BARTEC

Moisture Analyzer Control Software

MACS HYF 5674

Software Manual

459318MDSEN - V1.0
Software V1.0.1
07/2023

en

Read this software manual and the operating manual carefully before installing and using the device. BARTEC BENKE GmbH will not accept any liability for damage caused by failure to observe the software manual, the operating manual or the safety instructions.

When translated into other languages, the German version of the manual must be regarded as definitive.

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Contact details
see imprint of operating manual

Contents

1 About this manual

This manual supplements the device's safety manual. Please pay particular attention to the safety instructions in that manual.

This manual contains information on the measuring process procedure for the device. It describes in detail the operation of the MACS software (MACS for short) for controlling the measuring process.

This manual relates to the software version that was valid at the time of publication (see the *Software version* cover sheet).

Optionally, the readings from the device can be transferred to the DCS (distributed control system) using a Modbus transmission protocol.

NOTICE	
	**Information on the Modbus transmission protocol can be found in the *Chapter 6.4 "Modbus parameters" on page 44*.**

Aid for troubleshooting in the event of error messages from the software see *chapter 5 "Troubleshooting" on page 35*.

2 Operating MACS

MACS is normally operated locally using the touchscreen. The following describes the basic operation and clarifies what the individual fields and displays mean.

2.1 Description of main window controls

The following figure shows the basic controls for operation.

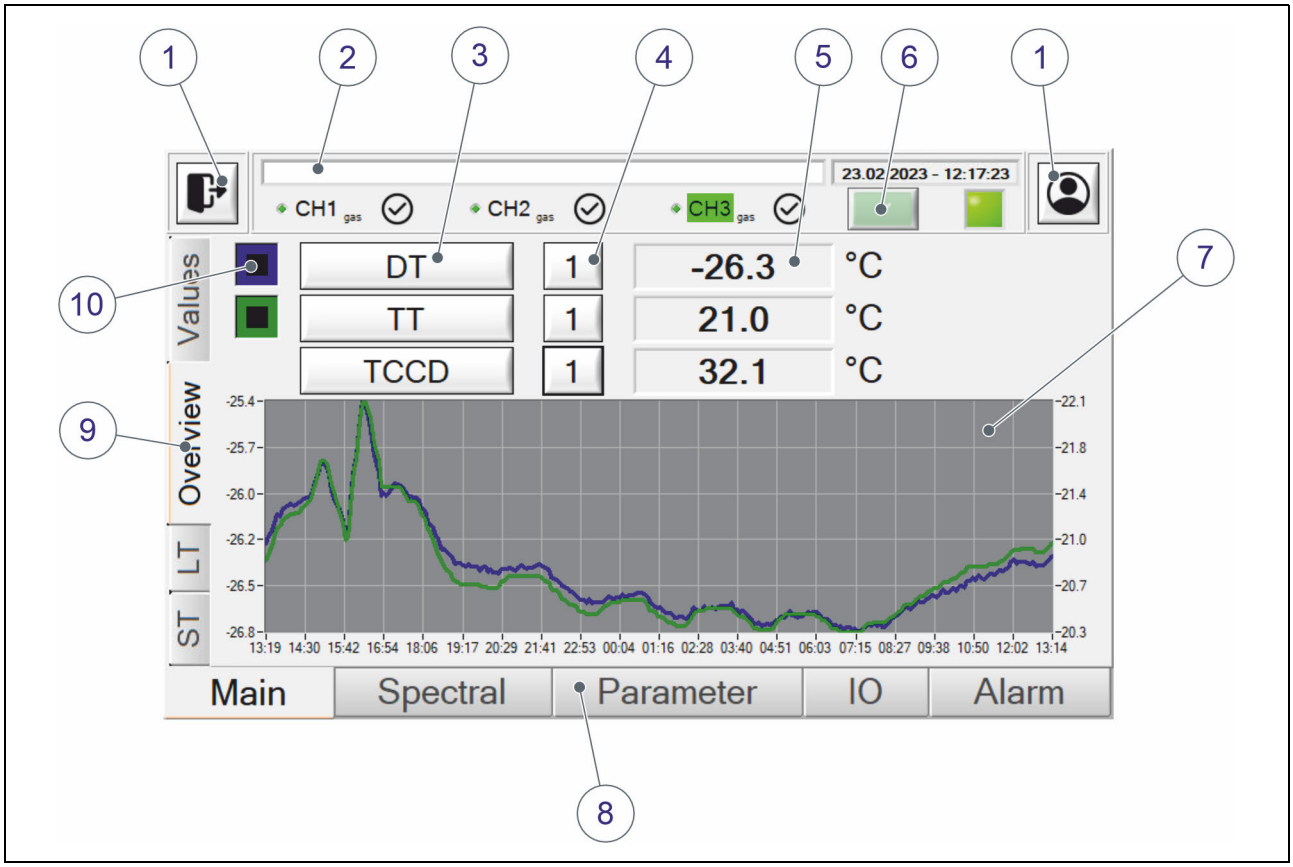
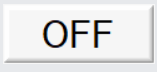
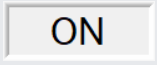


Figure 2.1: Overview of controls

1. Action button
2. Display of error messages
3. Modifiable display of a value
4. Modifiable display of a channel
5. Text field for displaying values
6. Button for acknowledging alarms
7. Graphical display of measured values
8. Main pages at bottom
9. Sub-pages (left or top)
10. Selection boxes

2.1.1 Control and display elements

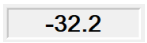
The following table briefly outlines the various control and display elements:

Element	Meaning
	*Exit* button for closing MACS, shutting down/ restarting device. (see *chapter 2.2 "Top menu bar" on page 7*)
	Button for switching user level. (see *chapter 2.8 "Selecting the user level" on page 24*)
	Button for saving changes on the main page *Parameter*, *IO* or *Alarm*
	Button for canceling an action. Changes are discarded.
	Acknowledging all pending alarms. (see *chapter 2.7 "Alarm main page" on page 23*)
	Button for accepting a value and inserting it into a text field to the left of this button. (see *chapter 2.6.2 "IO - AI (analog inputs) sub-page" on page 17*)
	Button for accepting a value and inserting it into a text field to the right of this button. (see *chapter 2.6.2 "IO - AI (analog inputs) sub-page" on page 17*)
	LED display (status, pending signal etc.)
	Button for deactivating a function (Simulation e.g. - see *chapter 2.6.4 "IO - Settings sub-page" on page 20*)
	Button for activating a function (Simulation e.g. - see *chapter 2.6.4 "IO - Settings sub-page" on page 20*)
	Button for opening the alarm log book (see *chapter 2.7 "Alarm main page" on page 23*)
	Button for opening the general log book (see *chapter 2.7 "Alarm main page" on page 23*)

Element	Meaning
	Only from *Expert* user level and above: Button for changing the password of the *Expert* user level (Default password see *chapter 2.5 "Parameters main page" on page 14*)
	Button for showing/hiding the mouse cursor. Useful when using remote access (e.g. TeamViewer) (see *chapter 2.5 "Parameters main page" on page 14*)
	*Backup to SD card* button (see *Figure 2.10 on page 14*)
	Only from *Expert* user level and above: Button for saving LED calibration (see *chapter 6.2 "Calibrating spectrometer with argon lamp" on page 40*)
	Only from *Expert* user level and above: Button for saving the calibration of the spectrometer using an argon source (see *chapter 6.2 "Calibrating spectrometer with argon lamp" on page 40*)
-32.2	Display or text field. Tap on an editable text field in order to enter a new value (see *chapter 2.1.2 "Notes on operation" on page 5*).

2.1.2 Notes on operation

- Tapping on the changeable display of a value selects the next value. Tapping and holding selects the previous value.



- Tapping on an editable text field (parameter, IO etc.) opens an input window in which you can adjust the value.
- Tapping twice in a graphical display similarly opens an input window
  (see position **(7)** in *Figure 2.1 on page 3*).

Example of an input window

The following figure shows an example of an input window and explains the function of the buttons:

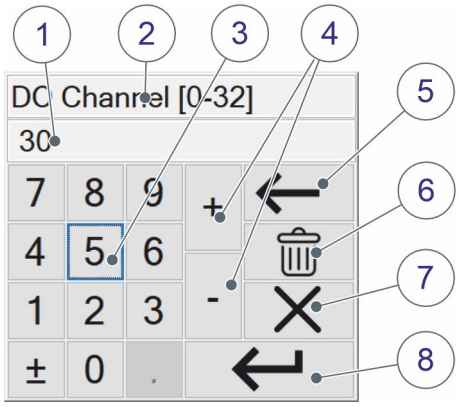


Figure 2.2: Input window

(1) Input field for the value
(2) Designation of the selected value
(3) Numerical input keyboard
(4) Increase/reduce value incrementally
(5) Delete last character
(6) Clear entire entry field
(7) Cancel input and close input window
(8) Confirm entry and accept value

2.2 Top menu bar

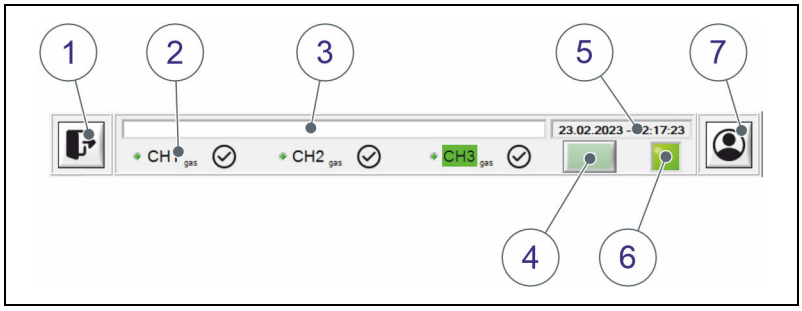


Figure 2.3: Top menu bar

1. *Close/restart/shutdown* button
2. Status display of channels
3. Display of last error message
4. Button for acknowledging alarms
5. Display of current date and current time
6. Status LED (green = system working as normal)
7. *Select user level* button

The status is displayed for each connected channel (green = measurement successful). The designation at the bottom right indicates the medium in which measurement is performed.

