Embracing Challenge

Electric Gas Cooler Series ECP®

ECPX000C

Instruction Manual
Version 1.02.01
Software Version 1.0

Dear customer,

Thank you for buying our product. In this manual you will find all necessary information about this M&C product. The information in the manual is fast and easy to find, so you can start using your M&C product right after you have read the manual.

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. You will find all the addresses in the appendix of this instruction manual.

For additional information about our products, please go to M&C's website www.mc-techgroup.com. There you can find the data sheets and manuals of our products in German and English.

With the release of this version all older manual versions will no longer be valid. The German instruction manual is the original instruction manual. In case of arbitration only the German wording shall be valid and binding.

ECP® is a registered trade mark.

Version: 1.02.01
Software version: 1.0

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1 General Information

The product described in this instruction manual has been built and tested in our production facility.

All M&C products are packed to be shipped safely. To ensure the safe operation and to maintain the safe condition, all instructions and regulations stated in this instruction 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.

Follow all instructions and warnings closely.

Read this 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 your M&C authorized distributor.

2 Declaration of Conformity

CE - Certification

The product described in this operating manual complies with the following EU directives:

EMC-Instruction

The requirements of the EU directive 2014/30/EU "Electromagnetic compatibility" are met.

Low Voltage Directive

The requirement of the EU directive 2014/35/EU "Low Voltage Directive" are met.
The compliance with this EU directive has been examined according to DIN EN 61010.

Declaration of conformity

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

3 Safety Instructions

Follow these basic safety procedures when mounting, starting up or operating this equipment:

- Read this operating manual before starting up and use of the equipment. The information and warnings given in this operating manual must be heeded.
- Any work on electrical equipment is only to be carried out by trained specialists as per the regulations currently in force.
- 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.
- For start-up, the mains plug must be connected first. The mains plug connects the device to ground.
- For decommissioning and maintenance, first disconnect the alarm relay plug from the mains. Disconnect the mains plug last. The mains plug grounds the device until it is disconnected from the mains.
- Check the details on the type plate to ensure that the equipment is connected to the correct mains voltage.
- Protection against touching dangerously high electrical voltages:
- Before opening the equipment, it must be switched off and hold no voltages. This also applies to any external control circuits that are connected.
- The device is only to be used within the permitted range of temperatures and pressures.
- Check that the location is weather-protected. It should not be subject to either direct rain, sun or moisture.
- Do not use the device in hazardous areas.
- Installation, maintenance, inspections and any repairs of the devices must be carried out only by qualified skilled personnel in compliance with the current regulations.

3.1 Intended Use

The ECPX000C gas cooler is intended for use in general purpose areas (non-hazardous environments). It may only be operated in compliance with the information in chapter "8 Technical Data". Only use the device within the permitted temperature and pressure ranges.

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.

4 Warranty

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

5 Used Terms and Signal Indications

Danger

The 'Danger' warning sign indicates that death, serious injury and/or significant material damage will be the consequence, if the appropriate precautions should not be taken.

Warning

The 'Warning' warning sign indicates that death, serious injury or damage to property may occur if the relevant precautionary measures are not observed.

Caution

The 'Caution' warning sign indicates that slight personal injury can occur if the appropriate safety precautions are not observed.

Caution

'Caution' indicates that damage to property can occur if the appropriate safety precautions are not observed.

Note

'Note' indicates important information relating to the product or highlights parts of the documentation for special attention.

Qualified personnel

'Qualified personnel' are experts who are familiar with the installation, mounting, commissioning and operation of these types of products.

Electrical voltage!
Danger to life due to electric shock!
Keep a safe distance and avoid contact with the electrical system. It is MANDATORY to take suitable measures to reduce the risk and for personal protection.

Toxic!
Danger to life if swallowed, in contact with skin or inhaled!
Do not swallow toxic substances, avoid skin contact and do not inhale toxic vapors. It is MANDATORY to take appropriate measures to reduce the risk and for personal protection.

Corrosive!
Risk of severe skin burns and serious eye damage! Living tissue and many materials are destroyed on contact with this chemical.
Do not inhale vapors and avoid contact with skin, eyes and clothing!
It is MANDATORY to take appropriate measures to reduce the risk and for personal protection.

Container contains gas under pressure!
Risk of the container bursting! Risk of injury from flying objects!
Check the pressure of the container and adjust to atmospheric pressure.
Only open containers carrying atmospheric pressure. Use personal protective equipment (PPE).

Hot surface!
Risk of burns from touching the surface!
Do not touch the surfaces which are marked with this warning sign. Allow the surfaces to cool down after operation. Use personal protective equipment (PPE).

Rotating parts in the device! Risk of being crushed!
Rotating parts cause crushing injuries to hands or other extremities.
Switch off the power supply and ensure that the part is no longer rotating.
Use personal protective equipment (PPE).

Use protective gloves!
Risk of injury from corrosive, hot or sharp objects!
Use adequate hand protection when working with chemicals, sharp objects or extreme temperatures.

Wear safety goggles!
Risk of injury to the eyes from splashes or flying particles!
Use suitable safety goggles.

Wear protective clothing!
Risk of injury from corrosive, hot or sharp objects!
Wear adequate protective clothing when working with chemicals, sharp objects or extreme temperatures.

Use safety shoes!
Risk of injury from falling objects, slippery floors or sharp objects on the floor!
Wear safety shoes with a suitable safety class.

Use head protection and full safety goggles!
Risk of injury from falling objects and splashes or flying particles from all directions.
Wear a helmet and full safety goggles when working with heavy equipment and where there is a risk to the eyes from splashes or flying particles from all directions.

6 Application

The Peltier gas sample cooler type **ECPX000C** is used in analyzer sample system design to reduce the dew point of wet gases to a level that is stable and low. Sample gas cooling prevents subsequent condensation in the analyzer. The stability of the dew point is also extremely important at it helps to prevent water vapour cross sensitivity and volumetric error, especially in infrared analyzers.

The sample gas passes through a sampling probe to the type **ECPX000C** cooler where it is lowered to a dew point of +5 °C [41 °F]. Solids will have been trapped in the filter of the sample probe, (If provided in the type used) or are trapped in a downstream fine filter with optional liquid alarm sensor type LA1 or LA1S (evaluation of the sensor is integrated in the ECPX000C). The conditioned gas can now be passed to the analyzer.

If the downstream analyzer does not have gas quantity control/display, this must be done by an external device.

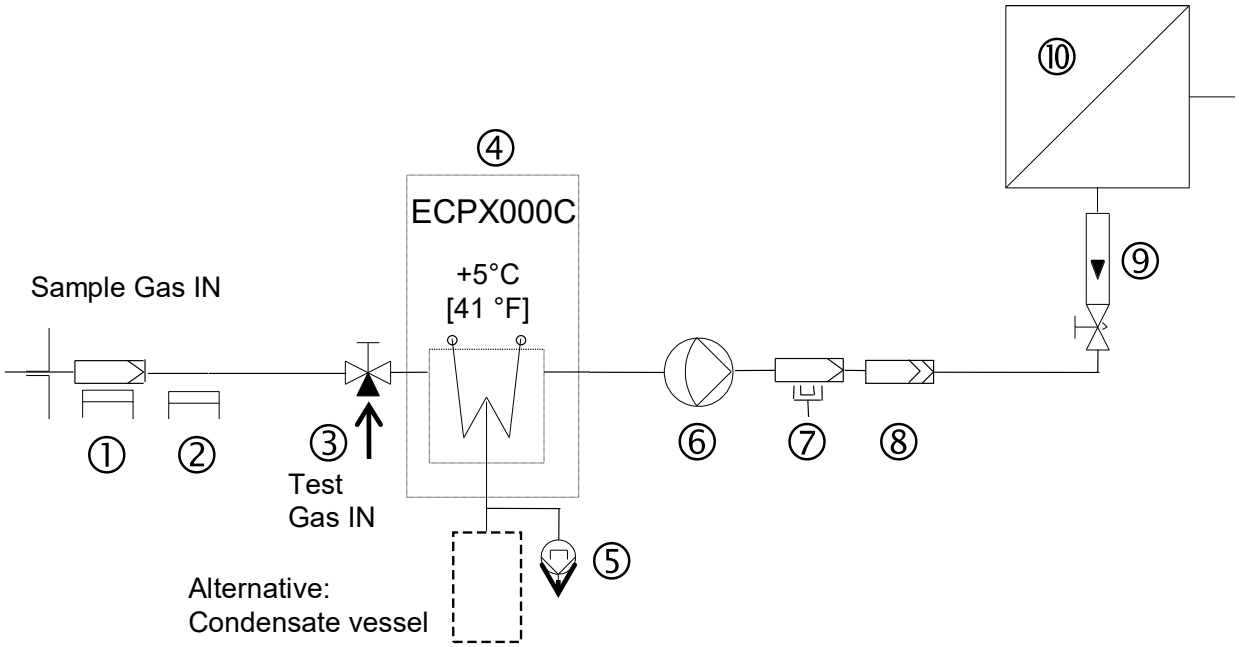
When feeding pressure-less gases, an external gas pump must be installed.

The condensate is discharged externally. For operations under pressure, an automatic condensate drain or collection vessel is used. For operations in partial vacuum (suction), a condensate vessel with a manual drain or a peristaltic pump for automatic condensate removal is used.

Note

For protection against liquid breakthrough and to increase the dependability of the complete system we recommend the use of a liquid alarm sensor type LA1 or LA1S. The evaluation of the M&C liquid alarm sensor is integrated in the ECPX000C.

The following figure shows the flow diagram of a typical application of the electric gas cooler **ECPX000C**.



① Gas sample probe SP…
② heated sample line
③ 3-way ball valve
④ Gas cooler ECPX000C
⑤ Peristaltic pump (option)
⑥ Diaphragm pump
⑦ Universal filter FP.. with LA1S (option)
⑧ Liquid particles filter CLF..
⑨ Flowmeter FM..
⑩ Analyzer

Figure 1 Application example ECPX000C

7 Function of the M&C Jet-Stream Heat Exchanger

The coolers **ECP1000C/2000C/3000C** with special design for analysis technique are prepared for maximum flow rates of 350 Nl/h.

The Jet-Stream heat exchangers made of Duran® glass, optional PVDF or stainless steel are located in a heat insulated cooling block. All the heat exchangers are easily accessible and are arranged in such a way that they can be removed very easily. Figure 2 shows a schematic diagram of the heat exchanger function.

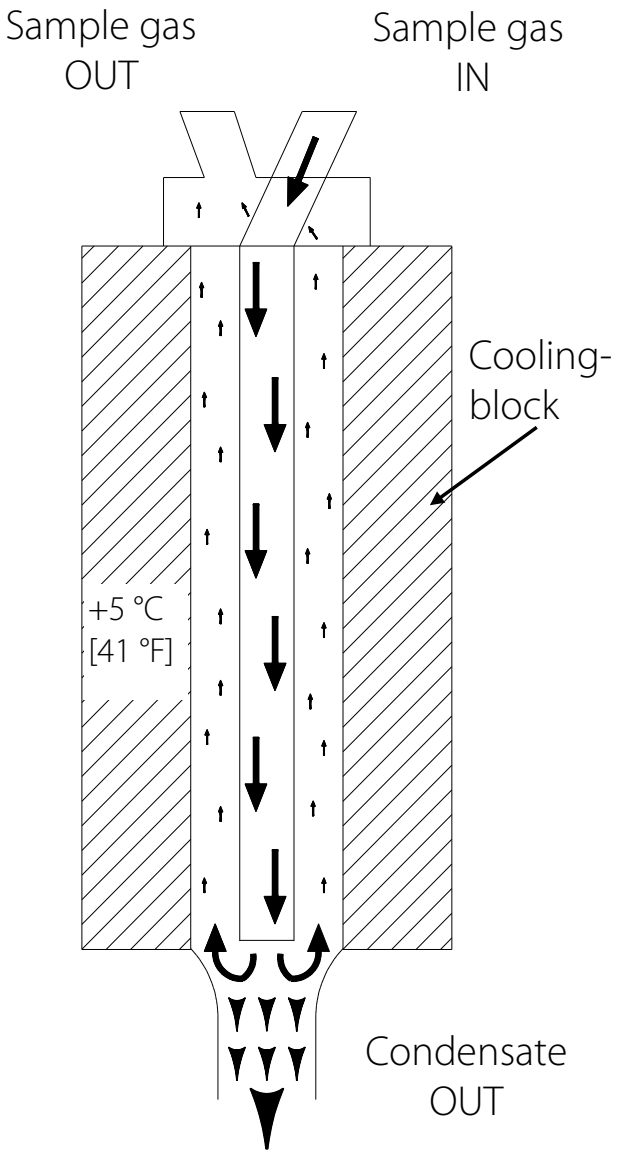


Figure 2 Diagram of the heat exchanger function

8 Technical Data

Electro Gas Cooler Version	ECP1000C	ECP2000C	ECP3000C
Part-No. without heat exchangers	01K1400x	01K2400x	01K3400x
Number of possible heat exchangers	1	2	1
Gas flow rate per heat exchanger	150 Nl/h*	2 x 150 Nl/h*	350 Nl/h*
Ambient temperature	+5 to +50 °C [41 to 122 °F]		
Storage temperature	-20 to +60 °C [-4 to 140 °F]		
Sample outlet dew point	Range of adjustment: +2 to 15 °C [35.6 to 59 °F], factory setting: +5 °C [41 °F]		
Sample outlet dew point stability	At const. conditions: ±0.1 °C [±0.18 °F]		
Sample inlet temperature	Max. 180 °C* [356 °F*]		
Sample inlet water vapor saturation	Max. 80 °C* [176 °F*]		
Total cooling power at +25 °C [77 °F] ambient temperature	110 kJ/h	2 x 90 kJ/h	110 kJ/h
ΔP per heat exchanger at	1 mbar at 150 Nl/h	1 mbar at 150 Nl/h	5 mbar at 350 Nl/h
Stagnant space per heat exchanger	50 ml	2 x 50 ml	100 ml
Power consumption	150 VA	275 VA	150 VA
Power supply	115 to 230 V ±10 %, 50/60 Hz		
Ready for use	< 3 min. (at 25 °C [77 °F] ambient temperature, no load applied)		
Max. loudness	58 dBA		
Electrical connection	Power: Pluggable via solenoid valve plug type A Alarm relay: Pluggable via solenoid valve plug type C mA: When purchasing the mA option, pluggable via Phoenix circular connector		
Signal input and output	One potential-free mA output per channel possible (max. burden 500 Ω, no shielding required) One M&C LA liquid alarm sensor type LA1 or LA1S can be connected per channel. The evaluation is integrated as standard.		
Status alarm: 2 changeover contacts	Max.: 250 V AC, 2 A, 500 VA Max.: 24 V DC, 2 A, 50 W Note: Inductive DC loads (e.g. relays, solenoid valves) may only be connected via flyback diodes.		
Case protection	IP20, EN 60529		
Electrical standard	EN 61010		
EMC standard	EN 61326		
Case colour	RAL 9003 (white)		
Method of mounting	Wall-mount		
Case dimensions (W x H x D)	300 x 200 x 225 mm [11.8" x 7.9" x 8.9"]		
Weight without heat exchangers	6.5 kg [14.3 lb]	8.2 kg [18.1 lb]	6.7 kg [14.8 lb]

* Maximum values in technical data must be rated in consideration of total cooling capacity at 25 °C [77 °F] ambient temperature and an outlet dew point of 5 °C [41 °F].

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.

Electric Gas Cooler type	**ECP1000C/ECP2000C**				
Heat exchanger type	**ECM-2/ ECP(1/2)000C/E CC-1 G, WT**	**ECM-2/ ECP(1/2)000C/ ECC-1 PV, WT**	**ECM-2/ ECP(1/2)000C/E CC-1 SS, WT**	**ECM-2/ ECP(1/2)000C/E CC-1 SS/NPT, WT**	**ECM-2/ ECP(1/2)000C/E CC-1 G/GL14, WT**
Part No.	97K0100	97K0110	97K0115	97K0115NN	97K0101
Heat exchanger material	Duran® glass	PVDF	SS 316Ti	SS 316Ti	Duran® glass
Admissible gas pressure.	Max. 3 bar abs.[1] (2 bar abs.[2])	Max. 3 bar abs. (2 bar abs.[2])	Max. 10 bar abs. (2 bar abs.[2])	Max. 10 bar abs. (2 bar abs.[2])	Max. 3 bar abs.[1] (2 bar abs.[2])
Sample gas connection	GL18 for tube Ø 6 mm OD	Tube Ø 6 mm	Tube Ø 6 mm	1/4" tube	GL 18 for tube Ø 6 mm OD; GL 14 for sensor
Condensate connection	GL 25 for tube Ø 12 mm, Ø 8 mm* or Ø 10 mm*	G 3/8" female	G 3/8" female	3/8" NPT	GL 25 for tube Ø 12 mm, Ø 8 mm* oder Ø 10 mm*

Electric Gas Cooler type	**ECP3000C**			
Heat exchanger type	**ECM-1/ ECP3000(C)/ ECC-1 G, WT**	**ECM-1/ ECP3000(C)/ ECC-1 PV, WT**	**ECM-1/ ECP3000(C)/ ECC-1 SS, WT**	**ECM-1/ ECP3000(C)/ ECC-1 SS/NPT, WT**
Part No.	93K0140	93K0170	93K0160	93K0160N
Heat exchanger material	Duran® glass	PVDF	SS 316Ti	SS 316Ti
Admissible gas pressure	Max. 3 bar abs.[1] (2 bar abs.[2])	Max. 3 bar abs. (2 bar abs.[2])	Max. 10 bar abs. (2 bar abs.[2])	Max. 10 bar abs. (2 bar abs.[2])
Sample gas connection	GL18 for tube Ø 6 mm OD	G 1/4" female	G 1/4" female	1/4" NPT
Condensate connection	GL25 for tube Ø 12 mm, Ø 8 mm* or Ø 10 mm*	G 3/8" female	G 3/8" female	3/8" NPT

* Option
1) With GL adapter
2) With peristaltic pump SR25.2-W

8.1 Dimensions

Figure 3 shows the **ECP2000C** cooler unit.

