ModbusRTU

Sample gas cooler TC-Double+

Many analysis processes require extracting sample gas from the process. This also extracts process-related contamination such as particles or moisture. These can impact the measurement results or damage the measuring cells. The sample gas must therefore be conditioned before entering the analyser. The sample gas cooler reduces the gas temperature to below the dew point for this purpose, causing moisture to drop out, which is then discharged as condensate.

In addition to the status output to monitor the sample gas cooler function, we offer an optional 4 – 20 mA analog output or digital interface. The process control can access the process and diagnostic data via the Modbus RTU interface as well as configure the device settings.

The TC-Double+ series combines the double cooling system of the TC-Double with special heat exchangers. The TC-Double+ features a new generation of heat exchangers with particularly low washout effect of water-soluble components and are specifically suitable for measuring emissions. Most notably, the washout of SO_2 is low. These coolers can therefore be used for so-called automated measuring systems (AMS) per DIN EN 15267-3.

- Low washout effects
- Two separate temperature settings
- Two-stage cooling option
- Duran glass or PVDF heat exchanger
- Nominal cooling capacity 256 Btu/h (104 °F version) or 294 Btu/h (140 °F version)
- Max. ambient temperature 140 °F
- Dew point stability 0.2 °F
- Status display and output
- Optional 4 - 20 mA or Modbus RTU signal output
- Optional CE mark or FM approval
- Moisture detector, filter and condensate pump optional

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Overview

TC-Double+ 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	TC-Double+ 6112

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

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

In addition, we offer different signal outputs:

- Status output
- Analog output, 4...20 mA, incl. status output,
- Modbus RTU digital output, incl. status output

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 τ_a setting.

For the low temperature the range is τ_a -1 to - 3 K (at a minimum 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 the add-on peristaltic pump.

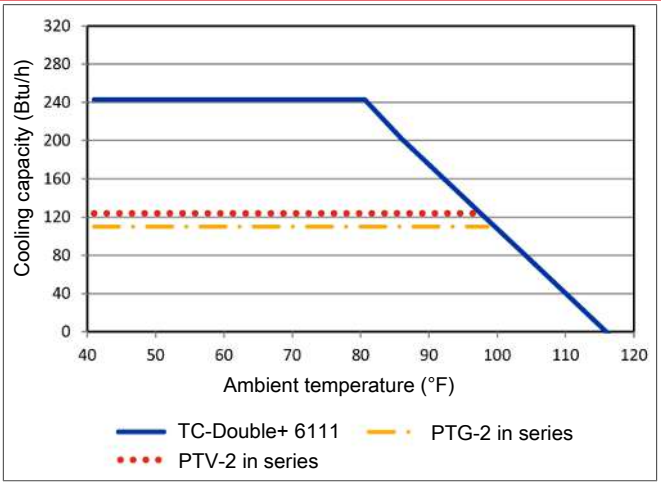
In addition, a fine filter can be attached to the cooler, which an optional moisture detector can be integrated into. The glass dome allows the dirt level of the filter element to easily be determined. The moisture detector can also be installed separately and is generally easy to remove. This may be 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.