If no symbol is displayed next to the channel name, MACS is waiting for the measurement. The various symbols next to the channel name are as follows:

Symbol	Meaning
	Reading is valid
	Limit exceeded (see *chapter 5.1 “Limit violations” on page 36*)
	Limit undershot (see *chapter 5.1 “Limit violations” on page 36*)
	Measured value invalid
	Sensor being serviced. The last valid measured values are retained, meaning that erroneous measured values do not occur in the DCS. (see *chapter 2.6.4 “IO - Settings sub-page” on page 20*)

If a fault or alarm is generated, the last reported is displayed with a yellow or red background:

Yellow	Warning
Red	Alarm

The *Alarm* main page provides detailed alarm information. Alarms can also be acknowledged on this page (see *chapter 2.7 "Alarm main page" on page 23*).

Information on selecting the user level is provided in *Chapter 2.8 "Selecting the user level" on page 24*.

2.2.1 Closing, restarting or shutting down

Only from *Expert* user level and above: Tapping on the button displays the following window:

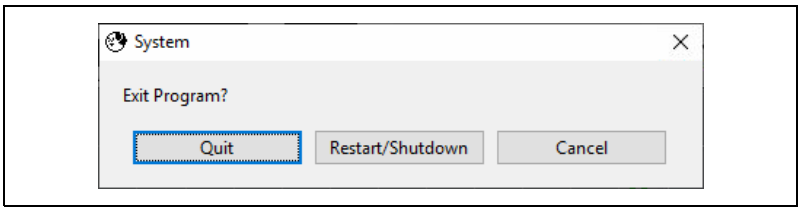


Figure 2.4: System window

- *Quit* closes *MACS* and you can access the Windows user interface.
- *Restart/shutdown* closes *MACS* and Windows and restarts the IPC. Upon restarting, MACS is automatically restarted.
- *Cancel* closes the window.

2.3 *Main* main page

The *Main* main page provides several sub-pages accessible on the left.

2.3.1 *Main - Values* sub-page

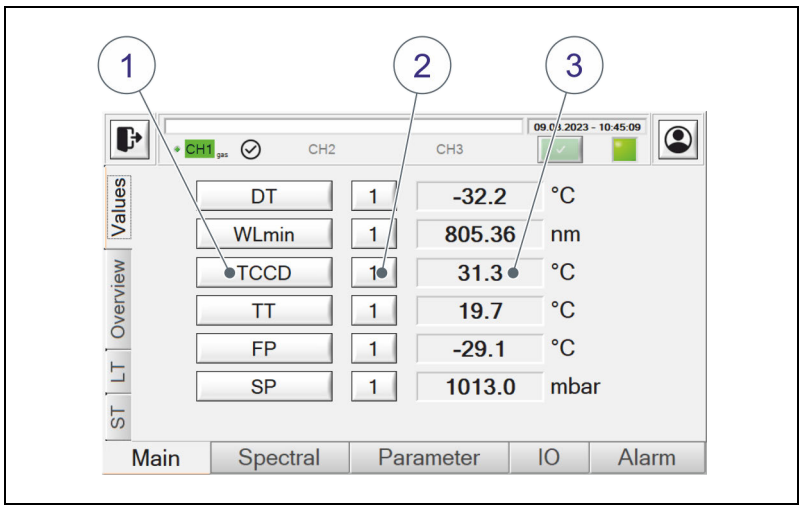


Figure 2.5: *Main - Values* sub-page

(1) Various measured values can be selected/displayed.

(2) Selection of channel 1-3.

(3) Display of selected measured value.
The units can be changed on the Parameters page.
(see *Section 2.5 "Parameters main page" on page 14*)

The following measured values can be selected:

Measured value	Description
DT	Dew point temperature
FP	Freezing point temperature
DTref	Reference dew point temperature (for GERG only)
MC (B)	***M**oisture **C**ontent* Measuring method according to *Bukacek*
MC (A)	***M**oisture **C**ontent* Measuring method according to *Alliance*
MC (D)	***M**oisture **C**ontent* *Default* measuring method
MC (G)	***M**oisture **C**ontent* Measuring method according to *GERG*
PPMV (B)	Moisture content volume in *Parts per million* Measuring method according to *Bukacek*
PPMV (A)	Moisture content volume in *Parts per million* Measuring method according to *Alliance*

Measured value	Description
PPMV (D)	Moisture content volume in *Parts per million* *Default* measuring method
PPMV (G)	Moisture content volume in *Parts per million* Measuring method according to *GERG*
VOL% (B)	Moisture content volume in percent Measuring method according to *Bukacek*
VOL% (A)	Moisture content volume in percent Measuring method according to *Alliance*
VOL% (D)	Moisture content volume in percent *Default* measuring method
VOL% (G)	Moisture content volume in percent Measuring method according to *GERG*
WLmin	Measured minimum wavelength
TT	Corrected temperature value of sample
TCCD	Temperature of spectrometer
SP	Pressure in the sample
SPref	Virtual reference pressure when used under real conditions (for GERG only)
RH	Relative humidity
SVP	Saturated vapor pressure
VP	Vapor pressure
VPeff	Effective vapor pressure

2.3.2 *Main - Overview* sub-page

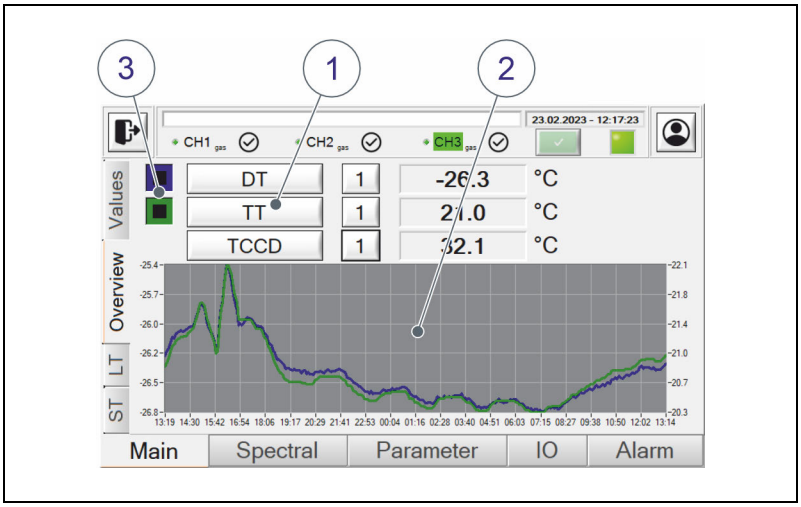


Figure 2.6: *Main - Overview* sub-page

3 different measured values **(1)** can be selected on this page. Selection is performed as described in *Section 2.3.1 "Main - Values sub-page" on page 9*.

All measured values show the current measurement result in the text field. For the first two measured values, the values for past hours can also be graphically depicted. The time period can be modified by double-tapping on the graphic **(2)**.
(For information on operation see *Figure 2.2 on page 6*)

The graphical depiction is activated or deactivated using the boxes **(3)**. Selecting the boxes shows the measurement curve for the respective measured value in the chart. In the example shown, the blue curve represents the *DT* and the green curve the *TT*. The selected measured values are also graphically depicted on the *LT* and *ST* pages.

2.3.3 *Main - LT (Long Term)* sub-page

The first two measured values selected on the *Overview* page are graphically depicted on this page. The chart represents an extended period (***Long* Term**) in hours.

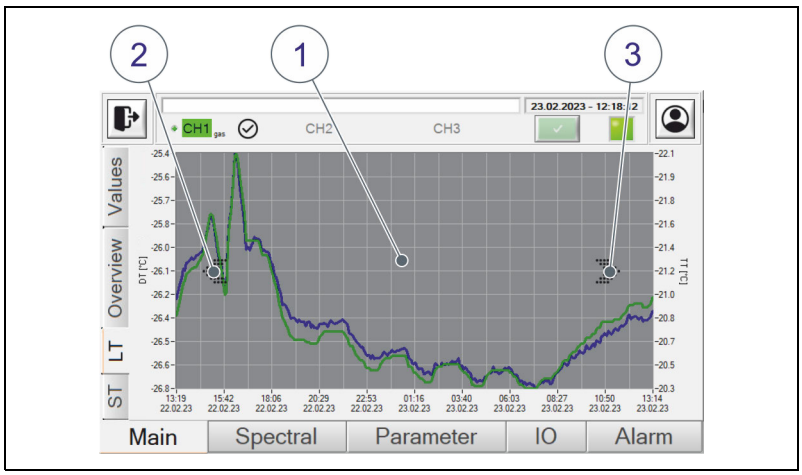


Figure 2.7: *Main - LT* sub-page

(1) By double-tapping on the chart, you can enter a desired period in hours (see *Figure 2.2 on page 6*).

(2) Tapping on the left arrow starts the period earlier.

(3) Tapping on the right arrow starts the period later. The values are shown up to max. the current time.
The display is regularly updated.

2.3.4 *Main - ST (Short Term)* sub-page

The first two measured values selected on the *Overview* page are graphically depicted on this page. The chart represents a shortened period (***Short* Term**) in minutes.

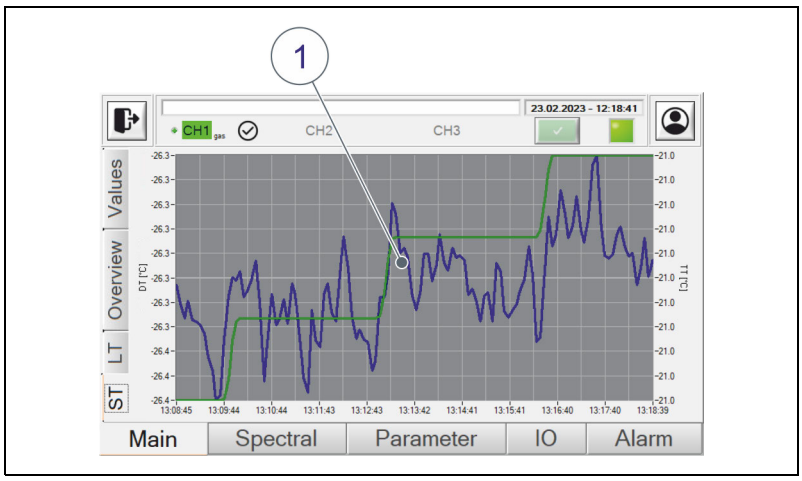


Figure 2.8: *Main - ST* sub-page

(1) By double-tapping on the chart, you can enter a desired period in minutes (see *Figure 2.2 on page 6*).

2.4 *Spectral* main page

Values and data for the spectrometer are shown on this page.

