



ModbusRTU

## Gas cooler series TC-Standard

Many analysis processes require extracting sample gas from the process. This also extracts process-related contamination such as particles or moisture. These can impact the measurement results or damage the measuring cells. The sample gas must therefore be conditioned before entering the analyser. The sample gas cooler reduces the gas temperature to below the dew point for this purpose, causing moisture to drop out, which is then discharged as condensate.

In addition to the potential-free status output to monitor the sample gas cooler function, we offer an optional 4 - 20 mA analog output or digital interface. The process control can access the process and diagnostic data via the Modbus RTU communication protocol as well as configure the device settings.

Despite its compact size, the TC-Standard is a powerful sample gas cooler and already covers a large percentage of standard applications in gas analysis. Plug-in heat exchangers are available in a variety of materials and a large range of accessories can be directly built in to adapt the unit to the operating conditions.

Compact design: Pre-installed and ready to connect

Low maintenance costs based on easy accessibility

One or two gas paths

Heat exchanger made from stainless steel, Duran glass or PVDF

Adjustable outlet dew point and alarm thresholds

Nominal cooling capacity 100 kJ/h (40 °C version) or 90 kJ/h (50 °C version)

Dew point stability 0.1 °C

Status display and output

Cooling block temperature display

Optional 4 - 20 mA or Modbus RTU signal output

Optional CE mark or FM approval

Moisture detector, filter and condensate pump optional



**Overview**

The TC-Standard series was designed specifically for high cooling capacities and high ambient temperatures.

The Peltier cooler is distinguished by two types according to cooling capacity or reasonable operating temperature. This classification is reflected in the type designation. The exact item number of the model defined by you is determined by the model code in the category ordering information.

Application	Standard applications		
	Operating temperature	40 °C	50 °C
1 heat exchanger	TC-Standard 6111	TC-Standard 6112	3rd digit=1
2 heat exchangers	TC-Standard 6121	TC-Standard 6122	3rd digit=2
	4th digit=1	4th digit=2	

Additional components which every conditioning system should feature can optionally be integrated:

- Peristaltic pump for condensate separation,
- Filter,
- Moisture detector

In addition, we offer different signal outputs:

- Status output
- Analog output, 4...20 mA, incl. status output,
- Modbus RTU digital output, incl. status output

This allows for various configurations of cooler and options. Here the approach is to simplify creating a complete system in a cost-efficient way through pre-installed components with hoses connected. We further paid attention to easy access to wear parts and consumables.

**Description of functions**

The cooler is controlled by a microprocessor. With the factory preset the control already incorporates the various characteristics of the built-in heat exchangers.

The programmable display shows the block temperature in the selected display unit (°C / °F) (factory preset °C). Application-specific settings can easily be configured guided by the menu, using the 5 buttons. For one, this applies to the target outlet dew point, which can be set from 2 to 20 °C (36 °F to 68 °F) (factory preset 5 °C/41 °F).

And then the warning thresholds can be adjusted for low and excess temperature. These are set relative to the outlet dew point  $\tau_a$  setting.

For the low temperature the range is  $\tau_a - 1$  to  $- 3$  K (at a minimum 1 °C/ 34 °F cooling block temperature), for the excess temperature the range is  $\tau_a + 1$  to  $+ 7$  K. The factory presets for both values are 3 K.

The flashing display and the status relays indicate the conditions are below or above the configured warning range (e.g. after switching on).

The status output can e.g. be used to control the sample gas pump to allow for the gas flow to only be switched on once the permissible cooling range has been reached or shut off the pump in the event of a moisture detector alarm.

The separated condensate can be drained via connected peristaltic pumps or add-on automatic condensate drains.

Fine mesh filters can also be used, which in turn can be installed in optional moisture detectors.

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

The moisture detector is easy to remove. This may be required if a condensate enters the cooler due to a malfunction and the peristaltic pump or the automatic condensate drain is unable to remove it.

### Delta T control option

Not all applications require an outlet dew point of 5 °C (41 °F). In some applications a higher dew point is sufficient. In other applications a stable outlet dew point doesn't matter, it's enough for the gas to be dry, so if the outlet dew point has an adequate difference in temperature below the ambient temperature.

