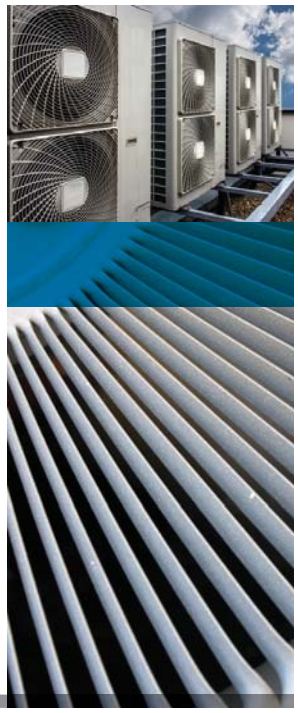
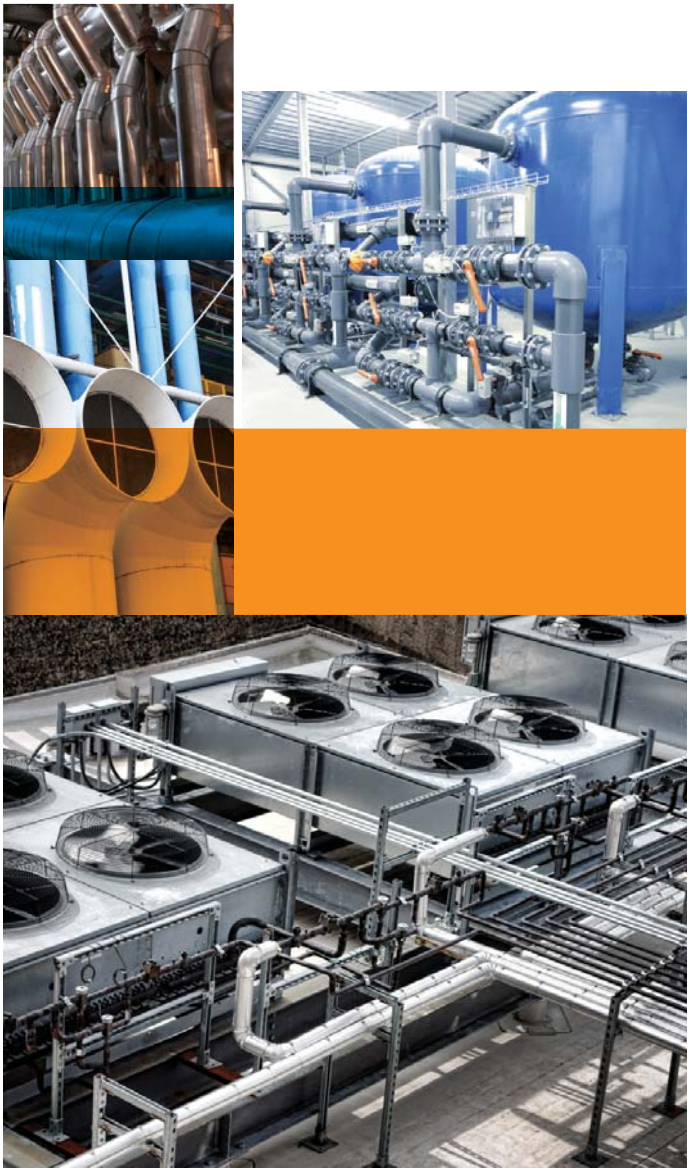


# SENSOR SOLUTIONS FOR HVACR FROM TE CONNECTIVITY

# SENSOR SOLUTIONS FOR HVACR FROM TE CONNECTIVITY

TE Connectivity (TE) is a global technology leader, providing connectivity and sensor solutions essential in today's increasingly connected world. With the acquisition of Measurement Specialties (MEAS), a global designer and manufacturer of sensors and sensor-based systems, TE is one of the largest sensor companies in the world. Our broad portfolio of sensor technologies is designed for a wide range of applications. We collaborate with engineers to help transform concepts into creations—redefining what's possible using intelligent, efficient and high-performing TE products and solutions proven in harsh environments.



