

A top-down view of a medical device, possibly a patient bed or a specialized chair, with a light blue and white plastic frame. The device features several circular openings, some of which are covered with clear, circular sensor covers. There are also two red, textured circular components and a black cylindrical protrusion. The background is a soft, out-of-focus light blue and white. An orange semi-transparent banner is overlaid at the bottom of the image.

# MEDICAL SENSORS

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TE Connectivity (TE) is one of the largest sensor companies in the world, with innovative sensor solutions that help customers transform concepts into smart, connected creations. Electronic systems in medical equipment, devices and probes rely on sensor signals as a basis for control activities, accurate diagnosis and treatment. TE designs and manufactures sensors to exacting specifications for the rigors of medical applications, with ISO 13485 certification and FDA registration for various products. Our engineers provide full support of application-specific, standard and custom requirements, from product concept through manufacturing.



## SENSOR TECHNOLOGIES

- AIR BUBBLE
- FORCE
- HUMIDITY
- LIQUID LEVEL
- PIEZO FILM
- POSITION
- PRESSURE
- PULSE OXIMETRY
- TEMPERATURE
- VIBRATION

## QUALITY CERTIFICATION AND AUDITED PROCESSES

- ISO 13485
- ISO 9001
- CE-MDD
- FDA
- CMDR-Health Canada



## MEDICAL APPLICATION SOLUTIONS

### MEDICAL PUMP TECHNOLOGY

The body and the medical devices that support them rely on liquids to flow continuously without interruption. Infusion pumps, hemodialysis and blood flow monitoring applications are vital technologies for surviving certain medical conditions. Sensors are embedded in various pump and flow applications to confirm the continuous, accurate flow, detect occlusion, externally detect bubbles in lines, and measure liquid levels. These robust sensors from TE Connectivity (TE) are easy to integrate, provide superior reliability and deliver confidence and trust in system performance.

### BLOOD PRESSURE MONITORING

Blood pressure is a key indicator of health and can provide insight into future health problems. There are two ways in which blood pressure can be measured: non-invasive blood pressure (NIBP) monitoring and invasive blood pressure (IBP) monitoring. TE's 1620 and 1630 series pressure sensors are fully piezoresistive pressure sensors for use in invasive blood pressure monitoring. These sensors are designed to be used with automated assembly equipment and can be dropped directly into a customer's disposable blood pressure housing.

### BODY TEMPERATURE MEASUREMENT

External temperature measurement has advanced in technology with the addition of sensor technologies, increasing patient comfort, improving accuracy, and creating better tools for monitoring. Its data can be crucial to patients suffering from various conditions, from infections to hypothermia. The temperature measurement of the surface of the body can be accomplished using different sensor technologies. TE manufactures NTC (negative thermal coefficient) thermistors, thermopiles, and digital temperature sensors to support the wide range of accuracy, packaging, and performance conditions amongst the different applications.

### WEARABLE TECHNOLOGY

The expectation of connectivity anytime, anywhere drives the need for wearable products. And as TE sensor platforms bring wearable technologies to life, users become safer and healthier. To get powerful functionality to fit inside wearable health monitoring devices, TE relies on cross-industry experience and an ongoing commitment to research and development. From heart pacemaker and prosthetic sensor technologies to wearable fitness bands, TE can help you develop solutions for your wearable ideas.

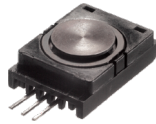
# MEDICAL SENSORS

## FORCE SENSORS



### FS19

Sensor Type	OEM compression load cell
Dimensions (mm)	ø9.50 x 3.45
Accuracy	±1% FSO (CNL&H)
Range	1 - 7 Lbf
Unique Features	<ul style="list-style-type: none"> <li>• Low range</li> <li>• High overload protection</li> <li>• Ultra high cycle life</li> <li>• Analog output</li> </ul>
Typical Applications	Medical devices, physical therapy, oxygen tank, infusion pumps



### FS20

Sensor Type	Miniature force sensor
Dimensions (mm)	30.708 x 17.272 x 8.255
Accuracy	±1% FSO (CNL&H)
Range	1 - 7 Lbf
Unique Features	<ul style="list-style-type: none"> <li>• Low range</li> <li>• High overload protection</li> <li>• Ultra high cycle life</li> <li>• Analog output</li> </ul>
Typical Applications	Medical devices, physical therapy, oxygen tank, infusion pumps



