

**P-Series**

The P-series humidifiers can set the humidity, temperature and flow rate of a gas. The equipment is accurate, easy-to-use and reliable - developed for laboratory experiments and for continuous operation in industrial production.

The P-Series is suitable for flow rates in the range 0 to 250 litres per minute and pressures from vacuum up to 20 bar(a).

The P-Series is available in versions from the basic version to full-feature units for full control and wide operating range of humidity, temperature, flow and pressure.



**Advantages**

- No condensation at low flow rate, down to 0 l/min
- No droplets at full flow
- Fully automatic
- Maintenance free
- Compact
- Suitable for air, oxygen, hydrogen and other gases.

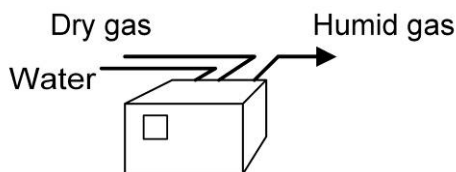
**Humidity control**

- Industrial production and laboratory
- Climate chambers
- Environmental simulation
- Fuel Cell testing
- Semiconductor industry
- Tube furnaces
- Pharmaceutical industry
- Humidity control of vacuum dryers

**Technology**

- Membrane humidifier for accurate humidity control without droplets
- Microprocessor controlled digital display.
- Stainless steel and PTFE components
- CE-compliance

**Principle**



**Capacity**

Model	P-2	P-10	P-50	P-100	P-250
Flow (l/min)	0...2 <sup>1</sup>	0...10	0...50	0...100	0...250
Humidity	0 <sup>2</sup> ...100 % RH				
	-20 <sup>2</sup> ...90 (-70...125 °C) Tdew				
Temperature	20...300 °C				
Pressure	0...20 bar(a)				

<sup>1</sup> nominal gas flow can be chosen freely down to 10 ml/min

<sup>2</sup> for low dewpoints, choose humidity control option S, with range down to -70 °C dewpoint.

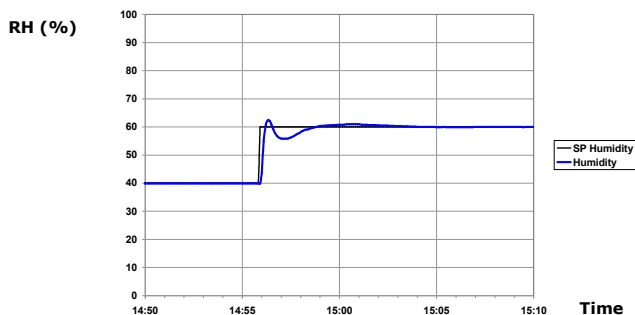
**Display**

The front panel display will give all information about the produced gas flow. The P-Series can control the humidity and optionally: flow rate, temperature, pressure and gas composition.

	PV	SP	
Flow	10.0	10	nlpm
Temperature	45.1	45	°C
Humidity	50.0	50	%RH
Pressure	2.00		bara

Menu

**Transient and stable**



The graph shows the setpoint and the process value of humidity for a P-10 unit at max flow (10 NI/min). Even quicker transients are available upon request.