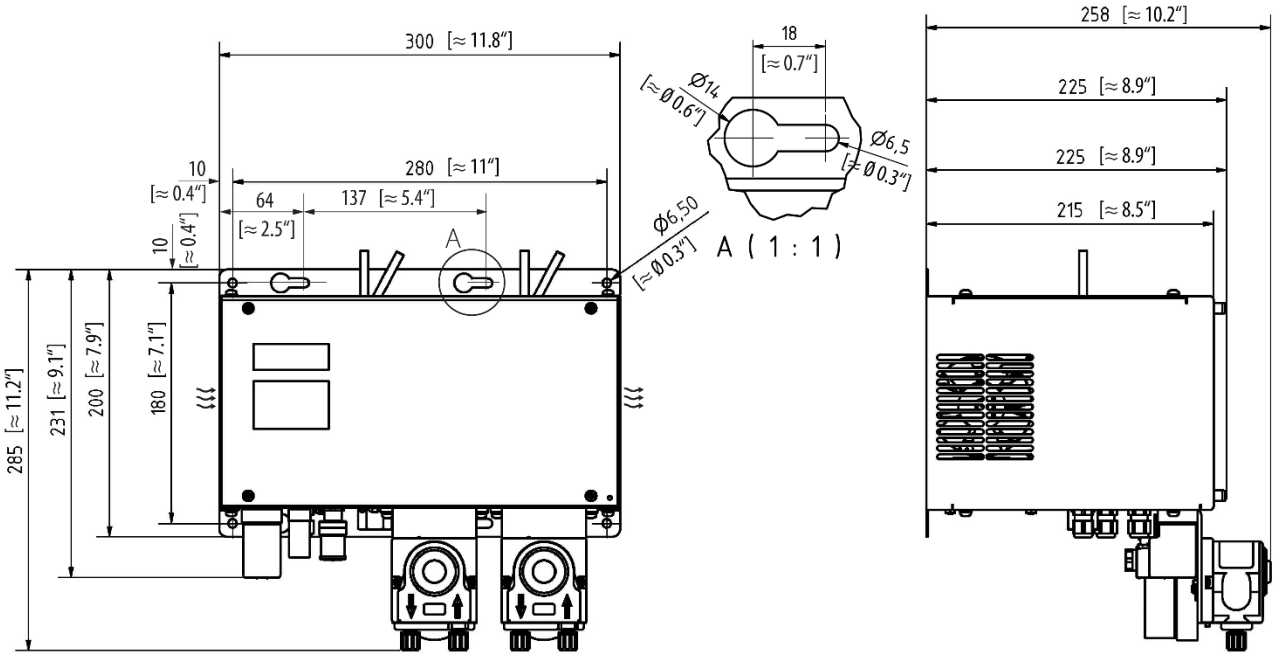


Figure 3 Dimensions

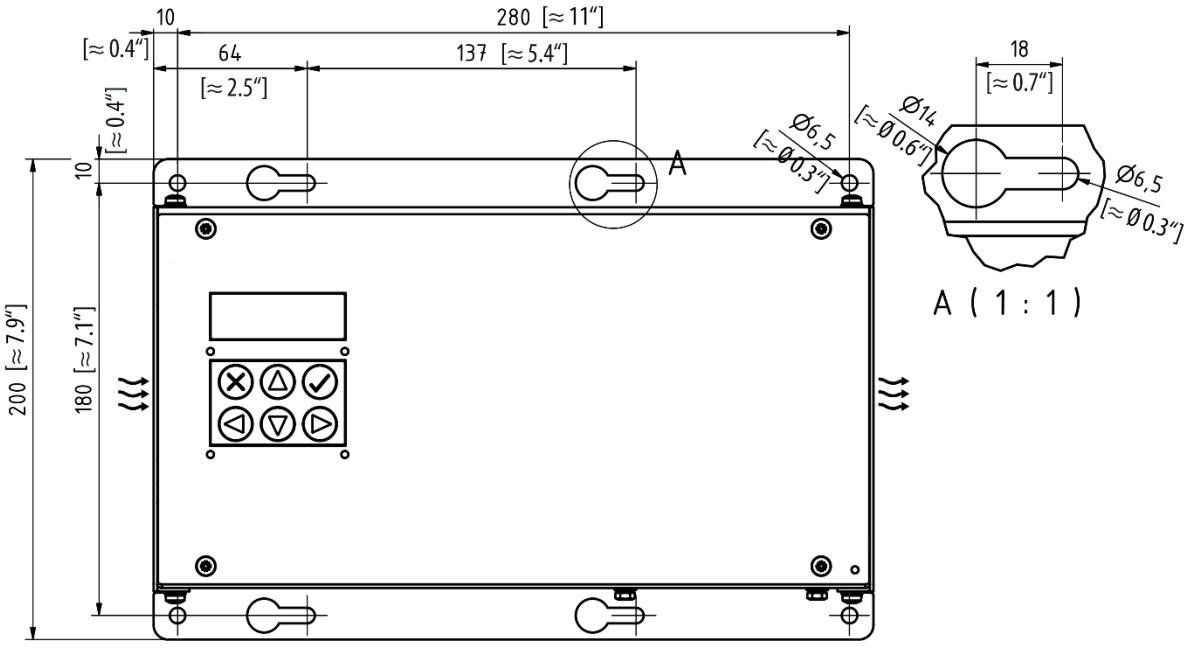


Figure 4 Borehole pattern

9 Description

The gas coolers ECP1000C/2000C/3000C have been specially developed for the analysis technology. All ECPX000C gas coolers are available with Duran® glass, PVDF or stainless steel 316Ti Jet-Stream heat exchangers.

The ECP1000C cools a gas path with a maximum gas flow of 150 Nl/h. The ECP2000C can be equipped with up to two heat exchangers. This makes it possible to cool two gas paths with a maximum volume flow of 2 x 150 Nl/h. The ECP3000C is used for cooling a gas path with a gas flow rate of up to 350 Nl/h max.

The heat exchangers are located in a heat-insulated cooling block and are easily replaceable.

The cooling block is cooled to a constant temperature of +5 °C [41 °F] by an electronically controlled Peltier element.

The excess thermal energy of the cooling system is dissipated via a large cooling fin block which is forced ventilated by a fan.

9.1 Operating Modes and Monitoring Functions

The ECPX000C gas cooler can be operated in two modes. In the first operating mode, the cooler temperature can be set as an absolute value and in the second mode as the differential temperature to the ambient temperature. The display shows the respective operating mode with an “A” for absolute value control and a small “d” for differential temperature control when setting the setpoint.
With the two-channel ECP2000C, both operating modes can be used, i.e. one of the heat exchangers can be controlled to absolute temperature and the other to differential temperature independently of each other.

The cooler has several monitoring functions. In addition to the cooler temperatures, it monitors the fan rotation and optionally connected liquid alarm sensors. Occurring alarm or error messages are shown on the display. The alarm limits can be configured so that the limit values can be adapted to the corresponding application.

9.2 Fan Speed Setting

The ECPX000C is equipped with a large cooling fin block which is forced-ventilated by a fan. The minimum speed of the fan can be changed without affecting the final performance of the cooler. The setting range is between 0 and 5 and level 1 is set by default. At level 0 the fan rotates slower and is quieter. At higher values, the fan rotates faster and the air flow rate is increased.

If the ECPX000C is installed in a cabinet, two fan grilles are recommended: for fresh air on the suction side of the cooler and for exhaust air. It is also recommended to increase the fan speed to level 3.

9.3 Cooling Capacity, Inlet and Outlet Dew Point ECP1000C

The following diagram shows the cooling capacity of the ECP1000C as a function of the ambient temperature. The continuous characteristic curve shows the electrical cooling capacity of the cooler without taking the heat exchanger properties into account.
The thermal conductivity of the heat exchanger materials has a significant influence on how much of the possible cooling capacity can be transferred from the cooler to the sample gas.
The dashed lines represent the characteristic curves of the heat exchangers. The characteristic curves of the heat exchangers require good lubrication, i.e. the best possible heat transfer.

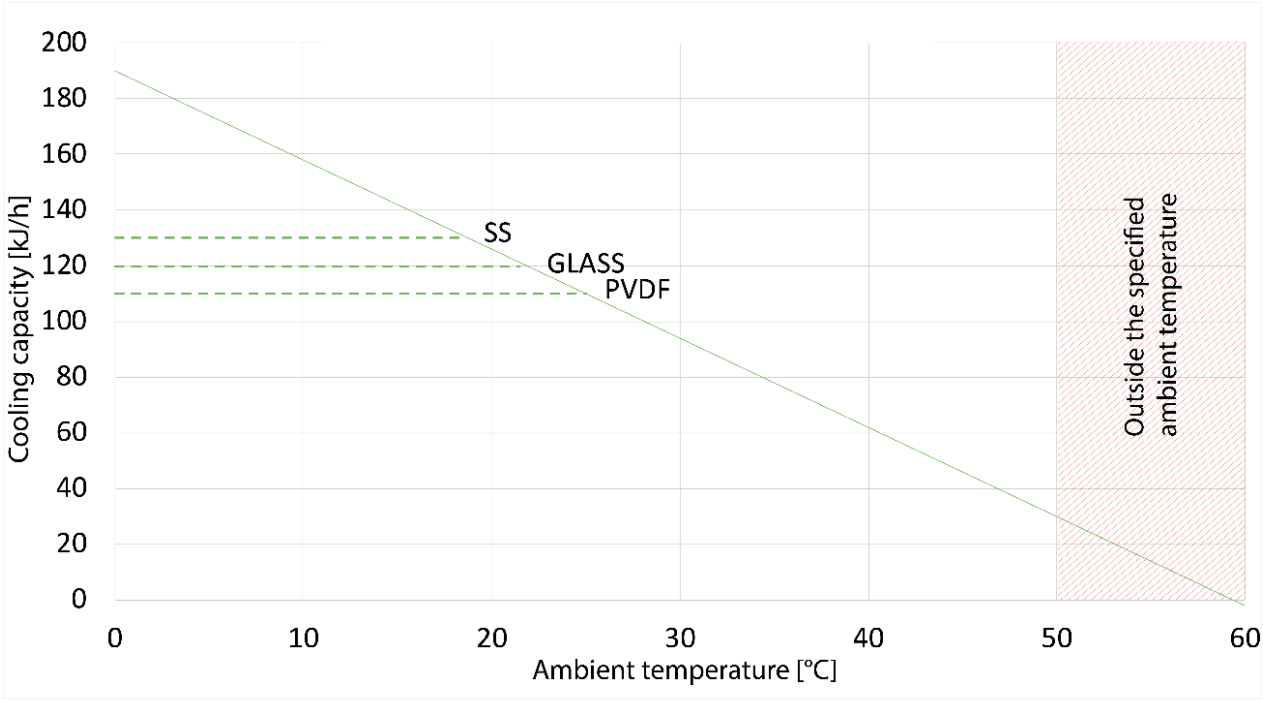


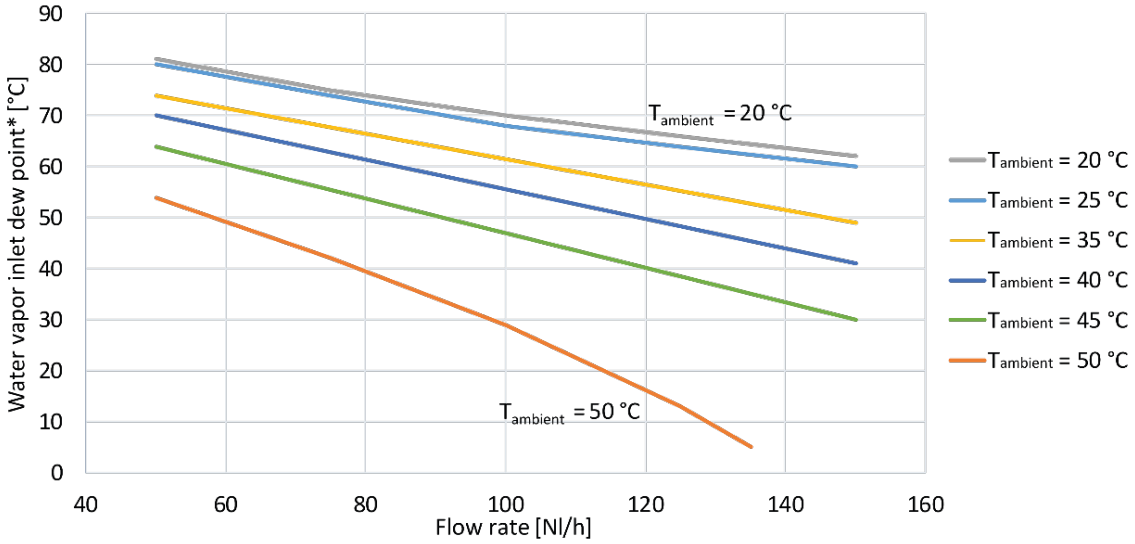
Figure 5 Electrical cooling capacity ECP1000C

The following figure shows the max. inlet water vapor dew point (with a Ø 25 mm heat exchanger) of the ECP1000C as a function of the gas flow.
Calculating the energy in a gas is very complex. The energy content extracted from the sample gas is determined by three main parameters:

- Temperature,
- dew point and
- flow velocity of the sample gas.

Fixed parameters in the diagram are the gas temperature (180 °C [356 °F]), the cooler temperature (5 °C [41 °F]) and the sample gas (air). The flow rate is measured after the cooler.
If the process now specifies, for example, a water vapor with a dew point of 50 °C [122 °F], the approximate maximum possible flow rate at which the cooler is not yet overloaded can be read from the diagram. To do this, one has to always stay below the respective characteristic curve which corresponds to the prevailing ambient temperature.

The upper characteristic curve in the diagram ($T_{ambient}$ = 20 °C [68 °F]) represents the maximum water vapor inlet dew point as a function of the flow rate. Higher values cannot be achieved by further reducing the ambient temperature.

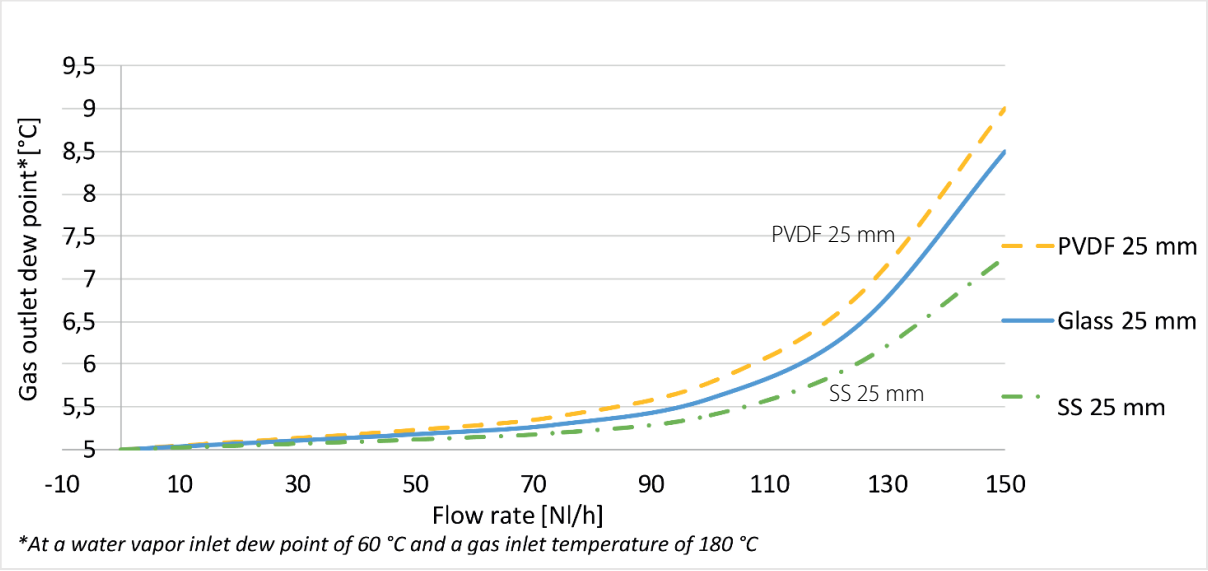


** At a gas temperature of 180 °C, a cooling temperature of 5 °C and air as sample gas*

Figure 6 Maximum inlet dew point ECP1000C

The next diagram shows the heat exchanger-dependent gas outlet dew point as a function of the flow rate. Fixed parameters in the diagram are the gas inlet temperature (180 °C [356 °F]) and the water vapor inlet dew point: (60 °C [140 °F]). The flow rate is measured after the cooler.

The more energy there is in the sample gas, the more losses occur during heat transfer from the sample gas via the heat exchanger to the cooling block of the cooler. This is a physical effect.
The better the thermal conductivity of the heat exchanger material, the lower this effect. This diagram can be used to estimate and schedule this effect.
Since the effect is strongly dependent on the flow rate, it is recommended to keep the flow rate constant and to select only the maximum flow rate required by the process. The minimum and maximum permissible flow rate of the heat exchangers must be taken into account.



**At a water vapor inlet dew point of 60 °C and a gas inlet temperature of 180 °C*

Figure 7 Outlet dew point ECP1000C

9.4 Cooling Capacity, Inlet and Outlet Dew Point ECP2000C

The following diagram shows the cooling capacity of the ECP2000C as a function of the ambient temperature. The continuous characteristic curve shows the electrical cooling capacity of the cooler without taking the heat exchanger properties into account.
The thermal conductivity of the heat exchanger materials has a significant influence on how much of the possible cooling capacity can be transferred from the cooler to the sample gas.
The dashed lines represent the characteristic curves of the heat exchangers. The characteristic curves of the heat exchangers require good lubrication, i.e. the best possible heat transfer.

