Sample gas cooler TC-MIDI X2 with -H2/-O2 heat exchanger

When powerful cooling is required, the TC-MIDI X2 sample gas cooler with -H2/-O2 heat exchanger is the ideal solution for reliable cooling of hydrogen (H_2) and oxygen (O_2) in extractive gas analysis. Green hydrogen produced by electrolysis using renewable energy sources is the key to a sustainable, emission-free future in the energy industry.

The safe, reliable cooling of the sample gas is decisive for gas analytics in the electrolyser (e.g. for LEL monitoring), as a higher moisture content is to be expected with some processes. The moisture in the process gas can damage the sensitive measuring cells in the analyser, so the gas temperature is kept below gas dew point at all times, thus causing the moisture to be emitted. The condensate is discharged via an automatic condensate drain.

As well as material-refining measures to prevent hydrogen-induced component damage, the heat exchangers for the H_2 series are subjected to a leak test using helium. For the O_2 version, special cleaning processes are used to remove particles, oils and fats from parts coming into contact with media. The contamination limits are based on the internationally used and applicable guideline EIGA Doc 33/18 “Cleaning of Equipment for Oxygen Service”.

Many applications require equipment which can be used in explosive areas. This is where the TC-MIDI X2 series provides solutions for Zone 2 or Class I, Division 2.

- ATEX and IECEx Zone 2 approval
- FM C-US approval for Class I, Division 2
- For applications with high-purity hydrogen or oxygen
- Cleaning standard is based on EIGA Doc 33/18 as regards the absence of particles, oils and fats for heat exchangers with the O_2 version
- Materials in contact with media are suitability-tested for high H_2 and O_2 concentrations
- Heat exchanger leak tests using helium are performed on the H_2 series as standard
- Nominal cooling capacity 195 kJ/h (40 °C version) or 175 kJ/h (50 °C version)
- Constant dew point stability ± 0.1 °C
- Adjustable outlet dew point and alarm thresholds
- Cooling block temperature display

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Overview

The TC-MIDI X2 with -H2/-O2 heat exchanger series was specially developed for use with high-purity hydrogen and oxygen.

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 ordering information category.

Application	Standard applications	
Operating temperature	40 °C	50 °C
1 heat exchanger for H_2/O_2 applications	TC-MIDI 6111	TC-MIDI 6112

We also offer different signal outputs:

- Status output,
- Analog output, 4...20 mA, incl. status output.

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 using the 5 buttons with the guidance of the menu. This applies to the target outlet dew point, which can be set from 2 to 20 °C (36 to 68 °F) (factory setting 5 °C/41 °F),

as well as the warning thresholds, which 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/34 °F cooling block temperature); for the excess temperature, the range is τ_a +1 to +7 K. The factory settings for both values are 3 K.

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

The separated condensate can be drained via add-on automatic condensate drains.

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).