## SENSOR SOLUTIONS

- PRESSURE
- TEMPERATURE
- HUMIDITY
- POSITION
- VIBRATION
- FLOW
- MASS AIR FLOW
- ULTRASONIC

## QUALITY STATEMENTS

- ISO 13485
- ISO 14001
- ISO 9001
- Measuring Instruments Directive 2004/22/EC annex D
- TS 16949
- UL/CSA



# HVACR APPLICATION SOLUTIONS

## Alternative Energy and Solar

- Room air temperature
- Flue temperature for efficiency
- Outside air temperature to modulate damper
- Water inlet and outlet for solar water heaters
- Solar refrigerators

## Boiler Controls

- Inlet and outlet water temperature
- Level sensing
- Outside air temperature for reset control
- Heat and cooling rate for boiler mass
- Boiler lead and lag timing temperature

## Building and Energy Management

- Room air temperature for thermostats
- Duct air temperature
- Duct air pressure
- Room air humidity
- Outside air temperature
- Mass air flow sensors

## Commercial Chillers

- Inlet and outlet refrigerant temperature
- Suction line temperature
- Room and outside air temperature
- Compressor high side and low side pressure
- Room humidity
- Variable volume valve position
- Sump water level sensors

## Commercial Cooking Equipment

- Non-contact temperature sensors for flame detection
- Temperature sensors for monitoring
- Vibration sensors for fan motors

## Compressors and Motors

- Motor winding temperature
- Compressor discharge
- Compressor suction temperature
- Compressor high side and low side pressure
- Compressor oil pressure
- Compressor staging—pressure
- Vibration and acoustic sensors for machine health monitoring

## Container Storage

- Evaporator inlet and outlet water temperature
- Compressor gas temperature
- Condenser inlet and outlet water temperature
- Compressor motor temperature
- Container air temperature
- Outside air temperature
- Evaporator line pressure
- Condenser line pressure
- Container humidity
- Defrost control—humidity or temperature
- Anti-sweat heater control—humidity

## Electronic Expansion Valves

- Expansion valve pressure
- Expansion valve temperature

## Forced Air Furnaces

- Inlet and outlet air temperature
- Room and outside air temperature
- Room humidity
- Air inlet and outlet pressure

# HVACR APPLICATION SOLUTIONS

## Heat Pumps

- Cabinet entering and leaving air temperature
- Compressor high side and low side pressure
- Compressor discharge, compressor suction temperature
- Entering and leaving hot water temperature
- Load entering and leaving water temperature
- Source entering and leaving water temperature
- Water coil and air coil temperature

## Humidifiers and Dehumidifiers

- Room air humidity
- Water temperature for humidification

## HVACR Diagnostic Equipment

- Digital manifold pressure
- Temperature for superheat monitoring

## Ice Machines

- Bin level sensor temperature
- Discharge water temperature
- Water inlet temperature

## Packaged Terminal Air Conditioner (PTAC) and Small A/C

- Coil temperature
- Defrost termination temperature
- Room temperature
- Room humidity

## Pool Heater and Equipment

- Flue temperature
- Inlet and outlet water temperature
- Outside air temperature
- Pressure sensor for clogged filter monitoring

## Refrigerators

- Dewpoint measurement for anti-sweat control
- Compartment humidity for food conservation
- Humidity monitoring for defrost control
- Zone air temperature

## Refrigerated Beverage Dispensing

- Cabinet air temperature
- Condenser inlet and outlet temperature
- Compressor discharge, compressor suction temperature
- Compressor high side and low side pressure

## Refrigeration Controls

- Compressor head pressure
- Compressor high side and low side pressure
- Defrost termination temperature
- Inlet and outlet refrigerant temperature
- Suction line temperature

## Underfloor Heating and Ice Melting

- Floor temperature monitoring
- Liquid temperature
- Room air temperature

## VAV Systems and Air Handlers

- Damper position
- Differential pressure
- Fan pressure optimization
- Inlet and outlet air temperature