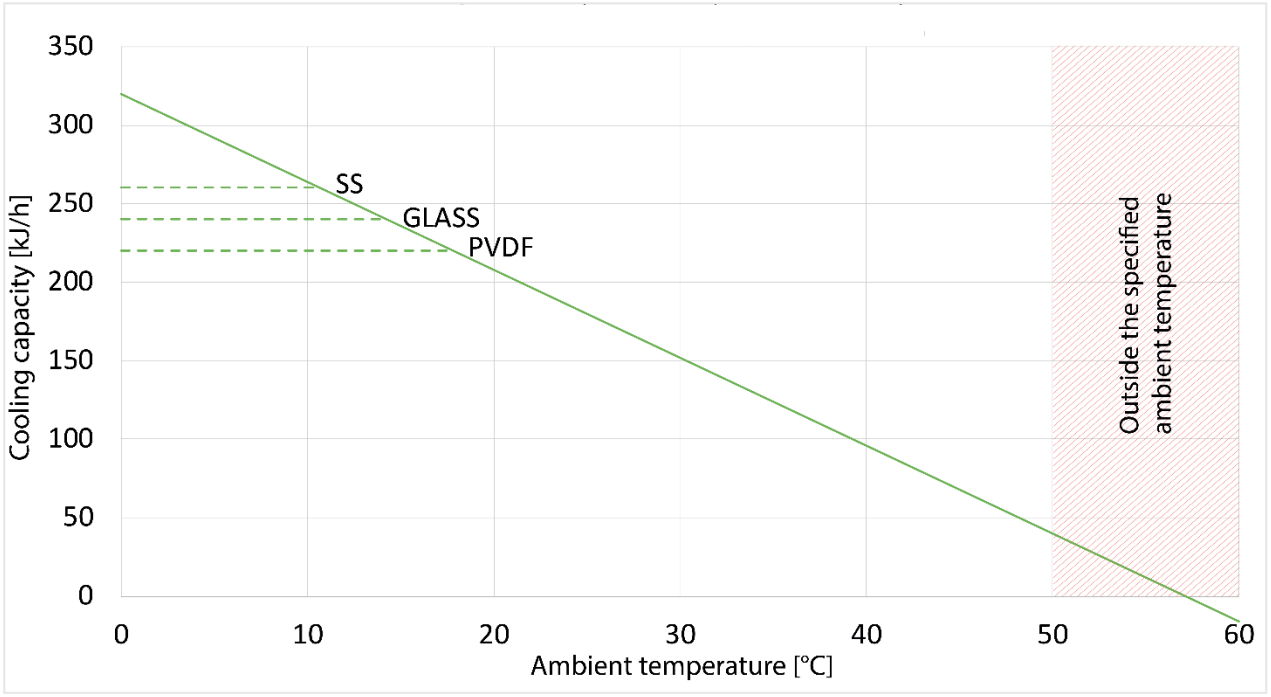


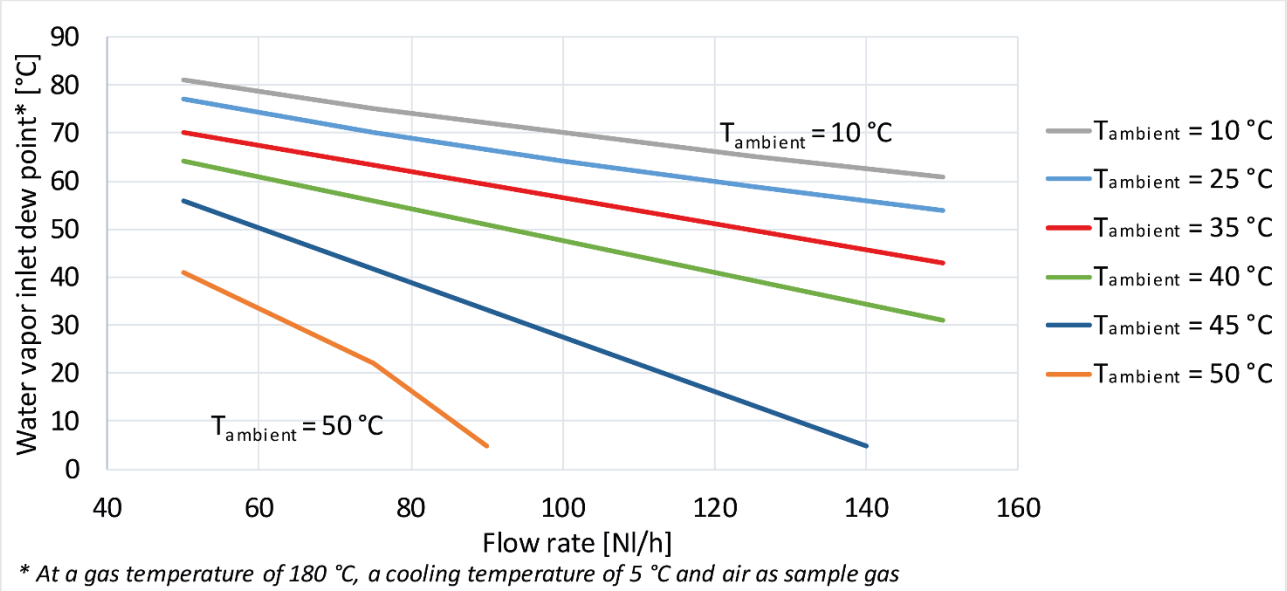
Figure 8 Electrical cooling capacity ECP2000C

The following figure shows the max. inlet water vapor dew point (with a Ø 25 mm heat exchanger) of the ECP2000C as a function of the gas flow.
Calculating the energy in a gas is very complex. The energy content extracted from the sample gas is determined by three main parameters:

- Temperature,
- dew point and
- flow velocity of the sample gas.

Fixed parameters in the diagram are the gas temperature (180 °C [356 °F]), the cooler temperature (5 °C [41 °F]) and the sample gas (air). The flow rate is measured after the cooler.
If the process now specifies, for example, a water vapor with a dew point of 50 °C [122 °F], the approximate maximum possible flow rate at which the cooler is not yet overloaded can be read from the diagram. To do this, one has to always stay below the respective characteristic curve which corresponds to the prevailing ambient temperature.

The upper characteristic curve in the diagram ($T_{ambient}$ = 10 °C [50 °F]) represents the maximum water vapor inlet dew point as a function of the flow rate. Higher values cannot be achieved by further reducing the ambient temperature.

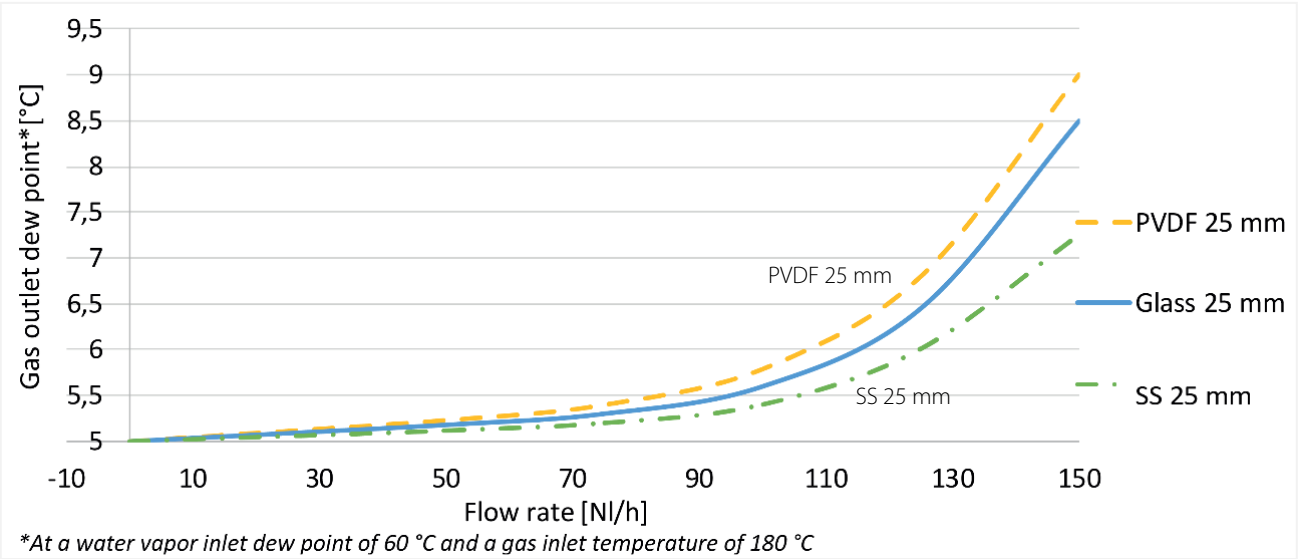


** At a gas temperature of 180 °C, a cooling temperature of 5 °C and air as sample gas*

Figure 9 Maximum inlet dew point ECP2000C per channel

The next diagram shows the heat exchanger-dependent gas outlet dew point as a function of the flow rate: Fixed parameters in the diagram are the gas inlet temperature (180 °C [356 °F]) and the water vapor inlet dew point: (60 °C [140 °F]). The flow rate is measured after the cooler.

The more energy there is in the sample gas, the more losses occur during heat transfer from the sample gas via the heat exchanger to the cooling block of the cooler. This is a physical effect.
The better the thermal conductivity of the heat exchanger material, the lower this effect. This diagram can be used to estimate and schedule this effect.
Since the effect is strongly dependent on the flow rate, it is recommended to keep the flow rate constant and to select only the maximum flow rate required by the process. The minimum and maximum permissible flow rate of the heat exchangers must be taken into account.



**At a water vapor inlet dew point of 60 °C and a gas inlet temperature of 180 °C*

Figure 10 Outlet dew point ECP2000C

9.5 Cooling Capacity, Inlet and Outlet Dew Point ECP3000C

The following diagram shows the cooling capacity of the ECP3000C as a function of the ambient temperature. The continuous characteristic curve shows the electrical cooling capacity of the cooler without taking the heat exchanger properties into account.
The thermal conductivity of the heat exchanger materials has a significant influence on how much of the possible cooling capacity can be transferred from the cooler to the sample gas.
The dashed lines represent the characteristic curves of the heat exchangers. The characteristic curves of the heat exchangers require good lubrication, i.e. the best possible heat transfer.

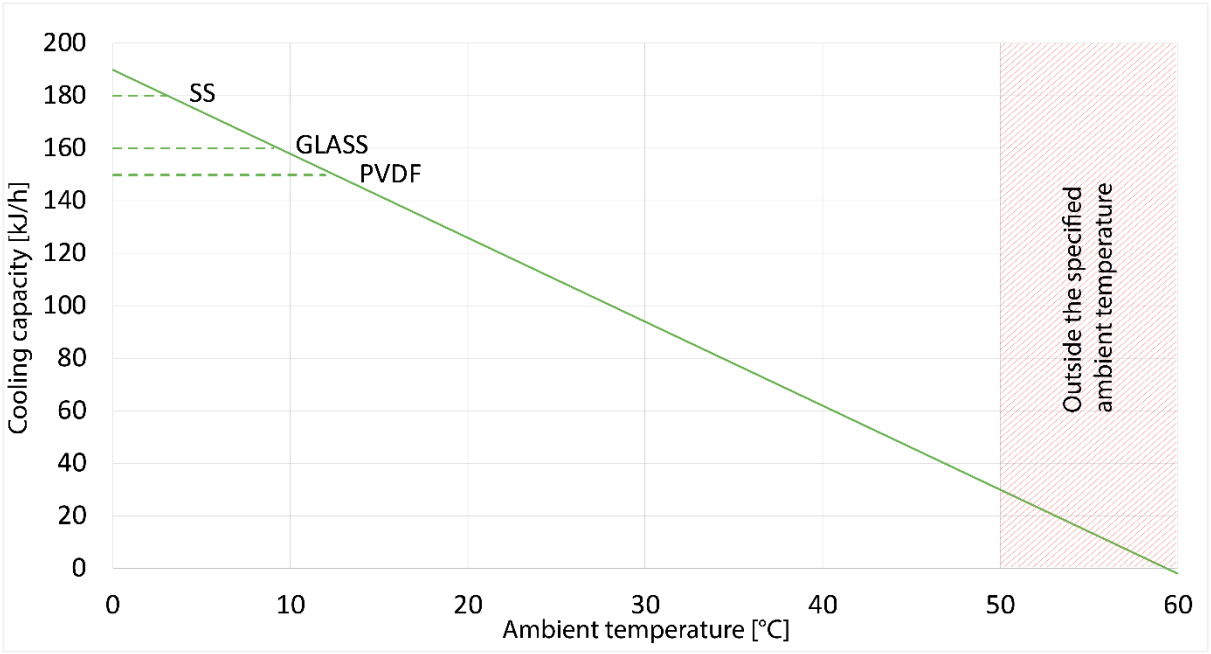


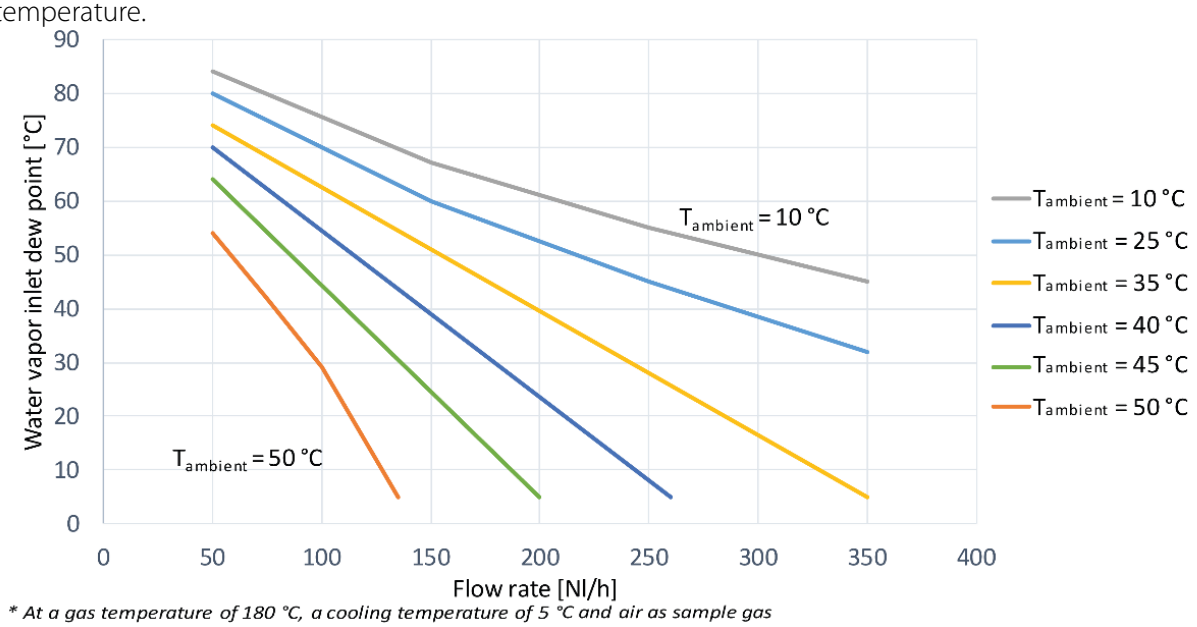
Figure 11 Electrical cooling capacity ECP3000C

The following figure shows the max. inlet water vapor dew point (with a Ø 50 mm glass heat exchanger) of the ECP3000C as a function of the gas flow.
Calculating the energy in a gas is very complex. The energy content extracted from the sample gas is determined by three main parameters:

- Temperature,
- dew point and
- flow velocity of the sample gas.

Fixed parameters in the diagram are the gas temperature (180 °C [356 °F]), the cooler temperature (5 °C [41 °F],) and the sample gas (air). The flow rate is measured after the cooler.
If the process now specifies, for example, a water vapor with a dew point of 50 °C [122 °F], the approximate maximum possible flow rate at which the cooler is not yet overloaded can be read from the diagram. To do this, one has to always stay below the respective characteristic curve which corresponds to the prevailing ambient temperature.

The upper characteristic curve in the diagram ($T_{ambient}$ = 10 °C [50 °F]) represents the maximum water vapor inlet dew point as a function of the flow rate. Higher values cannot be achieved by further reducing the ambient temperature.

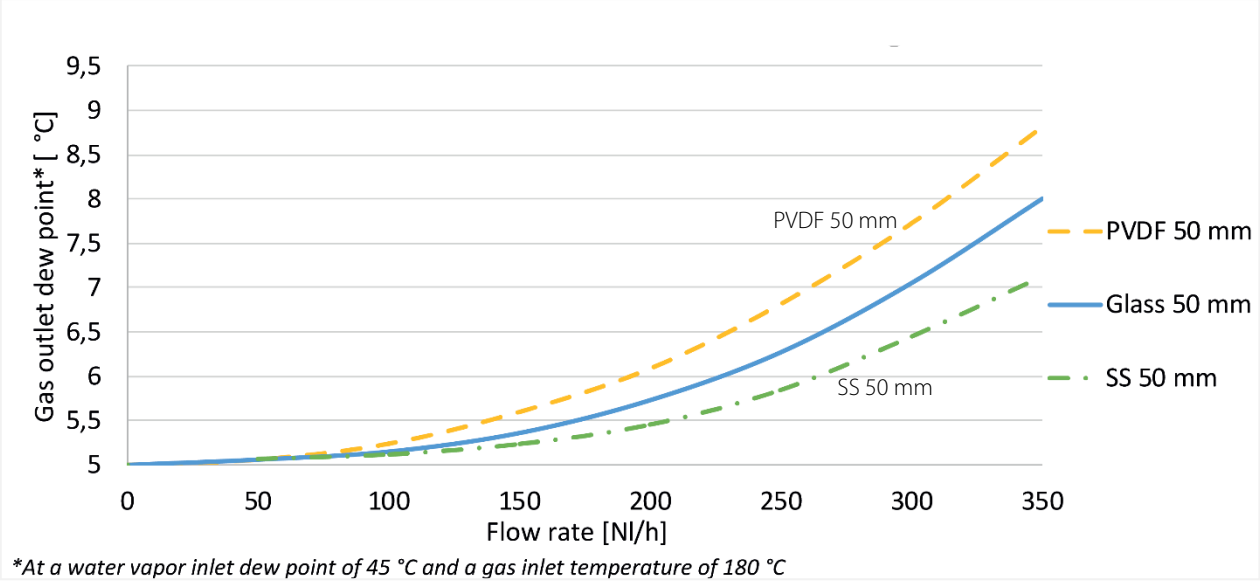


** At a gas temperature of 180 °C, a cooling temperature of 5 °C and air as sample gas*

Figure 12 Maximum inlet dew point ECP3000C

The next diagram shows the heat exchanger-dependent gas outlet dew point as a function of the flow rate: Fixed parameters in the diagram are the gas inlet temperature (180 °C [356 °F]) and the water vapor inlet dew point: (45 °C [113 °F]). The flow rate is measured after the cooler.

The more energy there is in the sample gas, the more losses occur during heat transfer from the sample gas via the heat exchanger to the cooling block of the cooler. This is a physical effect.
The better the thermal conductivity of the heat exchanger material, the lower this effect. This diagram can be used to estimate and schedule this effect.
Since the effect is strongly dependent on the flow rate, it is recommended to keep the flow rate constant and to select only the maximum flow rate required by the process. The minimum and maximum permissible flow rate of the heat exchangers must be taken into account.

