Gas cooler series TC-MIDI

In the chemical industry, petrochemistry or biochemistry, reliable process control relies on prompt and exact determination of the operating parameters.

Here, gas analysis is key for safe and efficient control of process flows, environmental protection and quality assurance. This benefits controlling flue gas emission in power stations or exhaust gas analysis in automotive engineering, as well as the efficient control of air separators or sterile production and packaging in the food industry.

Many of the analysis processes used in these fields require extracting the sample gas. This inevitably also extracts process-related contamination such as particles or moisture. These in turn can impact the measurement results or damage the measuring cells. The sample gas must therefore be conditioned before entering the analyser.

The TC-MIDI sample gas cooler is a component in this conditioning chain if 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
- Low operating noise
- Nominal capacity 195/175 kJ/h, 40 °C / 50 °C - Version
- Dew point stability 0.1 °C
- Status display and output
- Cooling block temperature display
- Moisture detector, filter, analogue output, peristaltic pump and sample gas pump optional
- Successor of the PKE 52

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Overview

The TC-MIDI series features various models which can be classified by two criteria:

1. The number of heat exchangers.
2. The available cooling capacity or sensible ambient temperature.

This classification is reflected in the type designation. The exact item number of the model defined by you is determined by the type code in the category ordering information.

Application	Standard applications	
max. sensible ambient temperature	40 °C	50 °C
1 heat exchanger	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

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 (factory preset 5 °C).

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

For the low temperature the range is τ_a -1 to - 3 K (at a minimum 1 °C cooling block temperature), for the excess temperature the range is τ_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 TC-MIDI, 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

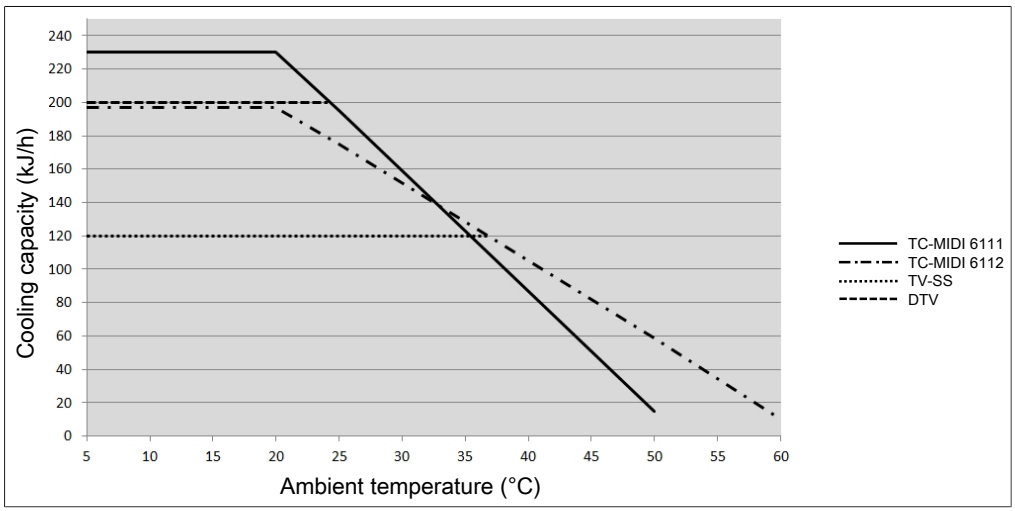
Not all applications require an output dew point of 5 °C. In some applications a higher dew point is sufficient. In other applications a stable output dew point doesn't matter, it's enough for the gas to be dry, so if the output dew point has an adequate difference in temperature below the ambient temperature.

Here the electronics measure the ambient temperature and regulate the output 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 output 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, at a set output dew point of 5 °C this means the dew point remains stable up to an ambient temperature of approx. 35 °C, and the safe drop is only preferred over the ambient temperature with ambient temperature peaks over 35 °C. The cooling capacity specified in the cooling capacity graphs at 35 °C is then available at above 35 °C.