## Water Heater

- Water flow sensor
- Water inlet and outlet temperature

## Zone Controls

- Air temperature
- Damper position
- Duct temperature

# PRESSURE SENSORS

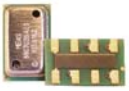
## Transducers and Transmitters

| | M7100, U7100 | M5200, U5200, D5100 |
|---|---|---|
| **Package** | Automotive grade, stainless steel hermetic pressure ports and integral electrical connector | Industrial stainless steel housing with a large selection of threaded fittings, electrical connectors, cable options and customized housings |
| **Type** | Gage, no vent gage (M7100)<br>Gage, sealed gage, absolute (U7100) | Gage (M5200) Gage, sealed gage, absolute(U5200), Differential wet-wet (D5100) |
| **Pressure Range** | 0 - 10 thru 0 - 689 bar / 0 - 150 thru 0 - 10K psi (M7100)<br>0 - 1 thru 0 - 10 bar / 0 - 15 thru 0 - 150 psi (U7100) | 0 - 3 bar thru 0 - 2K bar / 0 - 50 psi thru 0 - 30K psi (M5200)<br>0 - 0.14 bar thru 0 - 700 bar / 0 - 2 psi thru 0 - 10K psi (U5200)<br>0 - 0.07 bar thru 0 - 34 bar / 0 - 1 psi thru 0 - 500 psi (D5100) |
| **Output/Span** | 0.5 - 4.5 VDC [Ratiometric output], 1 - 5 VDC [Regulated] (M7100)<br>0.5 - 4.5 VDC [Ratiometric output] (U7100) | 0.5 - 4.5 VDC, 1 - 5 VDC, 0 - 5 VDC, 0 - 10 VDC, 4 - 20 mA |
| **Unique Features** | • 1% total error band (-20°C to 85°C)<br>• Solid state reliability<br>• Survives high vibration and immersion<br>• Microfused technology (M7100)<br>• UltraStable technology (U7100)<br>• Copper tube for HVACR (M7100) | • Microfused technology (M5200)<br>• UltraStable technology (U5200, D5100)<br>• High performance at a low cost<br>• Solid state reliability<br>• 1% total error band (-20°C to 85°C all possible errors combined) (M5200, D5100)<br>• 0.75% total error band (-20°C to 85°C all possible errors combined) (U5200)<br>• Line pressure max. 1000 psi (D5100) |
| **Accuracy** | ±0.25% FSO | ±0.25% FSO (M5200, D5100), ±0.1% FSO (U5200) |
| **Operating Temp.** | -40°C to 125°C | -40°C to 125°C |
| **Dimensions (mm)** | 26.7 x 26.7 x 50.0 | M5200: 22.23 x 22.23 x 80.77 /<br>U5200: 22.23 x 22.23 x 98.04 / D5100: 25.4 x 58.4 x 72.0 |
| **Typical Apps** | HVACR refrigeration controls, compressors, hydraulic, energy and water management | HVACR controls, energy and water management, pumps, compressors, pneumatic equipment, filter blockage, pressurized tank level |
| **Agency Approvals** | CE [EMC], UL 508 | CE [EMC] (M5200, D5100), CE [EMC], UL 508 (U5200) |

## Board Mountable Digital Output

## Board Mountable Amplified Output

## Combination Module Digital Output



| | MS4515DO, MS4525DO | MS4515, MS4525 | MS8607 |
|---|---|---|---|
| **Unique Features** | • 14-bit digital sensor<br>• Pressure and temperature measurement<br>• Single supply of 3.3 or 5.0 VDC<br>• Top, side barbed or manifold O-ring port<br>• J lead or thru hole pins | • Ratiometric analog output sensor<br>• Single supply of either 3.3 or 5.0 VDC<br>• Top, side barbed or manifold O-ring port<br>• J lead or thru hole pins<br>• Optional gel coat | • QFN package pressure, temperature and humidity sensor<br>• High resolution module: 0.016 mbar, 0.04% RH, 0.01°C<br>• Supply voltage: 1.5 to 3.6 V<br>• Integrated pressure, humidity and temperature<br>• Fully factory calibrated |
| **Options** | Gel coat, low power | Gel coat | — |
| **Linearity/Absolute Accuracy** | ±0.25% / ±1% TEB | 0.25% Non-linearity / 1% TEB | ±2 mbar / ±0.03 psi, ±3.0% RH at 25°C, ±1.0°C |
| **Output / Span** | 14-bit digital word SPI or I²C protocol | 10% to 90% or 5% to 95% of supply | Digital 24-bit I²C |
| **Type** | Gage, differential (MS4515DO)<br>Gage, absolute, differential, compound (MS4525DO) | Gage, differential (MS4515)<br>Gage, absolute, differential, compound (MS4525) | Absolute |
| **Pressure Range** | 0 - 2, 4, 5, 10, 20, 30" H₂O (MS4515DO)<br>0 - 0.07, 0.14, 0.35, 1, 2, 3, 10 bar /<br>0 - 1, 2, 5, 15, 30, 50, 150 psi (MS4525DO) | 0 - 2, 4, 5, 10, 20, 30" H₂O (MS4515)<br>0 - 0.07, 0.14, 0.35, 1, 2, 3, 10 bar /<br>0 - 1, 2, 5, 15, 30, 50, 150 psi (MS4525) | 10 – 2K mbar, 0 – 100% RH, -40°C to 85°C |
| **Overpressure** | 0.69 bar / 10 psi (MS4515DO)<br>3X range (MS4525DO) | 0.69 bar / 10 psi (MS4515)<br>3X range (MS4525) | 6 bar / 87 psi |
| **Operating Temp.** | -25°C to 125°C | -25°C to 105°C | -40°C to 85°C |
| **Dimensions (mm)** | 12.5 x 9.9 | 12.5 x 9.9 | 5 x 3 x 1 |
| **Typical Apps** | Air flow measurements, process control, leak detection | Air flow measurements, process control, leak detection | Energy management systems, thermostats, humidifiers, dehumidifiers, home automation |

