Gas cooler series TC-Standard X2

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.

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.

Despite its small size, the TC-Standard X2 sample gas cooler already covers a large percentage of standard applications in gas analysis.

ATEX and IECEx Zone 2 approval

FM C-US approval for Class I, Division 2

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

Rated capacity 100/90 kJ/h, 40 °C/50 °C version

Dew point stability 0.1 °C

Status display and output

Cooling block temperature display

Moisture detector connection, analog output, filter, and peristaltic pump optional

Overview

The TC-Standard X2 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	TC-Standard 6111 X2	TC-Standard 6112 X2	3rd digit=1
2 heat exchangers	TC-Standard 6121 X2	TC-Standard 6122 X2	3rd digit=2
	4th digit=1	4th digit=2	

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

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

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 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 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.

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 temperature preset: adjustable:	5 °C 2 °C...20 °C or Delta T-control					
Protection class	IP 20					
Mechanical load	Tested to DNVGL-CG-0339, Table 6 [1] 2 Hz-13.2 Hz Amplitude ± 1.0 mm 13.2 Hz -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) approx. 9 kg fully upgraded					
Electrical data	Unit without add-on			Unit with add-on (1 peristaltic pump)		
	24 V DC	230 V AC	115 V AC	24 V DC	230 V AC	115 V AC
	5 A	0.6 A	1.2 A	5.5 A	0.7 A	1.4 A
	120 W	110 W / 140 VA		130 W	130 W / 160 VA	
Recommended fuse (characteristic: delayed action)	6,3 A	1,25 A	2,5 A	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					
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: Tubing:	see "Technical Data - Options" see "Technical Data - Options" see table "Heat Exchanger Overview" see "Technical Data - Options" PTFE/Viton					
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					

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

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

Technical Data peristaltic pumps CPsingle X2 / CPdouble X2

|	
Ambient temperature	0°C to 50 °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 44
Materials	
Hose:	Norprene (Standard), Marprene, Fluran
Connections:	PVDF

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

Outlet

One heat exchanger	Two heat exchangers

Model TC-Standard 6111 (X2)

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 6121 (X2)

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
Temperature difference between heat exchangers	
	< 0.5 K
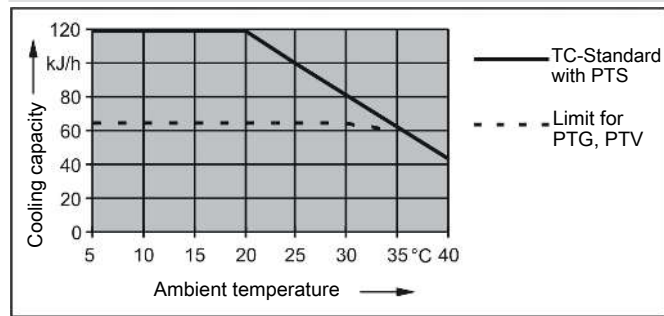
Model TC-Standard 6112 (X2)

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
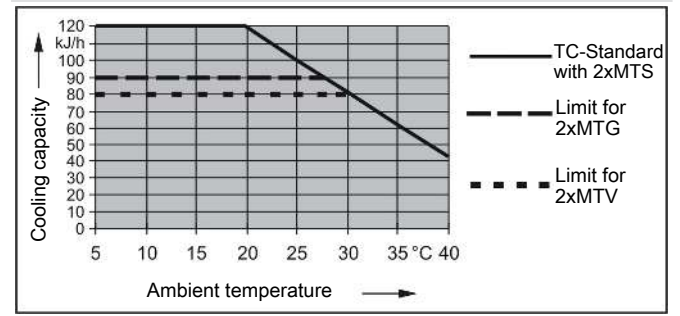
Model TC-Standard 6122 (X2)

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
Temperature difference between heat exchangers	
	< 0.5 K
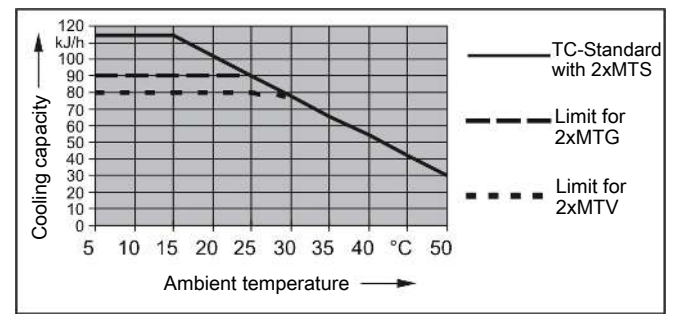
Note: The limit curves for the heat exchangers exchanger PTG, PTV or MTV apply to a dew point of 40 °C.

