



Gas cooler series TC-MINI

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

Here, gas analysis is the 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 small dimensions make the TC-MINI sample gas cooler particularly suited for OEMs to build into compact sample gas conditioning systems.

Peltier cooler with 1 heat exchanger

Version for high ambient temperatures

Nominal capacity 55 kJ/h (at 5 °C outlet dew point)

Power supply 24 V DC

Status display and output

Analogue signal output

Stainless steel, glass or PVDF heat exchanger

Adjustable dew point 3/5/10/15 °C

Adjustable Delta T Control

Add-on filter option

Moisture detector option

Maintenance-free

Low operating noise



Description and Overview

The TC-MINI series has two standard models which may have additional options added.

Standard

TC-MINI 6111	moderate ambient temperature (up to approx. 40 °C)
TC-MINI 6112	higher ambient temperature (up to approx. 50 °C)

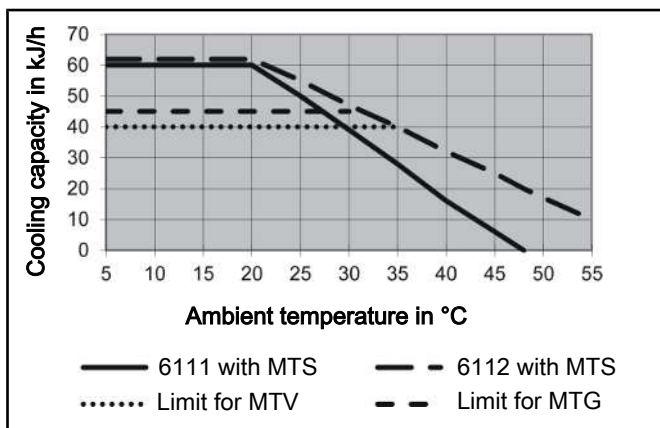
Typically intended for **small systems** designed for sample gas with low dew points and flow rate, providing a **24 V DC power supply**. In this context, typical is sample gas around normal pressure with a dew point of 40 °C, a gas inlet temperature of 70 °C, and an outlet per litre of approx. 100 L/h. This more or less corresponds to a cooling capacity of 23 kJ/h. Of course gasses with other parameters can also be cooled.

The cooler is **controlled** by a **microprocessor**. Flashing LEDs 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.

Connecting a **moisture detector** allows for the control to be expanded to monitoring condensate penetration.

Performance data



A selected outlet dew point of 10 or 15 °C shifts the curves 5 or 10 °C to the right.

The MTV and MTG limits apply to a normal operating point of $\tau_e = 40$ °C and $\vartheta_c = 70$ °C.

Outlet dew point

Remarks on outlet dew point

Not all applications require an outlet dew point of 5 °C. 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 for the outlet dew point to have an adequate difference in temperature below the ambient temperature.

The advantage of a higher outlet temperature is that at a given ambient temperature the Peltier cooler provides significantly more cooling performance. So on the e.g. TC-MINI version model 6111, at an ambient temperature of 40 °C this means:

Outlet dew point:	5 °C	10 °C	15 °C
Available cooling capacity:	16 kJ/h	28 kJ/h	39 kJ/h

To fully utilize these advantages, the electronics feature several parameter settings:

1. Adjustable outlet dew point

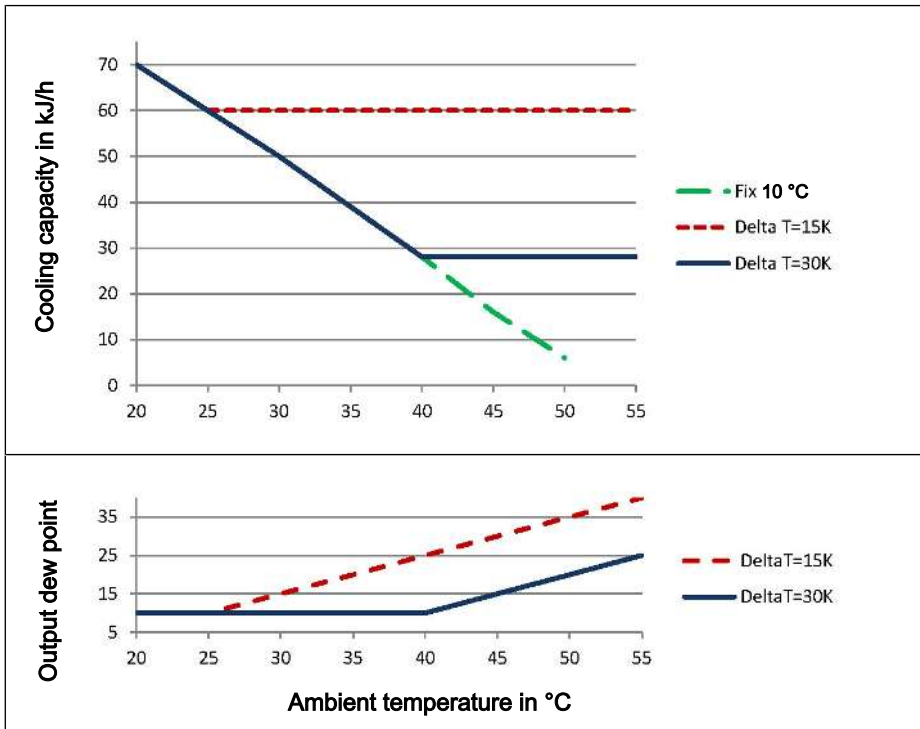
An outlet dew point of 3, 5, 10 or 15 °C can be set to reach the specified values. Here it's important the ambient temperature is always ABOVE the outlet dew point setting, or condensation may form in the lines after the cooler. So the ambient temperature range is limited.

