Embracing Challenge

EC®

Ultra Low Gas Cooler

EC30C

Instruction Manual

Version 1.00.07

Software Version 1.0x

Embracing Challenge

Quick support

If you have any questions about this product regarding commissioning, handling or technical service - feel free to contact us. We will support you directly, quickly and of course free of charge with our experience and product knowledge.

Please contact our service center in Ratingen, Germany,

for US Service Ventura, California

Please help us by providing this information about the device, if possible:

- Product model
- Product serial number
- M&C order or invoice number

- Germany service center:
  +49 2102 935 - 888
  service@mc-techgroup.com
- US service:
  +1 805-654-6970
  info-usa@mc-techgroup.com

In addition, we are continuously working on providing further assistance for many of our products online on our webpage:

- www.mc-techgroup.com

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1 About this instruction manual

Welcome to the M&C product manual. The goal of this document is to give a broad overview of the main functions of the EC30C. It will help you to get started with using the EC30C.

If you have any questions about this instruction manual, please contact M&C or one of our official distributors.

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This instruction manual does not claim to be complete and it may be subject to technical modifications. We appreciate any feedback you may have to this document .

With the release of this version all older manual versions will no longer be valid.

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2 Important safety information

Please read this important safety information carefully before installing the EC30C. Follow these safety precautions during commissioning, start-up and regular operation.

2.1 Intended use

This product is designed to be used as an ultra-low cooler to reduce the dew-point of humid sample gas to provide a stable and very low dew point.

Do not use this product for any other purpose. Improper use and handling can create hazards and cause damage. For more information, please refer to the safety information in this instruction manual.

2.2 Personal safety

Please read this instruction manual carefully before commissioning and operating the device. If you have any questions regarding the product or the application, please don't hesitate to contact M&C or an M&C authorized distributor.

Please follow all instructions and warnings closely.

The product described in this instruction manual has been built and tested in our production facility. All ultra-low cooler are packed to be shipped safely. To ensure the safe operation and to maintain the safe condition, all instructions and regulations stated in this manual need to be followed.

This instruction manual includes all information regarding proper transportation, storage, installation, operation and maintenance of this product by qualified personnel.

2.3 Warning signs and definitions

DANGER DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

ATTENTION ATTENTION is used to address practices not related to physical injury.

 **High Voltage!**	Caution, risk of electric shock!
 **High Pressure!**	Caution, system might be under pressure.
 **Hot Surface!**	Caution, hot surface! Do not touch!
 **Hazardous Gas!**	Caution, hazardous and toxic gas! Do not inhale!
 **Qualified personnel**	'Qualified personnel' are experts who are familiar with the installation, mounting, commissioning and operation of these types of products.
 **Safety Gloves!**	Put on safety gloves for your protection.
 **Pull Main Plug!**	Unplug power supply before opening!
 **Note**	'Note' indicates important information relating to the product or highlights parts of the documentation for special attention.
 **Do you need help?**	Please contact M&C!

2.4 Safety instructions

Please follow these safety directions and instructions regarding installation, commissioning and operation of the EC30C.

 **Qualified personnel**	Installation, commissioning, maintenance, inspections and any repairs of all M&C products and components must be carried out by qualified personnel in compliance with the current regulations.

Install the device only in protected areas, sheltered from sun, rain and moisture.

Operate the device only in the permitted temperature and pressure ranges. See details on page 14 chapter '5 Technical Data' .

Don't repair or maintain this product without M&C's specific maintenance- and service instructions.

When replacing parts, use only original M&C spare parts.

Pull Main Plug!	If there is any indication that safe operation of the EC30C is no longer possible, turn off the power and disconnect the device from the power supply immediately.

Then protect the defective device against accidental switch-on and mark it clearly as defective.

2.5 Working on electrical and electronic devices

Only qualified and authorized personnel are permitted to work on equipment which operates on 115 or 230 VAC supply voltage. Please be sure to observe the generally accepted engineering standards and all of your national and local regulations.

Note	Before connecting the device, please make sure that the supply voltage matches the specified voltage on the product label.

High Voltage!	Protect yourself and others against damages which might be caused by high voltages. Disconnect the power supply before opening the device for access. Make sure that all external power supplies are disconnected.

Please make sure to take appropriate precautions even by working on unplugged or low-voltage devices. Unplugged devices need to be properly grounded to prevent damage to internal electronics from electrostatic discharges (ESD).

2.6 Not certified in hazardous areas

This device is NOT certified to be installed or operated in hazardous areas.

WARNING	Explosion hazard! For general purpose areas ONLY. Don't use the EC30C in hazardous areas.

3 Introduction

Congratulations on your purchase of the EC30C ultra-low cooler. We know from experience that you surely will enjoy this reliable and durable M&C product.

M&C is one of the premium and performance-driven companies in the business. With this in mind, our customers benefit from a number of significant advantages. We offer proven, durable and advanced products and solutions. We have listened to our customers needs, when designing our products, allowing M&C to provide premium products at a comparatively lower cost over the entire life cycle.

Our products and special systems are designed and tested in our own facilities by our highly skilled staff that are always quality-oriented. We carefully package our goods and send them to our customers worldwide.

With our 30-years of experience in customer specific solutions for almost 30 different industries and applications, it is our goal to supply you with an excellent product. Our products offer fast commissioning, safe and reliable day-to-day operation and low maintenance.

We expect that our products fully meet your expectations. If you have any question regarding the product or the application, please don't hesitate to contact M&C or your M&C authorized distributor. Our service does not end with delivery of the products.

Thanks again for your purchase.

We appreciate your business.

4 Product overview

4.1 Application

The M&C ultra-low cooler EC30C is used in the gas analysis technique to reduce the dew point of humid sample gases and to provide a stable and very low dew point. This eliminates condensate built-up and aerosol formation in the analyzer.

Due to the extremely stable and low gas dew point, there are no water vapor cross-sensitivity and volumetric errors.

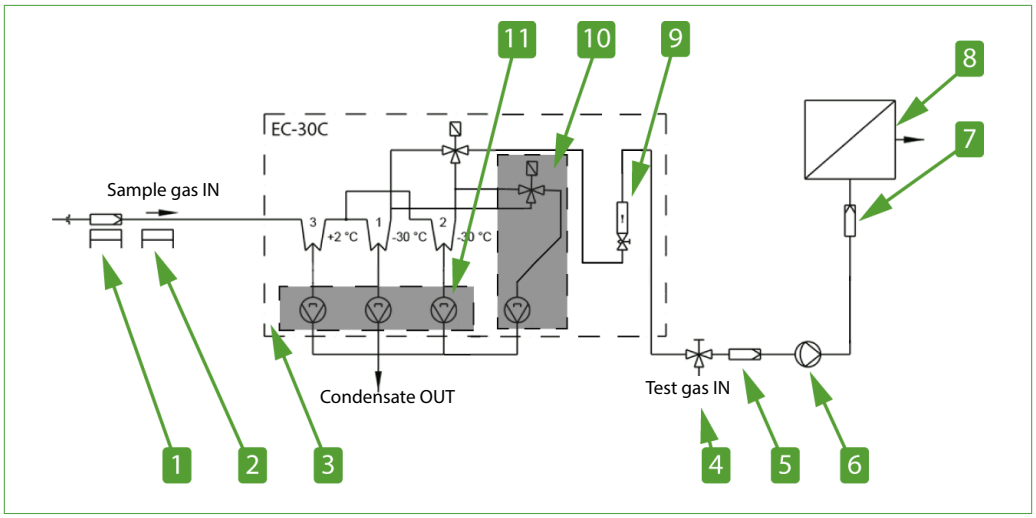


Fig. 1: Application example of the EC30C

1 *Gas sample probe SP2000-H*
2 *Electrically heated sample line 4M4/6*
3 *Ultra-low cooler EC30C*
4 *3-way ball valve 3L/PV-1*
5 *Filter*
6 *Bellows pump MP-F*
7 *Aerosol filter CLF -5/W optional depending on application*
8 *Analyzer, e.g. PMA1000*
9 *Flow meter FM40, 25-250 Nl/h*
10 *Option: 4.peristaltic pump with solenoid valve (heat exchanger purging)*
11 *Option: three SR25.2 peristaltic pumps (condensate removal)*

4.2 Principle

The M&C gas cooler EC30C is a two stage combination of compressor and Peltier cooler. The automatic defrost function of the dual deep freezer unit ensures 100 % availability during operation.

The micro processor-controlled electronics of the EC30C in combination with the graphical display, offers a high degree of functionality, convenience in use, and safe operation.

The EC30C is built for 24/7 hours of operating time. The cooling capacity of 130 kJ/h is constant, even under maximum allowed ambient temperature.

A capacity reserve compensates parts of the natural aging process and maximizes the service life of the EC30C.

The pre-cooler unit is equipped with a Jet-Stream heat exchanger. The heat exchanger is cooled down to the constant temperature of +2 °C [35.6 °F] by a separate, microprocessor controlled, compressor cooling unit.

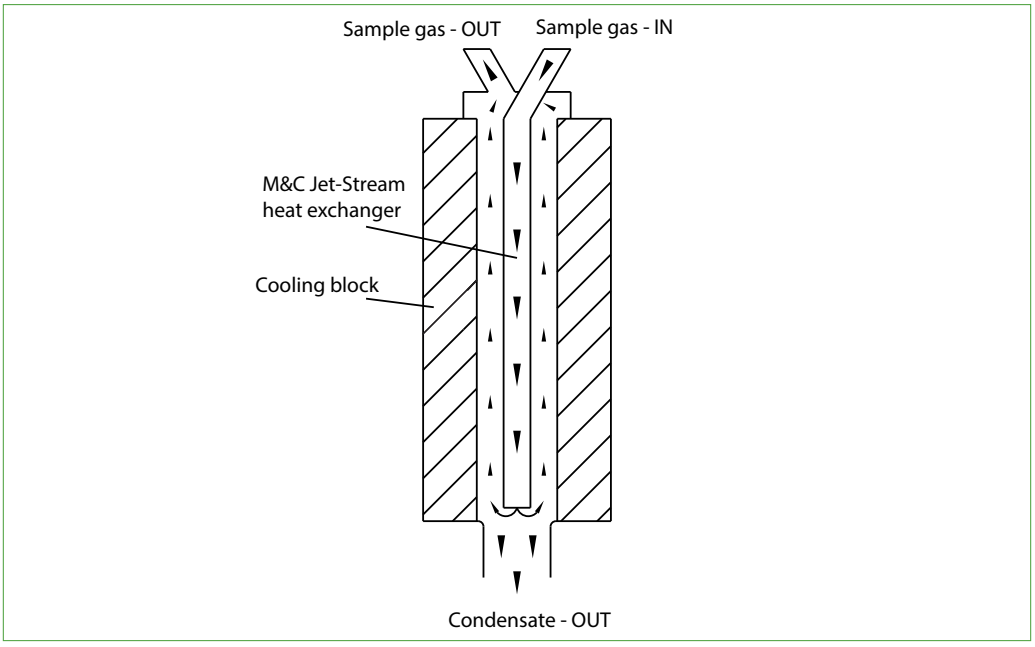


Fig. 2: Jet-Stream heat exchanger

The Jet-Stream heat exchanger in the pre-cooler unit removes a large amount of condensate, this ensures a safe and reliable pre-drying of the sample gas. An additional external vessel to separate the condensate is under normal conditions not necessary. The cooling unit of the pre-cooler dissipates the heat of the Peltier elements.

The dual deep freezer unit is equipped with two modified Jet-Stream heat exchangers. Two separate pairs of Peltier elements are cooling the heat exchangers down to a constant temperature between -20 °C [-4 °F] and -30 °C [-22 °F]. The factory setting is -30°C [-22 °F].

The EC30C switches automatically every 3 hours between the two deep freezer units. The

deep freezer which is currently not in use, will be defrosted to prevent freezing of the heat exchanger and clogging of the gas lines. Upon special request, this cycle of 3 hours can be reduced directly at your facility by M&C personnel.

The new graphical user interface is icon-based for easy and intuitive navigation. The messages are displayed in form of easy-to-understand icons. Features like time stamps for the alarm message history, periodically self-monitoring and pre-warning messages to inform about upcoming maintenance work ensure a maximum degree of comfort, ease-of-use and safety of operation of the EC30C.

The smart periodically self-monitoring of the EC30C, helps to plan upcoming maintenance and service work to prevent unnecessary down time.

A configurable mA-output is part of the EC30C standard version.

Three optional peristaltic pumps SR-25.2 for automatic condensate removal can be installed into the unit.

An internal flow meter including an optical flow sensor can be installed into the unit as an option. Another option would be an external flow meter including an optical flow sensor or an external humidity sensor.

A fourth optional peristaltic pump can be installed in combination with a second solenoid valve to provide permanently fresh test gas to the inactive cooling unit. This makes sure that even in systems, where water vapor cross sensitivity exists, there are no visible peaks at switching of the dual deep freezer unit. This also prevents short peaks in the sample gas concentration due to stagnant gas.

5 Technical Data

Series EC©	Version EC30C	
Part No.:	**02K6100**	**02K6100a**
Gas connection	Tube connector DN 4/6	
Condensate connections	3 x tube connector GL 25-12 mm	
Material of sample contacting parts	Duran® Glass, PTFE, PVDF	
Single stream, gas flow rate	90 Nl/h to 250 Nl/h	
Gas pressure	Max. 3 bar abs.	
Ambient temperature	+5 to +45 °C [+41 to +113 °F]	
Storage temperature	-20 to +60 °C [-4 to +140 °F]	
Sample outlet dew point	-20 to -30 °C [-4 to -22 °F] (default -30 °C [-22 °F])	
Sample inlet temperature	Max. 180 °C [+356 °F]	
Water vapor dew point input	Max. 70 °C [+158 °F]	
Cooling capacity	Max. 130 kJ/h* (at given input conditions)	
Main power connection/ Power consumption	230 V, 50 Hz/380 VA	115 V, 60 Hz/380 VA
Start up time	< 60 min	
Dead space	Approx. 160 ml [≈ 5.4 fl. oz]	
ΔP at 250 Nl/h flow rate	5 mbar	
Electrical connection	2.5 mm^2 terminals, cable glands 1 x M12, 2 x M16, 2 x M20	
mA-output	0 - 20/4 - 20 mA, max. 500 Ohm load (including cable resistance),	
Relay output alarm	1 changeover contact: 230 V AC 3 A, 24 V DC 3 A Alarm: COM & NC closed No alarm: COM & NO closed	
Relay output warning	1 NO contact, 24 V (AC/DC), 0.5 A Warning: open	
Relay output freezer units I and II	1 NO contact, 24 V (AC/DC), 0.5 A Unit I on: closed Unit II on: open	
Case protection	IP20, EN 60529	
Electrical equipment standard	EN 61010	
Method of mounting	19" rack or wall mount	
Case color	RAL 9003	
Dimension (W x H x D)	19“ or wall-mount device with monting brackets: 482 x 342 x 376 mm [≈ 19“ x 13.5“ x 14.8“] Device with equipment feet: 440 x 363 x 371 mm [≈ 17.3“ x 14.3“ x 14.6“]	
Weight	Approx. 39.4 kg [≈ 86.9 lbs]	

** For the given input conditions, please have a look at the table on page 15 chapter ‘5.1 Max. possible water vapor dew point input [°C] / [°F]’ .*

Duran® is a brand name for borosilicate glass produced by the German company Duran Group GmbH.

Please note: Nl/h and Nl/min refer to the German standard DIN 1343 and are based on these standard conditions: 0 °C [32 °F], 1013 mbar.

Part-No.	Options
01P9145	Peristaltic pump SR25.2, front panel mounting (three peristaltic pumps are required for the EC30C), See spare parts for SR25.2 on page 70 chapter '12.3 Spare parts and consumables'
03F3000	Aerosol-Filter CLF-5: External mounting in the outlet of an ultra low gas cooler EC30C when sample tends to form aerosols. Technical data see data sheet for Fluid particle filter CLF-5
02K9700	Heat-exchanger purging: 4. peristaltic pump with solenoid valve for EC30C with 230 V 50 Hz
02K9700a	Heat-exchanger purging: 4. peristaltic pump with solenoid valve for EC30C with 115 V 60 Hz
03E1001	LA 1S humidity sensor, 4 m [≈ 13.1 ft] cable with cable breakage detection
03E3500	FA 20 (Flow sensor with 0.45 m [1.48 ft] cable)
02K9710	FM 40 (Flow meter, 25-250 Nl/h)

5.1 Max. possible water vapor dew point input [°C] / [°F]

This table shows the max. possible water vapor dew point input (°C)/[°F] depending on the incoming gas temperature and the flow rate.

These values correspond to the maximum cooling capacity of 130 kJ/h. The maximum possible water vapor dew point input (°C)/[°F] indicated must not be exceeded.