Performance data



Remark: The limit curves for the heat exchangers exchanger 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 output dew temperature preset: adjustable:	 5 °C 2 °C...20 °C or Delta T control			
Protection class	IP 20			
Mechanical load	Tested to GL 2012 –VI, Part 7 – Table 3.15 [1] 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 kg approx. 14.5 kg at full expansion stage			
Electrical power input	Unit without add-on		Unit with add-on (P1.x + Peristaltic pump)	
	230 V AC	115 V AC	230 V AC	115 V AC
	1.2 A	2.4 A	1.8 A	3.6 A
	200 W / 280 VA		290 W / 420 VA	
Status output switching capacity	max. 230 V AC, 150 V DC 2 A, 50 VA, potential-free			
Electrical connections	Plug per DIN 43650			
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 mediums Filter: Moisture detector: Heat exchanger: Peristaltic pump: Sample gas pump: Tubing:	 see "Technical Data - Options" see "Technical Data - Options" see table "Heat Exchanger Overview" see "Technical Data - Options" see "Technical Data - Options" PTFE/Viton			

[1] 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 M12x1 plug

Technical Data Peristaltic Pumps CPsingle / CPdouble	
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
Output 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: Connections:	 Norprene (Standard), Marprene, Fluran PVDF

Technical Data Sample Gas Pump P1	
Ambient temperature	0 °C to 50 °C
Nominal output	280 L/h
Materials in contact with media vary by configuration	PTFE, PVDF, 1.4571, 1.4401, Viton, PFA

Technical Data Filter AGF-PV-30-F2-L	
max. operating pressure with filter	2 bar
Filter surface	125 cm^2
Filter fineness	2 µm
Dead volume	108 ml
Materials Filter: Seal: Filter element:	 PVDF, Duran glass (parts in contact with mediums) Viton 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 ϑ_G, dew point τ_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 τ_e = 50 °C and ϑ_G = 70 °C. The maximum volume flow v_{max} in Nl/h of cooled air is indicated, so after moisture has condensed.

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

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

Heat exchanger overview

Heat exchanger	TS TS-I [2]	TG TG	TV-SS TV-SS-I [2]	DTS (DTS-6 [3]) DTS-I (DTS-6-I [3]) [2]	DTG DTG	DTV [3] DTV-I [2] [3]
Version / Material	Stainless steel	Glass	PVDF	Stainless steel	Glass	PVDF
Flow rate v_{max} [1]	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 $\tau_{e,max}$ [1]	80 °C	80 °C	65 °C	80 °C	65 °C	65 °C
Gas inlet temperature $\vartheta_{G,max}$ [1]	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 Δp (v=150 L/h)	8 mbar	8 mbar	8 mbar	5 mbar each	5 mbar each	15 mbar each
Dead volume V_{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) [4]	DN 4/6	6 mm tube	GL14 (6 mm) [4]	DN 4/6
Gas connections (US)	NPT 1/4"	GL 14 (1/4") [4]	1/4"-1/6"	1/4" tube	GL14 (1/4")[4]	1/4"-1/6"
Condensate out connections (metric)	G3/8	GL 25 (12 mm) [4]	G3/8	Tube 10 mm (6 mm)	GL18 (10 mm) [4]	DN 5/8
Condensate out connections (US)	NPT 3/8"	GL 25 (1/2") [4]	NPT 3/8"	Tube 3/8" (1/4")	GL18 (3/8") [4]	3/16"-5/16"

