GE Measurement & Control Business Overview

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November 29, 2011

THE GENERAL ELECTRIC COMPANY

125+ years • 290,000 global employees • 2010 revenue $150B

Energy

- Power & Water
- Oil & Gas
- Energy Services

Technolog y

- Aviation
- Healthcare
- Transportation

GE Capital

- Energy
- Aviation
- Comm Real Estate
- Commercial
- GE Money

Home/Business

- Appliances
- Lighting
- Intelligent Platforms

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GE ENERGY

Employees: 66,000 • ‘10 revenue: $37.5B • Operating in 150 countries

Energy Services

- Contractual agreements
- Smart Grid
- Field services
- Parts and repairs
- Optimization technologies
- Plant management

Power & Water

- Power generation
- Renewable energy
- Gas engines
- Nuclear
- Gasification
- Water treatment and process chemicals

Oil & Gas

- Drilling/production
- LNG and pipelines
- Refining/petrochemical
- Industrial power gen
- Complete lifecycle services

ENERGY SERVICES

~ 27,000 employees ~ 180 locations 2009 revenue ~ $13.8B

Environmental Services

Digital Energy

Measurement & Control

~$2B Rev
7,000 employees
60 countries

Power Generation Services

Industrial Solutions

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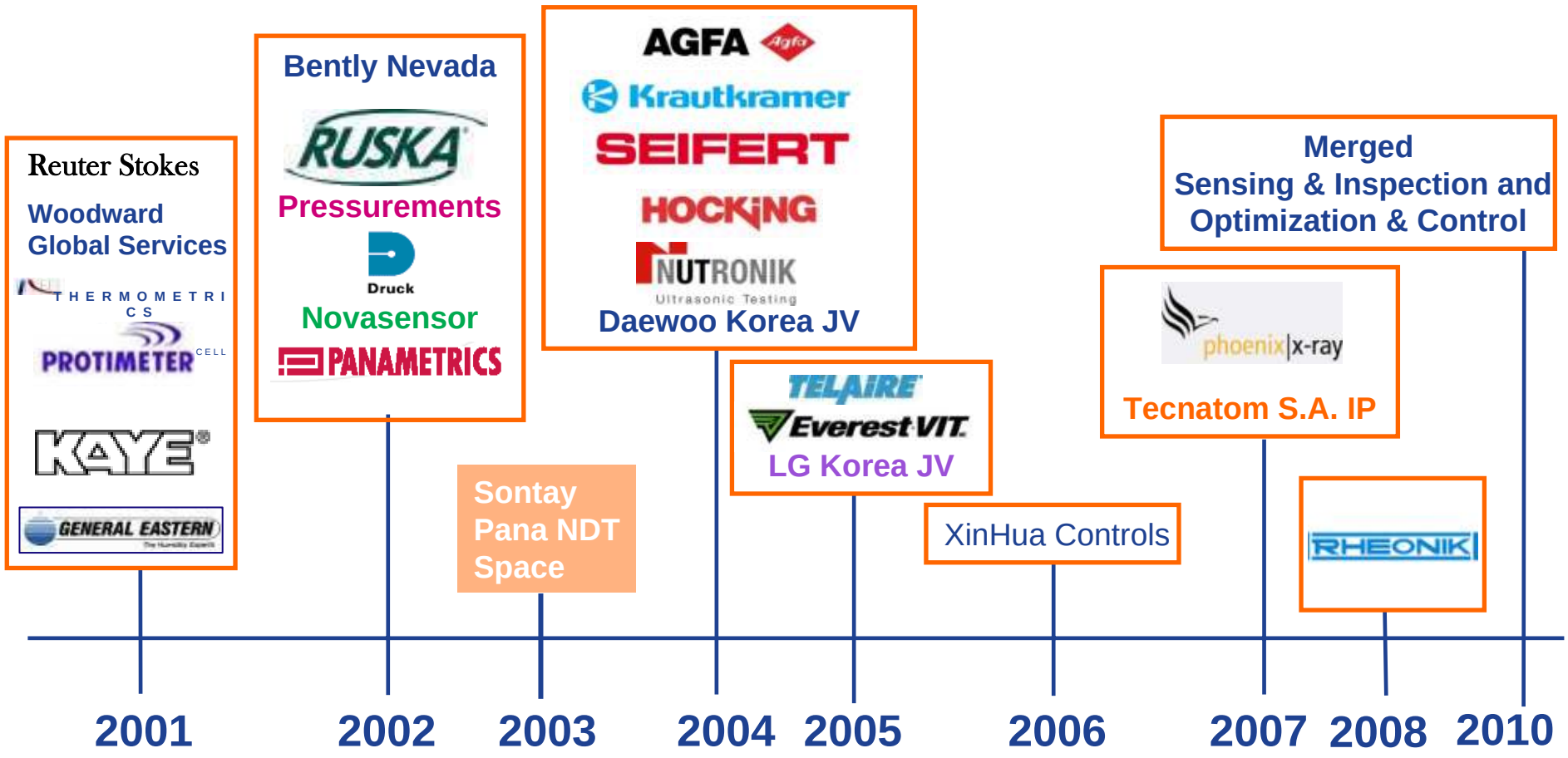
MC – 30 AQUISITIONS