### FC22

Sensor Type	Miniature force sensor
Dimensions (mm)	Ø 26.00 x 42.00 x 19.50
Accuracy	±1% FSO (CNL&H)
Range	10 - 100 Lbf
Unique Features	<ul style="list-style-type: none"> <li>• Low range</li> <li>• High overload protection</li> <li>• Ultra high cycle life</li> <li>• Analog output</li> </ul>
Typical Applications	Medical devices, physical therapy, oxygen tank, infusion pumps

## HUMIDITY SENSORS



### HTU3500

Sensor Type	Analog voltage RH and NTC temperature
Dimensions (mm)	27 x 11.9 x YY (Depending on the connector, from 6 to 10.8 length)
Accuracy	20% to 80%RH
Range	0 to 100% RH
Unique Features	<ul style="list-style-type: none"> <li>• PTFE filter (Optional)</li> <li>• Electronics fully protected (5 V)</li> <li>• Multiple connector choices (JST, Samtec board through hole)</li> <li>• Based on HTU21</li> </ul>
Typical Applications	Plug and play transducers for OEM medical devices



### HTU2x

Sensor Type	Digital miniature humidity and temperature sensor
Dimensions (mm)	3.0 x 3.0 x 1.0
Accuracy	±3% RH at 25°C (10 to 95% RH) ±0.3°C at 25°C
Range	0 to 100% RH
Unique Features	<ul style="list-style-type: none"> <li>• Low power consumption</li> <li>• Fast response time</li> <li>• Very low temperature coefficient</li> <li>• I<sup>2</sup>C interface or PWM interface or SDM interface</li> </ul>
Typical Applications	Humidifier for medical ventilator



### HS1101LF

Sensor Type	Analog RHS humidity sensor
Dimensions (mm)	ø10 x 6.0
Accuracy	±2% (10%RH to 90% RH)f
Range	0 to 100% RH
Unique Features	<ul style="list-style-type: none"> <li>• High reliability and long term stability</li> <li>• Fast response time</li> <li>• Lead free component</li> <li>• Very low temperature coefficient</li> </ul>
Typical Applications	Sleep apnea, respirator

## PHOTO OPTIC SENSORS



### ELM 4000

Sensor Type	Photo optic lead frame emitter
Dimensions (mm)	4.4 x 5.1 x 1.9
Accuracy	Sensor dependent
Range	660 - 940 nm
Unique Features	<ul style="list-style-type: none"> <li>• Low cost</li> <li>• Dual drive</li> <li>• Clear epoxy lens</li> </ul>
Typical Applications	Pulse oximetry, finger and ear probes, disposable



### EPM 4001

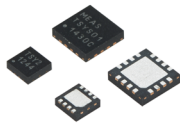
Sensor Type	Photo optic lead frame detector
Dimensions (mm)	4.4 x 5.1 x 1.8
Accuracy	Sensor dependent
Range	660 - 940 nm
Unique Features	<ul style="list-style-type: none"> <li>• Low cost</li> <li>• High efficiency</li> <li>• Clear epoxy lens</li> </ul>
Typical Applications	Pulse oximetry, finger and ear probes, disposable



### Finger Clip, Disposable SpO<sub>2</sub>

Sensor Type	Biocompatible SpO <sub>2</sub> sensor
Dimensions (mm)	Application dependent
Accuracy	Sensor dependent
Range	Adult / neonatal
Unique Features	<ul style="list-style-type: none"> <li>• Soft pads</li> <li>• Lightweight</li> <li>• Easily cleaned</li> </ul>
Typical Applications	Pulse oximetry

## TEMPERATURE SENSORS



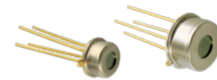
### TSYS03

Sensor Type	I <sup>2</sup> C, SPI, PWM, SDM (Convertible to analog voltage)
Dimensions (mm)	QFN16: 4 x 4 x 0.85 TDFN: 2.5 x 2.5 x 0.75
Accuracy	Up to ±0.1°C at -5°C to 50°C
Range	-
Unique Features	<ul style="list-style-type: none"> <li>• Low power</li> <li>• Small size</li> <li>• Calibrated and ready to use</li> <li>• 16-bit resolution</li> </ul>
Typical Applications	Patient monitoring, temperature logging, fluid temperature, warming blanket