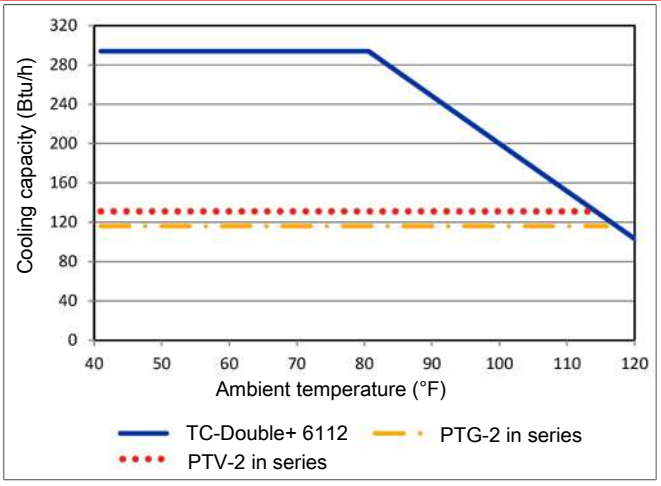
Performance curves

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

Typ TC-Double+ 6111



Typ TC-Double+ 6112



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 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 = 122 °F and ϑ_G = 158 °F. 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	2x PTG-2 2x PTG-2-I	2x PTV-2 2x PTV-2-I [2]
Materials in contact with media	Glass PTFE	PVDF
Flow rate v_{max} [1]	4.2 lpm	4.2 lpm
Inlet dew point $\tau_{e,max}$ [1]	158 °F	158 °F
Gas inlet temperature $\vartheta_{G,max}$ [1]	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 Δp (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) [3]	DN 4/6
Gas connections (US)	GL 14 (1/4") [3]	1/4"-1/6"
Condensate out connections (metric)	GL 25 (12 mm) [3]	G3/8
Condensate out connections (US)	GL 25 (1/2") [3]	NPT 3/8"

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

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

[3] Gasket inside diameter

Gas Cooler Technical Data

Gas Cooler Technical Data				
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)	
	230 V AC	**115 V AC**	**230 V AC**	**115 V AC**
	+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: 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			
FM no.:	3062014			

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

Digital interface technical data	
Signal	Modbus RTU (RS-485)
Connection	M12x1 connector, DIN EN 61076-2-101

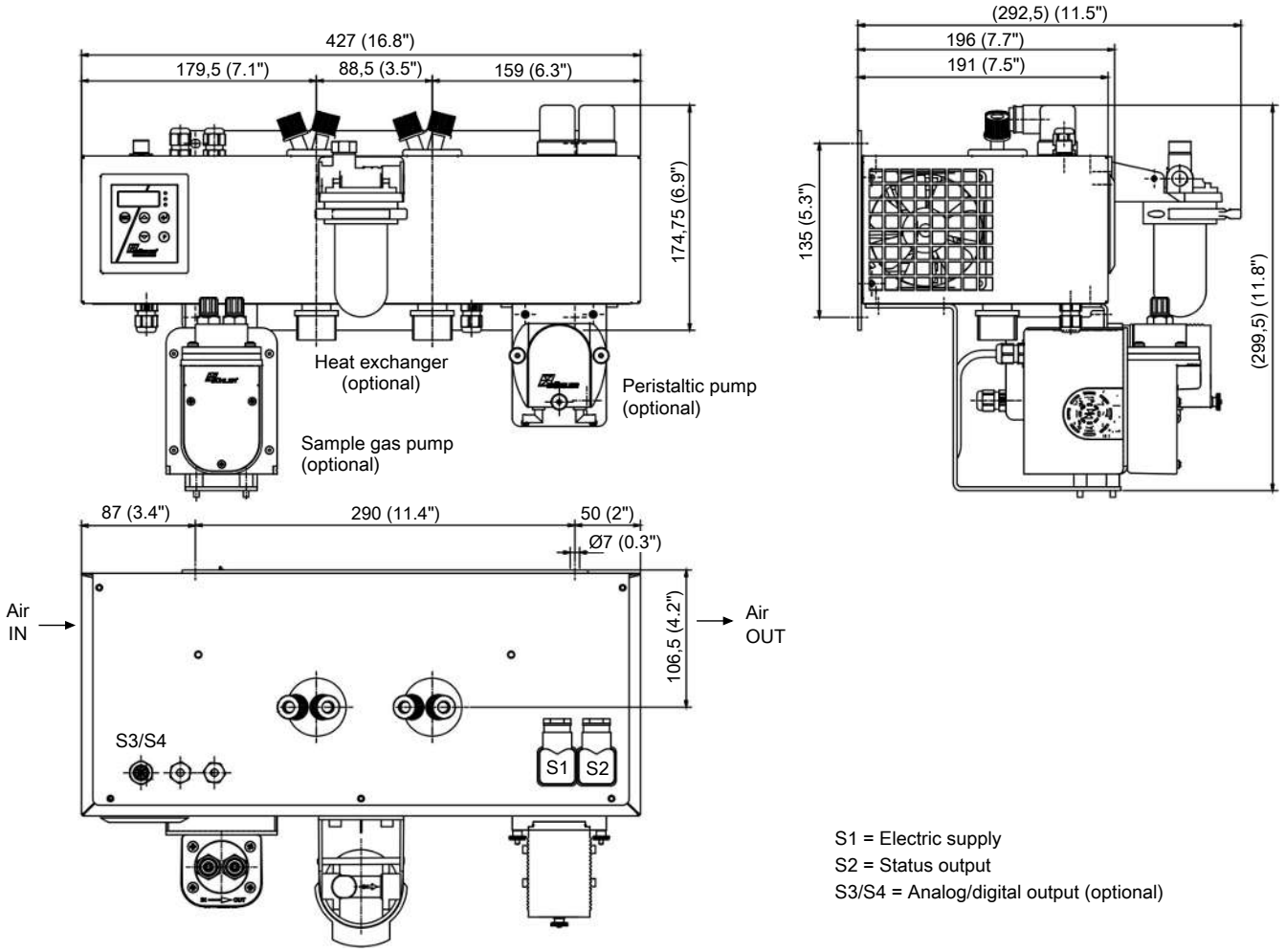
Technical Data FF-3-N Moisture Detector	
Ambient temperature	37 °F to 122 °F
max. operating pressure with FF-3-N	29 psi
Material	PVDF, PTFE, epoxy resin, stainless steel 1.4571, 1.4576