# PRESSURE SENSORS

## Media Isolated Modules
## Digital Output

| | 85BSD, 86BSD | 89BSD |
|---|---|---|
| **Package** | • 13 mm diaphragm diameter with weldable or process fittings (85BSD)<br>• 16 mm diaphragm diameter with O-ring mount (86BSD) | • 9 mm diaphragm diameter<br>• Threaded/weldable<br>• Pressure and temperature read-out<br>• Low power: 1 µA (Standby < 0.15 µA) |
| **Accuracy** | ±0.25% span | ±0.3% span |
| **Output/Span** | Digital 14-bit I²C or SPI | Digital 24-bit I²C |
| **Total Error Band** | ±1.0% FSO | ±3.0% FSO Max |
| **Type** | Gage, absolute | Absolute, sealed gage |
| **Pressure Range** | 0 - 0.35, 1, 2, 3, 7, 10, 14, 20 bar /<br>0 - 5, 15, 30, 50, 100, 150, 200, 300 psi (85BSD)<br>0 - 0.07, 0.14, 0.35, 1, 2, 3, 7, 10, 14, 20 bar /<br>0 - 1, 2, 5, 15, 30, 50, 100, 150, 200, 300 psi (86BSD) | 0 - 6, 12, 18, 28, 30 bar /<br>0 - 87, 174, 261, 406, 435 psi |
| **Overpressure** | 2X | 2X |
| **Operating Temp.** | -40°C to 125°C | -40°C to 85°C |
| **Dimensions (mm)** | Ø 15.9 x 7.9 (85BSD), Ø 15.9 x 9.3 (86BSD) | Ø 9.0 x 7.5 |
| **Typical Apps** | Level controls, tank level measurement, corrosive fluids and gas measurement systems, sealed systems, submersible depth monitoring | Level controls, tank level measurement, corrosive fluids and gas measurement systems, sealed systems, manifold pressure measurement, dive computers |

## Media Isolated Modules
## Analog Output

| | U86B |
|---|---|
| **Package** | Mountable with O-ring seal |
| **Type** | Sealed gage, absolute |
| **Pressure Range** | 0 - 5, 10, 12, 13 bar /<br>0 - 50, 100, 150, 200 psi |
| **Output/Span** | 0.5 - 4.5 VDC (Ratiometric output) |
| **Unique Features** | • Amplified |
| **Accuracy** | ±0.5% span |
| **Operating Temp.** | -7°C to 105°C |
| **Dimensions (mm)** | Ø 15.82 x 13.6<br>Socket spacing: 31.75 |
| **Typical Apps** | Liquid level, liquid pressure |

## Transducers and Transmitters
## Industrial

| | MSP100 |
|---|---|
| **Package** | Small housing with O-ring and proprietary 'snap-in' feature that lowers the total installed cost and customized housings for OEM applications |
| **Type** | Gage |
| **Pressure Range** | 0 - 7 bar thru 0 - 34 bar /<br>0 - 100 psi thru 0 - 500 psi |
| **Output/Span** | 100 mV typical |
| **Unique Features** | • Microfused technology<br>• Low cost stainless steel isolated transducer<br>• No threads needed for pressure connect<br>• Highly customized for OEM application<br>• Solid state reliability |
| **Accuracy** | ±0.5% FSO |
| **Operating Temp.** | 0°C to 55°C |
| **Dimensions (mm)** | 12.7 x 24.38 x 20.32 |
| **Typical Apps** | Beverage dispensing systems, automation, HVACR controls, energy and water management, pumps, compressors, pneumatic equipment |

