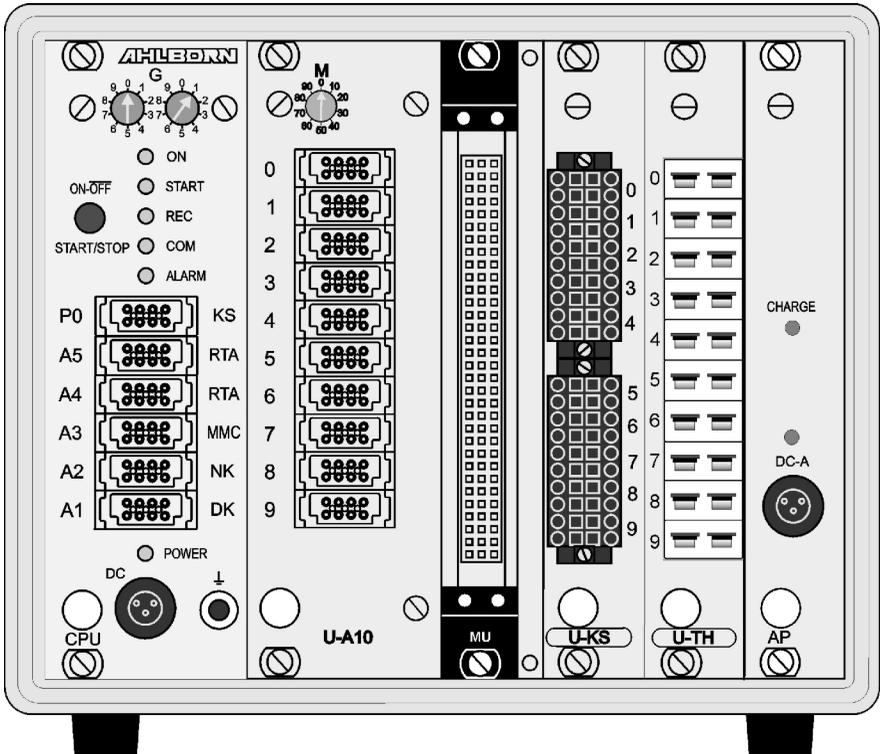//AHLBORN

Operating instructions

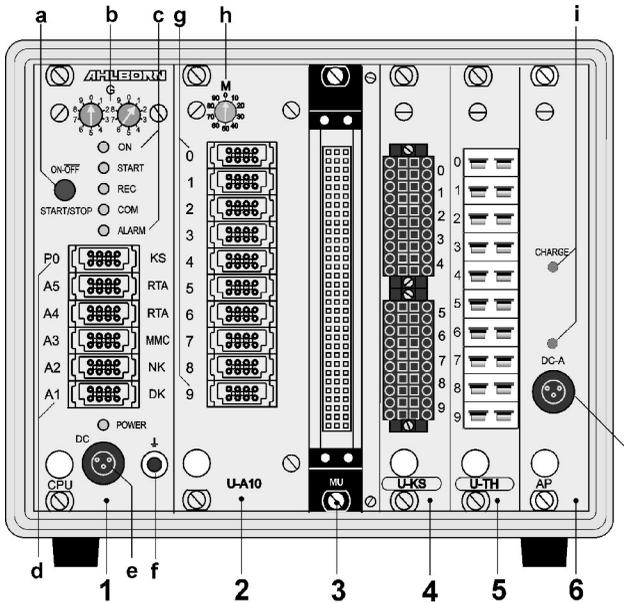

V6

Data acquisition system
ALMEMO® 5690-1CPU

V1.0
26.03.2008

www.ahlborn.com

1. OPERATING CONTROLS

(1) Plug-in CPU module :
CPU measuring circuit

(a) Key ON / OFF, START / STOP
ON Power ON
START Start measuring
STOP Stop measuring
OFF Power OFF, <u>Hold key pressed down</u>

(b) Code switches
G Device address 00 to 99
With option XU or XM
3 addresses are used,
device address 0 to 7 only !

(c) Status LEDs
ON Device switched ON
START Measuring operation started
REC Measuring with results saved
COM Measuring with output
ALARM Limit value overshoot
Sensor breakage,
LoBat (flashes)

(d) Output sockets A1 to A5, P0
A1 V24 interface / optic fiber (ZA1909-DK5/L)
USB interface (ZA1919-DKU)
RS 422 (ZA 5099-NVL/NVB)
Ethernet (ZA 1945-DK)
A2 Network cable / optic fiber (ZA1999-NK5/NKL)

Analog output (ZA1601-RK)
V5 / V6 periphery (ZA 1000/6-EAK)
A3 MMC card connector (ZA1904-MMC)
A4 V6 periphery (ZA 8006-RTA3)
A5 V6 trigger input (ZA 1006-ET/EK)
P0 option Relay, trigger, analog, internal

(e) DC connection socket 12 V
Mains adapter (ZB 1212-NA6, 12 V, 3 A)
Cable, electrically isolated
(ZB 3090-UK2, 10 to 30 V, 1.2 A)
Status LED
POWER Mains supply, present

(f) Ground socket

Measuring inputs implemented with selector switch boards :

(2) Plug-in module U-A10 : Selector switch board 10 ALMEMO sockets
 (g) Code switches M :   Measuring point x : for any 10 ALMEMO sensors
(h) Measuring inputs 0 to 9 x0 to x9   for all ALMEMO sensors
                                   x+10 to x+39   maximum 30 additional channels

