

5 Operation and control

NOTICE



The device must not be started or operated outside the specifications!

5.1 Before startup

Before commissioning, the device should be left to stand quietly and upright for at least 1 hour after transport, positioning, or installation.

After switching on the cooler, the display shows the cooling block temperature. The display flashes until the cooling block temperature has reached the setpoint value ($\pm$ adjustable alarm range). The status contact is in the alarm position.

When the set temperature range is reached, the cooling block temperature is displayed continuously and the status contact switches over.

If the display flashes or an error message appears during operation, please refer to the section 'Troubleshooting and Correction'. The performance data and limits can be found in the technical data in the appendix.

5.2 Description of functions

The cooler is controlled by a microprocessor. The factory settings of the controller already take into account the different characteristics of the installed heat exchangers.

The programmable display shows the cooling block temperature according to the selected unit of display ($^{\circ}\text{C}/^{\circ}\text{F}$) (factory setting: $^{\circ}\text{C}$). Application-specific settings can easily be made in the menu using the five keys. This not only applies to the target outlet dew point, which can be set from 3°C to 20°C (37°F to 68°F) (factory setting $5^{\circ}\text{C}/41^{\circ}\text{F}$),

but also the warning thresholds for high/low temperature. These are set relative to the configured outlet dew point τ_a .

For the low temperature, a range from $\tau_a - 1\text{ K}$ to -3 K (but at least $1^{\circ}\text{C}/34^{\circ}\text{F}$ coolant block temperature) is available; for the high temperature, a range from $\tau_a + 1\text{ K}$ to $+7\text{ K}$. The factory settings for both values are 3 K .

Falling below or exceeding the configured warning range (e.g. after switching on) is indicated both by the LED S2 blinking on the display and by the status relay.

The status output can be used, for example, to control the sample gas pump, allowing the gas flow to be enabled only once the permissible cooling range has been reached, or to switch off the pump in the event of a humidity sensor alarm.

The separated condensate can be discharged via connected condensate pumps or attached automatic condensate drains.

Furthermore, fine filters can be used, into which humidity sensors can optionally be integrated.

The glass dome allows the dirt level of the filter element to easily be determined.

The humidity sensor can be easily removed. This may be necessary if, due to a fault, a breakthrough of condensate into the cooler occurs which can no longer be removed by the condensate pump or automatic condensate drain.

5.3 Use of menu functions

Brief description of the operating principle:

The unit is operated using 5 keys. Their functions are:

Button	Section	Functions
← or OK	Display	– Switches from the measurement display to the main menu
	Menu	– Selects the menu item displayed
	Enter	– Applies an edited value or a selection
▲	Display	– temporarily switches to the alternative measurement display (if option installed)
	Menu	– Back
	Enter	– Increase value or browse selection – Note: – Press button 1 x = changes parameter / value by one; – Hold button = fast mode (numerical values only) – Display flashes: modified parameter/value – Steady display: original display/value
▼	Display	– temporarily switches to the alternative measurement display (if option installed)
	Menu	– Next
	Enter	– Reduce value or browse selection
ESC	Menu	– Move one level up
	Enter	– Return to menu Changes will not be saved!
F or Func		– Sets a menu to favourite. (Note: The favourite menu will also be activated with the menu locked!)

5.3.1 Lock Menu

Some menus can be locked to prevent inadvertently changing the settings of the unit. This requires setting a code. For information on setting up or disabling the menu lock please refer to "Global Settings" (*t_{OP}*) under menu item *t_{OP}* > *L_{oc}*.

The menu lock is **not** enabled at the time of delivery, all menu items can be accessed.

With the menu locked, only the following menu items will be visible without entering the correct code:

Menu item	Explanation
<i>t_{OP}</i> > <i>uni</i> <	Temperature unit selection (°C or °F).
F or Func.	Accessing the Favourites menu
	NOTICE! This menu may be one that is normally locked.

5.3.2 Menu navigation overview

When pressing the **OK** button in normal mode, the display will show the prompt *codE* if the menu is locked. Use the ▲ and ▼ buttons to enter the correct code and press **OK**.

If an incorrect code or no code is entered, the menu will not be unlocked and you will not be able to access all menu items.