MC PRODUCT LINES

2010 $2B Rev

Advanced Sensors

- Temperature
- Pressure (MEMS)
- Infrared
- Validation

Measurement Solutions

- Flow
- Gas and Moisture
- Pressure

Inspection Technologies

- Ultrasonic, Eddy current
- Remote Visual
- CR/DR, X-Ray, CT
- Software

Bently Nevada

- Monitors
- Field devices
- Tech support
- System 1® software
- Machinery diagnostics

Control

- Retrofits and parts
- EX2100
- Mark IV, V, VI, VIe
- OC 4000 DCS
- Software upgrades

Reuter Stokes

- Nuclear instrumentation
- Flame detectors
- He-3 detectors
- Scintillations sensors
- Mechanical assemblies

ADVANCED SENSORS

Temperature

- NTC & PTC Thermistors
- Temperature Sensors
- Infrared Thermopiles
- Qualification Testing and Calibration
- Custom Design Capabilities

Pressure (MEMS)

- Worldwide On-site Fabrication
- Research & Development
- Design, modeling and Fabrication
- Advanced Prototyping
- Package Development
- Device Integration

Moisture & Gas

(commercial)

- Hand-held Moisture and Humidity Meters
- CO_2 Sensors and Transmitters
- Hand-held CO_2 and Temperature Meter
- CO_2 Modules for OEMs

