



## VENTILATOR SENSOR SOLUTIONS

Mechanical ventilators are life saving devices for patients who are unable to breathe unassisted or need additional oxygen intake. Ventilators pump breathable air or a mixture of air and gases into and out of the lungs and are found everywhere from intensive care units to home portable units. TE Connectivity's (TE) sensor technology allows for highly reliable and accurate measurements for these life critical applications.

TE's comprehensive pressure portfolio covers ultra-low to high pressure ranges, media compatible and stainless steel solutions, analog and digital interfaces, and products that are cleaned for oxygen service. The offering expands to temperature, humidity and CO<sub>2</sub> sensors as well as equipment for motor control.

Devices differ in the level of breathing aid. Invasive ventilators introduce air into the patient via an artificial airway (e.g. a tube). In a less invasive approach non-invasive ventilators support the breathing process via a mask that is placed over nose and/or mouth. For either device type the air composition may be adjusted by adding oxygen and removing carbon dioxides to help increase the blood oxygen level. For patients that can breathe unassisted but have a low level of blood oxygen, an oxygen concentrator provides a beneficial oxygen boost. Concentrators accomplish this by lowering the nitrogen content of the air. Oxygen conservers supply oxygen enriched air to the patient fed by an oxygen tank. TE sensors help these machines work efficiently, reliably, and give better medical outcomes.

