument can be operated with 12V or 24V mains supply. The cable ZB 5090-EK with 2 banana plugs (1e) must be used for the connection. However, the mains adapter ZB 5090-NA2 still allows for operation with mains supply.

#### 3.4 Switch On/Off

The switch (1a) is used for **switching** the device **on** or **off**. If a rechargeable battery is installed (option A) the lamp serves as a charge control (see 3.2).

When switching the device off the momentary operation status of the system is lost. However, the device configuration and the programming of the sensors in the ALMEMO® connectors will not be influenced at all.

Meas. circuit boards with the **option S** are buffered with a Lithium battery, so that the memory, all parameters and the real time clock will remain active after the device has been switched off.

## 4. CONNECTION OF THE TRANSDUCERS

Any ALMEMO® sensors can be connected to the ALMEMO® input sockets Mxx of the device. For connecting existing sensors it is only necessary to connect a corresponding ALMEMO® connector.

### 4.1 Transducers

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

**The programming of the sensor connectors** can only be altered via the serial interface on the ALMEMO® 5990-1 (see man. section 6). However, this can be performed using very simple commands with a PC, via the configuration software AMR-Control or via a terminal (e.g. Windows Terminal). By storing the data in the connector the programming can also be performed using ALMEMO® 2290 series handheld instruments via keypad. In all cases the sensor connector must be connected to the selected channel. When programming, it must be considered that factory-set parameters are protected with a locking mode against unintentional alteration and that the locking level must be decreased if an alteration is required. The connectors ZA9000-FS or ZA5590-MU are not locked and, therefore, most suitable for self-programming.

### 4.2 Measuring Inputs, Additional Channels

**The master plug-in module ES 5590-G2** of the system ALMEMO 5990-1 has 10 input sockets with, at first, the meas. channels M0 to M9 being allocated to them. However, ALMEMO® sensors can, if required, provide up to 4 channels so that 40 channels are available with 10 input sockets. The additional channels can be especially used with humidity sensors with 4 meas. variables (temperature, humidity, dew point, mixture ratio) or used for function channels. If required, the sensor can also be programmed with several ranges or different scaling or, depending on the pin assignment, 2 or 3 sensors can be combined in one connector (e.g. TE/Ntc, mV/V, mA/V etc.).

The additional meas. channels of a connector are increased in steps of 10 (e.g. the first sensor has the channels M0, M10, M20, M30, the second sensor has the channels M1, M11, M21, M31 etc.).

	M0	M1	M2	M3	M4	M5	M6	M7	M8	M9	A1
chann.1	00	01	02	03	04	05	06	07	08	09	
chann.2	10	11	12	13	14	15	16	17	18	19	
chann.3	20	21	22	23	24	25	26	27	28	29	
chann.4	30	31	32	33	34	35	36	37	38	39	



All analogue inputs are electrically isolated by using photovoltaic relays and a potential difference of 50V at maximum is permissible between them. However, sensors combined within one connector and sensors with an own power supply are electrically connected to each other and must, therefore, be operated in isolation. The voltage applied to the measuring inputs must not exceed  $\pm 5V$  (between B,C,D and A or - respectively).

The cold junction compensation for thermocouple measurement is integrated in socket M3 of the device.

## Options Master Plug-In Board OA 5590-G3 or OA 5590-G0

Alternatively, the system can be equipped with a master plug-in board ES 5590-G3 or ES 5590-G0.

The master plug-in board **ES 5590-G3** (see below) has no additional channels. The sensor connection and the cold junction compensation are established through the 10-fold connector ZA 5590-MU. A passive extension with selector switch boards is available.

The master plug-in board **ES 5590-G0** has only one measuring input M0 with the additional channels M1 to M3. A passive extension is not available.

## 4.3 Extension of the Measuring Points

Principally, a total of 8 passive and 100 active modules can be used for the **extension of the measuring points**.

### Extension with Passive Selector Switch Boards

The master meas. circuit board ES 5590-G2 or ES 5590-G3 can trigger up to **8 passive selector switch boards**, each with 10 photovoltaic relays. However, the total number of meas. channels is limited to 100 at max. To be able to adapt the number of sensors and channels to the individual requirements, the number of channels of the master meas. circuit board and the selector switch boards can be independently configured to 10, 20, 30 or 40 (s.man. 6.10.13.1). The numbering of meas. points starts and continues from the last meas. point of the master board. The selector switch boards can be coded from 0 to 7 by

the on-board code switches. The duration of a meas. point scan proportionally increases to the number of meas. channels. Analogue output cables can only be connected to the master board.

