BARTEC

Moisture Analyzer Control Software

MACS HYF 5674

Software Manual

459318MDSEN B V3
Software V1.1.19
01/2025

en

IMPORTANT!

READ CAREFULLY BEFORE USE!

KEEP FOR FUTURE REFERENCE!

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.

Should you have any queries, please contact the address below:

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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 6.6 "Modbus parameters" on page 67*.**

Aid for troubleshooting in the event of error messages from the software see *chapter 5 "Troubleshooting" on page 47*.

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.

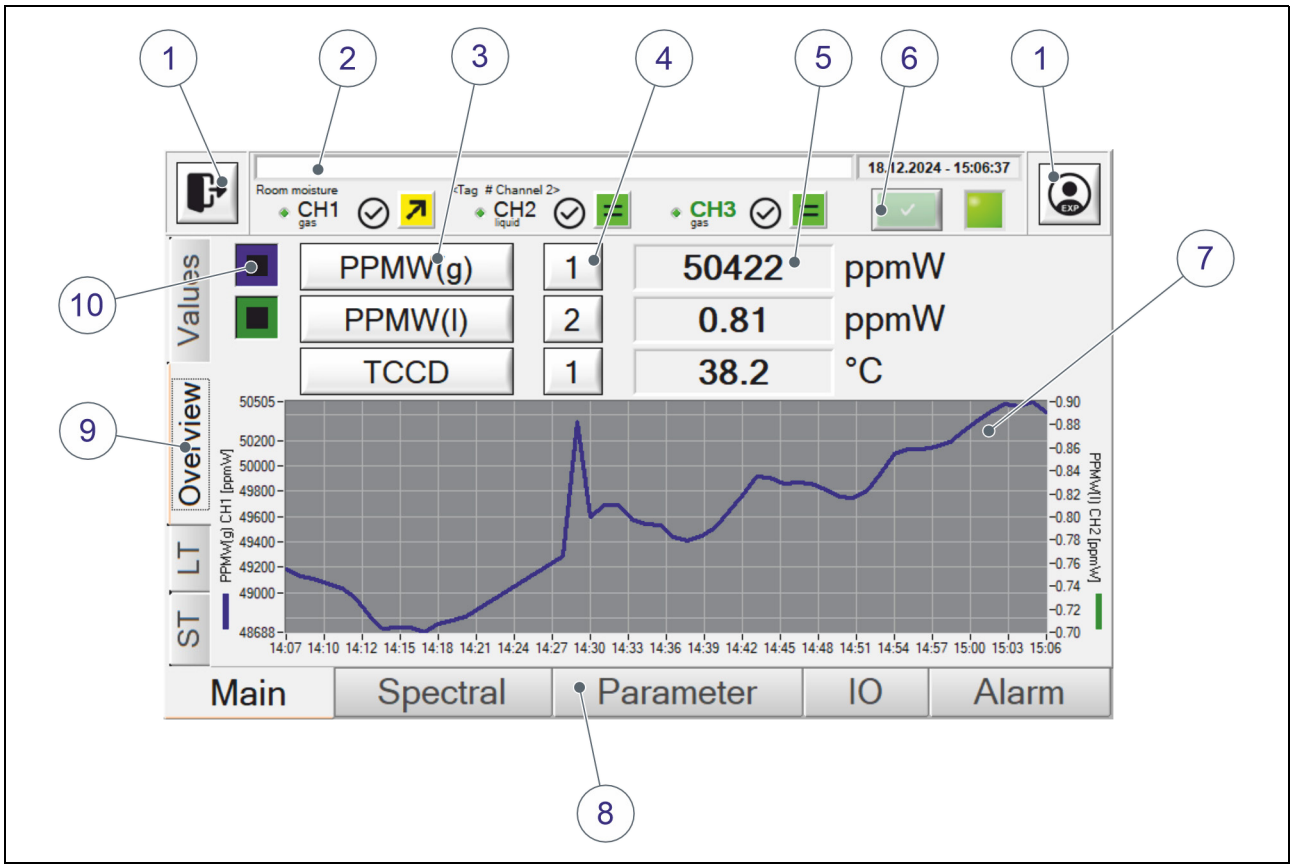
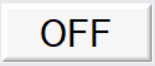


Figure 2.1: Overview of controls

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 32*)
	Button for saving changes on the main page *Parameter*, *IO* or *Alarm*
	Button for canceling an action. Changes are discarded.
	Button to clean up the sensor calibration backup files (.bak) in the config\ch1 to ..\ch3 directories. (see *chapter 2.6.6 "IO - Info sub-page" on page 30*)
	Acknowledging all pending alarms. (see *chapter 2.7 "Alarm main page" on page 31*)
	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 20*)
	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 20*)
	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 26*)

Element	Meaning
ON	Button for activating a function (Simulation e.g. - see *chapter 2.6.4 "IO - Settings sub-page" on page 26*)
	Button for opening the alarm log book (see *chapter 2.7 "Alarm main page" on page 31*)
	Button for opening the general log book (see *chapter 2.7 "Alarm main page" on page 31*)
	Button for opening the connection diagram for the relay connection card and the channel card (see *chapter 2.6 "IO (inputs and outputs) main page" on page 19*)
	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 17*)
	Button to create a local backup (SD card drive Z:\) (see *Figure 2.11 on page 17*)
	Only from *Expert* user level and above: Button for saving LED calibration (see *chapter 6.2 "Calibrating spectrometer with argon lamp" on page 53*)
	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 53*)
-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 6*).

2.1.2 Notes on operation

DT

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

-32.2

- 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:

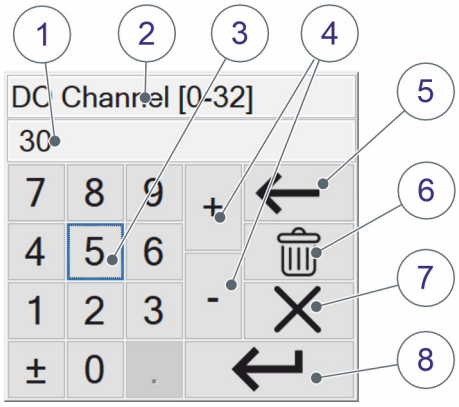


Figure 2.2: Input window

(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

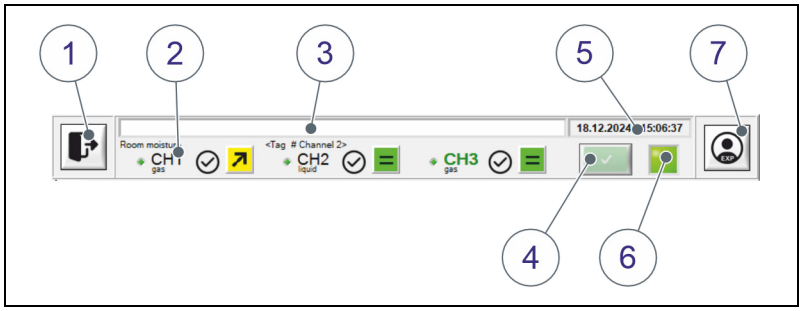


Figure 2.3: Top menu bar

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

Symbols of the status LED

When MACS is first installed, the first maintenance interval is set depending on the country of delivery. The status LED indicates the next maintenance date as a reminder. The symbols are as follows:

Symbol	Meaning
	The next appointment is in less than 3 months. A message will be displayed at the bottom of the main page informing you of the upcoming date.
	The date is coming up or is already in the past.

- Tap on the red text on the main page to hide it.
- Tap on the symbol to display the remaining days until the appointment.
- **Only in *Manufacturer* user level:**
  Hold down the icon (right-click) to set the interval. Enter the desired number of years and confirm with Enter.
- The icon turns green again.

2.2.1 Display of status of the channels

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

Figure 2.4: Display exemplary

- *gas*: Gas application (the calibration file *.hyf* is used).
  Measurement of humidity in gases.
- *liquid*: Liquid application (the calibration file *.sol* is used).
  Measurement of moisture in liquids.
  Only the measured values in *PPMW* are relevant.
  Settings and measured values in connection with gases are ignored.

Note: Upon delivery, the device is calibrated with one of the above applications.

Symbols next to channel name

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 resp. undershot (see *chapter 5.1 "Limit violations" on page 48*)
	
	**From *Expert* user level:** Trend of the readings (moisture), whether increasing, decreasing or constant. The colors describe the dispersion of the last measurements over 20 minutes).
	
	
	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 26*)

2.2.2 Display of error message

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

Yellow	Warning
Red	Alarm

In case of channel-specific error messages, the relevant channel is also displayed on the right (e.g. *CH1*).

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 31*).

2.2.3 Selecting of user level

Information on selecting the user level is provided in *chapter 2.8 “Selecting the user level” on page 32*.

2.2.4 Closing, restarting or shutting down

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

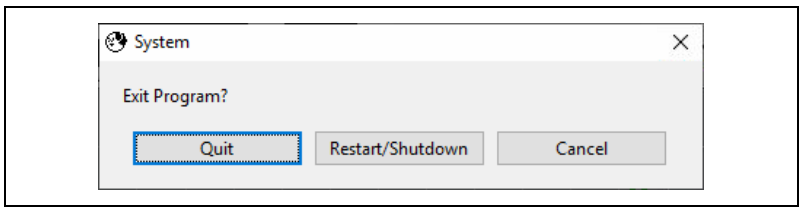


Figure 2.5: System window

- *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

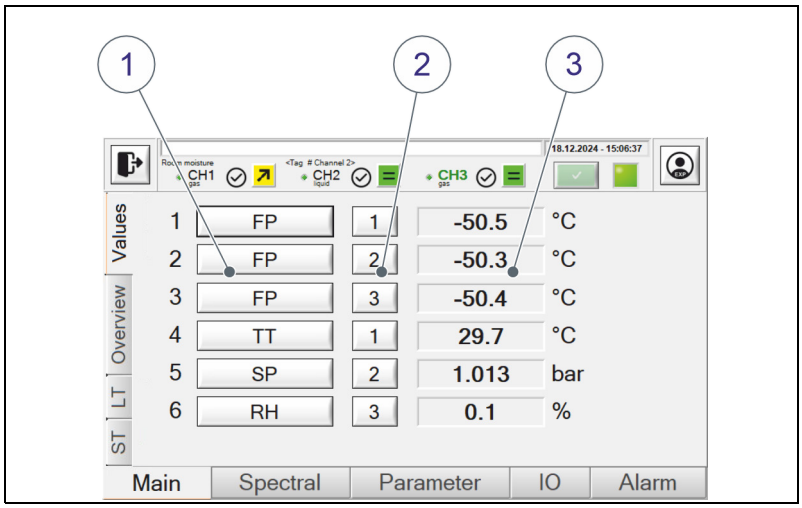


Figure 2.6: *Main - Values* sub-page

(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 17*)

The following measured values can be selected:

Measured value	Application	Description
DT	Gas	Dew point temperature
FP	Gas	Frost point temperature
DT2 (DTref)	Gas	Reference dew point temperature (for GERG only) DT calculation at pressure *SP_REF* (channel-specific parameter)
MC (D) MC (G)	Gas	***M**oisture **C**ontent Default* measuring method (Selection by gas quality for channel parameters) **(D)** = *Default*: Calculation with standard gas **(G)** = The GERG calculation is used for other gases.
PPMV (D)	Gas	Moisture content volume-related in *Parts per million* *Default* measuring method
PPMV (G)	Gas	Moisture content volume-related in *Parts per million* Measuring method according to *GERG*
PPMW(l)iquid PPMW(g)as	Gas/Liquid	Moisture content weight-related in *Parts per million* (if medium=gas, the calculation is made using the channel-specific parameter *M_GAS*)
PPMWsat	Liquid	Moisture content (saturated) weight-related in *Parts per million* (in liquids only)
VOL% (D)	Gas	Moisture content volume in percent *Default* measuring method
VOL% (G)	Gas	Moisture content volume in percent Measuring method according to *GERG*
WL	Gas/Liquid	Measured wavelength
TT	Gas/Liquid	Corrected temperature value of sample (***T**rue **T**emperature*)
TCCD	Gas/Liquid	Temperature of spectrometer
SP	Gas	Pressure in the sample
SPref	Gas	Virtual reference pressure when used under real conditions
RH	Gas/Liquid	Relative humidity
SVP	Gas	Saturated vapor pressure
VP	Gas	Vapor pressure
VPeff	Gas	Effective vapor pressure

2.3.2 *Main - Overview* sub-page

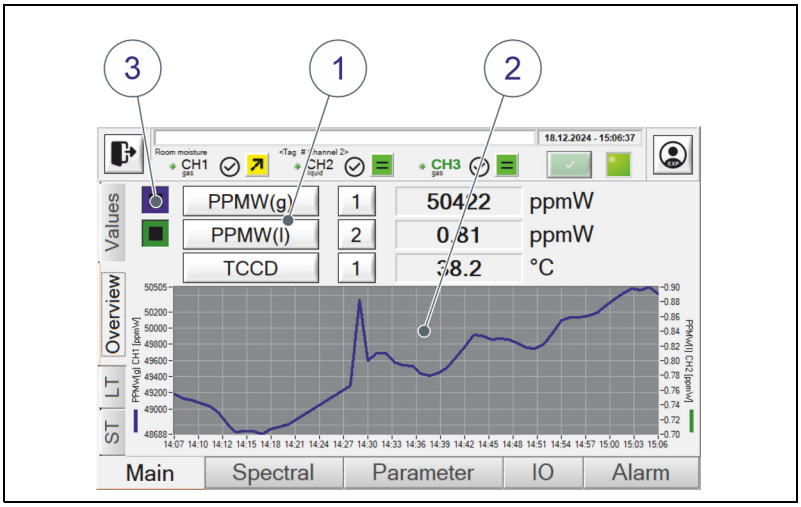


Figure 2.7: *Main - Overview* sub-page

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 10*.