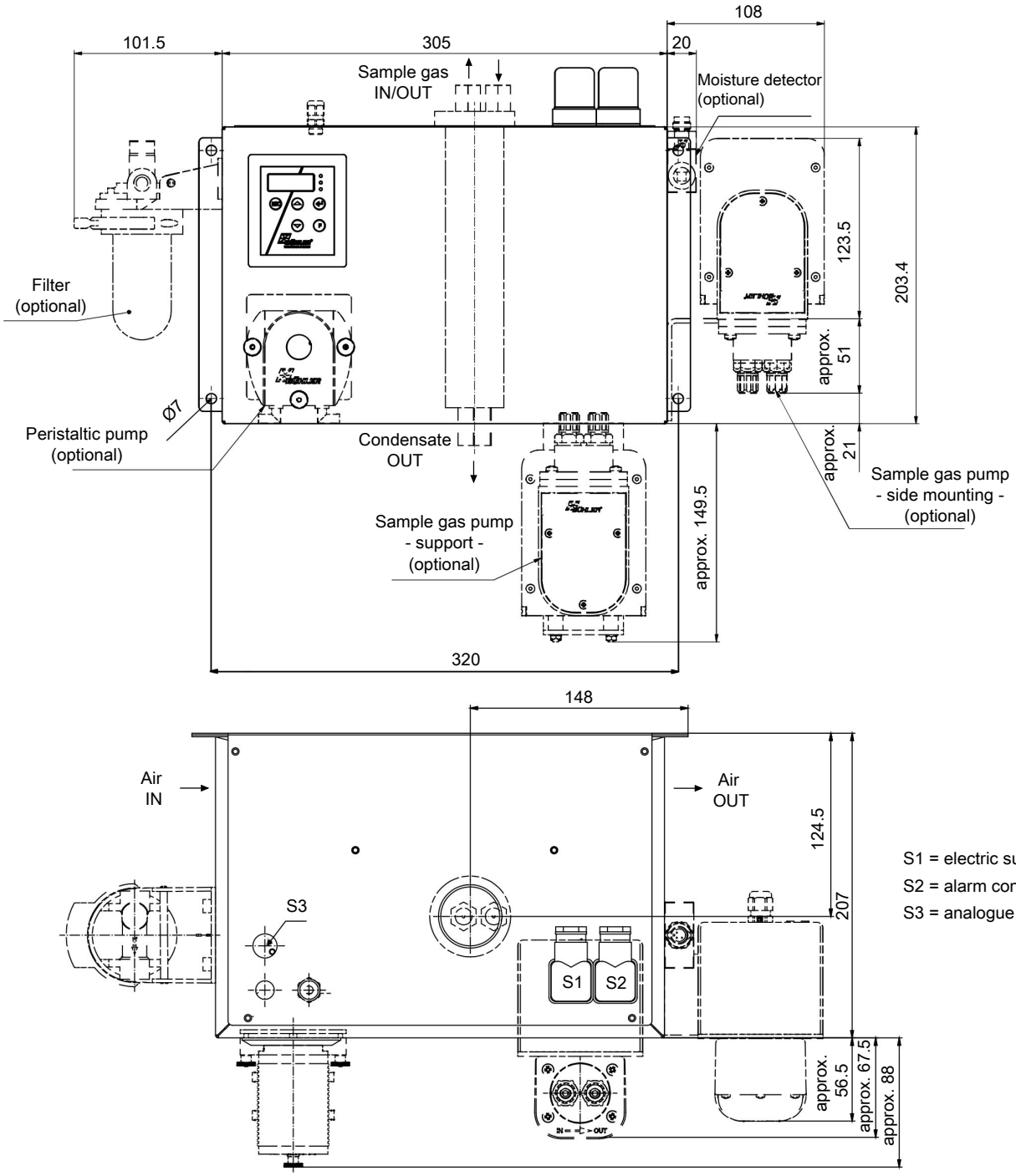
[1] Max. cooling capacity of the cooler must be considered

[2] Models marked I have NPT threads or US tubes, respectively.

[3] Condensate drain only possible with condensate pump

[4] 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 key:

4496	3	1	1	X	0	X	X	X	X	X	X	X	X	0	X	0	Product characteristic
																	Gas cooler models
				1													TC-MIDI 6111: Ambient temperature 40 °C
				2													TC-MIDI 6112: Ambient temperature 50 °C
																	Certifications
					0												Standard unit, no special certification
																	Supply voltage
						1											115 V AC, 50/60 Hz
						2											230 V AC, 50/60 Hz
																	Heat exchanger
							1	1	0								Stainless steel, TS, metric
							1	1	5								Stainless steel, TS-I, US fittings
							1	2	0								Duran glass, TG, metric
							1	2	5								Duran glass, TG, US
							1	3	0								PVDF, TV-SS, metric
							1	3	5								PVDF, TV-SS-I, US
																	Peristaltic Pumps [2]
										0							without peristaltic pump
										1							CPsingle with hose nipple
										3							CPsingle with screw connection
																	Sample gas pumps [1]
											0						without sample gas pump
											1						P1, PVDF, mounted to the bottom
											2						P1, with bypass valve, mounted to the bottom
											6						P1, PVDF, side mounting
											7						P1, with bypass valve, side mounting
																	Moisture detector [2] **/ Filter**
												0	0				without filter, without moisture detector
												0	1				without filter, 1 moisture detector with adapter
												1	0				1 filter, without moisture detector
												1	1				1 filter with built-in moisture detector
																	Status outputs
														0	0		status output only
														1	0		Analogue output option, add-on
																	Delta T control
																0	0	without Delta T control
																1	0	Delta T control option

[1] Factory installed tubing for suction operation.