1. With the **passive selector switch boards ES 5590-MF (3)** the number of measuring points is increased in steps of 10 electrically isolated ALMEMO® inputs. Limit value relay cables can be connected to all boards. The plug-in module requires 2 PCB slots in the housing.
2. The **passive selector switch boards ES 5590-MU (4)** also have 10 inputs, which are guided to a 64-pole socket terminal strip. The connection of the sensors is performed via a 10-fold plug ZA 5590-MU each having 4 screw-type terminals A, B, C and D, as each single ALMEMO® connector (see man. 4.1). Double sensors and sensors that require a power supply or an ALMEMO® connector with logic control (e.g. humidity sensors, rotating vanes etc.) cannot be connected. Independent from the configuration of the channel number, 10 channels are only available. The programming can be individually entered for each sensor, however, it is stored in a common EEPROM that is located in the connector. Two limit value relays, separately for Max and Min, are already mounted on the board and can be connected via the MU connector.

### Extension with Active Measuring Circuit Boards and Devices

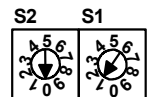
**Active measuring circuit boards** are independent measuring modules with a microcontroller, ALMEMO® measuring circuit board and own address. All plug-in modules are electrically isolated from each other and it is also possible to connect an analogue output cable or an output relay cable, with the exception of the ES 5590-G3. If the master board will be operated with a baud rate that is different from 9600 it is also possible to set the slave boards via jumpers to 2400 bd or 57600 bd. The measuring point scan of all active boards is performed simultaneously so that the time for scanning all measuring points is significantly reduced. The identification of measuring points is based on the two digit module number and the two digit measuring point number. The module numbers usually start at the first active measuring circuit board from 00 and are increased by one for each additional module.

3. The **active measuring circuit boards ES 5590-G2 (5)** with 10 ALMEMO® sockets each provide 10 to 40 measuring channels for all sensors with an ALMEMO® flat connector.

For setting the address two code switches are located on the board.

The plug-in module requires 2 PCB slots.

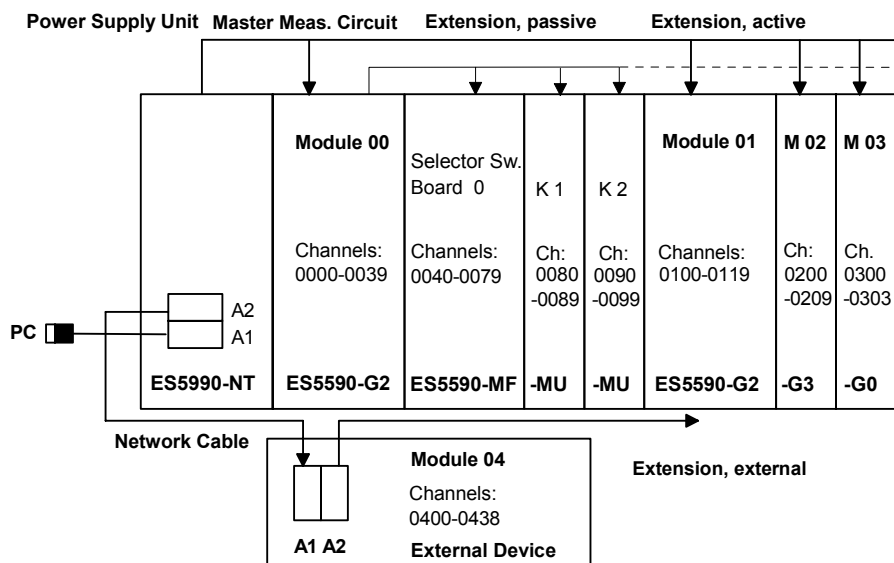
*Example:* Module Address 01



Module Address      0      1

4. Alternatively, the **active measuring circuit board ES5590-G3** (6) with 10 meas. channels and 10-fold connector ZA5590-MU can be used like the selector switch board ES5590-MU. Analogue output and limit value relays are not available here. The plug-in module requires only one PCB slot.
5. Furthermore, the **active measuring circuit boards ES 5590-G0** (7) with one ALMEMO® socket (4 channels) are available. An integrated electrically isolated analogue output (2V, 10V or 20mA) is available as an option. Two limit value relays, separately for Max and Min, are mounted on the board and can be connected via screw clamp connectors. The plug-in module requires only one PCB slot.

*Example for a configuration:*



6. In addition, the extension of the measuring points is also possible via any **external ALMEMO® devices** with serial interface. They are connected to the socket A2 (1d) of the power supply board ES5990-NT via network cables or network distributors (see manual 5.3). It is just necessary to ensure that all active modules of the system and all external devices are set to the baud rate 9600 and that they have different addresses. The addresses must be continuously available, however, their sequence within the network is of no importance.

