



ModbusRTU

## Gas cooler series TC-MIDI

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 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 interface as well as configure the device settings.

The TC-MIDI series is in the top performance class of sample gas coolers with one or two gas paths. 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. The TC-MIDI Sample gas cooler is particularly a component in gas conditioning when the process or ambient conditions require a higher cooling capacity.

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 195 kJ/h (40 °C version) or 175 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, condensate pump and sample gas pump optional



## Overview

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

The Peltier coolers are distinguished according to cooling capacity/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 (single or double)	TC-MIDI 6111	TC-MIDI 6112

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

- Peristaltic pump for condensate separation,
- Filter,
- Moisture detector,
- sample gas pump.

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.

A P1 gas pump can be attached to the gas cooler, optionally also with bypass valve for regulating the flow. This allows the sample gas pump to be expanded by a single-leg system, so when equipped with a single heat exchanger or for the respective application the two gas paths of the dual heat exchangers are switched in series, for example Cooling 1 – Pump – Cooling 2.

### Delta T control option

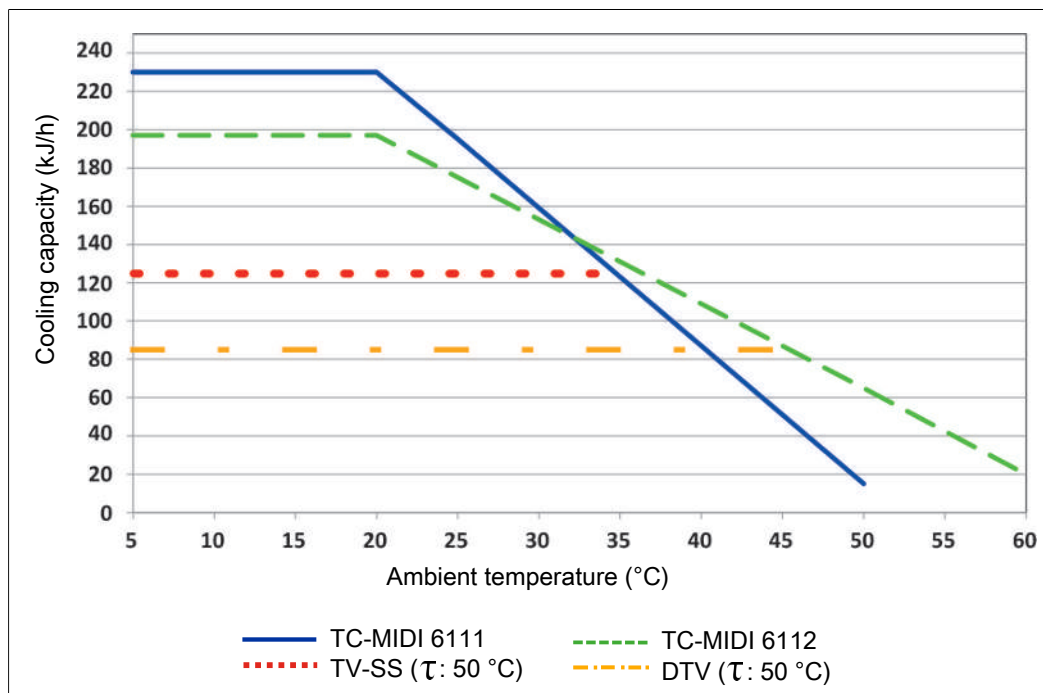
Not all applications require an outlet dew point of 5 °C (41 °F). In some applications a higher dew point is sufficient. In other applications a stable outlet dew point doesn't matter, it's enough for the gas to be dry, so if the outlet dew point has an adequate difference in temperature below the ambient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

### Performance Data



Note: The limit curves for the heat exchangers apply to a dew point of 50 °C.

## Gas cooler technical data

Gas Cooler Technical Data				
Ready for operation	after max. 10 minutes			
Ambient temperature	5 °C to 60 °C			
Gas outlet dew point preset: adjustable:	5 °C 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) <sup>1)</sup> 2 Hz-13.2 Hz amplitude ± 1.0 mm 13.2 Hz -100 Hz acceleration			
Housing	Stainless steel, brushed			
Packaging dimensions	approx. 350 x 220 x 220 mm			
Weight incl. heat exchanger	approx. 11.5 kg approx. 15 kg at full expansion stage			
Electrical data	Unit without add-on		Unit with add-on (P1.x + peristaltic pump)	
	<b>230 V AC</b>	<b>115 V AC</b>	<b>230 V AC</b>	<b>115 V AC</b>
	+5/-10%	+5/-10%	+5%	+5%
	50/60 Hz	50/60 Hz	50 Hz	60 Hz
	1.2 A	2.4 A	1.8 A	3.6 A
	200 W / 280 VA		290 W / 420 VA	
Recommended fuse (characteristic: delayed action)	3.15 A	6.3 A	3.15 A	6.3 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"			
Sample gas pump:	see "Technical Data - Options"			
Tubing:	PTFE/Viton			
FM no.:	3062014			