2. Delta-T Control

Here the electronics measures the ambient temperature and regulates the outlet dew point to a an about 15 °C or 30 °C lower value, but no less than the dew point set under 1. 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.

As seen in the following graphics using the TC-MINI 6111 as an example, a difference of 15 °C from the ambient temperature means the focus is on drying the sample gas. The stability of the dew point then takes a backseat to the high performance which can be achieved.

At a difference of 30 °C, at a set outlet dew point of 10 °C this means the dew point remains stable up to an ambient temperature of approx. 40 °C, and the safe drop is only preferred over the ambient temperature with ambient temperature peaks over 40 °C.



Gas cooler technical data

Gas Cooler Technical Data

Ready for operation	after max. 10 minutes
Ambient temperature	5 °C to 55 °C
Gas outlet dew temperature, preset:	5 °C
IP rating:	IP 20
Housing	Stainless steel, brushed
Packaging dimensions	approx. 235 x 225 x 280 mm (without add-on filter)
Weight incl. heat exchanger	approx. 3.5 kg
Power supply	24 VDC
24 V output	max. 1 A
Power input	max. 70 VA (plus max. 25 VA at 24 V output)
Status output switching capacity	33 VAC / 70 VDC, 1 A
Electrical connections, standard applications	Phoenix plug

Technical Data - Options

A moisture detector may be connected to the control. The moisture detector can be mounted to the cooler using a block or by installing it into the optional filter.

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

AGF-PV-30-F2 Filter Technical Data

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

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 following limits for the maximum flow are specified for a standard operating point of $\tau_e = 40$ °C and $\vartheta_g = 70$ °C. Indicated is the maximum flow v_{max} in NI/h of cooled air, 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 design program.

Heat exchanger overview

Heat exchanger	MTS ³⁾ MTS-I ²⁾³⁾	MTG ³⁾ MTG ³⁾	MTV ³⁾ MTV-I ²⁾³⁾
Version / Material	Stainless steel	Glass	PVDF
Flow rate v_{max} ¹⁾	300 NI/h	210 NI/h	190 NI/h
Inlet dew point $\tau_{e,max}$ ¹⁾	65 °C	65 °C	65 °C
Gas inlet temperature $\vartheta_{G,max}$ ¹⁾	140 °C	140 °C	140 °C
Max. Cooling capacity Q_{max}	95 kJ/h	80 kJ/h	65 kJ/h
Gas pressure p_{max}	25 bar	3 bar	2 bar
Pressure drop Δp ($v = 150$ L/h)	20 mbar	19 mbar	18 mbar
Dead volume V_{tot}	19 ml	18 ml	17 ml
Gas connections (metric)	6 mm tube	GL14 (6 mm) ⁴⁾	DN 4/6
Gas connections (US)	1/4" tube	GL14 (1/4") ⁴⁾	1/4"-1/6"
Condensate out connections (metric)	G1/4	GL18 (8 mm) ⁴⁾	G1/4
Condensate out connections (US)	NPT 1/4"	GL18 (8 mm) ⁴⁾	NPT 1/4"