	Incoming gas temperature in °C [°F]				
Gas flow [l/h]	**70 [158 °F]**	**90 [194 °F]**	**120 [248 °F]**	**150 [302 °F]**	**180 [356 °F]**
90	70 [158 °F]	70 [158 °F]	69 [156.2 °F]	68 [154.4 °F]	67 [152.6 °F]
110	68 [154.4 °F]	67 [152.6 °F]	66 [150.8 °F]	65 [149 °F]	63 [145.4 °F]
130	65 [149 °F]	64 [147.2 °F]	63 [145.4 °F]	61 [141.8 °F]	59 [138.2 °F]
150	62 [143.6 °F]	61 [141.8 °F]	59 [138.2 °F]	58 [136.4 °F]	56 [132.8 °F]
170	59 [138.2 °F]	58 [136.4 °F]	56 [132.8 °F]	55 [131 °F]	53 [127.4 °F]
190	57 [134.6 °F]	56 [132.8 °F]	54 [129.2 °F]	52 [125.6 °F]	50 [122 °F]
210	55 [131 °F]	54 [129.2 °F]	52 [125.6 °F]	49 [120.2 °F]	46 [114.8 °F]
230	53 [127.4 °F]	52 [125.6 °F]	49 [120.2 °F]	47 [116.6 °F]	43 [109.4 °F]
250	52 [125.6 °F]	50 [122 °F]	47 [116.6 °F]	44 [111.2 °F]	41 [105.8 °F]

5.2 Dimensions

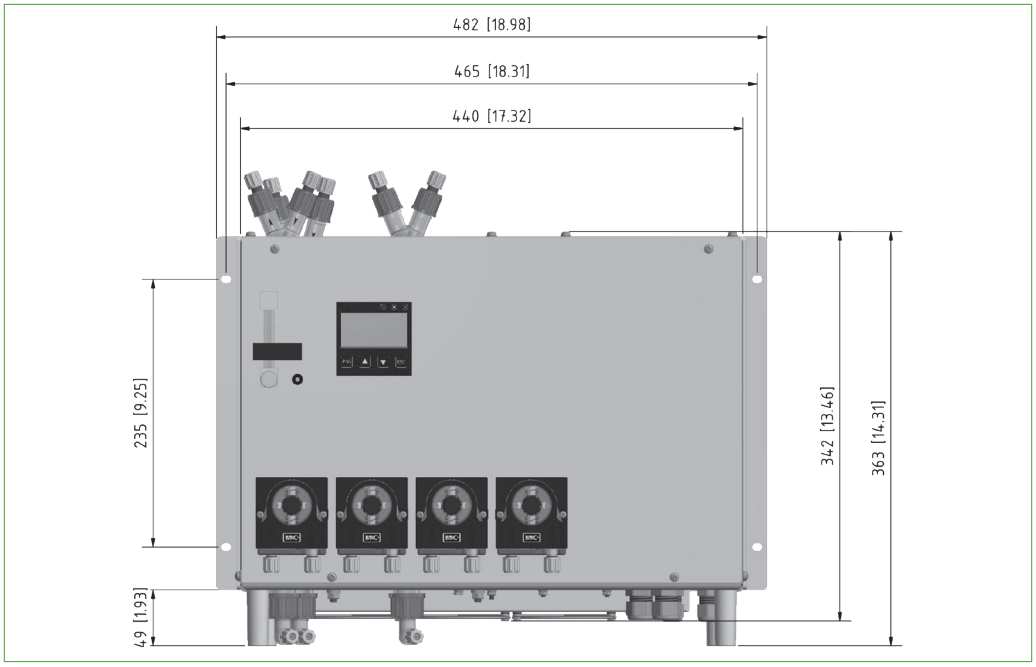


Fig. 3: Front view: dimensions including optional peristaltic pumps

Note

You will find mounting directions on page 40 chapter '8 Installation instructions and mounting of the EC30C' .

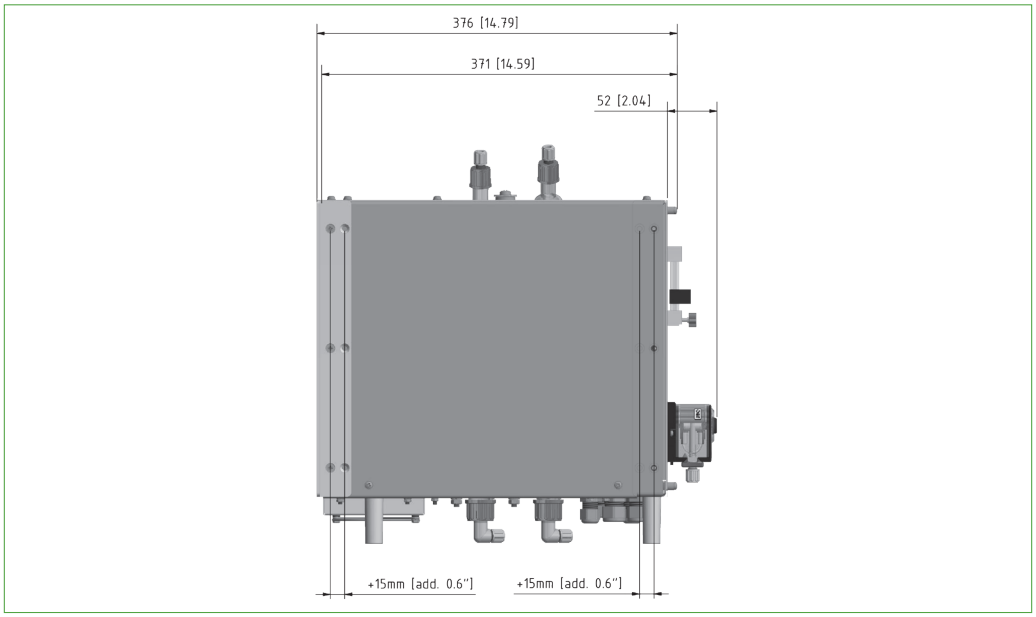


Fig. 4: Side view: dimensions including optional peristaltic pumps

6 Receiving the EC30C

CAUTION	Heavy device! Risk of injury when handling heavy equipment. Do not lift, move or carry the device without help. A second person is required to lift, move or carry the device.

Note	The cooler should always be transported and stored in an upright position, with the equipment feet facing downwards to ensure that the oil in the closed compressor circuit cannot run out of the compressor case. If the device is transported on its back, it needs to be standing in an upright position for at least 2 hours before turning on.

The ultra-low cooler EC30C is a complete pre-installed unit.

Please remove the cooler carefully from the packaging. Check the scope of the delivery specified on the delivery note. Please make sure that you have received all items stated on the delivery note.

Please check the unit for any transport damages after receipt and report any complaints to the transport company immediately.

For transport reasons, the heat exchangers are not mounted inside of the cooler. They are included in the packaging, but wrapped separately. Connect the heat exchangers properly before commissioning.

Note	Follow the instructions to connect the tubing to the heat exchangers on page 40 chapter '8 Installation instructions and mounting of the EC30C'

6.1 Product label and serial number

There are two product labels on the EC30C. One of them is located on the right side of the cooler and the second one is inside the cooler housing on the bottom plate. Please refer to this serial number if you have any questions about the device or if you need to order spare parts or consumables.

Note	The EC30C features two serial numbers. One serial number is for the device and the other one for the display controller.

7 Using the EC30C

7.1 Graphical user interface (GUI)

The EC30C has a graphical, icon-based intuitive menu navigation. The graphic user interface includes three LED indicators, the display and the operating buttons. The figure below shows the screen, where the deep cooling unit has reached its target temperature of -30 °C [-22 °F], and describes the components of the user interface.

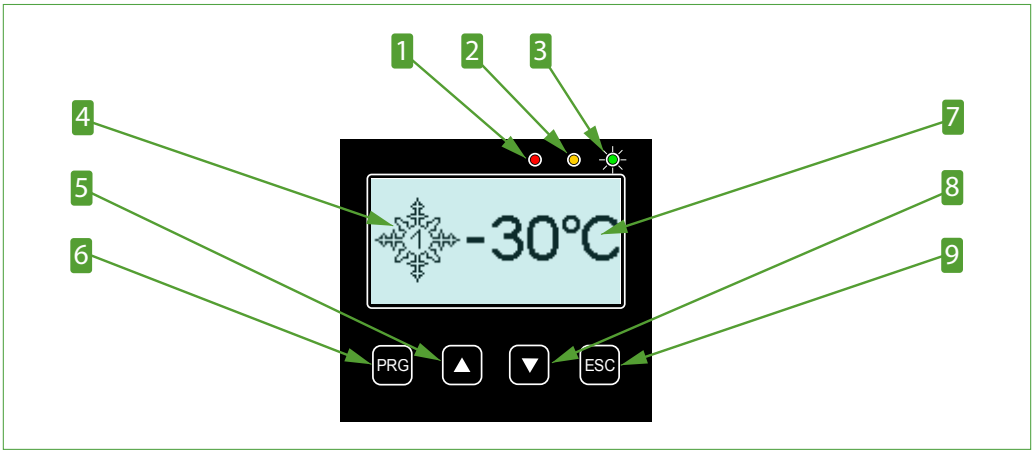


Fig. 5: Graphic user interface

1 *Red LED (alarm message)*
2 *Yellow LED (warning message)*
3 *Green LED is on (OK)*
4 *Snow-flake-symbol with '1' in its center (Temperature ≤ 0 °C and DCU 1 is active)*
5 *UP button (upwards pointing arrow)*
6 *PROGRAM button (PRG)*
7 *Temperature indication*
8 *DOWN button (downwards pointing arrow)*
9 *ESCAPE button (ESC)*

Note With the ESC button you will return to the start screen from any other screen.

7.2 LED color coding and possible color combinations

Red	Yellow	Green	Description
		●	Everything is OK
	●		One or more warning messages
●			One or more alarm messages
●	●		A combination of one or more alarm messages and warning messages

7.3 Self-monitoring after powering-on the unit

The EC30C automatically monitors and controls its correct functioning and the wear out of its components. The self-test includes six different tests, each of them being symbolized by a smiley icon.

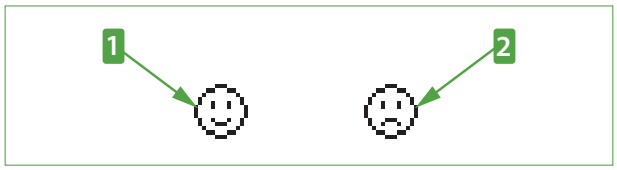


Fig. 6: Smiley symbols during self-test

1 *'Test passed'-symbol*
2 *'Test failed'-symbol*

Please switch on the EC30C. After powering-on the unit starts the self-testing. After successful self-testing the display shows the following picture.

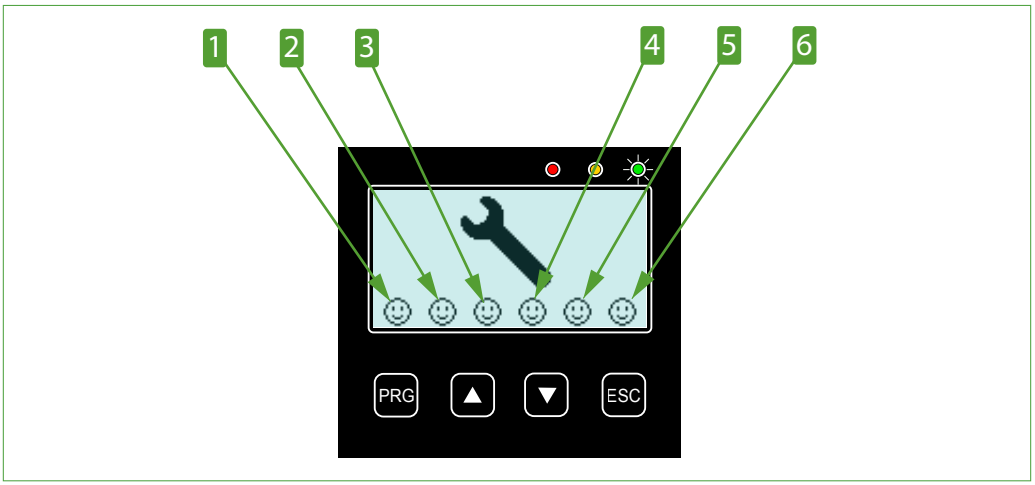


Fig. 7: The smileys on the display after self-testing

1 *Internal low voltages*
2 *Power supply voltage*
3 *D/A converter*
4 *0-20 V-Module*
5 *Peltier elements*
6 *decoupling capacitor/ rectifier*

If the self-test has succeeded, the unit enters the start-up phase and starts cooling.

If the display shows a 'Test failed'-symbol, this means that an error has been detected which prevents the correct operation of the unit.

In case of a failed self-test the display alternates between the monitor with smiley symbols and the service monitor. These monitors will be shown on the display until the fault is cleared.

Please contact the M&C Service in case of self-test failures. The M&C Service will recommend suitable measures to repair the unit.

Fig. 8: 'Service'-monitor: Self-test failed

Note	In some cases it is helpful to switch off the unit and to switch it on again after approx. one hour. If a 'Test failed'-symbol is shown again after that, please contact the M&C Service!

7.4 Self-monitoring during operation

Note	During its regular operation the unit runs automatic self-tests.

7.4.1 Power consumption readjustment

Over time the signs of aging of the Peltier elements increase gradually the value of the internal resistance. As a consequence the power necessary to keep the target temperature constant can not be supplied anymore. The projected capacity reserve compensates this unavoidable aging effect and maximizes the service life of the EC30C.

7.4.2 Pre-warning messages

If the capacity reserve has been exhausted up to a critical value, the unit will show a warning message about the upcoming failure. An exact definition of the remaining time, until the breakdown of the unit, is not possible.

Note	Please plan servicing the unit ahead of time. The remaining service life of the unit after the failure warning can not be determined exactly.

If the reserve capacity is exhausted, an alarm message will occur. The unit still keeps on cooling, but the target temperature will not be reached any more. The longer the unit will be kept in this modus, the less it will be able to cool. The possible cooling temperature will constantly rise.

If the operation process allows it, it is possible to set the target temperature a little bit higher, e.g. to -25 or -20 °C [-13 or -4 °F]. This will delay the alarm message until the capacity reserve will be exhausted even for this higher target temperature.

7.5 Display during start-up of the EC30C

Note

The start screen will always show the temperature of the active deep-cooling unit (DCU).
At the beginning of the start-up phase the temperature will decrease very slowly, given that the active DCU is cooled only via the passive pre-cooler unit (PCU). After the PCU reaches +2 °C [35.6 °F], the active cooling phase of the DCU starts. From this point on, the temperature will decrease considerably faster.

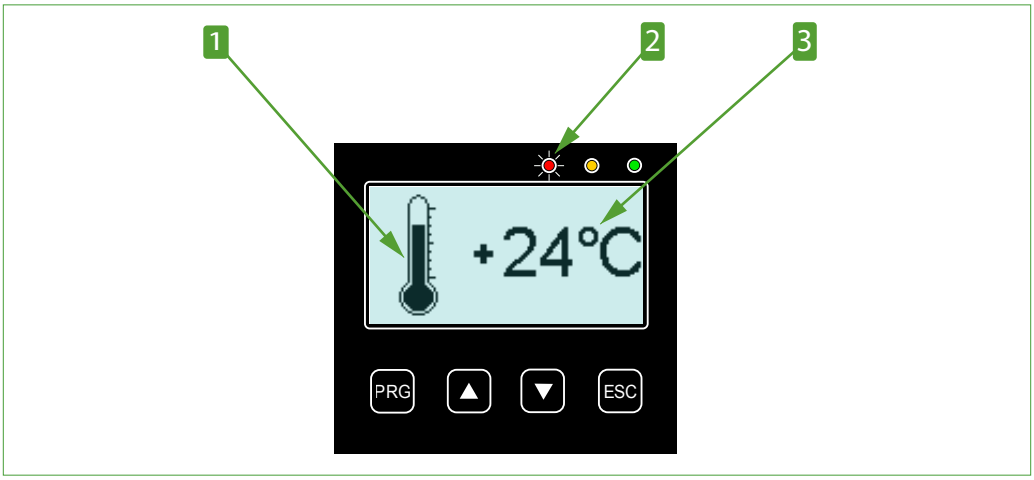


Fig. 9: Start-up phase: first cooling phase

1 *'Falling' thermometer*
2 *Red LED is on (alarm)*
3 *Temperature of the active DCU*

Directly after the successful self-test, the EC30C will start cooling the pre-cooling unit (PCU) to +2 °C [35.6 °F] (target temperature of the pre-cooling unit). Depending on the load, the compressor of the pre-cooling unit will switch between 12 to 120 times per hour, in order to reach this target temperature.

The 'falling' thermometer is the symbol for this first cooling phase. At this point the initial dew point of the sample gas is still higher than 0 °C [32 °F], which means that the target temperature has not been reached yet, and the EC30C is still in alarm modus.

Note

The red LED shows the status of the alarm relay. Operation mode of the relay (safety first): alarm active = red LED

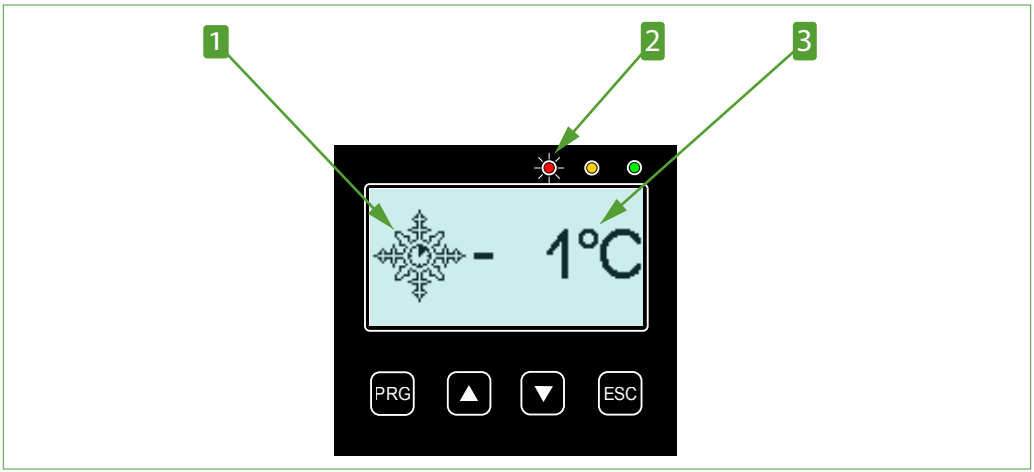


Fig. 10: Start-up phase: TKS reaches and/or exceeds '0 °C / 32 °F'-limit

1 *Snowflake-symbol with a clock in its center* 2 *Red LED is on (alarm)*
3 *Temperature of the active DCU*

As soon as the first DCU reaches the 0 °C [32 °F] temperature limit, the thermometer-symbol changes to a snowflake-symbol. The clock in its center stands for the start-up phase of the active DCU. The EC30C is still in alarm modus (red LED is on), because the DCU has not reached its target temperature yet.