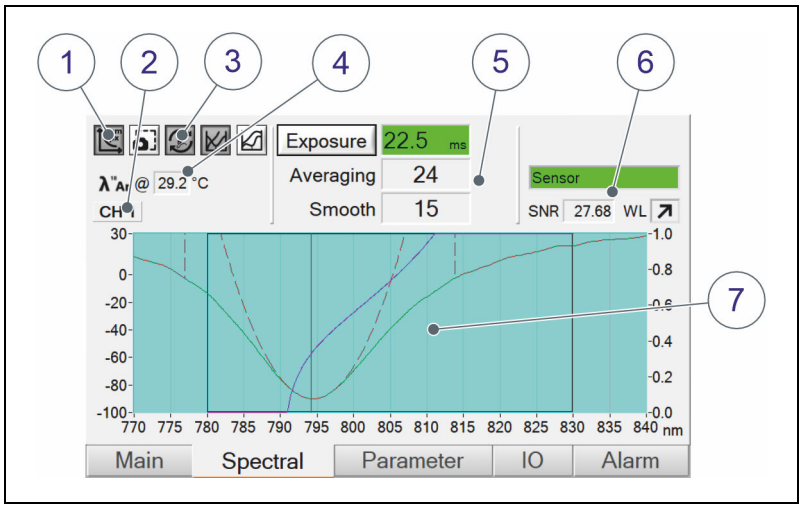


Figure 2.9: *Spectral* main page

(1) The graphical display (6) can be modified using the buttons (from *Expert* user level and above).

(2) Current channel on which measurement is running.

(3) The graphical display (6) is continually updated or a new graph superimposed using this button. The latter allows e.g. *jittering* or shifting to be identified.

(4) Temperature at which the spectrometer was calibrated.

(5) Spectrometer settings (display).

- *Exposure* = exposure time.
  Automatically set in all cases.
  Readjustment can be initiated by tapping on the button.
- *Averaging* and *smooth* can be set using the parameters (see *chapter 4.1 "Device parameters" on page 29*).

(6) Sensor data:

- *SNR* (*Signal Noise Ratio*) of the current channel
- Identified sensor in the indicated channel

The *WL* (wavelength) field graphically displays whether the measured value changes:

=	Measured value is stable
↗	Measured value increasing
↘	Measured value reducing

NOTICE	
	**If you have replaced a sensor and reconnected it to a channel card, you must reimport the associated sensor files incl. spectrum and save them to the device. To do this, follow the instructions in *Chapter 6.3 "Backup and update tool" on page 43*.**

(7) Graphical display
(shown only in *Expert* user level).

Section 2.8 "Selecting the user level" on page 24 describes the process for alternating the user level.

2.5 *Parameters* main page

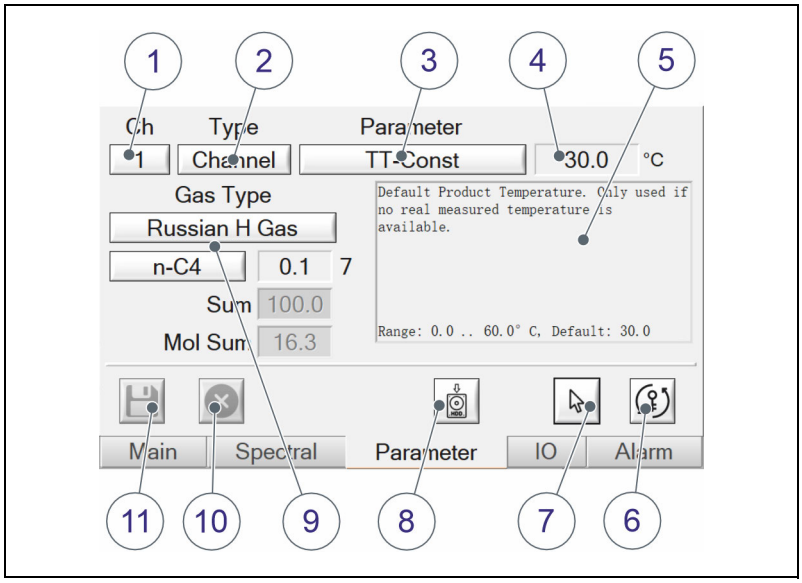


Figure 2.10: *Parameters* main page

(1) Channel selectable, if *Channel* has been selected for (2).

(2) Parameter type: Device parameters (*Device*) or channel parameters (*Channel*).

(3) Parameters. For selection, see *Section 2.1.2 "Notes on operation" on page 5*.

(4) Value of parameter.
In *Expert* user level only: Tap in the text field to change the value. Entering is as described in *Section "Example of an input window"*

on page 6.
(To change user level see *chapter 2.8 "Selecting the user level" on page 24*.)

(5) Description of selected parameter.

(6) From *Expert* user level and above only:
Change password for *Expert* user level
(for default password, see *Section 2.8 "Selecting the user level" on page 24*).

(7) Show/hide mouse cursor. Useful when using remote access (e.g. TeamViewer).

(8) In *Expert* user level only:
Saving of entire MACS HYF 5674 main directory to SD card as backup. For directory structure, see *Section 6.1 "Directories and files" on page 39*.

(9) **In the *User* user level**, the gas type cannot be changed. Only the constituent parts of the gas are shown.
In the *Expert* user level, the gas type can be changed. The values of the gas composition **cannot** be changed. **This is set by the manufacturer.**

(10) Only from *Expert* user level and above: Discard changes.

(11) Only from *Expert* user level and above: Save changes.

2.6 *IO* (inputs and outputs) main page

2.6.1 *IO - DO / DI* (digital inputs and outputs) sub-page

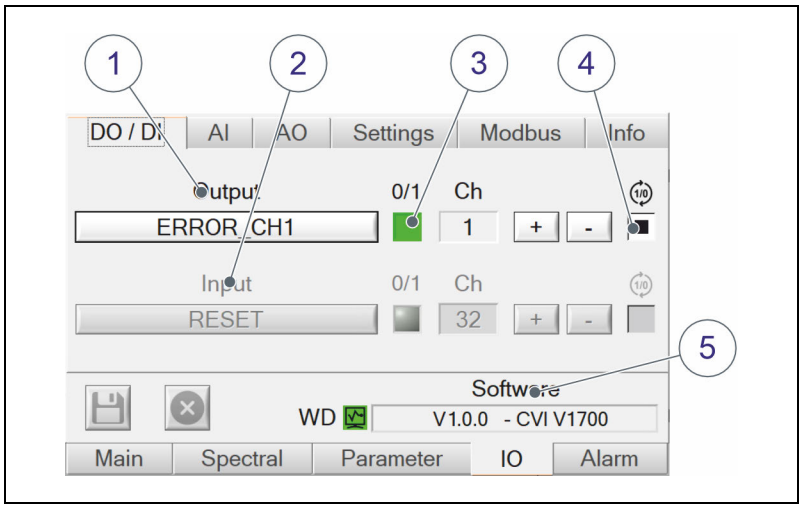


Figure 2.11: *IO - DO/DI* (digital inputs and outputs) sub-page

The digital outputs (*DO*) and inputs (*DI*) are shown and, if necessary, configured on this page.

(1) Show/select outputs

(2) Inputs (currently none available)

(3) Status of selected output (green = signal at output).
The selected output can be activated/deactivated by tapping, if *Simulate DO* is activated.

Note: The digital outputs *TDO_LED_CH1* to *TDO_LED_CH3* can be

manually tested if *Simulate LED* is activated.
They will then no longer be controlled by MACS.
For further information, see *Section 2.6.4 “IO - Settings sub-page” on page 20*.
The output can be assigned to channel 1 to 6 on the channel card via *Channel* (*Ch*).

(4) Invert signal.

(5) Used MACS version.
WD = *Watchdog*-status: green = MACS is monitored.

2.6.2 *IO - AI* (analog inputs) sub-page

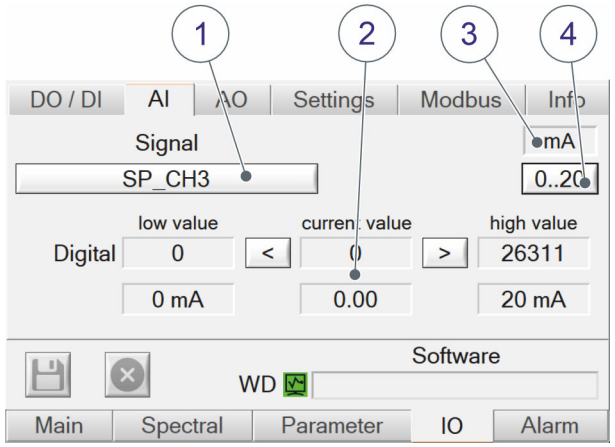


Figure 2.12: IO - AI (analog inputs) sub-page

(1) Like on page *DO/DI*, this page shows the inputs.

(2) The digital and physical values and ranges of the selected input are shown.

(3) Button to alternate the display of physical values in mA.

(4) Switch for range *0..20 mA* and *4..20 mA*.

NOTICE	
	The inputs *SP_CH1, 2, 3* and *GP_1, 2, 3, 4* can be configured only in the *Expert* user level. **The inputs TT_CH1, 2, 3 can be configured only in the *Manufacturer* user level.**

2.6.3 *IO - AO* (analog outputs) sub-page

The analog outputs are shown on the *IO - AO* page and can be configured approximately as described in the following.

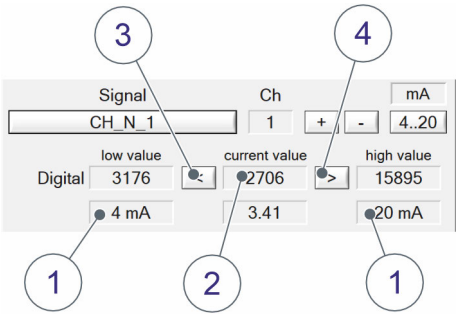
NOTICE	
	These settings are made at the factory and may not be changed. If calibration should become necessary as a result of a malfunction, the measuring process must first be ended.

The calibration of the analog inputs and outputs is based on a 2-point linear equation, i.e. the relationship between the physical variable and the value in the transformer is assumed to be linear. If two pairs of values are known, the relationship between them can be shown using a linear equation.

The measurement results are output as an analog signal (0-20 mA or 4-20 mA). This means the physical measuring range of the individual channels must be adjusted to the digital measuring range by means of calibration.