Here the electronics measure the ambient temperature and regulate the outlet dew point to an adjustable value below it. This extends the potential cooling capacity to the limits of the heat exchanger. Here it's important to note the outlet dew point fluctuates along with the ambient temperature and a stable dew point cannot be a prerequisite for the measurement.

The target temperature range is defined by the ambient temperature, the adjustable temperature difference and the alarm limits. If the block temperature is not within the target range with active Delta T-control, the status message "dt" will flash in the display.

**Example:** At a difference of 30 °C (30 K/54 °F), at a set outlet dew point of 5 °C (41 °F) this means the dew point remains stable up to an ambient temperature of approx. 35 °C (95 °F), and the safe drop is only preferred over the ambient temperature with ambient temperature peaks over 35 °C (95 °F). The cooling capacity specified in the cooling capacity graphs at 35 °C (95 °F) is then available at above 35 °C (95 °F).

### Gas cooler technical data

Gas Cooler Technical Data						
Ready for operation	after max. 10 minutes					
Ambient temperature	5 °C to 50 °C					
Gas output dew temperature preset:	5 °C					
adjustable:	2 °C...20 °C or Delta T control					
IP rating	IP 20					
Mechanical load	Tested based on DNV-GL CG0339 vibration class A (0.7g) 2 Hz-13.2 Hz amplitude ± 1.0 mm 13.2 Hz -100 Hz acceleration					
Housing	Stainless steel, brushed					
Packaging dimensions	approx. 355 x 220 x 205 mm					
Weight incl. heat exchanger	approx. 7.5 kg approx. 6 kg (for 24 V DC) approx. 9 kg at full expansion stage					
Electrical data	Unit without add-on			Unit with add-on (1 peristaltic pump)		
	<b>24 V DC</b>	<b>230 V AC</b>	<b>115 V AC</b>	<b>24 V DC</b>	<b>230 V AC</b>	<b>115 V AC</b>
	±10%	+5/-10%	+5/-10%	±10%	+5/-10%	+5/-10%
	-	50/60 Hz	50/60 Hz	-	50/60 Hz	50/60 Hz
	5 A	0.6 A	1.2 A	5.5 A	0.7 A	1.4 A
	120 W	110 W / 140 VA		130 W	130 W / 160 VA	
Recommended fuse (characteristic: delayed action)	6.3 A	1.25 A	2.5 A	6.3 A	1.25 A	2.5 A
Status output switching capacity	max. 250 V AC, 150 V DC 2 A, 50 VA, potential-free					
Electrical Connections	Plug per EN 175301-803					
Gas connections and condensate outlet	Heat exchanger see table "Heat Exchanger Overview" Filter, moisture detector adapter G1/4 or NPT 1/4"					
Parts in contact with media	see "Technical Data - Options"					
Filter:	see "Technical Data - Options"					
Moisture detector:	see "Technical Data - Options"					
Heat exchanger:	see table "Heat Exchanger Overview"					
Peristaltic pump:	see "Technical Data - Options"					
Tubing:	PTFE/Viton					
FM no.:	3062014					

**Technical Data - Options**

**Analogue Output Cooler Temperature Technical Data**

Signal	4-20 mA or 2-10 V corresponds to -20 °C to +60 °C cooler temperature
Connection	M12x1 plug, DIN EN 61076-2-101

**Digital interface technical data**

Signal	Modbus RTU (RS-485)
Connection	M12x1 connector, DIN EN 61076-2-101

**Technical Data FF-3-N Moisture Detector**

Ambient temperature	3 °C to 50 °C
max. operating pressure with FF-3-N	2 bar
Material	PVDF, PTFE, epoxy resin, stainless steel 1.4571, 1.4576

**Technical Data Peristaltic Pumps CPsingle / CPdouble**

Ambient temperature	0 °C to 55 °C
Flow rate	0.3 L/h (50 Hz) / 0.36 L/h (60 Hz) with standard hose
Vacuum inlet	max. 0.8 bar
Pressure inlet	max. 1 bar
Outlet pressure	1 bar
Hose	4 x 1.6 mm
Condensate outlet	Hose nipple Ø6 mm Screw connection 4/6 (metric), 1/6"-1/4" (US)
Protection class	IP 44
Materials	
Hose:	Norprene (Standard), Marprene, Fluran
Connections:	PVDF

