



## Gas cooler series TC-Double+ X2

In emission measurement, 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 as well as measurements in small combustion plants or exhaust gas analysis in automotive engineering.

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-Double+ 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

Low wash out effects

One gas path

Duran glass or PVDF heat exchanger

Rated power 256/294 Btu/h, 104 °F/140 °F version

Max. ambient temperature 140 °F

Dew point stability 0.2 °F

Status display and output

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



**Overview**

TC-Double+ X2 coolers were designed specifically for high cooling capacities, high ambient temperatures and to cool in two cycles to minimise wash out effects. The two cooling blocks can be set do different temperatures.

Any other use of this cooler is determined by the type of built-in passive pre-cooling, i.e. the first cooling level is not controlled electronically.

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	104 °F	122 °F
2 heat exchangers in series	TC-Double+ 6111 X2	TC-Double+ 6112 X2

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 temperatures 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. This applies to the outlet dew point setting on one hand and to the low and excess temperature warning thresholds on the other hand. 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 34 °F cooling block temperature), for the excess temperature the range is  $\tau_a +1$  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 the add-on peristaltic pump.

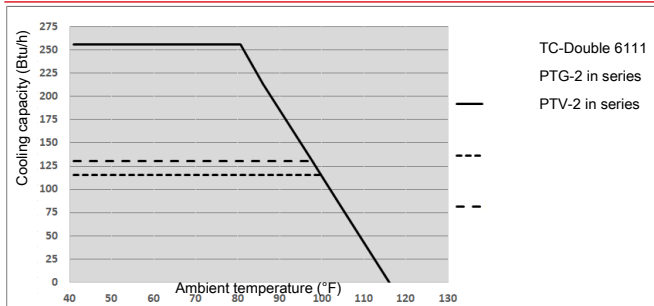
In addition, a fine filter can be attached to the cooler, which an optional moisture detector can be integrated into. The glass dome allows the dirt level of the filter element to easily be determined. The moisture detector can also be installed separately and is generally easy to remove. This may be required if water enters the cooler due to a malfunction and the peristaltic pump can no longer remove it.

A gas pump can be attached to the TC-Double+ and controlled. These are also available with bypass valve to regulate the flow rate.

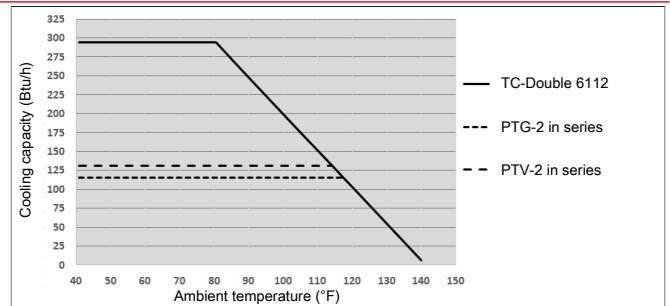
**Performance curves**

The TC-Double+ 6111 (X2) is designed for ambient temperatures of up to 104 °F. The cooling capacity is adequate up to this temperature. The TC-Double+ 6112 (X2) on the other hand can be used in higher temperatures up to nominal 140 °F. Please note the available cooling capacity.

**Model TC-Double+ 6111 (X2)**



**Model TC-Double+ 6112 (X2)**



Note: The limit curves for the heat exchangers exchanger apply to a dew point of 122 °F.

**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  $\tau_e = 122$  °F and  $\vartheta_G = 158$  °F. 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	2x PTG-2 2x PTG-2-I	2x PTV-2 2x PTV-2-I <sup>2)</sup>
Version / Material	Glass	PVDF
Flow rate $v_{max}$ <sup>1)</sup>	4.2 lpm	4.2 lpm
Inlet dew point $\tau_{e,max}$ <sup>1)</sup>	158 °F	158 °F
Gas inlet temperature $\vartheta_{G,max}$ <sup>1)</sup>	284 °F	284 °F
Max. Cooling capacity $Q_{max}$	218 Btu/h	204 Btu/h
Gas pressure $p_{max}$	44 psi	29 psi
Pressure drop $\Delta p$ ( $v=2.5$ lpm) total	0.29 psi	0.29 psi
Dead volume $V_{tot}$ total	3.6 cu.in.	7 cu.in.
Gas connections (metric)	GL 14 (6 mm) <sup>3)</sup>	DN 4/6
Gas connections (US)	GL 14 (1/4") <sup>3)</sup>	1/4"-1/6"
Condensate out connections (metric)	GL 25 (12 mm) <sup>3)</sup>	G3/8
Condensate out connections (US)	GL 25 (1/2") <sup>3)</sup>	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, respectively.