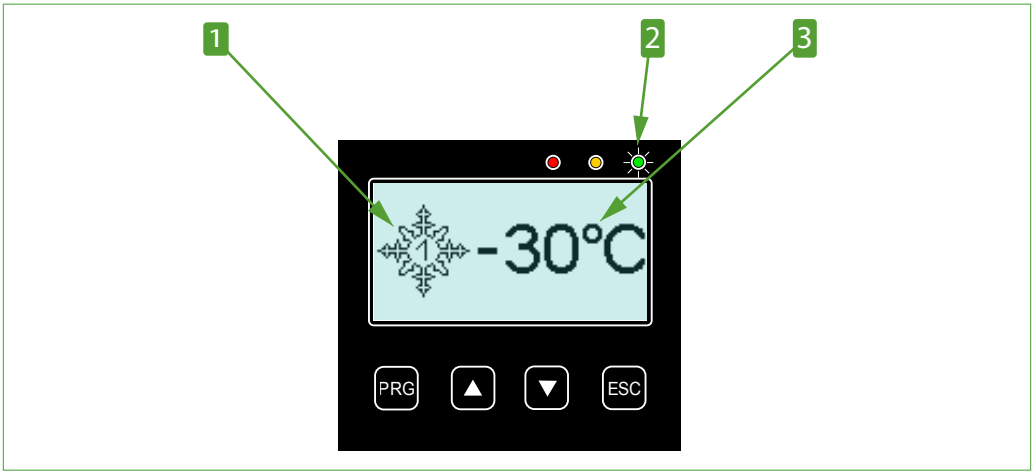


Fig. 11: Start-up phase: Target temperature reached

1 *Snowflake-symbol with '1' for DCU 1* 2 *Green LED is on (ready for operation)*
3 *Temperature of the active DCU (here DCU 1)*

Note The '1' in the center of the snowflake stands for the active deep-cooling unit DCU 1.

As soon as the EC30C reaches the target temperature of DCU 1, including the alarm hysteresis of 5 °C [41 °F], it changes from alarm modus to OK modus. The red LED goes out and the green LED turns on.

7.6 Overview screen

The overview screen shows detailed information about the pre-cooling unit PCU and the two deep-cooling units DCU 1 and DCU 2. You can change from the start display to the overview display by pressing the DOWN button.

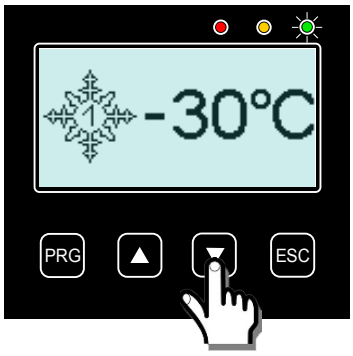


Fig. 12: That's how you reach the overview screen

The icons on the overview screen inform you about the current conditions of the three cooling units.

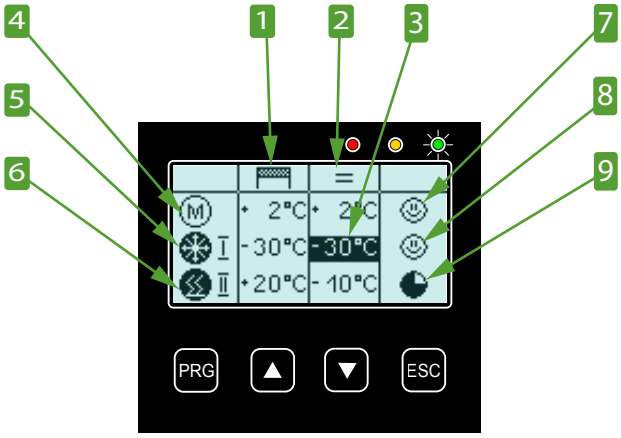


Fig. 13: Overview screen

1 *Column: target-temperatures*
2 *Column: current temperatures*
3 *DCU 1 temperature displayed on start screen*
4 *'M'-symbol: PCU (not active)*
5 *DCU 1-symbol: cooling (active)*
6 *DCU 2-symbol: heating (active)*
7 *Smiley icon: PCU target temperature reached*
8 *Smiley icon: DCU 1 target temperature reached*
9 *Clock icon: DCU 2 target temperature not reached*

The following table shows the icons occurring on the display and their descriptions:

Symbol	Description
	Pre-cooling unit is cooling
	Pre-cooling unit is not cooling
	Deep-cooling unit I and/or II is cooling
	Deep-cooling unit I and/or II is not cooling
	Deep-cooling I or II is heating
	Status display: The unit has reached its target temperature.
	Status display: A warning or an alarm has occurred
	Status display: The unit has not reached its target temperature yet

7.7 Alarm and warning history

The alarm and warning history shows in detail all warnings and alarms occurred.

The EC30C is able to record 768 messages. In case of more than 768 messages the oldest messages will be deleted and replaced automatically.

You can reach the alarm and warning history from the overview screen by pressing the DOWN button.

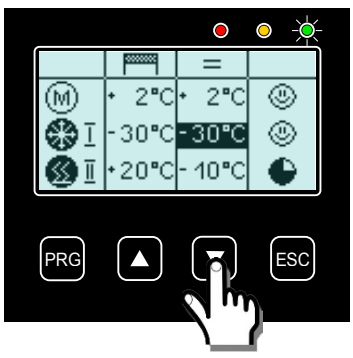


Fig. 14: How to reach the alarm and warning history

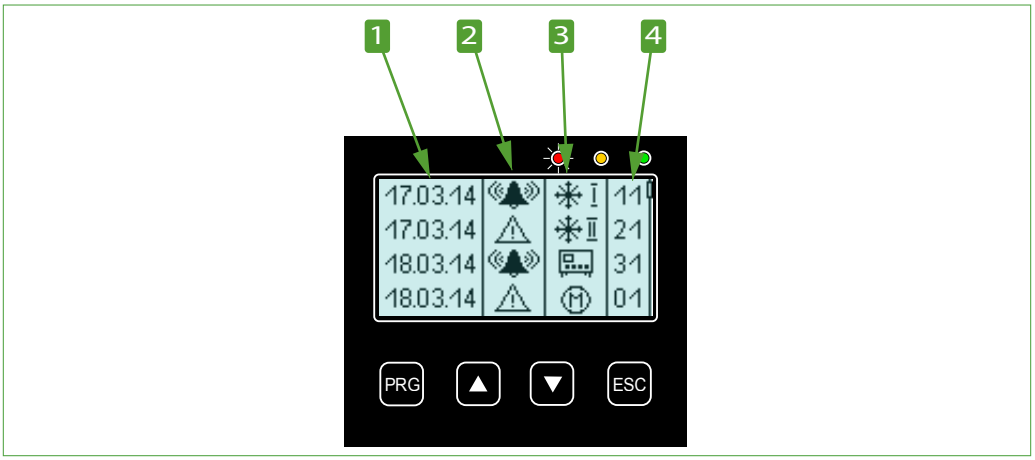


Fig. 15: Alarm and warning history

1 *Column: date or time*
2 *Column: alarm or warning icon*
3 *Column: component Icons*
4 *Column: error code*

Please press the PRG button to see the messages in detail.

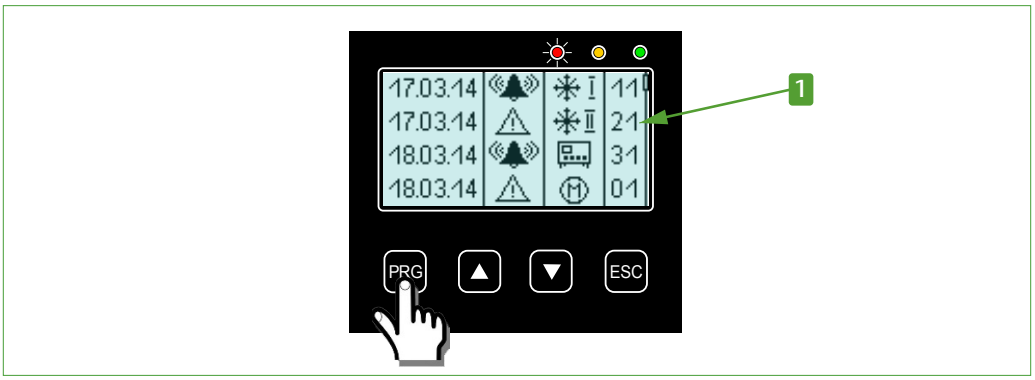


Fig. 16: How to chose an alarm or warning message

1 *Line, which is highlighted in Fig. 17 and Fig. 18*

After pressing the PRG button the last line of the alarm and warning history screen will be displayed inverted (highlighted).

With the UP and DOWN buttons you can scroll through the stored messages. You will reach the highlighted message in Fig. 17 by pressing the UP button two-times.

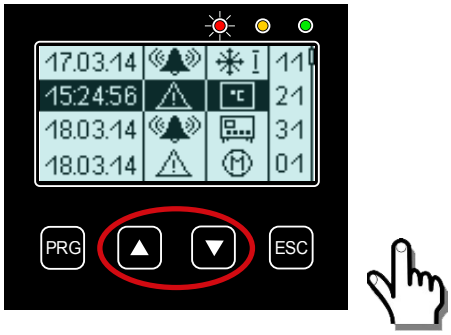


Fig. 17: How to scroll through stored messages

The highlighted line will show the time instead of the date of the selected alarm or warning message. The column for component icons will display the component of the device, the warning or alarm refers to.

In the selected line shown above the DCU 2-icon has changed into the temperature icon, which means that the warning refers to the temperature of the second deep-cooling unit.

Note A slider on the right side of the display indicates the current position in the alarm and warning history.

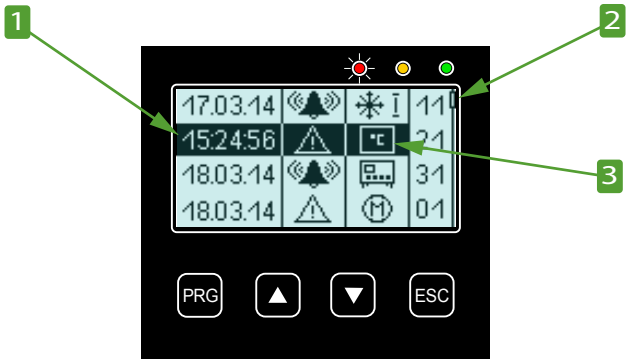


Fig. 18: Detailed information for a selected message

1 *Time of the selected message*
2 *Slider*
3 *Temperature icon*

7.7.1 Error codes

The error code in an alarm and warning history consists of two digits. The first digit in the error code refers to the component:

First digit	Description
0	Pre-cooling unit
1	Deep-cooling unit I
2	Deep-cooling II
3	General device error

The second digit of the error code offers detailed information about alarm or warning messages.

The following chapters describe the error codes for warning and alarm messages in detail.

7.7.2 Warning symbols

In the alarm and warning history there are two different warning symbols:

Warning symbol	Description
	Warning
	Canceled warning (warning triangle with check mark)

The warning triangle stands for a warning. A canceled warning is symbolized by a warning triangle with check mark.

When a warning has been canceled, the alarm and warning history will show a line displaying a warning triangle with check mark including date and hour of cancellation.

Note

If you want to contact our service department to report a warning or alarm message, please keep ready the following information:
- Is the message an ‚alarm' or a ‚warning' message?
- Which error code is being displayed on the screen?

The following table shows the symbols that can occur in case of a warning and explains their meaning.

Components	Warning type	Symbols	Code	Description	Comments
Pre-cooling unit	Tempera-ture		01	Temperature too low	T1 ≤ 0 °C [32 °F]
			02	PCU takes too long to cool down	> 45 min.
Deep-cooling unit I	Tempera-ture		10	Cooling temperature too low	$T2 < T2_{set}$ - 3 °C [$T2_{set}$ - 5.4 °F]
			11	Heating temperature too low	$T2 < T2_{set}$ - 5 °C [$T2_{set}$ - 9 °F] after heating cycle
	Peltier-element(s)		12	Loss of power	$U_{PE1} \geq 19$ V
	0 - 20 V Module 1		13	0 - 20 V Module deteriorated	$U_{OUT} \leq U_{OUT, set}$ - 0.5 V or $U_{OUT} \geq U_{OUT, set}$ + 0.5 V
	Tempera-ture		14	Heating/ cooling takes too long	> 45 min. Thermal load maybe too high or ambient temperature too high
Deep-cooling unit II	Tempera-ture		20	Cooling temperature too low	$T3 < T3_{set}$ - 3 °C [$T3_{set}$ - 5.4 °F]
			21	Heating temperature-too low	$T3 < T3_{set}$ - 5 °C [$T3_{set}$ - 9 °F] after heating cycle
	Peltier-Element(s)		22	Loss of power	$U_{PE2} \geq 19$ V
	0 - 20 V Module 2		23	0 - 20 V Module deteriorated	$U_{OUT} \leq U_{OUT, set}$ - 0.5 V or $U_{OUT} \geq U_{OUT, set}$ + 0.5 V
	Tempera-ture		24	Heating/ cooling takes too long	> 45 min. Thermal load maybe too high or ambient temperature too high

Components	Warning type	Symbols	Code	Description	Comments
General device	Service		30	Service due in 20 days	Service-remaining time ≤ 20 days
			31	Service expired	Service-remaining time ≤ 0 days
	Device temperature		32	Device temperature too high	T_{device} ≥ +70 °C [158 °F]
			33	Device temperature to low	T_{device} ≤ +5 °C [41 °F]
	Gas flow alarm		34	No gas flow	Heat exchanger maybe frozen or gas line defect
	Back-up battery		35	Back-up battery empty	≤ 2.3 V
	Decoupling capacitor or rectifier		36	Power supply needs to be checked	Decoupling capacitor deteriorated or rectifier defect

7.7.3 Alarm symbols

In the alarm and warning history there are two different alarm symbols:

Alarm symbol	Description
	Alarm
	Canceled alarm (alarm symbol with check mark)

The bell stands for an alarm. A canceled alarm is symbolized by a bell with check mark.

When an alarm has been canceled, the alarm and warning history will show a line displaying a bell with a check mark including the date and hour of cancellation.

Note

If you want to contact our service department to report a warning or alarm message, please keep ready the following information:
- Is the message an ‚Alarm' or a ‚Warning' message?
- Which error code is being displayed on the screen?

The following table shows the symbols that can occur in case of an alarm, and explains their meaning.

Components	Alarm type	Symbols	Code	Description	Comments
Pre-cooling unit 	Temperature		01	Temperature too high	T1 ≥ +5 °C [41 °F]
			02	Temperature too low	T1 ≤ -1 °C [30.2 °F]
Deep-cooling unit I 	Temperature		10	Cooling temperature too high	T2 ≥ $T2_{set}$ + 3 °C [$T2_{set}$ + 5.4 °F]
			11	Heating temperature too high	T2 ≥ +30 °C [86 °F]
	Peltier-element(s)		12	Loss of power	U_{PE1} ≥ 19.7 V
			13	defect	No cooling despite the FET, relay etc. OK
	0 - 20 V Module 1		14	defect	U_{OUT} ≤ $U_{OUT, set}$ - 1 V or U_{OUT} ≥ $U_{OUT, set}$ + 1 V
Deep-cooling unit II 	Temperature		20	Cooling temperature too high	T3 ≥ $T3_{set}$ + 3 °C [$T3_{set}$ + 5.4 °F]
			21	Heating temperature too high	T3 ≥ +30 °C [86 °F]
	Peltier-element(s)		22	Loss of power	U_{PE2} ≥ 19.7 V
			23	defect	No cooling despite the FET, relay etc. OK
	0 - 20 V Module 2		24	defect	U_{OUT} ≤ $U_{OUT, set}$ - 1 V or U_{OUT} ≥ $U_{OUT, set}$ + 1 V

Components	Alarm type	Symbols	Code	Description	Comments
General device	Liquid alarm		30	Liquid alarm 1	
			31	Liquid alarm 2 (only for M&C service personnel)	
	Device temperature		32	Device temperature too high	$T_{Gerät} \geq +80$ °C [176 °F]
			33	Device temperature too low	$T_{Gerät} \leq +2$ °C [35.6 °F]
	Sensor temperature		3A	Sensor temperature outside the valid range	T1 ≥ 50 °C [122 °F] or T1 ≤ -10 °C [14 °F], T2 ≥ 50 °C [122 °F] or T2 ≤ -40 °C [-40 °F], T3 ≥ 50 °C [122 °F] or T3 ≤ -40 °C [-40 °F] Possibly temperature sensor defective or disconnected. As a result, the pre-cooling unit and deep-cooling units are switched off.
	Voltage error		34	Couplings capacitor or bridge rectifier defect	
	Only for M&C Service Personnel		35	I^2C communication doesn't work	One IC doesn't answer; probably IC defect
			36	I^2C communication doesn't work	All IC's don't answer (probably power cord defect or removed)
			37	One internal voltage supply (5 V or 12 V) is incorrect	5 V voltage < 4.5 V 12 V Voltage < 9 V
			38	H/K Relay unit 1 defect	Cools down, but does not heat up, or heats up, but does not cool down
			39	H/K Relay unit 2 defect	Cools down, but does not heat up, or heats up, but does not cool down

7.8 Temperature diagrams

The EC30C shows the temperature diagrams of the pre-cooling unit and the two deep-cooling units. The temperature diagrams display a time period of 6 hours.