**AGF-PV-30-F2 Filter Technical Data**

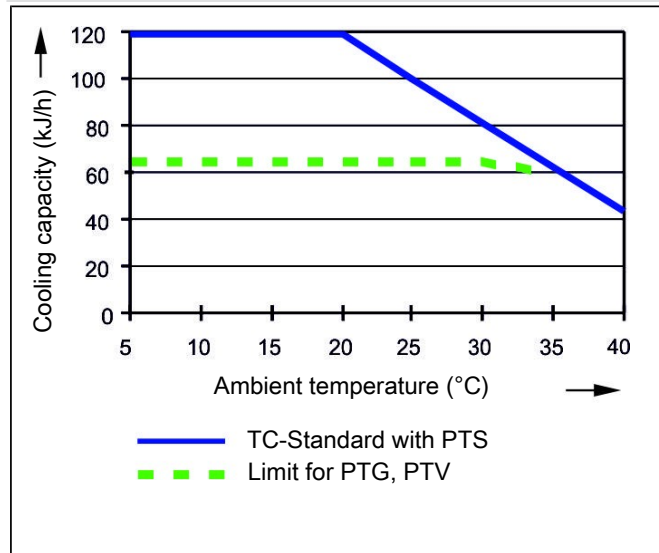
Ambient temperature	3 °C to 100 °C
max. operating pressure with filter	4 bar
Filter surface	60 cm <sup>2</sup>
Filter fineness	2 µm
Dead volume	57 ml
Materials	
Filter:	PVDF, Duran glass (parts in contact with media)
Seal:	Viton
Filter element:	sintered PTFE

Output

One heat exchanger

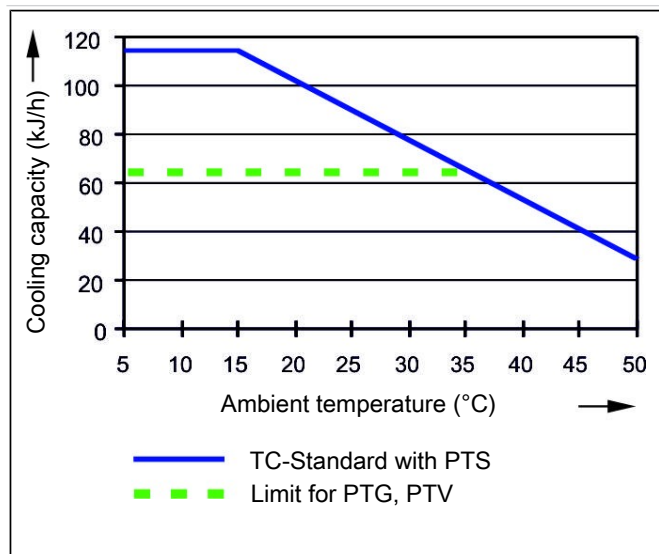
Model TC-Standard 6111

Rated cooling capacity (at 25 °C)	100 kJ/h
Max. Ambient temperature	40 °C
Dew point fluctuations static	± 0.1 K
in the entire specification range	± 1.5 K



Model TC-Standard 6112

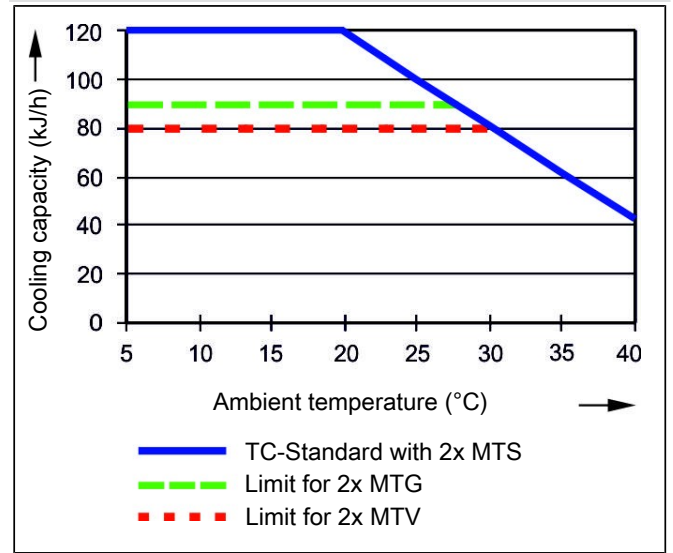
Rated cooling capacity (at 25 °C)	90 kJ/h
Max. Ambient temperature	50 °C
Dew point fluctuations static	± 0.1 K
in the entire specification range	± 1.5 K