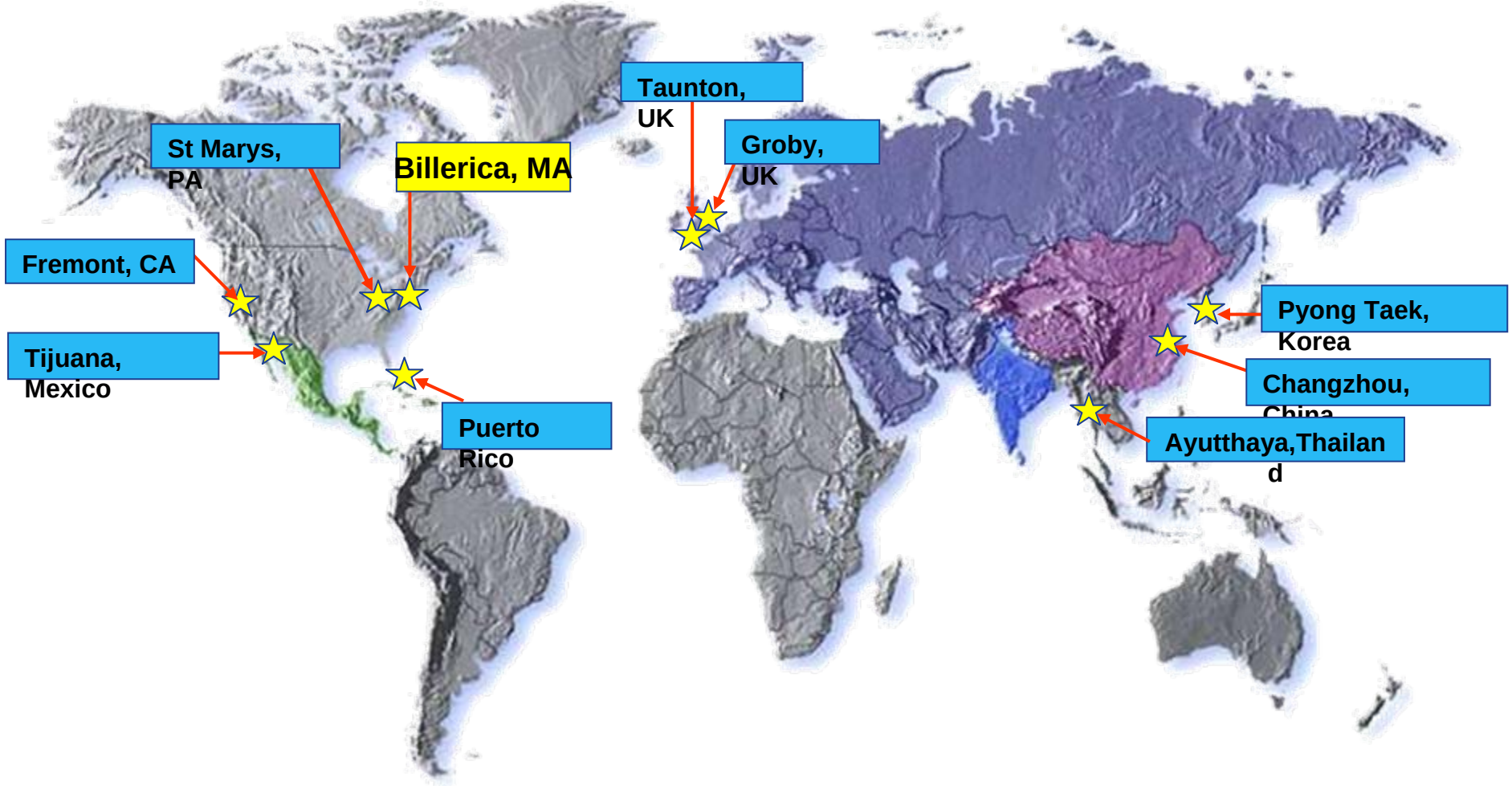
Validation

- Thermal Processing Validation
- Wireless Process Validation
- Environmental Monitoring
- Turbine Test Cell Monitoring
- Calibration Laboratories

INDUSTRIES WE SERVE….

	Healthcare	Transportation	Industrial &	Pharma
				
Sample Applications	• Sleep Apnea • Thermometry • Neonatal • Critical Care • Anesthesia • Blood pressure	• Climate Control • EMS (Engine management systems) • Tire Pressure monitoring • Occupancy Detection	• Indoor Air quality monitoring • CO2-based ventilation control • Aerospace • White Goods • Home flood damage	• Cleaning • Thermal • Facility monitoring • Process Analytical Technologies (PAT)
Enabling Technology	• MEMS pressure • Temperature • Catheter thermistors • MEMS IR	• NTC/PTC Thermistor assemblies • MEMS NPP & NPX • MEMS IR	• Temperature • Humidity • MEMS Die / IR • Wireless	• Validator • Valprobe • Lab Watch • Calibration