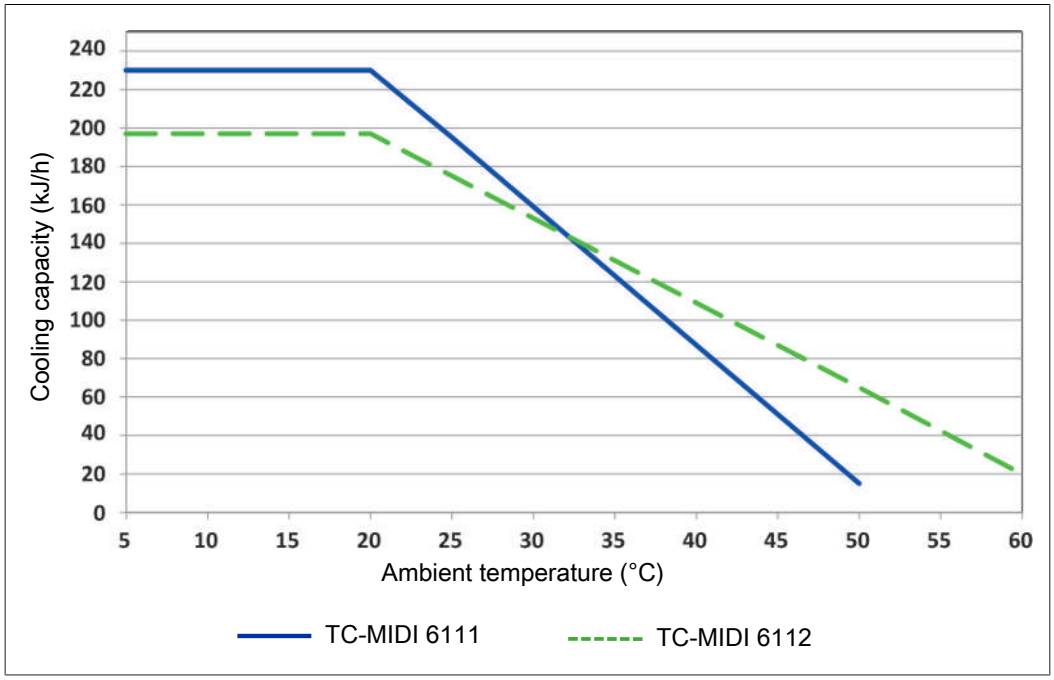
Gas cooler technical data

Gas Cooler Technical Data		
Ready for operation	after max. 10 minutes	
Ambient temperature	5 °C to 60 °C	
Gas outlet dew point preset: adjustable:	 5 °C 2 °C...20 °C	
IP rating	IP 20	
Mechanical load	Tested based on DNV-GL CG0339 vibration class A (0.7 g) 2–13.2 Hz amplitude ± 1.0 mm 13.2–100 Hz acceleration	
Housing	Stainless steel, brushed	
Packaging dimensions	approx. 350 x 220 x 220 mm	
Weight incl. heat exchanger	approx. 12 kg	
Electrical data	Unit without add-on	
	230 V AC	**115 V AC**
	+5/-10%	+5/-10%
	50/60 Hz	50/60 Hz
	1.2 A	2.4 A
	200 W / 280 VA	
Recommended fuse (characteristic: delayed action)	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	
Parts in contact with media Heat exchanger:	 see table ”Heat Exchanger Overview”	
Markings:	FM18ATEX0012X: II 3 G Ex ec nC IIC T4 Gc IECEx FMG 18.0005X: Ex ec nC IIC T4 Gc FM18US0021X/FM18CA0010X: CL I DIV 2 GP ABCD RU C-DE.HA65.B.00608/20	