CPdouble Peristaltic Pump Technical Data	
Ambient temperature	32 °F to 131 °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: Connections:	 Norprene (standard), Marprene, Fluran PVDF

Technical Data Sample Gas Pump P1	
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, PFA

AGF-PV-30-F2 Filter Technical Data	
Ambient temperature	37 °F to 212 °F
max. operating pressure with filter	58 psi
Filter surface	9.3 in^2
Filter fineness	2 µm
Dead volume	3.47 cu. in.
Materials Filter: Seal: Filter element:	 PVDF, Duran glass (parts in contact with media) Viton sintered PTFE

Dimensions (inch)



S1 = Electric supply
S2 = Status output
S3/S4 = Analog/digital output (optional)

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	X	X	1	X	X	X	X	X	X	0	0	0	0	Product Characteristics
																		Gas cooler model
				1														TC-Double+ 6111: Ambient temperature 104 °F
				2														TC-Double+ 6112: Ambient temperature 140 °F
																		Certifications
					0													Standard applications – CE
					1													for common locations - FM
																		Supply voltage
						1												115 V AC, 50/60 Hz
						2												230 V AC, 50/60 Hz
																		Heat exchanger
							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
																		Condensate drain [1]
										0								without condensate drain
										2								CPdouble with hose nipple, angled
										4								CPdouble with screw connection [2]
																		Sample gas pumps [1] [3]
											0							without sample gas pump
											1							P1, PVDF
											2							P1, with bypass valve
																		Humidity sensor/filter [1] [2]
												0	0					without filter, without moisture detector
												0	1					without filter, 1 moisture detector with PVDF adapter [3]
												1	0					1 filter, without moisture detector
												1	1					1 filter with built-in moisture detector
																		Signal outputs
														0	0			status output only
														1	0			Analog output, 4...20 mA incl. status output
														2	0			Modbus RTU digital output incl. status output [4]

[1] With this option, the maximum ambient temperature is limited to 122 °F.

[2] Metric or US connection, per heat exchanger.

[3] Also available in stainless steel.

[4] Option only available for CE version.

Consumables and accessories

Item no.	Description
4510008	Automatic condensate drain AK 5.2 (pressure operation only)
4510028	Automatic condensate drain AK 5.5 (pressure operation only)
4410004	Automatic condensate drain AK 20 (pressure operation only)
4410001	Automatic condensate drain 11 LD V 38 (pressure operation only)
41030050	Replacement filter element F2; 5-pack
9144050038	Cable for cooler temperature analog output 4 m
4410005	Condensate trap GL1, 0.4 L
44920035012	Condensate pump replacement hose, Tygon (Norprene), angled hose nipple
44920035016	Condensate pump replacement hose, Tygon (Norprene), angled hose nipple and screw connection (metric)
44920035017	Condensate pump replacement hose, Tygon (Norprene), angled hose nipple and screw connection (US)
4228003	Bellow for P1 pump
9009398	O-ring for bypass P1 pump
4228066	Set inlet/outlet valves 158 °F for P1 pump