## 4.4 Output Relays

As described in the previous section, each measuring plug-in module (exception ES 5590-G3) is, for alarm signalling purposes, equipped with integrated semiconductor relays or pre-configured to allow the use of a corresponding relay cable. For triggering the two relays, the exceeding of the Max limit value and the dropping below the Min limit value are, for all measuring channels of the **corresponding board**, submitted to an OR operation.

For controlling **all measuring points** of the master measuring circuit board, including all selector switch boards, the plug-in module ES 5990-N provides integrated own semiconductor relays R0 (Max) and R1 (Min) (1c), each with make and break contacts. As long as no other output cable is connected to the socket A2 (1d) these relays will in the device programming be indicated as output module 'AK1' (see manual 6.2.5). The type of the relay function can be changed, i.e. the relays can be allocated to particular measuring points or can be controlled via the interface (see man. 6.10.9). However, for internal relays and output cables only one common type is possible.



The relays are only suitable for switching low voltages up to maximum 50VDC or AC and currents up to 300mA. For higher loads power relays (e.g. relay adapter ZB 2280-RA 250V, 6A) or contactors must be connected in series.

## 5. DATA ACQUISITION

The data acquisition system ALMEMO® 5990-1 provides the following options for data acquisition:

1. Continuous measurement of a selectable meas. point, see manual 6.4  
Output of measuring data to the analogue output, see manual 5.1.1.
2. Single measuring point scan of a measuring circuit board, see man. 6.5.1.1
3. Cyclic measuring point scan of a measuring circuit board, see man. 6.5.1.2
4. Continuous measuring point scan, see manual 6.5.1.3

Meas. point scans can be used to acquire and document data from the selected meas. point and from other meas. points. For meas. point scans the system must generally be connected to an independent data acquisition system ALMEMO® 5590-3 or a computer via interface module (s. man. 5.2/3).

### 5.1 Automatic Measuring Point Scan of one Meas. Instrument

If the data acquisition systems consists of only one active module, possibly also with selector switch boards, it can automatically perform measuring point scans and can provide a data output via interface with an independent time control and measuring and print cycle. The measurement is also started and stopped via the interface or a trigger cable (see man. 6.6). By using terminal software on a PC (AMR-Control or Windows Terminal) it is possible to save the measured values on-line in a file and to evaluate them subsequently by means of spreadsheet software (see manual 6.1).

**The programming of the process flow control** is also performed via the serial interface; ideally by using the configuration software AMR-Control or by using a terminal (PC) (see manual 6.5, 6.6).

With the **option 'data memory'** all options regarding the data storage are provided according to manual section 6.9. As a standard, all single and cyclic meas. point scans are stored in the print cycle. The data can be provided in various output formats to be transmitted and evaluated on a computer.

### 5.2 Automatic Measuring Point Scan of several Meas. Modules

As described in section 4.2 the data acquisition system ALMEMO® 5990-1 can consist of several networked modules and devices. For communication with networked modules it is mandatory that each module has its own address as only one module is allowed to respond to each command. The measuring point scan of several modules can only be performed with a higher CPU that also performs the addressing of the modules. Within the ALMEMO® range of measuring instruments the system ALMEMO® 5590-3 is equipped with a CPU that performs this task. The system ALMEMO® 5990-1 can be connected as an external system. The CPU performs, with an own real time clock, cyclic measuring point scans of all modules and, as required, stores the data in an own data memory.



### 5.3 Data Acquisition via Software

Alternatively, it is possible that networked modules or devices can be operated via data acquisition software on a computer. Two software packages are available for cyclic addressing of the modules and data scanning:

1. Win-Control (Windows 3.xx, 95, 98 and NT)
2. Data-Control ((Windows 3.xx, 95 and 98)

All software packages allow for online display of data as line chart, bar chart or table and for data storing. Furthermore, it is also possible to recall, evaluate and to print the data offline.

## 6. TROUBLESHOOTING

The data acquisition system ALMEMO® 5990-1 can be configured and programmed in many different ways. It allows for a connection of many different sensors, additional measuring instruments, alarm signalisers and peripheral devices. As a result, it is possible that, under certain conditions, it does not perform as the user would expect. In most cases this will not be related to a defective device but to operating errors such as wrong settings or an inadmissible wiring. The following tests should be performed to correct or to correctly identify the error.

**Error:** Incorrect measured values.

**Remedy:** Check the programming of the channel thoroughly (AMR-Control), Query the entire programming using the command P15 (see man. 6.2.3) and f1 P15 (see manual 6.10.1).