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

Performance Data



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

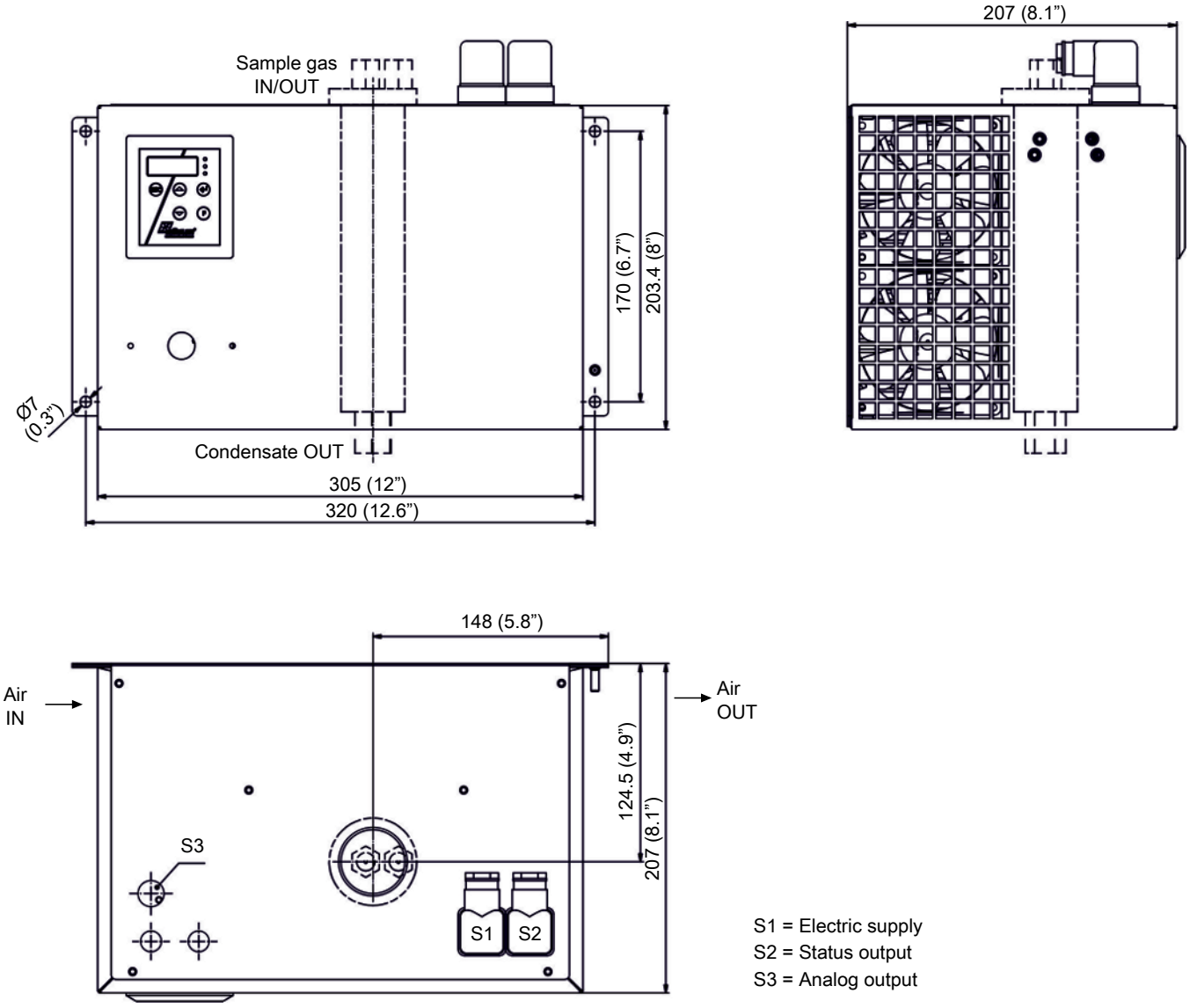
Heat exchanger overview

Heat exchanger	TS-H2/-O2 TS-I-H2/-O2 [2]	DTS-H2/-O2 DTS-I-H2/-O2 [2]
Materials in contact with media	Stainless steel	Stainless steel
Flow rate v_{max} [1]	500 l/h	2x 250 l/h
Inlet dew point $\tau_{e,max}$ [1]	80 °C	80 °C
Gas inlet temperature $\vartheta_{G,max}$ [1]	180 °C	180 °C
Max. cooling capacity Q_{max}	450 kJ/h	450 kJ/h
Gas pressure p_{max}	1.5 bar	1.5 bar
Pressure drop Δp (v=150 l/h)	8 mbar	5 mbar each
Dead volume V_{dead}	69 ml	28/25 ml
Gas connections (metric)	G1/4	6 mm tube
Gas connections (US)	NPT 1/4"	1/4" tube
Condensate out connection (metric)	G3/8	Tube 10 mm (6 mm)
Condensate out connection (US)	NPT 3/8"	Tube 3/8" (1/4")

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

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

Dimensions (mm)



Ordering instructions

Gas cooler models with one or two gas paths in the heat exchanger for H2/O2 applications

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

4496	3	1	1	X	2	X	X	X	X	0	0	0	0	X	0	X	0	X	Product Characteristics
																			Gas cooler models
				1															TC-MIDI 6111 X2: Ambient temperature 40 °C
				2															TC-MIDI 6112 X2: Ambient temperature 60 °C
																			Certifications
					2														for explosive areas
																			Supply voltage
						1													115 V AC, 50/60 Hz
						2													230 V AC, 50/60 Hz
																			Heat exchanger
							1	1	0									-O2	Stainless steel, TS-O2, metric
							1	1	5									-O2	Stainless steel, TS-I-O2, US
							1	1	0									-H2	Stainless steel, TS-H2, metric
							1	1	5									-H2	Stainless steel, TS-I-H2, US
							2	6	0									-O2	Stainless steel, DTS-O2, metric
							2	6	5									-O2	Stainless steel, DTS-I-O2, US
							2	6	0									-H2	Stainless steel, DTS-H2, metric
							2	6	5									-H2	Stainless steel, DTS-I-H2, US
																			Signal outputs
										0	0								status output only
										1	0								Analog output, 4..20 mA, incl. status output
																			Delta T control
															0	0			without Delta T control
															1	0			Delta T control option

Spare parts and accessories for cooler with -H2/-O2 heat exchanger

Item no.	Description
4410001 (see data sheet 450005)	Automatic condensate drain 11 LD V 38 [1]
4410001-O2 (see data sheet 450005)	Automatic condensate drain 11 LD V 38 optimised for oxygen
see data sheet 400016	Stainless steel pipe fittings for high-purity oxygen applications

[1] For use with high hydrogen concentrations max. 1.5 bar overpressure.