# ALMEMO®

**AMR**

**V5**

**Operating Instructions**

# Data Acquisition System
# ALMEMO® 5590-1 V5

V1.0
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# Operating Instructions

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# ALMEMO® 5590-1/0 V5

For Reference with the ALMEMO® Manual

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# 1. INTRODUCTION

The data acquisition system ALMEMO® 5590-1$Version\ 5$ 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, the sections dealing with the system control via keyboard will only often provide a note referring to a more detailed description within the manual (manual section x.x.x).

## 1.1 Function Range

The system ALMEMO® 5590-1 is a modular, universal data acquisition system with a maximum of 99 measuring circuit boards, which can also be housed and networked locally in individual housings. Each device is, as a minimum, equipped with a power supply, bus board and a master measuring circuit board ES5590-G1 with 9 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-G0, G2 or G3 with 10 inputs each. The additional modules can also be externally networkable ALMEMO® devices. The 2 output sockets A1 and A2 of the master module allow for alternatively connecting interface cables with analogue output, digital interface or alarm contacts. However, the system ALMEMO® 5590-0 is equipped with a master meas. circuit board ES5590-G0 and one measuring input. It can only be extended by active slave meas. circuit boards.

## 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

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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 indicated on the display or, 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, dynamic pressure sensors and $O_2$ 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. For this purpose, the real time clock, the print cycle and the measuring cycle are available and, if fast processing is required, the conversion rate is available. The measurement can be started and stopped by using the keyboard, the interface, an external trigger signal, the real time clock 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 real time clock with date function or the pure measuring time are used for an accurate recording of any measurement.

### Print Cycle

The print cycle is programmable between 1s and 59h/59min/59s and provides a cyclic output of measured values to the interfaces or memories and also provides 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 scanning the measuring junctions 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 store all measured values in the memory and/or to perform an output 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, RS485 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

Within the system ALMEMO® 5590-1 the active measuring circuit boards are already internally networked via their address. Furthermore, it is possible to connect additional ALMEMO® devices or slave systems simply connecting with network cables or by using network nodes in case of longer distances.

## OPTION Memory Extension

Each active measuring circuit board can optionally be equipped with real time clock and 500 kilobytes 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 capacity is ok for up to 100,000 measured values. The memory organisation can be configured as linear or ring memory. The output can be optionally performed via interface or, if available, via analogue 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
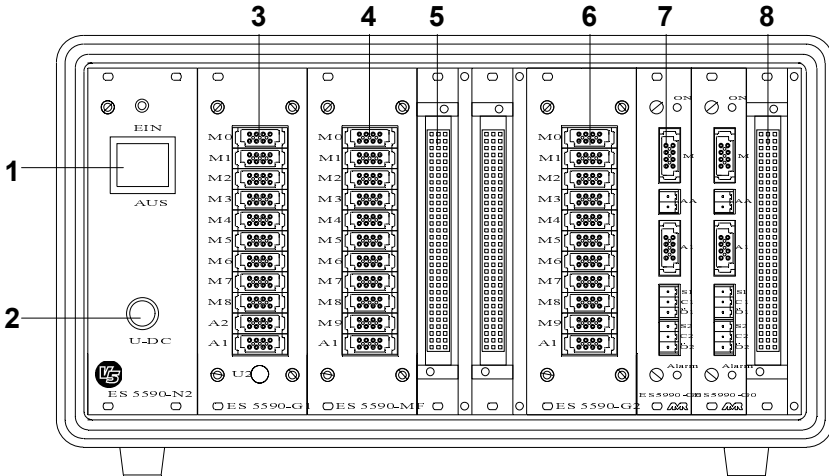


### Power Supply ES 5590-N1/2

| (1) **ON Switch** | | **Device** | **Control Lamp** | |
|---|---|---|---|---|
| OFF | | OFF | off | |
| ON | with power supply: | ON | on | |
| Option rech. batt. w. power supply: | | ON | on | (batt. being charged) |
| | | ON | flashes | (batt. is recharged) |
| | without power supply: | ON | off | (battery operation) |

(2) **Socket U-DC**  12V DC ±5% for plug-type mains adapter ZB 5090-NA2
Option U: 9..36V DC for ext. supply or plug-type mains adapter
Option A: 12V DC f. charging the battery f. mains adapter ZB 5090-NA2
Option N: mains socket 90 to 260V AC 50-60Hz