(3) Module U-MU :   Selector switch board 10x MU connector
   Code switch, internal : Measuring point x : 10 to 90 on board
   Measuring inputs   x0 to x9   for analog sensors without their
                                             own power supply
                                   x+10 to x+39   maximum 30 additional channels

(4) Plug-in module U-KS : Selector switch board 2x 5 clamp connector
   Code switch, internal : Measuring point x : 10 to 90 on board
   Measuring inputs   x0 to x9   for analog sensors without their
                                             own power supply
                                   x+10 to x+39   maximum 30 additional channels

(5) Plug-in module U-TH : Selector switch board 10 thermal sockets
   Code switch M :   Measuring point x : for 10 sensors with
                                             miniature thermal connectors
   Measuring inputs   x0 to x9   for analog sensors without their
                                             own power supply
                                   x+10 to x+39   maximum 30 additional channels

Active selector switch boards with their own measuring circuit
(option 5690-M) are labeled with **M** instead of **U** : **M-A10**, **M-MU**, **M-KS**, **M-TH**

(6) Plug-in module AP :   **Rechargeable battery**
(i) Connection socket DC-A   Mains adapter 12 V
                                            (ZB 1212-NA6, 12 V, 5 A)
(j) Status LEDs   **DC-A**   Mains supply, present
                           CHARGE   Batteries are being charged

2. TABLE OF CONTENTS

3. GENERAL

Congratulations on your purchase of this new and innovative ALMEMO® data acquisition system. 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 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 return your device to us, please observe the advisory notes in Chapter 12 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 circumstances :
- 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 an unsuitable power supply and / or in conjunction with unsuitable peripheral equipment.
- 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 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 Standard delivery

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

Measuring instrument ALMEMO® 5690-1CPU,
Mains adapter ZB 1212-NA6 12 V / 3 A,
These operating instructions,
ALMEMO® Manual,
CD with the AMR-Control software and various useful accessories

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

3.3 How to deal with rechargeable batteries (option)

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 changes in temperature may cause substantial measuring errors. You are advised therefore to wait until the device has adjusted to the ambient temperature before starting to use it.
- Before using the mains adapter make sure that the mains voltage is suitable.
- Be sure to observe the maximum load capacity of the sensor power supply.
- Sensors with their own integrated power supply are not electrically isolated from one another.
- Do not run sensor lines in the vicinity of high-voltage power cables.
- Before you touch any sensor lines, ensure that all static electricity has been discharged.

4. INTRODUCTION

The data acquisition system ALMEMO® 5690-1CPU is a new member in our family of unique measuring devices - all equipped with Ahlborn's patented AL-MEMO® 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, operating instructions, 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 USB, RS232, optic fiber, 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 How the system functions

The ALMEMO® 5690-2CPU system has a CPU measuring circuit board for over 70 measuring ranges without their own measuring inputs. These are implemented in the form of various selector switch boards. The 84-DU housing can accommodate up to 190 electrically isolated inputs - for all ALMEMO® sensors (U-A10) but also for sensors with thermal connector (U-TH) or free ends (U-MU or U-KS). High scanning rates can be achieved thanks to the active selector switch boards with their own measuring circuit (option 5690-M). To accommodate the various expansion stages the desktop housing is available in 12-DU / 32-DU / 84-DU sizes and a 19-inch rack is available. For the purposes of recording and logging data the device incorporates a 2-MB battery-buffered RAM (or non-volatile FeRAM, available as an option) with capacity for some 400,000 measured values. With an external memory connector and multimedia card storage capacity is virtually unlimited. There are six output sockets which can be used to connect all types of ALMEMO® output module, e.g. analog output, digital interface, memory connector, trigger input, or alarm contacts simultaneously. Several devices can be networked by simply linking them together via cable.

The system is fed by default via a 12-V mains adapter. A rechargeable battery module AP is also available as an option.

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, and differential values of certain measuring points can be programmed as function channels and can be processed and printed like normal measuring points. There are also function channels available for special measuring tasks, e.g. to determine volume flow, temperature coefficient $Q/\Delta T$, and wet bulb globe temperature, etc..

Units

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

Measured value designation

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

Correction of measured values

The measured value on each measuring channel can be corrected both in terms of zero-point and gain; 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; (see Section 11).

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

Limit values and alarm
Per measuring channel two limit values can be set (1 maximum and 1 minimum). In the event of one of these limit values being exceeded two internal relays (option) or external relay output modules actuate the alarm contacts; these can be allocated individually to specific limit values. Hysteresis is set by default to 10 digits; however, it can be adjusted to any value between 0 and 99 digits. The exceeding of a limit value can also be used to automatically start or stop measured value recording or to initiate other specified action; (see Manual 6.6.5).

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
Up to 4 measuring channels are available per transducer; i.e. it is also possible to evaluate double sensors, individually scaled sensors, and sensors with function channels. All activated measuring points are scanned continuously at the selected measuring rate (standard 10 mops, maximum 100 mops) (mops = measuring operations per second). Data is output, if available, to the interface, to a measured value memory, or to an analog output.
A higher scanning rate of up to 400 mops can be achieved by using selector switch boards with their own measuring circuit (option 5690-M); these operate in parallel and are scanned via a high-speed bus. However, in this mode semi-continuous measuring point scanning and sleep mode are no longer supported.

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 outputs 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.

Maximum and minimum values

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

Average value

Measured values can be expressed as a sliding average obtained by continuous automatic smoothing or manually averaged over a certain period or cycle or over a series of individual measuring operations.