Two heat exchangers

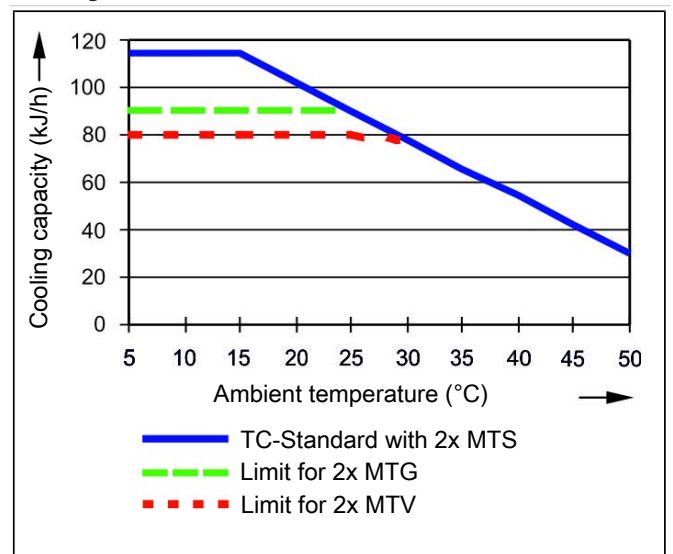
Model TC-Standard 6121

Rated cooling capacity (at 25 °C)	100 kJ/h
Max. Ambient temperature	40 °C
Dew point fluctuations static	± 0.1 K
in the entire specification range	± 1.5 K
Temperature difference between heat exchangers	< 0.5 K



Model TC-Standard 6122

Rated cooling capacity (at 25 °C)	90 kJ/h
Max. Ambient temperature	50 °C
Dew point fluctuations static	± 0.1 K
in the entire specification range	± 1.5 K
Temperature difference between heat exchangers	< 0.5 K



Note: The limit curves for the heat exchangers exchanger PTG, PTV or MTV apply to a dew point of 40 °C.

## Heat exchanger description

The energy content of the sample gas and the required cooling capacity of the gas cooler is determined by three parameters: gas temperature  $\vartheta_G$ , dew point  $\tau_e$  (moisture content) and volume flow  $v$ . The outlet dew point rises with increasing energy content of the gas. The following limits for the maximum flow are specified for a standard operating point of  $\tau_e = 40\text{ °C}$  and  $\vartheta_G = 70\text{ °C}$ . The maximum flow  $v_{\max}$  in NI/h of cooled air indicated, so after moisture has condensed. Values may differ for other dew points and gas inlet temperatures. However, the physical facts are so vast we decided to omit the illustration. Please contact our experts for clarification or refer to our calculation programme.

## Heat exchanger overview

Heat exchanger	PTS PTS-I <sup>2)</sup>	PTG PTG-I <sup>2)</sup>	PTV PTV-I <sup>2)</sup>	MTS <sup>3)</sup> MTS-I <sup>2)3)</sup>	MTG <sup>3)</sup> MTG-I <sup>2)3)</sup>	MTV <sup>3)</sup> MTV-I <sup>2)3)</sup>
Materials in contact with media	Stainless steel	Glass PTFE	PVDF	Stainless steel PVDF	Glass PTFE	PVDF
Flow rate $v_{\max}$ <sup>1)</sup>	450 NI/h	250 NI/h	250 NI/h	300 NI/h	210 NI/h	190 NI/h
Inlet dew point $\tau_{e,\max}$ <sup>1)</sup>	65 °C	65 °C	65 °C	65 °C	65 °C	65 °C
Gas inlet temperature $\vartheta_{G,\max}$ <sup>1)</sup>	180 °C	140 °C	140 °C	140 °C	140 °C	140 °C
Max. Cooling capacity $Q_{\max}$	150 kJ/h	90 kJ/h	90 kJ/h	95 kJ/h	80 kJ/h	65 kJ/h
Gas pressure $p_{\max}$	160 bar	3 bar	2 bar	25 bar	3 bar	2 bar
Pressure drop $\Delta p$ ( $v=150\text{ L/h}$ )	10 mbar	10 mbar	10 mbar	20 mbar	19 mbar	18 mbar
Dead volume $V_{\text{tot}}$	29 ml	29 ml	57 ml	19 ml	18 ml	17 ml
Gas connections (metric)	6 mm	GL 14 (6 mm) <sup>4)</sup>	DN 4/6	6 mm tube	GL14 (6 mm)	DN 4/6
Gas connections (US)	1/4"	GL 14 (1/4") <sup>4)</sup>	1/4"-1/6"	1/4" tube	GL14 (1/4")	1/4"-1/6"
Condensate out connections (metric)	G3/8	GL 25 (12 mm) <sup>4)</sup>	G3/8	G1/4	GL18 (8 mm)	G1/4
Condensate out connections (US)	NPT 3/8"	GL 25 (1/2") <sup>4)</sup>	NPT 3/8"	NPT 1/4"	GL18 (8 mm)	NPT 1/4"