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 *PPMW(g)* and the green curve the *PPMW(l)*. 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 (***L**ong* **T**erm) in hours.

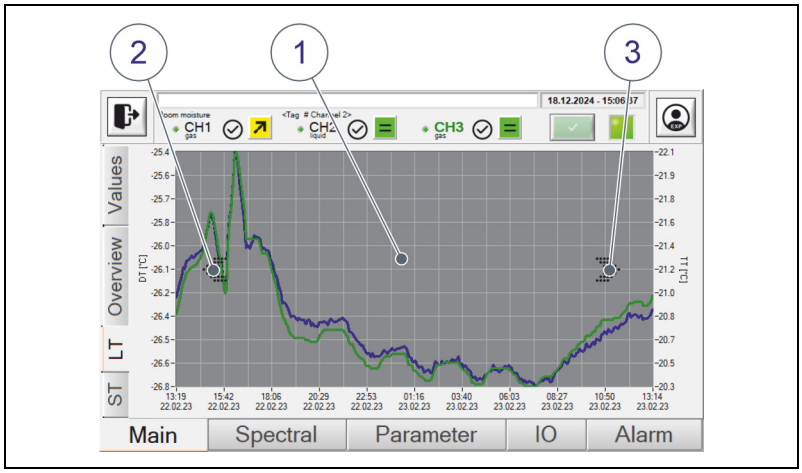


Figure 2.8: *Main - LT* sub-page

(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 (***S**hort* **T**erm) in minutes.

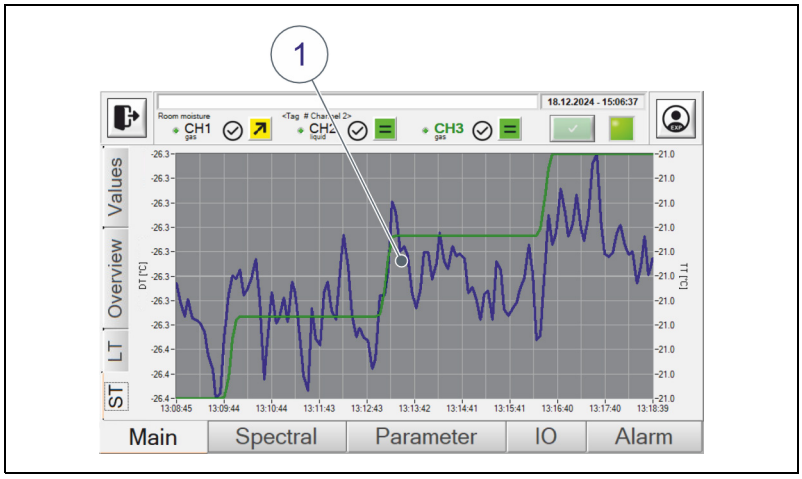


Figure 2.9: *Main - ST* sub-page

(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.

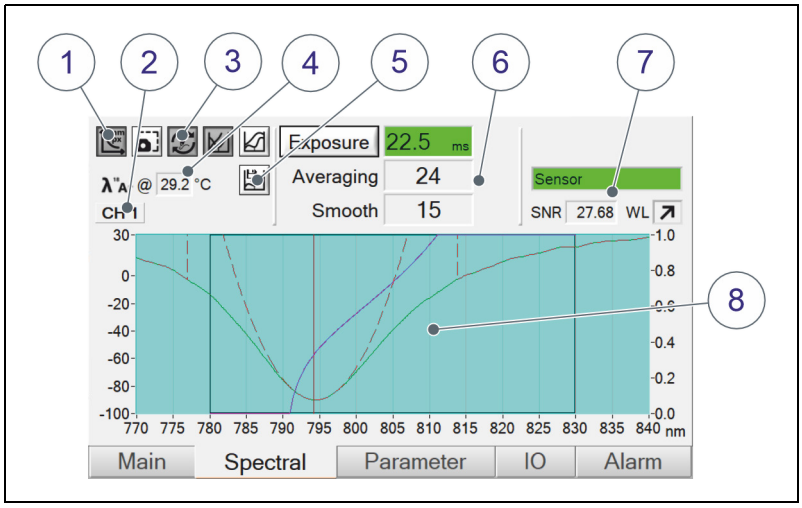


Figure 2.10: *Spectral* main page

(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) **Only in user level *Manufacturer*:** This button can be used to switch periodic saving of the spectrum as a *csv* file. If this function is switched on, the spectrum is saved every 60 seconds.
(for more information on the files see *page 51*).

(6) Spectrometer settings (display).

- *Exposure* = exposure time.
  Automatically set in all cases.
  The correct exposure time is set and saved at the factory. However, MACS can adjust the time automatically if necessary (*AutoExposure*).
  Readjustment can be initiated by tapping on the button.
- **Only in user level *Manufacturer:*** with the on the right the exposure time can be saved. This time is loaded at program start. The stored value is also used to check whether the current

exposure time is still in the valid range. In case of a deviation, an alarm is generated (cable or sensor defective).

- **Only in user level *Manufacturer*:** By right-clicking (or long pressing with the finger) on the text field next to *Exposure* (here "22.5 ms") *AutoExposure* is deactivated and the field turns magenta. Now the exposure time can be entered manually for test purposes. Press and hold again to reactivate *AutoExposure*.
- *Averaging* and *smooth* can be set using the parameters (see *chapter 4.1 “Device parameters” on page 39*).

(7) 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 56*.**

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

section 2.8 “Selecting the user level” on page 32 describes the process for alternating the user level.

2.5 *Parameters* main page

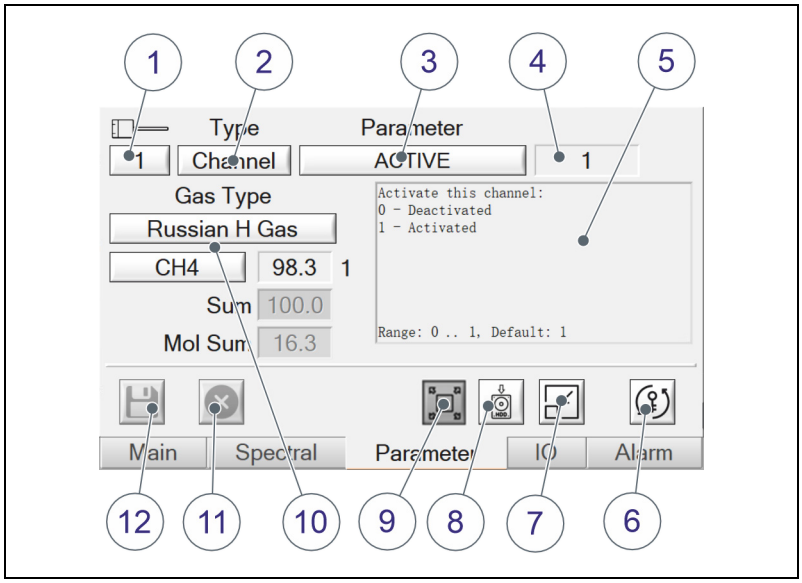


Figure 2.11: *Parameters* main page

(1) Channel selectable, if *Channel* **(2)** has been selected for. This refers to the number of the measuring channel I, II or III (1, 2, 3)
(labeling on the device *CH I*, *CH II* and *CH III*).

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

(3) Parameters. For selection, see *section 2.1.2 “Notes on operation” on page 6*.

(4) Value of parameter.
From *Expert* user level and above 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 32*.)

(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 32*).

(7) **Only in user level *Manufacturer*:**
Minimize the main window to display the desktop.

(8) **From *Expert* user level and above 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 51*.

(9) **Only in the *Manufacturer* user level:**
You can use this button to switch MACS between full screen and windowed mode.

(10) **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. These settings are only used for gas application.**

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

(12) **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

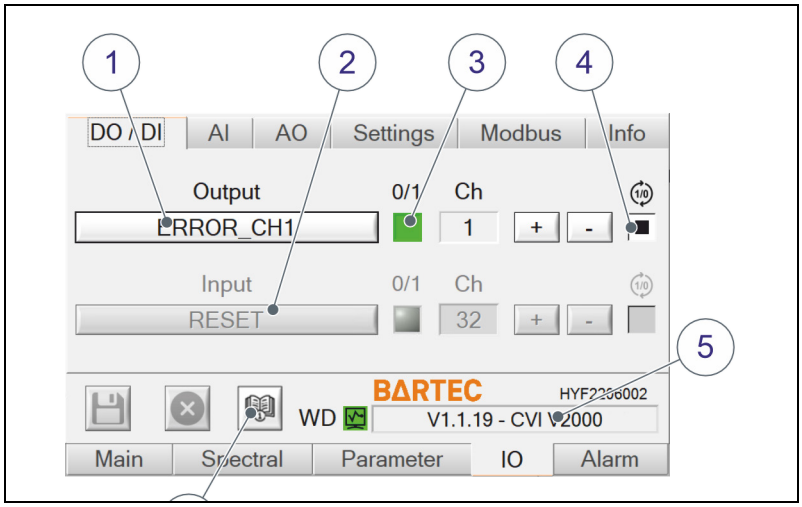


Figure 2.12: *IO - DO/DI* (digital inputs and outputs) sub-page

The digital outputs (*DO*) and inputs (*DI*) are shown and, if necessary, can be 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 26*.
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.

(6) Button for opening the connection diagram for the relay connection card and the channel card.

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

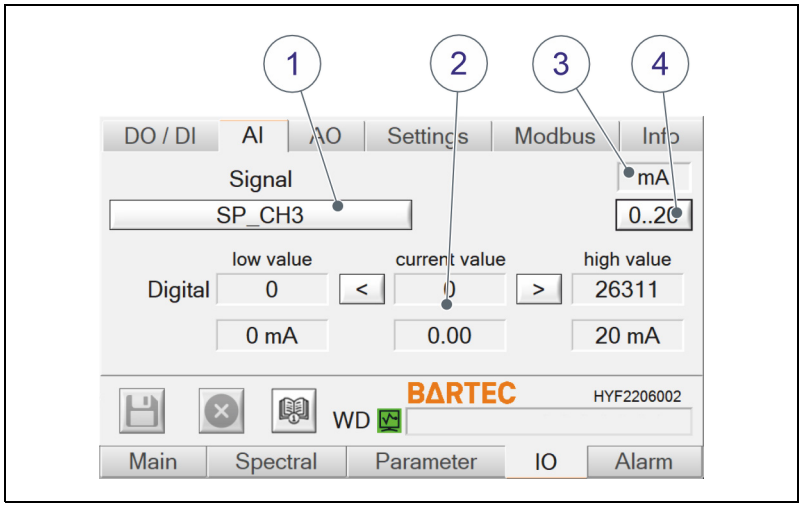


Figure 2.13: IO - *AI* (analog inputs) sub-page

Like on page *DO/DI*, on this page the analog inputs (*AI*) are shown, and if necessary, can be configured.

(1) Show 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 analog inputs and outputs are calibrated at the factory and can be configured only in the *Manufacturer* user level. If there are any deviations, contact customer service (*see chapter 1.7 „Customer service“ in the operating manual safety instructions*).**

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

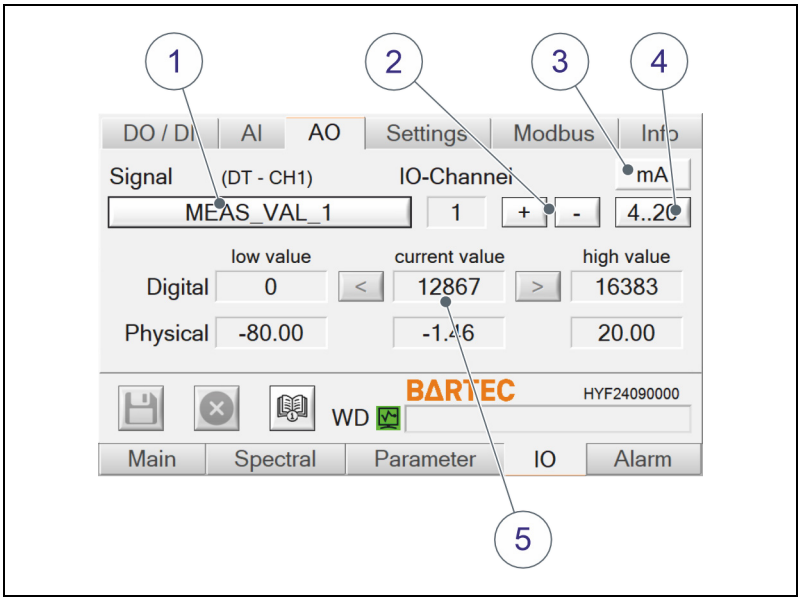


Figure 2.14: Sup-page *IO - AI* (analog ouputs)

On this page, the analog inputs (*AO*) can be displayed and set if required.

