



## Sample gas cooler TC-Standard X2 with -H<sub>2</sub>/-O<sub>2</sub> heat exchanger

When a compact design is required, the TC-Standard X2 sample gas cooler with -H<sub>2</sub>/-O<sub>2</sub> heat exchanger is the ideal solution for reliable cooling of hydrogen (H<sub>2</sub>) and oxygen (O<sub>2</sub>) 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<sub>2</sub> series are subjected to a leak test using helium. For the O<sub>2</sub> 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-Standard 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<sub>2</sub> version

Materials in contact with media are suitability-tested for high H<sub>2</sub> and O<sub>2</sub> concentrations

Heat exchanger leak tests using helium are performed on the H<sub>2</sub> series as standard

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

Constant dew point stability  $\pm 0.1$  °C

Adjustable outlet dew point and alarm thresholds

Cooling block temperature display

Easy accessibility reduces maintenance costs



## Overview

The TC-Standard X2 with -H<sub>2</sub>/-O<sub>2</sub> 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 <sub>2</sub> /O <sub>2</sub> applications	TC-Standard 6111	TC-Standard 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  $\tau_a$  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 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 50 °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 (0.7 g) 2–13.2 Hz amplitude ± 1.0 mm 13.2–100 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)		
Electrical data	Unit without add-on		
	<b>24 V DC</b>	<b>230 V AC</b>	<b>115 V AC</b>
	±10%	+5/-10%	+5/-10%
	-	50/60 Hz	50/60 Hz
	5 A	0.6 A	1.2 A
	120 W	110 W / 140 VA	
Recommended fuse (characteristic: delayed action)	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		
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		

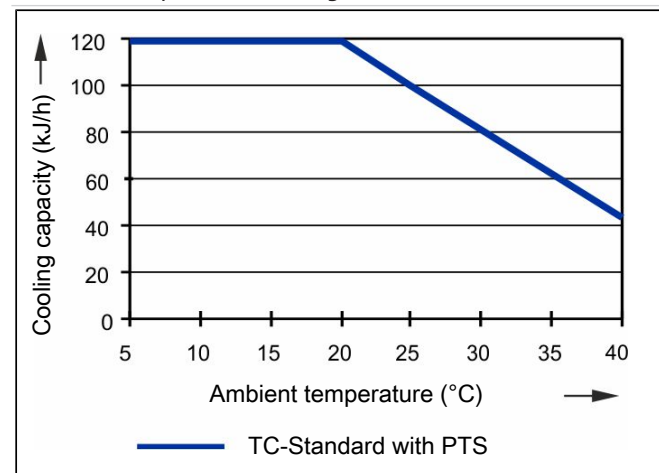
**Technical Data - Options**
**Analogue Output Cooler Temperature Technical Data**

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 curves

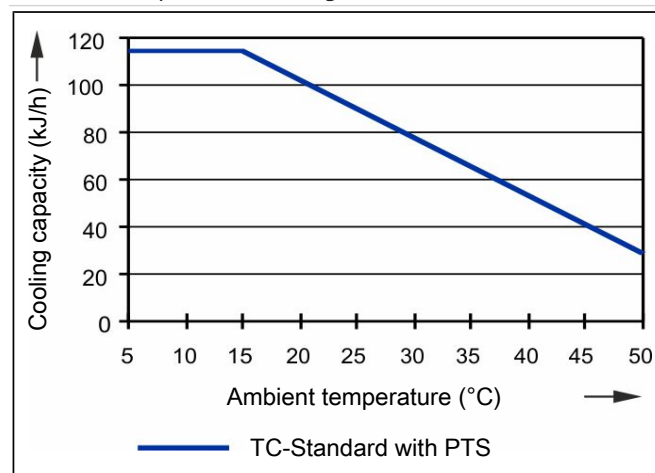
Model TC-Standard 6111

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



## 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  $\tau_e = 40$  °C and  $\vartheta_G = 70$  °C. The maximum flow  $v_{max}$  in l/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.