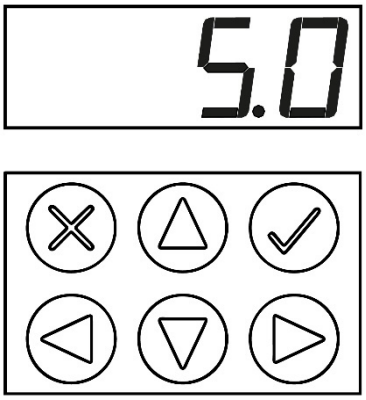


**At a water vapor inlet dew point of 45 °C and a gas inlet temperature of 180 °C*

Figure 13 Outlet dew point ECP3000C

10 Operating Instructions

The display and control panel of the ECPX000C are clearly visible on the front panel of the device. In the main menu, the cooler temperature, the ambient temperature, the set absolute or differential setpoint and the current setpoint can be displayed. The setpoint entry and the menu for parameter setting can be accessed via a PIN entry. PIN entry prevents unintentional adjustment of the setpoint and the device configuration.



Use the arrow keys to navigate through the menu and enter values. Press the "OK" key ✓ to confirm entries and the "Exit" key ⊗ to exit the input area or to reject an entry.

10.1 Menu Structure ECP1000C and ECP3000C

After approx. 3 minutes the device is ready for operation. The current cooler temperature is displayed first. Use the arrow keys to navigate through the main menu. The following figure shows an example of how you can navigate through the main menu.

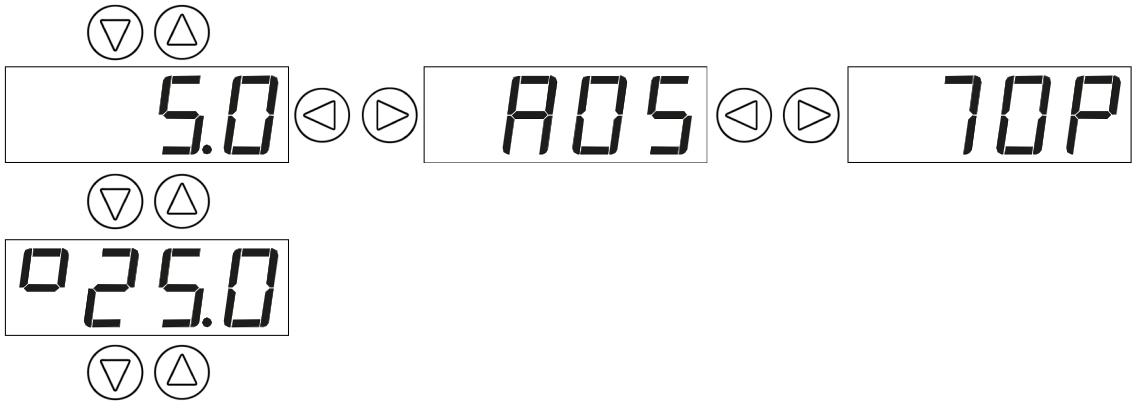


Figure 14 Navigating through the ECP1000C/ECP3000C main menu

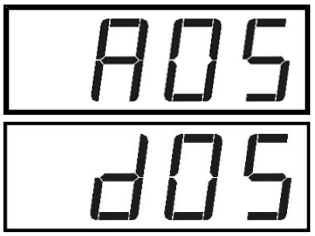
Note

Tap on the ⊗-key, to go back to the cooling temperature.

The cooling temperature is shown in the display as follows:

The cooler temperature is shown on the display.

The ambient temperature is indicated by a "°" sign on the left side of the displayed temperature.



The setpoint for absolute value control is indicated by an "A" and the setpoint for differential control by a small "d" before the temperature value. The absolute value control temperature can be set between 2 to 15 °C [35.6 to 59 °F]. The differential value control temperature can be set between dT = 2 to 15 °C [dT = 3.6 to 27 °F].

The display of the current signal value is indicated by a capital "P" on the right-hand side. The signal value is a measure for the percentage workload. The signal value can assume values from 0 to 99.

Note

You will find the complete menu structure of the ECP1000C and the ECP3000C in the appendix of this instruction manual.

10.2 Menu Structure ECP2000C

After approx. 3 minutes the device is ready for operation. The current cooler temperature of the first channel is displayed first. Use the arrow keys to navigate through the main menu. The following figure shows an example of how you can navigate through the main menu.

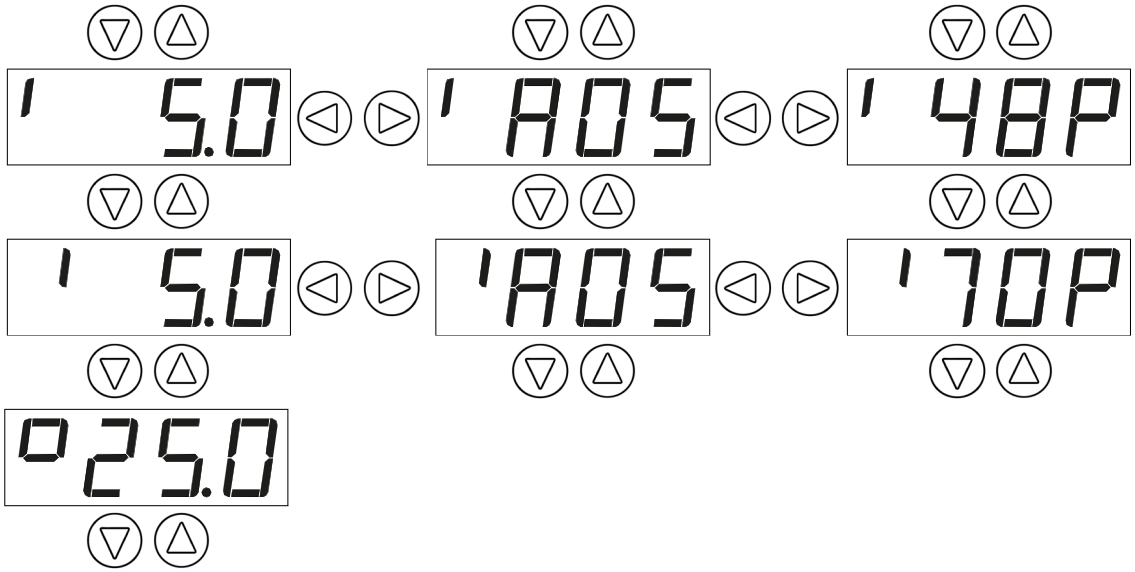
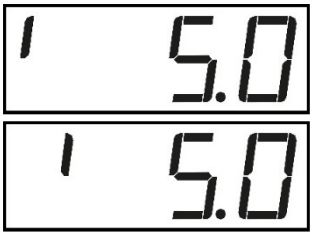


Figure 15 Navigating through the ECP2000C main menu

Note

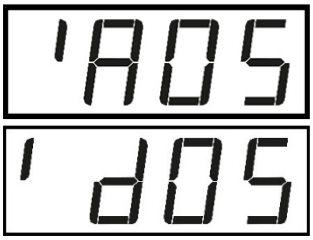
Tap on the ⊗-key, to go back to the cooling temperature.

The current cooler temperatures are displayed first. The display of the ECP2000C alternates between the first and second channel every 7 seconds.



The line on the left side of the display shows which of the two cooler temperatures is currently displayed. The left line stands for channel 1, the right line for channel 2. This configuration is also found inside the unit: the first cooling stage is located on the left and the second on the right inside the cooler.

The ambient temperature is indicated by a "°" sign on the left side of the displayed temperature.



The setpoint for absolute value control is indicated by an "A" and the setpoint for differential control by a small "d" before the temperature value. The absolute value control temperature can be set from 2 to 15 °C [35.6 to 59 °F]. The differential value control temperature can be set from dT = 2 to 15 °C [dT = 3.6 to 27 °F].
Also in the setpoint display, the left line stands for channel 1 and the right line for channel 2.

The display of the current signal value is indicated by a large "P" on the right-hand side. The signal value is a measure for the percentage workload. The signal value can assume values from 0 to 99. The lines again show the two channels 1 and 2.

In principle, the second channel has a higher workload than the first channel. This is because the first channel receives fresh air for cooling, while the second channel cools with the already heated air from the first channel. The maximum cooling capacity specified in the data sheet takes this circumstance into account.

Note

You will find the complete menu structure of the ECP2000C in the appendix of this instruction manual.

10.3 PIN Entry

To enter the range of setpoint input or parameter setting, a PIN must be entered. The PIN "1234" is factory-set and cannot be changed.
To enter the PIN, proceed as follows:

Press and hold the ✓-key until "0000" appears in the display.
The "0" on the left side is blinking. Use the △ and ▽- keys to enter the first digit of the PIN.
Use the ◁ and ▷- keys to switch to the other digits. If a digit is blinking, the PIN digit can be entered.

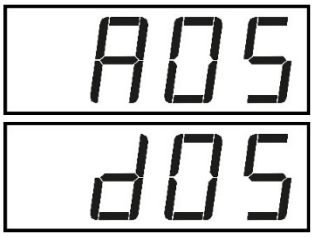
The PIN "1234" looks like this on the display.
Confirm the PIN with the ✓-key.

After confirmation, immediately the display for the setpoint entry is shown. Press and hold the ✓-key longer to access the parameter setting area.

The PIN is valid for 15 minutes. If you exceed this time, the display field reappears with "0000" when you press and hold the ✓-key. The PIN must be entered there again.

10.4 Setpoint Entry

If you tap the ✓-key briefly after entering the PIN, the setpoint for the cooler temperature appears. This setpoint can belong to the operating mode "absolute control" ("A") or "differential control" ("d").
The two digits start blinking. The absolute value control temperature can be set from 2 to 15 °C [35.6 to 59 °F] using the △ and ▽-keys. The differential value control temperature can be set from dT = 2 to 15 °C [dT = 3.6 to 27 °F] using the △ and ▽-keys. The factory setting is absolute value control temperature of 5 °C [41 °C].



Use the ◁ and ▷-keys to switch between the operating mode and setpoint settings.
If the letter on the left side is blinking, you can use the △ and ▽-keys to switch between absolute and differential value control of the setpoint temperature.
.

Note

Tap the ⊗-key, then the entries are discarded, and you return to the cooler temperature channel 1.

As long as the PIN is active, the setpoint entry can also be accessed from the main menu. To change a setpoint, press the ✓-key for 2 seconds during the current temperature or setpoint display. The display then changes to setpoint input. The two digits start blinking. Values can be set here.
With the ECP2000C you only get from the current temperature or setpoint display of channel 1 to the corresponding channel 1 setpoint input. The same applies to channel 2.

The following figure shows, using the example of an ECP1000C/ECP3000C, how to access the setpoint input from the main menu.

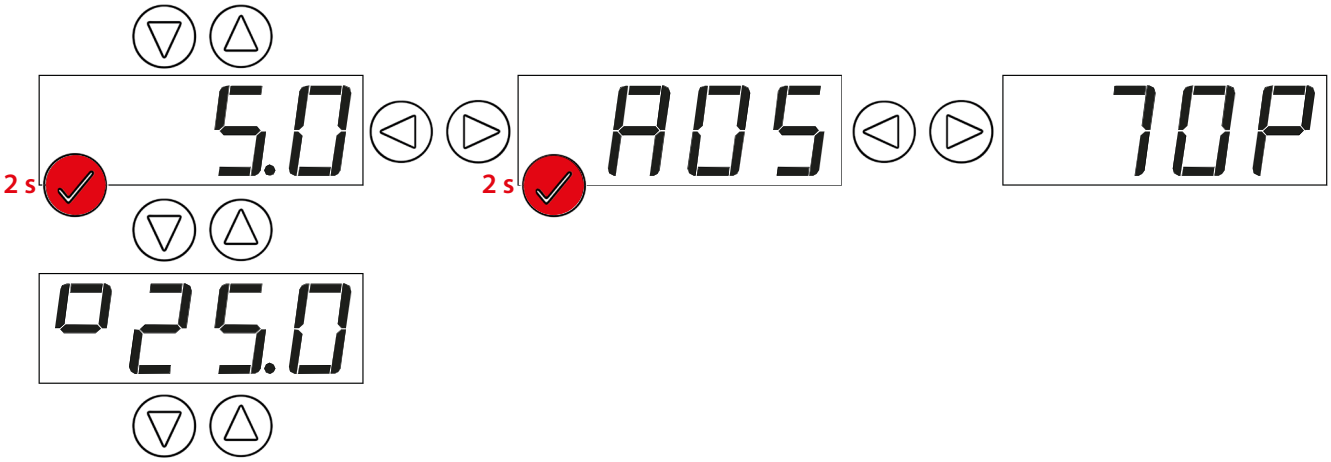


Figure 16 Reaching the setpoint entry from the ECP1000C/ECP3000C main menu

10.5 Parameter Setting

If you tap the ✓-key after entering the PIN, the setpoint for the cooler temperature appears first. If the ✓-key is pressed and held for a short moment, the display changes to code entry. Here you can enter the codes that belong to the respective parameter settings.

You can also access the parameter setting from the main menu. To do this, keep the ✓-key pressed until the code entry is displayed. The PIN must be active in this case.

Note

The codes for parameter settings can be found in the appendix of this instruction manual.

To adjust the device parameters, the code belonging to the parameter must be entered and confirmed in this display. The left digit of the code entry is blinking. The first digit can be entered here.

Use the ◁ und ▷-keys to switch between the digits and the △ and ▽-keys to set the individual digits.

A code can have up to 3 digits. Single-digit codes are device-specific, two-digit codes are important basic settings (tens digit corresponds to the channel number), three-digit codes are used for calibration (hundreds digit: “2” stands for LA, “3” for mA calibration). The only exception is the “777” code for resetting the factory settings.

The PIN is valid for 15 minutes. If you exceed this time, the display field reappears with “0000” when you press and hold the ✓-key. The PIN must be entered there again.

If you enter an invalid code and press the ✓-key, the display returns to the cooler temperature of channel 1.

10.5.1 Setting Temperature Alarm Limits

You use the temperature alarm limits to determine when the alarm is triggered. HIGH dT and LOW dT are independently adjustable from dT = 2 to 8 °C [dT = 3.6 to 14.4 °F]. In the following figure, the upper temperature alarm limit is set at 8 °C [46.4 °F] and the lower one at 3 °C [37.4 °F].
The hysteresis is set to "1".

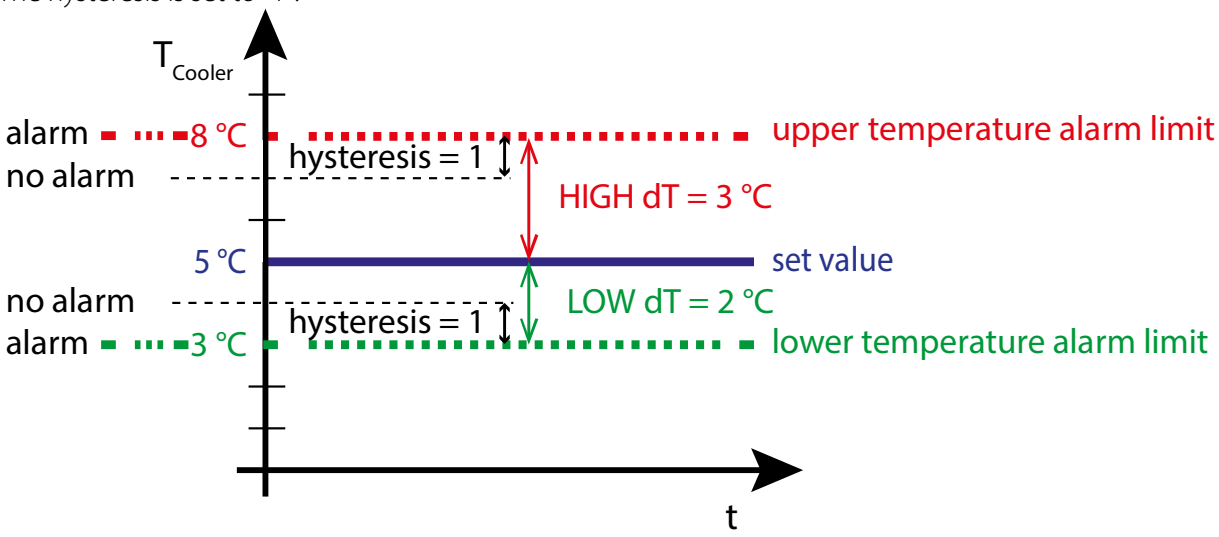


Figure 17 Temperature alarm limits and hysteresis

To set the temperature limits:

The code for setting HIGH dT of the first channel is "012", for the second channel "022". Confirm the code with the ✓-key, then the display of the pre-set value appears.

After confirming the code, the default value "3" appears. The value is blinking, and you can enter values from dT = 2 to 8 °C [dT = 3.6 to 14.4 °F] with the △ and ▽-keys.
Press ✓ to confirm your change or ⊗ to leave the code range without making any changes. After changing or aborting the display shows the cooler temperature again.

The code for LOW dT is "013" for the first channel and "023" for the second. If you enter this code, you can also change the lower temperature alarm limit.

The hysteresis setting can be changed via code "014" (channel 1) or code "024" (channel 2). The hysteresis ensures that no "fluttering" occurs in the event of a temperature alarm. The differential value dT = 1 or 2 °C [1.8 or 3.6 °F] can be entered.

Note

If HIGH dT or LOW dT is reduced to "2", the hysteresis is automatically reduced to the differential value dT = 1 °C [1.8 °F].

10.5.2 Resetting to Factory Settings

With the parameter setting "777", the settings made on the device can be reset to the factory settings. Except for the calibrations performed, all set values will be reset.

Note

A table with the codes reset by the "777" parameter setting can be found in the appendix of this instruction manual.

If you hold down the ✓ -key after entering the PIN, the setpoint for the cooler temperature appears first. A little later the display changes to the code entry.

You can also enter the code from the main menu. To do this, keep the ✓ -key pressed until the display for code entry appears. The PIN must be active in this case.

Enter the code "777" and confirm the code with the ✓-key.

A "0" appears on the display.

Use the △ and ▽-keys to change the value to "1".

Now you can cancel the process with the ⊗-key and exit the code entry without making any changes.

Confirm "1" with the ✓ -key, then the parameter settings are reset to the factory settings and the device will restart.

After resetting to the factory settings, the device restarts.

10.5.3 Brightness Setting of Display

It may be necessary to change the brightness of the display due to different lighting conditions at the locations where the cooler is used. The brightness of the display can be adjusted on the control panel of the ECPX000C.

If you press and hold the ✓--key after entering the PIN, the setpoint for the cooler temperature appears first. A little later the display changes to code entry.