The analog inputs and outputs are calibrated at the factory to 0 to 20 mA or 4 to 20 mA. If further calibration is subsequently required, proceed as per the following example:

Calibrate analog output



Example (4 - 20 mA output):

☞ Select an analog output.
In this example, the display has been changed to mA.

☞ **Always follow the safety instructions in the operating manual and on the device when testing the hardware.**

☞ Connect an ammeter to the output
(in series to GND).

☞ The lowest value is indicated in the *low value* input field and the highest value in the *high value* input field **(1)**.

☞ Set the output current to 4 mA by entering “4” in the *current value* input field at the bottom **(2)**. The ammeter may indicate a different value if not yet calibrated. Adjust the digital value in the upper input field using the input window (see *Figure 2.2 on page 6*), until the measuring device shows 4 mA.

☞ Transfer the upper value to the *low value* input field by tapping on button < **(3)**.

☞ Set the output current to 20 mA by entering “20” in the *current value* input field at the bottom **(2)**. The ammeter may indicate a different value if not yet calibrated. Adjust the digital value in the upper input field using the input window (see *Figure 2.2 on page 6*), until the measuring device shows 20 mA.

☞ Transfer this value to the *high value* input field by tapping on button > **(4)**. Calibration is now complete.

☞ If you want to apply the pairs of values permanently, click the 💾 button; otherwise click the ⊗ button.

NOTICE	
ℹ	**The physical measuring range of an analog output can be changed at any time, and the calibration to the measuring range of 4-20 mA remains.**

2.6.4 *IO - Settings* sub-page

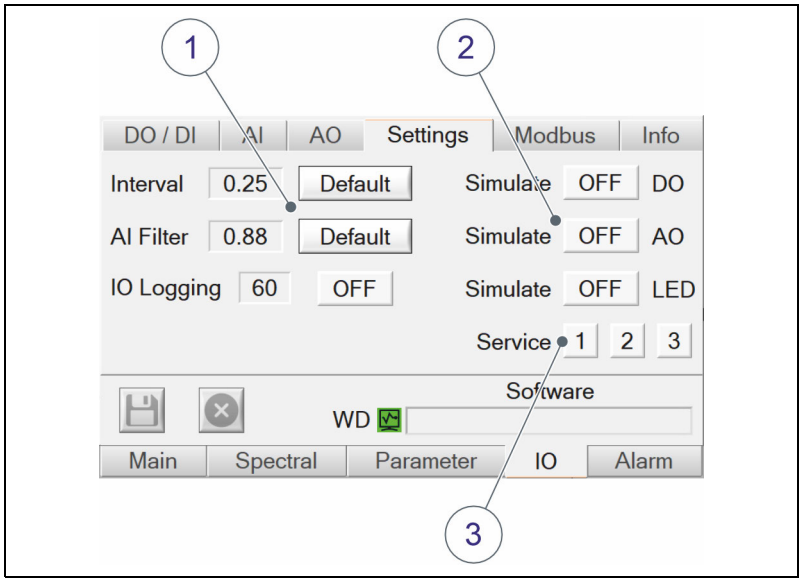


Figure 2.13: *IO - Settings* sub-page

(1) **Applies to user level** *Manufacturer*:
Settings for the signals of the analog inputs
These settings may be changed only by BARTEC BENKE!

(2) Applies to user level *Expert*: Activate/deactivate different simulations:

- *Simulate DO*: If the button is *On*, the digital outputs are no longer updated by MACS and remain in the most recent state. They can be manually activated and deactivated e.g. to test to connection to the DCS.
- *Simulate AO*: If the button is *On*, the same occurs for the analog outputs as per the description for *Simulate DO*.
- *Simulate LED*: If the button is *On*, the digital outputs for the LEDs of the channel cards are no longer updated by MACS (*TDO_LED_CH1* to *TDO_LED_CH3*). They can be manually activated or deactivated for testing purposes (see *Section 2.6.1 “IO - DO / DI (digital inputs and outputs) sub-page” on page 15*).

(3) Buttons to “freeze” the measured values of a channel.
During maintenance on a sensor, this allows you to avoid sending erroneous measured values to the *DCS*. The most recently valid measured values are retained. Alarms are also not issued for this channel. Once maintenance is complete, you can use these buttons to restart the updating of measured values.

2.6.5 *IO - Modbus* sub-page

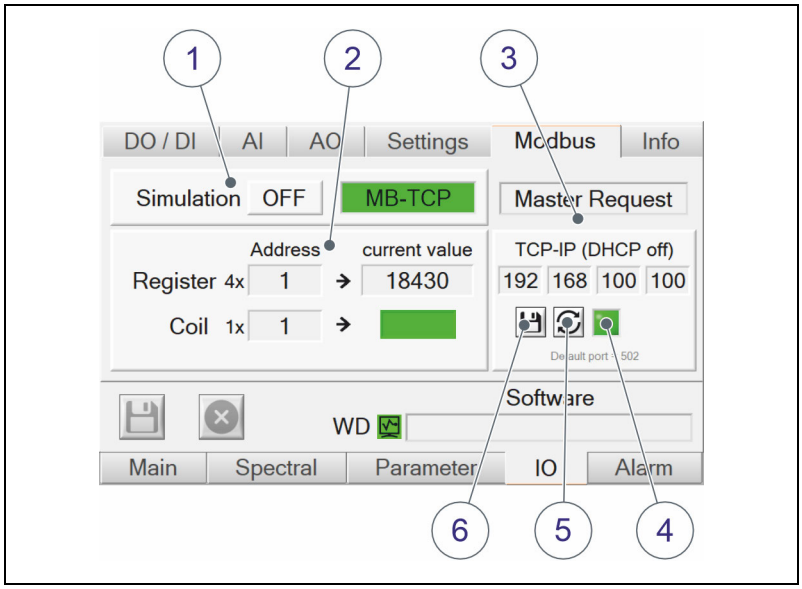


Figure 2.14: *IO - Modbus* sub-page

(1) Activate/deactivate simulation of Modbus signals

(2) Input fields for testing registers and addresses

(3) Status display of transfer via Modbus: *Master Request* indicates that a Modbus master (client) is currently sending a request via RTU or that an active Modbus connection exists via TCP. The default IP address is specified by BARTEC BENKE (192.168.2.1) and can be changed here.

(4) Green LED: Connection exists to Modbus TCP adapter.

(5) Button for displaying the IP address assigned by the DHCP server.

(6) The IP address can be changed by tapping on the relevant field. By tapping on the button, the IP address is accepted and becomes active after approx. 15 s.
A permanent IP address can be assigned (range 1 to 255). If the IP is to be assigned by the DHCP server, connect the Modbus LAN port to a network with DHCP server and enter *0.0.0.0* in the fields. Then restart the device.

2.6.6 *IO - Info* sub-page

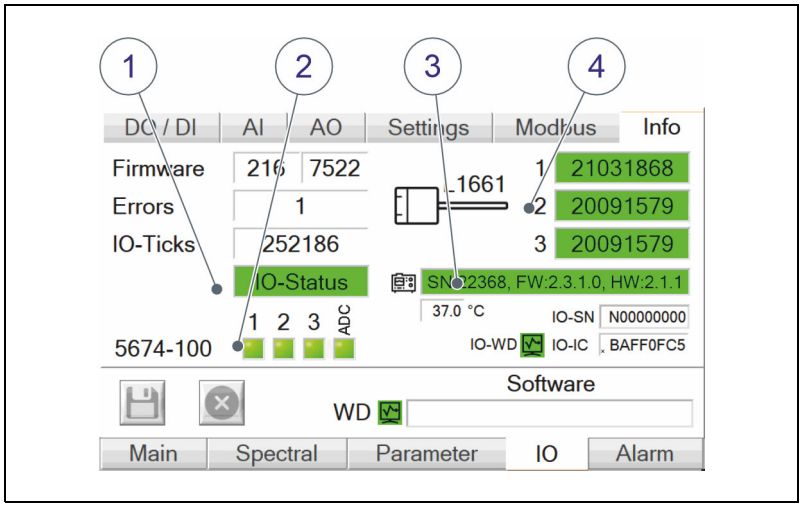


Figure 2.15: *IO - Info* sub-page

(1) Information on the status of interfaces (inputs/outputs)

(2) Status of the device.
LED is green if a sensor is connected.

(3) Information on the device: Serial number, firmware and hardware

(4) Serial numbers of connected sensors
Note: The number of the file in the directory of the channel must correspond to the connected sensor
(see *chapter 6.3 "Backup and update tool" on page 43*).

2.7 *Alarm* main page

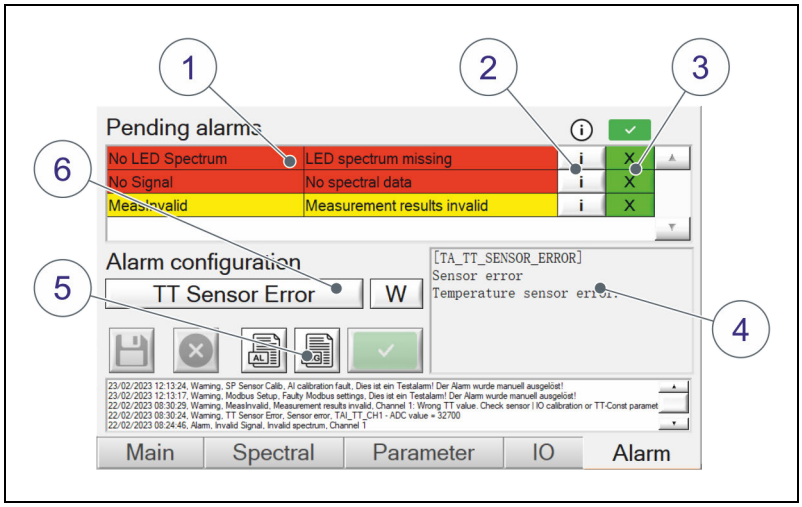


Figure 2.16: *Alarm* main page

(1) Listing of all pending alarms

(2) Further information on the respective error

(3) Acknowledgment of an alarm in the relevant line

(4) Description of the selected alarm **(6)**

(5) Opening of log books and alarms, saving of changes and acknowledgment of all pending alarms

(6) Selection of an alarm

- W: Warning, doesn't need to be acknowledged (yellow)
- A: Alarm, must be acknowledged (red)
- -: Alarm deactivated

Handling error messages

In the case of warnings and error messages (not for limit violations), you can display details of the errors reported by tapping on the information button **(2)**. This also gives you instructions on rectifying errors and faults.