(3) **Plug-In Module Master Measuring Circuit Board ES 5590-G1**

|  | for ALMEMO® single connectors |
|---|---|
| M00 to M09 | 9 measuring inputs for all sensors |
| M10 to M39 | at max. 27 add. channels for double sensors, function channels |
| A1 | V24 interface to PC with cable ZA 1909-DK |
| | V24 fiber optics cable (ZA 1909-DKL) |
| | RS 422 network distributor (ZA 5099-NVB) |
| A1 or A2 | analogue output with cable ZA 1601-RK |
| A2 | networking with network cable ZA1999-NK |
| | 2 alarm outputs with cable ZA 1000-EGK |
| | 2 relay outputs with cable ZA 1000-EAK |
| **Code Switches** | module address 00 to 99 internally on-board |

**(4) Plug-In Module Selector Switch Board ES 5590-MF**

for ALMEMO® single connectors

| | |
|---|---|
| Mx0 - Mx9 | 10 measuring inputs for all sensors |
| Mx0+10 - Mx0+39 | at max. 30 add. channels f. double sensors, arithmet. channels |
| A1 | analogue output with cable ZA 1601-RK |
| | 2 alarm outputs with cable ZA 1000-EGK |
| **Code Switches** | board number 0 to 7 internally on-board |

**(5) Plug-In Module Selector Switch Board ES 5590-MU**

for 10-fold plug ZA 5590-MU

| | |
|---|---|
| Mx0 to Mx9 | 10 meas. inputs for analogue sensors without power supply |
| LV min, LV max | 2 alarm outputs f. all meas. points of the plug-in module |
| **Code Switches** | board number 0 to 7 internally on-board |

**(6) Plug-In Module Slave Measuring Circuit Board ES 5590-G2**

for ALMEMO® single connectors

| | |
|---|---|
| Mx0 to Mx9 | 10 measuring inputs for all sensors |
| Mx0+10 - Mx0+39 | 10 secondary inputs for double sensors |
| A1 | analogue output with cable ZA 1601-RK |
| | 2 alarm outputs with cable ZA 1000-EGK |
| | 2 relay outputs with cable ZA 1000-EAK |
| **Code Switches** | module address 00 to 99 internally on-board |

**(7) Plug-In Module Slave Measuring Circuit Board ES 5590-G0**

for ALMEMO® single connectors

| | |
|---|---|
| M00 | 1 measuring input for all sensors |
| M01 to M03 | 3 additional channels |
| AA | analogue output internally electrically isolated |
| | (option R1:2V, R2:10V, R3:20mA) |
| A1 | analogue output not electr. isol. with cable ZA 1601-RK |
| S1 C1 Ö1 | alarm contact 1 limit value Max, make and break contact |
| | (50V, 300mA) |
| S2 C2 Ö2 | alarm contact 2 limit value Min, make and break contact |
| | (50V, 300mA) |
| **Code Switches** | module address 00 to 99 internally on-board |

**(8) Plug-In Module Slave Measuring Circuit Board ES 5590-G3**

for 10-fold plug ZA 5590-MU

| | |
|---|---|
| M00 to M09 | 10 meas. inputs for analogue sensors without power supply |
| **Code Switches** | module address 00 to 99 internally on-board |

# 2. INITIAL OPERATION

1.  Connect the **transducers** to the sockets Mxx (3), see 4.
2.  **For power supply** connect mains adapter to socket U-DC (2), see 3.1.
3.  **For switch-on** operate the ON switch (1), see 3.4.
4.  **Data output** to printer or computer (one measuring circuit board only!)
    Connect peripheral device via data cable to socket A1, see manual 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, output channel and output format, see manual 6.2.2/6.5.2/6.5.5
    Start and stop the automatic measuring point scan, see manual 6.6.
5.  **Data acquisition** via computer
    Connect computer via data cable to socket A1 of master board, s. m. 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.
    Connect alarm device via alarm module to socket A2, see man. 5.1.2/5.1.3
    Activate the output channel for the output of alarm values, see man. 6.2.2.
    Start and stop the automatic measuring point scan, see manual 6.6.