You can reach the temperature diagrams from the alarm and warning history screen by pressing the DOWN button.

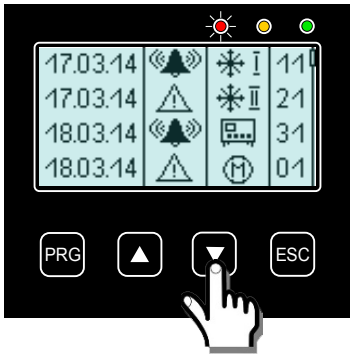


Fig. 19: How to reach the graphical temperature diagrams

Note	With the UP and DOWN buttons you can switch between the graphical temperature diagrams of the pre-cooling unit and the two deep-cooling units.

7.8.1 Diagram of the pre-cooler unit (PCU)

You can reach the temperature diagram of the pre-cooler unit (PCU) from the alarm and warning history screen by pressing the DOWN button.

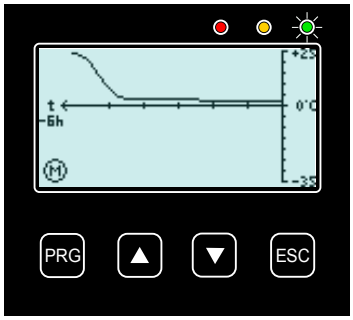


Fig. 20: Temperature diagram of the pre-cooling unit

After the commissioning of the EC30C, the temperature diagram starts adding measurement readings from right to left. Every three minutes the characteristic line is updated with a new temperature value. The diagram always shows the measured temperature of the last 6 hours. Temperature values older than 6 hours will be deleted.

The y-axis of the PCU temperature diagram shows a temperature range from -35 to +25 °C [-31 to +77 °F]. Measured values exceeding or going below this temperature range will not be displayed.

7.8.2 Diagram of the deep cooling units (DCU 1 and DCU 2)

Starting from the pre-cooling unit (PCU) temperature diagram screen, please press the DOWN button to reach the temperature diagram of the two deep-cooling units. Here both deep-cooling units are displayed in one diagram.

The fine line shows the temperature characteristic of DCU 1 and the thicker line shows the characteristic of DCU 2.

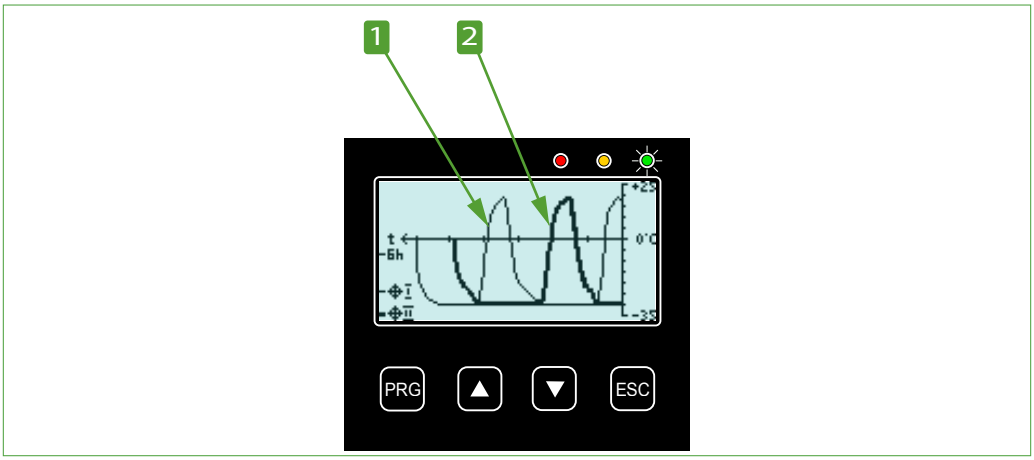


Fig. 21: Temperature diagram of the deep-cooling units

1 *Diagram of DCU 1*

2 *Diagram of DCU 2*

The temperature range of the y-axis is limited from -35 to +25 °C [-31 to +77 °F]. Measured values exceeding or going below this temperature range will not be displayed.

Note	Broken temperature lines are caused by switching the unit off and on again. When the EC30C is turned off, and for excample after 2 hours turned on again, the temperature of the deep-cooling units will have changed. This leads to a broken line in the diagram.

7.9 Parameter menu

The parameter menu is used for setting the individual parameters e.g. service interval or deep-cooling temperature. The parameter menu has two screens. You can switch between these screens by using the UP and DOWN buttons.

You can reach the parameter menu from the temperature diagram of the deep-cooling units by pressing the DOWN button.

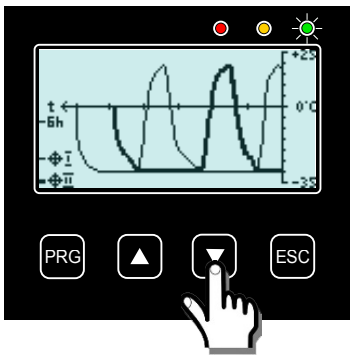


Fig. 22: How to reach the parameter menu (screen 1)

The first parameter screen shows the following information:

- Operating time of the EC30C
- Requested service interval
- Settings for the mA-output

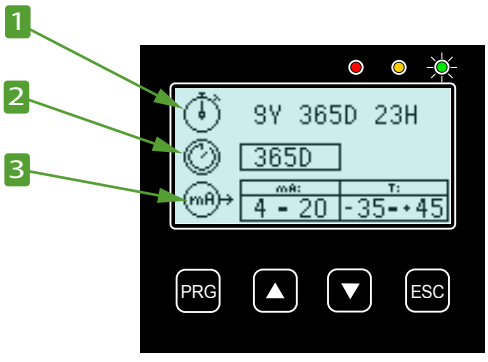


Fig. 23: Parameter menu, screen 1

1 *Line 1: operating time*
2 *Line 2: Service interval in days*
3 *Line 3: mA-output*

In the second part of the parameter menu, there are the following parameters:

- Required deep-cooling temperature
- Current date
- Current time

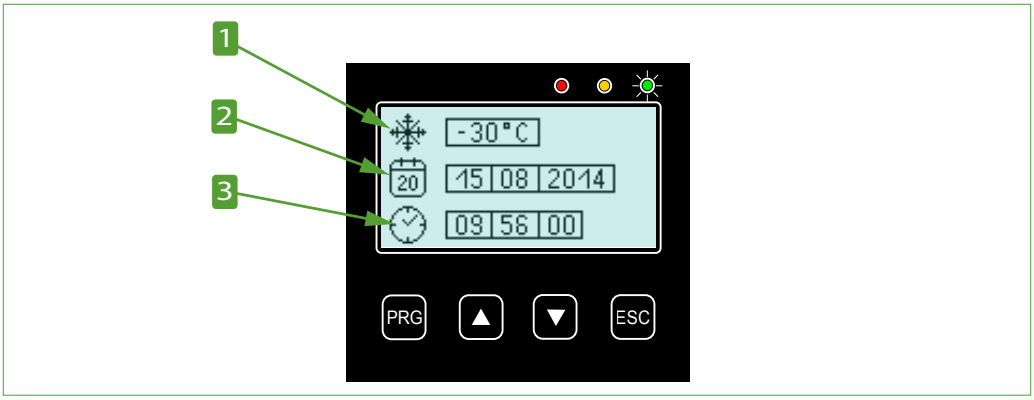


Fig. 24: Parameter menu, screen 2

1 *Line 1: Deep-cooling temperature*
2 *Line 2: Current date*
3 *Line 3: Current time*

Note You will find the permitted parameter ranges on page 36 chapter '7.9.1 Parameter settings' .

Here are the definitions of the symbols used in the parameter menu:

Symbol	Definition
	Information about the time period the unit has already been running
	Setting of the required service interval
	Setting of the mA-output and of the correlated temperature interval
	Setting the required deep-cooling temperature
	Information: current date
	Information: current time

7.9.1 Parameter settings

The parameters displayed on the screens can be adjusted within a defined parameter range.

You can set the following parameters:

Parameter	Parameter range	Default value
Service interval	Off (0 days), 1-1095 Tage	365 days
mA-output (power range)	0-20 mA, 4-20 mA	4-20 mA
mA-output (correlated temperature range)	Min: -40 to -10 °C [Min: -40 to 14 °F] Max: +10 to +60 °C [Max: +50 to 140 °F]	-30 to +30 °C [-22 to +86 °F]
Required deep-cooling temperature	-20 to -30 °C [-4 to -22 °F]	-30 °C [-22 °F]
Date [Day, Month, Year]	Day: 01 to 31 Month: 01 to 12 Year: 15 to 99	01.01.16
Time [Hour, Minute, Second]	Hour: 00 to 23 Minute: 00 to 59 Second: 00 to 59	12:00:00

To reach the program level for setting the parameters please start from the corresponding parameter screen and press the PRG button.

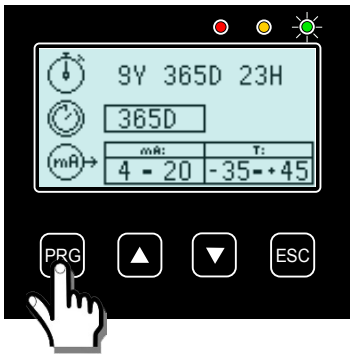


Fig. 25: How to reach the parameter settings

Note	The screens of the parameter menu are independent screen pages. You can change only the parameters of the screen that is currently displayed. If you want to change parameters from a different parameter screen, you have to leave the current setting level first by pressing the ESC button.

The first parameter of the parameter menu will be highlighted. You can switch between the parameters of this screen page with the PRG button.

First you have to invert the parameter you want to change. Then you use the UP and DOWN button to switch between the different parameter ranges.

You can exit this screen without changing any parameter by pressing the ESC button.

To accept the value shown on the display, please press the PRG button for about 3 seconds. The parameter will change from highlighted to not highlighted. This means that the value has been set to the new parameter. You can also change more than one parameter on the screen, and accept all of them by pressing the PRG button for 3 seconds.

You can exit this program level by pressing the ESC button.

Note	Please find more details about the program levels on page 67 chapter '12.1 Overview of the EC30C screens' .

7.10 Device information

Please start from the parameter menu (screen 2) and press the DOWN button to change to the device information screen.

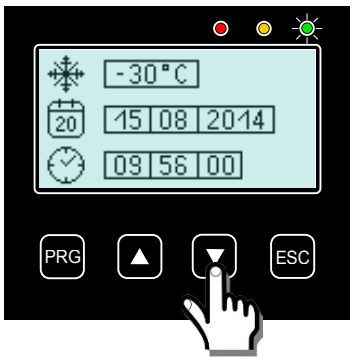


Fig. 26: How to reach the device information

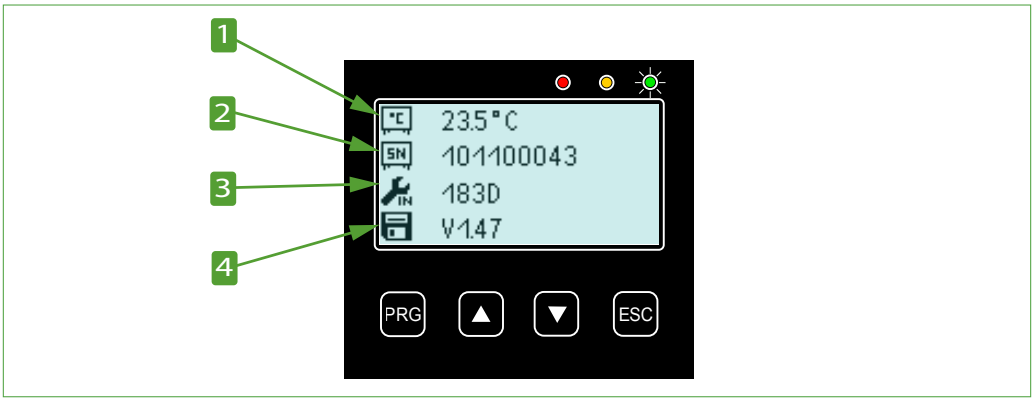


Fig. 27: Device information

1 *Line 1: Device temperature*
2 *Line 2: Serial number of the display controller*
3 *Line 3: Days left until servicing*
4 *Line 4: Software version number*

This screen displays the following device information:

- Device temperature
- Serial number of the device controller
- Days left until servicing
- Software version number

The symbols used on the device information screen are as follows:

Symbol	Description
	Device temperature
	Serial number of the display controller
	Days left until service
	Software version number

7.11 Service-Reset (qualified personnel only)

Note	Loss of data caused by service reset! There is no security query, whether you really want to carry out the service reset or not. Service reset has to be carried out only by qualified personnel!

The service reset can be activated from the start screen by pressing simultaneously the UP, DOWN and ESC button for three seconds.

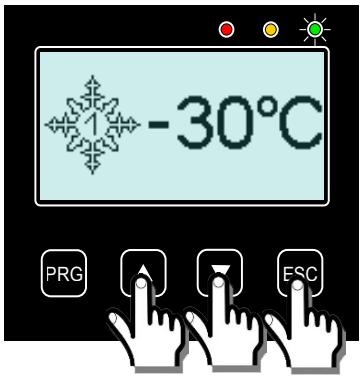


Fig. 28: Activating Service Reset (Qualified personnel only)

After activating service reset all messages from the error memory will be deleted. The service time will also be reseted.

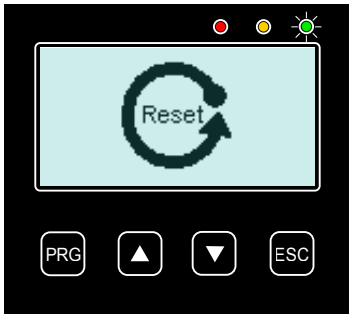


Fig. 29: Reset screen (Qualified personnel only)

8 Installation instructions and mounting of the EC30C

CAUTION

Heavy device!
Risk of injury when handling heavy equipment.
Do not lift, move or carry the device without help. A second person is required to lift, move or carry the device.

The cooler EC30C is suitable for both: wall and 19“ rack mounting.

8.1 Installation instructions

Follow these installation instructions:

- The operating position of the cooler is exclusively upright. The operation in vertical position ensures the faultless separation and removal of the condensate in the heat exchanger.
- Mount the cooler in a ventilated place away from heat sources. This way you avoid disturbing heat accumulations.
- When mounted outdoors, the cooler has to be installed into a protective case. Make sure that the place of operation is frost-free in winter and sufficiently ventilated in summer. Avoid direct sunlight.
- Take into consideration the required minimum assembly dimensions.
- For optimum measurement results we recommend to use an electrically heated gas sample line.
- Heated sample gas lines need to end at least 20 cm [≈ 7.9“] before the gas line reaches the cooler to make sure that the heated sample line and the cooler is thermally decoupled. That means, the last 20 cm [≈ 7.9“] of the gas lines are not isolated.
- Un-heated sample gas lines need to be installed with a declining angle towards the cooler. In this case, any built-up condensate in the gas lines can flow towards the cooler and will be removed by the heat exchanger in the pre-cooler unit.

8.2 Wall and rack mount

Note

The tubes for condensate removal will be directly connected to the DN10/12 mm connectors at the bottom of the heat exchangers. These condensate removal connectors stick out of the bottom plate of the cooler housing.

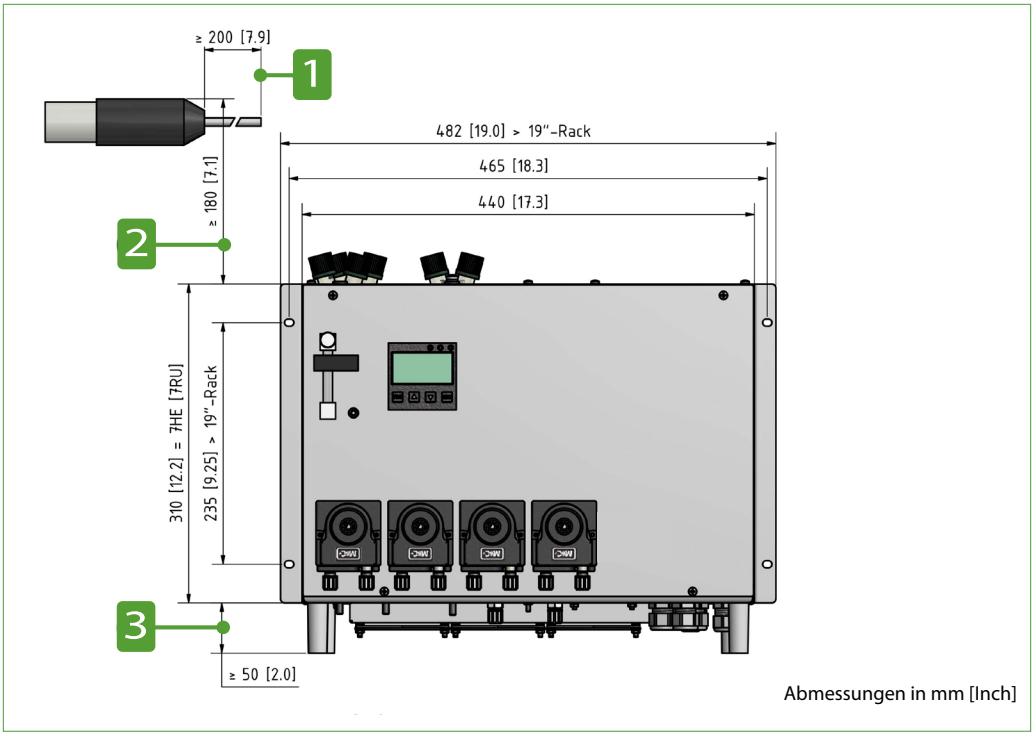


Fig. 30: Min. assembly dimensions (unit with optional peristaltic pumps)

1 *Min. distance between isolation and attachment point of the unit*

2 *Min. installation space above the EC30C*

3 *Min. installation space below the EC30C*

Please follow these instructions for mounting of the EC30C (numbers correspond to Fig. 30 on page 41):

1 For heated gas sample lines, the insulated part of the line must end at least 200 mm [≈ 7.87"] before the line reaches the device.