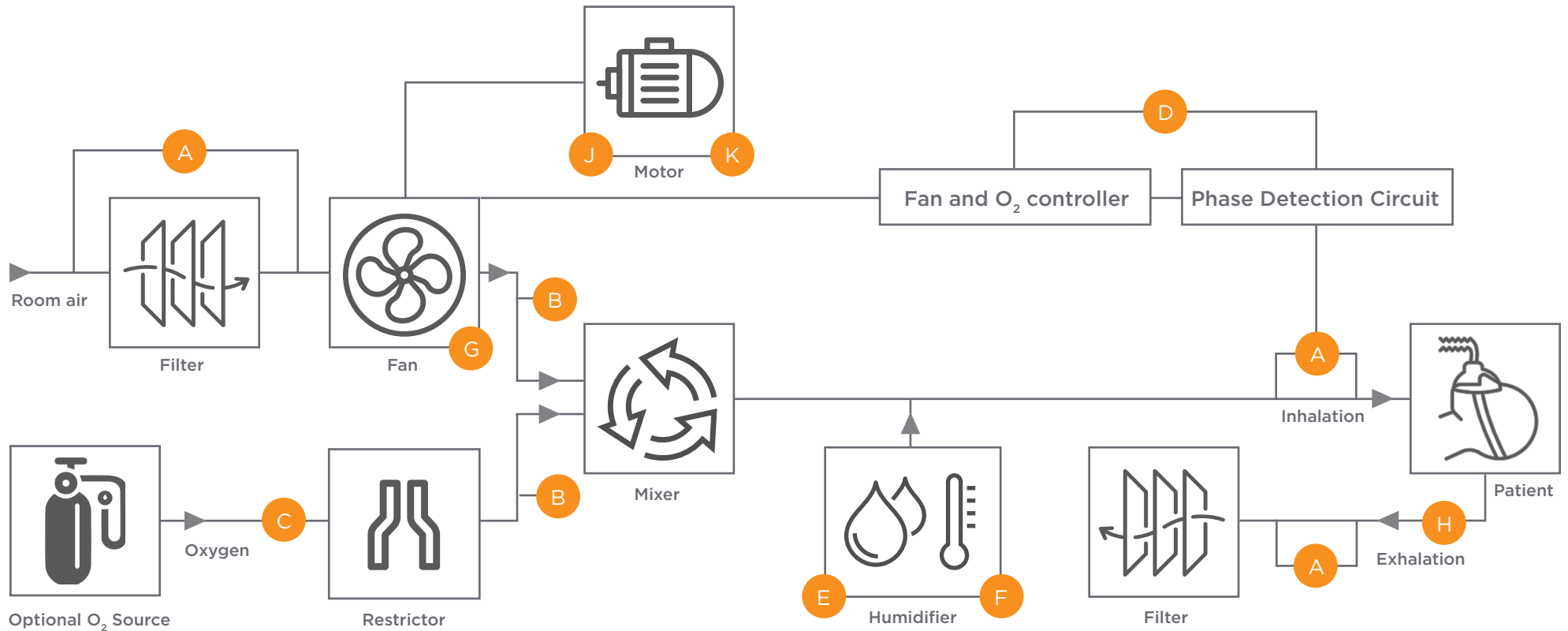
### TE CONNECTIVITY ADVANTAGES

- Portfolio Breadth
- Medical Experience
- Manufacturing Scale
- Customization Capability

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# NON-INVASIVE VENTILATOR



**A** Pressure 0 to 5 cmH<sub>2</sub>O (flow +300 slpm measured via  $\Delta p$ )

**C** Pressure 35 to 90 PSI

**E** Temperature 60 to 120 F

**G** Rotation 15,000 to 60,000 RPM

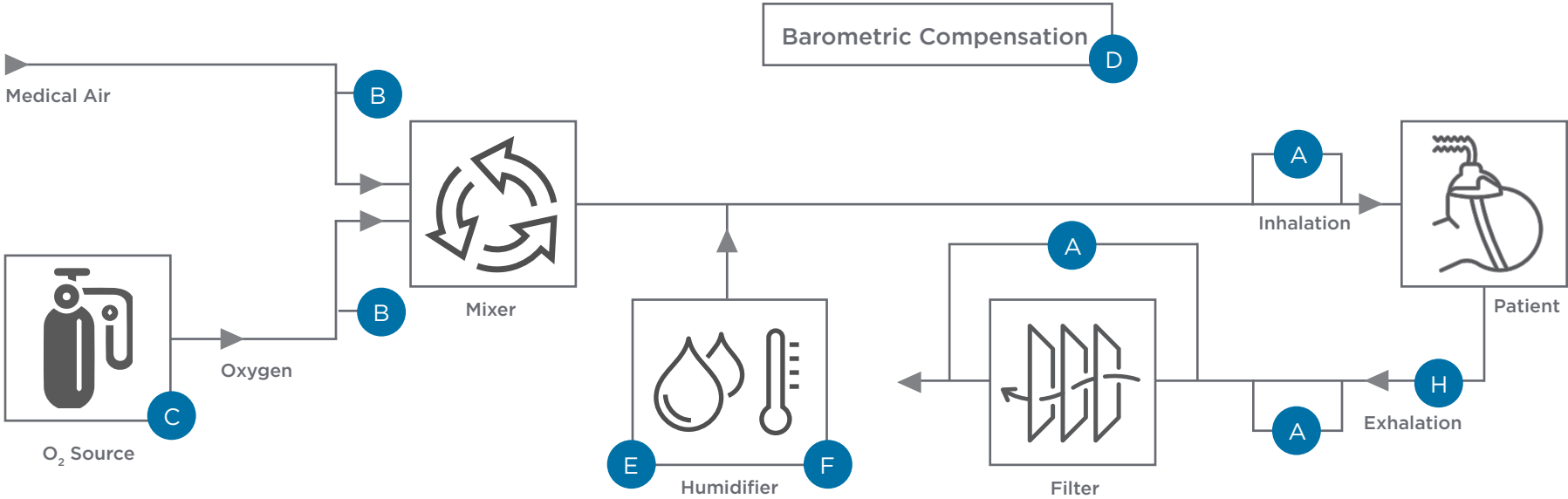
**B** Pressure 30 to 40 cmH<sub>2</sub>O