### Model 600 / G22K7MCD8

Sensor Type	Micro-thermocouple / Micro-thermistors
Dimensions (mm)	From 0.23 OD
Accuracy	From ±0.1°C
Range	Thermocouple type T, K / NTC from 1K to 100KΩ
Unique Features	<ul style="list-style-type: none"> <li>• Welded or soldered junction (Thermocouple)</li> <li>• Low profile, fast response</li> <li>• Polyesterimide wire insulation</li> </ul>
Typical Applications	Medical catheters



### TS / TSD Series

Sensor Type	Thermopiles / Single thermopile digital output series
Dimensions (mm)	Dia. 9.15mm x 4.3mm (body)
Accuracy	Application dependent Typical 1% full range (TSD only)
Range	-20°C to +85°C (Permanent) 20°C to +100°C (Non-permanent) 0°C to +300°C (TSD only)
Unique Features	<ul style="list-style-type: none"> <li>• High signal output</li> <li>• Accurate reference sensors</li> <li>• Calibrated and ready to use, I<sup>2</sup>C interface (TSD only)</li> </ul>
Typical Applications	Medical thermometer (ear and forehead), pyrometer

## PRESSURE SENSORS



### 1620, 1630

<b>Sensor Type</b>	Invasive blood pressure monitoring
<b>Dimensions (mm)</b>	1620: 11.43 x 8.13 x 4.20 1630: 12.7 x 5.08 x 3.94
<b>Accuracy</b>	1.0% FSO
<b>Range</b>	-30 to 300 mmHg
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• Low cost, disposable design</li> <li>• Supplied in tape and reel</li> <li>• Compliant to AAMI spec</li> </ul>
<b>Typical Applications</b>	Disposable blood pressure, surgical procedures, ICU, kidney dialysis machines, medical instrumentation



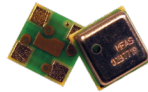
### 85 Flush Mount

<b>Sensor Type</b>	Media isolated pressure sensor for aggressive fluids
<b>Dimensions (mm)</b>	Ø 17.2 x 11.4
<b>Accuracy</b>	±0.1% FSO non-linearity
<b>Range</b>	0 - 1, 2, 3, 7, 21, 34 bar / 0 - 15, 30, 50, 100, 300, 500 psi
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• High performance</li> <li>• High stability</li> <li>• Minimizes trapped volume</li> </ul>
<b>Typical Applications</b>	Dialysis machines, infusion pumps, medical systems



### MS5805

<b>Sensor Type</b>	Miniature board mounted pressure sensors
<b>Dimensions (mm)</b>	4.5 x 4.5 x 3.5
<b>Accuracy</b>	±2.0 mbar at 25°C
<b>Range</b>	10 to 2K mbar
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• 24-bit digital sensor</li> <li>• 20 cm resolution</li> <li>• Supply voltage: 1.8 to 3.6 V</li> <li>• Sealing designed for 2.5 x 1 mm o-ring</li> <li>• Silicone gel protection</li> <li>• Waterproof</li> </ul>
<b>Typical Applications</b>	Fall detection, pneumatic handheld drills, respirators / ventilators



### MS5637

<b>Sensor Type</b>	Miniature board mounted pressure sensors
<b>Dimensions (mm)</b>	3 x 3 x 0.9
<b>Accuracy</b>	±2.0 mbar / ±0.03 psi at 25°C
<b>Range</b>	10 to 2000 mbar abs. / 0.15 to 29 psi abs.
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• 24-bit digital sensor</li> <li>• Altitude resolution of less than 15 cm</li> <li>• Supply voltage: 1.5 to 3.6 V</li> <li>• Low power, 0.6 µA (Standby ≤ 0.1 µA at 25°C)</li> <li>• Digital temperature readout</li> </ul>
<b>Typical Applications</b>	Fall detection, pneumatic handheld drills, respirators / ventilators