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 automatically starting / stopping a measuring operation the start / stop date and time-of-day and / or the actual measuring duration can be programmed.

Cycle

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

Print cycle factor

The print cycle factor can be used to restrict data output from particular channels (in order to save storage capacity) or to obtain cyclic average values and summation values over longer periods.

Averaging over measuring point scans

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

Measuring rate

The possible measuring rates are 2.5 / 10 / 50 / 100 mops (measuring operations per second) and on just one channel even 400 mops. Recording can be

accelerated if all measured values are saved to memory and / or output to the interface at the full measuring rate. With option XM and using selector switch boards with integrated measuring circuit the scanning time can be further reduced; these boards operate in parallel and are thus scanned with most active measuring points within the measuring time per board.

Measured value memory

To save measured values there are 3 methods.

As standard the device incorporates a 2-MB battery-buffered RAM; this provides sufficient storage capacity for up to 400,000 measured values. For higher reliability for applications conducted over long periods a non-volatile FeRAM is available as an option. Both memory types can be organized and configured in either linear or ring form. Output is via the interface. Selection can be specified according to a time interval or number.

New Or alternatively an external memory connector with multimedia memory card can simply be connected at socket A3. This solution, depending on the size of the card, offers a virtually limitless memory capacity. With an external memory connector, available as an accessory, up to 128 files can be saved and then read out very quickly via any standard card reader. For applications conducted over long periods it is even possible to have daily files generated automatically.

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

Up to 90 output relays or analog outputs in appropriate external adapters (ZA-8006-RTA3) or on plug-in boards 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 or the Win-Control software package. The print header can be programmed to refer specifically to your company or to your application.

Networking

All ALMEMO® devices can be addressed and can be easily networked by simply linking them together via network cable or for longer distances via RS422 network distributors. The CPU with option XU or XM occupies 3 addresses because each address can manage only 100 measuring channels.

Software

Each ALMEMO® Manual is accompanied by the software package AMR-Control; this 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 also available; this can be used for the purposes of measured value acquisition via networked devices, for graphical presentation, and for more complex data processing.

5. COMMISSIONING

1. Sensor connection Plug in the sensor at any socket **M0** to **Mxx** (2h); see Section7.

2. Power supply Connect mains adapter at **DC**socket (1a); see Section 6.1.

3. Switching on Press the **ON** key (1d); see Section 6.5.

4. Device configuration by PC via the interface
Connect computer via interface cable to socket A1 (1c); (see Manual 5.2).
Activate the software, e.g. the supplied AMR-Control.
Identify the device by means of <Search network>.
If the device is not found select <Setup interface>.
Set the appropriate COM interface and baud rate to 9600 baud; (see Manual 6.1.1).
<Update list>
<Program device>
Input "cycle" for automatic measuring point scan; (see Manual 6.5.2).
Activate "With memory" to save (only with option S or memory connector).
If necessary "Accept date and time-of-day from PC"; (see Manual 6.2.8).
Program the output format; (see Manual 6.5.5 and 6.6.1).
"Table" for MS-Excel / "List" or "Columns" for printer or text editor

5. Measured data acquisition from PC without saving in device
Call up <File - terminal>; (see Manual 6.1.3).
<Open file - terminal - log>, enter file name, "Save"
Start measuring operation by actuating the "Start" button or pressing the **START/ STOP** key; (see Manual 6.6).
Stop measuring operation by actuating the "Stop" button or pressing the **START/ STOP** key.
<Close file - terminal - log>
Call up file e.g. from MS-Excel and import using semi-colon ";" as separator; (see Manual 6.1.4)..

6. Saving measured values in the device
Call up <Devices - Measured value memory>.
If necessary "Clear memory" "Execute"; (see Manual 6.9.3).
For long-term recording (cycle > 2 minutes) Activate sleep mode; see Section 10.2.4.
"Start saving to memory" immediately or

Start measuring operation on site by pressing **START/ STOP** key.

Or in <Program device> enter measuring operation "Start date / time"´and "End date / time"; (see Manual 6.6.2).

At the end of the measuring operation stop recording again by pressing **START/ STOP**.

Transferring data from memory to the computer

If you are using a memory connector remove the multimedia card and transfer via a USB reader to the PC (see Manual 6.9.4.2) or

Reconnect the computer via the interface cable at socket A1 (2f); see above.

In AMR-Control call up <Devices - Measured value memory>.

Click on "Read out complete memory".

Read out "Execute", enter file name, "Save"; (see Manual 6.9.3).

Call up file e.g. from MS-Excel and import using semi-colon ";" as separator; (see Manual 6.1.4).

6. POWER SUPPLY

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

Mains adapter 12 V / 3 A   ZB1212NA6

Electrically isolated power supply cable, 10 to 30 VDC, 1.25 A ZB3090UK2

Rechargeable battery module, NiMH 9.6 V / 1600 mAh   ES5690AP

See product overview, Annex 14 and the following chapters.

6.1 Mains operation

To power the device from the mains use the mains adapter provided, 12 V / 3A (ZB 1212-NA6). The mains adapter must be connected to the DC socket (1a) and locked by twisting to the right; (LED **POWER** lights up).

If necessary the device can also be grounded via the bare socket (1g) (e.g. protective ground connector).

6.2 External DC voltage supply

The **DC** socket (1a) can also be used to connect another DC voltage, 10 to 13 V (minimum 200 mA). For this connection use a cable with 2 banana plugs (ZB 5090-EK). If, however, the power supply has to be electrically isolated from the transducers or if a larger input voltage range (10 to 30 V) is required, then electrically isolated supply cable ZB 3090-UK2 must be used. It will then be possible to use the measuring instrument in a 12-volt or 24-volt on-board supply system.