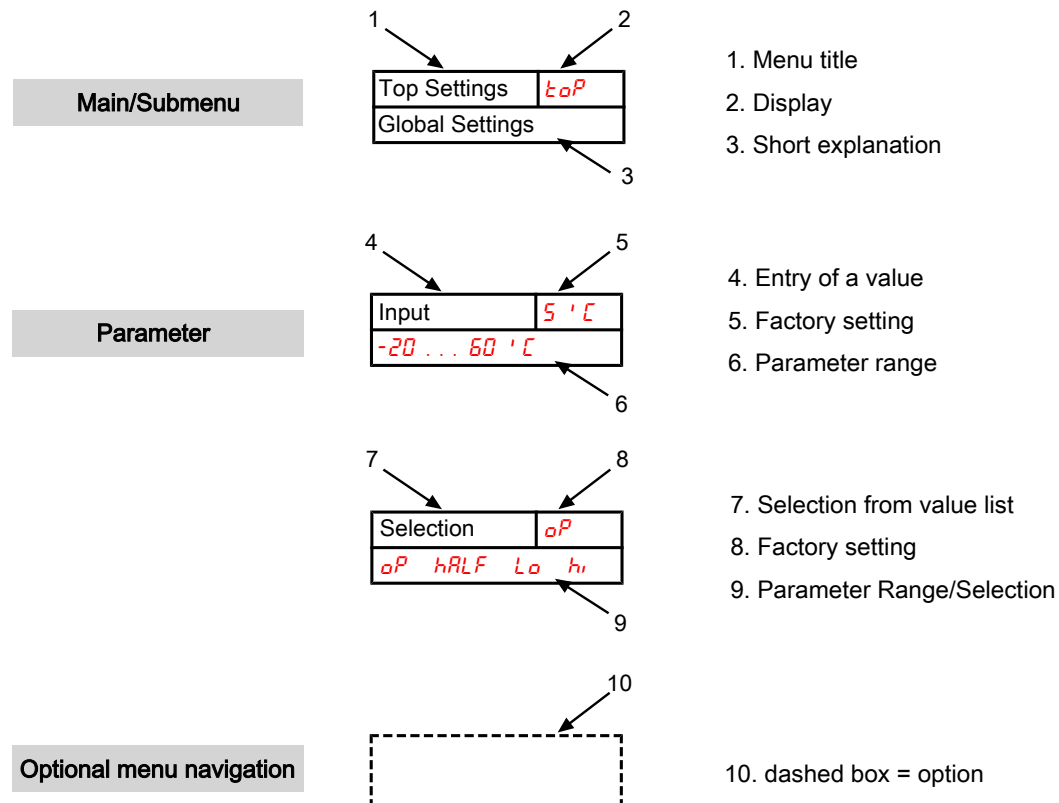
If you forgot the password you can always enter master code 287 to access the menu; the menu will be unlocked.