<sup>3)</sup> Gasket inside diameter

**Gas Cooler Technical Data**

<b>Gas Cooler Technical Data</b>				
Ready for operation	after max. 10 minutes			
Ambient temperature	41 °F to 140 °F			
Gas output dew temperature, preset: adjustable:	41 °F 36 °F...68 °F			
IP rating	IP 20			
Housing	Stainless steel, brushed			
Packaging dimensions	approx. 16.8 x 11.8 x 11.5 in			
Weight incl. heat exchanger	approx. 13.8 lb approx. 33 lb at full expansion stage			
Electrical data	Unit without add-on		Unit with add-on (peristaltic pump + gas pump)	
	<b>230 V AC</b>	<b>115 V AC</b>	<b>230 V AC</b>	<b>115 V AC</b>
	+5/-10%	+5/-10%	+5%	+5%
	50/60 Hz	50/60 Hz	50 Hz	60 Hz
	1.6 A	3.2 A	2.1 A	4.1 A
	278 W / 350 VA	296 W / 370 VA	390 W / 487 VA	377 W / 472 VA
Recommended fuse (characteristic: delayed action)	2.5 A	4 A	2.5 A	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	Heat exchange see table "Heat Exchanger Overview" Filter, moisture detector adapter, gas pump, G1/4 or NPT 1/4" or metric/US tube or pipe			
Parts in contact with media				
Filter:	see "Technical Data - Options"			
Moisture detector:	see "Technical Data - Options"			
Heat exchanger:	see table "Heat Exchanger Overview"			
Peristaltic pump:	see "Technical Data - Options"			
Tubing:	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 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 -4 °F to 140 °F cooler temperature
Connection	M12x1 plug, DIN EN 61076-2-101

**Technical Data FF-3-N Moisture Detector**

Ambient temperature	37 °F to 122 °F
max. operating pressure with FF-3-N	29 psi
Material	PVDF, PTFE, epoxy resin, stainless steel 1.4571, 1.4576

**Technical Data peristaltic pump CPdouble X2**

Ambient temperature	32 °F to 122 °F
Flow rate	0.005 lpm (50 Hz)/0.006 lpm (60 Hz) with standard hose
Vacuum inlet	max. 11.6 psi
Pressure inlet	max. 14.5 psi
Outlet pressure	14.5 psi
Hose	4 x 1.6 mm (0.04 in)
Degree of protection	IP 44
Materials	
Hose:	Norprene (standard), Marprene, Fluran
Connections:	PVDF