6.3 Operation with rechargeable battery (only with E5690AP)

For mains-independent operation the system must be equipped with 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 10.2.4). 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 without further delay. 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-NA6 (12 V / 3A) must be connected to socket **DC-A** on the AP module. The "CHARGE" lamp should then light up indicating that the batteries are being recharged. After approx. 3.5 hours the batteries should be fully recharged and the LED goes out again. After a certain period the batteries are then recharged again; the charge circuitry then switches 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.

6.4 Sensor supply

At the terminals + (plus) and – (minus) in the ALMEMO® connector there is, for mains operation, a sensor supply voltage available, approx. 11.5 V (400 mA / plug-in module) (self-healing fuse 500 mA); the total current requirement (device, sensors, output modules) is limited to approx. 1 A. 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, reinitialization

To switch the device **ON** press the ON / OFF key (1d); if all is in order the "ON" lamp lights up. To switch the device **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** (1f), before switching on, to address 99. This has the effect of also resetting the baud rate on the data cable (if connected) to 9600 baud. However, the programming of the sensors in the ALMEMO® connectors always remains unaffected and 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 data in the standard RAM and the date and time-of-day are buffered by a dedicated lithium battery; all this data is retained intact for years - even when the device is switched off and even in the absence of charged batteries. In the event of the lithium battery starting to weaken this will be indicated by a flashing ALARM LED. This still leaves enough time to read out and save the data stored in the memory. The plug-in CPU module can then be pulled out and the lithium battery replaced by a new one. If you have the option with the non-volatile FeRAM or you use the memory connector with the multimedia card then there is no risk of data being lost.

7. CONNECTING THE SENSORS / TRANSDUCERS

The **measuring inputs** are implemented by means of various passive and active selector switch boards with 10 inputs each; these are switched by photovoltaic relays; (see Section 7.3). The number of plug-in modules is only limited by the size of the housing and the number of available slots; however, the maximum number of channels is around 250. At over 100 measuring channels (requires option XU or XM) the system behaves like 3 devices with addresses as follows. To program and scan measuring points each hundreds group must be addressed with the device address and measuring point number. If only **passive selector switch boards** are being used, all measured values are acquired one after the other by the CPU measuring circuit; the time taken for a measuring point scan increases in proportion to the total number of active measuring channels. To determine the scan time more exactly one special measuring operation and where thermocouples are involved up to 2 cold junction compensation measurements / board are required.

A **higher measuring rate** of up to 400 mops can be obtained by means of **active selector switch boards** with integrated measuring circuit (requires option M), these - all simultaneously - acquire their measuring points themselves and are then quickly scanned by the CPU via the bus (requires option XM). The scanning rate is stipulated by the board with the most measuring points. It is advisable therefore to have the measuring channels distributed as evenly as possible over all selector switch boards.

At this higher measuring rate sensor presence is no longer checked during the measuring operation. Sensors must not be added or removed therefore during the measuring operation.
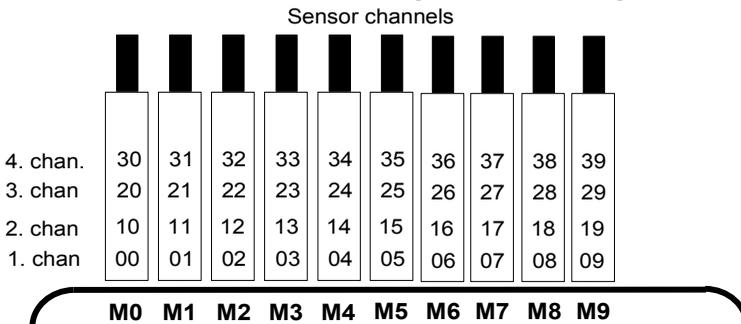
7.1 Sensor / transducer

At the ALMEMO® input sockets on the plug-in ALMEMO® modules, types U-A10 or M-A10 (2), any type of ALMEMO® sensor can simply be plugged in. The

ALMEMO® Manual includes detailed descriptions of the comprehensive range of ALMEMO® sensors (see Manual, Chapter 3) and of how to connect your own existing sensors to ALMEMO® instruments (see Manual, Chapter 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. To connect your own existing sensors you simply need the appropriate ALMEMO® connector.

7.2 Measuring inputs and additional channels

A selector switch module usually incorporates 10 inputs (2h) to which initially measuring channels M0 to M9 are allocated. However, each such input can if necessary provide up to 4 channels; 10 such inputs can thus provide a total of 40 possible channels. The additional channels can be used in particular with ALMEMO® humidity sensors for 4 measurable 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 2 or 3 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.).

On the 1st selector switch board this gives the following channel assignment :

Sensor channels

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

7.3 Selector switch boards

The **CPU measuring circuit board CPU** (1) manages all the selector switch boards and the data from all the measuring channels. The sensor and channel number of each module can be adapted to individual requirements by configuring the measuring point numbering and thus the channel number of the mod-

ules by means of a code switch (2i). This code switch defines the measuring point number of the first measuring point of each module and thus also the channel number of the previous module. The 1st plug-in module always begins at 0 (zero). The measuring point numbers of each subsequent plug-in module must be set between 10 and 40 measuring points higher than the previous module. Accordingly the channel number of the previous module will be limited to 10 to 40 measuring points. Multi-channel sensors should therefore be collected as far as possible in one module. At over 100 channels the measuring point numbering starts all over again with M00; the hundreds group is determined automatically from the overall order.