**D** Barometric Air Pressure

**F** Humidity 33 - 44 mg H<sub>2</sub>O/L

**H** CO<sub>2</sub> Level 30,000 to 40,000 ppm

# INVASIVE VENTILATOR



**A** Pressure 0 to 5 cmH<sub>2</sub>O (flow +300 slpm measured via Δp)

**C** Pressure 3500 PSI

**E** Temperature 60 to 120 F







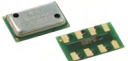
**H** CO<sub>2</sub> Level 30,000 to 40,000 ppm

**B** Pressure 35 to 50 PSI




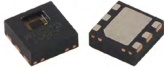



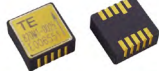
**D** Barometric Air Pressure

**F** Humidity 33 - 44 mg H<sub>2</sub>O/L

# SENSOR SOLUTIONS FOR VENTILATOR APPLICATIONS

Sensor Technology	Application	Featured Product	Key Product Features	Benefits
A 	Pressure Air flow and respiration control, filter cleanliness monitoring	<a href="#">SM9000</a> or <a href="#">SM7000</a>	<ul style="list-style-type: none"> <li>MEMS board mount pressure sensor</li> <li>Ultra-low pressure ranges as low as 125 Pa</li> <li>16-bit digital output</li> <li>Insensitive to mounting orientation</li> </ul>	<ul style="list-style-type: none"> <li>Detects minimal changes in pressure</li> <li>Simplified signal read-out</li> <li>Easy system integration</li> </ul>
B 	Pressure Fan pressure	<a href="#">SM6000</a>	<ul style="list-style-type: none"> <li>MEMS board mount pressure sensor</li> <li>Digital or dual (digital &amp; analog) output</li> <li>±1% FS accuracy (digital)</li> <li>Insensitive to mounting orientation</li> </ul>	<ul style="list-style-type: none"> <li>System design flexibility</li> <li>Reliable and accurate measurements over time</li> </ul>
C B 	Pressure Oxygen flow control Compressed air and gas pressure	<a href="#">MS4525</a> or <a href="#">MS4525DO</a>	<ul style="list-style-type: none"> <li>MEMS board mount pressure sensor</li> <li>Analog or digital output interface</li> <li>total error band less than ±1.0%</li> <li>Various ceramic package configurations available</li> </ul>	<ul style="list-style-type: none"> <li>System design flexibility</li> <li>Reliable and accurate measurements over time</li> </ul>
C 	Pressure Tank pressure oxygen side	<a href="#">M3200</a>	<ul style="list-style-type: none"> <li>Industrial pressure transducer</li> <li>Analog or digital output interface</li> <li>Media compatible</li> </ul>	<ul style="list-style-type: none"> <li>System design flexibility</li> <li>Compact design</li> <li>Stainless steel construction</li> <li>Optional cleaned for oxygen service</li> </ul>
C 	Pressure Tank pressure oxygen side	<a href="#">M5200</a>	<ul style="list-style-type: none"> <li>Analog pressure transducer</li> <li>Media compatible</li> <li>±0.25% accuracy</li> <li>±1.0% total error band</li> </ul>	<ul style="list-style-type: none"> <li>Excellent durability and accuracy while exposed to the pressure media</li> <li>Compact modular design</li> <li>Optional cleaned for oxygen service</li> </ul>
C 	Pressure Tank pressure oxygen side	<a href="#">AST4300</a>	<ul style="list-style-type: none"> <li>Non-incendive pressure transducer</li> <li>Media compatibility</li> </ul>	<ul style="list-style-type: none"> <li>Intrinsically safe</li> <li>Stainless steel construction</li> <li>Optional cleaned for oxygen service</li> </ul>
D 	Pressure Barometric compensation	SM11X1	<ul style="list-style-type: none"> <li>MEMS board mount pressure sensor</li> <li>Compact SOIC-8 housing</li> <li>Digital or analog version available</li> </ul>	<ul style="list-style-type: none"> <li>Compact design</li> <li>System design flexibility</li> </ul>
D 	Pressure Barometric compensation	<a href="#">MS5611</a>	<ul style="list-style-type: none"> <li>MEMS board mount pressure sensor</li> <li>I<sup>2</sup>C and SPI interface up to 20 MHz</li> <li>Minimal footprint package (5.0 x 3.0 x 1.0 mm<sup>3</sup>)</li> </ul>	<ul style="list-style-type: none"> <li>Excellent long term stability</li> <li>Fast conversion speed</li> <li>Low power consumption</li> </ul>