If several errors are simultaneously present, these are displayed line by line.

Once a fault or error has been resolved, the message and corresponding information disappears from the display. Alarms must be acknowledged.

2.8 Selecting the user level

Upon tapping the button on the *Main* main page, you can enter the password for the desired user level (see *Section 2.2 "Top menu bar" on page 7*).

The following user levels are possible and are indicated by corresponding symbols:

	*Operator* If you confirm the entry without entering a password, MACS switches to the *Operator* user level.
	*Expert* The password for the *Expert* user level is **"5674"** by default. You can change the password if logged in at this user level (see *Section 2.5 "Parameters main page" on page 14*). Note: If the symbol is displayed, MACS switches to the *Operator* user level by tapping on this button.
	*Manufacturer* (for servicing purposes only) The password for this user level cannot be changed. Note: If the symbol is displayed, MACS switches to the *Operator* user level by tapping on this button.

2.9 Setting date/time and time zone

You can adjust the date, time and time zone only under Windows settings. Proceed as follows:

☞ Close MACS (see *Section 2.2.1 "Closing, restarting or shutting down" on page 8*).

Figure 2.17: Taskbar

☞ Double-tap on the time **(1)** at the bottom right in the task bar (right-click via remote access).

☞

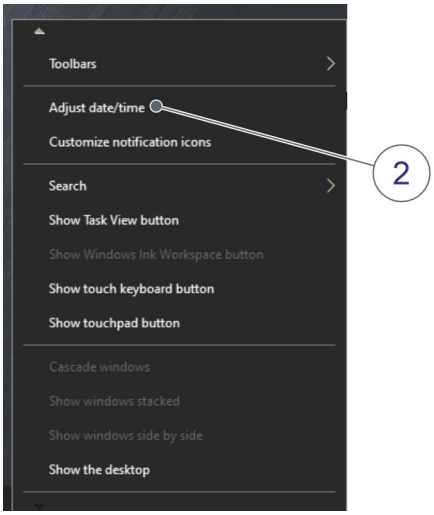


Figure 2.18: Menu

☞ Tap on *Adjust date/time* **(2)** in the menu.

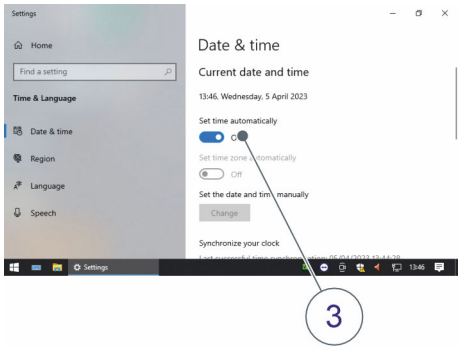


Figure 2.19: Set time automatically

☞ Tap on *Set time automatically* **(3)**, if the toggle switch is set to *Off*.

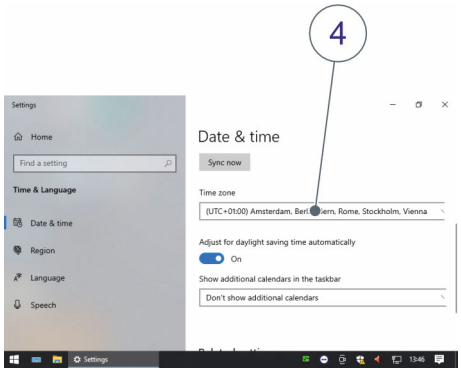


Figure 2.20: Select time zone

☞ Select your local time zone **(4)**.

☞ Close the Settings window.

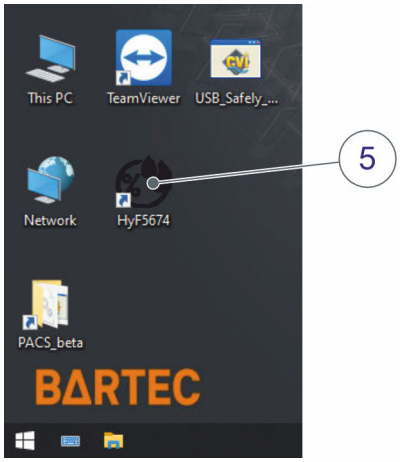


Figure 2.21: Start MACS

☞ Double-tap on *HyF5674* on the desktop to restart *MACS HYF 5674*.

3 Interface to the process control system

By default, the interface to the process control system is made functional by means of a number of discrete signals: analog and digital outputs.

Alternatively, these signals and other information can be transferred via a Modbus interface (optional).

3.1 Analog outputs

Tag	Name	Description
TAO_MEAS_VAL_1	Custom Analog Output 1	Measured value changeable via channel-specific parameters, analog output, freely configurable (see *chapter 4.2 "Channel-specific parameters" on page 32*)
TAO_MEAS_VAL_2	Custom Analog Output 2	
TAO_MEAS_VAL_3	Custom Analog Output 3	
TAO_MEAS_VAL_4	Custom Analog Output 4	
TAO_MEAS_VAL_5	Custom Analog Output 5	
TAO_MEAS_VAL_6	Custom Analog Output 6	
TAO_DT_CH1	FP Output Channel 1	Freezing point measured value, output channel freely selectable
TAO_DT_CH2	FP Output Channel 2	
TAO_DT_CH3	FP Output Channel 3	
TAO_TT_CH1	TT Output Channel 1	Corrected temperature measured value, output channel freely selectable
TAO_TT_CH2	TT Output Channel 2	
TAO_TT_CH3	TT Output Channel 3	
TAO_SP_CH1	SP Output Channel 1	Process pressure measured value, output channel freely selectable
TAO_SP_CH2	SP Output Channel 2	
TAO_SP_CH3	SP Output Channel 3	

3.2 Digital outputs

Tag	Name	Description
TDO_ERROR_CH1	Error Channel 1	Fault or cable break 1: OK
TDO_ERROR_CH2	Error Channel 2	
TDO_ERROR_CH3	Error Channel 3	
TDO_LIMIT_CH1	Out of Range Channel 1	Limit violation or cable breakage 1: OK
TDO_LIMIT_CH2	Out of Range Channel 2	
TDO_LIMIT_CH3	Out of Range Channel 3	
TDO_WARNING	Collective Warning	There are one or several active warnings 0: ACTIVE
TDO_ALARM	Collective Alarm	There are one or several active alarms (faults) 0: ACTIVE

4 Parameters

The following table provides an overview of the parameters, what they mean, and their values.

Usually a **typical value** is given for the parameters. This may be the preset default value or a recommended value. The **typical values** should only be regarded as guidelines, otherwise the values (measuring range, stream switching, etc.) must be adapted to the circumstances. The line below contains the permitted range where applicable.

4.1 Device parameters

You can find information on configuring the device parameters in *Section 2.5 "Parameters main page" on page 14*.

TAG	Name	Typical value/ range	Change becomes effective	Description
PAR_LANGUAGE	Language	**0** 0 or 1	Upon restarting	0: English 1: German
PAR_DATE_NOT	Date Time Notation	**0** 0 or 1	Immediately	Date and time format: 0: DD.MM.YYYY - HH:MM:SS (24-hour) 1: YYYY/MM/DD - HH:MM:SS am/pm (12-hour)
PAR_T_UNIT	T-Unit	**0** 0 to 2	Immediately	Unit of temperature: 0: °C 1: °F 2: K
PAR_P_UNIT	P-Unit	**0** 0 to 6	Immediately	Unit of pressure: 0: mbar 1: bar 2: Pa 3: hPa 4: kPa 5: psi 6: mmHg
PAR_MC_UNIT	MC-Unit	**0** 0 or 1	Immediately	Unit of moisture content: 0: mg/Nm³ 1: lb/MMscF

TAG	Name	Typical value/ range	Change becomes effective	Description
PAR_AUTO_CH	AutoChSwitching	**1** 0 or 1	Immediately	Activation of automatic channel switching (if channel parameter *Channel active* of the respective channel is set to “1”, this channel is activated): 0: deactivated 1: activated
PAR_MAN_CH	ManChActivation	**0** 0 to 3	Immediately	Activation of a channel, if parameter *AutoChSwitching* is set to “0”.
PAR_MEAN	Mean Horizon	**11** 0 to 120	Immediately	Number of measured values used for averaging (temperature, pressure, wavelength)
PAR_CLEAN	Clean Horizon	**90 days** 7 to 90 days	Upon restarting	Automatic deletion of measurement results, alarms, log files older than the period defined by this parameter. They will no longer be visible in the viewer. **Exception: Log files and alarms are initially archived after 30 days and then finally deleted after the number of days set by this parameter.**
PAR_LT_SAVE_ PERIOD	LongtermSavePeriod	**5 min** 0 to 30 min	Immediately	Saving interval of measured values. The values are saved to CSV files (format *MR_YYYY-MM-DD.csv*). 0: Do not save data
PAR_IO_RESTART	IOcard restart	**0** 0 or 1	Upon restarting	The 5674-120 IO card is restarted once if no 5674-100 channel card was found on program start in the activated channel. 0: deactivated 1: activated
PAR_TCCD_MAX	TCCD Max	**55°C** -15 to 60°C	Immediately	Max. spectrometer temperature at which the device is shut down.
PAR_MB_ENABLE	Modbus Enable	**0** 0 or 1	Immediately	Modbus interface with DCS: 0: deactivated 1: activated

TAG	Name	Typical value/ range	Change becomes effective	Description
PAR_MB_MODE	Modbus Mode	**1** 1 to 2	Immediately	Mode of Modbus communication: 1: MBus RTU RS485 set correct slave-ID, baud rate and parity 2: MBus TCP/IP (optional) set IP address to main page *IO - Mode*
PAR_MB_SLAVE_ID	Modbus Slave	**1** 1 or 247	Immediately	Address (ID) of Modbus slave for Modbus communication
PAR_MB_BAUDRATE	Modbus Baud	**3** 0 to 7	Immediately	Modbus communication baud rate: 0: 1200 1: 2400 2: 4800 3: 9600 4: 19200 5: 38400 6: 57600 7: 115200
PAR_MB_PARITY	Modbus parity	**0** 0 to 2	Immediately	Parity bit for Modbus communication: 0: None 1: Odd 2: Even

4.2 Channel-specific parameters

You can find information on setting the channel-specific parameters in *Section 2.5 "Parameters main page" on page 14*.