**Error:** Varying measured values, cyclic measuring point scan stops.

**Remedy:** Check cabling for inadmissible electrical connection.

Disconnect output modules, disconnect suspicious sensors and replace by hand-held sensors operated in air or by dummies (short circuit A-B at thermocouples, 100Ω resistance at Pt100 sensors).

If the error is corrected by this, re-connect sensors and modules successively and check.

If an error occurs at a connection, check the wiring, isolate the sensor, if necessary; prevent influences from disturbances by shielding or twisting.

**Error:** Data transmission via interface does not function.

**Remedy:** Check power supply, switch off and then switch on again, check interface module, connections and setting:

Are both devices set to the same baud rate and transmission mode (see manual 6.10.12)?

Is the correct COM interface addressed at the computer?

Is the printer set to ONLINE mode?

Are the handshake lines DTR and DSR active?



A small interface tester with LEDs is very useful for checking the data flow and the handshake lines (during standby mode the data lines TXD and RXD are on a negative potential of approximately -9V and the diodes are illuminated green. The handshake lines DSR, DTR, RTS and CTS have a positive voltage of approximately +9V and the LEDs are illuminated red. During the data transmission the data lines must flash red).

Test the data transmission by using a terminal (AMR-Control, WIN-Control, DATA-Control, WINDOWS Terminal):

Check module address and code switch setting on the PCB (s. 4.1).

Address the module with the device number Gxy (see man. 6.2.1).

Query the programming with using P15 (see manual 6.2.3).

**Error:** Data transmission within network does not function.

**Remedy:** Check that all modules are set to different addresses, address modules individually via terminal and command Gxy.

Addressed module is ok when the feedback is at least y CR LF.

If data transmission is still not possible, disconnect external devices or even active internal modules and check them individually using the data cable of the computer (see above),

check the wiring for short circuit or twisting.

Are all network distributors supplied with power?

Network and check the devices successively again (see above).

If the device is, after the above inspections, still not performing as specified in the operating instructions, it must be sent to the factory in Holzkirchen, Germany, including a short report and possibly control printouts. The software AMR-Control allows to print the monitor pages including the programming and also to save the terminal operation and to print it out.

## 7. ELECTROMAGNETIC COMPATIBILITY

The data acquisition system ALMEMO® 5990-1 meets the electromagnetic compatibility (EMC) safety requirements specified in the relevant CE directive issued by the council for the alignment of legal regulations of the member states (89/336/EWG).

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

EN 50081-1:1992

EN 50082-1:1992

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

IEC 801-3 3V/m: deviation < 100µV

The following notes must be observed when operating the instruments:

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

## Technical Data (see also manual section 2.2)

### Housing Dimensions:

19" desktop housing 24DU:	W 163 x H 145 x D 240 mm, 4 plug-in slots
19" desktop housing 84DU:	W 468 x H 145 x D 240 mm, 16 plug-in slots
19" sub rack 84DU:	W 483 x H 132.5 x D 273 mm, 16 plug-in slots
Operating/storage temperature:	-10 ... +60 °C / -30 ... +60 °C
Humidity of ambient air:	10 ... 90 % rH (non-condensing)

### Measuring Inputs:

Active Meas. Circ. Bd. ES 5590-G0	1 ALMEMO® socket for flat connector 1 meas. channel, 3 add. channels, 1 plug-in slot
Active Meas. Circ. Bd. ES 5590-G2	10 ALMEMO® sockets for flat connector 10 chann. electr. isol., 30 add. chann., 2 slots
Active Meas. Circ. Bd. ES 5590-G3	10 inputs through 10-fold MU connector 10 chann. electr. isol., 1 plug-in slot
Sensor Voltage Supply:	mains adapter: approx. 12V, max. 100mA recharg. battery: 7...9V, max. 100mA
Selector Switch Boards ES5590-MF	10 ALMEMO® sockets for flat connector 10 chann. electr. isol., 30 add. chann., 2 slots
Selector Switch Boards ES5590-MU	10 inputs through 10-fold MU connector 10 chann. electr. isol., 1 plug-in slot

### Equipment:

Time and date:	software clock not buffered
Microprocessor:	HD 6303 Y
Option S:	real time clock and data memory 500kB for 100000 meas. values buffered with Lithium battery

### Outputs:

	ES5590-N	ES5590-G2/MF	ES5590-MU	ES5590-G0
Master interface:	A1	-	-	-
Slave interface:	A2, bus	bus	bus	bus
Analog output:	-	A1 (only G2)	-	A1, option Rx
Limit value signals:	2 opto relays A1		2 opto relays	2 opto relays
	Max and Min		Max and Min	Max and Min
Relay capacity:	peak voltage 50VDC or AC, 300mA			