You can also enter the code from the main menu. To do this, keep the ✓--key pressed until the code entry is displayed. The PIN must be active in this case.

Enter the code "005" and confirm the code with the ✓--key.

Now the default brightness value appears. The factory setting is "5".

This value is blinking and can be set between "0" and "9" with the △ and ▽- keys. The brightness of the digits changes immediately. The lower the value, the darker the display.

Select the desired brightness value and confirm the selection with the ✓-key or cancel the procedure with the key. Use the ⊗-key to leave the range of codes without making any changes.

After changing the brightness or canceling, the display shows the cooler temperature again.

11 Receipt of Goods and Storage

The **ECP1000C/2000C/3000C** gas cooler is a complete pre-installed unit.

- Please take the ECP gas cooler and possible special accessories carefully out of the packaging material immediately after arrival and compare the goods with the items listed on the delivery note.
- Check the goods for any damage caused during delivery and, if necessary, notify your transport insurance company without delay of any damage discovered.

Note

The equipment should be stored in a protected, frost-free room!

12 Installation Instructions

The **ECPX000C** Peltier Gas Cooler is designed for wall mounting.

The Cooler can only operate in a vertical position! The perfect functioning of the separation and drainage procedures will only be guaranteed if the equipment is used in a vertical position!

The cooler should be installed away from heat sources and ventilated to prevent heat accumulation.


Note

For outdoor installation, the cooler must be installed in a protective housing, frost-free in winter and sufficiently ventilated in summer. Avoid direct sunlight.

Unheated gas extraction lines must be laid with a down slope to the cooler. Condensate pre-separation is then not necessary.

Connect heated gas sample lines with sufficient thermal decoupling to the cooler. The insolation of the heated gas sample line must end at least 20 cm [7.9"] before the gas cooler inlet. Do not insulate the last 20 cm [7.9"] of the heated gas sample line.

An easily accessible main switch with appropriate labeling must be provided externally.

13 Supply Connections

13.1 Hose Connections

The gas inlet and outlet is located on the top of the cooler and is indicated by arrows on the Jet-Stream heat exchangers. For possible connectors see technical data (chapter 8).

Corresponding tube or flexible tubing connection fittings are optionally available through M&C.


Note

Do not mix up the tubing connections; the inlet and outlet connections of the heat exchangers are marked with arrows;

After connecting all tubes and flexible tubing, the gas tightness must be checked.

To ensure free condensate discharge, the specified discharge cross-sections should not be reduced!

Ensure that the connections are sealed adequately by noting the following:

Duran® glass heat exchangers with connections GL 18-6 respectively GL 25-12

- Before assembly, check the GL coupling rings to see if the PTFE/silicon locking rings have been damaged.
- The sealing rings should be installed with the PTFE side facing the medium.

PVDF respectively stainless steel heat exchangers with G 1/4" female respectively G 3/8" female

- The correspondingly dimensioned tube respectively flexible tubing couplings with threaded connections have to be screwed in with PTFE thread sealing tape.
- To grant a functional and unproblematic mounting we recommend to use union pieces with taper pipe thread type R according to DIN 2999/1 in connection with suitable sealing tape.

Note

When fixing the connectors in the PVDF heat exchanger hold up with a wrench at the pane of the bolt head!

Option: stainless steel heat exchanger with NPT

- The heat exchangers with NPT threaded connectors are marked with circulated notches.
- The NPT thread must be screwed in with sealant or fixed with adhesive.

The tubes for condensate removal are connected directly to the bottom part of the heat exchangers, with the standard GL 25-12 tube connectors (Duran® glass heat exchanger) respectively with the standard G 3/8" thread joint (PVDF or stainless steel heat exchanger).

Condensate removal is to be provided by the customer according to the type of operation with:

- External peristaltic pump **SR25.2-W**;
- Automatic liquid drain **AD-...** only for over-pressure operation;
- Condensate collector container which needs to be emptied manually;

Note

Stainless steel heat exchangers with G 3/8" thread joint can be directly fitted up with the automatic liquid drain AD-SS by means of a thread adapter part number FF 11000 (1/2" NPT to G 3/8" female). This eliminates the need for wall mounting the AD-SS unit!

The gas sampling tubes or condensate tube must be installed as follows:

Note

The gas tightness of the connection can only be guaranteed if the connecting tube has a straight end edge (use a hose cutter)!

- Loosen the union nut of the clamping ring fitting by turning it counterclockwise; make sure that the nut is carefully removed from the fitting body so that the clamping ring which is loose in the nut is not lost;
- Push the union nut over the connecting tube;
- Push the clamping ring with the thicker bead facing the nut onto the connecting tube;
- Attach the tubing to the support nipple of the fitting body;
- Tighten the union nut by hand.

The tubing is now mounted non-slip and pressure-resistant.

13.2 Electrical Connections

Warning

Electric shock risk!
If a fault occurs, the housing is connected to the power supply!
Follow the connection sequence:
Connect the mains plug to the mains voltage first, then the alarm relay plug.

Wrong voltage can destroy the cooler.

When connecting the equipment, please ensure that the supply voltage is identical with the information provided on the model type plate.

Warning

Attention must be paid to the requirements of IEC 364 (DIN VDE 0100) when setting high-power electrical units with nominal voltages of up to 1000 V, together with the associated standards and stipulations.

An easily accessible main switch with appropriate labeling must be provided externally.
The supply circuit of the device is provided with a fuse corresponding to the rated current (overcurrent protection); the electrical data can be found in the technical data.

13.2.1 Power Supply Connection

The power connection is pluggable and uses a type A solenoid valve plug. The mains plug grounds the device. Always connect the mains plug first.

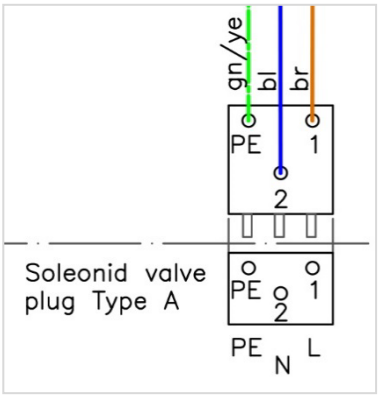


Figure 18 Circuit diagram detail: power supply connection

Note

The circuit diagram with the assignment of the mains plug can be found in the appendix of this instruction manual.

13.2.2 Alarm Relais Connection

Warning

Electric shock risk!
If a fault occurs, the housing is connected to the power supply!

Follow the connection sequence:
Connect the mains plug to the mains voltage first, then the alarm relay plug.

The alarm relay connection is pluggable and uses a type C solenoid valve plug. The switching capacity of the 2 changeover contacts is at 250 V, 2 A, 500 VA, 50 W. The length of the connecting cable is not restricted.

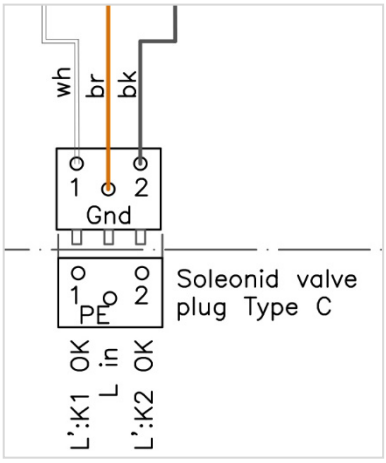


Figure 19 Circuit diagram detail: alarm relay connection

Note

Note: Inductive DC loads (e.g. relays, solenoid valves) may only be connected via flyback diodes.

Note

The circuit diagram with the assignment of the alarm plug can be found in the appendix of this instruction manual.

13.2.3 mA Output Connection for Cooler Block Temperature(s) (Optional)

The mA connection for the temperatures of the one to two cooling blocks (depending on the device) is pluggable and uses a Phoenix circular connector.

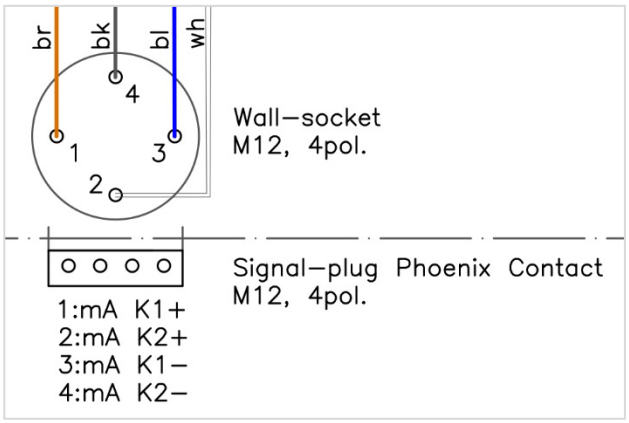


Figure 20 Circuit diagram detail: mA output connection for cooler block temperature(s)

The mA outputs of the cooling block temperatures are potential-free and the max. burden is 500 Ohm. The length of the connecting cable is not restricted.
The current output limits in the case of 4 - 20 mA in the lower range to 3.8 mA and in the upper range to 20.5 mA. In the case of 0 - 20 mA, it limits the upper range to 20.5 mA.

Note

If one or two mA outputs are ordered when ordering the instrument, the mA output is calibrated at the factory.
The mA output is set to 4 - 20 mA as standard, but can be changed to 0 - 20 mA on the instrument. In both cases the mA range corresponds to the temperature range -10 to +50 °C [14 to 122 °F].

Note

If a calibration error occurs and the mA output has been calibrated, the limiting values also change!

Note

The circuit diagram with the assignment of the mA plug can be found in the appendix of this instruction manual.

In chapter 25.4 “Calculations for mA Output” you will find the calculation of the temperature based on the mA value, the calculation of the mA value based on the temperature and the step size and resolution of the mA output.

13.2.4 mA Connection Thermocouple (Optional, ECP1000C Only)

If it is technically necessary to measure the output temperature in the gas, the thermocouple option can be purchased. This option is only available for the ECP1000C and includes:

- A special glass heat exchanger (with an additional gas screw connection for the thermocouple)
- One thermocouple type K class 1 shielded
- A built-in thermocouple transmitter with a mA range of 4 - 20 mA (corresponds to -10 to 50 °C [14 to 122 °F], not changeable)
- mA plug and socket

The mA output for the thermocouple is not electrically isolated. The cable length is not limited.
The maximum load is 180 Ohm. The measurement accuracy is as follows:

- ±0.5 °C [±0.9 °F] Measuring accuracy of the transmitter
- ±1 °C [±1.8 °F] Reference junctions' temperature accuracy
- ±1.5 °C [±2.7 °F] Limiting deviation for thermocouple type K class 1

Note

The assignment of the mA connector can be found in the "Wiring diagram: optional thermocouple (ECP1000C)" in the appendix of this instruction manual.

13.2.5 LA Connection (Optional, Type LA1 or LA1S)

External liquid alarm sensors type LA1 (without cable break detection) or LA1S (with cable break detection) can be connected to monitor the ECPX000C to protect the downstream analyzers. The liquid alarm sensors type LA1 or LA1S detect a condensate ingress in case of a possible defect or overload of the cooler.

The ECPX000C detects the channel-dependent alarm, reports it on the display and switches the corresponding alarm relay. The alarm relay can be used to interrupt the gas supply, either by switching off the sample gas pump or by controlling a shut-off solenoid valve.

Note

The M&C liquid alarm sensors type LA1 and LA1S operate on the principle of electrical conductivity from a conductance of 50 µS/cm.

The optional sensor type LA1S with cable breakage detection is offered as standard for the ECPX000C.
If no liquid alarm sensor is purchased with the device, the evaluation is deactivated. This can be subsequently activated by the customer if required.

The LA connection is located inside the device on the circuit board. When connecting external liquid alarm sensors type LA1 or LA1S, the connection cable must not exceed 3 m [≈ 9.8 ft] in length.

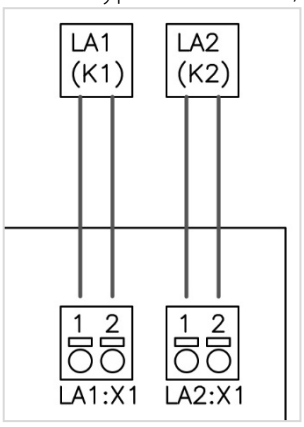


Figure 21 Circuit diagram detail: LA connection

Note

The LA evaluation has no hold function. This means that the cooler cancels the alarm as soon as the LA sensor has dried, and the alarm cancellation limit is undershot again.

Note

The circuit diagram with the assignment of the LA connection can be found in the appendix of this instruction manual.

14 Preparations for Commissioning

Before initial startup, all plant- and process-specific safety measures must be observed. It is mandatory for the operator to complete the enclosed risk assessment of the product.
The gas exposure risk must be assessed by the operator with regard to the hazards posed by process and calibration gas and the setup at the installation site (e.g. tubing, system cabinet/container/plant). If the risk assessment reveals increased exposure hazards, further measures are required.
A visible label must be attached to the installation site in accordance with the risk assessment provided by the operator.

15 Start-up

For start-up, the mains plug must be connected first. The mains plug connects the device to ground.

If the cooler is switched on after a slightly longer period of use on site, it displays the current heat sink temperature. The cooler immediately starts to cool down to the standard set absolute temperature of 5 °C [41 °F].

The display of the ECP1000C and ECP3000C switches between the current cooler temperature and the temperature alarm display A1 until the pre-set alarm cancellation limit of 6 °C [42.8 °F] is undershot.
With the ECP2000C, the display switches between the current cooler temperatures and the temperature alarm displays A1 and A2 of the respective channel.

After about 3 minutes the cooler drops below the alarm cancelation limit of 6 °C [42.8 °F]. The cooler now regulates the 5 °C [41 °F] and the alarm disappears. The alarm relay is switched according to the alarm, the alarm is triggered, and the relay is energised. The 3 minutes assume that the cooler is still unloaded. If there is gas in the cooler, the time increases depending on the energy content of the gas.

15.1 Parameter Setting during Commissioning

Immediately after starting the device, the pre-set parameters can be changed. The important basic settings are:

- **Set temperature:** 5 °C (adjustable from 2 to 15 °C) [41 °F (adjustable from 35.6 to 59 °F)]
- **Temperature control modi:** absolute temperature setpoint (A) or differential temperature setpoint (d)
    - **Absolute temperature setpoint** (A): The cooler cools to the set temperature regardless of the ambient temperature.

- **Differential temperature setpoint** (d): The cooler temperature usually corresponds to the ambient temperature currently measured by the device minus the setpoint temperature. To protect the cooler from freezing, the cooler temperature is limited to 2 °C [35.6 °F] at low ambient temperatures, regardless of the adjusted setpoint.

- **Temperature alarm limits:** ±3 °C [±5.4 °F] from setpoint temperature
  (HIGH dT and LOW dT are independently adjustable from dT = 2 to 8 °C [dT = 3.6 to 14.4 °F].

- **Hysteresis:** differential value 2 °C [3.6 °F] (differential value can be set to 1 or 2 °C [1.8 or 3.6 °F])
  As soon as one or both temperature alarm limits are reduced to 2, the hysteresis is automatically reduced to 1.

In addition, when commissioning a purchased mA output or LA sensor, it should be checked whether they are correctly preconfigured for the planned process.

16 Closing Down

Warning

Electric shock risk!
If a fault occurs, the housing is connected to the power supply!

Follow the disconnection sequence:
Disconnect the alarm relay plug from the mains voltage first, then the mains plug.

Note

The area in which the cooler is situated, when not in use, must be kept free of frost at all times!

No special measures need to be taken if the cooler is shut down for a short period of time.

If the cooler is to be shut down for a longer period of time, we recommend flushing it with inert gas or air. Residual condensate should be completely removed from the cooler.

Warning

Aggressive condensate is possible.

Wear protective glasses and proper protective clothing!

17 Maintenance

Before starting any maintenance work, follow all safety notes and descriptions stated in this instruction manual. Before the maintenance work is carried out, it is necessary to follow the specific safety procedures in regard to the system and operational process!

Warning

High voltage.
Disconnect the mains plug before opening the cooler housing!
Electric shock risk when opening the cooler housing!
If a fault occurs, the housing is connected to the power supply!

Follow the disconnection sequence:
Disconnect the alarm relay plug from the mains voltage first, then the mains plug.

The ECPX000C gas cooler requires no particular routine maintenance. Depending on the quality of the ambient air the cooling fin block should be blown out with compressed air from time to time.

17.1 Removing a Heat Exchanger

Warning

Aggressive sample gas or condensate residues possible.
Chemical burns due to aggressive media possible!

Wear protective gloves!

Wear safety goggles and appropriate protective clothing!

Removal of the heat exchangers may be necessary to carry out maintenance or repair work. The cooler does not need to be disconnected from the power supply to replace the heat exchanger.
The following step-by-step procedure is recommended when removing a heat exchanger:

1. Interrupt the sample gas supply.
2. Release the upper gas connections and lower condensate connections.
3. Pull the heat exchanger upwards from the cooling block by turning it slightly;

17.2 Cleaning a Heat Exchanger

Warning

Aggressive condensate residues and cleaning agents possible.
Chemical burns due to aggressive media possible!

Wear protective gloves!

Wear safety goggles and appropriate protective clothing!

You will need the following tools to clean the heat exchanger:

- A suitable cloth to remove the heat-conducting paste
- Suitable cloth for drying the heat exchanger
- Distilled water
- Collecting container
- If necessary, cleaning agent suitable for the heat exchanger material or an ultrasonic bath
- Disposal options for the contaminated liquids

The following step-by-step procedure is recommended for cleaning the heat exchanger:

1. The heat exchanger is coated on the outside with heat-conducting paste to improve thermal conductivity. Remove the heat-conducting paste with a suitable cloth.
2. Use distilled water to clean the heat exchanger. Rinse the heat exchanger with distilled water and collect the dirty water in a collecting container. Dispose of it in accordance with the applicable regulations. Dry the heat exchanger with a suitable cloth.

For persistent dirt, either a **suitable cleaning agent** or an **ultrasonic bath** can be used. Proceed as follows:

1. **Use cleaning agent:** The cleaning agent must be suitable for the respective material. Heat exchanger materials are Duran® glass, stainless steel and PVDF. Collect the contaminated cleaning agent in a collection container after cleaning and then dispose it according to the applicable regulations.
   Use an ultrasonic bath: When using an ultrasonic bath, follow the manufacturer's operating instructions.
2. After cleaning with a cleaning agent or inside an ultrasonic bath: Rinse the heat exchanger with distilled water and collect the contaminated water in a container. Dispose it according to the applicable regulations. Dry the heat exchanger with a suitable cloth.