# TEMPERATURE SENSORS

## Sensor Assemblies

| | Push-in Sensors | Screw-in Sensors | Refrigeration Molded Sensors |
|---|---|---|---|
| **Package** | Brass, copper or stainless steel closed-end tube | Brass, copper or stainless steel housing with integrated connector | PVC or TPE |
| **Type** | Epoxy potted element, miniature design | Epoxy potted element, rigid sheath | Overmolded |
| **Sensor Range** | • NTC<br>• RTD: Pt, Ni<br>• Thermocouple: Type J, K, T, E | • NTC<br>• RTD: Pt, Ni, Cu<br>• Thermocouple: Type J, K, T, E | • NTC<br>• RTD: Pt |
| **Unique Features** | • High moisture resistant<br>• Available with mounting tabs or clips | • Moisture resistant<br>• Different threads types<br>• Connectors available | • High moisture resistant |
| **Accuracy** | • NTC: Custom tolerances available<br>• Pt RTD: Class AA, A, B according to IEC60751 | • NTC: Custom tolerances available<br>• Pt RTD: Class AA, A, B according to IEC60751 | • NTC: Custom tolerances available<br>• Pt RTD: Class AA, A, B according to IEC60751 |
| **Operating Temp.** | Varies: -50°C to 250°C | Varies: -50°C to 250°C | -40°C to 125°C |
| **Dimensions (mm)** | Case specific dimensions | Custom lengths, diameters and threads available | 8 x 30, 6.5 x 25, 6 x 50, 6 x 5 x 15 |
| **Typical Apps** | Boiler, liquid, evaporator, HVACR, industrial processes control, district heating/cooling, gear boxes | Boiler, liquid, industrial processes control, district heating/cooling, immersion | Industrial processes control |

## Sensor Assemblies

| | Boiler Sensors | Air Temperature Sensors | Pipe Mount Sensors |
|---|---|---|---|
| **Package** | Brass housing | Flange mount, snap-in, ring terminal | Copper or stainless steel housing |
| **Type** | • Screw | • Epoxy potted element with rigid sheath or with snap-in ring and overmold | • Overmolded<br>• Epoxy potted |
| **Sensor Range** | • NTC<br>• RTD: Pt, Ni, Cu | • NTC<br>• RTD: Pt | • NTC |
| **Unique Features** | • Integrated connector<br>• Moisture resistant<br>• Different threads types<br>• Connectors available | • Easy mounting features<br>• Moisture resistant designs<br>• Fast response time<br>• Excellent thermal tracking | • Fast response time<br>• Moisture resistant construction |
| **Accuracy** | • NTC: Custom tolerances available<br>• Pt RTD: Class AA, A, B according to IEC60751 | • NTC: Custom tolerances available<br>• Pt RTD: Class A, B or custom | • NTC: Custom tolerances available |
| **Operating Temp.** | Varies: -50°C to 250°C | -40°C to 105°C or higher | -40°C to 125°C |
| **Dimensions (mm)** | Custom lengths, diameters and threads available | Varies by design | Custom configurations available |
| **Typical Apps** | Boiler control, liquid, industrial processes control, district heating and cooling, immersion | Cabinet air, leaving air, duct air, VAV air, inlet/outlet air, room air, outside air | Industrial process, boiler control, refrigeration, food service, energy management, test equipment |

# TEMPERATURE SENSORS

## Sensor Assemblies

| | Handy Box Sensors | Motor Temperature Sensors |
|---|---|---|
| **Package** | Duct mount or metal housing with PVC sun shield with or without weatherproof box | Epoxy case or plastic tube with PTFE extension leads |
| **Type** | Fully potted subassembly | Epoxy potted element |
| **Sensor Range** | • NTC<br>• RTD: Pt | • NTC<br>• RTD: Pt, Ni-Fe (Other options also avaialbe on request) |
| **Unique Features** | • Easy mounting features<br>• Moisture resistant designs<br>• Fast response time<br>• Excellent thermal tracking | • Very rugged design<br>• Epoxy case design provides rigidity and electrical isolation<br>• Withstand varnish and bake operations with hermetic motors<br>• PTFE insulated lead wires for extended temp range |
| **Accuracy** | • NTC: Custom tolerances available<br>• Pt RTD: Class A, B or custom | • NTC: Custom tolerances available<br>• Pt RTD: Class A, B or custom |
| **Operating Temp.** | -40°C to 105°C<br>High temp. models also available | -40°C to 175°C<br>High temp. models also available |
| **Dimensions (mm)** | Varies by design | Varies by design |
| **Typical Apps** | Residential and commercial building controls, energy management systems | Hermetic motor winding, general purpose motor winding |