(1) The analog outputs are displayed here.

(2) The + and - buttons can be used to change the number of the IO channel.

(3) Button for changing the display of physical values in mA.

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

(5) The digital and physical values and ranges of the selected input are displayed here.

The physical measuring range must be adjusted according to the selected measured variable of the channel parameter *AO_MEAS_VAL_x*. To do this, follow the steps in *section “Adjust the physical measuring range” on page 23*.

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.

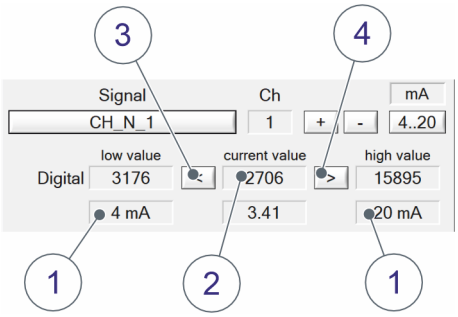
The measurement results are output as an analog signal (0-20 mA or 4-20 mA). This means the physical measuring range of the individual channels must be adjusted to the digital measuring range by means of calibration.

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.**

Adjust the physical measuring range

In order to display correct and more accurate measurement results, it is necessary to adjust the physical measuring range if a different measured variable has been selected for a channel parameter *AO_MEAS_VAL_x*. Proceed as follows:

☝ Change to the *Expert* user level
(see *chapter 2.8 "Selecting the user level" on page 32*).

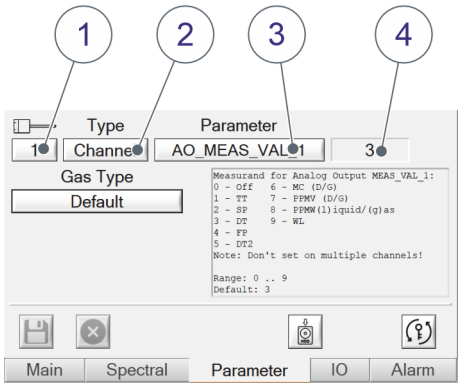


Figure 2.15: Channel parameter

☝ Select the parameter type *Channel* (channel parameter) in the main window *Parameter* **(2)**.

☝ Select channel 1 **(1)**.

☝ Select the channel parameter *AO_MEAS_VAL_1* **(3)**.

☝ Tap in the input field **(4)**.

☝ Enter the number of the desired measured variable.

☝ In this example, "3" for *DT* (dew point temperature).

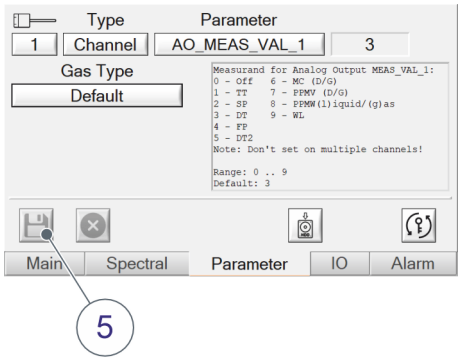


Figure 2.16: Save measured value

☝ Tap the button **(5)** to save the entry.

☝ Repeat the steps for channels 2 and 3, if available.

☝ Make sure that a parameter has not been selected twice. For example, use the parameters as follows:

- *AO_MEAS_VAL_2* for measuring channel 2
- AO_MEAS_VAL_3 for measuring channel 3

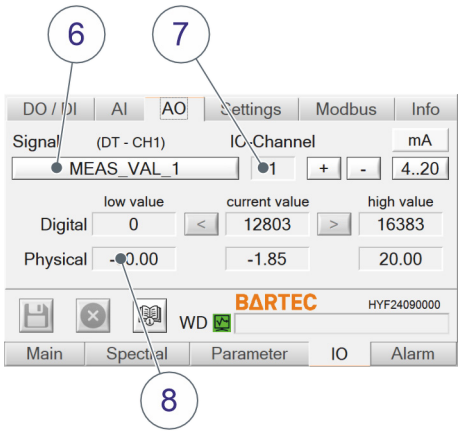


Figure 2.17: Set parameter - low value

- In the *IO - AO* main window, select the analog input *MEAS_VAL_1* under *Signal* **(6)**.
- Use the + and - buttons to select channel 1 **(7)**.
- In the *Physical* row, tap on the *low value* input field **(8)**.

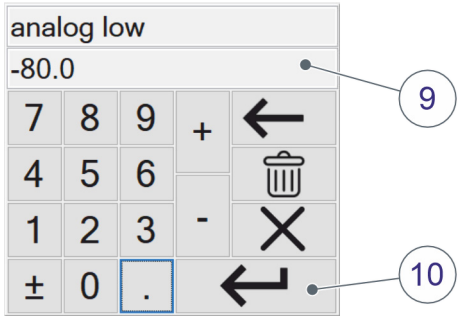


Figure 2.18: Enter low value

- Enter the low value **(9)**. In this example “-80”.
- Tap on Enter **(10)** to accept the value.

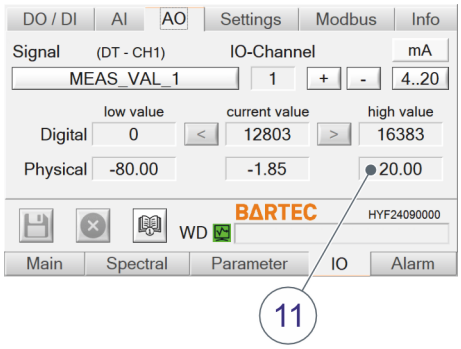


Figure 2.19: Set parameter - high value

- In the *Physical* row, tap on the *high value* input field **(11)**.

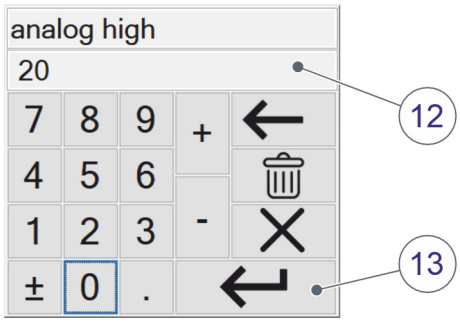


Figure 2.20: Enter high value

- Enter the high value **(12)**. In this example, “20”.
- Tap on Enter **(13)** to accept the value.

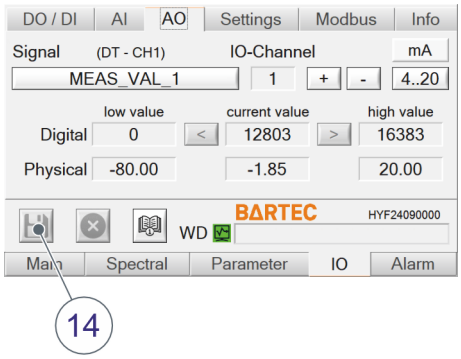


Figure 2.21: Save entries

- Tap the *Save* button to accept the entries **(14)**.
- Repeat the steps with the other analog outputs.

2.6.4 *IO - Settings* sub-page

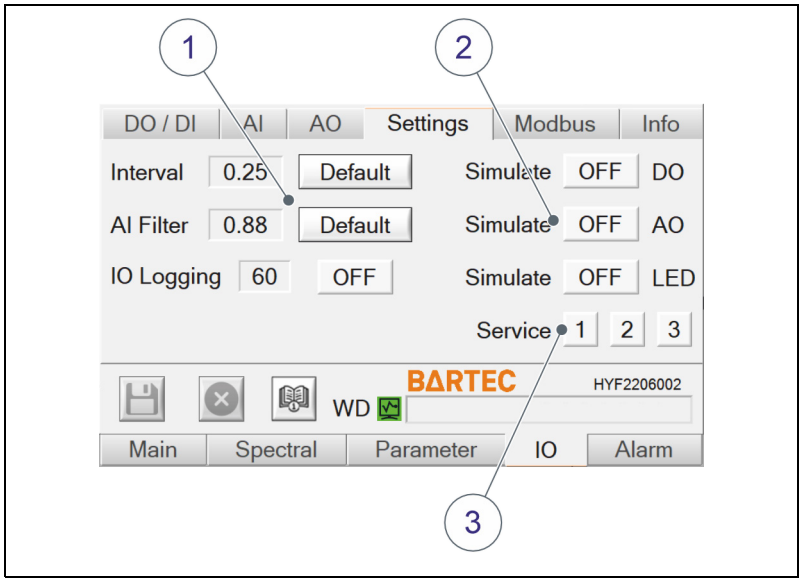


Figure 2.22: *IO - Settings* sub-page

(1) **Applies to user level *Manufacturer*:**
Settings for the signals of the analog inputs
These settings may be changed only by BARTEC BENKE!
I*O Logging*: The inputs and outputs are written to the logbook when the button shows *ON*.

(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 19*).

(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

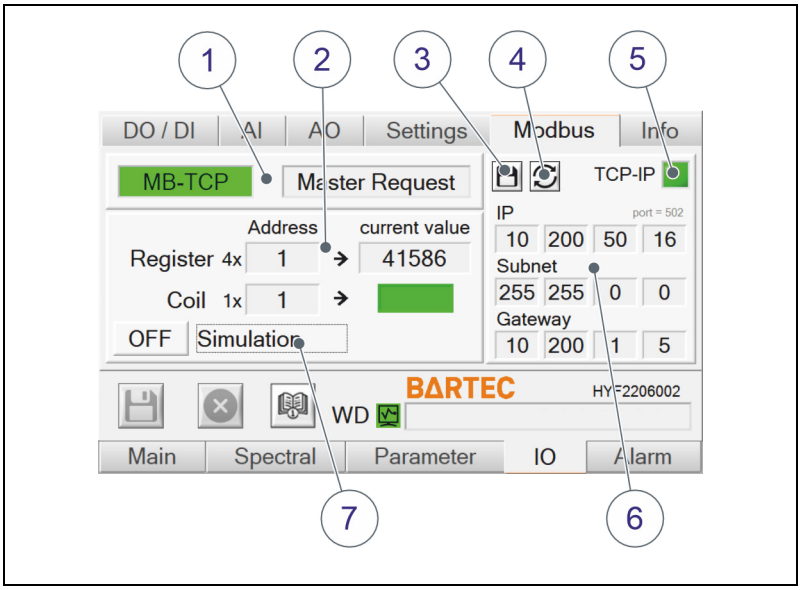


Figure 2.23: *IO - Modbus* sub-page

(1) 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.

(2) Input fields for testing registers and addresses.

(3) By tapping the *Save* button, the IP address is accepted and becomes active after approx. 15 s.
A permanent IP address can be assigned (range 1 to 255).

(4) *Refresh* button for displaying the IP address assigned by the DHCP server or the IP address saved in the device (internal Modbus adapter).

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

(6) The default IP address is specified by BARTEC BENKE (192.168.2.1). The IP address, subnet mask and gateway address can be changed by tapping in the respective field (Modbus mode can be set with the parameter *MB_Mode* - for more information, see *chapter 4.1 “Device parameters” on page 39*).

(7) Activate/deactivate simulation of Modbus signals.

Automatic assignment of the IP address by DHCP server:

(1) 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) If the device is connected to the DHCP server, tap *Save* **(6)**. The internal Modbus adapter restarts within approx. 10 seconds.

(3) The device receives a new IP address from the DHCP server.
Tap the *Refresh* button **(5)**. The IP address is displayed.

In case of problems with the IP address

- If this does not work, repeat steps 1 to 3 or shut down the device (see *chapter 2.2.4 "Closing, restarting or shutting down" on page 9* - select *Restart/Shutdown*). After the device has shut down, disconnect the power supply for 15 seconds. Then restart the device. Repeat the steps 1 to 3.
- If this did not work, enter any IP address, tap the *Save* button **(6)**, wait approx. 10 seconds and repeat the steps.

Change gateway address and subnet mask via remote access:

You can only change the address for the gateway and subnet mask via remote access in an Internet browser and not within MACS.
Proceed as follows:

- If not yet done, connect the Modbus LAN port to your network.
- Note the IP address, that is displayed in MACS on the sub-page *IO - Modbus*
- Enter the IP address in your Internet browser.
- Leave the login fields empty and press the Enter key. Change gateway address and subnet mask via remote access:
- You can only change the address for the gateway and subnet mask via remote access in an Internet browser and not within MACS.
- Proceed as follows:

- If not yet done, connect the Modbus LAN port to your network.
- Note the IP address that is displayed in MACS on the
- IO - Modbus subpage in MACS.
- Enter the IP address in your Internet browser.
- Leave the login fields empty and press the Enter key. If you have entered the correct IP address, the following page will open:

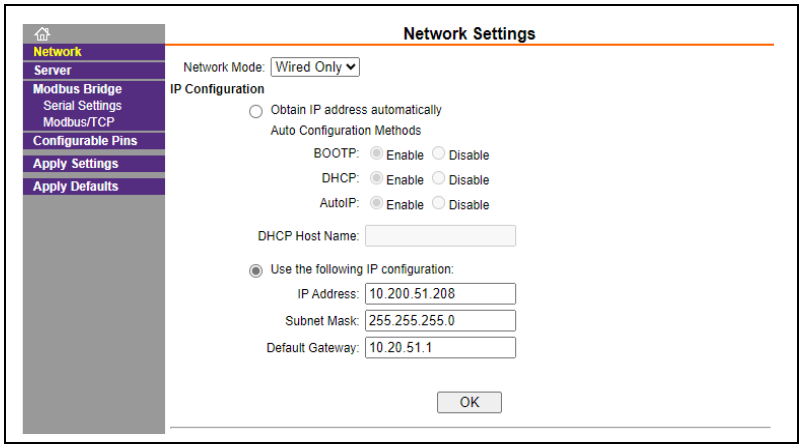


Figure 2.24: Change IP address in an Internet browser

- Select *Use the following IP configuration*.
- Enter the IP address in the *IP Address* field.
- Enter the desired subnet mask address in the *Subnet Mask* field.
- Enter the IP address of your router in the *Default Gateway field*.
- Click on the *OK* button.
- Click on the *Apply Settings* menu item.