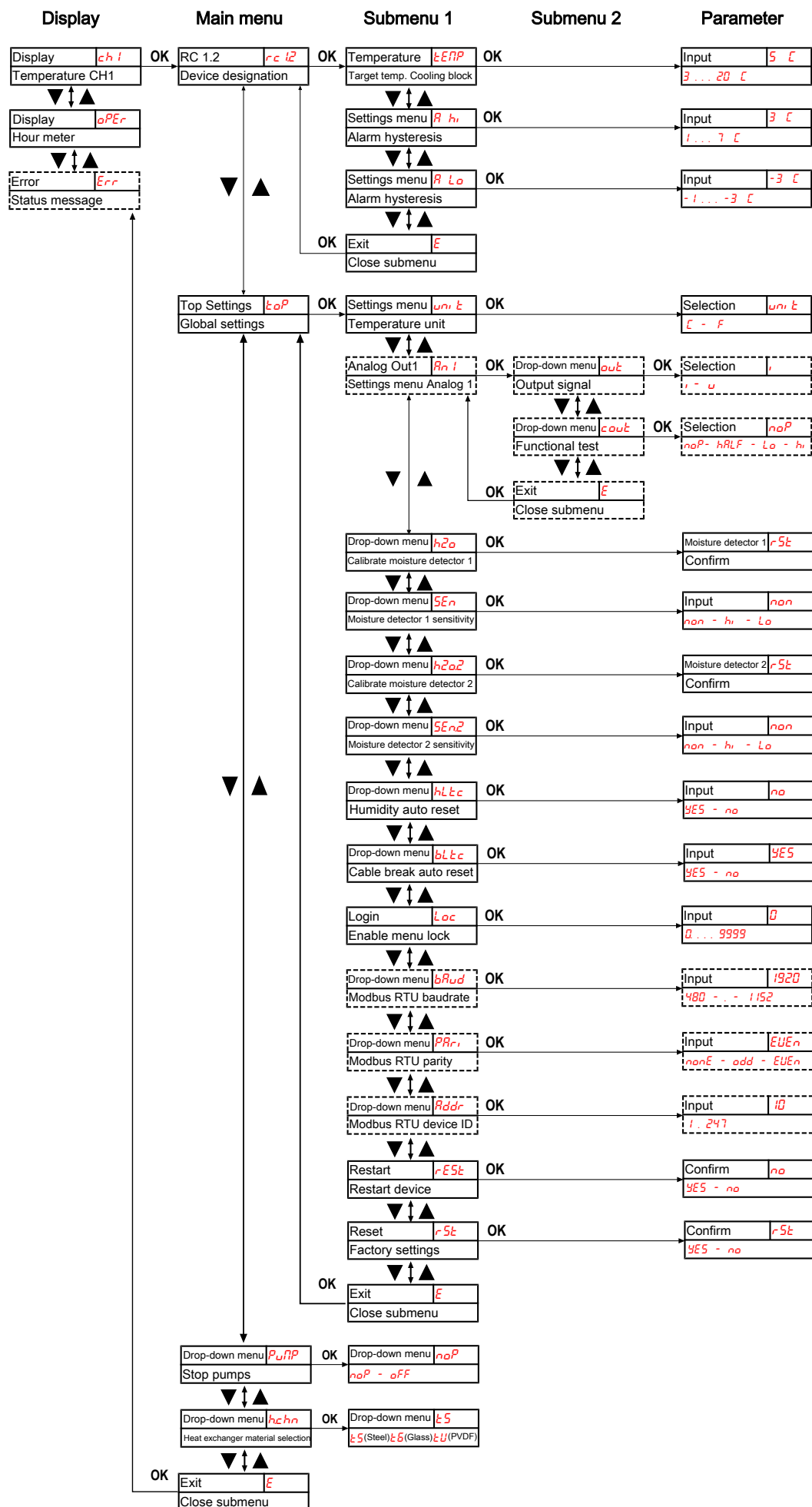
The following image shows an overview of the menu structure.

Items with a dashed frame will only appear with the respective settings or with the respective status messages.

The factory settings and ranges are specified in the overview as well as under the respective menu item. The factory settings apply unless otherwise agreed.

You can cancel entries and menu selections without saving by pressing the **ESC** key.



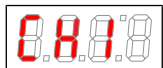


5.4 Description of menu functions

5.4.1 Display Menu

Block temperature display

Display → *ch i*



Depending on the device state, the temperature will be displayed as a constant, flashing, or alternating with a status message.

Operating hours /runtime display

Display → *oPEr*

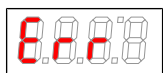


Displays the operating hours of the unit. The runtime cannot be reset and can be output in various display formats. To view/exit the runtime, press the „Enter“ key.

- *yyMm* – display in years and months (default)
- *Mm* – display in months
- *WEEh* – display in weeks
- *dAYS* – display in days
- One month corresponds to 30 days. Press the „F“ key to switch between the display formats. The display will then first show the selected format as short text, then the duration.

Error code display

Display → *Err*



In the event of errors/malfunctions not related to operation, the error code indicates possible causes and solutions.

5.4.2 Main menu

RC 1.2 Rack Cooler

Display → *rc i2*



From here, you can access the setpoint adjustment for the cooling block temperature and the tolerance range (alarm threshold).

Global setting

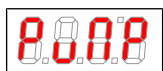
Display → *LoP* (ToP Settings)



This menu is used to configure the global cooler settings.

Peristaltic Pump

Display → *PuMP*



Switching the peristaltic pump on and off.

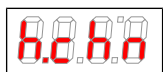
Parameter range: *noP*, *oFF*

Factory setting: *noP*

Note: Status switches, "*PuMP*" flashes.

Heat exchanger material selection

Display → *hchh*



Heat exchanger material selection

Parameter range: *h5* (Steel), *h6* (Glass), *hU* (PVDF)

Factory setting: *h5* (cooler without heat exchanger), or respective material per configuration

Exit main menu

Display → *E*



Selecting this will return you to display mode.

