

SENSOR SOLUTIONS FOR MEDICAL

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 SOLUTIONS

- 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.



SENSOR SOLUTIONS FOR MEDICAL

FORCE SENSORS



FS19

OEM compression load cell Sensor Type

Dimensions (mm) ø9.50 x 3.45 ±1% FSO (CNL&H) Accuracy

Range 1 - 7 Lbf

Unique Features · Low range

• High overload protection

• Ultra high cycle life

· Analog output

Typical **Applications** Medical devices, physical therapy, oxygen tank, infusion pumps



Miniature force sensor

30.708 x 17.272 x 8.255

±1% FSO (CNL&H)

1 - 7 Lbf

· Low range

• High overload protection

• Ultra high cycle life

• Analog output

Medical devices, physical therapy, oxygen tank, infusion pumps



Miniature force sensor

Ø 26.00 x 42.00 x 19.50

±1% FSO (CNL&H)

10 - 100 Lbf

· Low range

• High overload protection

• Ultra high cycle life

Analog output

Medical devices, physical therapy, oxygen tank, infusion pumps

HUMIDITY SENSORS



HTU3500

Analog voltage RH and NTC temperature Sensor Type

 $27 \times 11.9 \times YY$ (Depending on the connector, from 6 to 10.8 length) Dimensions (mm)

Accuracy 20% to 80%RH

0 to 100% RH Range

Unique Features • PTFE filter (Optional)

• Electronics fully protected (5 V)

• Multiple connector choices (JST,

Samtec board through hole)

• Based on HTU21

Typical

Plug and play transducers for OEM medical devices Applications



Digital miniature humidity and temperature sensor

3.0 x 3.0 x 1.0

±3% RH at 25°C (10 to 95% RH) ±0.3°C at 25°C

0 to 100% RH

• Low power consumption

• Fast response time

• Very low temperature coefficient

• I²C interface or PWM interface or SDM interface

Humidifier for medical ventilator



HS1101LF

Analog RHS humidity sensor

ø10 x 6.0

±2% (10%RH to 90% RH)f

0 to 100% RH

• High reliability and long term stability

• Fast response time

· Lead free component

• Very low temperature coefficient

Sleep apnea, respirator

PHOTO OPTIC SENSORS



ELM 4000

Photo optic lead frame emitter Sensor Type

Dimensions (mm) 4.4 x 5.1 x 1.9

Accuracy

Range

Unique Features

Typical **Applications** Sensor dependent

660 - 940 nm

- Low cost
- Dual drive
- Clear epoxy lens

Pulse oximetry, finger and ear probes, disposable



EPM 4001

Photo optic lead frame detector

4.4 x 5.1 x 1.8

Sensor dependent

660 - 940 nm

- Low cost
- High efficiency
- · Clear epoxy lens

Pulse oximetry, finger and ear probes, disposable



Finger Clip, Disposable SpO,

Biocompatible SpO₂ sensor

Application dependent

Sensor dependent

Adult / neonatal

- Soft pads
- Lightweight
- · Easily cleaned

Pulse oximetry

TEMPERATURE SENSORS



Temperature System Sensor (TSYS) Series

Sensor Type

I²C, SPI, PWM, SDM (Convertable 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

- Low power
- Small size
- Calibrated and ready to use
- 16-bit resolution

Typical **Applications** Patient monitoring, temperature logging, fluid temperature, warming blanket



Model 600 / G22K7MCD8

Micro-thermocouple / Micro-thermistors

From 0.23 OD

From ±0.1°C

Thermocouple type T, K / NTC from 1K to $100 \text{K}\Omega$

- Welded or soldered junction (Thermocouple)
- · Low profile, fast response
- Polvesterimide wire insulation

Medical catheters



400 AC Series Reuseable, 4400 Series Disposable

Patient monitoring probes

Reusable: 3 m cable with sensor Disposable: Sensor <1 m; 3 m reusable adapter cable

Probes meet both: EN-12470: ±0.1°C at 25°C to 45°C ISO-80601-2-56: ±0.2°C at 35°C to 42°C

400 series, 700 series (Reusable only)

- Autoclavable reusables
- Sterile disposables
- Developed by YSI temperature

Patient monitoring



TS / TSD Series

Thermopiles / Single thermopile digital output series

Dia. 9.15mm x 4.3mm (body)

Application dependent Typical 1% full range (TSD only)

-20°C to +85°C (Permanent) 20°C to +100°C (Non-permanent) 0°C to +300°C (TSD only)

- High signal output
- Accurate reference sensors
- Calibrated and ready to use, I²C interface (TSD only)