2 Please provide a minimum of 180 mm [≈ 7.1"] installation space above the unit for the tubing. Make sure that outgoing air can exit from the upper side of the device.

3 Provide a min. of 50 mm [≈ 2"] installation space below the unit for tubing, air intake and maintenance access. Our recommendation: min. 100 mm [≈ 3.94"].

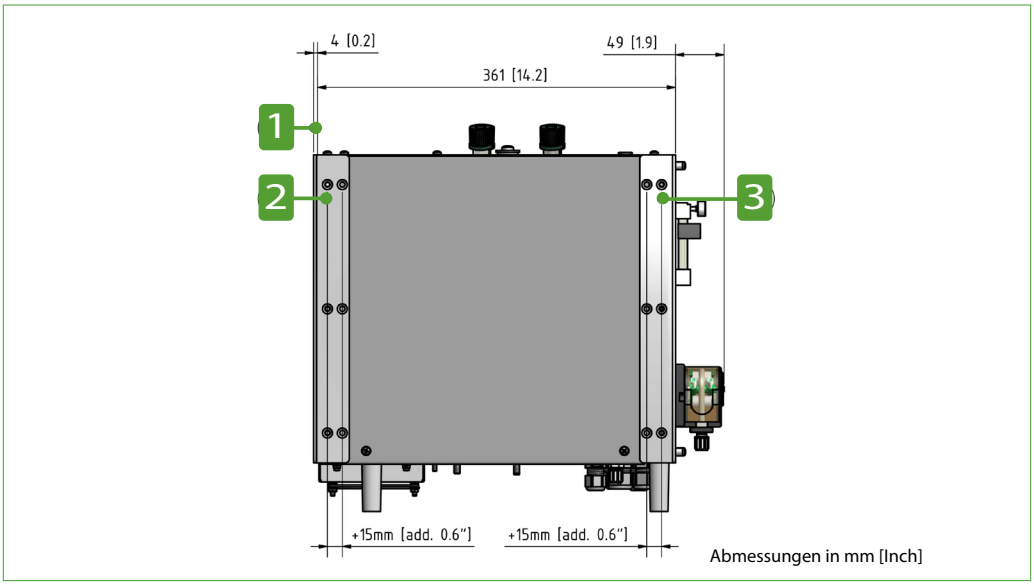


Fig. 31: Mounting rail for wall or rack mounting

1 *Back-mounting rail for wall mounting: min. 4 mm [≈ 0.16"] wall distance*

2 *Back-mounting rail for wall mounting: max. 19 mm [≈ 0.75"] wall distance*

3 *Front-mounting rail for 19" rack: housing front aligned to or 15 mm [≈ 0.6"] behind the front of the mounting bracket*

To mount the EC30C with the provided mounting rails, please follow these instructions (numbers correspond to Fig. 31 on page 42):

1 The mounting rails can be attached to the side panels close to the rear of the housing. The minimum distance between the wall and the housing will be in this case 4 mm [≈ 0,16"].

2 The mounting rails can be attached to the side panels close to the rear of the housing. The maximum distance between the wall and the housing will be in this case 19 mm [≈ 0.75"].

3 The mounting rails can be attached to the side panels close to the front of the housing (19" rack mount). In this case the front of the housing can either be aligned with or 15 mm [≈ 0.6"] behind the front of the mounting bracket.

8.3 Mounting instructions for SR25.2 peristaltic pump (optional)

Make sure to mount the pump to the front of the cooler with a minimum distance of 3.5 mm [≈ 0.14"] and a maximum distance of 5.5 mm [≈ 0.22"] between the pump motor and the front panel.

The minimum distance avoids damages to the pump motor and the maximum distance prevents the motor shaft from getting loose.

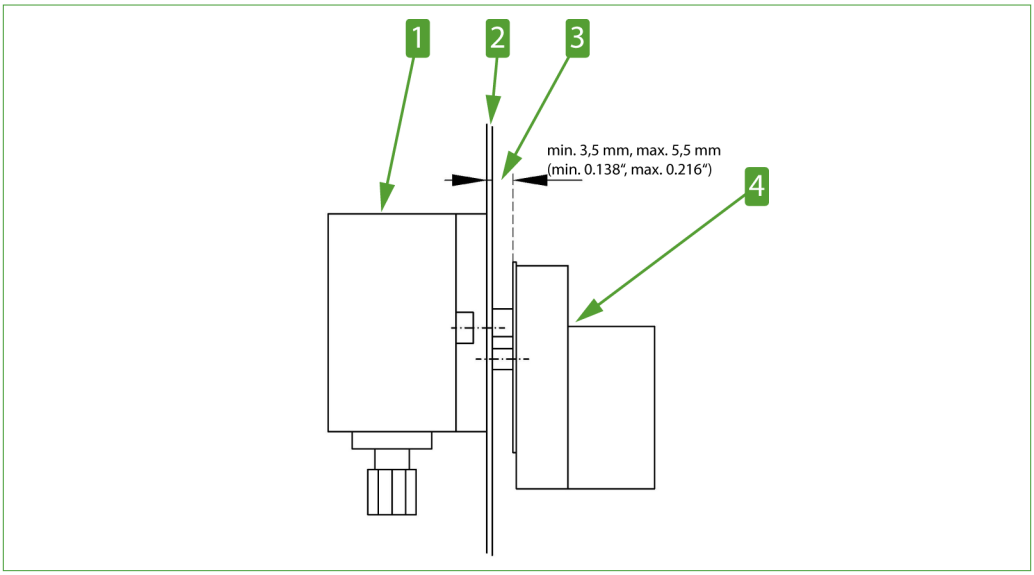


Fig. 32: SR25.2: Mounting distance between pump motor and front panel

1 *Pump head (outside the EC30C housing)*
2 *Front panel of the EC30C*
3 *Recommended mounting distance*
4 *Pump motor (inside the EC30C housing)*

Note

For more mounting instructions, see the SR25.2 instruction manual. The manual is available on our website www.mc-techgroup.com.

8.4 Tubing without heat exchanger purging (standard tubing)

Note

Do not mix up the tube connectors for sample gas inlet and outlet. The inlet and outlet connectors of the heat exchanger are marked with arrows.

Make sure that all the connections are sealed adequately.
To ensure free removal of the condensate, the stated diameters for the condensate removal lines can not be decreased!

The standard version of the EC30C is equipped with tubing without heat exchanger purging. This standard tubing includes one solenoid valve (valve 1), to switch between the two deep-cooling units.

The standard tubing of the EC30C is shown in the following figure.

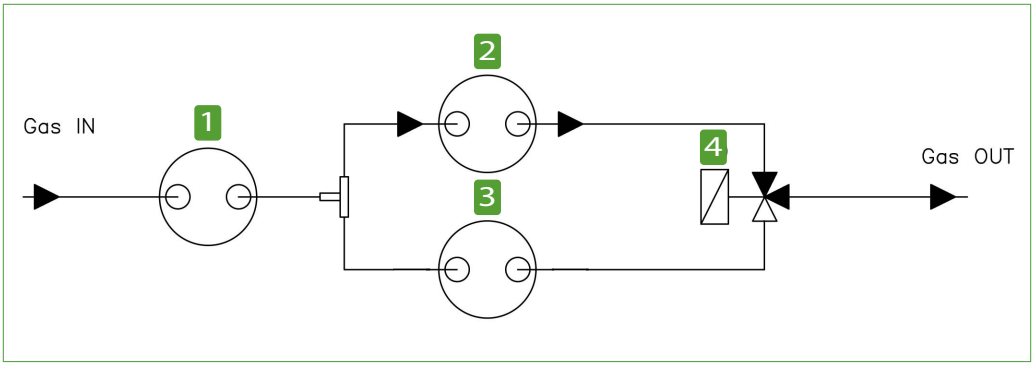


Fig. 33: Standard tubing: DCU 1 active, solenoid valve triggered, no FA

1 *Heat exchanger pre-cooling unit (PCU)*
2 *Heat exchanger DCU 1 (on the right, here: active)*
3 *Heat exchanger DCU 2 (on the left, here: not active)*
4 *Solenoid valve 1*

Gas IN is the connector of the PCU heat exchanger. The sample gas enters the cooler at this connection. Gas OUT is the connector at the solenoid valve 1, which sticks out of the bottom plate of the cooler on the left-hand side. The sample gas leaves the cooler at this connection.

8.4.1 Heat exchanger connections for tubing without purging

The EC30C provides six connectors for three heat exchangers, which protrude through the top panel of the device on the left hand-side. The sample gas enters the cooler at the sample gas inlet of the PCU heat exchanger.

The sample gas outlet DN 4/6 protrudes through the bottom plate of the cooler close to the front plate on the left-hand side.

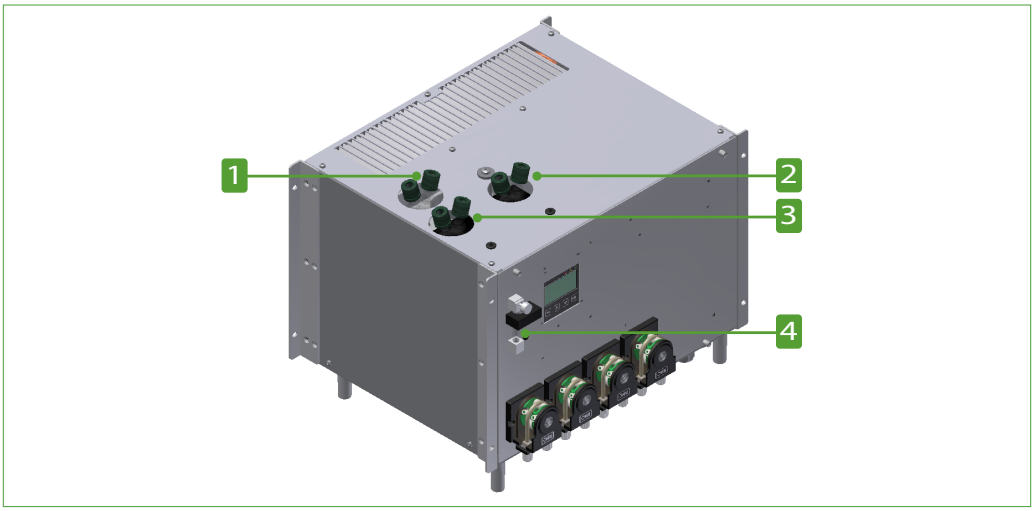


Fig. 34: Heat exchanger connectors (device with four optional peristaltic pumps)

1 *Heat exchanger pre-cooling unit*
2 *Heat exchanger DCU 1 (on the right)*
3 *Heat exchanger DCU 2 (on the left)*
4 *Flow alarm sensor FA (optional)*

The PCU heat exchanger has two connectors which are marked with arrows as gas inlet and gas outlet. The connectors of the DCU heat exchangers are also marked with arrows.

Connect the gas inlet connectors of the DCU heat exchangers with a tee connector to the outlet of the pre-cooling heat exchanger.

Route the gas outlets of the DCU heat exchangers through the top panel of the EC30C to the inside of the housing. Inside of the device connect the gas outlets of the DCU to the inlet connectors of the solenoid valve 1. Connect DCU 1OUT to the front and DCU 2OUT to the back connector of solenoid valve 1.

If you are using an internal flow alarm sensor FA: Connect the outlet of the solenoid valve 1 on the right hand-side to the gas inlet of the flow meter FM 40. Connect the outlet of the flow meter FM 40 to the gas outlet which protrudes through the bottom plate of the cooler close to the front panel on the left-hand side.

If you are using three optional peristaltic pumps: Connect the heat exchanger outlets to the peristaltic pumps. Each heat exchanger outlet will be connected to one peristaltic pump at the front panel of the cooler.

Keep the tubing of the heat exchanger condensate outlets as short and structured as possible. The tubing does not need to be connected in order.

8.5 Tubing with heat exchanger purging for special requirements (optional)

Note

Do not mix up the tube connectors for sample gas inlet and outlet. The inlet and outlet connectors of the heat exchanger are marked with arrows.

Make sure that all the connections are sealed adequately.
To ensure free removal of the condensate, the stated diameters for the condensate removal lines can not be decreased!

A fourth optional peristaltic pump can be installed in combination with a second solenoid valve 2 to provide permanently and slowly (0.4 l/h) fresh sample gas to the inactive cooling unit. This prevents short peaks of the sample gas concentration due to stagnant gas during switching between the two deep cooling units.

The tubing with heat exchanger purging for special requirements is shown in Fig. 35:

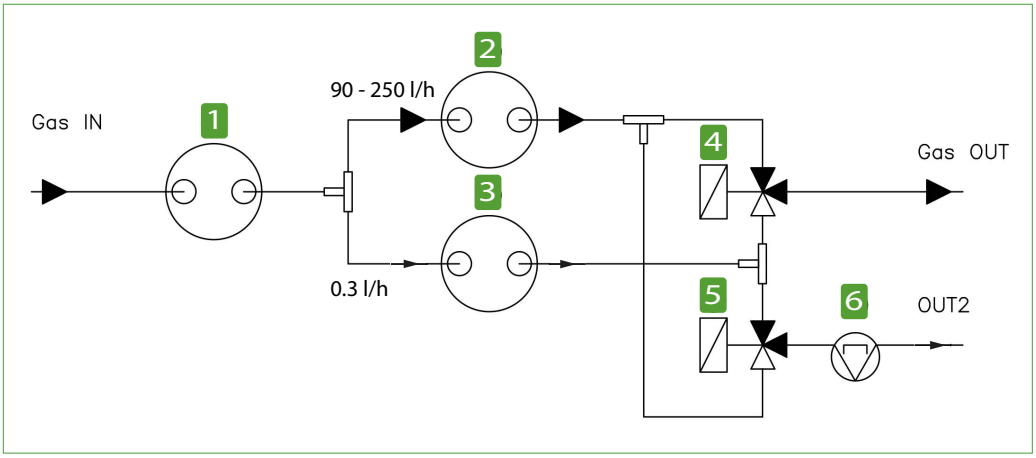


Fig. 35: Tubing with purging: DCU 1 activ, solenoid valves triggered, no FA

1 *PCU heat exchanger*
2 *DCU 1 heat exchanger (right, here: active)*
3 *Heat exchanger DCU 2 (left)*
4 *Solenoid valve 1 (right)*
5 *Solenoid valve 2 (left, optional for heat exchanger purging)*
6 *Fourth peristaltic pump, optional for heat exchanger purging*

Gas IN is the connector of the PCU heat exchanger. The sample gas enters the cooler at this connection. Gas OUT is the connector at the solenoid valve 1, which sticks out of the bottom plate of the cooler on the left-hand side. OUT2 is the optional connection to the fourth peristaltic pump, the gas outlet for the heat exchanger purging.

8.5.1 Heat exchanger connections for tubing with purging

The EC30C provides six connectors for three heat exchangers, which protrude through the top panel of the device. The sample gas enters the cooler at the sample gas inlet of the PCU heat exchanger.

The sample gas outlet DN 4/6 protrudes through the bottom plate of the cooler close to the front plate on the left-hand side.

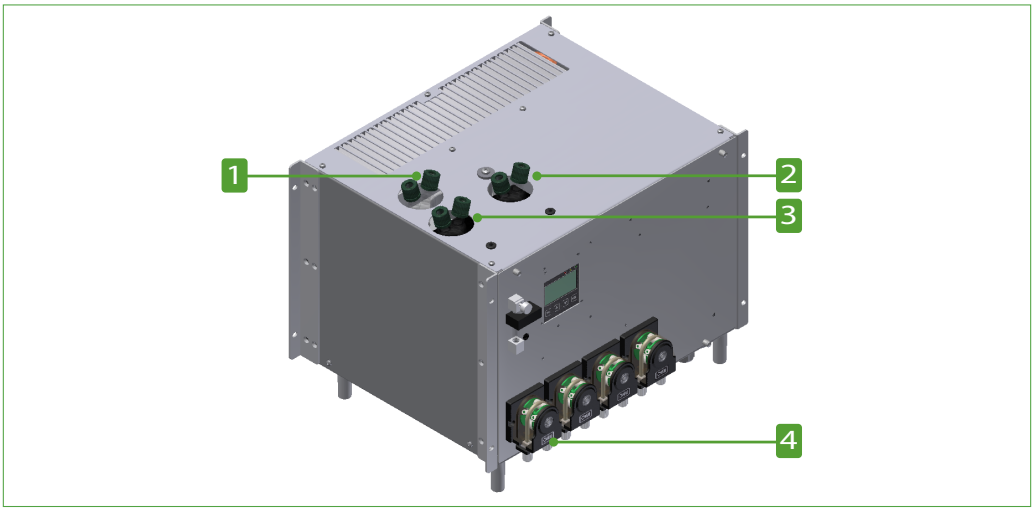


Fig. 36: Heat exchanger connections, tubing with purging

1 Heat exchanger pre-cooling unit
2 Heat exchanger DCU 2 (on the left)
3 Heat exchanger DCU 1 (on the right)
4 Heat exchanger purging: 4. peristaltic pump (here: far left)

The PCU heat exchanger has two connectors which are marked with arrows as gas inlet and gas outlet. The connectors of the DCU heat exchangers are also marked with arrows.