### Voltage Supply:

Mains adapter:	7 to 13V DC not electrically isolated
Option U:	ZB 5090-NA2 230V AC to 12V DC, 0.8A
Option A:	10 to 30V DC to 12V, 1A electrically isolated NiCd battery: 7.2 V, 1.5 Ah recharge time: approx. 2h quick and trickle charge

### Current consumption:

Plug-in module ES5590-G0/G2/G3:	approx. 30 mA without I/O modules
Plug-in module ES5590-MF:	approx. 20 mA without I/O modules
Plug-in module ES5590-MU:	approx. 2 mA

### Extent of the Delivery:

Data Acquisition System ALMEMO® 5990-1  
Mains Adapter ZB 5090-NA2 12V/0.8A  
Operating Instructions ALMEMO® 5990-1  
ALMEMO® Manual with AMR-Control software

## Product Overview

### Order No.

#### Data Acquisition System ALMEMO® 5990-1

Cascadable serial interface, power supply unit 12V, 0.8A

19" desktop housing 24 DU, 4 free plug-in slots

19" desktop housing 84 DU, 16 free plug-in slots

19" sub rack 84 DU, 16 free plug-in slots

Option A rech. battery 7.2V, 1.5Ah with 2h quick charge

Option U voltage supply 10 to 30V DC electrically isolated

MA 5990-1TG2

MA 5990-1TG8

MA 5990-1BT8

OA 5990-A

OA 5990-U

**Option Master Meas. Circuit Board:** description and option S below

Master meas. circ. board with 1 ALMEMO sensor socket (4 channels)

OA 5990-G0

Master meas. circ. bd. with 10 ALMEMO sensor sockets (40 channels)

OA 5990-G2

Master meas. circ. board with 10 inputs via 64-pin spring contact strip

OA 5990-G3

**Selector Switch Board** with 10 electrically isolated inputs for

ALMEMO® flat connector, 10 to 40 meas. channels, output socket

for alarm cable, 8 boards at max., space requirement 2 plug-in slots

ES 5590-MF

**Selector Switch Board** with 10 electr. isol. inputs, sensor connection

through 64-pin spring contact strip and ALMEMO® 10-fold MU

connector, 10 meas. chann. without power supply (no frequ./double

sensors), alarm contacts Max and Min, 8 boards at max., 1 plug-in slot

ES 5590-MU

**Active Meas Circ. Board** with 1 input for ALMEMO® flat connector,

4 meas. channels (no extension with selector switch boards)

output socket for analog output, space requirement 1 plug-in slot

ES 5590-G0

Option S memory 500kB for 100000 meas. values, real time clock

OA 5590-S0

**Active Meas Circ. Board** with 10 electrically isolated inputs für

ALMEMO flat connector, 10 to 40 measuring channels, output socket

for alarm cable and analog output, space required: 2 plug-in slots

ES 5590-G2

Option S memory 500kB for 100000 meas. values, real time clock

OA 5590-S0

memory 2 MB for 400000 meas. values, real time clock

OA 5590-S2

**Active Meas Circ. Board** with 10 electr. isol. inputs, sensor connection

via 64-pin spring contact strip and ALMEMO® 10-fold MU connector,

10 meas. channels without power supply, 2 plug-in slots required

ES 5590-G3

Option S data memory 500kB for 100000 meas. val., real time clock

OA 5590-S0

#### ALMEMO® 10-Fold MU Connector

for the connection of 10 sensors and 2 alarm devices

ZA 5590-MU

**ALMEMO® Recording Cable** no electr. isol. (-1.25...2.0V, 0.1mV/Digit)

ZA 1601-RK

**ALMEMO® V24 Data Cable**, electr. isolated, max. 9600 Bd, 4mA

ZA 1909-DK

**ALMEMO® V24 Data Cable**, electr. isolated, max. 57.6 kBd, 14mA

ZA 1909-DK2

**ALMEMO® V24 Fiber Optic Data Cable**, max. 57.6 kBd, 4mA

ZA 1909-DKL

**ALMEMO® Network Cable** current loop, electr. isolated

ZA 1999-NK

**ALMEMO® Trigger Cable** with optocoupler input 4..30V/key

ZA 1000-EK/T

**ALMEMO® I/O Cable** for Triggering and Limit Value Alarm

ZA 1000-EGK

**ALMEMO® Relay Trigger Analog Adapter** (4 relays, 2 trigger inputs)

ZA 8000-RTA

Option R1, R2, R3: electr. isol. analog output 2V, 10V or 20mA

OA 8000-Rx