In case of problems with the IP address

If the device can not be reached, use the *Lantronix DeviceInstaller* tool supplied. (For more information *see chapter 6.4 “Using Lantronix DeviceInstaller to change the IP address” on page 58*).

2.6.6 *IO - Info* sub-page

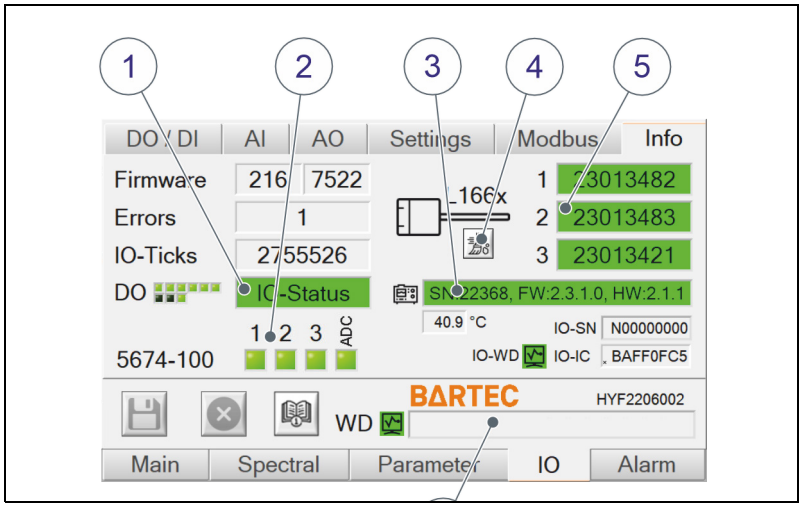


Figure 2.25: *IO - Info* sub-page

(1) Information on the status of interfaces (inputs/ outputs).
With *DO* the status of the digital outputs 1 to 6 is indicated by the upper LED (green = signal present).
The lower three LEDs compactly shows the status of the channels 1 to 3. The detailed display is described in *section 2.2.1 “Display of status of the channels” on page 8*.

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

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

(4) From user level *Expert*: Button for cleaning up the sensor calibration backup files (.bak) in the directories *config\ch1* to *..\ch3*.
The backup files are created automatically when transferring new sensor calibration files (.hyf) via USB stick before the new calibration file is copied.

(5) 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 56*).

Tapping on the serial number of a sensor displays the detailed info of the calibration.

(6) Tapping in the text field displays the **system information**. These are also written to the logbook file after program start (see *chapter 6.1 “Directories and files” on page 51*).

2.7 *Alarm* main page

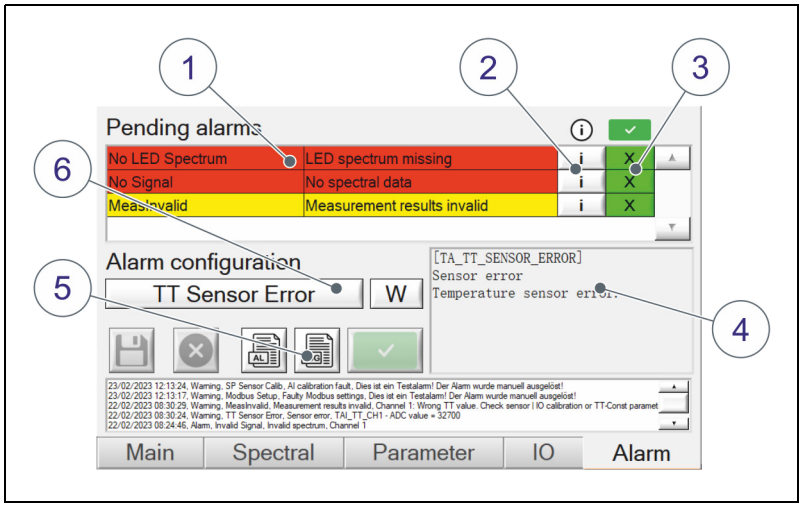


Figure 2.26: *Alarm* main page

(1) Listing of all pending alarms.
The first column contains the number of the channel if it is a channel-specific alarm.

(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:

OP	*Operator* If you confirm the entry without entering a password, MACS switches to the *Operator* user level.
EXP	*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 17*). Note: If the symbol is displayed, MACS switches to the *Operator* user level by tapping on this button.
MFG	*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 2.2.4 “Closing, restarting or shutting down” on page 9*).

Figure 2.27: Taskbar

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

How to set up remote access is described in *chapter 6.5 “Set up remote access” on page 60*.

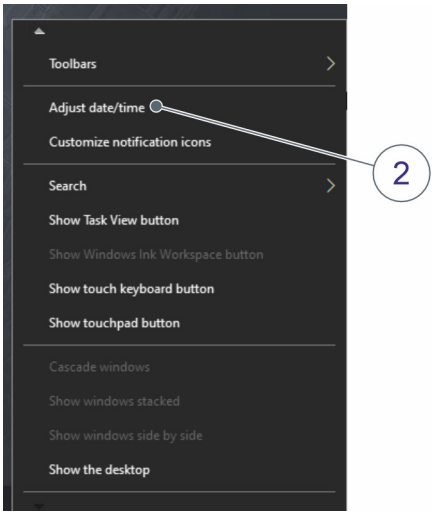


Figure 2.28: Menu

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

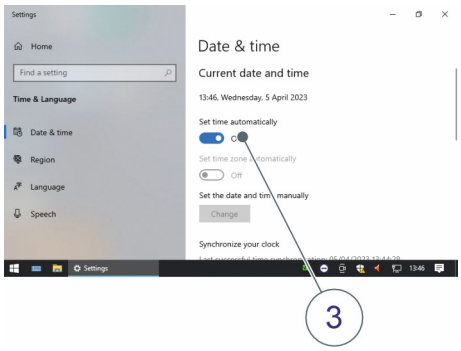


Figure 2.29: Set time automatically

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

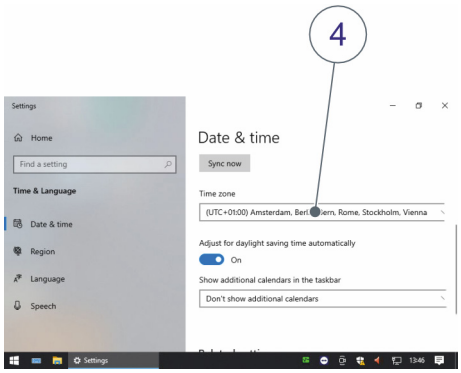


Figure 2.30: Select time zone

- Select your local time zone **(4)**.
- Close the Settings window.

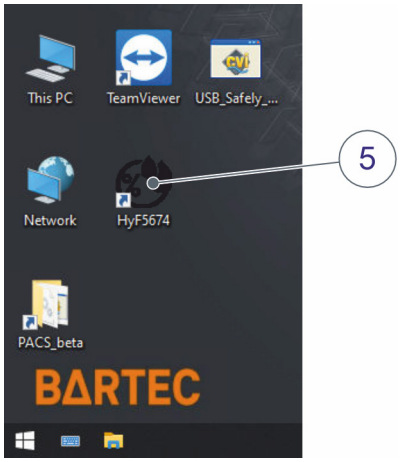


Figure 2.31: Start MACS

- 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
MEAS_VAL_1	Custom Analog Output 1	Measured value changeable via channel-specific parameters, analog output, freely configurable (see *chapter 4.2 "Channel parameters" on page 43*)
MEAS_VAL_2	Custom Analog Output 2	
MEAS_VAL_3	Custom Analog Output 3	
MEAS_VAL_4	Custom Analog Output 4	
MEAS_VAL_5	Custom Analog Output 5	
MEAS_VAL_6	Custom Analog Output 6	

3.2 Analog inputs

Tag	Name	Description	Value range
TT_CH1 TT_CH2 TT_CH3	Sample Temperature Channel x	Input for the temperature sensor (PT100) of the trace moisture sensor L166x.	0 to 60 °C **Only set by the service department!**
SP_CH1 SP_CH2 SP_CH3	Sample Pressure Channel x	Input for a optional pressure sensor on the measuring sensor.	adjustable from 0 to 200 bar
GP_1 GP_2 GP_3 GP_4	General Purpose Input	Input for general purposes, for testing or recording (logbook). No access from outside the device.	**Only for service purposes.**

3.3 Digital outputs

Tag	Name	Description
ERROR_CH1	Error Channel 1	Error on the corresponding channel. The measuring values may be invalid. 1: OK (relays energized - factory setting) is triggered if one of the following alarms is active: - CH_CARD - TT_CALIB - TT_ERROR - TT_OPEN SP_CALIB - SP_ERROR - INV_SIGNAL - NO_SIGNAL - HIGH_EXP - NO_SPEC_HW - NO_IO_CARD - RESULT_INV 1: Error (if inverted)
ERROR_CH2	Error Channel 2	
ERROR_CH3	Error Channel 3	
LIMIT_CH1	Out of Range Channel 1	Measured value of the corresponding channel is above the set limit or cable break. Alarm TA_OUTOFRANGE is ignored. 1: No limit (relays energized - factory setting)
LIMIT_CH2	Out of Range Channel 2	
LIMIT_CH3	Out of Range Channel 3	
WARNING	Collective Warning	There are one or several active warnings 1: No warning active (relays energized - factory setting)
ALARM	Collective Alarm	There are one or several active alarms (faults) 1: No alarm active (relays energized - factory setting)

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 17*.

TAG	Name	Typical value/ range	Change becomes effective	Description
LANGUAGE	Language	**0** 0/1	Upon restarting	0: English 1: German
DATE_NOT	Date Time Notation	**0** 0/1	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)
T_UNIT	T-Unit	**0** 0 to 2	Immediately	Unit of temperature: 0: °C 1: °F 2: K
P_UNIT	P-Unit	**1** 0 to 6	Immediately	Unit of pressure: 0: mbar 1: bar 2: Pa 3: hPa 4: kPa 5: psi 6: mmHg

TAG	Name	Typical value/ range	Change becomes effective	Description
MC_UNIT	MC-Unit	**0** 0/1	Immediately	Unit of moisture content: 0: mg/Nm³ 1: lb/MMscF
AUTO_CH	AutoChSwitching	**0** 0/1	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
MAN_CH	ManChActivation	**0** 0 to 3	Immediately	Activation of a channel, if parameter *AutoChSwitching* is set to “0”.
MEAN	Mean Horizon	**11** 1 to 120	Immediately	Number of measured values used for averaging (temperature, pressure, wavelength)
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.**
LT_SAVE_TIME	LongtermSavePeriod	**300 min** 0 to 1800 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

TAG	Name	Typical value/ range	Change becomes effective	Description
IO_RESTART	IOcard restart	**0** 0/1	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
DEBUG_LOG	DebugLog	**0** 0/1	Immediately	Activation of a debug logging (more/extra entries in the logbook, column Type = *Debug*). **Only for test/service purposes.**
TCCD_MAX	TCCD Max	**60°C** 5 to 60°C	Immediately	Max. spectrometer temperature at which the device is shut down.
MB_ENABLE	Modbus Enable	**1** 0/1	Immediately	Modbus interface with DCS: 0: deactivated 1: activated
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 - Modbus*
MB_SLAVE_ID	Modbus Slave	**1** 1 to 247	Immediately	**Only for Modbus RTU:** Address (ID) of Modbus slave for Modbus communication

TAG	Name	Typical value/ range	Change becomes effective	Description
MB_BAUDRATE	Modbus Baud	**6** 0 to 7	Immediately	**Only for Modbus RTU:** Modbus communication baud rate: 0: 1200 1: 2400 2: 4800 3: 9600 4: 19200 5: 38400 6: 57600 7: 115200
MB_PARITY	Modbus parity	**0** 0 to 2	Immediately	**Only for Modbus RTU:** Parity bit for Modbus communication: 0: None 1: Odd 2: Even

4.2 Channel parameters

You can find information on setting the channel parameters in *section 2.5 “Parameters main page” on page 17*.