17.3 Installing a Heat Exchanger

The installation is as follows:

1. Dry and clean the opening in the aluminium cooling block with a cloth.
2. Apply a thin and equal layer of thermal conductivity paste (part no. 90K0115) onto the opening.

3. Close the condensate removal connections of the heat exchanger with adhesive tape to prevent any thermal conductivity paste getting into the heat exchanger.
4. Apply a thin and equal layer of thermal conductivity paste over the whole surface of the heat exchangers (part no. 90K0115) to ensure good conduction of heat.
5. Lightly push and slightly rotate the heat exchanger back into the opening of the cooling block and press it to the upper block.
6. Remove the adhesive tape and any surplus thermal conductivity paste.
7. Reconnect the tubing.
8. Switch on the sample gas supply.

Note

Do not mix up the tubing connections; the inlet and outlet connections of the heat exchangers are marked with arrows.

17.4 Notes on Installing Glass Heat Exchangers

When installing heat exchangers made of Duran® glass, note the following:

1. Check PTFE/silicone clamping rings for damage. The clamping rings must be mounted with the PTFE surface pointing to the medium side, otherwise the necessary gas tightness cannot be guaranteed.
2. Hand tighten the GL union nuts by turning them clockwise;

To ensure a safe connection of the sample gas respectively condensate tubes to the Borosilicate glass heat exchanger(s) we recommend the use of GL-couplings.
Please feel free to contact us, if you need any help choosing the right connectors or couplings.

17.5 Information on Maintenance of the Optionally Installed Peristaltic Pump(s)

The instruction manual for the peristaltic pump type SR25.2-W contains all necessary information for qualified personnel to maintain the peristaltic pump.
Please read these instructions carefully before carrying out any maintenance work.

If you have any questions about the peristaltic pump or maintenance, please contact M&C or your authorized M&C dealer.

Note

Information for the qualified personnel on maintenance of the peristaltic pump can be found in the SR25 instruction manual (included in the scope of delivery of the peristaltic pump).

The SR25 instruction manual is also available on our website www.mc-techgroup.com.

18 Alarm and Error Messages

The ECPX000C has several monitoring functions. If an alarm limit is exceeded or not reached or if an error occurs during operation, the corresponding messages are shown on the display. These messages are displayed cyclically and alternate with the current cooler temperatures.
If several alarm or error messages occur simultaneously, the messages are shown on the display one after the other.

The alarm and error messages are listed here:

Display	Description	Action	Clear the alarm/error message
A1	The temperature of stage 1 has exceeded the outer limit of the alarm band	Relay 1 opens	The temperature of stage 1 exceeds the inner limit of the alarm band
A2	The temperature of stage 2 has exceeded the outer limit of the alarm band	Relay 2 opens	The temperature of stage 2 exceeds the inner limit of the alarm band
LA1	The liquid alarm sensor LA1 (channel 1) has registered a level of humidity corresponding to the set sensitivity	Relay 1 opens	The LA1 (channel 1) must register a dry state 15 % below the trip limit.
LA2	The liquid alarm sensor LA2 (channel 2) has registered a level of humidity corresponding to the set sensitivity	Relay 2 opens	The LA2 (channel 2) must register a dry state 15 % below the trip limit.
E1	The temperature sensor 1 cannot be queried or does not pass the plausibility check several times	Relay 1 opens, Control of the Peltier element is switched off	The measured values can be read again (e.g. after cable examination or sensor replacement)
E2	The temperature sensor 2 cannot be queried or does not pass the plausibility check several times	Relay 2 opens, Control of the Peltier element is switched off	The measured values can be read again (e.g. after cable examination or sensor replacement)
E3	The temperature sensor 3 cannot be queried or does not pass the plausibility check several times	No effect with absolute value control. With dT control, the corresponding relay opens, and the stage is switched off.	The measured values can be read again (e.g. after cable examination or sensor replacement)
E4	No voltage flanks resulting from a fan rotation are measured	Stage 1 and stage 2 switch off and both relays drop out.	The fan supplies voltage flanks again (e.g. after cable examination or fan replacement)
E5	The temperature of cooling stage 1 exceeds a maximum value of 60 °C [140 °F]	Relay 1 opens, Control of the Peltier element is switched off	Device restart after cooling down
E6	The temperature of cooling stage 2 exceeds a maximum value of 60 °C [140 °F]	Relay 2 opens, Control of the Peltier element is switched off	Device restart after cooling down

19 mA Output

The mA outputs built-in by M&C are factory calibrated and set to the range "4-20 mA". Later purchased mA outputs must be calibrated. To set the range and calibration, first enter the PIN:

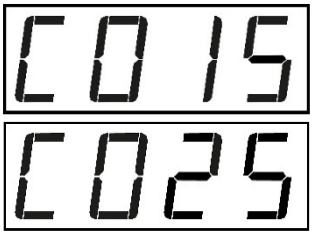
Press and hold the ✓-key until "0000" appears in the display.
The "0" on the left side is blinking. Use the △ and ▽- keys to enter the first digit of the PIN.
Use the ◁ and ▷- keys to switch to the other digits. When a digit is blinking, enter the PIN digit.

The PIN "1234" looks like this on the display.
Confirm the PIN with the ✓-key.

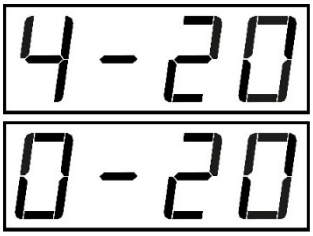
If you tap the ✓-key after entering the PIN, the setpoint for the cooler temperature appears first. If the ✓-key is pressed and held for a short moment, the display changes to code entry. The right digit of the code entry is blinking. Here you can enter the codes that belong to the respective parameter settings.
You can also access the parameter setting from the main menu. To do this, keep the ✓-key pressed until the code entry is displayed. The PIN must be active in this case.

19.1 mA Output Range Selection

The optional mA output can be changed from 4-20 mA to 0-20 mA. To select the mA range, proceed as follows:



Enter the code "015" for the first channel and "025" for the second channel.
Confirm the code with the ✓-key, then the display of the preset range appears.



The default value "4-20", which stands for 4 to 20 mA, appears on the display.
The whole display is blinking here. Use the △ and ▽-keys to switch between "4-20" and "0-20".
Press ✓ to confirm your change or ✗ to leave the code range without making any changes. After changing or aborting the display shows the cooler temperature again.

Note

The basic calculations of the mA output are listed in the appendix of this instruction manual.

19.2 Calibrating a mA Output

The mA outputs built-in by M&C are factory calibrated. If required, the basic accuracy of the mA outputs can be optimized by recalibration.
A later installed mA output must be calibrated. The mA output is suitable for a maximum load of 500 Ω only.
During calibration, first the lower and then the upper value of the mA output will be calibrated.

Note

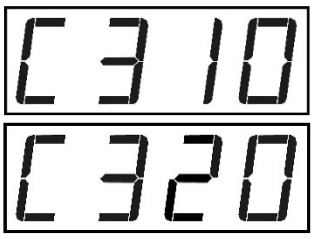
If one or two mA outputs are ordered when ordering the instrument, the mA output is calibrated at the factory. If a mA output is purchased by the customer and retrofitted by the customer, the calibration must be carried out by the customer. Optionally, the device can be sent to M&C for retrofitting.
The mA output is set to 4 - 20 mA as standard, but can be changed to 0 - 20 mA on the instrument. In both cases the mA range corresponds to the temperature range -10 to +50 °C [14 to 122 °F].

Current limitation:
The current output limits in the case of 4 - 20 mA in the lower range to 3.8 mA and in the upper range to 20.5 mA. In the case of 0 - 20 mA, it limits the upper range to 20.5 mA.

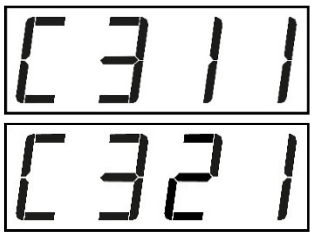
Note

If a calibration error occurs and the mA output has been calibrated, the limiting values also change!

To calibrate an mA output, proceed as follows:



Enter the code “310” for the calibration of the lower value of the mA output (channel 1). To calibrate the lower limit of the second channel of the ECP2000C, enter the code “320”.
Now connect a current meter to the connector of the mA output. This current meter should measure a value close to 1 mA. You can now adjust this value in 0.0054 mA steps with the up and down arrow keys. After the adjustment, the current meter should display 1 mA as accurately as possible.
Accept the value with the ✓-key.



Enter the code “C311” for the calibration of the upper value of the mA output (channel 1). To calibrate the upper limit of the second channel of the ECP2000C, enter the code “C321”.
Now connect a current meter to the connector of the mA output. This current meter should be used to measure a value close to 20 mA. You can now adjust this value in 0.0054 mA steps with the up and down arrow keys until the current meter displays 20 mA as accurately as possible. Accept the value with the ✓-key.

The cooler should then be in a steady state at 5 °C [41 °F] (absolute value control) and provide one of the following values:

- 8 mA (in case of 4 - 20 mA)
- 5 mA (in case of 0 - 20 mA)

The cable length is not limited and the cable does not need to be shielded.

20 Liquid Alarm Sensor (LA) Type LA1 and LA1S

The liquid alarm sensors LA1 or LA1S installed by M&C are factory calibrated to tap water and activated. Later purchased liquid alarm sensors must be activated and calibrated. To do this, first enter the PIN:

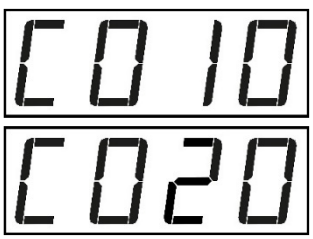
Press and hold the ✓-key until "0000" appears in the display.
The "0" on the left side is blinking. Use the △ and ▽- keys to enter the first digit of the PIN.
Use the ◁ and ▷- keys to switch to the other digits. When a digit is blinking, enter the PIN digit.

The PIN "1234" looks like this on the display.
Confirm the PIN with the ✓-key.

If you tap the ✓-key after entering the PIN, the setpoint for the cooler temperature appears first. If the ✓-key is pressed and held for a short moment, the display changes to code entry. The right digit of the code entry is blinking. Here you can enter the codes that belong to the respective parameter settings.
You can also access the parameter setting from the main menu. To do this, keep the ✓-key pressed until the code entry is displayed. The PIN must be active in this case.

20.1 Activating the LA

A retrofit liquid alarm sensor must be activated.



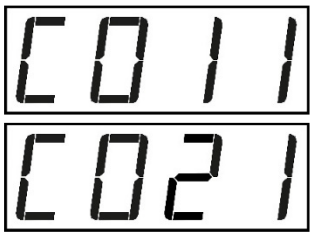
The code for activation is "010" for an ECP1000C or ECP3000C. To activate both channels of the ECP2000C, enter "010" for the first channel and "020" for the second channel.
Confirm the code with the ✓-key.

You can choose between the values “0”, “1” and “2”. With “1” you activate the sensor without cable break detection, with “2” you activate the sensor with cable break detection. With “0” the sensor is deactivated accordingly.

After activating the LA1S, the sensor needs to be calibrated.

20.2 LA Sensitivity Adjustment

The sensitivity can be changed by following these steps:



Enter the code “011” to change the sensitivity of the liquid sensor (channel 1). With code “021” you can change the sensitivity of the second channel of the ECP2000C.

The default value is 2 and can be changed from 1 to 7. The sensitivity corresponds to the switching threshold for the alarm and is to be understood as follows:

Sensor state	Sensitivity	Electrical conductivity
Dry	0 %	
7	30 %	~50 µS/cm
6	40 %	
5	50 %	
4	60 %	
3	70 %	
2	80 % (Standard)	~300 µS/cm
1	90 %	
Wet	100 %	

The cancellation limit is always 15 % below the sensitivity limit. If the sensitivity value of 2 is not changed, the alarm is triggered at 80 % and is automatically cancelled as soon as it falls below 65 %.
The following diagram illustrates the correlations:

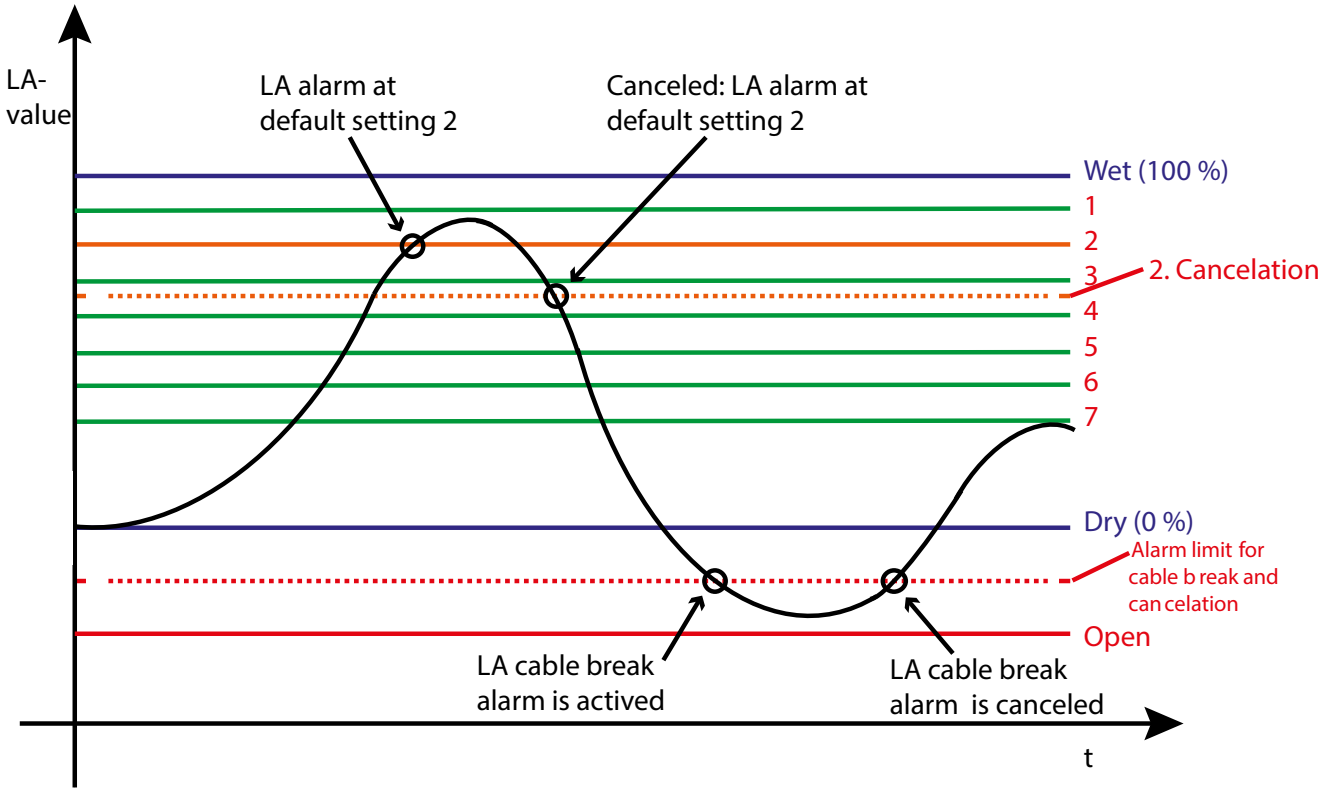


Figure 22 LA alarm limits

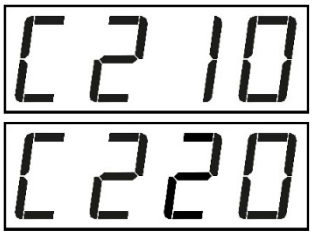
20.3 LA Calibration

The liquid alarm sensors type LA1 or LA1S installed by M&C are factory activated and calibrated. If required, the basic accuracy of the liquid alarm sensors can be optimized by recalibration. Later-installed liquid sensors must be activated and calibrated.

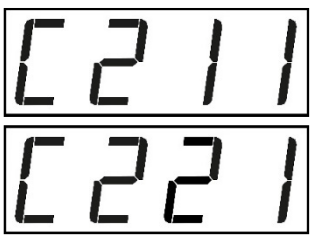
Note

Make sure that the LA is activated. If a retrofitted LA is not activated, the calibration has no effect and will be discarded.

To calibrate a liquid alarm sensor, proceed as follows:



First calibrate the "dry state" of the liquid alarm sensor.
To do this, leave the LA in the dry state and enter the code "210" (for channel 1) or "220" (for channel 2). Confirm the displayed value with the ✓-key.

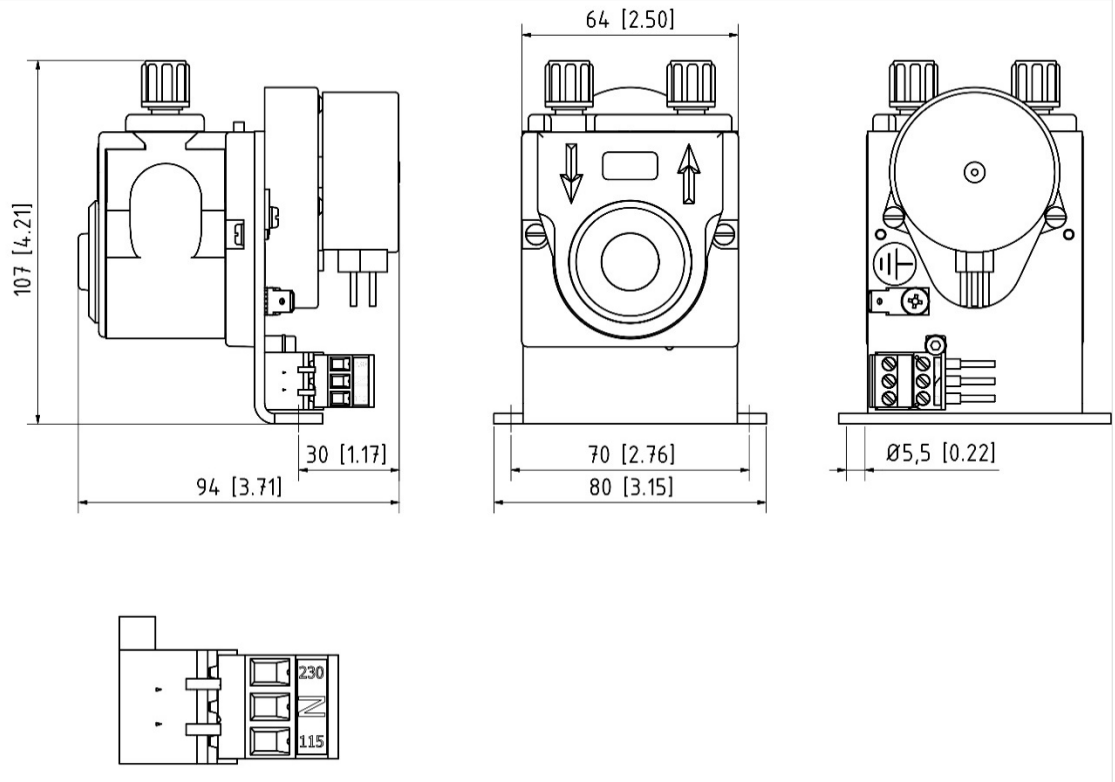


Then calibrate the "wet state" of the liquid alarm sensor.
Immerse the LA in the process-dependent condensate to calibrate the 100 % wet condition via code "211" (for channel 1) or "221" (for channel 2). Confirm the displayed value with the ✓-key.