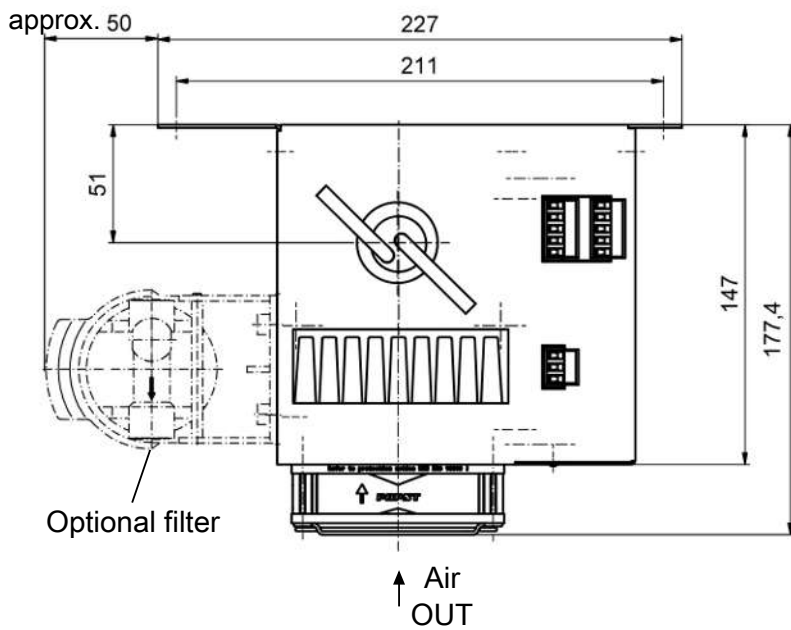
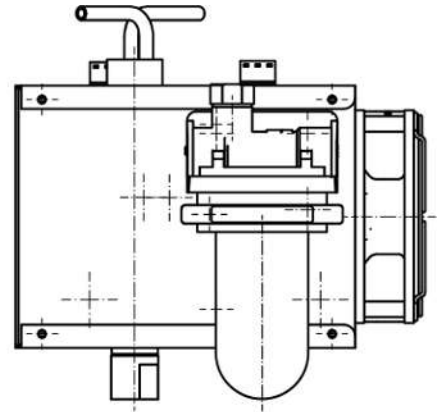
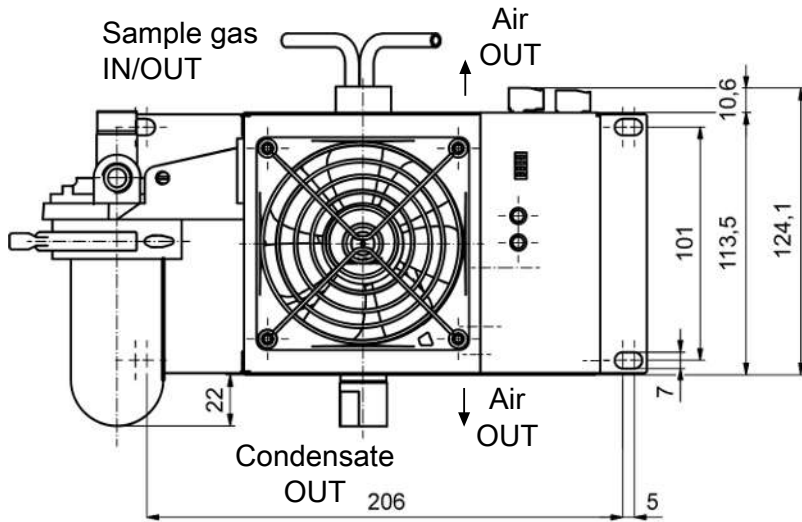
¹⁾ Max. cooling capacity of the cooler must be considered.

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

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

⁴⁾ Gasket inside diameter

Dimensions (mm)



Ordering instructions

Gas cooler

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

4496	1	1	1	X	0	4	X	X	X	0	0	X	X	1	Product characteristic
Gas cooler models (with 1 heat exchanger)															
1 TC MINI 6111: moderate ambient temperature 40 °C															
2 TC MINI 6112: higher ambient temperature 50 °C															
Certifications															
0 Standard unit, no special certification															
Supply voltage															
4 24 V DC															
Heat exchanger ¹⁾															
1 1 0 MTS, metric fittings															
1 1 5 MTS-I, US fittings															
1 2 0 MTG, metric fittings															
1 2 5 MTG, US fitting															
1 3 0 MTV, metric															
1 3 5 MTV-I, US fitting															
Sample gas pumps															
0 0 without sample gas pump															
Moisture detector / filter															
0 0 without filter, without moisture detector															
0 1 without filter, 1 moisture detector with block															
1 0 1 filter, without moisture detector															
1 1 1 filter with built-in moisture detector															
Status outputs															
1 Analogue output, 4...20 mA															

¹⁾ Filter tubing, metric or US, respectively

Consumables and accessories

Item no.	Description
91 12 00 00 39	24 V top-hat rail power supply
91 12 00 00 40	24 V top-hat rail power supply for using the 24 V output
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; 2 µm, Unit 5 count
43 81 045	Screw connection G1/4 - DN 8/12 for passive condensate connection MTS and MTV
43 81 048	Screw connection NPT 1/4" for passive condensate connection MTS and MTV

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