5.4.3 Submenu 1

Setpoint temperature

Display → Cooler → *hEMP*



This setting defines the target cooling block temperature.

Parameter range: 3 °C to 20 °C (37.4 °F to 68 °F)

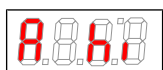
Factory setting: 5 °C (41 °F)

Note: If the temperature is changed, the indicator may blink until the new operating range has been reached.

This menu item is not visible when the key lock is active.

Upper alarm limit

Display → Cooler → *A hi* (Alarm high)



Here you can set the upper threshold for the optical alarm as well as for the status relay. The alarm limit is set relative to the selected cooling block temperature.

Parameter range: 1 °C to 7 °C (1.8 °F to 12.6 °F)

Factory setting: 3 °C (5.4 °F)

Note: This menu item is not visible when the key lock is active.

Lower alarm limit

Display → Cooler → *A Lo* (Alarm low)



Here you can set the lower threshold for the optical alarm as well as for the status relay. The alarm limit is set relative to the selected cooling block temperature.

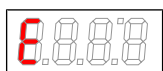
Parameter range: -1 °C to -3 °C (-1.8 °F to -5.4 °F)

Factory setting: -3 °C (-5.4 °F)

Note: This menu item is not visible when the key lock is active.

Exit submenu 1

Display → Submenu → *E*

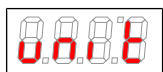


Selecting this will return you to the main menu.

5.4.4 Submenu 1 (global settings)

Temperature unit

Display → *LoP* → *uni t*



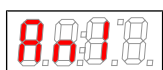
Used to select the temperature display unit.

Parameter range: *C*, *F*

Factory setting: *C*

Analog output

Display → *LoP* → *An l*

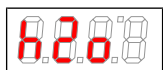


This submenu is used to specify the settings for analog output 1, see chapter Submenu 2 (Analog Output 1)

Note: This menu will be hidden if the menu is locked.

Calibrate moisture detector

Display → *LoP* → *h2o*



If a moisture detector is installed, calibration can now be performed. To do so, the unit must be flushed with dry gas.

Note: Calibration was performed at the factory using ambient air. After replacing the moisture detector a calibration is again required.

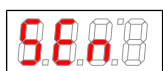
Calibrating the moisture detector will set the menu *SEn* to *h1*.

This menu will be hidden if the menu is locked.

If the unit has multiple moisture detectors built in, they will be numbered in the menu. In this case, *h2o* indicates the first, *h2o2* the second moisture detector. The same applies to setting the sensor sensitivity in menu *SEn*.

Moisture detector sensitivity

Display → *LoP* → *SEn*



If moisture detectors are installed, the sensitivity can be reduced here.

Parameter range: *h1* : high sensitivity
Lo: low sensitivity
non: no moisture detector

Factory setting: *h1*

Note: This menu will be hidden if the menu is locked.

Moisture detector: manual or automatic reset following moisture ingress

Display → *LoP* → *hLtc*

(*hLtc* = humidity latch). The setting applies to all connected moisture detectors.



Specifies whether the moisture ingress message must be reset manually or will automatically be reset after the sensor dries.

Parameter range: *YES*: The status will be indicated until the user restarts the device and the pumps will be disabled.
no: The status message will automatically be cleared/the pumps will be released again once moisture is no longer detected.

Factory setting: *no*

Note: This menu will be hidden if the menu is locked.

Moisture detector: error cleared automatically after cable break

Display → *LoP* → *bLk*

(*bLk* = broken wire latch). The setting applies to all connected moisture detectors.



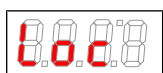
Determines whether the cable break alarm must be reset manually or will automatically clear on valid measuring signal.

Parameter range:	<i>YES</i> : The status will be indicated until the user restarts the device. Clears the error, and the pumps will be deactivated. <i>no</i> : The error message will disappear. The pumps will be switched on again once the moisture detector is reactivated again.
Factory setting:	<i>YES</i>
Note:	This menu will be hidden if the menu is locked.

Lock Menu

To protect the menu from unauthorised use, enter a value for the lock code. Menu items can then only be accessed after entering the correct code.

Display → *LoP* → *Loc*



This setting will cancel/enable the menu lock.

Parameter range:	0 to 9999
Factory setting:	0 (keylock cancelled)
Note:	This menu will be hidden if the menu is locked.