## Sensing Elements—NTC, RTD

| | Radial Leaded Thermistors | Axial Thermistors | Platinum Thin Film Sensors |
|---|---|---|---|
| **Package** | Radial, beads | DO-35 | Wired component |
| **Type** | • NTC<br>• Epoxy or glass coated | • NTC<br>• Glass coated | • RTD thin film platinum deposited on ceramic substrate, glass coated<br>• Tube outline available<br>• Connection via radial leads |
| **Resistance Range** | 100 to 1MΩ | 5kΩ to 100kΩ | 100Ω, 1000Ω (Other values on request) |
| **Unique Features** | • Interchangeable<br>• Moisture resistant<br>• Stability<br>• UL/CSA certified models available | • Tight tolerance (±1%)<br>• Max stability using high density (HD) chip<br>• Hermetically sealed<br>• Tinned and nickel plated leads | • Long term stability<br>• Interchangeability<br>• Small dimensions<br>• Short response time<br>• High electrical insulation |
| **Accuracy** | 0.25% to 20% | ±1% to ±3% | Class T (F0.1), A (F0.15), B (F0.3) according to DIN EN 60751 |
| **Operating Temp.** | -55°C to 280°C | -40°C to 300°C | -50°C to 600°C (Standard)<br>Down to -200 °C or up to 1000 °C (On request) |
| **Dimensions (mm)** | 0.4 to 4.9 | 2.0 x 4.0 body | 2.0 x 2.3 x 1.1 (Standard)<br>1.2 x 4.0 x 1.1 (Standard)<br>Other dimensions (On request) |
| **Typical Apps** | Environmental temperature, general purpose sensing element for HVACR applications | Refrigeration including cabinet sensing and evaporator coil, fire detection units, air-conditioning systems, PCB temp sensing, general purpose sensing element for HVACR applications | General purpose sensing element for HVACR applications (Element selection will depend upon many factors including accuracy, temperature range and mounting configuration) |

# TEMPERATURE SENSORS

## Sensing Elements—Digital Output


| | TSYS Series |
|---|---|
| **Package** | QFN16, TDFN8 |
| **Type** | I²C, SPI, PWM, SDM<br>(Convertible to analog voltage) |
| **Temp. Range** | — |
| **Unique Features** | • Low power<br>• Small size<br>• Calibrated and ready to use<br>• 16 bit resolution |
| **Accuracy** | Up to ±0.1°C at -5°C to 50°C |
| **Operating Temp.** | -40°C to 125°C |
| **Dimensions (mm)** | QFN16: 4 x 4 x 0.85<br>TDFN8: 2.5 x 2.5 x 0.75 |
| **Typical Apps** | Industrial control, replacement of precision RTDs, thermistors and NTCs, heating and cooling systems |

## Thermopiles

| | TSEV<br>Single or multi pixel series |
|---|---|
| **Package** | OEM-module |
| **Type** | Single pixel or multi pixel thermopile module |
| **Temp. Range** | Object temperature range 0°C to 300°C<br>(Other temperature ranges available upon request) |
| **Unique Features** | • Calibrated, interfaces: I²C, SPI<br>• Different field of views: 5° at 50%, 10° at 50%, 90° at 50%, others on request |
| **Accuracy** | Depends on temperature range, typical 1% full scale, max. accuracy 0.1°C |
| **Operating Temp.** | Ambient temperature range: 0°C to 85°C |
| **Dimensions (mm)** | 35 x 25 x 13 to 31 |
| **Typical Apps** | Contactless temperature measurement on moving parts, heated rolls, microwave oven, air conditioner |