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Sensor Technology	Application	Featured Product	Key Product Features	Benefits
 <p>E</p>	Air and gas temperature management	<a href="#">TSYS03</a>	<ul style="list-style-type: none"> <li>Digital temperature measurement</li> <li>Available in super small 1.5 mm x 1.5 mm package</li> <li>Resolution up to 0.01°C</li> <li>Supply voltage range from 2.4 V to 5.5 V</li> </ul>	<ul style="list-style-type: none"> <li>Ultra-compact design</li> <li>Precise digital output</li> <li>Low power consumption</li> </ul>
 <p>E</p>	Air and gas temperature management	<a href="#">44000 Series</a>	<ul style="list-style-type: none"> <li>NTC (negative temperature coefficient) thermistor</li> <li>Miniaturized components</li> <li>Rapid time response</li> </ul>	<ul style="list-style-type: none"> <li>High sensitivity</li> <li>Proven long-term stability and reliability</li> </ul>
 <p>E</p>	Air and gas temperature management	<a href="#">PTF Family</a>	<ul style="list-style-type: none"> <li>RTD (resistance temperature detector) sensor</li> <li>Thin film platinum deposited on ceramic substrate, glass coated</li> <li>Tube outline available</li> <li>Dimensions 1.2 x 4.0 x 1.1 mm<sup>3</sup></li> </ul>	<ul style="list-style-type: none"> <li>Long term stability</li> <li>High electrical insulation</li> <li>Small dimensions</li> </ul>
 <p>E F</p>	Air and gas mixture humidity & temperature management	<a href="#">HTU31</a>	<ul style="list-style-type: none"> <li>Digital or analog output available</li> <li>Fast response time of t63% in 10 sec after condensation</li> <li>Optional filter membrane for protection</li> </ul>	<ul style="list-style-type: none"> <li>Humidity and temperature combined</li> <li>System design flexibility</li> <li>Environmental robustness</li> </ul>
 <p>G</p>	Fan speed regulation	<a href="#">KMT36H</a>	<ul style="list-style-type: none"> <li>Magnetic angle sensor for precise position feedback for fans and motors</li> <li>Three bridge signals with 120° phase difference</li> <li>Accuracy better than ±0.5°</li> </ul>	<ul style="list-style-type: none"> <li>Contactless absolute angular measurement over full 360°</li> <li>Highly sensitive</li> </ul>
 <p>H</p>	Exhalation carbon dioxide level measurement	<a href="#">G-TPCO-035</a>	<ul style="list-style-type: none"> <li>Filter for NDIR CO<sub>2</sub> gas detection</li> <li>4.26µm Narrow Band Pass</li> <li>Small TO-18 package</li> </ul>	<ul style="list-style-type: none"> <li>Accurate Reference Sensor</li> <li>Very high signal</li> <li>Compact design</li> </ul>
 <p>J</p>	Motor speed control	<a href="#">KMA36</a>	<ul style="list-style-type: none"> <li>Magnetic angle sensor with 360°</li> <li>Digital output with resolution up to 0.01°</li> <li>Small TSSOP package</li> </ul>	<ul style="list-style-type: none"> <li>Contactless</li> <li>Maintenance free operation</li> <li>Precise and reliable measurements</li> </ul>
 <p>K</p>	Motor condition monitoring	<a href="#">820M1</a>	<ul style="list-style-type: none"> <li>Board mountable accelerometer</li> <li>Amplified analog output</li> <li>Hermetically sealed LLC package</li> </ul>	<ul style="list-style-type: none"> <li>Reliable and long-term stable output</li> <li>Low power consumption</li> </ul>