Modbus RTU baudrate

The default transfer rate is 19200 bps. This can be configured for the specific application within a defined range. The options are in the display are listed in kbps (19.2 corresponds to 19200 bps). The properties of the digital interface are not affected when re-setting the device to its factory settings!

This menu item is only available on devices with "Digital output Modbus RTU" option.

Display → *LoP* → *bAud*



Determines the transfer rate for the digital interface.

Parameter range:	<i>480</i> <i>960</i> <i>1920</i> <i>3840</i> <i>5760</i> <i>1152</i>
Factory setting:	<i>1920</i>
Note:	This menu will be hidden if the menu is locked.

Modbus RTU parity

The default parity is even/odd, options are odd parity, no parity. The number of stop bits is automatically set based on the respective setting. No parity uses two stop bits, otherwise it is one. The properties of the digital interface are not affected when resetting the device to its factory settings!

This menu item is only available on devices with "Digital output Modbus RTU" option.

Display → *LoP* → *PRr*



This setting restores the factory settings.

Parameter range: *nonE*
odd
EuEn

Factory setting: *EuEn*

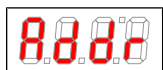
Note: This menu will be hidden if the menu is locked.

Modbus RTU device ID

Selecting the device ID for communication via digital interface. The ID can be any within a defined range, the default is 10. The properties of the digital interface are not affected when resetting the device to its factory settings!

This menu item is only available on devices with "Digital output Modbus RTU" option.

Display → *LoP* → *Addr*



Defines the ID.

Parameter range: *1 247*

Factory setting: *10*

Note: This menu will be hidden if the menu is locked.

Restart

Display → *LoP* → *rESt*

(*rESt* = restart)



The device will restart, all settings are saved. All error messages will be reset.
The moisture detector will be reset, irrespective of the settings in menus *hi Ec* and *hiLo*.

Parameter range: *YES*: Restart. The display will show the software version for the device and returns to measurement display.
no: Exit menu without restarting.

Note: The user settings will be saved.

Factory settings

Display → *LoP* → *rSt*



This setting restores the factory settings.

Parameter range: *YES*: factory settings restored.
no: Exit menu without making changes.

Factory setting: *no*

Note: This menu will be hidden if the menu is locked.

Exit submenu 1Display → Submenu → **E**

Selecting this will return you to the main menu.

5.4.4.1 Submenu 2 (Analog Output 1)

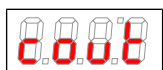
The cooling block temperature of the cooler is output at the analogue output. For devices with the “Digital Output Modbus RTU” option, the menu items for the analogue output are not available.

Signal behaviour

In normal operation (**noP**), the cooling block temperature is output at the measuring point. For test purposes, the constant values **hi**, **Lo** or **hRLF** can be generated. A constant signal is present at the analogue output, the value of which is specified in the table.

Constant	Current output 4 – 20 mA	Voltage output 2 – 10 V
hi	20 mA	10 V
fi	12 mA	6 V
Lo	4 mA	2 V
noP	4 – 20 mA	2 – 10 V

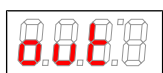
After testing, the signal behaviour must be changed back to normal mode (**noP**).

Display → **LoP** → **An I** → **out**

This setting determines how the analogue output will behave.

Parameter range: **noP** = Operation (normal mode), **hi**, **Lo**, **hRLF**Factory setting: **noP**

Note: This menu will be hidden if the menu is locked.

Selection -> Output SignalDisplay → **LoP** → **An I** → **out**

Select the type of output signal.

Parameter range: **0** Status output 4... 20 mA**1** Status output 2...10 VFactory setting: **0**

Note: Disconnect meter before switching!
This menu item is hidden if the keylock is enabled.

Exit Submenu 2Display → **LoP** → **An I** → **E**

Selecting this will return you to submenu 1.

5.4.5 Set favourite menu

Use the **F** or **Func** (function) key to set a favourite menu to later open it with just the push of a button.

- Open the menu you wish to set as the favourite. This menu can also be a lockable menu.
- Press the function key for more than 3 sec.
The current menu has been set as the favourite. The display will briefly show the message *Func*.
- Press **ESC** or **E** (Exit) to return to the display.

To now access the favourite menu, press the **F** or **Func** key.

NOTICE! The favourite menu can also be accessed if the menu is locked.