# 3. POWER SUPPLY

## 3.1 Mains Operation

The universal mains adapter ZB 5090-NA3 for 100 to 260V AC to 12V DC, 2A, is generally used for the power supply of the measuring instrument. It is connected to the socket U-DC (7) and is locked by turning it to the right. In addition, the banana plug with the connection for the protective earth conductor must for interference suppression be connected to the bare socket beside.

Only in case of exceptions (e.g. in industrial environments) the protective earth conductor itself can show such high voltage spikes that it is better to avoid its connection.

The **option N** involves the installation of the plug-in module ES 5590-N1 with an integrated switched-mode power supply that allows for a voltage supply from 90 to 260V AC (50 to 60Hz) via a standard mains cable.

 **Danger! Mains Voltage!** The mains plug must whatever happens be disconnected from the power supply plug-in module ES 5590-N1 before a plug-in module is installed into or removed from the system!

## 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-NA3 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. 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) and the connecting cable ZB 5090-EK with 2 banana plugs is required. It has a wide input voltage range from 9 to 36V DC and an electrical isolation allowing that the measuring instrument can be operated with 12V or 24V mains supply. However, the mains adapter ZB 5090-NA3 still allows for operation with mains supply.

## 3.4 Switch On/Off

The rocker switch (1) is used for **switching** the device **on** or **off**. If the power supply is properly connected the green control lamp will be on during operation. 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.

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# 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 (see manual section 3) and the connection of existing sensors (see manual 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® 5590-1/0 system (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 keyboard. In all cases the sensor connector must be connected to the selected channel. When programming, it must be considered that factory-programmed 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 ZA 9000-FS or ZA 5590-MU are not locked and are, therefore, most suitable for self-programming.

## 4.1 Measuring Inputs, Additional Channels and Extension

The master plug-in module ES 5590-G1 of the system 5590-1 has 9 input sockets with, at first, the measuring channels M0 to M8 being allocated to them. However, ALMEMO® sensors can, if required, provide up to 4 channels so that 36 channels are available with 9 input sockets. The additional channels can be especially used with humidity sensors with 4 measuring 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 measuring 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.). The master plug-in module ES 5590-G0 of the system 5590-0 is only equipped with one measuring input M0 with the additional channels M1 to M3.

|          | M0 | M1 | M2 | M3 | M4 | M5 | M6 | M7 | M8 | A2 | A1 |
|----------|----|----|----|----|----|----|----|----|----|----|----|
| chann.1  | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 |    |    |
| chann.2  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |    |    |
| chann.3  | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |    |    |
| chann.4  | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 |    |    |

⚠️ 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 $\pm5V$ (between B,C,D and A or - respectively).

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

Several options are available for the **extension of the measuring points**. A total of 8 passive and 100 active modules can be used.

With the system 5590-1 the first active master measuring circuit board can trigger up to 8 **passive selector switch boards,** each with 10 photovoltaic relays. However, the total number of measuring channels is limited to 98 at maximum. To be able to adapt the number of sensors to the individual requirements, the number of channels of the master measuring 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 measuring points starts and continues from the last measuring 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 measuring point scan proportionally increases to the number of measuring channels. Analogue output cables can only be connected to the master board.

1. With the **passive selector switch boards ES 5590-MF** (4) 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** (5) 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

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screw-type terminals. The programming can be individually entered for each sensor, however, it is stored in a common EEPROM that is located in the connector. The plug-in module requires only one PCB slot and, independent from the configuration of the channel number, 10 channels are only available. For this reason, 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. Two limit value relays, separately for Max and Min, are already mounted on the board and can be connected via the MU connector.

**Active measuring circuit boards** are independent measuring modules with a microcontroller, ALMEMO® measuring circuit 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** (6) 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.
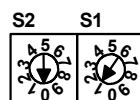
   *Example:*  module address 01