TAG	Parameters	Typical value/ range	Change becomes effective	Description
PAR_CH_ACTIVE	Channel Active	**1** 0 or 1	Immediately	Deactivating/activating measurement and "freezing" outputs (Modbus, IO) 0: deactivated 1: activated
PAR_CH_TT_CONST	TT-Const	**30°C** 0 to 60°C	Immediately	Standard value for media temperature. Used if no valid measured value is present (-20 to +60°C)
PAR_CH_TT_ON	Use Temp Sensor	**1** 0 or 1	Immediately	Activate/deactivate temperature measurement for testing 0: *Use PAR_CH_TT_CONST* as temperature.
PAR_CH_SP_CONST	SP-Const	**1.013 bar** 0 to 200 bar	Immediately	Standard value for the pressure in the medium. Used if no valid measured value is present (0 to 100 bar).
PAR_CH_SP_REF	SP-Ref	**70 bar** 10 to 300 bar	Immediately	Value for converting the FP/DT of the media pressure to this reference pressure
PAR_CH_SP_ON	Use Pressure Sensor	**0** 0 or 1	Immediately	Optionally connected pressure sensor used? 0: *Use PAR_CH_SP_CONST* as pressure
PAR_CH_SPEC_AVG	Spectral Average	**32** 0 to 100	Immediately	Number of spectra used for averaging
PAR_CH_SMOOTH	Smooth Horizon	**15** 0 to 30	Immediately	Number of spectral points used for smoothing
PAR_CH_OFFSET_SEL	Offset Selection	**0** 0 to 4	Immediately	Selection of measured variable for the Offset measured value. See *PAR_CH_OFFSET_VAL*: 0: Off 1: DT (gas) 2: FP (gas) 3: PPMwsat (liquids) 4: Wlmin (liquids)

TAG	Parameters	Typical value/ range	Change becomes effective	Description
PAR_CH_ OFFSET_VAL	Offset Value	**0** -200 to 200	Immediately	Offset measured value. Measured variable is defined by *PAR_CH_OFFSET_SEL*.
PAR_CH_FP_ SHIFT	FP-Shift	**0 K** -5 to 5 K	Immediately	Offset of freezing point for correcting/shifting calibration curve.
PAR_CH_ LIMIT_MR	Limit MR Select	**1** 0 to 4	Immediately	Selection of measured variable for checking limits (units selectable via device parameters *MC-Unit* or *T-Unit*): 0: deactivated 1: FP 2: DT 3: SP 4: TT 5: MC (D/G)* 6: PPMV (D/G)* * G = GERG, if the gas vector has been correctly specified. D = Default, if the gas vector has not been correctly specified.
PAR_CH_L_LIMIT	Upper Limit MR	**0** -10000 to 1000 (Unit according to *Limit MR Select*)	Immediately	Lower limit for measured values (selectable via channel parameter *Limit MR Select*) for triggering an alarm.
PAR_CH_H_LIMIT	Lower Limit MR	**0** -10000 to 1000 (Unit according to *Limit MR Select*)	Immediately	Upper limit for measured values (selectable via channel parameter *Limit MR Select*) for triggering an alarm.

TAG	Parameters	Typical value/ range	Change becomes effective	Description
PAR_CH_AO_ MEAS_VAL_1 PAR_CH_AO_ MEAS_VAL_2 PAR_CH_AO_ MEAS_VAL_3 PAR_CH_AO_ MEAS_VAL_4 PAR_CH_AO_ MEAS_VAL_5 PAR_CH_AO_ MEAS_VAL_6	Customer analog output	**0** 0 to 8		Measured value for the analog output MEAS_VAL_1: 0: Off 1: TT 2: SP 3: DT 4: FP 5: DT2 6: MC(D/G) 7: PPMV(D/G) 8: PPMW Note: Use this parameter only for one channel. Double allocations will be deleted! * G = GERG, if the gas vector has been correctly specified. D = Default, if the gas vector has not been correctly specified.

5 Troubleshooting

MACS independently monitors the functionality of the system and generates error messages when a device malfunction occurs. MACS makes a basic distinction between two types of error.

- Alarm
- Warning

Warnings, alarms and instructions on limit violations are displayed in the top status bar on the *Main* main page and on the *Alarm* main page. If warnings or errors are displayed, further information on them and instructions for troubleshooting can be obtained by tapping on the information button (see *chapter 2.7 “Alarm main page” on page 23*).

Interruptions to operation with the *HYF 5674* can be caused by faulty plug connections. Therefore first check that all connections (sensors, analog cards) are plugged in correctly. If a defective sensor or card is suspected, check whether replacing it resolves the issue.

Electromagnetic fields are another possible cause of interference. Check whether there are possible sources of interference in proximity to the device. If interference is brief, the problem usually resolves within a few minutes or after restarting the device.

In case of doubt concerning the accuracy of measured values or in the event of interference that cannot be resolved by the steps indicated when tapping the information button, please contact our customer service team. You may need to send the device to the manufacturer for repairs (see *HYF 5674 safety manual*).

An error is displayed in the text field at the top in the main window (see see *chapter 2.2 “Top menu bar” on page 7*):

NOTICE	
	**If MACS “freezes” due to an error, the watchdog is triggered, which means a reset is executed. The PC and MACS are restarted.**

5.1 Limit violations

If a programmed limit value is exceeded or fallen short of for a measured variable, an error message is displayed in the status indicator at the top of the *Main* main page and an arrow for the corresponding channel (see *chapter 2.2 “Top menu bar” on page 7*).

A signal is issued at the limit output. This is not an error or interference.

5.2 Error messages

For all error messages:

☞ Identify the error and resolve it.

☞ Restart the measurement.

If the error persists:

☞ Contact BARTEC BENKE.

MACS differentiates between warnings and alarms. Further information on the warning can be displayed on the *Alarm* main page (see *chapter 2.7 “Alarm main page” on page 23*).

The difference is described in more detail below.

5.2.1 Warning

These messages indicate peculiarities in measurement conditions. Measurement operation is maintained. The warning is displayed at the top of the *Main* main page.

5.2.2 Alarm

All errors occurring for which measurement operation is not possible are reported at the top of the *Main* main page. A signal is issued at the error output. Limit violations may also be reported as a result of incorrect or missing calculation principles.

5.2.3 List of alarms

The table below describes the alarms and the factory settings on delivery:

No.	TAG	Report in MACS	Description	Category
0	TA_INV_SIGNAL	Invalid spectrum	Weak or no signal (no sensor connected) The following causes are possible: ■ FOC or LED faulty ■ IO configuration error	Alarm
1	TA_NO_SIGNAL	No spectral data	No data from spectrometer Spectrometer faulty or not connected	Alarm
2	TA_TMAX_CCD	Temperature exceeded	Spectrometer temperature too high	Alarm
3	TA_OUTOFRANGE	Measurement out of range	Measurement result is outside of limit. Configured in channel parameter *PAR_CH_LIMIT_MR* (see *chapter 4.2 “Channel-specific parameters” on page 32*). *FP*, *RH*, *MC* or *PPM* is above or below the limit.	Alarm
4	TA_RESULT_INV	Measurement results invalid	Measurement result is invalid as one or more parameters or other values are incorrect for the calculation. The *Alarm Logbook* provides further information (see *Figure 2.16 on page 23*).	Alarm
5	TA_NO_LEDSPEC	Warning: LED spectrum missing	LED spectrum has not yet been measured or saved	Alarm
6	TA_NO_CALIB	Calibration file is missing .hyf	Calibration data (.hyf) was not found	Alarm
7	TA_BAD_FIT	Bad spectral fit	Correlation coefficient of the spectral adjustment is too low.	Alarm
8	TA_NO_SPEC_HW	No CCD device found	Spectrometer could not be initialized on program start	Alarm
9	TA_NO_IO_CARD	5674-120Card problem	IO card could not be initialized on program start	Alarm
10	TA_NO_CFG	Configuration missing	Configuration was not found (*.eni). MACS was started with default values.	Alarm

No.	TAG	Report in MACS	Description	Category
11	TA_TT_CALIB	AI calibration fault	Calibration (analog input) of temperature sensor not correct	Alarm
12	TA_TT_OPEN	Sensor not connected	Moisture measurement sensor not connected or cable breakage	Alarm
13	TA_TT_ERROR	Sensor error	Temperature sensor error	Alarm
14	TA_SP_CALIB	AI calibration fault	Configuration of pressure sensor is not correct (analog input)	Warning
15	TA_SP_ERROR	Pressure sensor	Pressure sensor is not connected or is faulty	Warning
16	TA_CH_CARD	5674-100Card problem	Channel card is not installed or is faulty	Alarm
17	TA_MBUS_SETUP	Faulty Modbus settings	Modbus cannot be started due to a configuration error. (For further information, see Modbus manual from manufacturer.)	Warning
18	TA_MBUS	Modbus problem	Problem with Modbus communication. (For further information, see Modbus manual from manufacturer.)	Warning
19	TA_SYSTEM	System problem	General problem in the system. (For further information, see alarm log book.)	Warning

6 Appendix

This section provides additional information with further details on settings. Some of this information is intended only for servicing purposes and is provided to users only for information purposes.

6.1 Directories and files

The following describes the directory structure that MACS uses for loading and saving files. MACS is installed in the following directory: *C:\Program Files (x86)\BBS\HyF5674*. The directory structure comprised is illustrated in the following:

Directory	Description	Files
\Hyf5674	Main directory for MACS	HyF5674.exe (MACS) Watchdog.exe exit_os.exe
\config	Configuration files, parameter and alarms **These files are saved to the SD card once backup has been manually started** (see *chapter 2.5 "Parameters main page" on page 14*).	alarm.ini alarmCfg.ini HyPro.ini ioCfg.ini language.ini paramCfg.ini programCfg.ini
\ch1 \ch2 \ch3	Sensor data per channel and LED spectrum for each channel. **These files are saved to the SD card once backup has been manually started** (see *chapter 2.5 "Parameters main page" on page 14*).	<*Sensor number*>.hyf LED_Spectrum.a2f
\data	Various data generated by MACS for testing etc.	
\alarm	Alarms occurring	alarm.csv
\ch1 \ch2 \ch3	Measurement results per channel. Files are archived in the *\old* subfolder once the duration configured in the *Clean Horizon* parameter has been reached.	MR_<*YYYY-MM-DD*>.csv
\iolog	Log books for inputs/outputs	IO_<*YYYY-MM-DD*>.csv
\logbook	MACS log book, also accessible from *Alarm* main window (see *chapter 2.7 "Alarm main page" on page 23*). The file is saved automatically to the *\archive* subdirectory if it becomes too large.	logbook.csv
\screenshots	Manually generated screenshots of *Spectral* (see *chapter 2.4 "Spectral main page" on page 13*) main page.	<*Time stamp*>.jpg
\history	LongTerm histories per channel	

Directory	Description	Files
\ch1	One history per day	His_<*YYYYMMDD*>.bin
\ch2		
\ch3		

6.2 Calibrating spectrometer with argon lamp

The spectrometer is calibrated using an argon lamp prior to delivery. If the spectrometer is replaced, it must be recalibrated. Proceed as follows:

☞ Wait at least 30 mins after switching on until the device has warmed up.