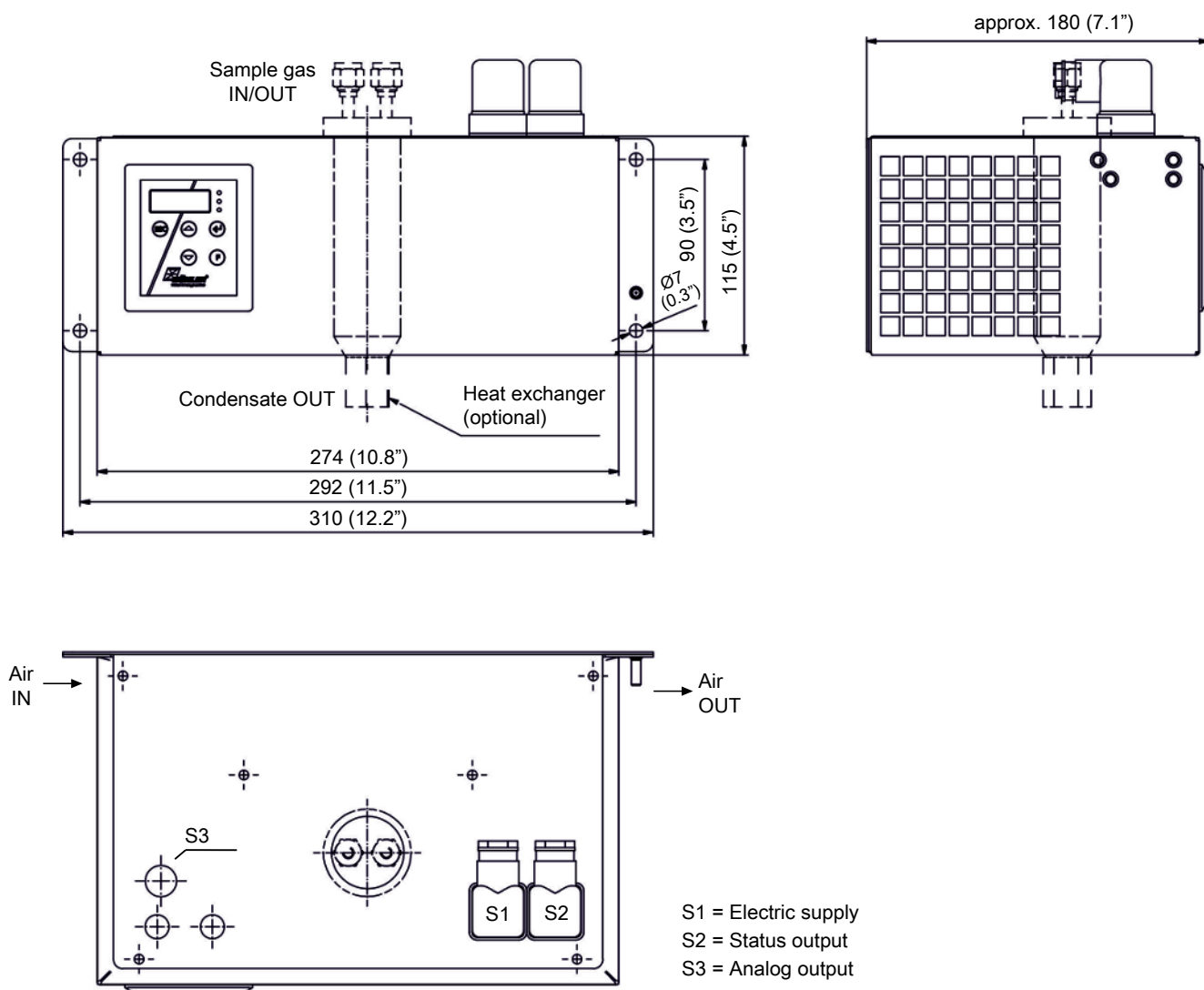
## Heat exchanger overview

Heat exchanger	PTS-H2/-O2 PTS-I-H2/-O2 <sup>2)</sup>
Materials in contact with media	Stainless steel
Flow rate $v_{max}$ <sup>1)</sup>	450 l/h
Inlet dew point $\tau_{e,max}$ <sup>1)</sup>	65 °C
Gas inlet temperature $\vartheta_{G,max}$ <sup>1)</sup>	180 °C
Max. cooling capacity $Q_{max}$	150 kJ/h
Gas pressure $p_{max}$	1.5 bar
Pressure drop $\Delta p$ ( $v=150$ l/h)	10 mbar
Dead volume $V_{dead}$	29 ml
Gas connections (metric)	6 mm
Gas connections (US)	1/4"
Condensate out connection (metric)	G3/8
Condensate out connection (US)	NPT 3/8"

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

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

**Dimensions (mm)**



## Ordering instructions

### Gas cooler models with one 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	2	1	1	X	2	X	1	1	X	0	0	0	X	0	X	0	X	Product Characteristics
																		<b>Gas cooler models (with 1 heat exchanger)</b>
				1														TC-Standard 6111 X2: Ambient temperature 40 °C
				2														TC-Standard 6112 X2: Ambient temperature 50 °C
																		<b>Certifications</b>
				2														for explosive areas
																		<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												-O2 Stainless steel, PTS-O2, metric
				1	1	5												-O2 Stainless steel, PTS-I-O2, US
				1	1	0												-H2 Stainless steel, PTS-H2, metric
				1	1	5												-H2 Stainless steel, PTS-I-H2, US
																		<b>Signal outputs</b>
								0	0									status output only
								1	0									Analog output, 4...20 mA, incl. status output
																		<b>Delta T control</b>
								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 <sup>1)</sup>
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

<sup>1)</sup> For use with high hydrogen concentrations max. 1.5 bar overpressure.