TAG	Parameters	Typical value/ range	Change becomes effective	Description
ACTIVE	Channel Active	**1** 0/1	Immediately	Deactivating/activating measurement and “freezing” outputs (Modbus, IO) 0: deactivated 1: activated
TT_CONST	TT-Const	**30°C** 0 to 65°C	Immediately	Standard value for sample temperature. Used if no valid measured value is present (analog input *TT_CHx* 0 to +60°C) or the temperature sensor is deactivated (*TT_ON* = 0).
TT_ON	Use Temp Sensor	**1** 0/1	Immediately	Activate/deactivate temperature measurement for testing 0: *Use TT_CONST* as temperature.
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).
SP_REF	SP-Ref	**70 bar** 1 to 300 bar	Immediately	Value for converting the FP/DT of the media pressure to this reference pressure
SP_ON	Use Pressure Sensor	**0** 0/1	Immediately	Optionally connected pressure sensor used? 0: *Use SP_CONST* as pressure
SP_COMP	Pressure Compensation	**0** 0/1	Immediately	**Only for test/service purposes.** Only effective for SP > 1 bar. 0: Use pressure as fixed value (channel parameter) 1: Gas pressure compensation The optional SP sensor is used as the pressure (*SP_ON*)

TAG	Parameters	Typical value/ range	Change becomes effective	Description
SPEC_AVG	Spectral Average	**24** 0 to 200	Immediately	Number of spectra used for averaging
SMOOTH	Smooth Horizon	**15** 0 to 30	Immediately	Number of spectral points used for smoothing
OFFSET_SEL	Offset Selection	**0** 0 to 5	Immediately	Selection of measured variable for the Offset measured value. See *OFFSET_VAL*: 1: DT (±15 K) 2: FP (±15 K) 3: PPMW(l)iquid/(g)as (±10 ppmW) 4: PPMV Gas (±1200 ppmV) 5: WL (±1 nm) only for test purposes
OFFSET_VAL	Offset Value	**0** -1200 to 1200	Immediately	Offset measured value. Measured variable is defined by *OFFSET_SEL*.
LIMIT_MR	Limit MR Select	**1** 0 to 7	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 6: PPMV (Gas) 7: PPMW(l)iquid PPMW(g)as
L_LIMIT	Upper Limit MR	**-100** -10,000 to 10,000 (Unit according to *Limit MR Select*)	Immediately	Lower limit for measured values (selectable via channel parameter *Limit MR Select*) for triggering an alarm.
H_LIMIT	Lower Limit MR	**100** -10,000 to 10,000 (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
M_GAS	Molar Mass of Gas	**28,9626** 2 to 100	Immediately	Molar mass of the medium used (gas) to calculate PPMW in the gas phase (not for liquids).
AO_ MEAS_VAL_1 AO_ MEAS_VAL_2 AO_ MEAS_VAL_3 AO_ MEAS_VAL_4 AO_ MEAS_VAL_5 AO_ MEAS_VAL_6	Customer analog output	**0** 0 to 9	Immediately	Measured value for the analog output MEAS_VAL_x: 0: Off 1: TT 2: SP 3: DT 4: FP 5: DT2 6: MC(D/G*) 7: PPMV(D/G*) 8: PPMW (l)iquid / PPMW(g)as 9: WL **Note: Only assign the respective parameter to one channel. Duplicate assignments will be deleted!** (see *chapter 2.6.3 “IO - AO (analog outputs) sub-page” on page 21* * 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 31*).

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 31*).

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 Preset
1	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
2	TA_NO_SIGNAL	No spectral data	No data from spectrometer Spectrometer faulty or not connected	Alarm
3	TA_TMAX_CCD	Temperature exceeded	Spectrometer temperature too high	Warning
4	TA_OUTOFRANGE	Measurement out of range	Measurement result is outside of lower or upper limit. Configured in channel parameter *PAR_CH_LIMIT_MR*, *L_LIMIT* und *H_LIMIT* (see *chapter 4.2 “Channel parameters” on page 43*). *FP*, *RH*, *MC* or *PPM* is above or below the limit.	Alarm
5	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 2.26 on page 31*).	Alarm
6	TA_NO_LEDSPEC	Warning: LED spectrum missing	LED spectrum has not yet been measured or saved	Alarm
7	TA_NO_CALIB	Calibration file is missing .hyf	Calibration data (.hyf) was not found	Alarm
8	TA_BAD_FIT	Bad spectral fit	Correlation coefficient of the spectral adjustment is too low.	Alarm
9	TA_NO_SPEC_HW	No CCD device found	Spectrometer could not be initialized on program start	Alarm

No.	TAG	Report in MACS	Description	Category Preset
10	TA_NO_IO_CARD	5674-120Card problem	IO card could not be initialized on program start	Alarm
11	TA_NO_CFG	Configuration missing	Configuration was not found (*.eni). MACS was started with default values.	Alarm
12	TA_TT_CALIB	AI calibration fault	Calibration (analog input) of temperature sensor not correct	Warning
13	TA_TT_OPEN	Sensor not connected	Temperature sensor (PT100) within the trace moisture sensor not connected or cable breakage	Warning
14	TA_TT_ERROR	Sensor shorten or faulty	Temperature sensor (PT100) within the trace moisture sensor is short-circuited or channel card is faulty	Warning
15	TA_SP_CALIB	AI calibration fault	Configuration of pressure sensor is not correct (analog input)	Warning
16	TA_SP_ERROR	Sensor faulty or not connected	Pressure sensor is not connected or is faulty	Warning
17	TA_CH_CARD	5674-100Card problem	Channel card is not installed or is faulty	Alarm
18	TA_MBUS_SETUP	Faulty Modbus settings	Modbus cannot be started due to a configuration error. (For further information, see Modbus manual from manufacturer.)	Warning
19	TA_MBUS	Modbus problem	Problem with Modbus communication. (For further information, see Modbus manual from manufacturer.)	Warning
20	TA_SYSTEM	System problem	General problem in the system. (For further information, see alarm log book.)	Warning
21	TA_HIGH_EXP	High exposure time	Problem with a Sensor. The exposure time is too long. The measurement on this channel is slow.	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: *D:\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
\Hyf5674\config	Configuration files, parameter and alarms ini files are unencrypted for analysis purposes in case of error. eni files are encrypted and are only used by MACS. **These files are saved to the SD card once backup has been manually started** (see *chapter 2.5 "Parameters main page" on page 17*).	alarm.ini alarm.eni HyPro.ini HyPro.eni ioCfg.ini language.ini paramCfg.ini paramCfg.eni programCfg.ini
\Hyf5674\config\ch1	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 17*).	<*Sensor number*>.hyf LED_Spectrum.a2f <*Sensor number*>.sol (for moisture in liquids)
\Hyf5674\config\ch2		
\Hyf5674\config\ch3		
\Hyf5674\data	Measuring values, logs, alarms, screenshots	
\Hyf5674\data\alarm	Alarms occurring	alarm.csv

Directory	Description	Files
\Hyf5674\data\ch1	Measurement results per channel.	MR_CH<n>_<*YYYY-MM-DD*>.csv **n** = 1, 2 or 3 Only for service purposes: spectrum (if set): <xYYYYMMDDHHmmss>.csv **x = Q:** values in the file: **y** = Quotient, **x** = wavelength **W:** values in the file: **y** = raw AD-counter (smoothed) **x** = wavelength
\Hyf5674\data\ch2		
\Hyf5674\data\ch3		
\Hyf5674\data\iolog	Log books for inputs/outputs *IO Logging* must be activated. (see *chapter 2.6.4 "IO - Settings sub-page" on page 26*)	IO_<*YYYY-MM-DD*>.csv
\Hyf5674\data\logbook	MACS log book, also accessible from *Alarm* main window (see *chapter 2.7 "Alarm main page" on page 31*). The file is saved automatically to the *\archive* subdirectory if it becomes too large.	logbook.csv
\Hyf5674\data\screenshots	Manually generated screenshots of *Spectral* (see *chapter 2.4 "Spectral main page" on page 15*) main page.	<*Time stamp*>.jpg
\Hyf5674\history	LongTerm histories per channel (is used internally by MACS)	
\Hyf5674\history\ch1	One history per day	His_<*YYYYMMDD*>.bin
\Hyf5674\history\ch2		
\Hyf5674\history\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

Figure 6.1: Argon source

- Connect and activate argon source.

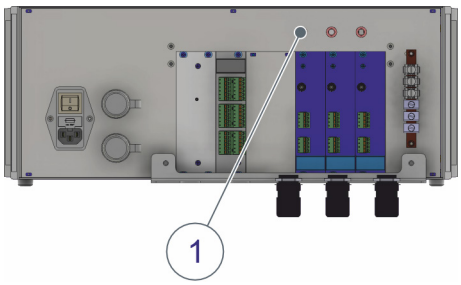


Figure 6.2: FOC input channel card

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

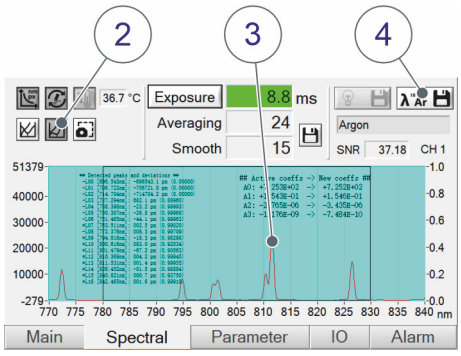


Figure 6.3: *Spectral* page, saving spectrum

- 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

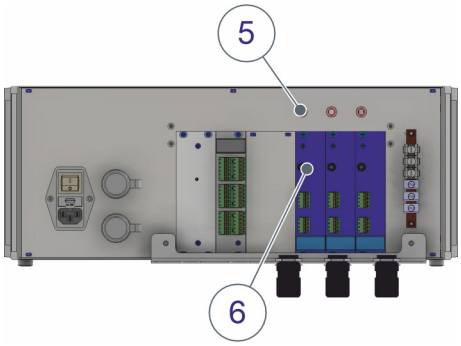


Figure 6.4: FOC at channel card 1

(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.

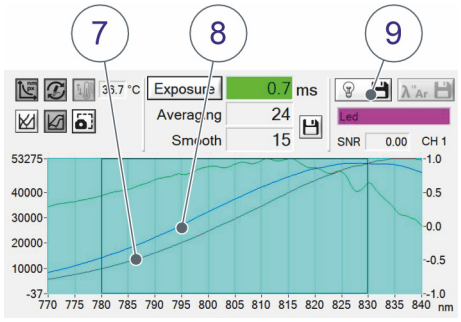


Figure 6.5: Correlating LED spectrum

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).

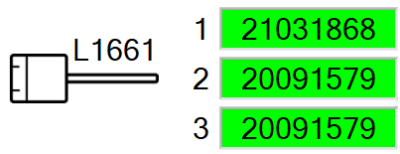


Figure 6.6: Sensor numbers

- 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 30*provides further information.

The process for reimporting sensor files is described in *section 6.3 “Backup and Update Tool” on page 56*.

Configuring exposure time

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

Proceed as follows:

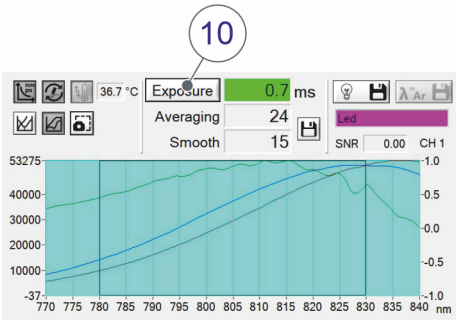


Figure 6.7: Optimum value for exposure time

- 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 51* 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 follows for the tool to recognize the USB stick:

Directory	Description	Remark
5674	Main directory for MACS	**Necessary for the USB stick to be recognized by the *Backup and Update Tool*.**
5674\config**ch1**	Directories for calibration data of the sensors	Only necessary if you want to update or replace the sensor calibration.
5674\config**ch2**		
5674\config**ch3**		
5674**update**	Update files for MACS (HyF5674.exe)	Only necessary if you want to update MACS. This directory can also contain several files and subdirectories.

NOTICE	
	**A ZIP file that you have received from customer service already contains the required directory structure. Unzip this file onto your USB stick. The directories are created automatically and contain all the required files.**

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:

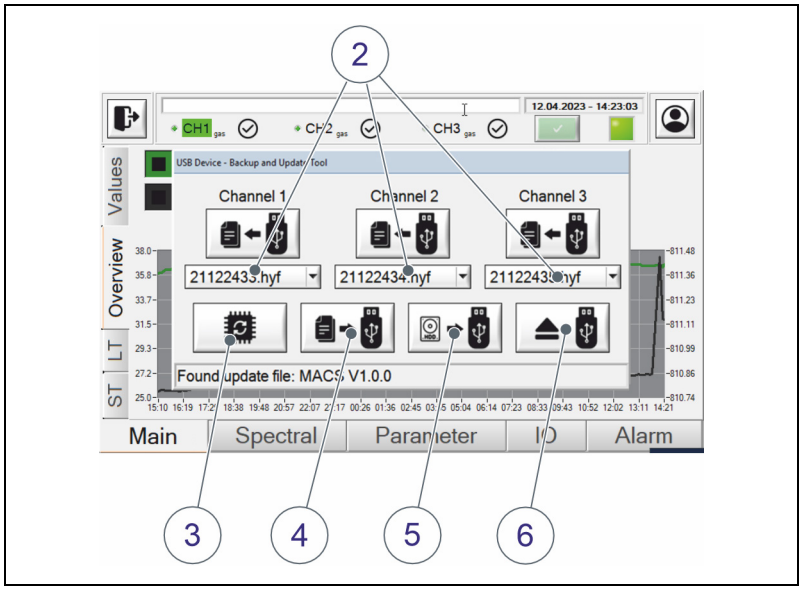


Figure 6.9: Backup and update tool

- 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 Using *Lantronix DeviceInstaller* to change the IP address

If the device cannot be reached via the IP address or the settings have been lost, you can resolve these problems using the *Lantronix DeviceInstaller* tool. Proceed as follows:

- Connect the two rear LAN ports with a short LAN cable (crossover or patch).