5.5 Using the Digital Interface

The digital interface on this device is a Modbus RTU protocol, which physically communicates via RS485 (2-wire). The cooler therefore takes on the role of the slave in communication.

The Modbus interface enables direct access to process and diagnostic data and parameters during operation.

5.6 Modbus Configuration

The settings listed below correspond to the default settings; with the interface active, the parameters can be adjusted.

Structure of a character:

1 start bit

8 data bits

1 parity bits (configurable)

1 stop bit (*)

Baudrate: 19200 bps (configurable)

Device ID: 10 (configurable)

(*) The length of a character is always 11 bits. If the interface is configured with 0 parity bits, the number of stop bits automatically changes to 2.

5.7 Modbus Communication

Communication via Modbus RTU is always initiated by the master (request). The slave (typically) responds to the request with a response. A Modbus RTU frame for a request/response always has the following structure:

Address field (A)	Function code (FC)	Data	CRC
1 byte	1 byte	1 ... 252 bytes	2 bytes

Register addresses and data are transferred in Big Endian format.

Every register stands for a 16 bit value, with the information represented in various data types. The data type and required function code are assigned to the respective registers in the following tables.

To read/write data types with sizes larger than an individual register, multiple registers must be addressed.

Supported function codes:

Function code (FC)	FC values
Read Holding Registers	3
Write Multiple Registers	16

Data types:

Description	Number of bytes	Number of registers
Float	4	2
Int16	2	1
UInt16	2	1
Int32	4	2
UInt32	4	2

5.8 Modbus Register

Description	FC	Address	Access	Data type	Default	Min	Max	Selection	Resolution	Unit
Cooling block temperature measurement	3	2000	R	Float	-	-	-	-	0.5	°C
Cooling block temperature status	3	2002	R	Uint32	-	-	-	Bit 0 := Error Bit 1..15 := Reserved Bit 16:= Sensor not calibrated Bit 17:= Initialization/measurement invalid Bit 18 := Stabilisation phase Bit 19:= Load limit reached Bit 20:= Measurement outside target range Bit 21..31 := Not used	-	-
Cooling block temperature setpoint	3, 16	5000	R/W	Float	5.0	3.0	20.0	-	0.5	°C
Positive alarm tolerance setpoint	3, 16	5002	R/W	Float	3.0	1.0	7.0	-	1.0	K
Negative alarm tolerance setpoint	3, 16	5004	R/W	Float	-3.0	-3.0	-1.0	-	1.0	K
Moisture detector signal store error	3, 16	9002	R/W	Uint16	2	-	-	1 := No 2 := Yes	-	-
Moisture alarm signal store	3, 16	9003	R/W	Uint16	1	-	-	1 := No 2 := Yes	-	-
Sensitivity moisture detector 1	3, 16	9004	R/W	Uint16	1 (with FF) 2 (without FF)	-	-	0 := Sensitivity low 1 := Sensitivity high 2 := Moisture detector inactive	-	-
Sensitivity moisture detector 2	3, 16	9005	R/W	Uint16	1 (with FF) 2 (without FF)	-	-	0 := Sensitivity low 1 := Sensitivity high 2 := Moisture detector inactive	-	-
Display unit selection	3, 16	9006	R/W	Uint16	1	-	-	1 := °C 2 := °F	-	-
Heat exchanger type selection	3, 16	9007	R/W	Uint16	2	-	-	2 := Steel 3 := Glass 4 := PVDF	-	-
De-/activate condensate pump(s)	3, 16	9008	R/W	Uint16	3	-	-	3:= Pump active 4:= Pump inactive	-	-
Modbus Baudrate selection	3, 16	9009	R/W	Uint16	3	-	-	1 := 4800 2 := 9600 3 := 19200	-	-