<sup>1)</sup> not in conjunction with add-on sample gas pump

## 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 Peristaltic Pumps CPsingle / CPdouble

Ambient temperature	0 °C to 60 °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 40
Materials	
Hose:	Norprene (Standard), Marprene, Fluran
Connections:	PVDF

### Technical Data Sample Gas Pump P1

Ambient temperature	0 °C to 50 °C
Operating pressure	max. 1,3 bar abs.
Nominal outlet	280 l/h (at p = 1 bar abs.)
Materials in contact with media vary by configuration	PTFE, PVDF, 1.4571, 1.4401, Viton, PFA

### Technical Data Filter AGF-PV-30-F2-L

Ambient temperature	3 °C to 100 °C
max. operating pressure with filter	4 bar
Filter surface	125 cm <sup>2</sup>
Filter fineness	2 µm
Dead volume	108 ml
Materials	
Filter:	PVDF, Duran glass (parts in contact with mediums)
Seal:	Viton
Filter element:	sintered PTFE

### 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

## 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 approved energy load from the gas is therefore determined by the tolerated rise in the dew point.

The following limits are specified for a standard operating point of  $\tau_e = 50\text{ °C}$  and  $\vartheta_G = 70\text{ °C}$ . The maximum volume flow  $v_{\max}$  in l/h of cooled air is indicated, so after moisture has condensed.

If the values fall below  $\tau_e$  and  $\vartheta_G$ , the flow  $v_{\max}$  may be increased. For example, on the TG heat exchanger the parameter triple  $\tau_e = 40\text{ °C}$ ,  $\vartheta_G = 70\text{ °C}$  and  $v = 425\text{ l/h}$  may also be used in place of  $\tau_e = 50\text{ °C}$ ,  $\vartheta_G = 70\text{ °C}$  and  $v = 345\text{ l/h}$ .

Please contact our experts for clarification or refer to our design program.

## Heat exchanger overview

Heat exchanger	TS TS-I <sup>2)</sup>	TG TG-I <sup>2)</sup>	TV-SS TV-SS-I <sup>2)</sup>	DTS (DTS-6 <sup>3)</sup> ) DTS-I (DTS-6-I <sup>3)</sup> ) <sup>2)</sup>	DTG DTG-I <sup>2)</sup>	DTV <sup>3)</sup> DTV-I <sup>2)3)</sup>
Materials in contact with media	Stainless steel	Glass PTFE	PVDF	Stainless steel	Glass PTFE	PVDF
Flow rate $v_{\max}$ <sup>1)</sup>	500 l/h	400 l/h	235 l/h	2 x 250 l/h	2 x 200 l/h	2 x 160 l/h
Inlet dew point $\tau_{e,\max}$ <sup>1)</sup>	80 °C	80 °C	65 °C	80 °C	65 °C	65 °C
Gas inlet temperature $\vartheta_{G,\max}$ <sup>1)</sup>	180 °C	140 °C	140 °C	180 °C	140 °C	140 °C
Max. Cooling capacity $Q_{\max}$	450 kJ/h	230 kJ/h	120 kJ/h	450 kJ/h	230 kJ/h	185 kJ/h
Gas pressure $p_{\max}$	160 bar	3 bar	3 bar	25 bar	3 bar	2 bar
Pressure drop $\Delta p$ ( $v=150\text{ l/h}$ )	8 mbar	8 mbar	8 mbar	5 mbar each	5 mbar each	15 mbar each
Dead volume $V_{\text{tot}}$	69 ml	48 ml	129 ml	28 / 25 ml	28 / 25 ml	21 / 21 ml
Gas connections (metric)	G1/4	GL 14 (6 mm) <sup>4)</sup>	DN 4/6	6 mm tube	GL14 (6 mm) <sup>4)</sup>	DN 4/6
Gas connections (US)	NPT 1/4"	GL 14 (1/4") <sup>4)</sup>	1/4"-1/6"	1/4" tube	GL14 (1/4") <sup>4)</sup>	1/4"-1/6"
Condensate out connections (metric)	G3/8	GL 25 (12 mm) <sup>4)</sup>	G3/8	Tube 10 mm (6 mm)	GL18 (10 mm) <sup>4)</sup>	DN 5/8
Condensate out connections (US)	NPT 3/8"	GL 25 (1/2") <sup>4)</sup>	NPT 3/8"	Tube 3/8" (1/4")	GL18 (3/8") <sup>4)</sup>	3/16"-5/16"