Medical thermometer (ear and forehead), pyrometer



SENSOR SOLUTIONS FOR MEDICAL

PRESSURE SENSORS



1620, 1630

Sensor Type Invasive blood pressure monitoring

1620: 11.43 x 8.13 x 4.20 1630: 12.7 x 5.08 x 3.94 Dimensions (mm)

1.0% FSO Accuracy

-30 to 300 mmHg Range

Unique Features · Low cost, disposable design • Supplied in tape and reel

· Compliant to AAMI spec

Disposable blood pressure, surgical procedures, ICU, Typical Applications kidney dialysis machines, medical instrumentation



85 Flush Mount

Media isolated pressure sensor for aggressive fluids

Ø 17.2 x 11.4

±0.1% FSO non-linearity

0 - 1, 2, 3, 7, 21, 34 bar / 0 - 15, 30, 50, 100, 300, 500 psi

· High performance

• High stability

• Minimizes trapped volume

Dialysis machines, infusion pumps, medical systems



Sensor Type Miniature board mounted pressure sensors

45 x 45 x 35 Dimensions (mm)

±2.0 mbar at 25°C Accuracy 10 to 2K mbar Range

Unique Features • 24-bit digital sensor

• 20 cm resolution

 \bullet Supply voltage: 1.8 to 3.6 V

• Sealing designed for 2.5 x 1 mm o-ring

• Silicone gel protection

• Waterproof

Typical Fall detection, pneumatic handheld drills, **Applications** respirators / ventilators



Miniature board mounted pressure sensors

 $3 \times 3 \times 0.9$

±2.0 mbar / ±0.03 psi at 25°C

10 to 2000 mbar abs. / 0.15 to 29 psi abs.

- 24-bit digital sensor
- Altitude resolution of less than 15 cm
- \bullet Supply voltage: 1.5 to 3.6 V
- Low power, 0.6 µA (Standby ≤ 0.1 µA at 25°C)

• Digital temperature readout

Fall detection, pneumatic handheld drills, respirators / ventilators



MS45XX, MS55XX

Miniature board mounted pressure sensor

125 x 99

0.25% / 1% TEB

0 - 2, 4, 5, 10, 20, 30, H₂O 0 - 2, 4, 3, 10, 20, 30, H20 (MS4515/DO) 0 - 1, 2, 4, 5, 10, 30, 50, 150 psi (MS4525/DO)

- MS4515/25 (12-bit DAC analog)
- MS4515DO/25DO (14-bit digital SPI or I²C)
- MS5525DSO
- (24-bit digital SPI or I^2C)
- Wide supply voltage: 1.8 to 5.7 VDC
- Small package footprint
- Varied port configurations

Medical instruments, respirators / ventilators



POSITION SENSORS



Sensor Type Angular sensor

TDFN: 2.5 x 2.5 x 0.8 / TSSOP20: 5 x 4 x 1.75 Dimensions (mm)

Typ. 0.1° to 1.0° Accuracy Range 180° angle

Unique Features · High accuracy

• High resolution

Typical Various position control Applications applications



MS32, KMA36

Magnetoresistive linear and angular sensors

TDFN: 2.5 x 2.5 x 0.8 / TSSOP20: 6.5 x 6.4 x 1.2

Typ. 0.1 kA/m / typ. 0.3°

1 to 3 kA/m magnetic switching field / 360° angle

• Ultra low cost • Ultra small size

• High accuracy

• Digital / analog output

Various position control applications



Magnetic linear position sensor

TDLMP12 6.0 x 2.0 x 0.75

10-50 μm

1-5mm

- Magnetoresistive (MR)
- High precision and resolution
- Easy assembly
- Superior performance

Surgical robots, prosthetics, syringe pumps



SM, SP

Cable extension transducer

43 x 45 x 68

+0.25% to +1%

0 - 2.5 to 0 - 50 inches

- Compact design
- Low cost, high value stringpot
- Custom configurations available for **OEM** customers

Medical imaging systems, surgical robots

ULTRASONIC SENSOR



AD-101

Ultrasonic Sensor Type air-in-liquid detectors

Application dependent Dimensions (mm)

Accuracy Application dependent

Detects bubbles 4 μl and larger (Standard; consult factory for 1 μl and smaller bubble size) Range

Unique Features • Bubble detection from 1 mm tube

• Integral electronics

• Occlusion option • Fluid differentiation

• 3.3 and 5 V input option

Infusion pumps, dialysis machines, apheresis, auto-transfusion, 3D printing Typical Applications

VIBRATION SENSOR



MiniSense 100

Piezoelectrical film sensors

19.05 x 6.35 x 6.35

±20.0% (Typical)

±10 g (Typical)

- · Very low cost
- High sensitivity (1 V/g)
- Ultra low power (Self generating)

Wake-up switch, impact sensing, vital signs monitoring



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TE CONNECTIVITY

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