21 Retrofitting: Peristaltic Pump SR25.2-W

Note

For installation instructions and supply connections please refer to the SR25 instruction manual (included in the peristaltic pump delivery).
The SR25 instruction manual is also available on our website www.mc-techgroup.com.



Metric dimensions are rounded. Inch dimensions are for reference only. In case of doubt or conflict metric units take priority.

Figure 23 Dimensions SR25.2-W

22 Proper Disposal of the Device

At the end of the service life 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, follow the rules and regulations of your country regarding recycling and waste management.

23 Spare Parts and Options List

The replacement intervals for consumables (C), recommended spare parts (R) and spare parts (S) depend on your operating conditions and the specific operating condition of the equipment.

The following table gives recommendations on the stocking of consumables (parts with an expected service life) and recommended spare parts (to ensure a high availability of the unit).

The quantities indicated for these parts for operation in years are based on empirical values.

For spare parts (S), spare parts/options (S/O) and options (O) no recommended quantities can be given for operation in years.

(C) Consumables, (R) Recommended spare parts, (S) Spare parts, (O) Options

Part-No.:	**Description:**	**C/R/S/O:**	**Recommended amount based on number of years of operation [years]**		
			1	**2**	**3**
90K7200	Electronics for ECP1000C and ECP3000C	S	-	-	-
90K7200	Electronics for ECP2000C	S	-	-	-
90K7220	mA-electronics	S	-	-	-
EZ0034	Power supply for ECP1000C and ECP3000C	S	-	-	-
EZ0035	Power supply for ECP2000C	S	-	-	-
93K0012	Fan	S	-	-	-
93K2080	Peltier element	S	-	-	-
93K2070	Temperature sensor	S	-	-	-
01K9200	1 x mA- output incl. plug and socket, mounting and calibration (per channel)	O	-	-	-
01K9250	1 x Thermocouple incl. plug, socket and signal converter, and mounting incl. special heat exchanger with three gas connections (ECP1000C only)	S/O	-	-	-
01K9260	Type LA1S: Liquid alarm sensor with cable break detection *Note: Evaluation is carried out as standard in the ECPX000C, LA1S for M&C universal filters with D connection*	S/O	-	-	-
01K9270	Type LA1: Liquid alarm sensor without cable break detection *Note: Evaluation is carried out as standard in the ECPX000C, LA1 for M&C universal filters with D connection*	S/O			
97K0100	Heat exchanger Ø 25 mm glass	R/O	1	1	1
97K0115	Heat exchanger Ø 25 mm stainless steel	R/O	1	1	1
97K0110	Heat exchanger Ø 25 mm PVDF	R/O	1	1	1
93K0103	Heat exchanger Ø 25 mm with 3 connections, one for thermocouple, glass only	R/O	1	1	1
93K0140	Heat exchanger Ø 50 mm glass	R/O	1	1	1
93K0160	Heat exchanger Ø 50 mm stainless steel	R/O	1	1	1

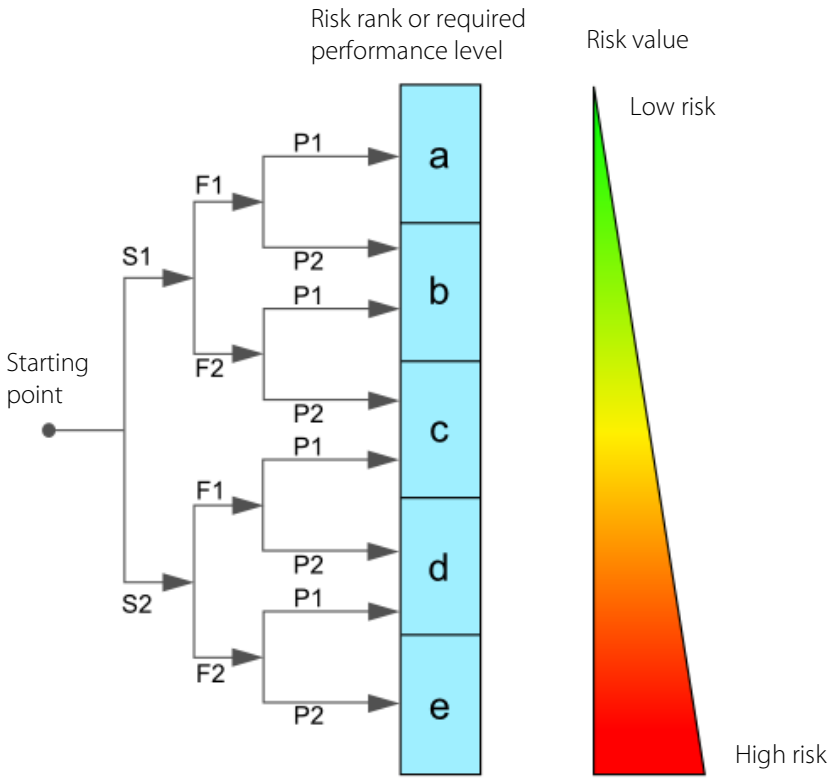
Part-No.:	Description:	C/R/S/O:	Recommended amount based on number of years of operation [years]		
			1	2	3
93K0170	Heat exchanger Ø 50 mm PVDF	R/O	1	1	1
90K0115	Heat sink compound für heat exchanger (50 g)	R	1	1	1
90K0116	Heat sink compound silver	S	-	-	-
01P1307	Peristaltic pump SR25.2-W, 0,3 Nl/h, 115 / 230 V AC with PVDF tube connection fitting DN 4/6 mm	S	-	-	-
90P1020	SR25.2: Driver, complete	R	-	1	2
90P1050	SR25.2: Conveying belt	R	-	1	2
90P1007	SR25 pump tubing with PVDF tubing connection DN 4/6 mm	C	2	4	8
01P9160X	SR25.2-W Connection set without peristaltic pump (PVDF screw connections for SS, PVDF and Glass HE, 0.5 m Novoprene hose and fixing screws)	O			

24 Risk Assessment

The risk assessment provided in this chapter is intended for all work activities on the product. The hazards can occur in the work steps of assembly, commissioning, maintenance, disassembly and in the event of a product fault. During normal operation, the product is protected by a system cabinet or appropriate covers.
Only qualified personnel is permitted to perform the work. The following minimum knowledge is required for the work:

- Employee instruction provided in process engineering
- Employee instruction provided in electrical engineering
- Detailed knowledge of the instruction manual and the applicable safety regulations

The product complies with the current regulations according to state-of-the-art science and technology. Nevertheless, not all sources of danger can be eliminated while observing technical protective measures. Therefore, the following risk assessment and the description of exposure hazards refer to the work steps mentioned above.



Severity of injury:
S1 = 1 = minor (reversible injury)
S2 = 2 = serious (irreversible injury, death)

Frequency and duration:
F1 = 1 = infrequent or short exposure to hazard
F2 = 2 = frequent (more than once per hour/shift)

Possibility of preventing or limiting the damage
P1 = 1 = possible
P2 = 2 = hardly possible

Figure 24 Overview risk assessment

Aggressive condensate possible

Risk rank group A
Chemical burns due to aggressive media possible!
This applies to all liquids in vessels and in the product.
In general, for electrical and mechanical work on the product, wear personal protective equipment (PPE) in accordance with the risk assessment.

Caution risk of being crushed by rotating parts

Risk rank - group A
The product contains rotating parts. Do not open covers until the device has been switched off.

Caution glass

Risk rank - group A

The product contains glass components. In general, for electrical and mechanical work on the product, wear personal protective equipment (PPE) in accordance with the risk assessment.

Caution hot surfaces

Risk rank group A

The temperature inside the product can be higher than 60 °C.
The hot parts are shielded by mechanical devices. Before opening the products, they must be disconnected from the power supply and a cooling time of more than 20 minutes must be observed. In general, for electrical and mechanical work on the product, wear personal protective equipment (PPE) in accordance with the risk assessment.

Caution electric shock

Risk rank group C

When installing high-power systems with nominal voltages of up to 1000 V, the requirements of VDE 0100 and their relevant standards and regulations must be observed!
This also applies to any connected alarm and control circuits. Before opening the products, they must always be disconnected from the power supply.

Gas hazard

Risk rank group A-B-C

The hazard potential mainly depends on the gas to be extracted.
If toxic gases, oxygen displacing or explosive gases are conveyed with the product, an additional risk assessment by the operator is mandatory.
In principle, the gas paths must be purged with inert gas or air before opening the gas-carrying parts.
The escape of potentially harmful gas from the open process connections must be prevented.
The relevant safety regulations must be observed for the media to be conveyed. If necessary, flush the gas-carrying parts with a suitable inert gas. In the event of a gas leakage, the product may only be opened with suitable PPE or with a monitoring system.
Furthermore, the work safety regulations of the operator must be observed.

Caution crushing hazard

Risk rank group A
The work must be performed by trained personnel only.
This applies to products weighing less than 40 kg [≈ 88.2 lbs]:
The product can be transported by 1 to 2 person(s). The instructions for appropriate personal protective equipment (PPE) must be observed.
The weight specifications are contained in the technical data of this product.
Furthermore, the work safety regulations of the operator must be observed.

25 Appendix

For additional manuals and data sheets please look on our home page
www.mc-techgroup.com

Instruction manual peristaltic pump **SR 25.2**

Data sheet for Condensate vessel **TG**, **TK**

Data sheet for **GL**-connectors

Data sheet for Automatic liquid drain **AD-SS**

Data sheet for Automatic liquid drain **AD-P**

25.1 Main Menu: ECP1000C and ECP3000C

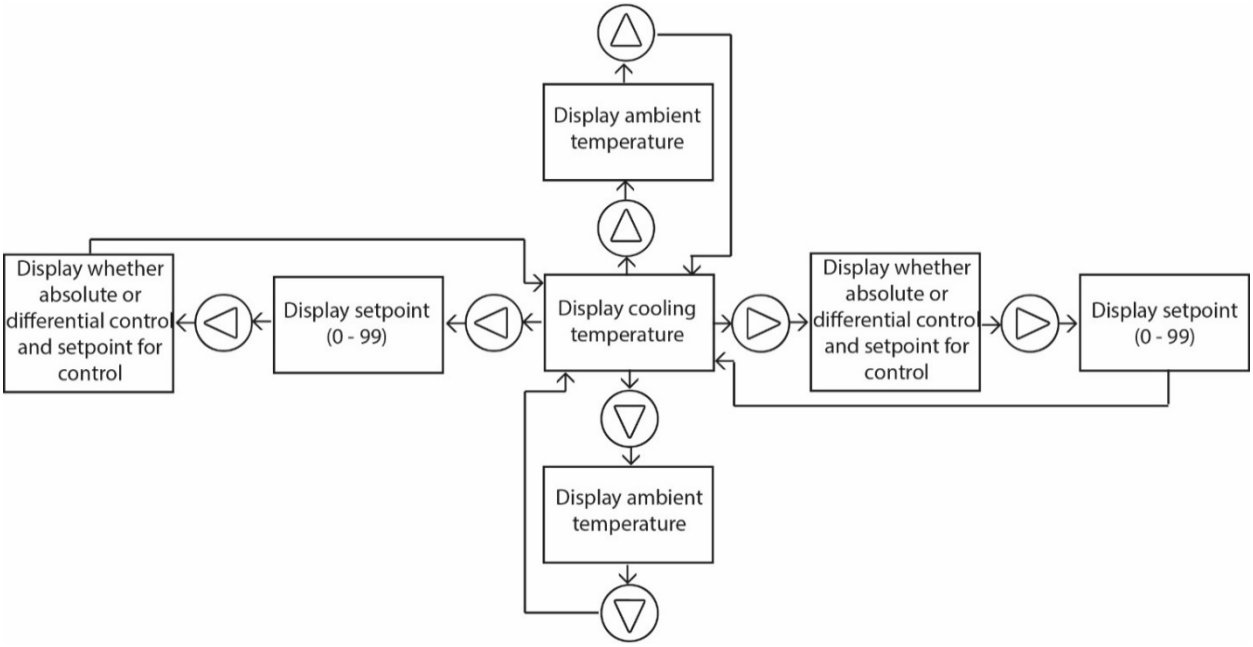


Figure 25 Menu structure of a one channel cooler

25.2 Main Menu: ECP2000C

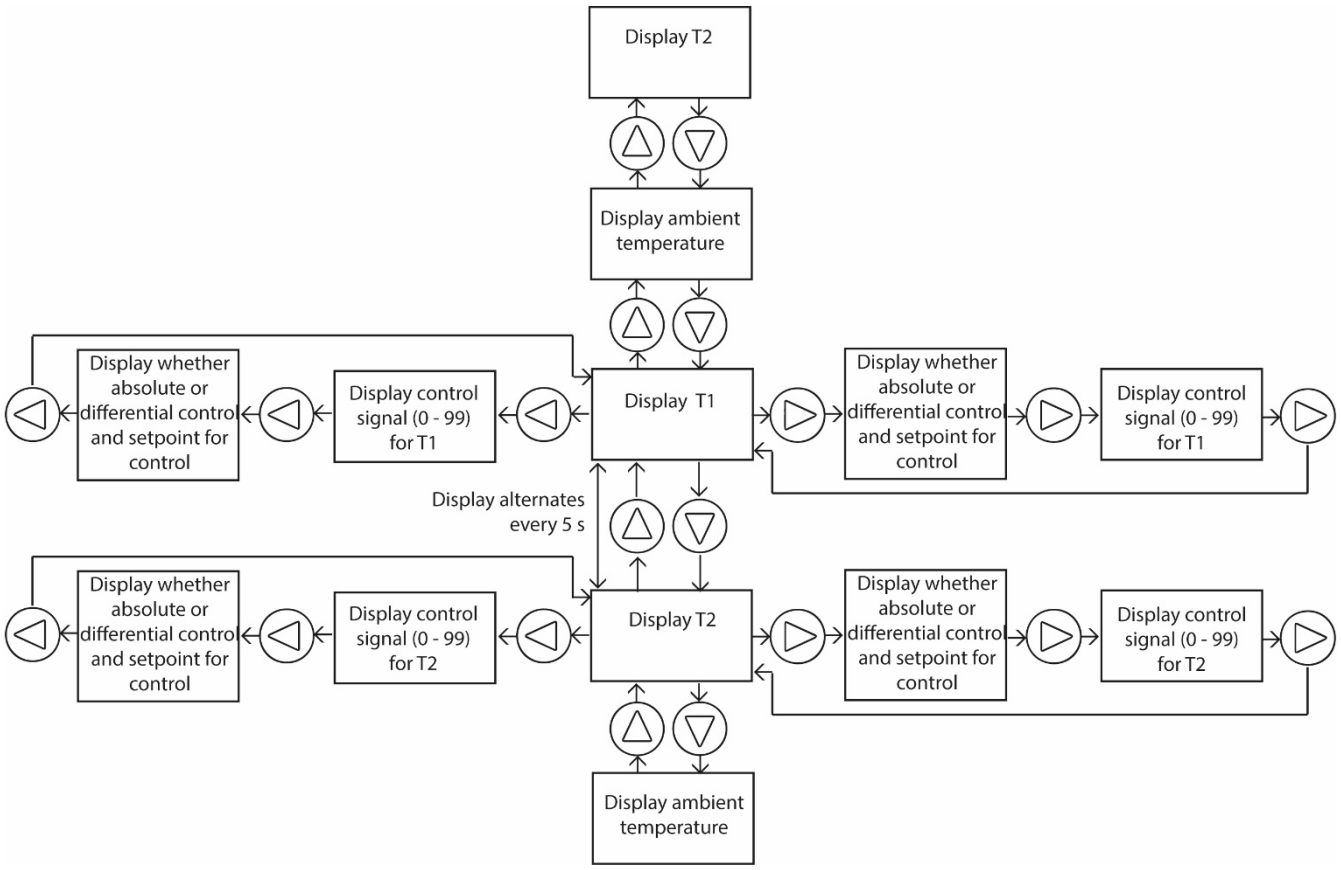


Figure 26 Menu structure of the ECP2000C

25.3 Menu Structure after Entering the PIN

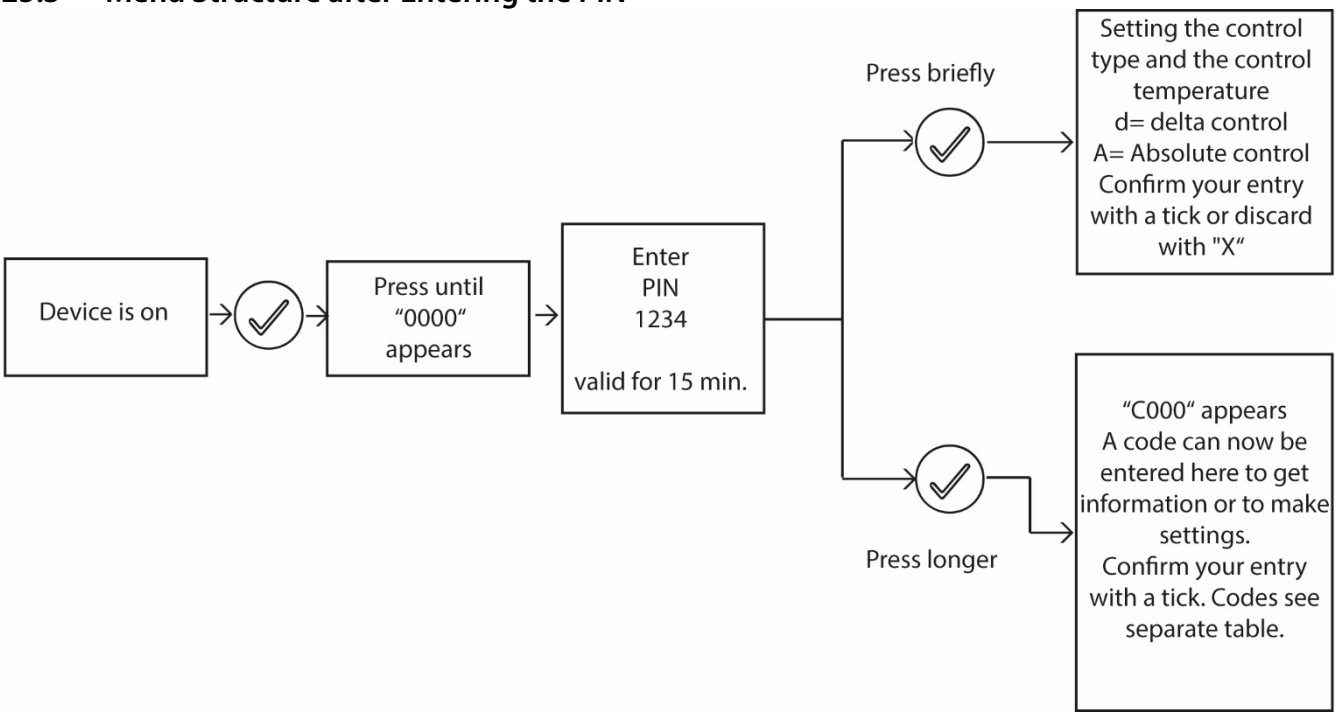


Figure 27 Menu structure after entering the PIN

25.4 Calculations for mA Output

The mA output value always corresponds to the current cooler temperature.