<sup>1)</sup> Max. cooling capacity of the cooler must be considered.

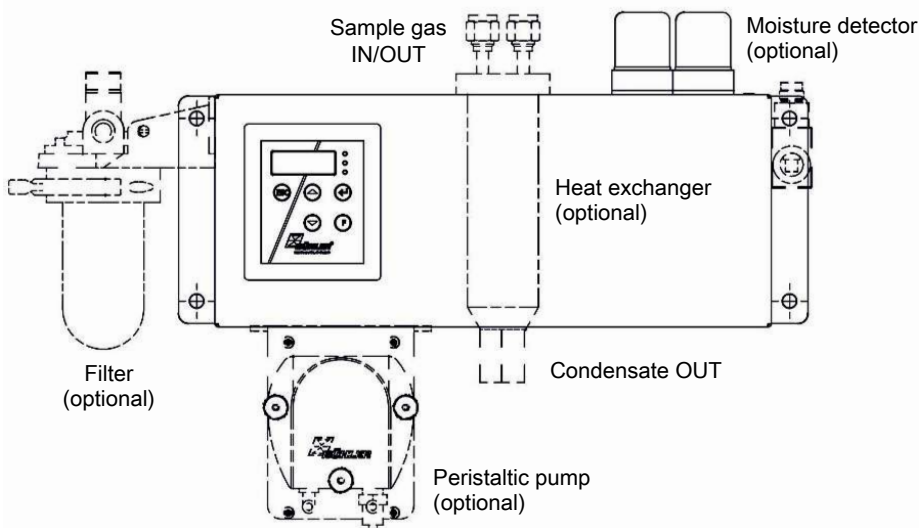
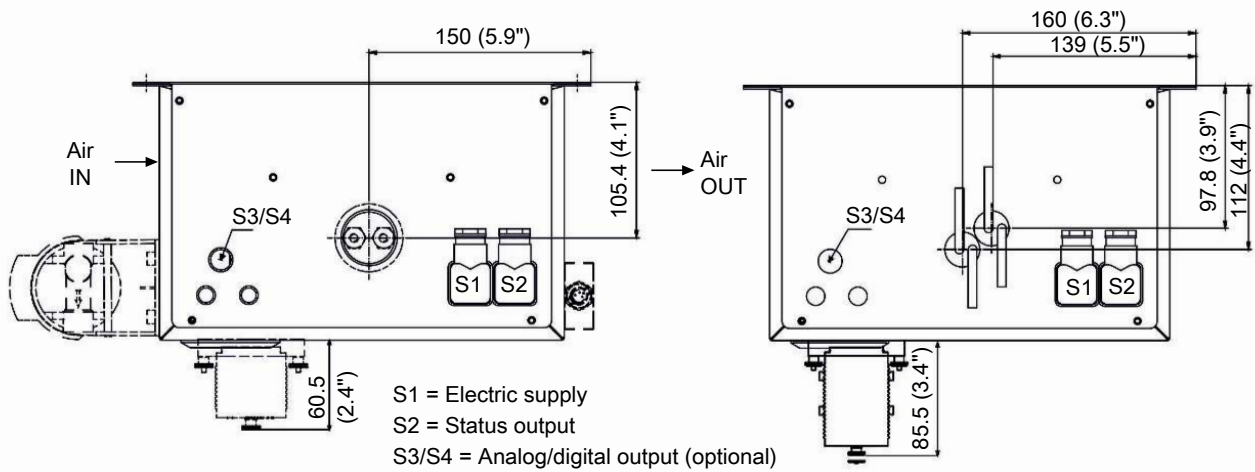
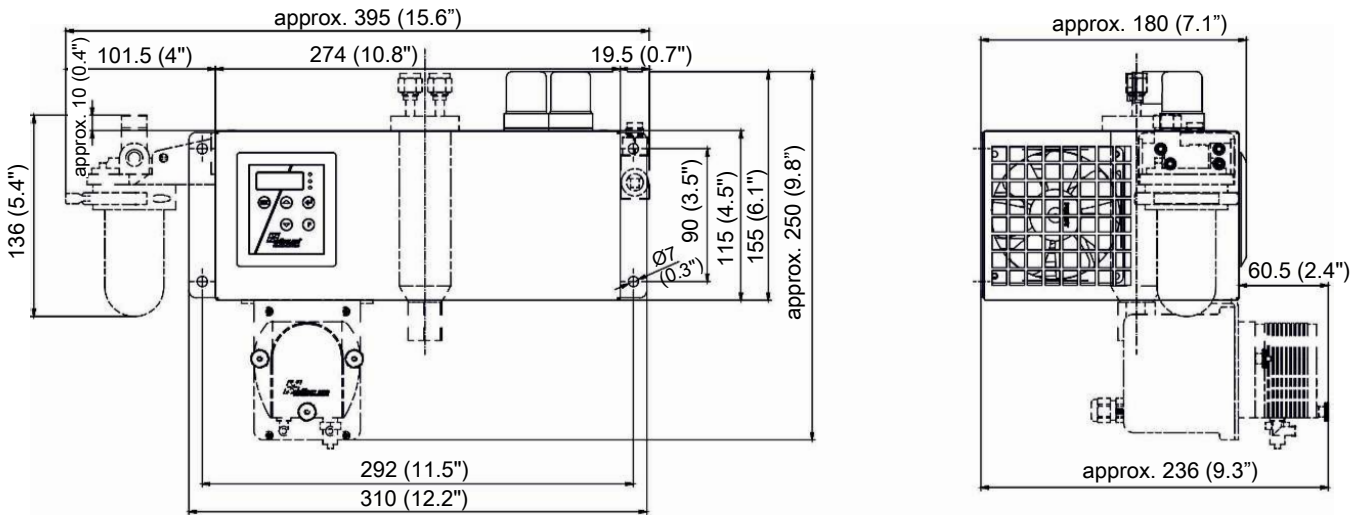
<sup>2)</sup> Models marked I have NPT threads or US tubes, respectively.