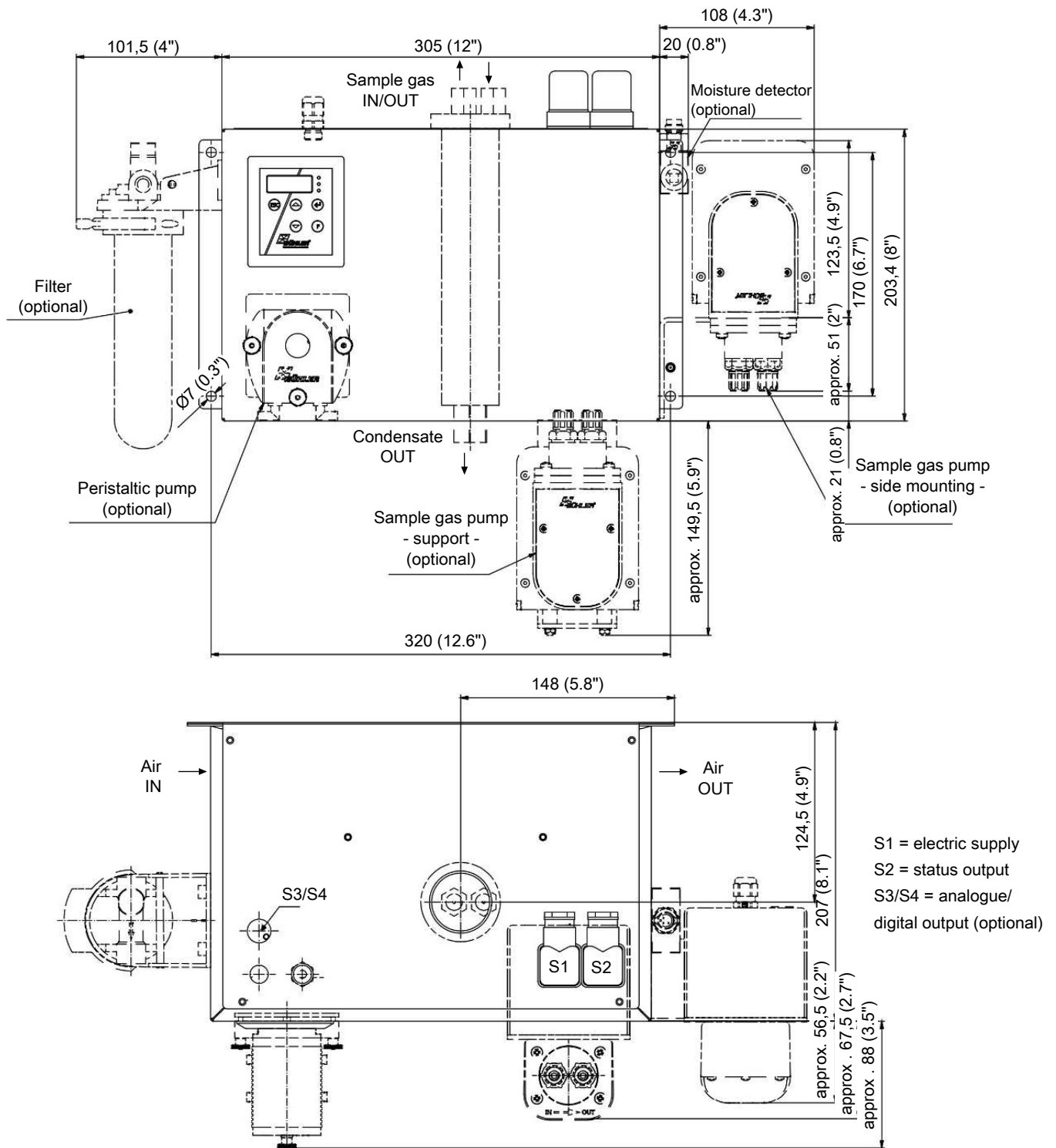
<sup>1)</sup> Max. cooling capacity of the cooler must be considered.

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

<sup>3)</sup> Condensate drain only possible with condensate pump.