- Note the IP address display in *MACS* on the sup-page *IO - Modbus*.

- Quit MACS by tapping on the button in the top menu bar and tap on *Quit* (see *chapter 2.2.4 “Closing, restarting or shutting down” on page 9*).

- Open the Windows explorer. *DeviceInstaller* can be found in the internal drive of the *HYF 5674* in the directory
Z:\Installs\ModbusTCP\DeviceInstaller<x.x>

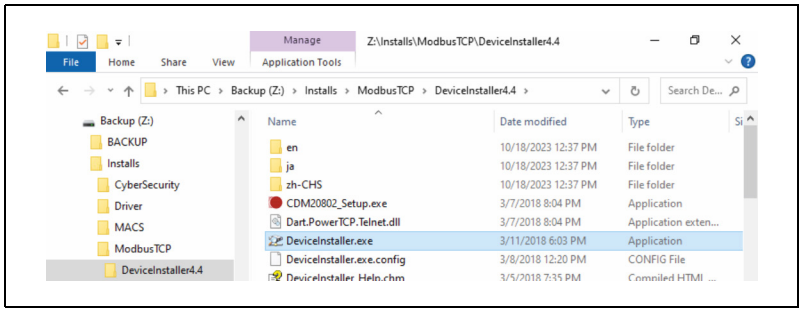


Figure 6.10: Starting *DeviceInstaller*

- Double-tap on the file *DeviceInstaller.exe.*

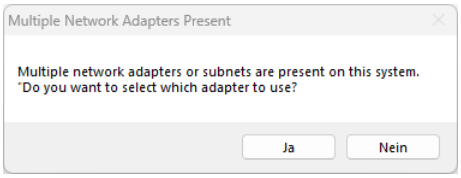


Figure 6.11: Window select network adapter

- Tap on the *Yes* button.
- Confirm further messages with the *No* button:
  - Question about updates
  - Question about tutorial
- If a query about the firewall appears, confirm this with the *Allow* button.

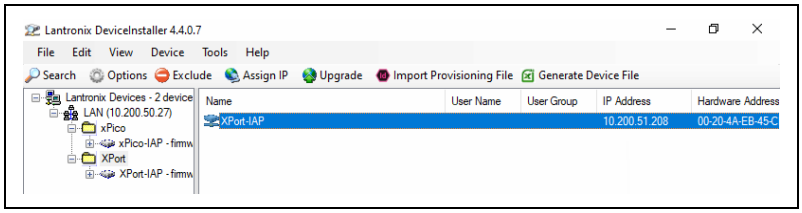


Figure 6.12: Select Modbus adapter

- Select the Modbus adapter *XPort-IAP* of your HYF 5674 by double-tapping.

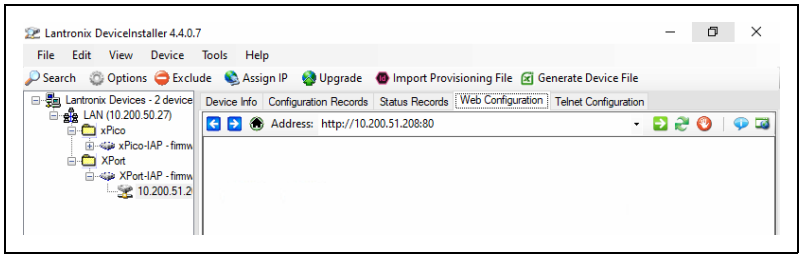


Figure 6.13: Page *Web Configuration*

- Tap on the *Web Configuration* tap.
- Tap the green arrow on the right next to the address bar.
- Follow the steps from *Figure 2.24 on page 29* and continue with the next steps described here.
- Close the Windows explorer in MACS HYF 5674
- Remove the short LAN cable from the rear LAN ports.
- Reconnect the Modbus LAN port with your network.
- Double-tap on *HyF5674* of the desktop, to restart *MACS HYF 5674*.

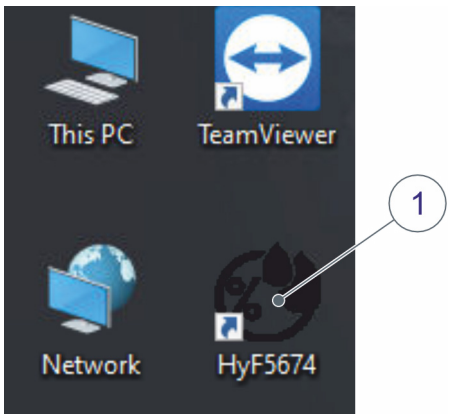


Figure 6.14: Start MACS

6.5 Set up remote access

You can set up remote access to the device using the pre-installed TeamViewer software. Access is provided via a local TeamViewer client.

Alternatively, you can also access the device via Windows Remote Desktop (*RDP*). To do this, follow the description in *section 6.5.4 “Set up remote access via Windows Remote Desktop (RDP)” on page 62*.

You can start *TeamViewer* for one-time access or have it open automatically when the device is started. First carry out the steps in the following section.

6.5.1 Quit or minimize *MACS*

- If you are logged in from the *Expert* user level, quit *MACS* (see *chapter 2.2.4 “Closing, restarting or shutting down” on page 9*.) or minimize *MACS* (see *chapter 2.5 “Parameters main page” on page 17*).

6.5.2 Start *TeamViewer* once (Host)

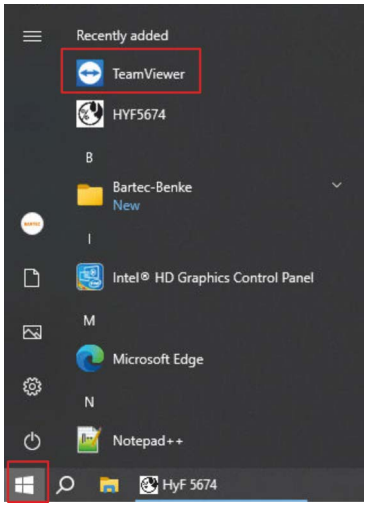


Figure 6.15: Windows menu

- Tap TeamViewer in the Windows menu of the device.
- Make a note of the access data.
- Start *HYF5674 (MACS)* or maximize it again.
- Start the TeamViewer client on your PC.
- Start the connection to HYF 5674 with the noted access data. On delivery the password for the connection is ***benkebenke***.

6.5.3 Start *TeamViewer* automatically as service in Windows (Host)

- Start the file *activate autostart and start app (as service).cmd* in the directory *Z:\Installs\Teamviewer*.

If the file is not available, you can set up the automatic start of TeamViewer as follows:

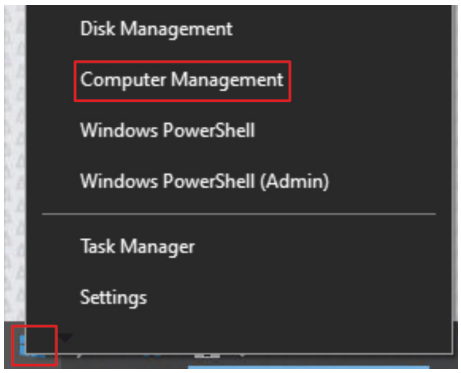


Figure 6.16: Computer Management

- Tap on the Windows menu and hold down your finger until a right-click is triggered (indicated by a frame that appears briefly).
- Tap on the *Computer Management* menu item.

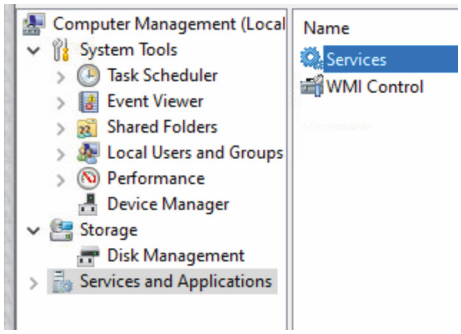


Figure 6.17: Services

- Tap on *Services and Application*.
- Double-tap on *Services*.

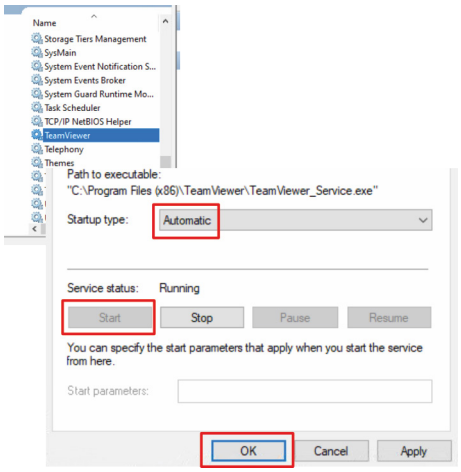


Figure 6.18: *TeamViewer* service

- Double-tap on the *Teamviewer* entry in the list.
- Select *Automatic* from the *Startup type* drop-down menu in the window.
- Tap on the *Start* button and the on *OK*.

Service status shows *Running* when the service is started. *TeamViewer* is started automatically every time the device is restarted in Windows.

- Start *TeamViewer* manually once if you have not already done so (see *chapter 6.5.2 “Start TeamViewer once (Host)” on page 60*).

6.5.4 Set up remote access via *Windows Remote Desktop (RDP)*

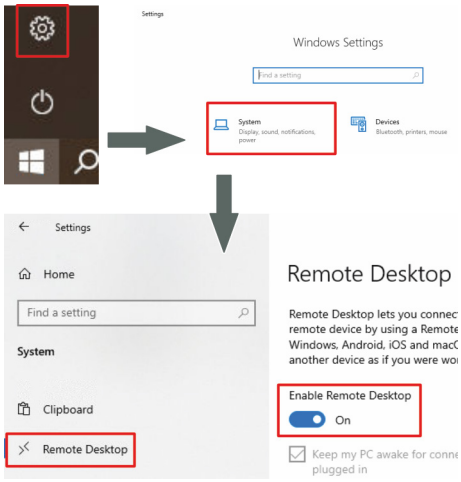


Figure 6.19: Activate remote desktop

- Tap the gear icon (*settings*) in the Windows menu of the device.
- Double-tap on *System*.
- Tap on the *Remote Desktop* entry.
- Tap on *Enable Remote Desktop* so that the switch is set to *On* and the *Remote Desktop* is activated.

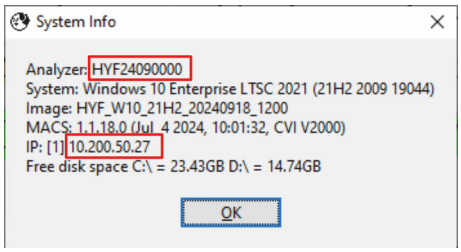


Figure 6.20: System info

- Start *HYF5674* (*MACS*) or maximize it again.
- Open the *System Info window* (see *page 30*).
- For remote access, you can either use the name of the device (analyzer) or the IP address in the next steps.

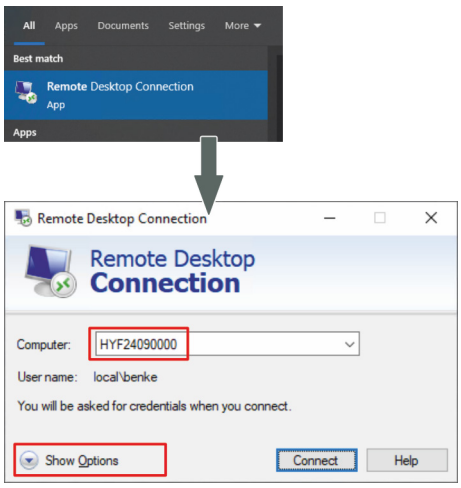


Figure 6.21: Remote desktop

- Start the remote desktop connection on your PC (e.g. by entering the search term *Remote* in the Windows menu).
- Enter either the device name or the IP address of the device in the Computer input field.
- Click on *Show options*.

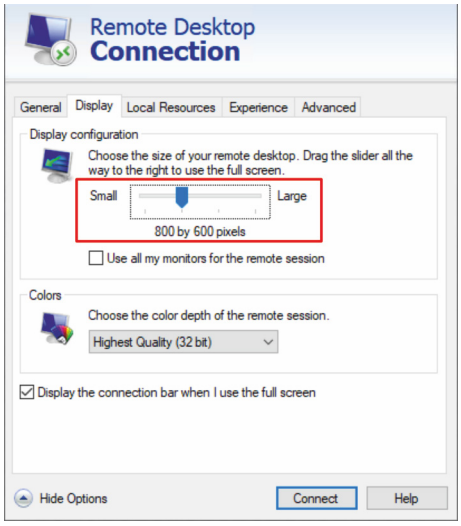


Figure 6.22: Remote desktop display

- Tap on the *Display* tab.
- If you do not want the display to be in full screen mode, set the slider to 800 by 600 pixels, for example.
- **Note:** The native resolution of MACS is 800 by 480 pixels. As this resolution cannot be set precisely using the slider, the display will be distorted during the remote desktop connection. If this is a problem, follow the instructions in the *section "Set the native resolution of MACS" on page 64*.
  Otherwise, continue here.