**Technical data**

	<b>P-2</b>	<b>P-10</b>	<b>P-50</b>	<b>P-100</b>	<b>P-250</b>
<b>Flow</b>					
Capacity	0...2 l/min	0...10 l/min	0...50 l/min	0...100 l/min	0...250 l/min
Flow accuracy (flow control option)	± 0.5 % reading ± 0.1 % of full scale				
<b>Humidity</b>					
Capacity <sup>1</sup>	0...100 % RH, -20...90 (-70...125 °C) Tdew (max 30 g/min evaporation)				
Sensor accuracy	± 1.5 %RH (± 1.0 %RH available as option)				
Sensor accuracy (configuration for atm pressure and max 75 °C)	At 0 ... +40 °C: ±1.5 % RH (0 ... 90 %RH) ±2.5 % RH (90 ... 100 %RH) At +40 ... +80 °C: ±3.0 % RH (0 ... 90 %RH) ±4.0 % RH (90 ... 100 %RH)				
<b>Temperature</b>					
Capacity <sup>2</sup>	20...150 (300) °C (no integrated cooling, max 650 W gas heating)				
Accuracy at 0 ... +40 °C gas temperature	±0.2 °C				
<b>Pressure</b>					
Pressure range	0.8...1.2 bara (atm), 1...6 bar(a) or free def. Between 0 (vacuum)...20 bar(a)				
Pressure drop	2500 mbar with flow control, 0-300 mbar without flow control				
Pressure drop (low limited versions)	50 mbar	50 mbar	300 mbar	150 mbar	300 mbar
<b>Liquid supply</b>					
Water quality	Deionised or distilled (max 10µS / cm)				
Suction capacity of inlet water <sup>2</sup>	1 m (with atmospheric supply option only)				
Max pressure of inlet water (optional)	8 bar (with pressurized supply option only)				
<b>General</b>					
Power	1000 W	1200 W	2000 W	2000 W	2400 W
Ambient temperature in use	+5... +45 °C				
Ambient temperature storage	-40... +60 °C				
Start-up time to Tdew 50 °C	5 min				
Wetted materials	Perfluorinated sulphonic acid membrane, PTFE, Stainless steel				
Certification	CE certified				
<b>Mechanical</b>					
Standard bench top enclosure (WxHxD)	471x280.5x391 mm				
Weight (approximate)	15 kg	15 kg	15 kg	23 kg	25 kg
<b>Interface</b>					
Voltage <sup>3</sup>	208-230 V / 50-60 Hz AC				
Remote control digital <sup>2</sup> (optional)	RS 232 / RS 485 Modbus RTU or Modbus TCP Open source Java-based software included with data logging, real time graphs and an advanced recipe function.				
Remote control analogue <sup>2</sup> (optional)	4...20 mA				
Liquid inlet	6 mm or 1/4" compression fitting Swagelok®				
Gas inlet/outlet (Swagelok® fitting)	6 mm or 1/4"	6 mm or 1/4"	12 mm or 1/2" (P-50 gas inlet may be 6 mm or 1/4")		

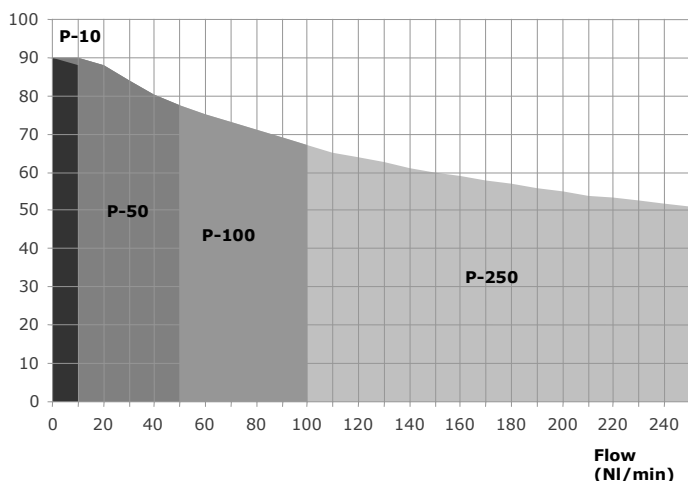
<sup>1</sup> Min level of humidity=Inlet gas humidity, Max level – see graph below. For lower dewpoints, choose Cellkraft DP-Series.

<sup>2</sup> Depending on ordered configuration.