S2    S1

module address    **0    1**

4. Alternatively, the **active measuring circuit board ES5590-G3** (8) 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 ALMEMO® sockets (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:*
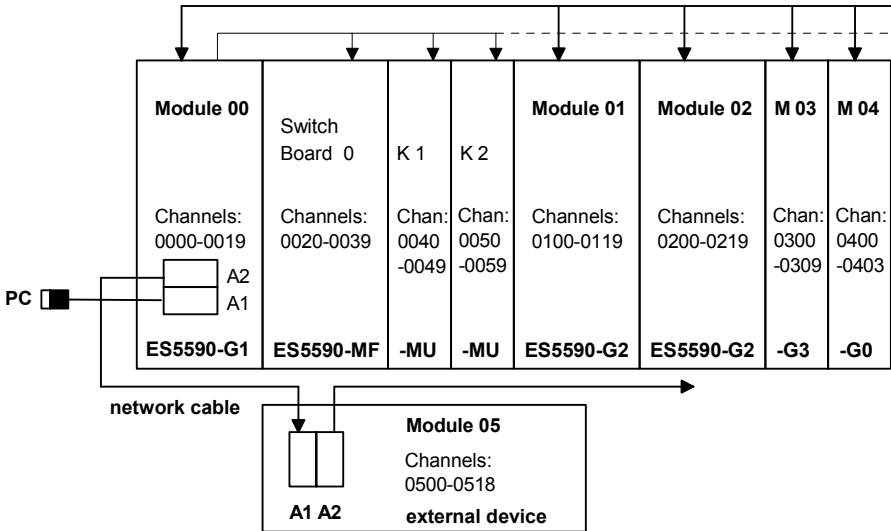


6. In addition, the extension of the measuring points is also possible via any **external ALMEMO® device** with serial interface. They are connected to the socket A2 of the master board ES5590-G1 via network cables or network distributors (see manual 5.3). It is just necessary to ensure that all active 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.

# 5. DATA ACQUISITION

The data acquisition system ALMEMO® 5590-1 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

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

## 5.1 Automatic Measuring Point Scan of one Meas. Circuit Board

If the system is equipped with only **one** active measuring circuit board and also possibly with selector switch boards, it can automatically perform automatic 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 possibilities regarding the data storage are provided according to the manual section 6.9.

## 5.2 Automatic Meas. Point Scan of Several Meas. Circuit Boards

As described in section 4.1 the data acquisition system ALMEMO® 5590-1 and 5590-0 can consist of several internal or external 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® 5590-1 can be connected as slave 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® 5590-1/0 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 all suspicious sensors.
Connect hand-held sensors operated in air or dummies (short circuit AB at thermocouples, $100\Omega$ at Pt100 sensors) and check.
Then, re-connect and check the sensors successively.
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 output channel set to "U" (see manual 6.2.2)?
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 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 systems ALMEMO® 5590-1 and 5590-0 meet 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 2.2)

**Measuring Inputs ALMEMO® 5590-0:**
Master Meas. Circuit Board ES 5590-G0  1 socket for ALMEMO® flat connectors (4 chann.)

**Measuring Inputs ALMEMO® 5590-1:**

| | |
|---|---|
| Master Meas. Circuit Board ES 5590-G1 | 9 ALMEMO® sockets for flat connectors |
| Measuring channels: | 9 primary channels, electr. isol., max. 27 add. channels for double sensors and function channels |
| Free plug-in slots for extension: | 40DU (depth units) housing: 5 / 84DU housing:16 |
| Selector Switch Board ES 5590-MF | 10 ALMEMO® sockets for flat connectors |
| | 10 channels electr. isol., 30 add. chann., 2 slots |
| Selector Switch Board ES 5590-MU | 10 inputs via 10-fold MU connector |
| | 10 channels electr. isol., 1 slot |
| Active Meas. Circ. Board ES 5590-G0 | 1 ALMEMO® socket for flat connector |
| | 4 channels, 1 plug-in slot |
| Active Meas. Circ. Board ES 5590-G2 | 10 ALMEMO® sockets for flat connectors |
| | 10 channels electr. isol., 30 add. chann., 2 slots |
| Active Meas. Circ. Board ES 5590-G3 | 10 inputs via 10-fold MU connector |
| | 10 channels electr. isol., 1 slot |
| Sensor voltage supply: | mains adapter: approx. 12V, max. 100mA |
| | rechargeable battery: 7...9V, max. 100mA |

## Equipment:

| | |
|---|---|
| Time and date: | software clock not buffered |
| Microprocessor: | HD 6303 Y |

## Outputs:

| | ES5590-G1 | ES5590-G2/MF | ES5590-MU | ES5590-G0 |
|---|---|---|---|---|
| Master interface: | A1 | - | - | - |
| Slave interface: | A2, bus | bus | bus | bus |
| Analogue output: | A1, A2 | A1 (G2 only) | - | A1, option Rx |
| Limit value signals: | A2 | A1 | 2 opto relays Max and Min | 2 opto relays Max and Min |