1. Each **selector switch board U-A10** (2) provides 10 electrically isolated ALMEMO® inputs for all ALMEMO® sensors. In the housing each module occupies 2 plug-in slots. For the purposes of thermocouple measurement each module is equipped with 2 cold junction sensors whose values are interpolated for each measuring point. If thermocouples are involved the measuring time for this will affect the total sampling rate.

2. **Selector switch board U-MU** (3) has 10 inputs led out to a 64-contact socket strip. Sensors are connected via a 10x connector (ZA 5690-MU) each with 4 screw terminals A, B, C, D - in the same way as any standard ALMEMO® connector; (see Manual 4.1). Sensors requiring a power supply or an ALMEMO® ® connector with special interface circuitry (e.g. humidity sensors, rotating vanes, etc.) cannot be connected in this way. The new connector ZA 5690-MU with a larger EEPROM now permits 4 channels per sensor, i.e. 40 channels altogether; on the old connector ZA 5590-MU there are only 10 channels available. Measuring point numbering, however, is as described above, namely by means of code switches internally on the board. For this purpose the module must be withdrawn and the number on the switch multiplied by 10 (4 = measuring point 40). Each sensor can be programmed individually but all sensor programming data is saved together in a shared EEPROM located in the connector. A cold junction sensor is also provided for thermocouples.

3. **Selector switch board U-KS** (4) also has 10 inputs; these are led directly onto two 20-contact plug connectors with terminals. Sensors can be connected via terminals A, B, C, D, with the usual wiring arrangement; (see label on the side of the connector, example on the right). In order to feed in the wires the outside connectors must be opened by inserting a narrow screw-driver in the inside holes. These boards are also available with shunts for 20-mA signals (terminals A and B for units "mA" or "% ") and with dividers for 10-V signals (terminals A and C for units "mV 2"). A module is only suitable for thermocouples if these are connected using copper wires via an isothermal block with integrated cold junction sensors; (see Manual 6.7.3). Automatic sensor recognition is not possible with this

A B C D	0
A B C D	1
A B C D	2
A B C D	3
A B C D	4

plug-in module; the sensor data is saved to an EEPROM on the board and must be programmed depending on sensor type e.g. using the AMR-Control software. In the newest version (5.13) this several sensors can be programmed at the same time. Measuring point numbering is by means of the code switch internally on the board (see above). This module, similarly, occupies 1 plug-in slot only.

4. **Selector switch board U-TH** (5) has 10 inputs for thermocouples with a thermal connector. The sensor data is saved to an EEPROM on the board; this means that individual programming is required; (see above). This module occupies only 1 plug-in slot but if arranged in a series a dummy panel must be inserted between in order to operate the connectors. Measuring point numbering is by means of the code switch internally on the board (see above).

5. **Active selector switch board M-A10, M-MU, M-TH, M-KS** with integrated measuring circuit (all option M) can be scanned more rapidly (up to 400 mops); otherwise they have the same characteristics as passive selector switch boards.

7.4 Potential separation

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

The analog inputs are electrically isolated from one another by means of photovoltaic relays. A new feature on this device is the additional separation of the measuring inputs from the 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 common internal power supply ±U. If a sensor of this type has no connection to pin A, it must be electrically isolated by means of relay S (see above) or even be bridged by a wire jumper because otherwise the inputs would have no reference potential. The relay is set automatically by

means of 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. Sensors with their own integrated power supply must themselves be isolated or the device must be operated with an electrically isolated power supply (mains adapter or connecting cable ZB 3090-UK2 with DC/DC converter).

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

8. OUTPUTS

The CPU system 5690-1CPU provides not only the usual output sockets A1 and A2 for data cables, network cables, and V5 output cables (see Manual Ch 5) but also 4 additional sockets A3, A4, A5, and P0, so that the many possibilities of the ALMEMO® periphery can all be used simultaneously. For this purpose socket P0 has two integrated elements as option and new V6 output modules with which each element (relay, trigger input, or analog output) can be individually configured in all function variants. To ensure that all elements are addressed, each of these sockets has been assigned 10 port addresses pp.

Socket	Connection	Port
P0	internal elements (relay, analog outputs, trigger)	00 to 09
A1	V5 output cables or V6 output modules	10 to 19
A2	V5 output cables or V6 output modules	20 to 29
A3	MMC memory connector (see 10.2.2)	30 to 39
A4	V6 output modules (relay, trigger, analog outputs)	40 to 49
A4	V6 output modules (relay, trigger, analog outputs)	50 to 59
B6	V6 output module (relay, trigger, analog outputs)	60 to 69
:		

When using V5 and V6 output modules please note the following :

● All old output cables (V5) can only be used at sockets A1, A2 and using the old protocol.
● However, old output cables (V5) can be recoded to the V6 format.
● V6 output cables can be used on all sockets A1 to A5.
● Only V6 trigger cables can be used to execute command macros; (s. man. 6.6.5).
● Memory card connector (ZA 1904-MMC) must be connected at A3.
● For internal modules at socket P0 only a clamp connector (ZA1000-KS) must be used.

The V6 output modules can be configured comprehensively; new commands are available; (see Manual 6.10.9.2).

9. OPERATION AND CONFIGURATION

Data acquisition system ALMEMO® 5690-1CPU has only a few operating controls; it is operated mainly via a PC.

9.1 Combination key

The first function of the one and only key **ON / OFF - START / STOP** (1d) on the CPU measuring circuit board has already been described in Section 6.5.