<sup>3</sup> Some configurations available as 110-120 V / 50-60 Hz

**Capacity**

T<sub>dew</sub> (°C)



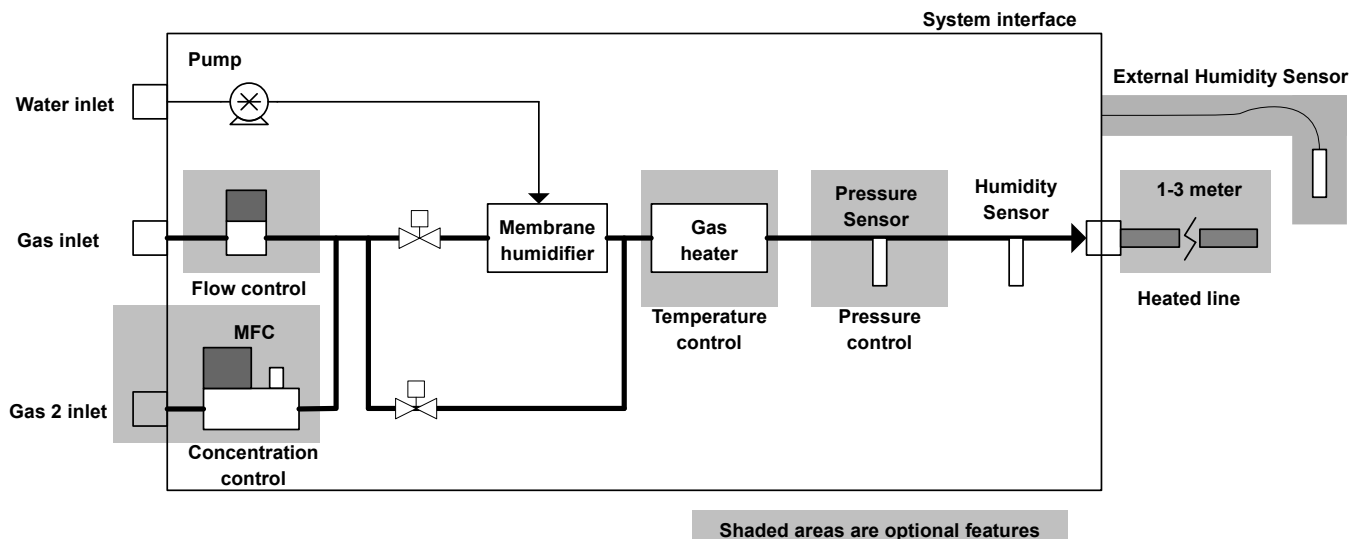
**Industrial version**

The P-Series humidifier is available in a version for industrial environments. The wall mount stainless steel enclosure is IP65 and also available with ATEX rating.



Accurate • Easy to use • Reliable

**Function**



**Flow**

In standard configuration the unit can control the flow rate from 0-100%. Optionally the unit can be equipped with flow monitoring device that allows for precise control and readout of the flow rate in terms of nlpm or nccm. For best humidity control, recommended range of operation is 5-100 % of nominal gas flow.

**Pressure**

The unit can be configured to monitor the gas pressure or even to set the pressure. Pressure control is effectuated by controlling a proportional valve at the downstream release point to atmosphere or vacuum system in order to keep the pressure at the set value.

**Temperature / heated tube**

The unit is available for output air/gas at room temperature or at increased temperature. An integrated internal heater will allow the user to set the temperature of the humidified gas. In this way the humidity and temperature can be set independently. Heated tube option will keep the gas heater between humidifier and downstream application. Standard tube will also keep both end fittings heated to avoid condensation also at very low gas flows.

**Humidity**

In standard configuration the unit will control the humidity utilising two principles:

1. At low humidity the unit works by splitting the inlet flow in two paths. One stream is humidified as it passes through the membrane humidifier. The other stream is bypassed. Proportional valves control the mix-ratio of humid and dry flows to set the humidity at the set level.
2. At high humidity operation the entire flow is passed through the membrane humidifier and the temperature of the humidifier will control the output humidity. Change between the two modes is seamless and humidity can be varied quick and accurate in the entire humidity interval at the set temperature.