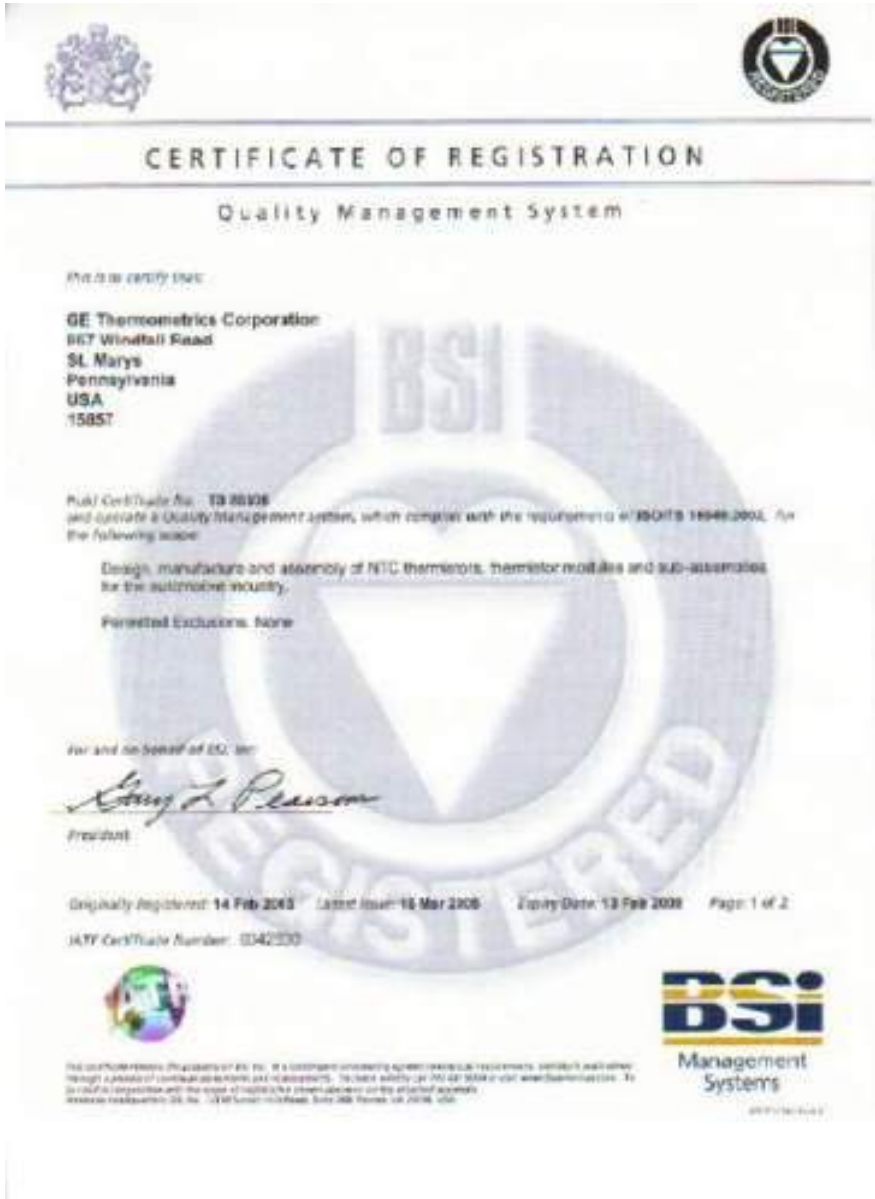
GE ADVANCED SENSOR SITES



Positioned globally – resourced locally

QUALITY ASSURANCE

- GE manufacturing facilities hold a variety of laboratory accreditations and certificates of approval for quality management systems in North America, Europe, and Asia.
  - ✓ ISO 13485 - Medical
  - ✓ ISO 9001 – Manufacturing
  - ✓ ISO 14001 - Environmental
  - ✓ ISO/TS 16949 – Automotive
  - ✓ QS 9000 – Automotive



CERTIFICATE OF REGISTRATION

Quality Management System

This is to certify that:

GE Thermometrics Corporation
867 Windfall Road
St. Marys
Pennsylvania
USA
15857

Design, manufacture and assembly of NTC thermistors, thermistor modules and sub-assemblies for the automotive industry.