<sup>3)</sup> Passive discharge via automatic condensate drains or traps not applicable for MTG heat exchangers. For passive discharge on the MTS and MTV heat exchangers, use a screw connection with a clearance of at least 7 mm (see accessories).

<sup>4)</sup> Gasket inside diameter.

**Dimensions (mm)**

Models for standard applications (TC-Standard 611x and 612x):



Ordering instructions

Gas cooler models with one heat exchanger

The item number is a code for the configuration of your unit. Please use the following model code:

4496	2	1	1	X	X	X	1	X	X	X	0	X	X	X	0	X	0	Product Characteristics
<b>Gas cooler models (with 1 heat exchanger)</b>																		
1 TC-Standard 6111: Ambient temperature 40 °C																		
2 TC-Standard 6112: Ambient temperature 50 °C																		
<b>Certifications</b>																		
0 Standard applications – CE																		
1 for common locations - FM																		
<b>Supply voltage</b>																		
1 115 V AC, 50/60 Hz																		
2 230 V AC, 50/60 Hz																		
4 24 V DC																		
<b>Heat exchanger</b>																		
1 1 0 Stainless steel, PTS, metric																		
1 1 5 Stainless steel, PTS-I, US																		
1 2 0 Duran glass, PTG, metric																		
1 2 5 Duran glass, PTG-I, US																		
1 3 0 PVDF, PTV, metric																		
1 3 5 PVDF, PTV-I, US																		
<b>Condensate drain <sup>1)</sup></b>																		
0 0 without condensate drain																		
1 0 CPsingle with hose nipple, angled																		
3 0 CPsingle with screw connection <sup>3)</sup>																		
<b>Moisture detector/filter</b>																		
0 0 without filter, without moisture detector																		
0 1 without filter, 1 moisture detector with PVDF adapter <sup>2)</sup>																		
1 0 1 filter, without moisture detector																		
1 1 1 filter with built-in moisture detector																		
<b>Signal outputs</b>																		
0 0 status output only																		
1 0 Analog output, 4...20 mA incl. status output																		
2 0 Modbus RTU digital output incl. status output <sup>4)</sup>																		
<b>Delta T control</b>																		
0 0 without Delta T control																		
1 0 Delta T control option																		