Press to switch the device 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.

9.2 Status LEDs

The status LEDs (3) report the current device status as follows :

ON is lit continuously - Device is switched on.

ON flashes briefly - Device is in SLEEP mode.

START is lit continuously - Cyclic measuring has been started.

COM is lit continuously - Measured value transfer to the PC - cyclic

COM flashes - Measured value transfer to the PC - at the conversion rate

REC is lit continuously - Measuring point scan with data saving - cyclic
This also lights up during memory output.

REC flashes - Data saving - at the conversion rate

START flashes briefly - Once-only measuring point scan by computer

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

REC flashes briefly - Once-only measuring point scan with data saving

ALARM - Limit value exceeded or sensor breakage

ALARM flashes Device supply voltage too low

9.3 Device address and networking

ALMEMO 5690-1C systems, 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 (1f), to different device numbers.
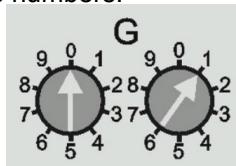
Example   Module address 01   0   1

☞ With option XU or XP permitting up to 250 measuring channels the system occupies altogether three device addresses. The measuring point hundreds groups must each be programmed and scanned just like separate devices (except for the purposes of memory output). The start address of the CPU must not be higher than value 7.

9.4 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.

10. MEASURED DATA ACQUISITION

Measured data acquisition can be performed in basically two ways.
1. Perform measurement online and transfer data to the PC immediately (device-internal memory need not be used).
2. Perform measurement offline, i.e. the data is first saved to the device memory or to an external memory connector with multimedia card and then transferred to the PC later.

10.1 Online measurement with PC

For conveniently recording measured data on the PC our Win-Control measured value acquisition software 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.

10.2 Offline measurement

Offline measuring operations, i.e. data logging in the device itself, can be performed using either the 2-MB memory on the CPU board or an external memory connector at A3 (1c) with multimedia card (ZA 1904-MMC).

10.2.1 Measured value memory, internal

The CPU measuring circuit board is equipped as standard with a 2-MB RAM: this is sufficient for 250000 to 400000 measured values (depending on the number of channels). This RAM is buffered by means of a lithium battery, just like the real-time clock. For critical applications conducted over long periods non-volatile FeRAMs are also available as an option. 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 <u>internal</u> memory supports the following functions :

 Recording to ring memory, sleep mode
 Selective data output according to date and time-of-day
 Selective data output by number
 However, only one connector configuration is possible.
 As output only table format is available.

10.2.2 Memory connector with multimedia card

The other convenient method for data recording is to use memory connector ZA1904-MMC with a conventional multimedia flash memory card.   The memory card should preferably be RS form (reduced size), half size, 32 to 512 MB; measured data is written to it via the memory connector in table mode and in standard FAT16 format. The MMC card can be formatted and its contents can be read and deleted via any normal PC using any card reader; (see Manual 6.9.4.2). Measured data can be imported into MS-Excel or into Win-Control. The memory connector works in a completely different way to the device-internal memory; this brings both restrictions and advantages.

Functions of the MMC memory connector

 Virtually unlimited memory capacity
 With each new connector configuration a new file is created.
 <u>No</u> recording to ring memory
 Sleep mode is possible.
 Data can be evaluated using any reader on site or 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.
 <u>No</u> selective data output according to date and time or by number

The memory connector with the memory card can be connected at socket A3 (1c); it is recognized automatically. If the external memory is connected at the start of any measuring operation, it will be used. 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, any number of measuring operations can be saved - 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.

10.2.3 Recording to memory
The following parameters must be configured :
1. Date, time-of-day
2. Cycle with memory activation, possibly conversion rate
3. Sleep mode, possibly
The easiest way to do this is by means of the AMR-Control software - in the menu <Program device> or the menu <Measured value memory> menu item "Start recording to memory".
If the computer is on during the measuring operation, you can, in menu item "Start recording to memory", also **start measuring**. Once this has started the program switches to the terminal window and lists the measured values in the programmed cycle. To **stop** press the "Stop" button.

To **start / stop a measuring operation** on site without the computer the following methods are available; (see Manual 6.6).
1. Press the **START / STOP** key (1d) 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 9.2).

To **read out the measured data** (see Manual 6.9.3) select AMR-Control menu item <Devices - Measured value memory>. Here, in the menu item "Read out memory", you can read out the internal memory and copy this to a file on the PC - either completely - or parts of it selected according to date and time-of-day or by number. In the menu item "Delete memory" you can clear the memory. In the case of a multimedia card only the last file can be read out completely and **clearing** the memory has the effect of **reformatting** the entire card.
Via the USB reading device on the PC all files can be accessed very quickly.

10.2.4 Sleep mode
For long-term monitoring involving large measuring cycles where power is supplied by rechargeable or normal battery the measuring system 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, depending on the number of measuring points, it is possible, with just one battery recharge, to perform up to 15000 measuring point scans; with a cycle last-

ing 10 minutes this represents a measuring duration of up to 100 days.

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

1. Enter a cycle lasting at least 2 minutes (see Manual 6.5.2).
2. Activate saving to memory in the cycle.
3. Activate sleep mode (see Manual 6.9.2.1 Scanning in sleep mode)
4. Start measuring as described; the device should then switch off automatically; as a check the status LED "**ON**" (1e) should flash rhythmically on and off.
6. In the specified cycle the instrument switches on automatically, performs one measuring point scan, and then switches off again.
7. To stop the measuring operation twice press key (1d), 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.