☞ Set parameter *AUTO_CH* to “0”.

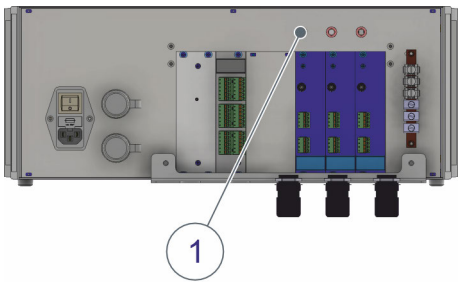
☞ Set parameter *MAN_CH* to “1”.

☞ Open the *Spectral* main page.

6.2.1 Saving spectrum of argon lamp

☞ Connect and activate argon source.

Figure 6.1: Argon source



☞ Connect FOC of argon source to the top fiber optic connection of channel card 1 **(1)**.

Figure 6.2: FOC input channel card

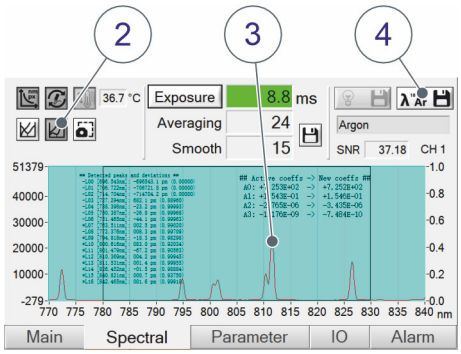


Figure 6.3: *Spectral* page, saving spectrum

☞ Activate the graphical display **(2)**.

☞ As soon as the argon source is recognized and the graphical curve is displayed **(3)**, the text field for *Exposure* turns green and the button for saving the spectrum is activated.

☞ Tap on the button **(4)** to save the spectrum of the argon source directly to the spectrometer.

☞ Remove the FOC from the channel card.

☞ Switch off the argon source.

6.2.2 Adjusting LED to spectrum and saving

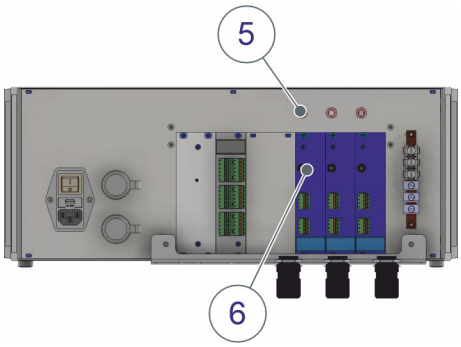


Figure 6.4: FOC at channel card 1

(1) Connect the FOC to the fiber optic input **(5)** and fiber optic output **(6)** of channel card 1 in order to effect a “short circuit”.

The spectrum of the LED is now read and displayed.

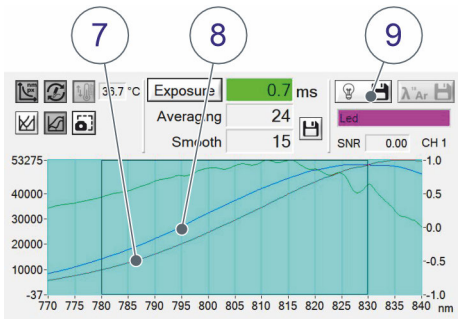


Figure 6.5: Correlating LED spectrum

If the spectrum of the LED has been imported, *LED* is displayed as source, the text field for *Exposure* turns green and the graphical display is updated:

The red curve **(7)** is the current spectrum of the LED. Any previous LED spectrum is depicted as a blue curve **(8)**.

(2) Tap on the button **(9)** to save the LED spectrum. The spectrum is saved using the argon calibration.

(3) Remove the FOC from the channel card.

(4) Repeat steps 1 to 3 for each additional channel card.

☞ Remove the FOC from the channel card(s).

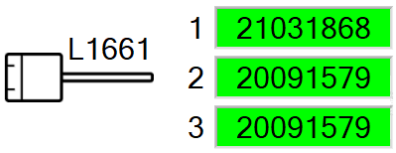


Figure 6.6: Sensor numbers

☞ Connect the respective sensor to the designated channel card (sensor number must correspond to the configured channel in MACS)
You can check this on the *IO - Info* sub-page.
*Section 2.6.6 “IO - Info sub-page” on page 22*provides further information.

The process for reimporting sensor files is described in *Section 6.3 “Backup and update tool” on page 43*.

Configuring exposure time

The exposure time for each sensor still needs to be adjusted.

Proceed as follows:

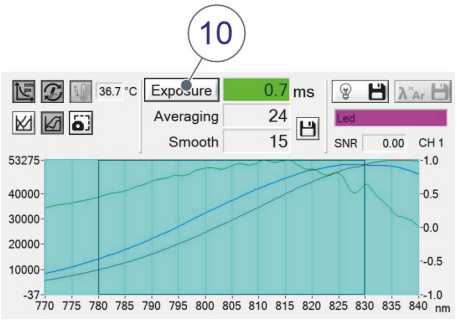


Figure 6.7: Optimum value for exposure time

☞ Tap on the *Exposure* **(10)** button to identify the optimum value for the exposure time.

☞ Repeat this step for each additional channel card.

Resetting parameters

☞ Set parameter *AUTO_CH* to “1”.

☞ Set parameter *MAN_CH* to “0”.

6.3 Backup and update tool

Data can be backed up and reimported using a USB stick. The following functions are available:

- Back up configuration MACS HYF 5674.
  *Section 6.1 “Directories and files” on page 39*indicates which files this includes.
- Update MACS software.
- Individually import sensor files incl. spectrum for each channel.

Format of USB stick

The USB stick must be formatted to *FAT32* or *NTFS* so that the tool can recognize it. The directory structure for the files must be created as described in *Section 6.1 “Directories and files” on page 39*.

Procedure for importing/saving

The procedure for importing and saving is specified below:

Figure 6.8: Inserting USB stick

☞ Connect the USB stick to the USB port on the device **(1)**.

☞ MACS automatically detects that the USB stick has been connected and opens the *Backup and update tool*.

The *Backup and update tool* has the following appearance:

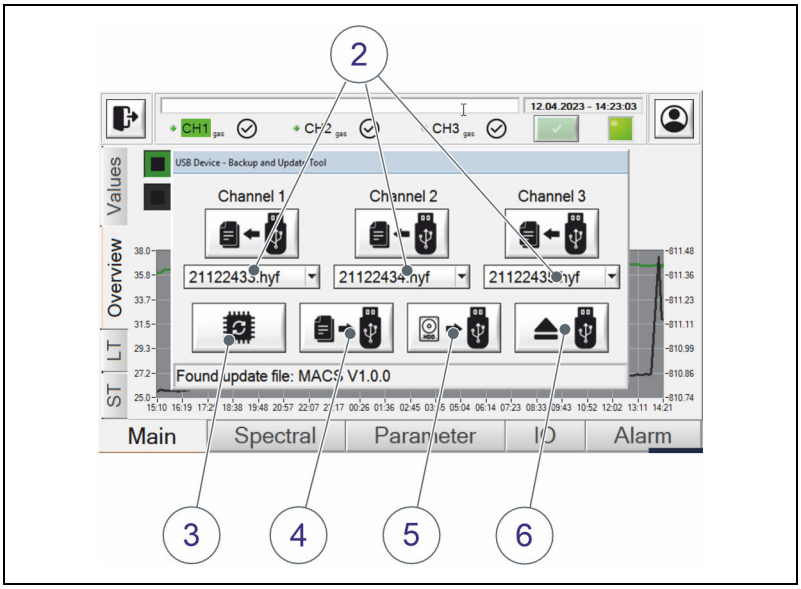


Figure 6.9: Backup and update tool

☞ The tool automatically detects which files are present on the USB stick and activates the respective buttons.

☞ You can select available sensor files **(2)** for each channel in the drop-down menu and save them to the device. To do so, tap on the corresponding button.
Ensure that the matching sensor is connected.

☞ You can update the MACS software by tapping button **(3)**. During the update process, MACS is closed and automatically restarted. The USB stick is automatically ejected by Windows.
For the tool to restart automatically, remove the USB stick and reconnected it to the USB port.

☞ Tapping button **(4)** saves the configuration files, measurement data, log files and alarms to the USB stick.

☞ Tapping button **(5)** saves the entire HyF5674 program directory to the USB stick.

☞ You can manually eject the USB stick by tapping on button **(6)**. This properly severs the connection to Windows to prevent loss of data.

6.4 Modbus parameters

The DCS (master) must use the configured Modbus addresses of the device (slave) in order to receive the values of the properties.

The equations of the AD/DA conversion of the property values must be identical at both the master and slave.

The universally valid addresses and device-specific addresses are listed below. The Modbus register is identical to the register of predecessor device *Hygrophil F 5673*.

Legend for abbreviations used

The following table describes the abbreviations used in TAGs:

Abbreviation	Description
TAI	Tag for analog input (**A**nalog **I**nput)
TAO	Tag for analog output (**A**nalog **O**utput)
TDI	Tag for digital input (**D**igital **I**nput)
TDO	Tag for digital output (**D**igital **O**utput)
P	Pressure (**P**ressure)
T	**T**emperature
CH	Channel
GP	Address for general purposes (**G**eneral **P**urpose)

6.4.1 General Modbus parameters

The following table shows all address registers that are possible in the Modbus client. The specific addresses and registers are specified from *Section 6.4.2 "Device-specific addresses" on page 45*.