Connect the gas inlet connectors of the DCU heat exchangers with a tee connector to the outlet of the PCU heat exchanger.

The outlet of solenoid valve 2 protrudes on the left side through the bottom plate of the cooler, close to the front plate. Connect the gas outlet of solenoid valve 2 to the fourth peristaltic pump (here: far left).

Route the gas outlet of DCU 1 (on the right) through the top panel of the EC30C to the inside of the housing. Inside of the device connect the gas outlet of DCU 1 to the forward-facing connectors of solenoid valve 1 and 2 with a tee.

Route the gas outlet of DCU 2 (on the left) through the top panel of the EC30C to the inside of the housing. Inside of the device connect the gas outlet of DCU 2 to the backward-facing connectors of solenoid valve 1 and 2 with a tee.

Connect the gas outlet of solenoid valve 1 on the right hand-side to the gas inlet of the flow meter FM 40. Connect the outlet of the flow meter FM 40 to the gas outlet which protrudes through the bottom plate of the cooler close to the front panel on the left-hand side.

The outlet of the left solenoid valve 2 protrudes on the left side through the bottom plate. Connect this outlet to the fourth peristaltic pump on the front panel of the cooler.

If you are using three optional peristaltic pumps: Connect the heat exchanger outlets to the peristaltic pumps. Each heat exchanger outlet will be connected to one peristaltic pump at the front panel of the cooler.

Keep the tubing of the condensate outlets as short and structured as possible. The tubing does not need to be connected in order.

8.6 Duran-glass heat exchanger with GL-connections

On mounting the glass heat exchangers, please follow these instructions:

- **Before mounting the GL connections, please check the PTFE/Silicone locking rings for damages.**
- **Mount the locking rings with the PTFE side facing the medium.**

After assembly please check the leak tightness of the GL connections at the Duran glass heat exchangers.

8.7 PVDF- heat exchanger with PVDF-tube connectors

Note	Compared to Duran glass heat exchangers, the PVDF heat exchangers have a lower heat conductivity. If you are using PVDF heat exchangers, please keep in mind, that the cooling capacity of these heat exchangers are lower.

On mounting the PVDF heat exchangers with PVDF compression fittings, please follow these instructions:

- **Carefully remove the nut from the screw-connection. Pay attention to the loose ferrule inside the nut.**
- **Push the union nut onto the 4/6 mm tubing.**
- **Push the ferrule with the thick bulb facing the nut onto the tubing.**
- **Push the tubing onto the support nipple in the screw-connection.**
- **Tighten the union nut hand-tight.**

Note	To tighten the connectors onto the PVDF heat exchanger, hold a wrench against the spanner flats of the bushing!

After assembling all lines check the leak tightness of the PVDF tube connectors.

8.8 Electrical connections

ATTENTION	Wrong supply voltage can destroy your cooler! When connecting the equipment, make sure that the supply voltage is identical with the information provided on the model type plate!

There are two EC30C versions available: 115 V and 230 V. Make sure to operate each version with the appropriate supply voltage stated on the model type plate.

Note	The installation and commissioning of the device must conform to the requirements of VDE 0100 (IEC 364) 'Regulations on the Installation of Power Circuits with Nominal Voltages below 1000 V' and must be in compliance with all relevant regulations and standards.

There are five cable fittings at the bottom of the EC30C, where all electrical connections can be lead through.

You can open the front of the EC30C by loosening the four front screws. The front of the cooler is hooked into the bottom plate with a guide rail and can be tilted to up to 90° forwards. The power supply electronics are inside the housing on the right. All necessary connections can be plugged in here without removing the shielding plate.

Fig. 37 shows all available electrical connections.

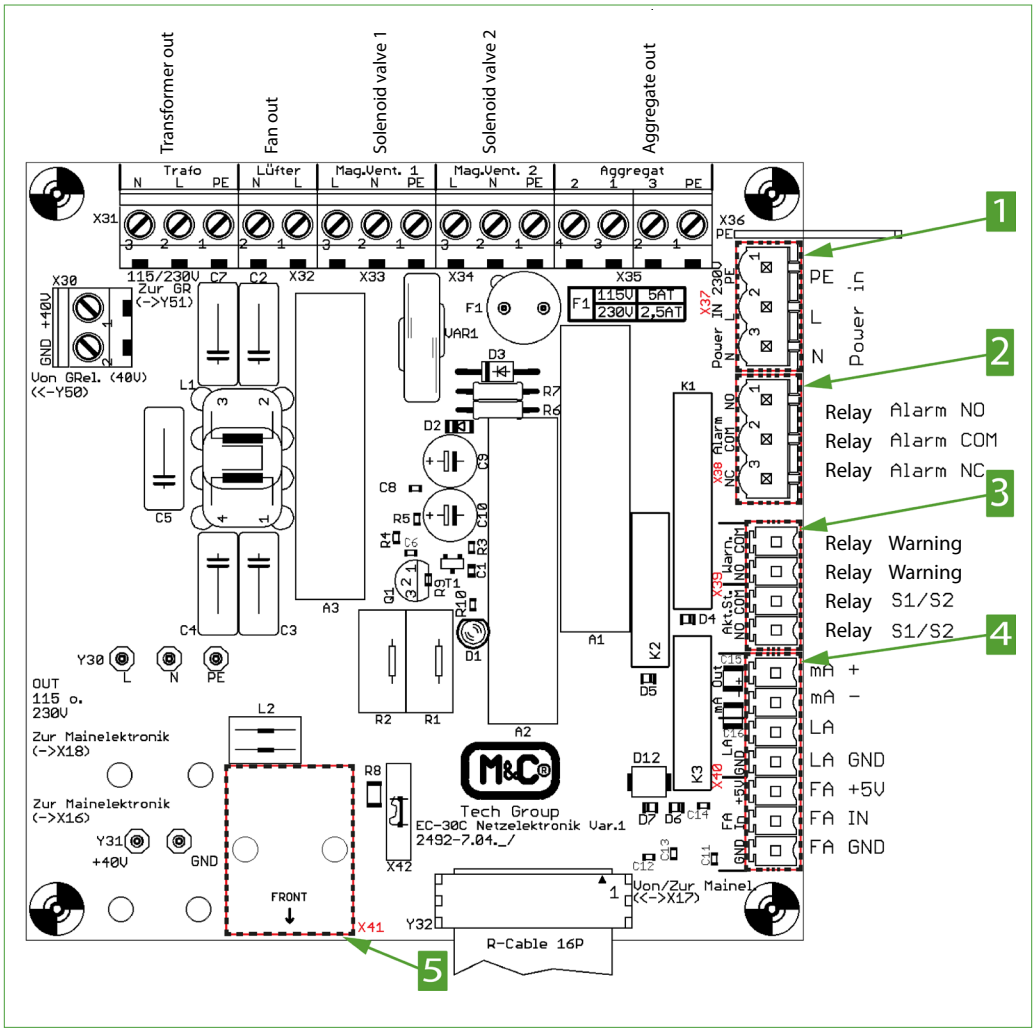


Fig. 37: Electrical connections

1 *X37*
2 *X38*
3 *X39*
4 *X40*
5 *X41*

The pins from Fig. 37 are marked as follows:

Pin No.	Definition	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
X37	Power IN	PE	L	N	---	---	---	---
X38	Alarm Relais	NO	COM	NC	---	---	---	---
X39	Warn+Ak.St.	W:COM	W:NO	A.St:COM	A.St:NO	---	---	---
X40	mA+LA+FA	mA:+	mA:-	LA:In	LA:GND	FA:+5V	FA:IN	FA:GND
X41	M&C BUS	x	x	x	x	x	x	x

x: M&C BUS configuration, only for M&C service personnel.

Note	It is important that the load of the relay contact meets the requirements stated on page 14 chapter '5 Technical Data' .

8.8.1 mA-output

By default, the EC30C has a configurable mA-output. The mA-output value always corresponds to the temperature of the active deep-cooling unit and represents the current outlet dew point.

You can assign the mA-output value range (0-20mA or 4-20 mA) to a temperature range ΔT. In this case the lower temperature limit T_{min} corresponds to the mA-output signal of 0 mA or 4 mA, and the upper temperature limit T_{max} corresponds to the mA-output signal of 20 mA.

This correlation makes it possible to influence the resolution of the mA signal and e.g. to achieve an improved measuring accuracy for a smaller temperature range.

The measuring error based on the display of the controller is ±2 % of the measuring range limit.

The maximum load of the mA output including the supply line is 500 Ohm.

Note	You will find information on how to calculate the correlation between the mA output signal range and the temperature range in the annex of this manual on page 68 chapter '12.2 How to configure the mA-output' .

8.8.2 Liquid alarm sensor LA (optional)

It is possible to connect an external liquid alarm sensor LA to monitor the EX30-C, in order to protect any downstream analyzing equipment. The LA will detect a condensate leakage caused by a possible cooler defect or overload.

The EC30C connected to the LA gives an alarm signal which will be registered in the alarm and warning history. The cooler switches the alarm relay to stop the gas supply by either turning off the sample gas pump or triggering a solenoid shut off valve.

Note	The M&C liquid sensors are based on the principle of electric conductivity starting from a conductive value of 50 µS/cm. Learn more about the M&C liquid sensors on our website www.mc-techgroup.com.

The connecting cable between cooler and external liquid sensor can not exceed a length of 3 m [≈ 19.8 ft].

The EC30C can be connected to a liquid sensor with or without cable breakage detection. The default configuration of the EC30C is for a sensor with cable breakage detection.

Note	Sensors without cable breakage detection can be connected only to devices with a specific configuration. When ordering the EC30C, please let us know whether you are going to use a sensor with or without cable breakage detection. We will configure your EC30C individually for the required sensor.

Do you need help?	Do you need further information about liquid sensors? Please contact the M&C Service!

8.8.3 Gas flow sensor FA 20 and gas flow meter FM 40 (optional)

The M&C gas flow alarm sensor FA 20 is used for monitoring of sample gas or test gas failures in analyzing devices or analyzing systems. The EC30C offers the option to process data coming from the mono-stable gas flow alarm sensor. The gas flow sensor allows both internal and external mounting.

In case of internal mounting of the FA20, it is necessary to mount into the EC30C an additional flow meter FM40 with a scale of 0 to 250 l/h.

The flow meter FM40 will be added at the end of the internal tubing. When the flow meter is triggered, the EC30C gives a warning message which will be recorded in the alarm and warning history. This allows to recognize a possible freezing up or leakage in the system at an early stage.

The connecting cable of an external flow meter must not exceed a length of 3m [≈ 19.8 ft].

Do you need help?	Do you need further information about gas flow sensors or flow meters? Please contact the M&C Service!

9 Start-up

ATTENTION	Wrong supply voltage can destroy your cooler! When connecting the equipment, make sure that the supply voltage is identical with the information provided on the model type plate!

ATTENTION	Damages of the downstream analyzers can occur! Observe the alarm contacts! Do not extract gas when the EC30C is turned off or when the LED light is red!

When the EC30C is started, one of the gas lines through the deep-cooler is always open. The outlet status contact must be connected to an external sample gas pump or a valve in the sample gas line to protect the entire analysis system by immediately cutting off the gas supply in the event of error messages of the cooler.

Note	Disruption in operation possible! Before starting up the gas cooler make sure that it has been placed in its operating position for at least two hours! Transport or mounting can lead to the redistribution of the cooling liquid within the system and this can cause operating trouble when the cooler is turned on to early.

Note	The start-up ambient temperature has to be +5 to +45 °C [+41 to +113 °F].

9.1 Preparation for start-up

Please take into consideration all equipment and process specific security measures before initial start-up.

Before initial start-up, follow these steps:

- Open the front panel of the EC30C and connect all cable connections required (power, relay, mA etc.).
- Connect all outputs required and - where necessary - connect them to the measuring station.
- Close and secure the device again.
- Apply the correct supply voltage 115 V/60 Hz o 230 V/50 Hz according to the specification plate.
- Connect the cooler to the power supply.

The control electronics of the EC30C permits automatic start up of the cooler, which ensures safe operation regardless of external influences such as a power failure. The error diagnostic will report possible error sources.

9.2 Temperature chart of the start-up stages

When started up, the EC30C carries out a self-test to check the main components of the unit.

The self-test consists of six testing steps. Each of the test steps is symbolized by a smiley icon. After successful self-testing the unit enters the starting phase and starts cooling.

When the display shows a 'Test failed'-icon, the unit has detected an error. The cooler will not enter the start-up phase.

If the self-test has failed, the display alternates between the screen with the smileys and the service screen. These screens will remain on the display until the problem has been solved.

Generally in a cases like this the unit has to be sent to M&C for check-up and/or repair. Please contact our service department by phone before sending the unit.

Note	Please find more details about the self-test on page 19 chapter '7.3 Self-monitoring after powering-on the unit' .

After successful testing, the unit starts the cooling process. It is carried out in several different stages, shown in the following phase diagram.

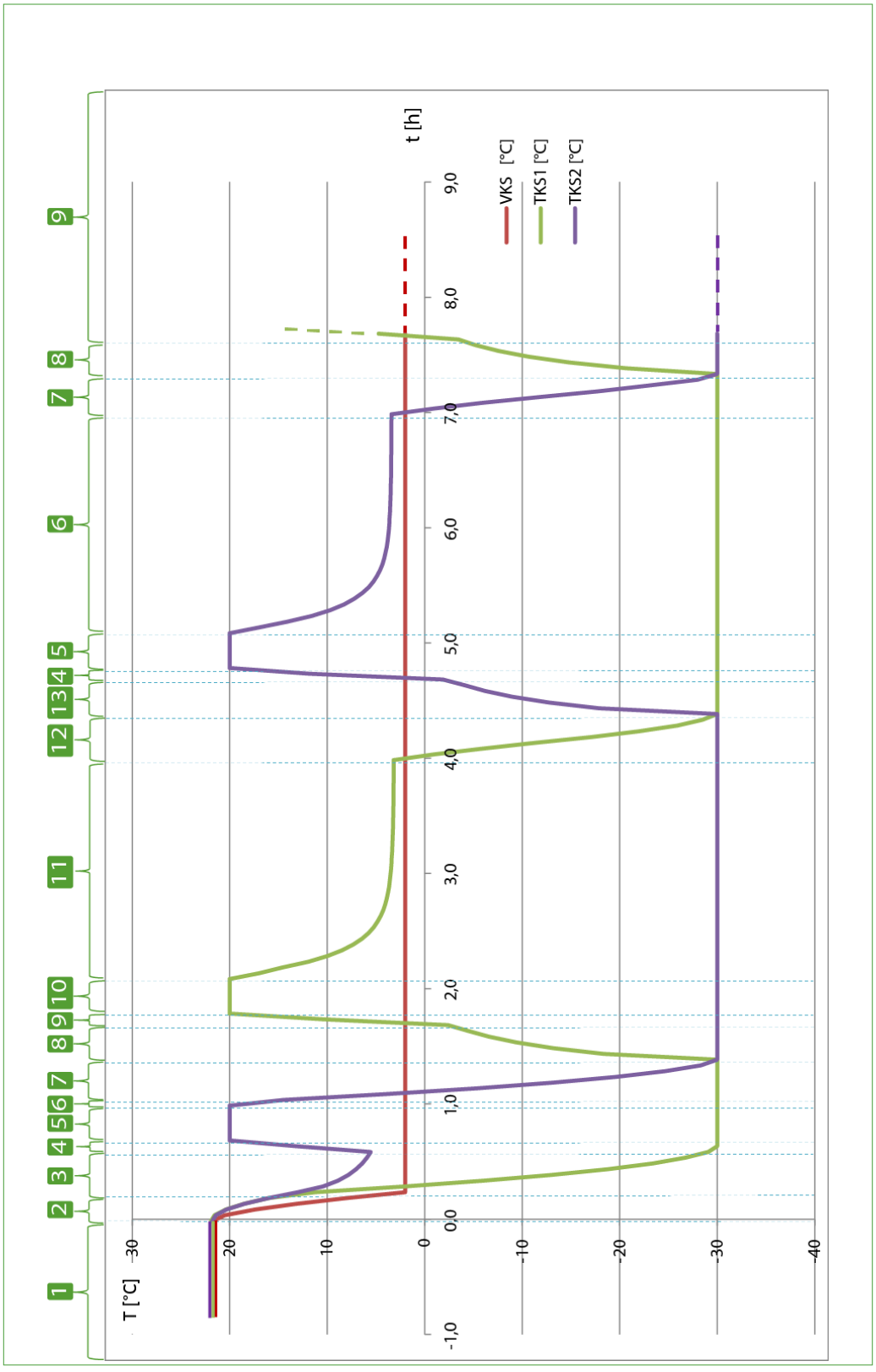


Fig. 38: Temperature chart of the start-up stages

Description of the start-up stages:

- 1 EC30C is turned off.
- 2 EC30C is turned on. The pre-cooling unit PCU is cooling down to the target temperature +2 °C [+35.6 °F]. Deep-cooling unit DCU 1 (green line) and deep-cooling unit DCU2 (purple line) are cooled passively by the pre-cooling unit. The temperatures of DCU 1 and DCU 2 are decreasing.
- 3 Pre-cooling unit PCU reaches the target temperature of +2 °C [+35.6 °F]. The DCU with the lower temperature (here DCU 1) is cooling down until it reaches its target temperature of -30 °C [-22 °F]. Second deep-cooling unit (here: DCU 2) is still passively cooled.
- 4 DCU 1 reaches the target temperature of -30 °C [-22 °F]. DCU 2 heats and starts defrosting to reach the target temperature of +20 °C [68 °F].
- 5 DCU 2 reaches target temperature of +20 °C [68 °F]. DCU 2 keeps the target temperature of +20 °C [68 °F] constant for 20 minutes in order to assure a successful defrost process. DCU 1 keeps a constant target temperature of -30 °C [-22 °F].
- 6 DCU 2 will be turned off. DCU 1 still at target temperature -30 °C [-22 °F].