Excluded Exclusions: None

President

Originally Registered: 14 Feb 2003 Latest Issue: 15 Mar 2006 Expiry Date: 13 Feb 2009 Page: 1 of 2

BSI Management Systems

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GLOBAL RESEARCH CENTERS

Global Research Center
Niskayuna, NY

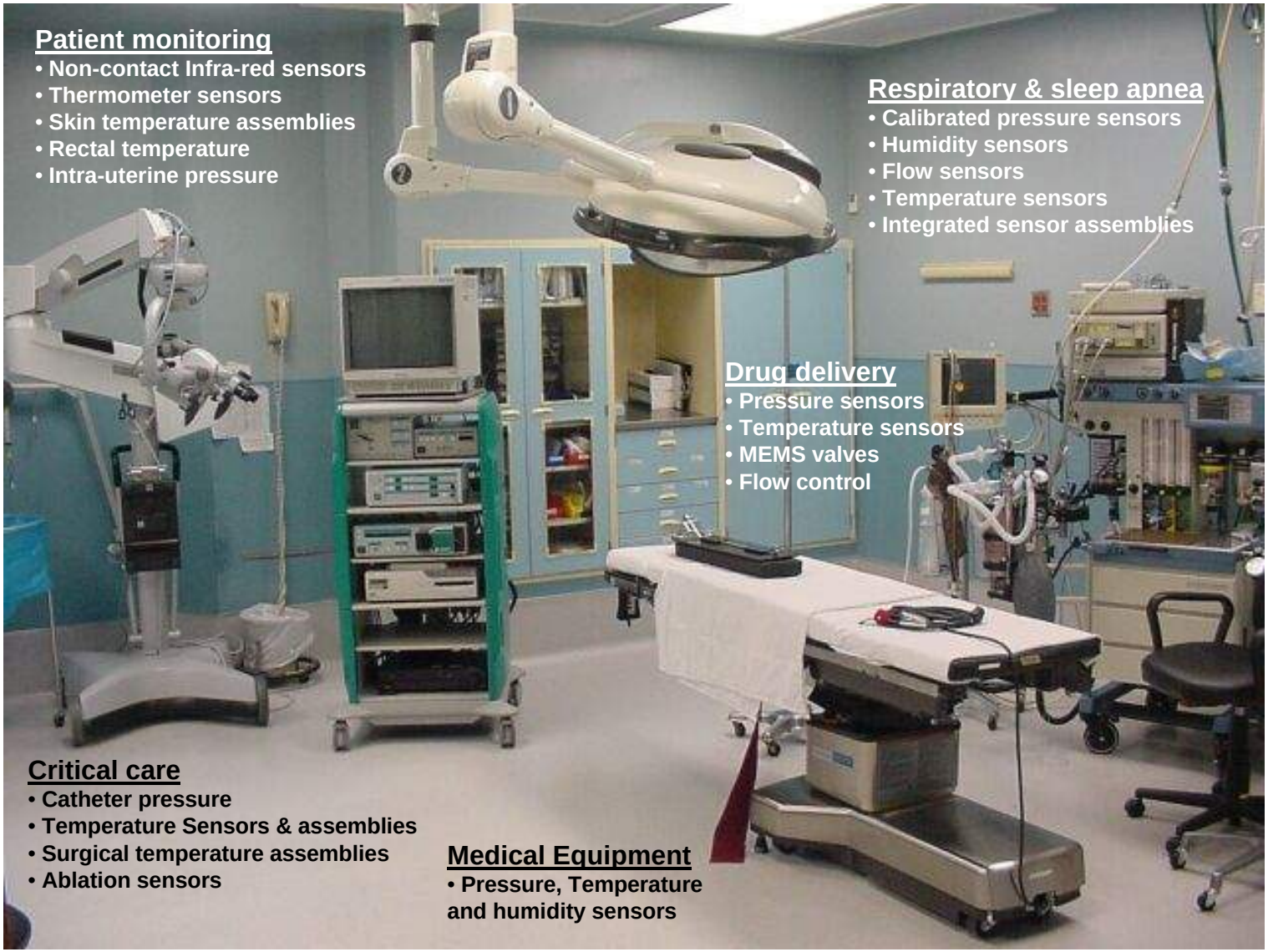
John F. Welch Technology Center
Bangalore, India