11. SPECIAL MEASURING RANGES , LINEARIZATION , MULTI-POINT CORRECTION 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 non-linear signals for voltage, current, resistance, or frequency characteristics
3. Multi-point adjustment of all sensors
4. Serial number and calibration data management in the sensor

The 5690-1CPU system can as a standard feature evaluate all appropriately programmed special connectors or connectors with multi-point correction on **all** selector switch boards. **Multi-point adjustment** of temperature sensors or pressure sensors can be performed as part of a factory or DKD calibration (KA9001DW) (DKD = Deutscher Kalibrier-Dienst = German calibration service). With option KL you can also, using the AMR-Control software, program a characteristic of up to 35 support values in the sensor EEPROMs (menu item <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; only then are the deviations 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´.

11. Special measuring ranges , Linearization ,Multi-point correction Calibration data management

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 internwtworked systems this permits automatic monitoring of the calibration intervals; (see Manual 7.4.4).

12. TROUBLE-SHOOTING

Data acquisition system ALMEMO 5690-1CPU can be configured and programmed in many versatile ways. It 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; usually the cause is incorrect operation by the user, an invalid setting, or unsuitable cabling. In such event try to pinpoint and clear the problem with the aid of the following tests.

Error No or all LEDs light up; keys do not react.
Remedy Check the power supply, charge the battery, switch off and then on again.
     If necessary re-initialize (see 6.5).
Error "ALARM" LED flashes, rechargeable battery pack or lithium battery discharged
Remedy Recharge battery pack (see 6.3) or replace lithium battery (see 6.6).
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 integrated power supply check element flag 5; (see 7.4).
     Unplug any suspicious sensors.
     Connect hand-held sensors in air or phantoms and check (thermocouples, short-circuit AB, use 100Ω for Pt100 sensors) .
     Connect the sensors again one at a time and check successively.
     If a fault persists for any one connection, then check all wiring; if necessary, insulate the sensor and eliminate interference by using shielded or twisted wiring.
Error Data transmission via the interface does not function.
Remedy Check interface module, connections, and settings.
     Are both devices set to the same baud rate and transmission mode ?

(see Manual 6.10.12).

In the event of a reset (see 6.5) with the interface module connected, the baud rate will be set to 9600 baud.

Is the correct COM interface on the computer being addressed ?

Is a printer in the ONLINE status ?

Are the handshake lines DTR and DSR active ?

To check the data flow and the handshake lines a small interface tester with LEDs comes in very handy; (in ready-to-operate status the data lines TXD, RXD carry negative potential of approx. -9V and these LEDs light up green, whereas the handshake lines DSR, DTR, RTS, CTS carry positive voltage of approx. +9V and these LEDs light up red. For the duration of data transmission the data LEDs should flash red.

Check data transmission by means of a terminal (AMR-Control, WIN-Control, WINDOWS-Terminal).

Address the device using its assigned device number "Gxy" (see Manual 6.2.1).

If the device is in the XOFF status, enter <ctrl Q> for XON.

Check the programming by means of "P15" (see Manual 6.2.3).

Test the transmit line only by entering the start command "S2", the LED **START** should light up.

Test the receive line only by pressing the **START / STOP** key.

Error Data transmission in the network does not function.

Remedy Check to ensure that all devices are set to different addresses.

Address all devices individually via the terminal using command "Gxy".

Addressed device is OK if at least "y CR LF" is returned as echo.

With option XU or XM 3 addresses are occupied.

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 showing the relevant programming and save and / or print out a comprehensive "Function test" in the device list or the terminal.

13. ELECTROMAGNETIC COMPATIBILITY

Data acquisition system ALMEMO 5690-1CPU complies in full with the safety requirements specified in the EU directive relating to electromagnetic compatibility (EMC) (89/336/EWG).

The following standards have been applied in evaluating the product.

IEC 61326:1997+A1:1998+A2:2000
IEC 61000-6-1:1997   IEC 6100-0-4-2: 1995+A1:1998+A2:2000 8kV
IEC 61000-6-3:1996   IEC 61000-4-4: 1995+A1:2000 2kV
                        IEC 61000-4-3: 1995+A1:1998+A2:2000 10V/m

The following advisory notes must be observed when operating the device.

1. If the standard sensor is extended (1.5 meters) care must be taken to ensure that the measuring lines are not laid together with high-voltage power cables and that, if necessary, they are properly shielded so as to prevent spurious interference being induced in the system.

2. Using the device in strong electromagnetic fields may aggravate measuring errors. After exposure to such irradiation ceases, the device will again operate within its technical specifications.

14. APPENDIX

14.1 Technical data   (see Manual 2.3 and 2.5)

CPU measuring circuit CPU

A/D converter	Delta - sigma, 24-bit, 2.5 / 10 / 50 / 100 mops, adjustable 1 to 100
Sensor power supply	11.5 V (rechargeable battery 9 to 11.5), current 0.4 A / plug-in module, total 1 A

Measuring inputs:

Selector switch board U-A10: 10 ALMEMO® sockets,
suitable for ALMEMO® flat connectors
10 channels, electrically isolated,
30 additional channels
with sensor power supply, 2 slots

Selector switch board U-MU: 10 inputs, electrically isolated, via 10x MU connector
without sensor power supply,
30 additional channels, 1 slot

Selector switch board U-TH: 10 inputs, electr. isol., via miniature thermal connector
Without sensor power supply,
30 additional channels, 2 slots
If arranged in series one dummy panel
must be inserted, 4 DU