  Only after a restart of the unit this stage takes a shorter periode of time. This way the unit can switch very quickly to the dewed DCU and avoid a freeze up.

  During operations the length of this stage follows the requirements of the 6 hours' cycle time. Because in any case the cooling DCU has to keep the required target temperature constant for three hours. (see stage 11).
- 7 DCU 2 cools down to target temperature -30 °C [-22 °F]. DCU 1 keeps constant the target temperature of -30 °C [-22 °F].
- 8 DCU 2 reaches the target temperature of -30 °C [-22 °F]. EC30C switches the gas flow to DCU 2. DCU 1 switches off for 20 minutes.
- 9 DCU 1 heats to the target temperature of +20 °C [68 °F]. DCU 2 stays at target temperature of -30 °C [-22 °F].
- 10 DCU 1 reaches target temperature of +20 °C [68 °F]. DCU 1 keeps the target temperature of +20 °C [68 °F] constant for 20 minutes in order to assure a succesful defrost process. DCU 2 stays at target temperature of -30 °C [-22 °F].

- 11 DCU 1 is turned off. DCU 2 stays at target temperature of -30 °C [-22 °F].

  Now the unit „knows“ how long it takes to cool DCU 1 down to the target temperature of -30 °C [-22 °F] with the current load. DCU 1 remains off until the cooling process starts.

  It depends on the required cooling process how long DCU 1 remains off. The goal is to alternate the deep-cooling units every 3 hours, in order to avoid freeze up of the unit.

- 12 DCU 1 cools down until the target temperature of -30 °C [-22 °F] is reached. DCU 2 stays at target temperature of -30 °C [-22 °F].

  From this moment on DCU 1 starts cooling, to reach the target temperature of -30 °C [-22 °F] in due time and to keep the required 6 hours`s cycle time.

- 13 DCU 1 reaches the target temperature of -30 °C [-22 °F]. EC30C switches the gas flow to DCU 1. DCU 2 turns off for 20 minutes.

From this point on the cooling stages of the EC30C keep on repeating themselves starting with stage 4. Unlike the restart phase, stage 6 will take a longer time period during the operation process.

10 Maintenance

DANGER	Dangerous voltage! Risk of death by electric shock! Do not open the deep-cooler! Disconnect power supply before opening the device for access. Make sure that all external power supplies are disconnected.

Before starting any maintenance work, please make sure that any work done on the device is in compliance with all relevant regulations and standards.

Depending on the degree of pollution of the ambient air, the cooling fins of the condenser need to be cleaned with pressure air periodically.

The intervals between servicing are dependent on the process and system conditions in your facility. The facility QA/QC plan should address the frequency for maintenance and should be updated based on your operations.

10.1 Maintenance of the peristaltic pump type SR25.2 (optional)

DANGER	Dangerous voltage! Risk of death by electric shock! Do not open the device! Disconnect power supply before opening the device for access. Make sure that all external power supplies, including all alarm and control circuits, are disconnected.

Flexible tube, conveying belt, contact pulleys and contact springs are the only consumables of the pump. Depending on the operating conditions, the flexible tubing needs to be checked and, if necessary, changed every three to six months.

Note	The service interval of the EC30C can be set according to the required maintenance interval of the peristaltic pump. You can find the details about setting the service interval on page 36 chapter '7.9.1 Parameter settings' .

Before starting any maintenance work, please make sure that any work done on the device is in compliance with all relevant regulations and standards.

Note	Please find details to spare parts for the SR25.2 peristaltic pump on page 70 chapter '12.3 Spare parts and consumables' .

10.1.1 Changing the pump tubing

WARNING	Aggressive condensate possible! Media residues in tubing! Chemical burns caused by aggressive media possible! Wear protective clothing and glasses!

Note	When sending the peristaltic pump to M&C customer service for repair, please indicate the type of medium pumped. Before shipping the pump, please remove hazardous or aggressive contaminations from all parts of the pump!

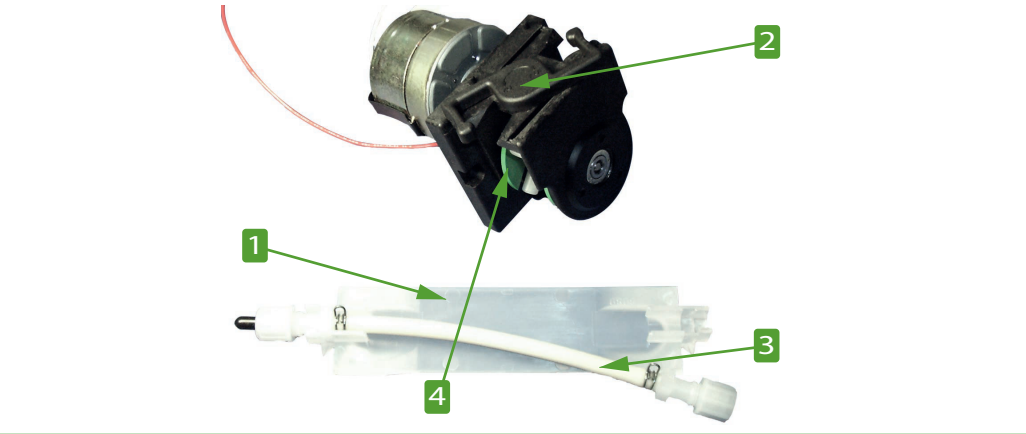


Fig. 39: Changing the pump tubing

1 *conveying belt*
2 *S-bolt*
3 *tubing*
4 *contact pulley*

For changing the pump tubing please proceed as follows:

- Unplug the cooler from the mains voltage. The device needs to be voltage free.
- Open tube connections at the pump; press conveying belt 1 at the recessed grips and turn S-bolt 2 clockwise up to limit stop;
- Remove conveying belt 1 and pull the old tubing 3 at the tube bushings out of the guides;
- Press the two contact pulleys 4 and check whether the spring pressure is still sufficient, if not, the contact springs have to be changed (see chapter 7.4.1 on page 20).
- Put the new tubing 3 with the tube bushing into the guides of the conveying belt 1 ;

Note	Use only the original M&C spare parts! Only the use of the original tubing set guarantees a perfect operation! Never lubricate tubing! Before mounting the pump, check all parts for contaminations and clean if necessary.

- Put the conveying belt 1 with the new tubing 3 into the dovetail guide of the pump body;
- Press conveying belt at the recessed grips and simultaneously turn the S-bolt 2 anticlockwise until it snaps;
- Switch on the EC30C.

10.1.2 Changing the contact pulley and springs

Note	While mounting, make sure that the center of rotation and the driver are aligned. Use genuine spare parts only!

Follow these instructions to change the contact pulley and springs:

- Disconnect the cooler from the power supply.
- Unscrew the nut of the pump head (wrench size 5.5).
- Remove the pump head from the motor shaft. Now the driver can be removed from the pump head and is ready for maintenance.
- The removal of the springs (4 pcs.) away from the driver is possible without any tools. Therefore press together the spring and pull it out of the groove in the driver, respectively out of the boring of the roll shaft. Now the roll shaft can be dismounted and the contact pulleys can be replaced.
- Assemble the pump in reversed order.

10.1.3 Cleaning the pump head

WARNING	Aggressive condensate possible! Media residues in tubing! Chemical burns caused by aggressive media possible! Wear protective clothing and glasses!

We recommend to clean the parts with a dry cloth. Solvent should not be used, because it can damage the plastics and synthetic rubber parts. Use oil-free compressed air to clean the parts if available.

10.2 Changing the heat exchanger

Removal of the heat exchangers may be necessary to carry out any maintenance or repair work. The PCU heat exchanger can be disassembled without switching off the cooler.

The DCU 1 and DCU 2 heat exchangers need to be defrosted before disassembly. At operation temperatures of -30 °C [-22 °F] the deep-freezer heat exchangers can not be disassembled because of freezing. Only after a defrost period of about one hour, the DCU heat exchangers can be removed.

We recommend the following procedure to replace the heat exchangers:

- Purge the heat exchanger to remove any possible residue of aggressive media.
- Release the upper gas connections and lower condensate connections by turning the green GL-connectors to the left.
- Pull the heat exchanger upwards and slightly rotate it out of the cooling block.
- Dry and clean the opening of the aluminum cooling block with a cloth.
- Apply a thin and equal layer of thermal conductivity paste over the whole surface of the heat exchanger to ensure good conduction of heat.
- Lightly push and slightly rotate the heat exchanger back into the opening of the cooling block and press it to the upper block.
- Remove any surplus thermal conductivity paste.
- Reconnect the tubing following the instruction in chapter 8.4 on page 44 or chapter 8.5 on page 46.

Note Do not use force to remove frozen DCU heat exchangers! Glass heat exchangers might break!

Note Do not mix up DCU and PCU heat exchangers!

Note Do not mix up tubing!
The outlet tube of the DCU 1 has a red mark.

Special instruction for Duran glass heat exchanger assembly:

- Check the PTFE/Silicon locking rings for damage. In assembly, the locking rings must have the PTFE side facing the medium, otherwise the required degree of sealing cannot be guaranteed!
- Fasten the green GL-connection hand-tight by turning them to the right.

10.3 Changing the 0-20 V-Module

DANGER

Dangerous voltage!
Risk of death by electric shock!
Do not open the device!
Disconnect power supply before opening the device for access.
Make sure that all external power supplies, including all alarm and control circuits, are disconnected.

If the self-test during start-up of the EC30C fails and the fourth icon shown on the screen is a 'Test failed'-icon, or if an alarm signal with the codes 14 or 24 is issued during operation, the 0-20 V-Module has to be changed. If a warning message with the codes 13 or 23 is shown, changing the module is not yet necessary, but recommended, to avoid break-down of the unit.

Follow these steps to change the 0-20 V-Module:

- Disconnect the cooler from the power supply.
- Unscrew and open the front panel, but keep it hinged to the rail at the bottom plate.
- Disconnect the electrical connectors X12, X13, X16, X17 and X18.
- Unscrew the electronics cover from the front panel and remove it.
- Carefully unplug the connector between main board and 0-20 V-Module electronics.
- Open the two screws which are holding the 0-20 V-Module. Replace the module.
- Carefully plug in the connector between main board and the 0-20 V-Module electronics.
- Fasten the electronics cover back to the front panel again.
- Connect the plugs X12, X13, X16, X17 and X18 again.
- Close and secure the front panel.
- Turn on the device and check the result.

10.4 Changing the buffer battery

The EC30C uses a type CR2032 buffer battery. To change the buffer battery please carry out the steps indicated below:

- Disconnect the EC30C from the power supply.
- Unscrew and open the front panel, but keep it hinged to the rail at the bottom plate.
- Unplug the connectors X12, X13.
- Unscrew the electronics cover from the front panel and remove it.
- Now you can change the battery.
- Fasten the electronics cover back to the front panel.
- Plug in the connectors X12, X13.
- Close and secure the front panel.
- Turn on the unit.
- Set date and time.

10.5 Checking the temperature sensors

All temperature sensors of the PCU, DCU 1 and DCU 2 are PT100 sensors.

The diagram below shows the resistance - temperature characteristics of the temperature sensor PT100.

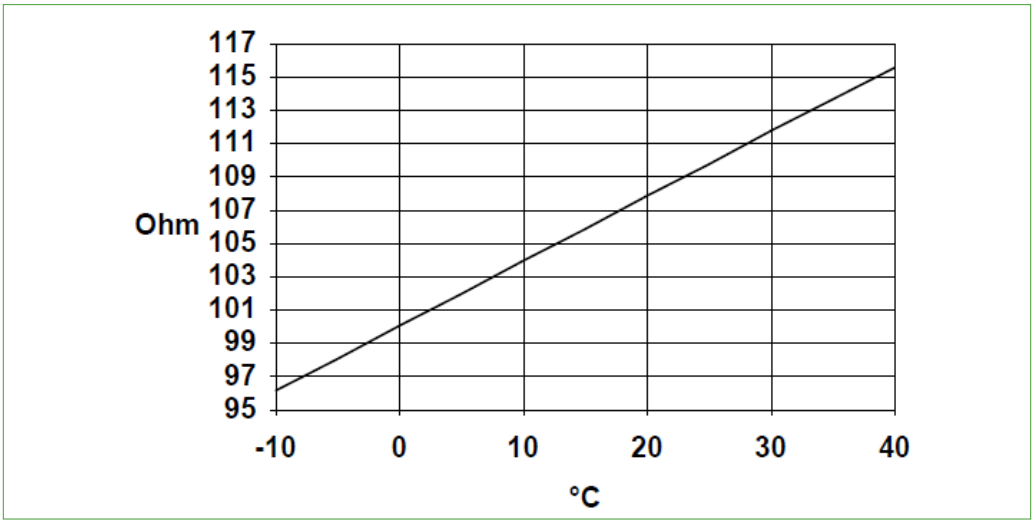


Fig. 40: Resistor - temperature characteristic of the PT100

If there are any problems during temperature measurements, please follow these steps to check the PT100:

- Disconnect the unit from the power supply.
- Unscrew and open the front panel, but keep it hinged to the rail at the bottom plate.
- Unscrew the faulty temperature sensor.
- When the EC30C has been in operating mode before, please wait until the temperature of the PT100 has adapted to the ambient temperature.
- Check the resistance of the PT100 with an ohmmeter.

Compare the measured value with the value of the resistance at ambient temperature shown in the resistance- temperature diagram. If the measured value corresponds to the diagram value with good approximation the PT100 is in working conditions. A large deviation means either that the temperature of the sensor is not yet adapted to the ambient temperature or that it is defective.

10.6 Changing the compressor unit

The compressor unit is connected to the electrical connections shown in Fig. 37 on page 50. The following figure shows the electrical connections of the compressor.

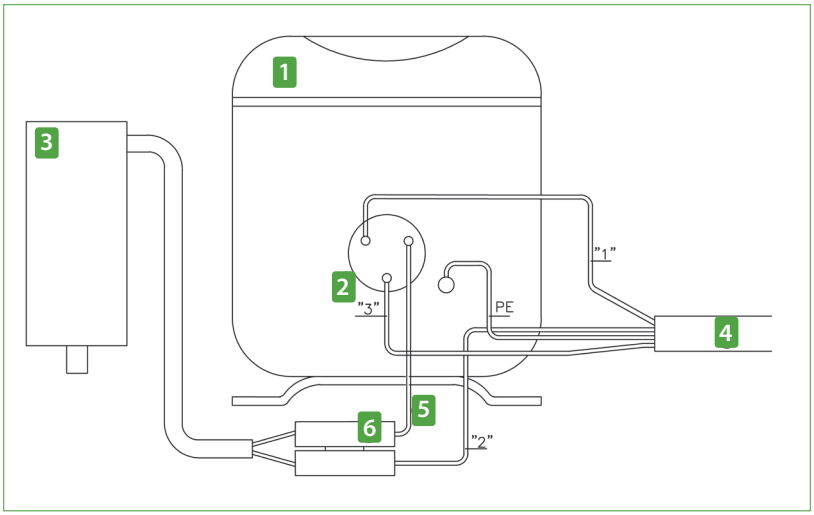


Fig. 41: Compressor: electrical connections

1 *Compressor*
2 *Terminal area inside the compressor terminal box*
3 *Starting capacitor of the compressor*
4 *Controller cable from the main electronics*
5 *Connection wires*
6 *Flat connector*

The four wires of the compressor unit are marked with the numbers '1', '2', '3' and the letter combination PE. These characters are printed on the power supply board belonging to terminal X35. Connect the wires to the corresponding numbers and letters.

ATTENTION	Connect wires in the correct order! Make sure to pay attention to the order of the printed numbers and letters!

11 Decommissioning

WARNING	Aggressive condensate possible! Media residues in tubing! Chemical burns caused by aggressive media possible! Wear protective clothing and glasses!

ATTENTION	Damages of the downstream analyzing units possible! Turn off up- or downstream sample gas pumps before decommissioning!

When the EC30C is out of operation, one of the gas lines through the deep-cooler will always remain open. If a sample gas pump is in-line before or after the EC30C, downstream analyzing units can be damaged.

Turn off the sample gas pump before decommissioning the EC30C.

It is recommended to connect the status contact output with an external sample gas pump or a solenoid valve in the gas line. In case of an alarm message this can protect the whole analyzing system by immediate interruption of the gas supply.

The alarm relay of the EC30C can be used to interrupt the gas supply either by turning off the sample gas pump or by triggering the shut-off solenoid valve.