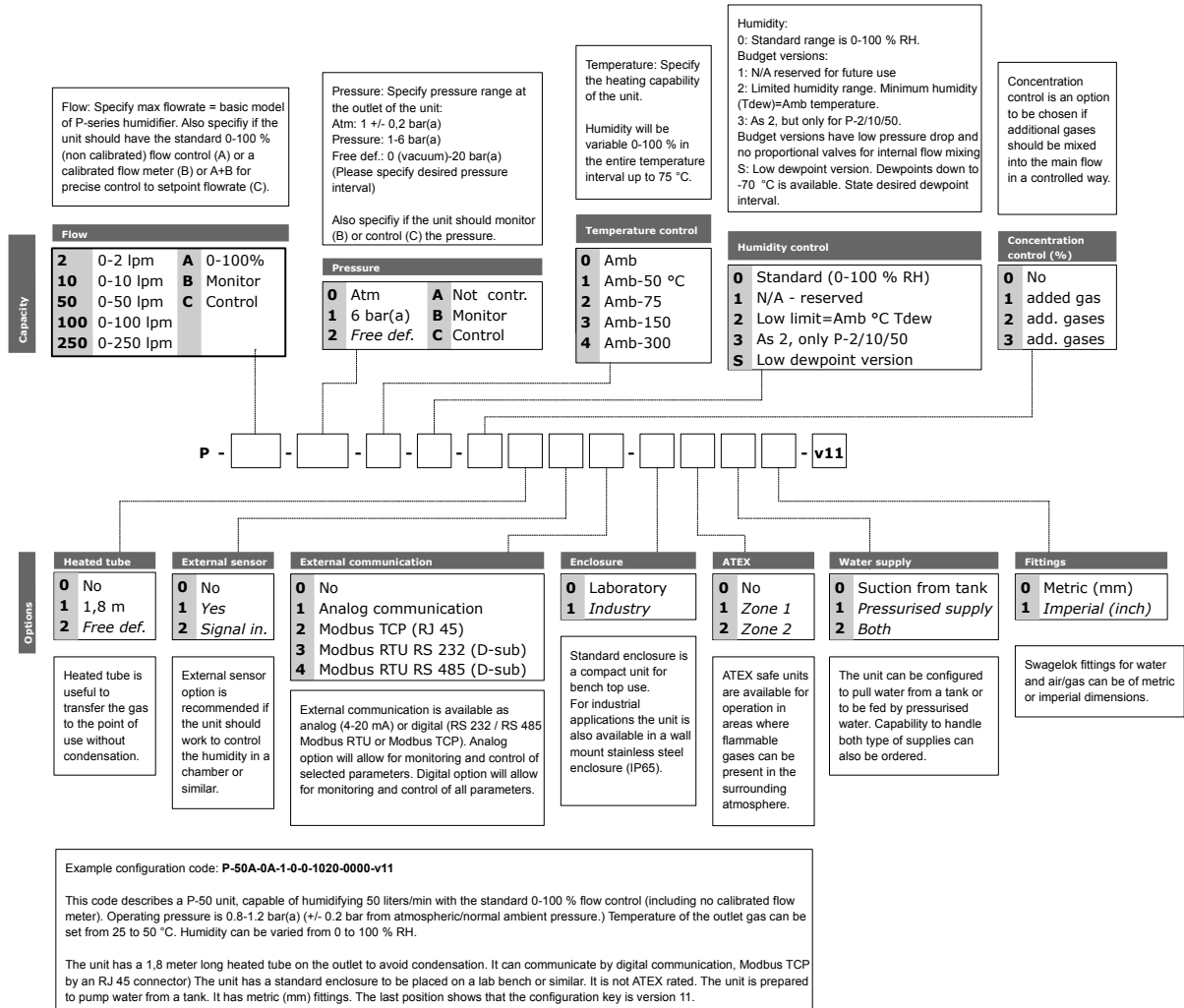
**Concentration**

Optionally the unit can be equipped with parallel flow control for several gases. In this way accurate concentration control can be achieved.

**The core – the membrane humidifier**

The core of the P-Series humidifier is the membrane humidifier. In this unit the dry flow is humidified by transfer of water molecules through membrane tubes. The concept allows for large surface area and high capacity humidification in compact dimensions. The humidity transfer is linked to the water vapour pressure. It is increased at higher temperatures and controlled by setting the temperature of the water surrounding the membrane tubes. The Cellkraft membrane concept gives extremely stable performance in the full flow range. No droplets at neither low nor high flow rates.

**Product configuration code**



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