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
- **Dry gas** → **Water** → **Humid gas**

### Capacity

<table>
<thead>
<tr>
<th>Model</th>
<th>Flow (l/min)</th>
<th>Humidity</th>
<th>Temperature</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-2</td>
<td>0...2</td>
<td>0...100 % RH</td>
<td>20...300 °C</td>
<td>0...20 bar(a)</td>
</tr>
<tr>
<td>P-10</td>
<td>0...10</td>
<td>-40...90 °C (125 °C) Tdew</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-50</td>
<td>0...50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-100</td>
<td>0...100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-250</td>
<td>0...250</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 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.

### Transient and stable

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

<table>
<thead>
<tr>
<th>P-2</th>
<th>P-10</th>
<th>P-50</th>
<th>P-100</th>
<th>P-250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Capacity</td>
<td>0…2 l/min</td>
<td>0…10 l/min</td>
<td>0…50 l/min</td>
<td>0…100 l/min</td>
</tr>
<tr>
<td>Flow accuracy (flow control option)</td>
<td>± 0.5 % reading ± 0.1 % of full scale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humidity Capacity</td>
<td>0…100 % RH, -40…90 (125 °C) Tdew</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensor accuracy</td>
<td>± 1.5 %RH</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensor accuracy (configuration for atm pressure and max 75 °C)</td>
<td>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)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature Capacity</td>
<td>20…300 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy at 0 … +40 °C gas temperature</td>
<td>±0.2 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure</td>
<td>0.8…1.2 bara (atm), 1…6 bar(a) or free def. between 0 (vacuum)...20 bar(a)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure drop</td>
<td>2500 mbar with flow control, 0-800 mbar without flow control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure drop (low limited versions)</td>
<td>50 mbar</td>
<td>50 mbar</td>
<td>300 mbar</td>
<td>150 mbar</td>
</tr>
<tr>
<td>Liquid supply Water quality</td>
<td>Deionised or distilled (max 10µS / cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suction capacity of inlet water</td>
<td>1 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max pressure of inlet water (optional)</td>
<td>8 bar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Power</td>
<td>1000 W</td>
<td>1200 W</td>
<td>2000 W</td>
<td>2000 W</td>
</tr>
<tr>
<td>Ambient temperature in use</td>
<td>+5… +45 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature storage</td>
<td>-40… +60 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start-up time to Tdew 50 °C</td>
<td>5 min</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wetted materials</td>
<td>Perfluorinated sulphonic acid membrane, PTFE, Stainless steel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certification</td>
<td>CE certified</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical Standard bench top enclosure (WxHxD)</td>
<td>471x280.5x391 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>15 kg</td>
<td>15 kg</td>
<td>15 kg</td>
<td>23 kg</td>
</tr>
<tr>
<td>Interface Voltage</td>
<td>208-230 V / 50-60 Hz AC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remote control digital (optional)</td>
<td>RS 232 / RS 485 Modbus RTU or Modbus TCP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open source Java-based software included with data logging, real time graphs and an advanced recipe function.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remote control analogue (optional)</td>
<td>4…20 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid inlet</td>
<td>6 mm or 1/4” compression fitting Swagelok®</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas inlet/outlet (Swagelok® fitting)</td>
<td>1/8”, 6 mm or 1/4” 6 mm or 1/4” 12 mm or 1/2”</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Min level of humidity=Inlet gas humidity

Capacity

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.
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.

Pressure
The unit can be configured to monitor the gas pressure or even to set the pressure. Pressure control is effectuated by controlling the flow rate in order to keep the pressure at the set value.

Temperature
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.

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 in 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 rate. The unit can be operated in the range from zero to full flow.
## Product configuration code

<table>
<thead>
<tr>
<th>Flow</th>
<th>Capacity</th>
<th>Pressure</th>
<th>Temperature</th>
<th>Temperature control</th>
<th>Humidity</th>
<th>Concentration control</th>
<th>Options</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0-2 lpm</td>
<td>→0-100%</td>
<td>A</td>
<td>Not contr.</td>
<td>A</td>
<td>No</td>
<td>U</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0-10 lpm</td>
<td>B</td>
<td>Monitor</td>
<td></td>
<td>B</td>
<td>No</td>
<td>U</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>0-50 lpm</td>
<td>C</td>
<td>Control</td>
<td></td>
<td>C</td>
<td>No</td>
<td>U</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>0-100 lpm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No</td>
<td>U</td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>0-250 lpm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No</td>
<td>U</td>
<td></td>
</tr>
</tbody>
</table>

### Flow
- Flow: Specify max flowrate = basic model of P-series humidifier. Also specify if the unit should have the standard 0-100 % (non calibrated) flow control (A) or a calibrated flow meter (B) or A+B for precise control to setpoint flowrate (C).

### Capacity
- Capacity:
  - 250: 0-250 lpm
  - 100: 0-100 lpm
  - 50: 0-50 lpm
  - 10: 0-10 lpm
  - 2: 0-2 lpm

### Pressure
- Pressure: Specify pressure range at the outlet of the unit:
  - Atm: 0-10 bar(a)
  - Free def.: 0 (vacuum)-20 bar(a)

### Temperature
- Temperature: Specify the heating capability of the unit.

### Temperature control
- Temperature control:
  - Ambient: 0-100% RH
  - A: Monitor
  - B: Control

### Humidity
- Humidity:
  - 0: Standard range is 0-100 % RH.

### Concentration control
- Concentration control (%):
  - 0: No added gas
  - 1: Add. gases

### Options
- Options:
  - U: Standard (IP65)
  - A: Ambient
  - M: Monitor

### Enclosure
- Enclosure:
  - Laboratory
  - Industry

### ATEX
- ATEX:
  - Zone 1
  - Zone 2

### Water supply
- Water supply:
  - Suction from tank

### Fittings
- Fittings:
  - Metric (mm)
  - Imperial (inch)

### Notes
- Heated tube is useful to transfer the gas to the point of use without condensation.
- External sensor is useful if the unit should work to control the humidity in a chamber or similar.
- External communication is available as analog (4-20 mA or 0-10 V) or digital (RS 232 / RS 485 Modbus RTU or Modbus TCP). Analog option will allow for monitoring and control of selected parameters. Digital option will allow for monitoring and control of all parameters.
- Standard enclosure is a compact unit for bench top use. For industrial applications the unit is also available in a wall mount stainless steel enclosure (IP65).
- ATEX safe units are available for operation in areas where flammable gases can be present in the surrounding atmosphere.

### Example configuration code
- P-50A-0A-100-102-0000-v10

This configuration code describes a P-50 unit, capable of humidifying 50 liters/min with the standard 0-100 % flow control (including no calibrated flow meter). Operating pressure is 0.8-1.2 bar(a) (±0.2 bar from atmospheric/normal ambient pressure). Temperature of the outlet gas can be set from 25 to 50 °C. Humidity can be varied from 0 to 100 % RH. The unit can be configured to pull water from a tank or to be fed by pressurised water. Capability to handle both types of supplies can also be ordered.

## Contact

**Joakim Nordlund**
+46 8 673 19 15
joakim.nordlund@cellkraft.se

**Anders Ocklind**
+46 8 673 19 14
anders.ocklind@cellkraft.se

**Cellkraft AB**
Lilla Frescativägen 4A
SE-114 18 Stockholm
Sweden

[www.cellkraft.se](http://www.cellkraft.se)