Note	Please find further details about the alarm relay on page 51 chapter '8.8.2 Liquid alarm sensor LA (optional)' .

In case of a short-term decommissioning of the cooler no special measures are required.

In case of a long-term decommissioning of the coolers we recommend to purge the cooler with inert gas or air.

Remove residual condensate entirely from the cooler.

12 Appendix

12.1 Overview of the EC30C screens

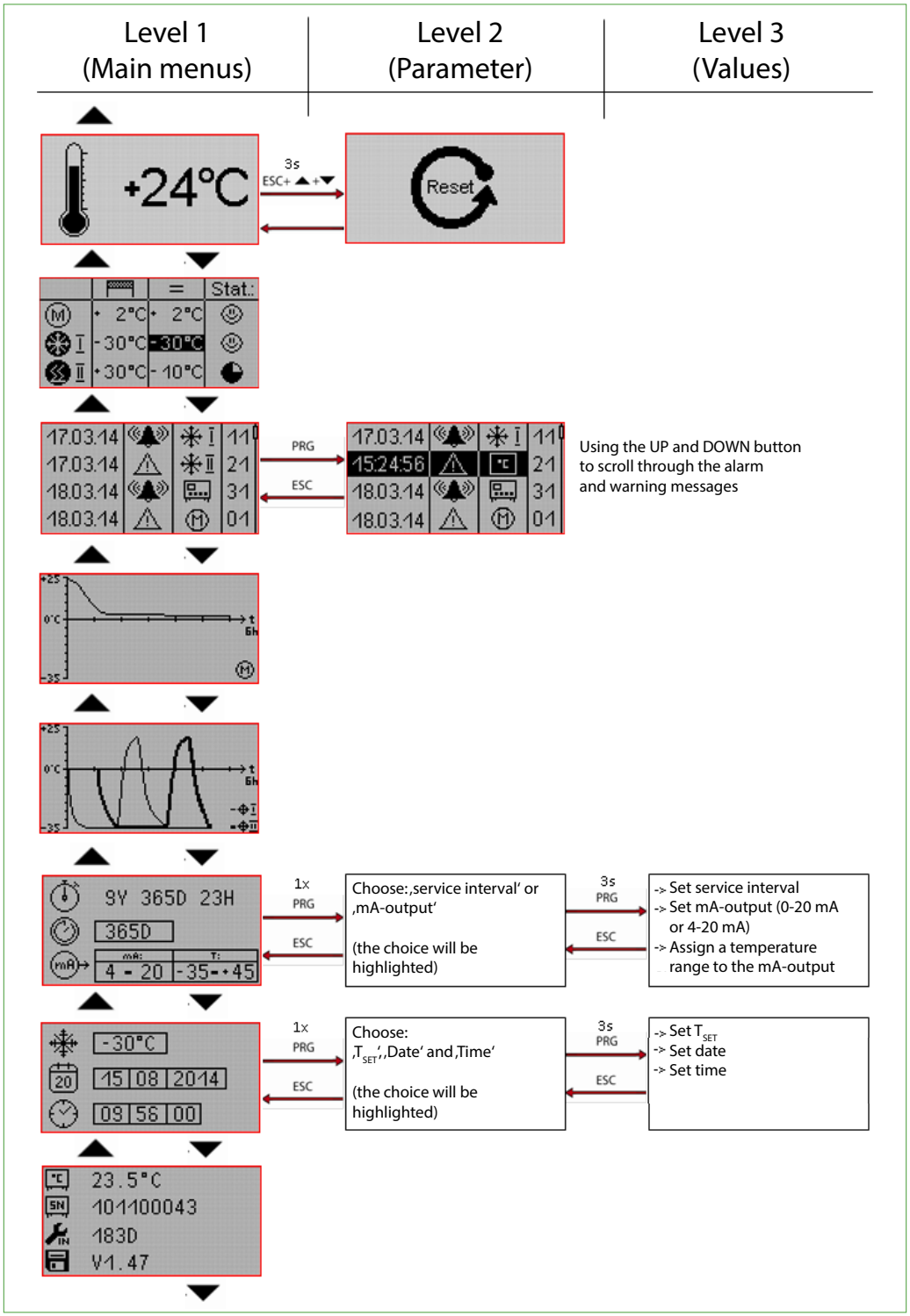


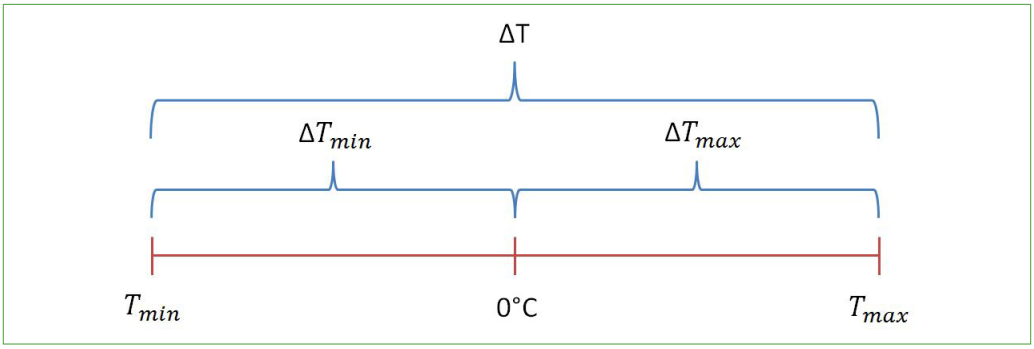
Fig. 42: Overview: screens

12.2 How to configure the mA-output

The mA-output value always corresponds to the temperature of the active deep-cooling unit. That means, that it always represents the current ouptut dew point. T_{min} is the lower temperature limit set in the parameter menu. T_{min} is either assigned to 0 mA or 4 mA. T_{max} is the upper temperature limit and is assigned to 20 mA.

By changing the temperature limits, the user can adapt the mA signal to the required temperature range ΔT. This way the resolution of the signal can be influenced.

Depending on the temperature limits set by the user, either ΔT_{min} or ΔT_{max} needs to be determent first.



12.2.1 How to calculate temperature based on measured mA-value

The temperature of the deep-cooling unit can be determent by using the measured mA-output values. To calculate the temperature, please use the following formulas:

For $T_{min} \leq 0$ °C [32 °F]:

$$T_{display} = \left(\frac{(I_{mes} - I_{offset}) * \Delta T}{\Delta I}\right) - \Delta T_{min}$$

For $T_{min} > 0$ °C [32 °F]:

$$T_{display} = \left(\frac{(I_{mes} - I_{offset}) * \Delta T}{\Delta I}\right) + \Delta T_{min}$$

With the following values for I_{offset} and ΔI:

$$I_{offset} = \begin{cases} 0\,mA, \text{when } 0-20\,mA \\ 4\,mA, \text{when } 4-20\,mA \end{cases}$$

$$\Delta I = \begin{cases} 20\,mA, \text{when } 0-20\,mA \\ 16\,mA, \text{when } 4-20\,mA \end{cases}$$

12.2.2 How to calculate mA-value based on measured temperature

Based on the displayed deep-cooling temperature, the value of the mA-output can be determent. For this calculation you can use the following formulas:

For $T_{min} \leq 0$ °C [32 °F]:

$$I_{mes} = \left(\frac{(T_{display} + \Delta T_{min}) * \Delta I}{\Delta T}\right) + I_{offset}$$

For $T_{min} > 0$ °C [32 °F]:

$$I_{mes} = \left(\frac{(T_{display} - \Delta T_{min} * \Delta I}{\Delta T}\right) + I_{offset}$$

With the following values for I_{offset} and ΔI:

$$I_{offset} = \begin{cases} 0\ mA, \text{when } 0-20\ mA \\ 4\ mA, \text{when } 4-20\ mA \end{cases}$$

$$\Delta I = \begin{cases} 20\ mA, \text{when } 0-20\ mA \\ 16\ mA, \text{when } 4-20\ mA \end{cases}$$

- Increments and resolution of the mA-output

The mA-output with the 0-20 mA setting has 400 increments per range. For the range of 4-20 mA the increments are proportionally reduced to 320.

Depending on the temperature range (see how to set the temperature range on page 34 chapter '7.9 Parameter menu'), the resolution or accuracy of the mA-output can be calculated as follows:

$(T_{max} - T_{min}) / 400$ for 0-20 mA

or:

$(T_{max} - T_{min}) / 320$ for 4-20 mA

Example:

Set: 4-20 mA for -30 to +30 °C [-22 to 86 °F]

The resolution of the mA-output is:

[30 °C - (-30 °C)] / 320 = 0.1875 °C [0.34 °F]

12.3 Spare parts and consumables

The replacement interval for spare parts and consumables depends on the specific operating condition of the analyzer. The quantities recommended in the following table are based on experience. Your replacement intervals will be based on your operating conditions.

The product label with the serial number is located on the back of the EC30C.

Type and name of the product

(C) Consumables
(R) recommended spare parts
(S) spare parts

recommended amount based on number of years of operation [years]

Part-No.	Name	C/R/S	1	2	3
90K6215	0-20 V Module	R	-	-	-
90K6210	Main electronics (Var 1)	R	-	-	-
90K6200	Power supply electronics (Var 1)	R	-	-	-
90K6205	Rectifier electronics (Var 1)	R	-	-	-
90K6220	Main adapter	R	-	-	-
EE02710005	Rectifier capacitor	R	-	-	-
90K6265	Converter	R	-	-	-
90K6225	Fuse set* EC30C 230 V	R	-	-	-
90K6225a	Fuse set* EC30C 115 V	R	-	-	-
90K6080	Temperature sensor pre-cooling unit PCU	R	-	-	-
90K6080	Temperature sensor deep-cooling unit DCU	R	-	-	-
93K0047	Peltier element	R	-	-	-
90K6245	O-ring set** Silicone EC30C	R	-	-	-
90K1014	Cooling aggregate 230 V	R	-	-	-
90K1014a	Cooling aggregate 115 V	R	-	-	-
90K1055	Starting capacitor: compressor 230 V: 80 µF	R	-	1	1
90K1060	Starting capacitor: compressor 115 V: 160 µF	R	-	1	1
90K6001	Heat exchanger glass DCU	R	1	1	1
02K9105	Heat exchanger glass PCU	R	1	1	1
90K6003	Heat exchanger PVDF DCU	R	1	1	1
02K9300	Heat exchanger PVDF PCU	R	1	1	1
90K0115	Heat conductivity paste (50 g)***				
90K6040	Solenoid valve 230 V	R	-	-	-
90K6044	Solenoid valve 115 V	R	-	-	-
90K0042	Fan 230 V	R	-	-	-
90K0042a	Fan 115 V	R	-	-	-
EZ0024	Display controller TCU	R	-	-	-
91B8600	Key-pad	R	-	-	-

Type and name of the product					
(C) Consumables (R) recommended spare parts (S) spare parts			recommended amount based on number of years of operation [years]		
Part-No.	**Name**	**C/R/S**	**1**	**2**	**3**
90P1007	SR25.2: Tubing set with PVDF-tube connectors 4/6mm, standard	C	1	2	4
90P1020	SR25.2: Driver, complete	S	-	1	1
90P1050	SR25.2: Conveying belt	S	-	1	2
90P1045	SR25.2: Contact pulley SR25 PVDF for driver	S	2	4	4
90P1010	SR25.2: 1 set (4 pcs) contact springs SR25 for driver	R	1	2	2

* Fuse set EC30C includes fuses for main, power supply and rectifier electronics.

** The O-ring set Silicone EC30C for the deep-cooling units DCU 1 and DCU 2 includes 2 x Ø 60 mm and 3 x Ø 16 mm O-rings. If you disassemble a deep-cooling unit, you always have to replace all five O-rings.

*** Each heat exchanger delivery includes 5 g [≈ 0.011 lb] heat conductivity paste. You will need additional heat conducting paste, if you insert the heat exchanger after cleaning.

12.4 Additional Information

More information about the EC30C can be found on our website:

www.mc-techgroup.com

12.5 Declaration of conformity

CE - Certification

The EC30C complies with the following EU directives:

EMC directives

The EC30C complies with the EC directive 2014/30/EU 'Electromagnetic compatibility'.

Low Voltage Directive

The EC30C meets the requirements of the Low Voltage Directive 2014/35/EU.

To ensure the compliance with this EC directive, the EC30C conforms to the DIN EN 61010 standard.

Declaration of conformity

The EU Declaration of conformity can be downloaded from the M&C website or directly requested from M&C.

12.6 Certificates

Certificates are available on our website:

www.mc-techgroup.com

12.7 Warranty

In case of a device failure, please contact M&C immediately or your authorized M&C distributor.

We have a warranty period of 12 months from the delivery date. The warranty covers only appropriately used products and does not cover the consumable parts. Please find the complete warranty conditions in our terms and conditions.

The warranty includes a free-of-charge repair at a M&C facility or the free replacement of the device. If you return a device to M&C, please be sure that it is properly packaged and shipped with protective packaging. The repaired or replaced device will be shipped free of delivery charges to the point of use.

For more information about shipping and handling of returned devices, please see on page 73 chapter '12.10 Shipping and handling' .

12.8 Liability and disclaimer

This instruction manual is an original M&C document. It does not claim to be complete and it may be subject to technical modifications. We are not responsible for any printing errors or errors in the content of the manual. Please be assured that precautions have been taken to prevent errors in our product documentation to provide you with the best possible and accurate information.

Liabilities for indirect and direct damages that are related to the delivery or the usage of this instruction manual are excluded.

We are not liable for the content of translations from sources which are not authorized by M&C.

Copy of this document or of its content is not allowed without explicit approval of M&C.

With the release of this version all older instruction manual versions will no longer be valid.

12.9 Storage

If you plan to store your M&C product before installing and operating, please follow these storage recommendations. Make sure that the device is stored in a protected, dry and well ventilated area. Please cover the device with an appropriate cover to protect it from dirt and liquids.

If you have any questions about proper storage of your M&C products, please feel free to contact us.

12.10 Shipping and handling

If you need to ship your M&C product to another department inside your company or back to M&C, please follow these shipping and handling recommendations.

Please ship the device in its original packaging. This is the best way to protect the device. If the original packaging is not available any more, please use a sturdy cardboard box with enough packaging material to protect the device from damages during shipping.

If you send your M&C product in for maintenance work at our M&C facility, please send the properly packaged device to the M&C TechGroup address in the USA or Germany as needed.

12.11 Proper disposal of the device

At the end of the life cycle of our products, it is important to take care of the appropriate disposal of obsolete electrical and non-electrical devices. To help protect our environment, please follow the rules and regulations of your country regarding recycling and waste management.

13 About us

13.1 M&C's group of companies

The M&C group of companies with its German headquarter and world wide market activities, has earned the reputation as one of the well-known and strongest partners in the market.

Our company, our products, special systems and overall services are well established in the market. We continuously belong to the best of the best of our industry. This makes us very proud. Our core competences are to find qualified solutions for even the most complex and demanding measuring tasks. We are developing answers to solve the technical demands of the future. With our focus on premium services, we are reliable, innovative and an overall cost effective market partner worldwide.

To learn more about M&C, please visit our website:

www.mc-techgroup.com

For even quicker access, please use our QR-code:

13.2 The quality-oriented M&C catalog

M&C offers national and international services, project planning and construction of special systems with a wide range of products. Our catalog covers a large variety of high quality products with in-depth knowledge of various customer applications. Our product excellence and innovative solutions continues to make M&C a world class company.

You can find the following product groups in our catalog. The combination of products from these groups offers a complete solution for most industrial needs. We develop, manufacture and test our products in accordance with a wide range of national and international standards.

Probes

Comprehensive range of probes with a large spectrum of available options for an almost unlimited range of applications.
Different materials available (Hastelloy, Titan, PTFE etc.)

Cooler

Optimised gas and condensate separation, low maintenance and self monitoring.
Compact design for wall mounting or 19" rack.

Filter

Suitable for all processes, due to the modular and user-specific configuration possibilities of the filter components.
Filter enclosures available in glass, stainless steel, PVDF, PTFE or in different metal combinations.

Portable components

Developed for high quality gas analysis at different locations.

Compact systems

Compact standard systems designed for a 19" enclosure or a plate structure.

Oxygen analyzer

A broad variety of products with high measuring accuracy.
Direct measuring is based on paramagnetic measuring principle (dumbbell-type).

13.3 Technical consulting services

M&C has earned a reputation as one of the most capable and experienced companies in the world, especially when it comes to difficult or complex measurement projects. We are proud that our customers have confidence in our products and continue to experience repeat business.

We also offer technical consulting for our components, devices and complete systems. We support our customers in finding individual solutions for their specific measuring tasks.

These individual solutions lead to new concepts of designing and building custom-made devices or complete systems. The dedication and commitment to finding solutions to the most complex and challenging tasks for our customers sets us apart from our competitors.

We have custom-made application experiences in many different fields worldwide. With this experience we are able to support our customers by seeking and finding errors, trouble shooting during day-to-day operation or identifying hard to find interferences.

13.3.1 Ideas, suggestions and feedback

All our activities are designed to meet and exceed the demands of the market and the specific interests of our customers. That's why M&C is very interested in developing products, processes and services which are in demand and up to date.

This means that your feedback, ideas and suggestions are very important to us.

Please let us know what kind of new improvements and innovations you would like to see at M&C. Tell us, what you like about M&C and what needs improvement.

Please send us an email or feel free to just call us ...

We appreciate your comment.

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Your M&C contacts world-wide

A detailed overview of our worldwide contacts can be found here:

http://www.mc-techgroup.com/en/contact