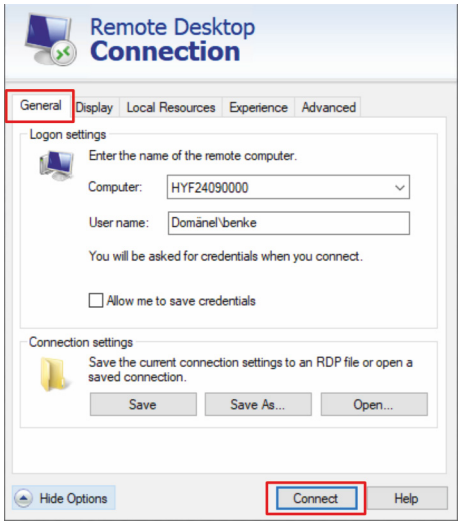


Figure 6.23: Connect remote desktop

- Click on the *General* tab.
- Enter ***benke*** in the *User name* input field.
- If the PC from which you want to start remote access is in a domain, you may need to insert ***local*** before the user name (*local\benke*) so that the PC does not log on to the device with the domain. If the login does not work, try it without ***local***.
- In the following window, enter the default password ***benkebenke***.

The remote desktop connection is established and you can access the device.

NOTICE	
	**If you disconnect the remote desktop connection again, the Windows user is logged out of the device.** **Operation directly on the device is then only possible after logging in again. To do this, simply enter the password mentioned above.**

Set the native resolution of MACS

If you want to use the native resolution of MACS (600 by 480), follow the instructions below:

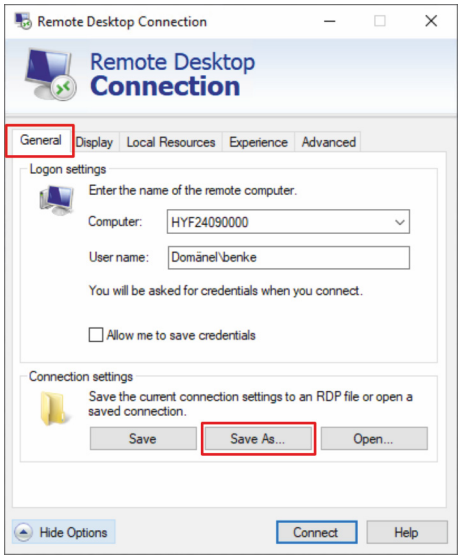


Figure 6.24: Save settings

- Tap on the *General* tab.
- Tap the *Save As* button to save the settings.
- Enter a file name (e.g. *HYF5674 Remote*) and save the file (e.g. on your desktop).

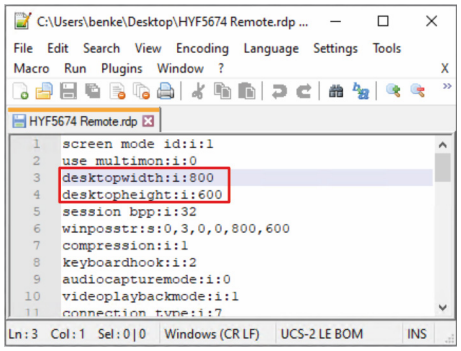


Figure 6.25: Change resolution

- Open the saved file (*HYF5674 Remote.rdp*) with an editor (*Notepad*).
- Change the value *600* in the *desktopheight* entry to *480*.
- You can also enter a larger resolution to match the aspect ratio: e.g. *1200 by 720 pixels*.
- To do this, change the values for *desktopheight* and *desktopwidth* accordingly.
- Save the file.
- If you execute this file (*HYF5674 Remote.rdp*), the connection is started with the saved resolution.

6.5.5 Change the Windows password on the device

If you want to restrict access to the device, we recommend changing the Windows password on the device. Proceed as follows:

- Exit or minimize MACS as described in *section 6.5.1 “Quit or minimize MACS” on page 60*.

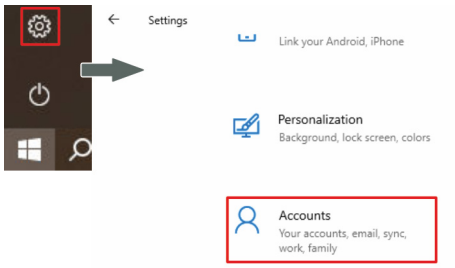


Figure 6.26: Accounts settings

- In the Window menu, tap on the gear icon (*Settings*).
- Double-tap on *Accounts*.

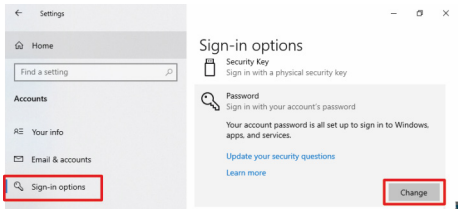


Figure 6.27: Sign-in options

- Tap on the entry *Sign-in options.*
- Tap on the *Password* entry.
- Tap on the *Change* button.

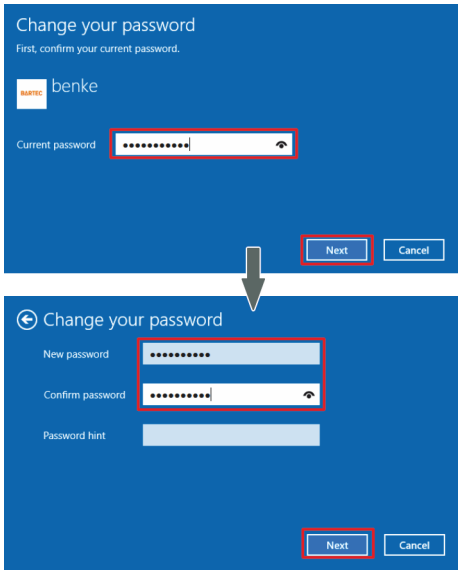


Figure 6.28: Change password

- Enter the current password (the default password on delivery is ***benkebenke***).
- Tap on the *Next* button.
- Enter the new password in each of the input fields *New password* and *Confirm password*.
- Tap on the *Next* button.

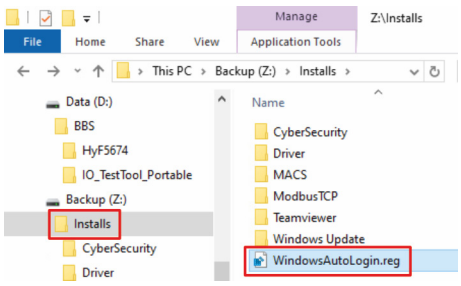


Figure 6.29: WindowsAutoLogin file

To ensure that the device automatically logs on to Windows after each restart, you have to modify the *Windows Registry*.
Proceed as follows:

Start *Windows Explorer*.

Tap on the *WindowsAutoLogin.reg* file and hold down your finger until a right-click is triggered.

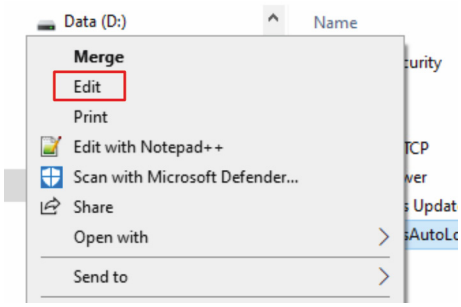


Figure 6.30: Edit file

Tap the *Edit* menu item in the local menu to open the file for editing.

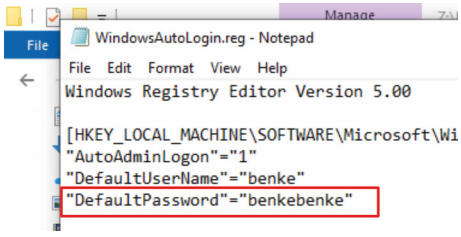


Figure 6.31: Change *DefaultPasswort*

Overwrite the password in the *DefaultPassword* entry (here *benkebenke*).

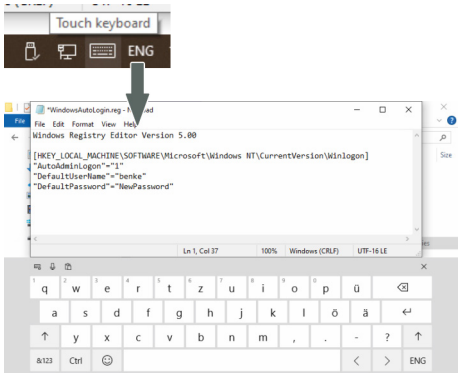


Figure 6.32: Open virtual keyboard

Open the virtual keyboard by tapping on the keyboard icon at the bottom right of the task bar.

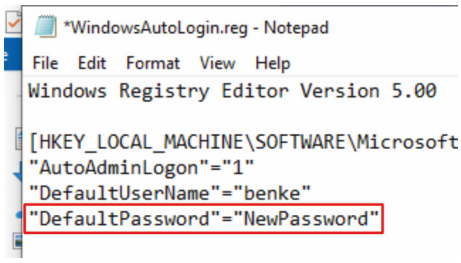


Figure 6.33: Change *DefaultPassword*

Overwrite the password in the *DefaultPassword* entry (in this case *benkebenke*).

The registry entry and the value must always be written in quotation marks.
The line looks like this, for example:
“DefaultPassword“=”NewPassword”

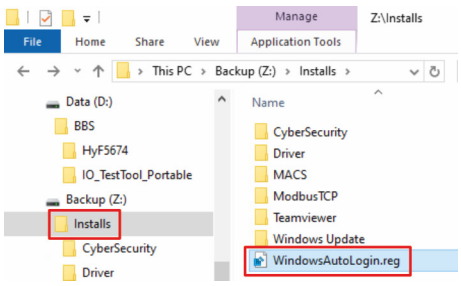


Figure 6.34: *WindowsAutoLogin* file

- Save and close the file.
- Close the virtual keyboard by tapping on the *X* in the top right-hand corner.
- In Windows Explorer, double-tap on the *WindowsAutoLogin.reg* file to make the changes in the registry.
- Close the *Windows Explorer*.
- Start *HYF5674* (*MACS*) or maximized it again.

When restarting, the device is automatically logged on to Windows with the new access data.

6.6 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.

NOTICE	
	For Modbus TCP/IP: Always use the *Slave ID* = 1.

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
P	Pressure (**P**ressure)
T	**T**emperature
CH	Channel
GP	Address for general purposes (**G**eneral **P**urpose)

6.6.1 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 6.6.2 "Device-specific addresses" on page 68*.

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

6.6.2 Device-specific addresses

Address	Name	Coils: Description	Value range	Format
1	CH1 present	0: Channel 1 unavailable 1: Channel 1 available	0/1	Boolean
2	CH2 present	0: Channel 2 unavailable 1: Channel 2 available	0/1	Boolean
3	CH3 present	0: Channel 3 unavailable 1: Channel 3 available	0/1	Boolean
4	HCDT hardware present	0: Hardware for HCDT measurement not installed 1: Hardware for HCDT measurement installed	0/1	Boolean
5	CH1 error	0: No fault 1: Error (For a detailed description of the digital output *ERROR_CH1*, see *section "Digital outputs" on page 37*)	0/1	Boolean

Address	Name	Coils: Description	Value range	Format
6	CH1 limit status	0: Measurement within the measuring range 1: Measurement outside the measuring range	0/1	Boolean
7	CH1 liquid	0: Medium is gaseous 1: Medium is liquid	0/1	Boolean
8	CH2 error	0: No fault 1: Error (For a detailed description of the digital output *ERROR_CH2*, see *section "Digital outputs" on page 37*)	0/1	Boolean
9	CH2 limit status	0: Measurement within the measuring range 1: Measurement outside the measuring range	0/1	Boolean
10	CH2 liquid	0: Medium is gaseous 1: Medium is liquid	0/1	Boolean
11	CH3 error	0: No fault 1: Error (For a detailed description of the digital output *ERROR_CH3*, see *section "Digital outputs" on page 37*)	0/1	Boolean
12	CH3 limit status	0: Measurement within the measuring range 1: Measurement outside the measuring range	0/1	Boolean
13	CH3 liquid	0: Medium is gaseous 1: Medium is liquid	0/1	Boolean
14	HCDT error	0: No fault 1: Error	0/1	Boolean

Address	Name	Coils: Description	Value range	Format
22	CH1 WL valid	0: not valid 1: valid	0/1	Boolean
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			
36	CH2 WL valid	0: not valid 1: valid	0/1	Boolean
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			

Address	Name	Coils: Description	Value range	Format
50	CH3 WL valid	0: not valid 1: valid	0/1	Boolean
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	0/1	Boolean

Address holding registers	Name	Description	Value range	Format
40001 .. 40163 (4x)	Measurement results for channel 1 to 3			