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

Dimensions (mm)



Ordering instructions

Gas cooler models with one gas path inside the heat exchanger

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

4496	3	1	1	X	X	X	1	X	X	X	X	X	X	X	0	X	0	Product Characteristics
<b>Gas cooler types</b>																		
1 TC-MIDI 6111: Ambient temperature 40 °C																		
2 TC-MIDI 6112: Ambient temperature 60 °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																		
<b>Heat exchanger</b>																		
1 1 0 Stainless steel, TS, metric																		
1 1 5 Stainless steel, TS-I, US																		
1 2 0 Duran glass, TG, metric																		
1 2 5 Duran glass, TG-I, US																		
1 3 0 PVDF, TV-SS, metric																		
1 3 5 PVDF, TV-SS-I, US																		
<b>Condensate drain <sup>2)</sup></b>																		
0 without condensate drain																		
1 CPsingle with hose nipple, angled																		
3 CPsingle with screw connection <sup>4)</sup>																		
<b>Sample gas pumps <sup>1)</sup></b>																		
0 without sample gas pump																		
1 P1, PVDF, bottom mounted																		
2 P1, with bypass valve, bottom mounted																		
6 P1, PVDF, mounted externally																		
7 P1, with bypass valve, mounted externally																		
<b>Moisture detector <sup>2)</sup> / filter</b>																		
0 0 without filter, without moisture detector																		
0 1 without filter, 1 moisture detector with PVDF adapter <sup>3)</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>5)</sup>																		
<b>Delta T control</b>																		
0 0 without Delta T control																		
1 0 Delta T control option																		

<sup>1)</sup> Factory installed tubing for suction operation.

<sup>2)</sup> With this option, the maximum ambient temperature is limited to 50 °C.

<sup>3)</sup> Also available in stainless steel.

<sup>4)</sup> Metric or US connection, per heat exchanger.

<sup>5)</sup> Option only available for CE version.



Gas cooler models with two gas paths inside the heat exchanger

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

4496	3	1	1	X	X	X	2	X	X	X	X	X	X	X	0	X	0	Product Characteristics
<b>Gas cooler types</b>																		
1 TC-MIDI 6111: Ambient temperature 40 °C																		
2 TC-MIDI 6112: Ambient temperature 60 °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																		
<b>Heat exchanger</b>																		
2 6 0 Stainless steel, DTS, metric																		
2 6 5 Stainless steel, DTS-I, US																		
2 6 1 Stainless steel, DTS 6, metric <sup>1)</sup>																		
2 6 6 Stainless steel, DTS 6-I, US <sup>1)</sup>																		
2 7 0 Duran glass, DTG, metric																		
2 7 5 Duran glass, DTG-I, US																		
2 8 0 PVDF, DTV, metric <sup>1)</sup>																		
2 8 5 PVDF, DTV-I, US <sup>1)</sup>																		
<b>Condensate drain <sup>4)</sup></b>																		
0 without condensate drain																		
2 CPdouble with hose nipple, angled																		
4 CPdouble with screw connection <sup>6)</sup>																		
<b>Sample gas pumps <sup>3)</sup></b>																		
0 without sample gas pump																		
1 P1, 1 gas path, PVDF, bottom mounted																		
2 P1, 1 gas path, with bypass valve, bottom mounted																		
6 P1, 1 gas path, PVDF, mounted externally <sup>2)</sup>																		
7 P1, 1 gas path, with bypass valve, mounted externally <sup>2)</sup>																		
<b>Moisture detector <sup>4)</sup> / filter</b>																		
0 0 without filter, without moisture detector																		
0 1 without filter, 1 moisture detector with PVDF adapter <sup>5)</sup>																		
0 2 without filter, 2 moisture detectors with PVDF adapter <sup>5)</sup>																		
1 0 1 filter, without moisture detector																		
1 1 1 filter with built-in moisture detector																		
2 0 2 filters, without moisture detector <sup>2)</sup>																		
2 1 2 filters, 1 moisture detector <sup>2)</sup>																		
2 2 2 filters, 2 moisture detectors <sup>2)</sup>																		
<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>7)</sup>																		
<b>Delta T control</b>																		
0 0 without Delta T control																		
1 0 Delta T control option																		

<sup>1)</sup> Condensate outlets only suitable when connecting peristaltic pumps.

<sup>2)</sup> External sample gas pump P1 only allows 1 filter.

<sup>3)</sup> Factory installed tubing for suction operation.

<sup>4)</sup> With this option, the maximum ambient temperature is limited to 50 °C.

<sup>5)</sup> Also available in stainless steel.

<sup>6)</sup> Metric or US connection, per heat exchanger.

<sup>7)</sup> Option only available for CE version.

## Consumables and accessories

Item no.	Description
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)
9144050038	Cable for cooler temperature analog output 4 m
41020050	Filter element F2-L; 2-pack
4410005	Condensate trap GL1, 0.4 L
4228003	Bellow for P1 pump
9009398	O-ring for bypass P1 pump
4228066	Set inlet/outlet valves 70 °C for P1 pump
see data sheet 420011	Sample Gas Pumps P1
see data sheet 450020	Peristaltic Condensate Pumps CPsingle, CPdouble