Note

The calculations do not apply to the thermocouple option (ECP1000C only). For more information see chapter 13.2.4 "mA Connection Thermocouple (Optional, ECP1000C Only)".

25.4.1 Calculating the mA Value Based on the Temperature

The value of the mA output signal can be calculated from the displayed cooler temperature.
The following formulas are available for calculation:

$$I_{measured}[mA] = \left(\frac{(T_{display}[°C]+10)*4}{15}\right) + 4$$ if 4 – 20 mA is set

$$I_{measured}[mA] = \left(\frac{T_{display}[°C]+10}{3}\right)$$ if 0 – 20 mA is set

25.4.2 Calculating the Temperature Based on the mA Value

The cooler temperature can be calculated from the measured mA output signal.
The following formulas are available for calculation:

$$T[°C] = \left(\frac{(I_{measured}[mA]-4)*15}{4}\right) - 10$$ if 4 – 20 mA is set

$$T[°C] = I_{measured}[mA] * 3 - 10$$ if 0 – 20 mA is set

25.4.3 Step Size and Resolution of the mA Output

The mA outputs have a resolution of 0.1 °C [0.18 °F].

- 4 - 20 mA: 0.1 °C [0.18 °F] corresponds to 0.027 mA
- 0 - 20 mA: 0.1 °C [0.18 °F] corresponds to 0.033 mA

25.5 Circuit Diagram

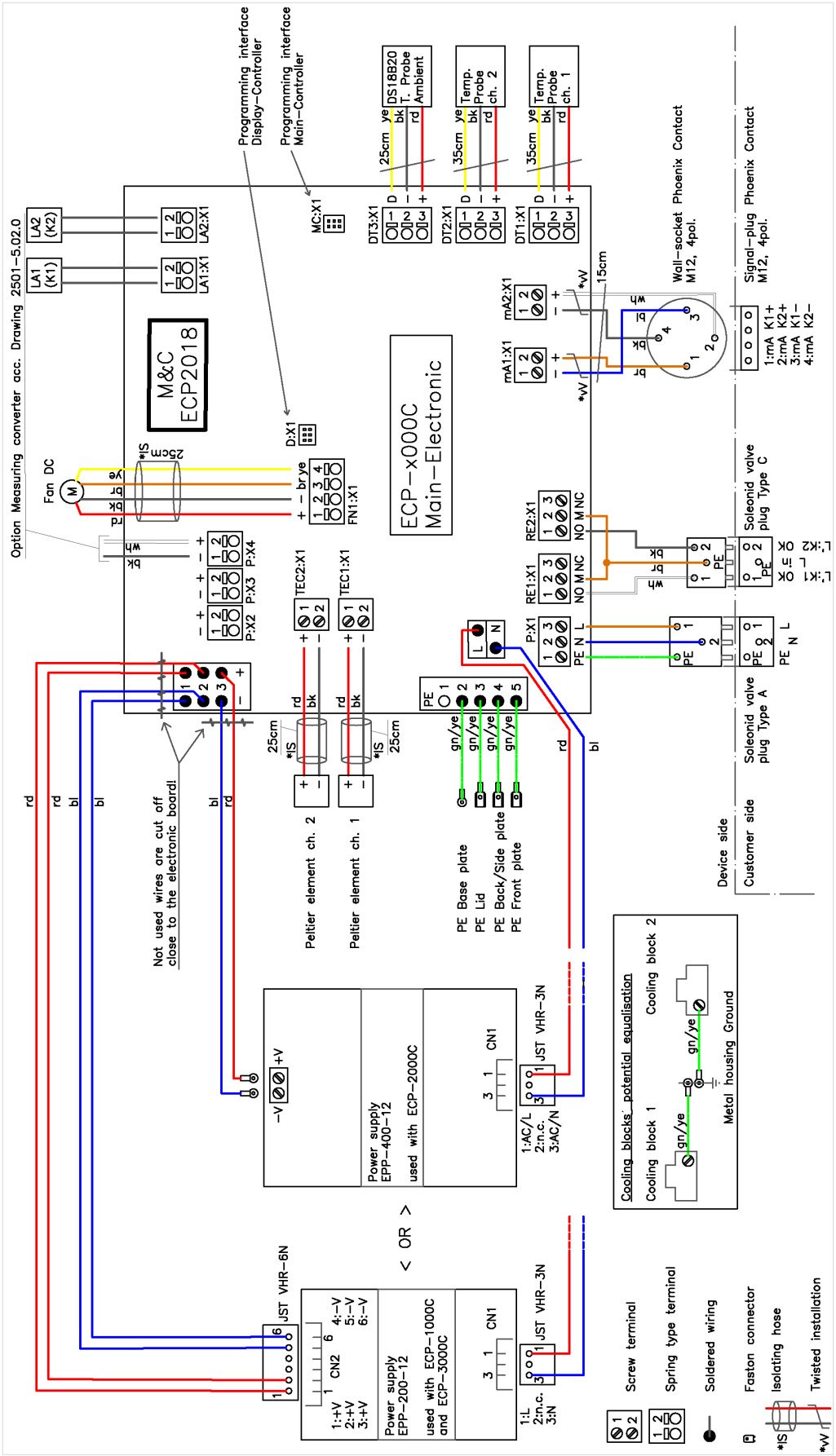


Figure 28 Circuit diagram

25.6 Wiring Diagram: Thermocouple Optional (ECP1000C)

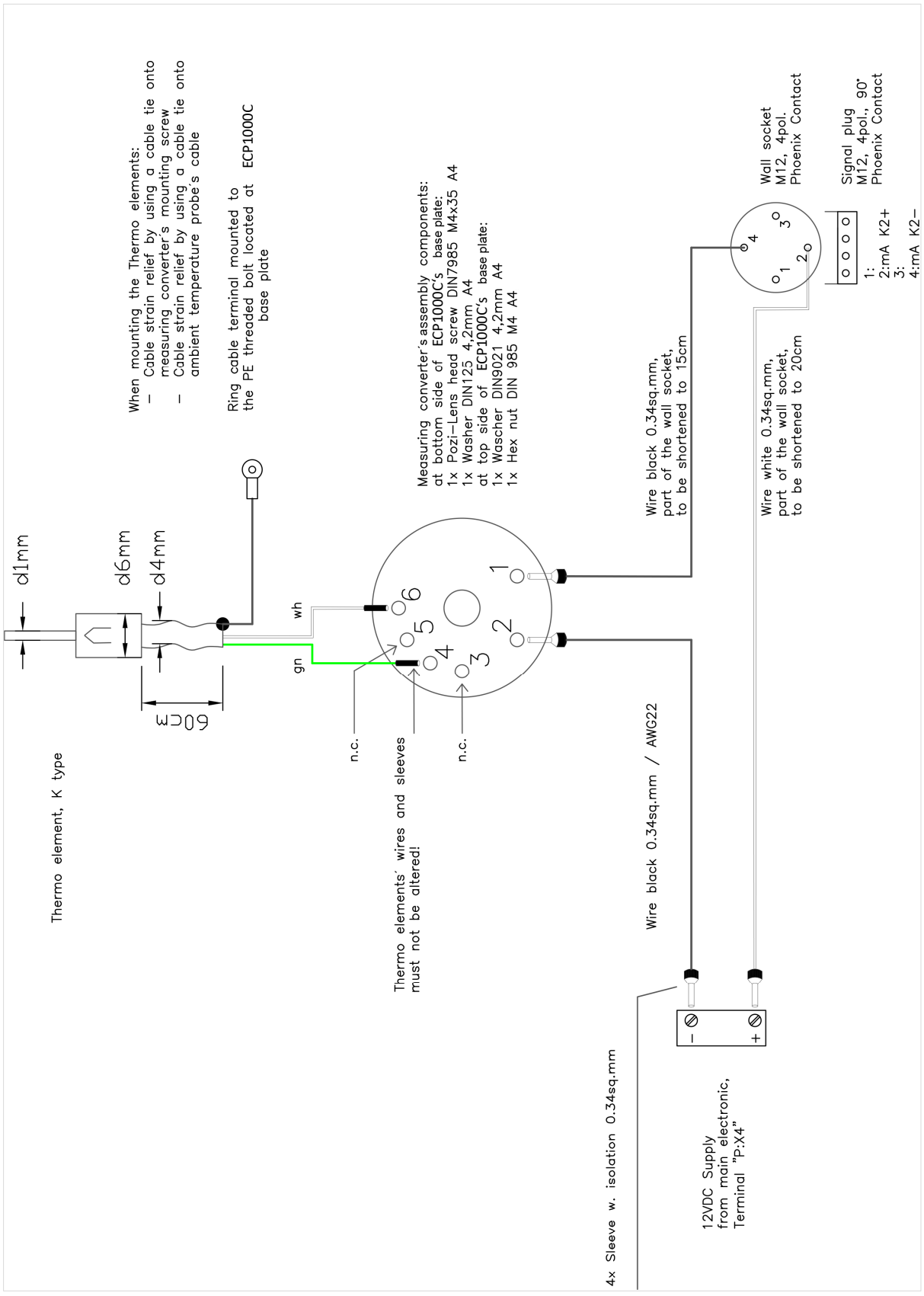


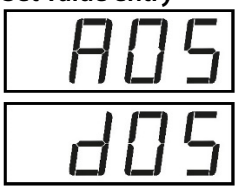
Figure 29 Wiring diagram: Thermocouple connection (ECP1000C)

25.7 Table of Parameter Codes

No.	Description:	Default:	Range:	Note:	Will be canceled after factory reset
1	Software version				
5	Brightness setting of display	5	0 - 9	Brightest display setting is 9	x
10	LA on/off switching Channel 1	0	0,1,2	0=off; 1= without cable break detection; 2= with cable break detection	x
11	Sensitivity LA Channel 1	2	1-7	The higher the value is, the sooner the alarm is triggered.	x
12	HIGH dT Channel 1	3	2 - 8 [°C]	Differential temperature between setpoint and upper temperature alarm limit	x
13	LOW dT Channel 1	3	2 - 8 [°C]	Differential temperature between setpoint and lower temperature alarm limit	x
14	Hysteresis (temperature alarm) Channel 1	2	1,2 [°C]	As soon as a temperature alarm limit of "2" is selected, the hysteresis is automatically reduced to 1	x
15	mA range selection Channel 1	4-20	0-20 / 4-20 [mA]	Corresponds to the temperature range: -10 °C to +50 °C (4 – 20 mA: at 5 °C = 8 mA)	x
20	LA on-/off switching Channel 2	0	0,1,2	0=off; 1= without cable break detection; 2= with cable break detection	x
21	Sensitivity LA Channel 2	2	1-7	The higher the value is, the sooner the alarm is triggered.	x
22	HIGH dT Channel 2	3	2 - 8 [°C]	Differential temperature between setpoint and upper temperature alarm limit	x
23	LOW dT Channel 2	3	2 - 8 [°C]	Differential temperature between setpoint and lower temperature alarm limit	x
24	Hysteresis (temperature alarm) Channel 2	2	1,2 [°C]	As soon as a temperature alarm limit of "2" is selected, the hysteresis is automatically reduced to 1	x
25	mA range selection Channel 2	4-20	0-20 / 4-20 [mA]	Corresponds to the temperature range: -10 °C to +50 °C (4 – 20 mA: at 5 °C = 8 mA)	x
70	Operating time in days			This value will not be deleted even after restarting	
84	Fan speed	1	0-5	Value has no influence on the output power	
210	Calibration LA dry Channel 1			Connect the sensor and confirm with the ✓-key.	
211	Calibration LA wet Channel 1			Hold the sensor in water and confirm with the ✓-key.	
212	Calibration LA open / cable break Channel 1			Disconnect the sensor and confirm with the ✓-key. The cable break detection **triggers in the middle between this value and that of dry.**	
213	Display LA dry			Check here the current value	

No.	Description:	Default:	Range:	Note:	Will be canceled after factory reset
	Channel 1				
214	Display LA wet Channel 1			Check here the current value	
215	Display LA open Channel 1			Check here the current value	
220	Calibration LA dry Channel 2			Connect the sensor and confirm with the ✓-key.	
221	Calibration LA wet Channel 2			Hold the sensor in water and confirm with the ✓-key.	
222	Calibration LA open / cable break Channel 2			Disconnect the sensor and confirm with the ✓-key. The cable break detection **triggers in the middle between this value and that of "LA dry".**	
223	Display LA dry Channel 2			Check here the current value	
224	Display LA wet Channel 2			Check here the current value	
225	Display LA open Channel 2			Check here the current value	
310	mA output LOW Calibration Channel 1	1 mA		Connect the multimeter and press or hold △ or ▽-keys until the display matches **1mA**.	
311	mA output HIGH Calibration Channel 1	20 mA		Connect the multimeter and press and hold △ or ▽-keys until the display matches **20 mA**.	
320	mA output LOW Calibration Channel 2	1 mA		Connect the multimeter and press or hold △ or ▽-keys until the display matches **1 mA**.	
321	mA output HIGH Calibration Channel 2	20 mA		Connect the multimeter and press and hold △ or ▽-keys until the display matches **20 mA**.	
777	Reset to factory settings			After "777" has been entered and confirmed, a "0" is blinking. Use the arrow keys to switch between "0" and "1". With "1" and confirmation, the device is reset to the factory setting.	

25.8 Quick Guide

Enter PIN „1234“ 	Press and hold the ✓-key until “0000” appears in the display. The “0” on the left side is blinking. Use the △ and ▽-keys to enter the first digit of the PIN. Use the ◁ and ▷-keys to switch to the other digits. If a digit is blinking, enter the PIN digit. Confirm the PIN with the ✓-key.
Set value entry 	After entering the PIN, briefly tap the ✓-key or keep the key pressed for 2 seconds in the main menu (temperature or setpoint display) while the PIN is active. The setpoint entry appears. The two digits are blinking. The setpoint can be set between 2 and 15 °C using the △ and ▽-keys. Use the ◁ and ▷-keys to switch between the operating mode and setpoint settings. When the letter on the left side is blinking, use the △ and ▽-keys to switch between absolute and differential value control of the setpoint temperature.
Parameter settings 	After entering the PIN, press and hold the ✓-key. First the setpoint of the cooler temperature appears, then the display changes to code entry. The left digit starts blinking. A code can have up to 3 digits. Use the △ and ▽-keys to enter the first digit of the code. Use the ◁ and ▷-keys to switch to the other digits. After entering all digits, press the ✓ -key to confirm, and press ⊗ to discard the entry. The display shows the cooler temperature again after changing or aborting.

No.	Description	Default	Range	Note	C777*
1	Software version				
5	Brightness setting of display	5	0 - 9	Brightest display setting is 9	x
10	LA on/off Channel 1	0	0,1,2	0=off; 1=w/o cable break; 2=with cable break	x
11	Sensitivity LA Channel 1	2	1 - 7	The higher the value is, the sooner the alarm is triggered.	x
12	HIGH dT Channel 1	3	2 - 8 [°C]	Differential temperature between setpoint and upper temperature alarm limit	x
13	LOW dT Channel 1	3	2 - 8 [°C]	Differential temperature between setpoint and lower temperature alarm limit	x
14	Hysterese (temperature alarm) Channel 1	2	1,2 [°C]	As soon as a temperature alarm limit of “2” is selected, the hysteresis is automatically reduced to 1.	x
15	mA range selection Channel 1	4-20	0-20 / 4-20 [mA]	Corresponds to the temperature range: -10 to +50 °C (4 – 20 mA: at 5 °C = 8 mA)	x
20	LA on/off Channel 2	0	0,1,2	0=off; 1=w/o cable break; 2=with cable break	x
21	LA Sensitivity Channel 2	2	1 - 7	The higher the value is, the sooner the alarm is triggered.	x
22	HIGH dT Channel 2	3	2 - 8 [°C]	Differential temperature between setpoint and upper temperature alarm limit	x
23	LOW dT Channel 2	3	2 - 8 [°C]	Differential temperature between setpoint and lower temperature alarm limit	x
24	Hysterese (temperature alarm) Channel 2	2	1,2 [°C]	As soon as a temperature alarm limit of “2” is selected, the hysteresis is automatically reduced to 1.	x
25	mA range selection Channel 2	4-20	0-20 / 4-20 [mA]	Corresponds to the temperature range: -10 to +50 °C (4 – 20 mA: at 5 °C = 8 mA)	x
70	Operating time in days			Value will not be deleted, even after restarting	
84	Fan speed	1	0-5	Value has no influence on the output power	
777	Reset to factory settings*			After “777” has been entered and confirmed, a “0” is blinking. Use arrow keys to switch between “0” and “1”. Enter “1” and confirm, device is reset to the factory setting.	

**Codes with “x” in “C777” column: values will be reset to factory default values if code “777” is confirmed.*