Measured value formats:
- **32Bit float** = 2 registers for 32Bit IEEE 754 floating point (big endian)
- **decimal** = 1 registers for 16Bit unsigned scaled value (big endian). Converted using the formula: Measuring value = (unsigned 16Bit value * (max - min) / 65535) + min
- **32Bit decimal** = 2 registers for 32Bit unsigned scaled value (big endian). Converted using the formula: Measuring value = (unsigned 32Bit merged value * (max - min) / 4294967295) + min
(32bit merged register value = (Reg_HI << 16) | Reg_LO)

Measurement results for channel 1				
40001	CH1 WL	Wavelength in [nm] for minimum value of measurement spectrum	780 to 830 nm	decimal
40002	CH1 V%	Moisture content in [vol%]	0 to 100 %	decimal
40003	CH1 PPM_HI	Moisture content in [ppmV (gaseous), ppmW (liquid)] (upper word)	0 to 25000 ppm	32 bit decimal
40004	CH1 PPM_LO	Moisture content in [ppmV (gaseous), ppmW (liquid)] (lower word)		
40005	CH1 DT	Dew point temperature in [°C]	-100 to 100 °C	decimal
40006	CH1 FP	Frost point temperature in [°C]	-100 to 100 °C	decimal
40007	CH1 VP_HI	Vapor pressure in [mbar] (upper word)	0 to 250 hPA, mbar	32 bit decimal
40008	CH1 VP_LO	Vapor pressure in [mbar] (lower word)		
40009	CH1 MC_HI	Moisture content in [mg/m³] (upper word)	0 to 30000 mg/m³	32 bit decimal
40010	CH1 MC_LO	Moisture content in [mg/m³] (lower word)		
40011	CH1 TT	Sample temperature in [°C]	-50 to 100 °C	decimal
40012	CH1 SP_HI	Sample pressure in [mbar] (upper word)	0 to 250000 hPa, mbar	32 bit decimal
40013	CH1 SP_LO	Sample pressure in [mbar] (lower word)		
40014	CH1 CO2	CO_2 content in [%]	0 to 100 %	decimal
40015	CH1 RH_HI	Relative humidity in [%] (upper word)	0 to 100 %	32 bit decimal
40016	CH1 RH_LO	Relative humidity in [%] (lower word)		
40017	CH1PPMW_HI	Moisture content in [ppmW] for gas applications (upper word) - see channel parameter *M_GAS*	0 to 25000 ppm	32 bit decimal
40018	CH1PPMW_LO	Moisture content in [ppmW] for gas applications (lower word) - see channel parameter *M_GAS*		

Address holding registers	Name	Description	Value range	Format
Measurement results for channel 2				
40019	CH2 WL	Wavelength in [nm] for minimum value of measurement spectrum	780 to 830nm	decimal
40020	CH2 V%	Moisture content in [vol%]	0 to 100%	decimal
40021	CH2 PPM_HI	Moisture content in [ppmV (gaseous), ppmW (liquid)] (upper word)	0 to 25,000 ppm	32 bit decimal
40022	CH2 PPM_LO	Moisture content in [ppmV (gaseous), ppmW (liquid)] (lower word)		
40023	CH2 DT	Dew point temperature in [°C]	-100 to 100°C	decimal
40024	CH2 FP	Frost point temperature in [°C]	-100 to 100°C	decimal
40025	CH2 VP_HI	Vapor pressure in [mbar] (upper word)	0 to 250hPA, mbar	32 bit decimal
40026	CH2 VP_LO	Vapor pressure in [mbar] (lower word)		
40027	CH2 MC_HI	Moisture content in [mg/m³] (upper word)	0 to 30,000mg/m³	32 bit decimal
40028	CH2 MC_LO	Moisture content in [mg/m³] (lower word)		
40029	CH2 TT	Sample temperature in [°C]	-50 to 100°C	decimal
40030	CH2 SP_HI	Sample pressure in [mbar] (upper word)	0 to 25,0000hPa, mbar	32 bit decimal
40031	CH2 SP_LO	Sample pressure in [mbar] (lower word)		
40032	CH2 CO2	CO_2 content in [%]	0 to 100%	decimal
40033	CH2 RH_HI	Relative humidity in [%] (upper word)	0 to 100%	32 bit decimal
40034	CH2 RH_LO	Relative humidity in [%] (lower word)		
40035	CH1PPMW_HI	Moisture content in [ppmW] for gas applications (upper word) - see channel parameter *M_GAS*	0 to 25000 ppm	32 bit decimal
40036	CH1PPMW_LO	Moisture content in [ppmW] for gas applications (lower word) - see channel parameter *M_GAS*		

Address holding registers	Name	Description	Value range	Format
Measurement results for channel 3				
40037	CH3 WL	Wavelength in [nm] for minimum value of measurement spectrum	780 to 830nm	decimal
40038	CH3 V%	Moisture content in [vol%]	0 to 100%	decimal
40039	CH3 PPM_HI	Moisture content in [ppmV (gaseous), ppmW (liquid)] (upper word)	0 to 25,000 ppm	32 bit decimal
40040	CH3 PPM_LO	Moisture content in [ppmV (gaseous), ppmW (liquid)] (lower word)		
40041	CH3 DT	Dew point temperature in [°C]	-100 to 100°C	decimal
40042	CH3 FP	Frost point temperature in [°C]	-100 to 100°C	decimal
40043	CH3 VP_HI	Vapor pressure in [mbar] (upper word)	0 to 250hPA, mbar	32 bit decimal
40044	CH3 VP_LO	Vapor pressure in [mbar] (lower word)		
40045	CH3 MC_HI	Moisture content in [mg/m³] (upper word)	0 to 30,000mg/m³	32 bit decimal
40046	CH3 MC_LO	Moisture content in [mg/m³] (lower word)		
40047	CH3 TT	Sample temperature in [°C]	-50 to 100°C	decimal
40048	CH3 SP_HI	Sample pressure in [mbar] (upper word)	0 to 25,0000hPa, mbar	32 bit decimal
40049	CH3 SP_LO	Sample pressure in [mbar] (lower word)		
40050	CH3 CO2	CO_2 content in [%]	0 to 100%	decimal
40051	CH3 RH_HI	Relative humidity in [%] (upper word)	0 to 100%	32 bit decimal
40052	CH3 RH_LO	Relative humidity in [%] (lower word)		
40053	CH1PPMW_HI	Moisture content in [ppmW] for gas applications (upper word) - see channel parameter *M_GAS*	0 to 25000 ppm	32 bit decimal
40054	CH1PPMW_LO	Moisture content in [ppmW] for gas applications (lower word) - see channel parameter *M_GAS*		
General				
40060	VERSION	Software version V[a.b.c.] (e.g. „V1.1.18“ = 1118) Version = [a] x 10000 + [b] x 1000 + [c] x 10	0 to 65535	decimal
40061 - 40080	ERROR_1 - ERROR_20	Currently pending alarm or warning ID (see see *chapter 5.2 “Error messages” on page 48*)	0 to 65535	decimal

Address holding registers	Name	Description	Format
Measurement results for channel 1 to 3 (higher resolution, as 4 bytes per measured value)			
49001	CH1 TT_HI	Sample temperature of channel 1 in [°C]	32 Bit IEEE 754 floating point (big endian)
49002	CH1 TT_LO		
49003	CH2 TT_HI	Sample temperature of channel 2 in [°C]	32 Bit IEEE 754 floating point (big endian)
49004	CH2 TT_LO		
49005	CH3 TT_HI	Sample temperature of channel 3 in [°C]	32 Bit IEEE 754 floating point (big endian)
49006	CH3 TT_LO		
49007	CH1 SP_HI	Sample pressure of channel 1 in [bar]	32 Bit IEEE 754 floating point (big endian)
49008	CH1 SP_LO		
49009	CH2 SP_HI	Sample pressure of channel 2 in [bar]	32 Bit IEEE 754 floating point (big endian)
49010	CH2 SP_LO		
49011	CH3 SP_HI	Sample pressure of channel 3 in [bar]	32 Bit IEEE 754 floating point (big endian)
49012	CH3 SP_LO		
49013	CH1 DT_HI	Dew point temperature of channel 1 in [°C]	32 Bit IEEE 754 floating point (big endian)
49014	CH1 DT_LO		
49015	CH2 DT_HI	Dew point temperature of channel 2 in [°C]	32 Bit IEEE 754 floating point (big endian)
49016	CH2 DT_LO		
49017	CH3 DT_HI	Dew point temperature of channel 3 in [°C]	32 Bit IEEE 754 floating point (big endian)
49018	CH3 DT_LO		
49019	CH1 MC_HI	Moisture content of channel 1 in [mg/m³]	32 Bit IEEE 754 floating point (big endian)
49020	CH1 MC_LO		
49021	CH2 MC_HI	Moisture content of channel 2 in [mg/m³]	32 Bit IEEE 754 floating point (big endian)
49022	CH2 MC_LO		
49023	CH3 MC_HI	Moisture content of channel 3 in [mg/m³]	32 Bit IEEE 754 floating point (big endian)
49024	CH3 MC_LO		

Address holding registers	Name	Description	Format
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	decimal
49075	CH1 WL_HI	Wavelength in [nm] for minimum value of measurement spectrum	32 Bit IEEE 754 floating point (big endian)
49076	CH1 WL_LO		
49077	CH2 WL_HI	Wavelength in [nm] for minimum value of measurement spectrum	32 Bit IEEE 754 floating point (big endian)
49078	CH2 WL_LO		
49079	CH3 WL_HI	Wavelength in [nm] for minimum value of measurement spectrum	32 Bit IEEE 754 floating point (big endian)
49080	CH3 WL_LO		
49081	CH1 RH_HI	Relative humidity in [%]	32 Bit IEEE 754 floating point (big endian)
49082	CH1 RH_LO		
49083	CH2 RH_HI	Relative humidity in [%]	32 Bit IEEE 754 floating point (big endian)
49084	CH2 RH_LO		
49085	CH3 RH_HI	Relative humidity in [%]	32 Bit IEEE 754 floating point (big endian)
49086	CH3 RH_LO		
49087	CH1 V%_HI	Moisture content in [vol%]	32 Bit IEEE 754 floating point (big endian)
49088	CH1 V%_LO		
49089	CH2 V%_HI	Moisture content in [vol%]	32 Bit IEEE 754 floating point (big endian)
49090	CH2 V%_LO		
49091	CH3 V%_HI	Moisture content in [vol%]	32 Bit IEEE 754 floating point (big endian)
49092	CH3 V%_LO		

Address holding registers	Name	Description	Format
49093	CH1 PPM_HI	Moisture content in [ppmV] (gas), ppmW (liquid)	32 Bit IEEE 754 floating point (big endian)
49094	CH1 PPM_LO		
49095	CH2 PPM_HI	Moisture content in [ppmV] (gas), ppmW (liquid)	32 Bit IEEE 754 floating point (big endian)
49096	CH2 PPM_LO		
49097	CH3 PPM_HI	Moisture content in [ppmV] (gas), ppmW (liquid)	32 Bit IEEE 754 floating point (big endian)
49098	CH3 PPM_LO		
49099	CH1 FP_HI	Frost point temperature in [°C]	32 Bit IEEE 754 floating point (big endian)
49100	CH1 FP_LO		
49101	CH2 FP_HI	Frost point temperature in [°C]	32 Bit IEEE 754 floating point (big endian)
49102	CH2 FP_LO		
49103	CH3 FP_HI	Frost point temperature in [°C]	32 Bit IEEE 754 floating point (big endian)
49104	CH3 FP_LO		
49105	CH1 VP_HI	Vapor pressure in [bar]	32 Bit IEEE 754 floating point (big endian)
49106	CH1 VP_LO		
49107	CH2 VP_HI	Vapor pressure in [bar]	32 Bit IEEE 754 floating point (big endian)
49108	CH2 VP_LO		
49109	CH3 VP_HI	Vapor pressure in [bar]	32 Bit IEEE 754 floating point (big endian)
49110	CH3 VP_LO		
49111	CH1 CO2_HI	CO_2 content in [%]	32 Bit IEEE 754 floating point (big endian)
49112	CH1 CO2_LO		
49113	CH2 CO2_HI	CO_2 content in [%]	32 Bit IEEE 754 floating point (big endian)
49114	CH2 CO2_LO		
49115	CH3 CO2_HI	CO_2 content in [%]	32 Bit IEEE 754 floating point (big endian)
49116	CH3 CO2_LO		

49119	VERSION_HI	Software version V[a.b.c.] (e.g. „V1.1.18“ = 1118) Version = [a] x 10000 + [b] x 1000 + [c] x 10	32 Bit IEEE 754 floating point (big endian)
49120	VERSION_LO		

Address holding registers	Name	Description	Format
49121	CH1 PPMW_HI	Moisture content in [ppmW] for gas applications (see channel parameter *M_GAS)*	32 Bit IEEE 754 floating point (big endian)
49122	CH1 PPMW_LO		
49123	CH2 PPMW_HI	Moisture content in [ppmW] for gas applications (see channel parameter *M_GAS)*	32 Bit IEEE 754 floating point (big endian)
49124	CH2 PPMW_LO		
49125	CH3 PPMW_HI	Moisture content in [ppmW] for gas applications (see channel parameter *M_GAS)*	32 Bit IEEE 754 floating point (big endian)
49126	CH3 PPMW_LO		

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