### MS45XX, MS55XX

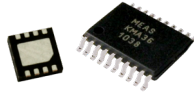
<b>Sensor Type</b>	Miniature board mounted pressure sensor
<b>Dimensions (mm)</b>	12.5 x 9.9
<b>Accuracy</b>	0.25% / 1% TEB
<b>Range</b>	0 - 2, 4, 5, 10, 20, 30, H <sub>2</sub> O (MS4515/DO) 0 - 1, 2, 4, 5, 10, 30, 50, 150 psi (MS4525/DO)
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• MS4515/25 (12-bit DAC analog)</li> <li>• MS4515DO/25DO (14-bit digital SPI or I<sup>2</sup>C)</li> <li>• MS5525DSO (24-bit digital SPI or I<sup>2</sup>C)</li> <li>• Wide supply voltage: 1.8 to 5.7 VDC</li> <li>• Small package footprint</li> <li>• Varied port configurations</li> </ul>
<b>Typical Applications</b>	Medical instruments, respirators / ventilators

## POSITION SENSORS



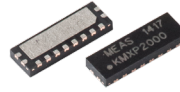
### **KMT32B**

<b>Sensor Type</b>	Angular sensor
<b>Dimensions (mm)</b>	TDFN: 2.5 x 2.5 x 0.8 / TSSOP20: 5 x 4 x 1.75
<b>Accuracy</b>	Typ. 0.1° to 1.0°
<b>Range</b>	180° angle
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• High accuracy</li> <li>• High resolution</li> </ul>
<b>Typical Applications</b>	Various position control applications



### **MS32, KMA36**

<b>Sensor Type</b>	Magnetoresistive linear and angular sensors
<b>Dimensions (mm)</b>	TDFN: 2.5 x 2.5 x 0.8 / TSSOP20: 6.5 x 6.4 x 1.2
<b>Accuracy</b>	Typ. 0.1 kA/m / typ. 0.3°
<b>Range</b>	1 to 3 kA/m magnetic switching field / 360° angle
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• Ultra low cost</li> <li>• Ultra small size</li> <li>• High accuracy</li> <li>• Digital / analog output</li> </ul>
<b>Typical Applications</b>	Various position control applications



### **KMPX Series**

<b>Sensor Type</b>	Magnetic linear position sensor
<b>Dimensions (mm)</b>	TDLMP12 6.0 x 2.0 x 0.75
<b>Accuracy</b>	10-50 μm
<b>Range</b>	1-5mm
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• Magnetoresistive (MR)</li> <li>• High precision and resolution</li> <li>• Easy assembly</li> <li>• Superior performance</li> </ul>
<b>Typical Applications</b>	Surgical robots, prosthetics, syringe pumps



### **SM, SP**

<b>Sensor Type</b>	Cable extension transducer
<b>Dimensions (mm)</b>	43 x 45 x 68
<b>Accuracy</b>	±0.25% to ±1%
<b>Range</b>	0 - 2.5 to 0 - 50 inches
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• Compact design</li> <li>• Low cost, high value stringpot</li> <li>• Custom configurations available for OEM customers</li> </ul>
<b>Typical Applications</b>	Medical imaging systems, surgical robots

## ULTRASONIC SENSOR



### **AD-101**

<b>Sensor Type</b>	Ultrasonic air-in-liquid detectors
<b>Dimensions (mm)</b>	Application dependent
<b>Accuracy</b>	Application dependent
<b>Range</b>	Detects bubbles 4 μl and larger (Standard; consult factory for 1 μl and smaller bubble size)
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• Bubble detection from 1 mm tube</li> <li>• Integral electronics</li> <li>• Occlusion option</li> <li>• Fluid differentiation</li> <li>• 3.3 and 5 V input option</li> </ul>
<b>Typical Applications</b>	Infusion pumps, dialysis machines, apheresis, auto-transfusion, 3D printing



### **MiniSense 100**

<b>Sensor Type</b>	Piezoelectrical film sensors
<b>Dimensions (mm)</b>	19.05 x 6.35 x 6.35
<b>Accuracy</b>	±20.0% (Typical)
<b>Range</b>	±10 g (Typical)
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• Very low cost</li> <li>• High sensitivity (1 V/g)</li> <li>• Ultra low power (Self generating)</li> </ul>
<b>Typical Applications</b>	Wake-up switch, impact sensing, vital signs monitoring

## [te.com/MedicalSensors](https://te.com/MedicalSensors)

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