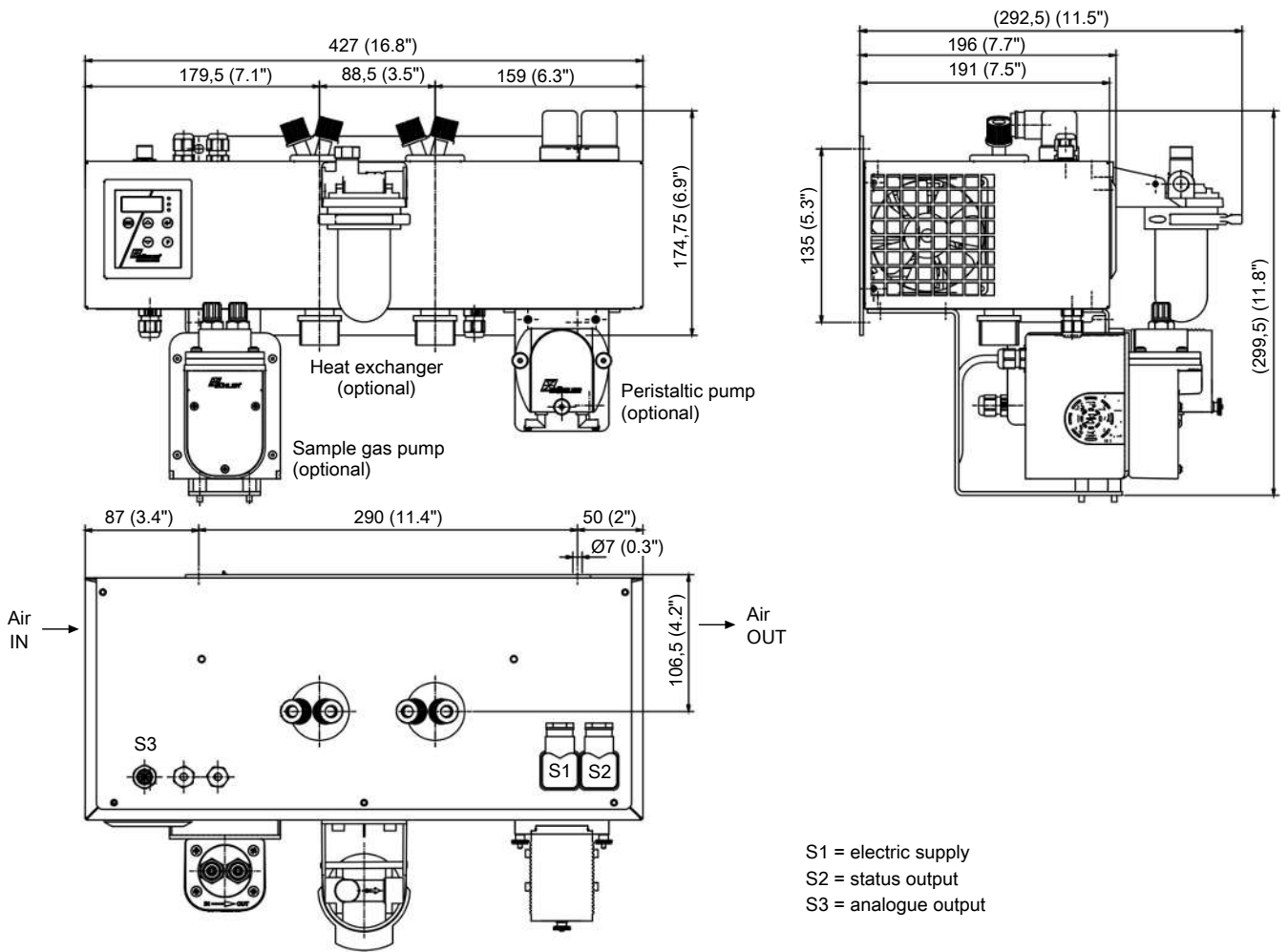
**Technical Data Sample Gas Pump P1.3**

Ambient temperature	32 °F to 122 °F
Operating pressure	max. 18.8 psi abs.
Nominal outlet	4.6 lpm (at p = 14.5 psi abs.)
Materials in contact with media vary by configuration	PTFE, PVDF, 1.4571, 1.4401, Viton

**AGF-PV-30-F2 Filter Technical Data**

Ambient temperature	37 °F to 212 °F
max. operating pressure with filter	29 psi
Filter surface	9.3 in <sup>2</sup>
Filter mesh	2 µm
Dead volume	3.47 cu. in.
Materials	
Filter:	PVDF, Duran glass (parts in contact with mediums)
Seal:	Viton
Filter element:	sintered PTFE

Dimensions (inch)



Ordering instructions

Gas cooler model with two heat exchangers in series

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

4496	6	1	1	X	2	X	1	X	X	X	X	X	X	X	0	0	0	Product Characteristics
<b>Gas cooler type</b>																		
1 TC-Double+ 6111 X2 Ambient temperature 104 °F																		
2 TC-Double+ 6112 X2 Ambient temperature 140 °F																		
<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 2 2 Duran glass, PTG-2, metric																		
1 2 7 Duran glass, PTG-2-I, US																		
1 3 2 PVDF, PTV-2, metric																		
1 3 7 PVDF, PTV-2-I, US																		
<b>Peristaltic Pumps</b> <sup>1)</sup>																		
0 without peristaltic pump																		
2 CPdouble X2 with hose nipple, angled																		
4 CPdouble X2 with screw connection <sup>2)</sup>																		
<b>Sample Gas Pumps</b> <sup>1) 3)</sup>																		
0 without sample gas pump																		
1 P1.3, PVDF																		
2 P1.3, with bypass valve																		
<b>Moisture Detector/Filter</b> <sup>1) 2)</sup>																		
0 0 without filter, without moisture detector																		
0 1 without filter, 1 moisture detector with PVDF adapter <sup>4)</sup>																		
1 0 1 filter, without moisture detector																		
1 1 1 filter with built-in moisture detector																		
<b>Signal outputs</b>																		
0 0 status output only																		
1 0 Analog output, 4...20 mA additional																		

<sup>1)</sup> With this option, the maximum ambient temperature is limited to 122 °F.

<sup>2)</sup> Metric or US connection, per heat exchanger.

<sup>3)</sup> Factory installed tubing for suction operation.

<sup>4)</sup> Also available in stainless steel.

## 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 (13 ft)
44 10 005	Condensate Trap GL1, 0.4 L
44 92 00 35 012	Norprene replacement hose with angled connections for peristaltic pump 0.005 lpm
44 92 00 35 016	Norprene replacement hose with one angled connection and one screw connection (metric) for peristaltic pump 0.005 lpm
44 92 00 35 017	Norprene replacement hose with one angled connection and one screw connection (US) for peristaltic pump 0.005 lpm
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 158 °F for P1 pump