Description	FC	Address	Access	Data type	Default	Min	Max	Selection	Resolution	Unit
								4 := 38400 5 := 57600 6 := 115200		
Modbus Parity selection	3, 16	9010	R/W	Uint16	2	-	-	0 := None 1 := Odd 2 := Even	-	-
Modbus Device address selection	3, 16	9011	R/W	Uint16	10	1	247	-	1	-
Lock menu	3, 16	9012	R/W	Uint16	0	0	9999	-	1	-
TEST	3	9990	R	Uint32	12648430	-	-	-	1	-
TEST_UINT16	3, 16	9992	R/W	Uint16	206	0	65535	-	1	-
TEST_INT16	3, 16	9993	R/W	Int16	-206	-32768	32767	-	1	-
TEST_UINT32	3, 16	9994	R/W	Uint32	2766	0	4294967295	-	1	-
TEST_INT32	3, 16	9996	R/W	Int32	-2766	0x80000000	0x7fffffff	-	1	-
TEST_Float	3, 16	9998	R/W	Float	-10.5			-	-	-
Status register overview	3	10000	R	Uint16	0			Bit 0 := Status information register 10001 Bit n := Status information register 10000 + n + 1	-	-
Condition code register 1	3	10001	R	Uint16	0	-	-	Bit 0 := Device status Bit 1 := Device in error status Bit 2 := Target temperature range overrun Bit 3 := Target temperature range underrun Bit 4 := Bit 5 := Bit 6 := Moisture detector 1 connected Bit 7 := Moisture detector 2 connected	-	-
Condition code register 2	3	10002	R	Uint16	0	-	-	Bit 0 := Bit 1 := Bit 2 := Initialization phase Bit 3 := Bit 4 := Bit 5 := Bit 6 := FF1 moisture alarm Bit 7 := FF2 moisture alarm	-	-
Condition code register 3	3	10003	R	Uint16	0	-	-	Bit 0 := Peristaltic pumps deactivated Bit 1 := Bit 2 := Bit 3 := Bit 4 :=	-	-

Description	FC	Address	Access	Data type	Default	Min	Max	Selection	Resolution	Unit
								Bit 5 := Bit 6 := Gas pump controller deactivated Bit 7 :=		
Condition code register 4	3	10004	R	Uint16	0	-	-		-	-
Error register 1	3	10005	R	Uint16	0	-	-	Bit 0 := Display communication error Bit 1 := Controller communication error Bit 2 := Bit 3 := Controller configuration error Bit 4 := EEPROM regulator error Bit 5 := Bit 6 := Bit 7 := Gen. software error	-	-
Error register 2	3	10006	R	Uint16	0	-	-		-	-
Error register 3 - moisture detector 1	3	10007	R	Uint16	0	-	-	Bit 0 := Bit 1 := Bit 2 := Cable break Bit 3 := Bit 4 := Bit 5 := Bit 6 := Bit 7 :=	-	-
Error register 4 – moisture detector 2	3	10008		Uint16	0	-	-	Bit 0 := Bit 1 := Bit 2 := Cable break Bit 3 := Bit 4 := Bit 5 := Bit 6 := Bit 7 :=	-	-
Error register 5 - PT100.1	3	10009	R	Uint16	0	-	-	Bit 0 := General error Bit 1 := Short-circuit/temperature low Bit 2 := Cable break/temperature high Bit 3 := Measurement fluctuation Bit 4 := Bit 5 := Bit 6 := Bit 7 :=	-	-
Error register 6	3	10010	R	Uint16	0	-	-		-	-
Error register 7	3	10011	R	Uint16	0	-	-	-	-	-
Error register 8	3	10012	R	Uint16	0	-	-	-	-	-

Description	FC	Address	Access	Data type	Default	Min	Max	Selection	Resolution	Unit
Error register 9	3	10013	R	Uint16	0	-	-	-	-	-
Error register 10	3	10014	R	Uint16	0	-	-	-	-	-
Utilisation controller 1	3	10017	R	Unit16	-	0	100	-	10	%
Device run time	3	10100	R	Float	-	0	-	-	6 min	h
Restart/ reset device	16	11000	W	Unit16	0x00	-	-	86 := Restart device 17:= Factory reset	-	-
Reset moisture detector 1	16	11002	W	Uint16	0xAA	-	-	-	-	-
Reset moisture detector 2	16	11003	W	Uint16	0xAA	-	-	-	-	-

Example:

Register 5000 = 0x1388

Read block temperature set values

	A	FC	Start register HI	Start register LO	No. register HI	No. register LO		CRC	CRC
Request	0x0A (10)	0x03 (3)	0x13	0x88	0x00 (0)	0x02 (2)		0x41	0xDE
	A	FC	No. of byte	DATA 3	DATA 2	DATA 1	Data 0	CRC	CRC
Response	0x0A (10)	0x03 (3)	0x04	0x40	0xA0	0x00	0x00	0x55	0x11