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 following limits for the maximum flow are specified for a standard operating point of τ_e = 40 °C and ϑ_G = 70 °C. Indicated is the maximum flow v_{max} in Nl/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	PTS PTS-I [2)	PTG PTG	PTV PTV-I [2)	MTS [3) MTS-I [2) 3)	MTG [3) MTG [3)	MTV [3) MTV-I [2) 3)
Version / Material	Stainless steel	Glass	PVDF	Stainless steel	Glass	PVDF
Flow rate v_{max} [1)	450 Nl/h	250 Nl/h	250 Nl/h	300 Nl/h	210 Nl/h	190 Nl/h
Inlet dew point $\tau_{e,max}$ [1)	65 °C	65 °C	65 °C	65 °C	65 °C	65 °C
Gas inlet temperature $\vartheta_{G,max}$ [1)	180 °C	140 °C	140 °C	140 °C	140 °C	140 °C
Max. Cooling capacity Q_{max}	150 kJ/h	90 kJ/h	90 kJ/h	95 kJ/h	80 kJ/h	65 kJ/h
Gas pressure p_{max}	160 bar	3 bar	2 bar	25 bar	3 bar	2 bar
Pressure drop Δp (v=150 L/h)	10 mbar	10 mbar	10 mbar	20 mbar	19 mbar	18 mbar
Dead volume V_{tot}	29 ml	29 ml	57 ml	19 ml	18 ml	17 ml
Gas connections (metric)	6 mm	GL 14 (6 mm) [4)	DN 4/6	6 mm tube	GL14 (6 mm)	DN 4/6
Gas connections (US)	1/4"	GL 14 (1/4") [4)	1/4"-1/6"	1/4" tube	GL14 (1/4")	1/4"-1/6"
Condensate out connections (metric)	G3/8	GL 25 (12 mm) [4)	G3/8	G1/4	GL18 (8 mm)	G1/4
Condensate out connections (US)	NPT 3/8"	GL 25 (1/2") [4)	NPT 3/8"	NPT 1/4"	GL18 (8 mm)	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 exchangers. 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)

Models for standard applications (TC-Standard 611x and 612x):
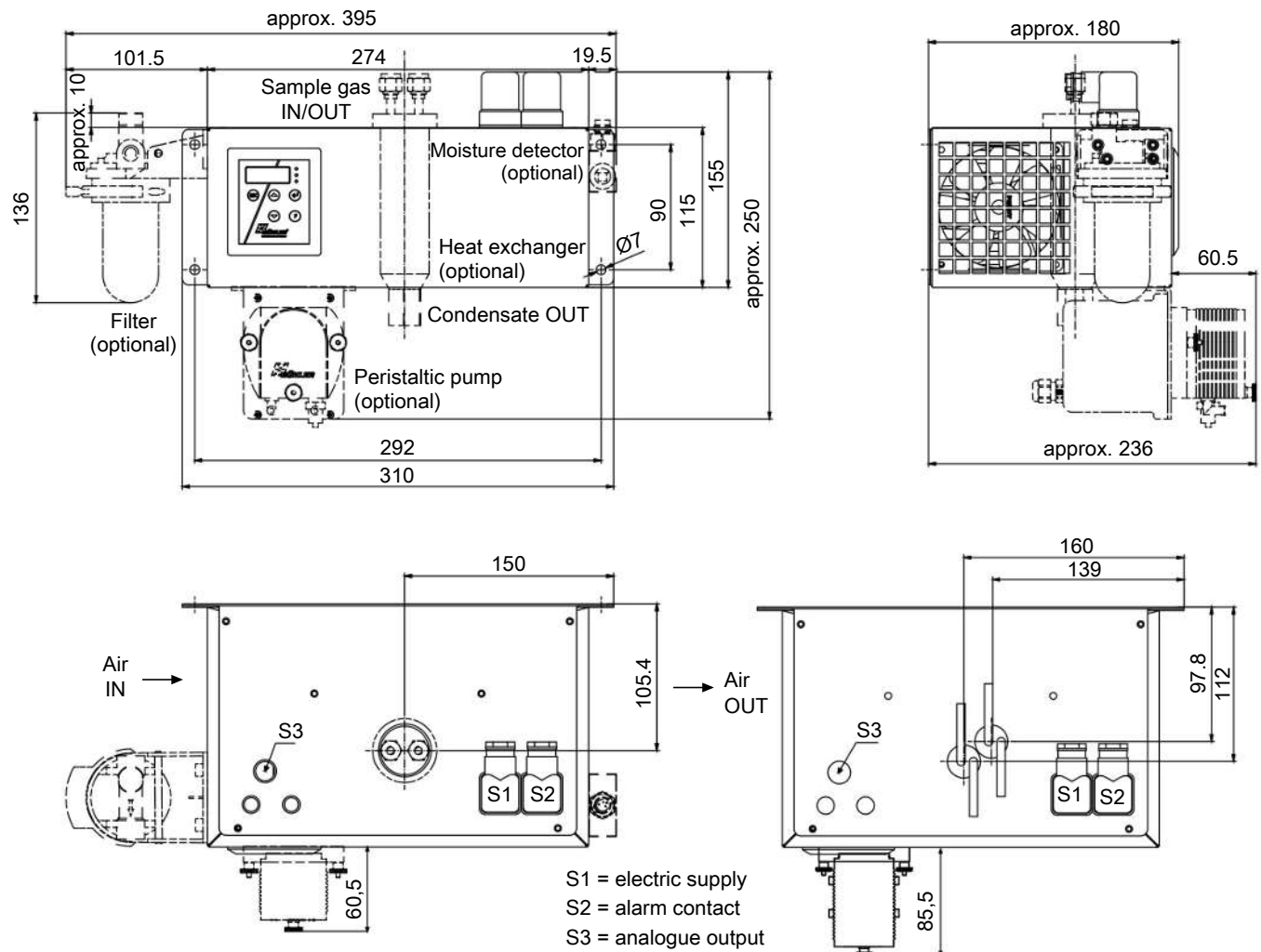
Ordering instructions