# HUMIDITY SENSORS

| | HTU2X Series | HTU3535PVBM/ Wire | HS1101LF | HTG351xCH | HTF3000LF |
|---|---|---|---|---|---|
| **Package** | DFN type | Cost effective small size mini-module | Through hole with side opening plastic cap | Cost effective small size mini-module | PCB for board to board |
| **Type** | Digital RH and temperature | Analog or digital voltage RH and NTC temperature | Capacitive humidity | Analog voltage RH and NTC temperature | Frequency output for RH, direct NTC for temperature |
| **Operating Range** | 0 to 100% RH | 0 to 100% RH | 0 to 100% RH | 0 to 100% RH | 0 to 100% RH |
| **Operating Temp** | -40°C to 125°C | -40°C to 110°C | -60°C to 140°C | -40°C to 110°C | -40°C to 85°C |
| **Unique Features** | • Low power consumption<br>• Fast response time<br>• I²C interface or PWM interface or SDM interface | • PTFE filter (Optional)<br>• Electronics fully protected (5 V)<br>• Multiple connector choices<br>• Based on HTU21 | • Very robust and recognized component capable of withstanding most of the applications in the humidity world in very cost effective ways | • Electronics fully protected with potting material (3.3 V or 5 V)<br>• Multiple connector choices | • Voltage supply from 3 to 8 VDC<br>• Through hole or SMD<br>• T and R available |
| **Calibration** | ±3% RH at 25°C (10 to 95% RH)<br>±0.3°C at 25°C | ±3% RH at 55% RH;<br>±0.25°C at 25°C | 180 pF, ±3 pF at 55% RH | ±3% RH at 55% RH;<br>±0.25°C at 25°C | ±3% RH at 55% RH<br>±0.25°C at 25°C |
| **Dimensions (mm)** | 3.0 x 3.0 x 1.0 | 27 x 11.9 x YY (Depending on the connector, from 6 to 10.8 mm length) | 10 x 10 x 19 | 27 x 11.9 x 6.7 | 12.5 x 18.5 x 11.2 |
| **Typical Apps** | Building automation systems, thermostats, humidifiers, dehumidifiers | Building automation systems, thermostats, humidifiers, dehumidifiers | Building automation systems, thermostats, humidifiers, dehumidifiers | Building automation systems, thermostats, humidifiers, dehumidifiers | Building automation systems, thermostats, humidifiers, dehumidifiers |

## POSITION SENSORS

| | KMA36 | PCI-650 Series | RVIT-Z |
|---|---|---|---|
| **Type** | • TSSOP<br>• Magnetic rotary position sensor, angle sensor | • Stainless steel<br>• Linear position transducer, absolute | • PCB for OEM volumes<br>• Angular position transducer, inductive, absolute |
| **Linearity** | — | ±1% | ±0.5% |
| **Excitation** | — | 12 to 28 VDC | DC Voltage |
| **Range** | 360° angle | 11, 40, 70, 85, 100mm | Up to ±75° |
| **Unique Features** | • Low cost MR encoder for rotational and incremental measurements | • ATEX certification<br>• Vibration and shock resistant<br>• 100 bar operation<br>• Compatible with refrigerants (Incl. ammonia) and compressor oils | • Absolute position |
| **Output** | Voltage 0 - 5 V, I²C, customer specific | 4 to 20mA | DC voltage, DC current, digital |
| **Resolution** | Typ. 0.1° | Infinite | Infinite |
| **Accuracy** | Typ. 0.3° | — | — |
| **Operating Temp** | -25°C to 85°C | -40°C to 120°C | -25°C to 85°C |
| **Dimensions (mm)** | TSSOP20: 6.5 x 6.4 x 1.2 | — | Custom |
| **Typical Apps** | Knobs, small robotics, angular and linear position, flap location, louver control | Refrigerant compressor capacity control valves, refrigerant compressor oil systems | Viscometers, valve position, robotics, HVACR vane position |

## VIBRATION SENSORS

DC and Piezoelectric Accelerometers


| | 808/808M1 | 810M1 | MiniSense 100 LDTC Family | 8011/ 8021-AR/AP | 8032-01 | 4020/4030 |
|---|---|---|---|---|---|---|
| **Package** | TO-8 | Board level | Piezo film elements with or without mass and pins | Stainless steel | Stainless steel | Molded plastic |
| **Type** | Adhesive (Stud mount option) | SMD | Cantilever beam with vertical or horizontal pins | Stud/through hole mount | Stud mount | Screw mount |
| **F.S. Range (g)** | ±10, 50 (808)<br>±4, 20 (808M1) | ±25, 100 | ±10 (Typical) | ±5 to ±50 | ±50 to ±500 | ±2 |
| **Unique Features** | • Hermetically sealed<br>• Case grounded design<br>• Bandwidth to 8 kHz | • Small size, low cost<br>• Dynamic response<br>• 6 kHz bandwidth | • Very low cost<br>• High sensitivity (1 V/g)<br>• Ultra-low power (Self generating) | • Industrial accelerometer<br>• Case isolated, internal shielding<br>• ±50, 20, 10, 5 g ranges | • Industrial accelerometer<br>• Case isolated, internal shielding<br>• Low cost<br>• Molded strain relief | • Low cost<br>• Biaxial, with triaxial option<br>• DC response<br>• Rugged construction |
| **Accuracy** | ±1.0% Non-linearity | ±2.0% Non-linearity | ±20.0% (typical) | ±1.0% Non-linearity | ±1.0% Non-linearity | ±1.0% Non-linearity |
| **Operating Temp** | -50°C to 100°C | -40°C to 125°C | -40°C to 70°C | -40°C to 85°C | -55°C to 100°C | -40°C to 85°C |
| **Dimensions (mm)** | Ø 15.2 x 16.6 | 12.70 x 15.24 | 19.05 x 6.35 x 6.35 | 22.23 x 48.26 | 14.3 x 45.3 | 71.2 x 40.0 x 15.2 |
| **Typical Apps** | Machine monitoring, data loggers, embedded applications | Data logging, impact detection | Wake-up switch, load imbalance, impact sensing | Industrial applications, machine monitoring | Industrial applications, machine monitoring | Structural monitoring |