<sup>1)</sup> 24 V DC CPsingle not connected electrically.

<sup>2)</sup> Also available in stainless steel.

<sup>3)</sup> Metric or US connection, per heat exchanger.

<sup>4)</sup> Option only available for CE version.



**Gas cooler models with two heat exchangers**

The item number is a code for the configuration of your unit. Please use the following model code:

4496	2	1	2	X	X	X	2	X	X	X	0	X	X	X	0	X	0	Product Characteristics
<b>Gas cooler models (with 2 heat exchangers)</b>																		
1 TC-Standard 6121: Ambient temperature 40 °C																		
2 TC-Standard 6122: Ambient temperature 50 °C																		
<b>Certifications</b>																		
0 Standard applications – CE																		
1 for common locations - FM																		
<b>Supply voltage</b>																		
1 115 V AC, 50/60 Hz																		
2 230 V AC, 50/60 Hz																		
4 24 V DC																		
<b>Heat exchanger</b>																		
2 1 0 Stainless steel, 2 MTS, metric																		
2 1 5 Stainless steel, 2 MTS-I, US																		
2 2 0 Duran glass, 2 MTG, metric																		
2 2 5 Duran glass, 2 MTG-I, US																		
2 3 0 PVDF, 2 MTV, metric																		
2 3 5 PVDF, 2 MTV-I, US																		
<b>Condensate drain <sup>1)</sup></b>																		
0 0 without condensate drain																		
2 0 CPdouble with hose nipple, angled																		
4 0 CPdouble with screw connection <sup>3)</sup>																		
<b>Moisture detector/filter</b>																		
0 0 without filter, without moisture detector																		
0 1 without filter, 1 moisture detector with PVDF adapter <sup>2)</sup>																		
0 2 without filter, 2 moisture detectors with PVDF adapter <sup>2)</sup>																		
1 0 1 filter, without moisture detector																		
1 1 1 filter with built-in moisture detector																		
2 0 2 filters, without moisture detector																		
2 1 2 filters, 1 moisture detector																		
2 2 2 filters, 2 moisture detectors																		
<b>Signal outputs</b>																		
0 0 status output only																		
1 0 Analog output, 4...20 mA incl. status output																		
2 0 Modbus RTU digital output incl. status output <sup>4)</sup>																		
<b>Delta T control</b>																		
0 0 without Delta T control																		
1 0 Delta T control option																		

<sup>1)</sup> 24 V DC CPdouble not connected electrically.

<sup>2)</sup> Also available in stainless steel.

<sup>3)</sup> Metric or US connection, per heat exchanger.

<sup>4)</sup> Option only available for CE version.

**Consumables and accessories**

<b>Item no.</b>	<b>Description</b>
4510008	Automatic condensate drain AK 5.2 (pressure operation only)
4510028	Automatic condensate drain AK 5.5 (pressure operation only)
4410004	Automatic condensate drain AK 20 (pressure operation only)
4410001	Automatic condensate drain 11 LD V 38 (pressure operation only)
41030050	Replacement filter element F2; 5-pack
9144050038	Cable for cooler temperature analog output 4 m
4410005	Condensate trap GL1, 0.4 L
44920035012	Condensate pump replacement hose, Tygon (Norprene), angled hose nipple
44920035016	Condensate pump replacement hose, Tygon (Norprene), angled hose nipple and screw connection (metric)
44920035017	Condensate pump replacement hose, Tygon (Norprene), angled hose nipple and screw connection (US)
4381045	Screw connection G1/4 – DN 8/12 for passive condensate connection MTS or MTV(-2)
4381048	Screw connection NPT 1/4" for passive condensate connection MTS-I or MTV(-2)-I