Address range	Type/ Reference	Content	Description	Function code (FC)	r/w
00001-200	0X	Status information	Various flags with return value	01, 05	r, w
40001-40163	4X	Measurement results	Moisture measurement results for channel 1-3	03	r
49001-49164	4X	Measurement results	Higher resolution of moisture measurement results for channel 1-3: 2 registers/value (total of 8 bytes)	03	r, w

6.4.2 Device-specific addresses

Address	Name	Description
1	CH1 present	0: Channel 1 unavailable 1: Channel 1 available
2	CH2 present	0: Channel 2 unavailable 1: Channel 2 available
3	CH3 present	0: Channel 3 unavailable 1: Channel 3 available
4	HCDT hardware present	0: Hardware for HCDT measurement not installed 1: Hardware for HCDT measurement installed
5	CH1 error	0: No fault 1: Error
6	CH1 limit status	0: Measurement within the measuring range 1: Measurement outside the measuring range
7	CH1 liquid	0: Medium is gaseous 1: Medium is liquid
8	CH2 error	0: No fault 1: Error
9	CH2 limit status	0: Measurement within the measuring range 1: Measurement outside the measuring range

Address	Name	Description
10	CH2 liquid	0: Medium is gaseous 1: Medium is liquid
11	CH3 error	0: No fault 1: Error
12	CH3 limit status	0: Measurement within the measuring range 1: Measurement outside the measuring range
13	CH3 liquid	0: Medium is gaseous 1: Medium is liquid
14	HCDT error	0: No fault 1: Error
22	CH1 WL valid	0: not valid 1: valid
23	CH1 V% valid	
24	CH1 PPM valid	
25	CH1 DT valid	
26	CH1 FP valid	
27	CH1 VP valid	
28	CH1 MC valid	
29	CH1 TT valid	
30	CH1 SP valid	
31	CH1 CO2 valid	
32	CH1 RH valid	

Address	Name	Description
36	CH2 WL valid	0: not valid 1: valid
37	CH2 V% valid	
38	CH2 PPM valid	
39	CH2 DT valid	
40	CH2 FP valid	
41	CH2 VP valid	
42	CH2 MC valid	
43	CH2 TT valid	
44	CH2 SP valid	
45	CH2 CO2 valid	
46	CH2 RH valid	
50	CH3 WL valid	0: not valid 1: valid
51	CH3 V% valid	
52	CH3 PPM valid	
53	CH3 DT valid	
54	CH3 FP valid	
55	CH3 VP valid	
56	CH3 MC valid	
57	CH3 TT valid	
58	CH3 SP valid	
59	CH3 CO2 valid	
60	CH3 RH valid	
62	HCDT valid	0: not valid 1: valid

Address	Name	Description
40001 .. 40163 (4x)	Measurement results for channel 1 to 3	
Measurement results for channel 1		
40001	CH1 WL	Wavelength in [nm] for minimum value of measurement spectrum
40002	CH1 V%	Moisture content in [vol%]
40003	CH1 PPM_HI	Moisture content in [ppmV (gaseous), ppmW (liquid)] (upper word)
40004	CH1 PPM_LO	Moisture content in [ppmV (gaseous), ppmW (liquid)] (lower word)
40005	CH1 DT	Dew point temperature in [°C]
40006	CH1 FP	Freezing point temperature in [°C]
40007	CH1 VP_HI	Vapor pressure in [mbar] (upper word)
40008	CH1 VP_LO	Vapor pressure in [mbar] (lower word)
40009	CH1 MC_HI	Moisture content in [mg/m³] (upper word)
40010	CH1 MC_LO	Moisture content in [mg/m³] (lower word)
40011	CH1 TT	Sample temperature in [°C]
40012	CH1 SP_HI	Sample pressure in [mbar] (upper word)
40013	CH1 SP_LO	Sample pressure in [mbar] (lower word)
40014	CH1 CO2	CO_2 content in [%]
40015	CH1 RH_HI	Relative humidity in [%] (upper word)
40016	CH1 RH_LO	Relative humidity in [%] (lower word)
Measurement results for channel 2		
40019	CH2 WL	Wavelength in [nm] for minimum value of measurement spectrum
40020	CH2 V%	Moisture content in [vol%]
40021	CH2 PPM_HI	Moisture content in [ppmV (gaseous), ppmW (liquid)] (upper word)
40022	CH2 PPM_LO	Moisture content in [ppmV (gaseous), ppmW (liquid)] (lower word)
40023	CH2 DT	Dew point temperature in [°C]
40024	CH2 FP	Freezing point temperature in [°C]
40025	CH2 VP_HI	Vapor pressure in [mbar] (upper word)
40026	CH2 VP_LO	Vapor pressure in [mbar] (lower word)
40027	CH2 MC_HI	Moisture content in [mg/m³] (upper word)
40028	CH2 MC_LO	Moisture content in [mg/m³] (lower word)
40029	CH2 TT	Sample temperature in [°C]
40030	CH2 SP_HI	Sample pressure in [mbar] (upper word)

Address	Name	Description
40031	CH2 SP_LO	Sample pressure in [mbar] (lower word)
40032	CH2 CO2	CO_2 content in [%]
40033	CH2 RH_HI	Relative humidity in [%] (upper word)
40034	CH2 RH_LO	Relative humidity in [%] (lower word)
Measurement results for channel 3		
40037	CH3 WL	Wavelength in [nm] for minimum value of measurement spectrum
40038	CH3 V%	Moisture content in [vol%]
40039	CH3 PPM_HI	Moisture content in [ppmV (gaseous), ppmW (liquid)] (upper word)
40040	CH3 PPM_LO	Moisture content in [ppmV (gaseous), ppmW (liquid)] (lower word)
40041	CH3 DT	Dew point temperature in [°C]
40042	CH3 FP	Freezing point temperature in [°C]
40043	CH3 VP_HI	Vapor pressure in [mbar] (upper word)
40044	CH3 VP_LO	Vapor pressure in [mbar] (lower word)
40045	CH3 MC_HI	Moisture content in [mg/m³] (upper word)
40046	CH3 MC_LO	Moisture content in [mg/m³] (lower word)
40047	CH3 TT	Sample temperature in [°C]
40048	CH3 SP_HI	Sample pressure in [mbar] (upper word)
40049	CH3 SP_LO	Sample pressure in [mbar] (lower word)
40050	CH3 CO2	CO_2 content in [%]
40051	CH3 RH_HI	Relative humidity in [%] (upper word)
40052	CH3 RH_LO	Relative humidity in [%] (lower word)
Measurement results for channel 1 to 3 (higher resolution, as 4 bytes per measured value) Format: 32 bit IEEE 754 floating point big Endian		
49001	CH1 TT_HI	Sample temperature of channel 1 in [°C]
49002	CH1 TT_LO	
49003	CH2 TT_HI	Sample temperature of channel 2 in [°C]
49004	CH2 TT_LO	
49005	CH3 TT_HI	Sample temperature of channel 3 in [°C]
49006	CH3 TT_LO	
49007	CH1 SP_HI	Sample pressure of channel 1 in [bar]
49008	CH1 SP_LO	
49009	CH2 SP_HI	Sample pressure of channel 2 in [bar]
49010	CH2 SP_LO	

Address	Name	Description
49011	CH3 SP_HI	Sample pressure of channel 3 in [bar]
49012	CH3 SP_LO	
49013	CH1 DT_HI	Dew point temperature of channel 1 in [°C]
49014	CH1 DT_LO	
49015	CH2 DT_HI	Dew point temperature of channel 2 in [°C]
49016	CH2 DT_LO	
49017	CH3 DT_HI	Dew point temperature of channel 3 in [°C]
49018	CH3 DT_LO	
49019	CH1 MC_HI	Moisture content of channel 1 in [mg/m³]
49020	CH1 MC_LO	
49021	CH2 MC_HI	Moisture content of channel 2 in [mg/m³]
49022	CH2 MC_LO	
49023	CH3 MC_HI	Moisture content of channel 3 in [mg/m³]
49024	CH3 MC_LO	

49073	Status information (1=yes/ error/limit)	1: Channel 1 active 2: Channel 2 active 3: Channel 3 active 4: n/a 5: HCDT active* 6: Channel 1 alarm/warning 7: Channel 2 alarm/warning 8: Channel 3 alarm/warning 9: HCDT alarm/warning 10: Channel 1 limit 11: Channel 2 limit 12: Channel 3 limit 13: HCDT limit 14: n/a 15: HCDT status 16: HCDT valid

49075	CH1 WL_HI	Wavelength in [nm] for minimum value of measurement spectrum
49076	CH1 WL_LO	
49077	CH2 WL_HI	Wavelength in [nm] for minimum value of measurement spectrum
49078	CH2 WL_LO	
49079	CH3 WL_HI	Wavelength in [nm] for minimum value of measurement spectrum
49080	CH3 WL_LO	

Address	Name	Description
49081	CH1 RH_HI	Relative humidity in [%]
49082	CH1 RH_LO	
49083	CH2 RH_HI	Relative humidity in [%]
49084	CH2 RH_LO	
49085	CH3 RH_HI	Relative humidity in [%]
49086	CH3 RH_LO	
49087	CH1 V%_HI	Moisture content in [vol%]
49088	CH1 V%_LO	
49089	CH2 V%_HI	Moisture content in [vol%]
49090	CH2 V%_LO	
49091	CH3 V%_HI	Moisture content in [vol%]
49092	CH3 V%_LO	
49093	CH1 PPM_HI	Moisture content in [ppmV]
49094	CH1 PPM_LO	
49095	CH2 PPM_HI	Moisture content in [ppmV]
49096	CH2 PPM_LO	
49097	CH3 PPM_HI	Moisture content in [ppmV]
49098	CH3 PPM_LO	
49099	CH1 FP_HI	Freezing point temperature in [°C]
49100	CH1 FP_LO	
49101	CH2 FP_HI	Freezing point temperature in [°C]
49102	CH2 FP_LO	
49103	CH3 FP_HI	Freezing point temperature in [°C]
49104	CH3 FP_LO	
49105	CH1 VP_HI	Vapor pressure in [bar]
49106	CH1 VP_LO	
49107	CH2 VP_HI	Vapor pressure in [bar]
49108	CH2 VP_LO	
49109	CH3 VP_HI	Vapor pressure in [bar]
49110	CH3 VP_LO	
49111	CH1 CO2_HI	CO_2 content in [%]
49112	CH1 CO2_LO	

Address	Name	Description
49113	CH2 CO2_HI	CO_2 content in [%]
49114	CH2 CO2_LO	
49115	CH3 CO2_HI	CO_2 content in [%]
49116	CH3 CO2_LO	
49119	VERSION_HI	Software version, e.g. “1843” -> version 1.8.43
49120	VERSION_LO	

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