## FLOW SENSORS

| | FS-01 |
|---|---|
| Package | Noryl |
| Type | Flow switch |
| Max Pressure | 10 Bar at 20°C |
| Operating Temp | -30°C to 85°C |
| Unique Features | • SPST reed switch<br>• Normally open, close on flow |
| Dimensions (mm) | 106 x 32 x 32 |
| Typical Apps | For direction of liquid and gas flow, mains water control, power shower, central heating systems, circulation pump protection, cooling systems |

## ULTRASONIC SENSORS

### Standard Contact Point Level

| | LL-01 |
|---|---|
| Type | Gap |
| Unique Features | • All 316L SS<br>• Integral electronics<br>• Miniature threads<br>• Single machined<br>• No adjustment for viscosity, density |
| Input | 6 - 24 VDC |
| Output | 1/2A contact |
| Pressure | 250 psi |
| Temperature | 100°C |
| Actuation point | 0.25" |
| Process Connection | 1/4" NPT or 1/2" NPT |
| Cable | 12" |
| Approvals | CE |
| Typical Apps | Histology processors, compressors, chillers, coolant reservoirs |

## MASS AIR FLOW SENSORS

| | LMM-H03 | LMM-H04 |
|---|---|---|
| Package | Hybrid | Hybrid |
| Type | Hot film anemometer component | Hot film anemometer component |
| Range | Bi-directional | Uni-directional |
| Operating Temp | -40°C to 125°C | -40°C to 125°C |
| Unique Features | • High sensitivity at low heater temperatures<br>• Fast response time<br>• True air temperature sensor | • High sensitivity at low heater temperatures<br>• Fast response time<br>• True air temperature sensor |
| Calibration / Accuracy | Dependent on electronics | Dependent on electronics |
| Dimensions (mm) | 23 x 10.15 x 1.1 | 24 x 10.15 x 1.1 |
| Typical Apps | Industrial gas flow | Industrial gas flow |

| PRODUCT AND APPLICATION MATRIX | Pressure | Temperature | Humidity | Position | Vibration | Flow | Mass Air Flow | Ultrasonic |
|---|---|---|---|---|---|---|---|---|
| Alternative Energy and Solar | | ● | ● | | ● | ● | | ● |
| Boiler Controls | | ● | ● | | | ● | | |
| Building and Energy Management | | ● | ● | ● | ● | | | |
| Cold Beverage Dispensing | ● | ● | | | | | | |
| Commercial Chillers | ● | ● | ● | ● | ● | ● | | ● |
| Commercial Cooking Equipment | | ● | | | | | | |
| Compressors and Motors | ● | ● | | | ● | ● | | ● |
| Container Storage | ● | ● | | | | | | |
| Electronic Expansion Valves | ● | ● | | | | | | |
| Forced Air Furnaces | ● | ● | ● | | ● | | ● | |
| Heat Pumps | ● | ● | ● | | ● | ● | | ● |
| Humidifiers and Dehumidifiers | | ● | ● | | | ● | | |
| HVACR Diagnostic Equipment | ● | ● | | | | | ● | |
| Ice Machines | ● | ● | | | | ● | | ● |
| PTAC and Small A/C | ● | ● | ● | | | | | |
| Pool Heater and Equipment | ● | ● | | | | ● | | |
| Refrigerators | | ● | ● | | | ● | | |
| Refrigerated Beverage Control | ● | ● | | | | | | |
| Refrigeration Controls | ● | ● | | | | ● | | |
| Underfloor Heating and Ice Melting | | ● | | | | ● | | |
| VAV Systems and Air Handlers | ● | ● | ● | ● | ● | | ● | |
| Water Heater | | ● | | | | ● | | ● |
| Zone Controls | ● | ● | ● | ● | | | ● | |

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