## Voltage Supply:

| | 7 to 13V DC, not electrically isolated |
|---|---|
| Mains adapter: | ZB 5090-NA3 100..230V AC to 12V DC, 2A |
| Option N: | power supply unit integrated, 90-260V AC, 1A |
| Option U: | 10 to 30V DC to 12V, 1A electr. isolated |
| Option A: | NiCd battery: 7.2 V, 1.5 Ah |
| | recharge time: ca. 2h quick and trickle charging |

Current consumption per meas. circuit board:  ca. 30 mA without input/output modules

## Housing Dimensions:

| | |
|---|---|
| 19" desktop housing 40DU: | W 230 x H 165 x D 270 mm |
| 19" desktop housing 84DU: | W 452 x H 165 x D 270 mm |
| 19" sub rack 84DU: | W 483 x H 132,5 x D 273 mm |
| Operating/storage temperature: | -10 ... +60 °C / -30 ... +60 °C |
| Humidity of ambient air: | 10 ... 90 % rH (non-condensing) |

## Extent of the Delivery:

Measuring Instrument ALMEMO® 5590-1
Mains Adapter ZB 5090-NA3 12V/2A
Operating Instructions ALMEMO® 5590-1
ALMEMO® Manual incl. software AMR-Control

ALMEMO®

# Product Overview
<div align="right">Order No.</div>

**Data Acquisition System ALMEMO® 5590-1**
incl. master measuring module with 9 ALMEMO® sensor sockets (36 channels),
serial interface that can be cascaded, mains adapter 12V, 2A

| | |
|---|---|
| 19" desktop housing 40 TE, 5 free slots | MA 5590-1TG4 |
| 19" desktop housing 84 TE, 17 free slots | MA 5590-1TG8 |
| 19" sub rack 84 TE, 17 free slots | MA 5590-1BT8 |
| Option N    mains adapter 90-260V AC | OA 5590-N |
| Option A    rechargeable battery 7.2V, 1.5Ah with quick charge in 2h | OA 5590-A |
| Option U    voltage supply 10 to 30V DC electrically isolated | OA 5590-U |
| Option S    500kB memory for 100,000 meas. values, real time clock | OA 5590-S |

**Data Acquisition System ALMEMO® 5590-0**
incl. master measuring module with 1 ALMEMO® sensor socket (4 channels),
serial interface that can be addressed, mains adapter 12V, 2A

| | |
|---|---|
| 19" desktop housing 40 DU, 5 free slots | MA 5590-0TG4 |
| 19" desktop housing 84 DU, 17 free slots | MA 5590-0TG8 |
| 19" sub rack  84 DU, 17 free slots | MA 5590-0BT8 |
| options, as above | |

**Selector Switch Board** with 10 electrically isolated inputs for
ALMEMO® flat connectors, 10 to 40 meas. channels, output socket
for alarm cable, 4 boards at max., space requirement 2 slots          ES 5590-MF

**Selector Switch Board** with 10 electrically isolated inputs,
sensor connection via 64-pin spring contact strip and ALMEMO® 10-fold
MU connector, 10 meas. channels (no frequency/double sensors),
alarm contacts Max and Min,
8 boards at max., space requirement 1 slot          ES 5590-MU

**Active Meas. Circuit Board** with 1 input for ALMEMO® flat connector,
4 meas. channels for double sensors and function channels,
output socket for analogue output, space requirement 1 slot          ES 5590-G0
option S     500kB memory for 100,000 meas. values, real time clock   OA 5590-S

**Active Meas. Circuit Board** with 10 electrically isolated inputs for
ALMEMO® flat connectors, 10 to 40 meas. channels, output socket
for alarm cable and analogue output, space requirement 2 slots          ES 5590-G2
option S     500kB memory for 100,000 meas. values, real time clock   OA 5590-S

**Active Meas. Circuit Board** with 10 electrically isolated inputs,
sensor connection via 64-pin spring contact strip and ALMEMO® 10-fold
MU connector, 10 meas. channels (no frequency/double sensors),
space requirement 1 slot          ES 5590-G3
option S     500kB memory for 100,000 meas. values, real time clock   OA 5590-S

**ALMEMO® 10-fold MU connector**
for connecting 10 sensors and 2 alarm contacts          ZA 5590-MU

## Your Contacts