[2] During installation the maximum ambient temperature is limited to 50 °C.

Gas cooler models with two gas paths insides the heat exchanger

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

4496	3	1	1	X	0	X	X	X	X	X	X	X	X	0	X	0	Product characteristic
																	Gas cooler models
				1													TC-MIDI 6111: Ambient temperature 40 °C
				2													TC-MIDI 6112: Ambient temperature 50 °C
																	Certifications
					0												Standard unit, no special certification
																	Supply voltage
						1											115 V AC, 50/60 Hz
						2											230 V AC, 50/60 Hz
																	Heat exchanger
							2	6	0								Stainless steel, DTS, metric
							2	6	5								Stainless steel, DTS-I, US fittings
							2	6	1								Stainless steel, DTS 6, metric [1]
							2	6	6								Stainless steel, DTS 6-I, US fittings [1]
							2	7	0								Duran glass, DTG, metric
							2	7	5								Duran glass, DTG, US fittings
							2	8	0								PVDF, DTV, metric [1]
							2	8	5								PVDF, DTV-I, US fittings [1]
																	Peristaltic Pumps [4]
										0							without peristaltic pump
										2							CPdouble with hose nipple
										4							CPdouble with screw connection
																	Sample gas pumps [3]
											0						without sample gas pump
											1						P1, 1 gas path, PVDF, mounted to the bottom
											2						P1, 1 gas path, with bypass valve, mounted to the bottom
											6						P1, 1 gas path, PVDF, side mounting [2]
											7						P1, 1 gas path, with bypass valve, side mounting [2]
																	Moisture detector [4] **/ Filter**
												0	0				without filter, without moisture detector
												0	1				without filter, 1 moisture detector with adapter
												0	2				without filter, 2 moisture detectors with adapter
												1	0				1 filter, without moisture detector
												1	1				1 filter with built-in moisture detector
												2	0				2 filters, without moisture detector [2]
												2	1				2 filters, 1 moisture detector [2]
												2	2				2 filters, 2 moisture detectors [2]
																	Status outputs
														0	0		status output only
														1	0		Analogue output option, add-on
																	Delta T control
																0	without Delta T control
																1	Delta T control option

[1] Condensate outlets only suitable when connecting peristaltic pumps.

[2] Installing the sample gas pump P1 on the side only allows 1 filter.

[3] Factory installed tubing for suction operation.

[4] During installation the maximum ambient temperature is limited to 50 °C.

Consumables and accessories

Item no.	Description
45 10 008	Automatic condensate drain AK 5.2
45 10 028	Automatic condensate drain AK 5.5
44 10 004	Automatic condensate drain AK 20
44 10 001	Automatic condensate drain 11 LD V 38
41 03 00 50	Replacement filter element F2; Unit 5 count
91 44 05 00 38	Cable for cooler temperature analogue output 4 m
44 10 00 5	Condensate trap GL1, 0.4 L
44 92 00 35 011	Norprene replacement hose with straight connections for peristaltic pump 0.3 L/h
44 92 00 35 012	Norprene replacement hose with angled connections for peristaltic pump 0.3 L/h
44 92 00 35 013	Norprene replacement hose with one straight and one angled connection for peristaltic pump 0.3 L/h
44 92 00 35 014	Norprene replacement hose with one angled connection and one screw connection (metric) for peristaltic pump 0.3 L/h
44 92 00 35 015	Norprene replacement hose with one angled connection and one screw connection (US) for peristaltic pump 0.3 L/h
42 28 00 3	Bellow for P1 pump
90 09 39 8	O-ring for bypass P1 pump
42 28 06 6	Set inlet/outlet valves 70 °C for P1 pump