Selector switch board U-KS: 10 inputs, electrically isolated, via 2 clamp connectors
without sensor power supply,
30 additional channels, 1 slot

Option KSU	10 inputs, A - C, with 100:1 divider Accuracy 0.1 % (22 °C), drift 0.003 % / K
Option KSI:	10 inputs, A - B, with shunt, 2 ohms Accuracy 0.1 % (22 °C), drift 0.005 % / K
Option MK:	Dedicated measuring circuit for all selector switch boards

Outputs (see 1)   6 ALMEMO® sockets suitable for all output modules

Socket **A1**	Data cable, relay-trigger analog modules, V5 and V6
Socket **A2**	Network cable, relay-trigger analog modules, V5 and V6
Socket **A3**	MMC connector, relay-trigger analog modules, V6 only
Socket **A4**	Relay-trigger analog modules, V6 only
Socket **A5**	Relay-trigger analog modules, V6 only
Socket **P0**	Relay-trigger analog modules, integrated (option)

Standard equipment :

Operation	1 key (On / Off, Start / Stop)
Date and time-of-day	Real-time clock, buffered with lithium battery
Memory	2-MB RAM (250000 to 400000 measured values) buffered
Option SF	2-MB FeRAM, non-volatile

Power supply :   external 10 to 13 VDC

Mains adapter   ZB 1212-NA6 230 VAC to 12 VDC, 3 A
Rechargeable battery with plug-in module AP   8 NiMH cells, AA, 9 to 11.5 V,
                                                    1600 mAh
Current consumption
    Active mode   approx. 25 mA (without input and output modules)
    Sleep mode   approx. 0.05 mA
    Selector switch boards   passive: approx. 5 mA; active with measuring circuit :
                                                    approx. 30 mA

Housing :
19-inch desktop housing, 12 DU   WxHxD 78 x 145 x 218 mm Polystyrene
19-inch desktop housing, 32 DU   WxHxD 179 x 158 x 232 mm Polystyrene, shielded
19-inch desktop housing, 84 DU   WxHxD 444 x 158 x 232 mm Polystyrene, shielded
19-inch sub-rack, 84 DU   WxHxD 483 x 132 x 273 mm

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

Product overview   Order no.
Data acquisition system ALMEMO 5690-1CPU
Measuring circuit for 100 measuring points with selector switch boards,
6 output sockets,1 key
2-MB memory, real-time clock, cascadable interface, mains adapter 12 V / 3 A
in 19-inch desktop housing, 12 DU, 1 slot   MA 56901CPUTG1
in 19-inch desktop housing, 32 DU, 6 slots   MA 56901CPUTG3
in 19-inch desktop housing, 84 DU, 19 slots   MA 56901CPUTG8
in 19-inch sub-rack, 84 DU, 19 slots   MA 56901CPUBT8

Options : (* only 1 option possible)
SF: 2-MB FeRAM non-volatile, instead of RAM, buffered   OA 5690-SF
XU: Passive selector switch, up to 190 measuring points, 250 channels OA 5690-XU
XM: Supports active selector switch with measuring circuit, up to 250 channels
      OA 5690-XM
SH2: 2 semiconductor relays, normally open, 1 Ω, 0.5 A, 50 V, internal   OA 5690-SH2*
TR2: 2 optocoupler trigger inputs, internal   OA 5690-TR2*
R22: 2 analog outputs, 10 V, internal   OA 5690-R22*
R32: 2 analog outputs, 20 mA, internal   OA 5690-R32*
KL: Linearization, multi-point calibration, calibration data management OA 5690-KL
R: Measuring ranges for temperature display for 10 refrigerants   SB 0000-R2

Additions
Rechargeable battery module (8 cells, NiMH, 1600 mAh)   ES 5690-AP
Selector switch board U-A10 with 10 inputs, electrically isolated
for ALMEMO® flat connectors, 10 to 40 channels, 2 slots   ES 5690-UA10
Selector switch board U-MU with 10 inputs, electrically isolated
Sensor connector with 10x MU connector, 10 to 40 channels, 1 slot   ES 5690-UMU
10x MU connector for 10 sensors, 10 to 40 channels   ZA 5690-MU
Selector switch board U-TH with 10 inputs, electrically isolated

Sensor connector with thermal connector, 10 to 40 channels, 2 slots   ES 5690-UTH
Selector switch board U-KS with 10 inputs, electrically isolated
Sensor connector with clamp connector, 10 to 40 channels, 1 slot   ES 5690-UKS
Option KSU Inputs for 10 V with 100:1 divider   OA 5690-UKSU
Option KSI: Inputs for 20 mA with shunt   OA 5690-UKSI
Option with measuring circuit (active selector switch)
for all selector switch boards   OA 5690-M

Accessories:
Memory connector, including multimedia card, minimum 128 MB,
USB card reader   ZA 1904-MMC
DC power cable, 10 to 30 VDC, 12 V / 1.25 A, electrically isolated   ZB 3090-UK2
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, electr. isol., maximum 115.2 kbaud   ZA 1999-NK5
ALMEMO® data cable with Ethernet interface, el. isol., max.115.2 kbaud   ZA 1945-DK
ALMEMO® V5 recording cable, not electrically isolated, -1.25 to 2.00 V   ZA 1601-RK
ALMEMO® V6 input / output cable for triggering and limit value alarm   ZA 1006-EAK
ALMEMO® V6 relay-trigger adapter (4 relays, 2 trigger inputs)   ZA 8006-RTA3

14.2 Index

14.3 your contact