Gas cooler models with one heat exchanger

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	X	X	X	0	X	X	X	0	X	0	Product characteristic
																		Gas cooler models (with 1 heat exchanger)
				1														TC-Standard 6111 X2: Ambient temperature 40 °C
				2														TC-Standard 6112 X2: Ambient temperature 50 °C
																		Certifications
					2													for explosive areas
																		Supply voltage
						1												115 VAC, 50/60 Hz
						2												230 V AC, 50/60 Hz
						4												24 VDC
																		Heat exchanger
							1	1	0									Stainless steel, PTS, metric
							1	1	5									Stainless steel, PTS-I, US fitting
							1	2	0									Duran glass, PTG, metric
							1	2	5									Duran glass, PTG, US fitting
							1	3	0									PVDF, PTV, metric
							1	3	5									PVDF, PTV-I, US fitting
																		Peristaltic Pumps *
										0	0							without peristaltic pump
										1	0							CPsingle X2 with hose nipple, angled
										3	0							CPsingle X2 with screw connection
																		Moisture detector / 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			Analog output option, add-on
																		Delta T-control
																0	0	without Delta T-control
																1	0	Delta T-control option

* 24 V DC version not available

Gas cooler models with two heat exchangers

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

4496	2	1	2	X	2	X	2	X	X	X	0	X	X	X	0	X	0	Product characteristic
																		Gas cooler models (with 2 heat exchangers)
		1																TC-Standard 6121 X2: Ambient temperature 40 °C
		2																TC-Standard 6122 X2: Ambient temperature 50 °C
																		Certifications
			2															for explosive areas
																		Supply voltage
				1														115 VAC, 50/60 Hz
				2														230 V AC, 50/60 Hz
				4														24 VDC
																		Heat exchanger
					2	1	0											Stainless steel, 2 MTS, metric
					2	1	5											Stainless steel, 2 MTS-I, US fitting
					2	2	0											Duran glass, 2 MTG, metric
					2	2	5											Duran glass, 2 MTG, US fitting
					2	3	0											PVDF, 2 MTV, metric
					2	3	5											PVDF, 2 MTV-I, US fitting
																		Peristaltic Pumps *
								0	0									without peristaltic pump
								2	0									CPdouble X2 with hose nipple, angled
								4	0									CPdouble X2 with screw connection
																		Moisture detector / 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	1							2 filters, 1 moisture detector
										2	2							2 filters, 2 moisture detectors
																		Status Outputs
														0	0			status output only
														1	0			Analog output option, add-on
																		Delta T-control
																0	0	without Delta T-control
																1	0	Delta T-control option

* 24 V DC version not available

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 analog output 4 m
44 10 005	Condensate trap GL1, 0.4 L
44 92 00 35 012	Norprene replacement hose with angled connections 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
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-I and MTV-I