China Technology Center
Shanghai, China

Global Research – Europe
Munich, Germany

- 2,600 research employees (nearly 1,000 PhDs)
- 27,000 GE technologists worldwide
- $5.7 billion technology spend

HEALTHCARE APPLICATIONS



Pressure Sensors

.....for Healthcare

MEMS PRODUCT
Healthcare strategy

Yesterday **Today** **Evolving** **Future**

Manual

Automated

Continuous

Sensor Intelligence

Value Proposition:

GE works with its customers to improve patient outcomes through advanced technologies for medical devices by pairing industry expertise in sensor and micro-system design with in depth customer knowledge to deliver the best solutions for respiratory, drug delivery and critical care treatment.

Respiratory

Drug Delivery

Critical Care & Patient Monitoring

GE Advanced Sensors Offerings

MEMS – HEALTHCARE PRODUCTS

Blood Pressure

NPC-100
Disposable

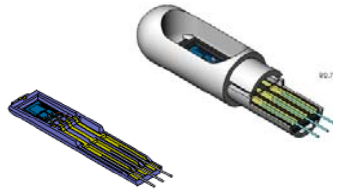
NPP-301
Cuff BP

Custom
Assemblie

Catheter Pressure

Catheter die

1 F & 3 F
Die



Catheter
Pressure
Assemblies

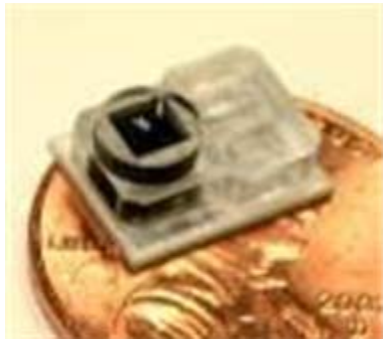
Respiratory Applications

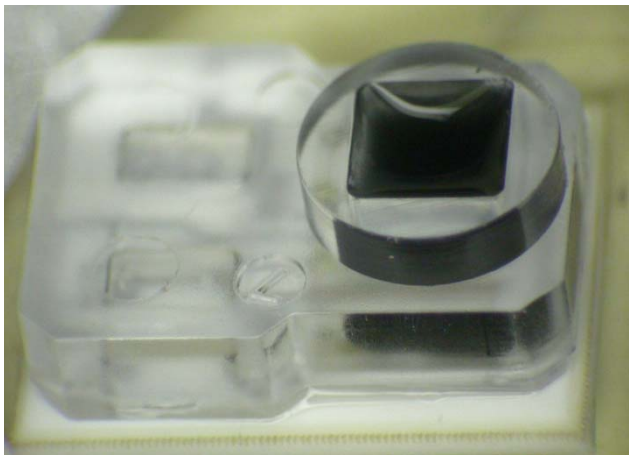
NPC-1260
10” H2O or 1psi

NPC-1210
10” H2O to 100 psi

Digital Packages NPA
Amplified, 10”H2O - 30psi

NPC-100
Disposable Blood Pressure Transducer





Features

- Solid State, High Reliability
- Media Compatibility, Factory filled with dielectric gel
- High Performance, Small size
- Fully Tested, Temperature tested
- Low Cost Disposable Design
- Designed to AAMI (BP-22) specifications

Applications

- Medical Instrumentations
- Blood Pressure Measurements
- Infusion Pumps
- Kidney Dialysis Machines

CHIPS
"Ceramic Hybrid Integrated Pressure Sensor"

NPC 1200 series

NPC 1200 Series
- PCB mountable DIP package
- Temp Compensated from 0-70°C
- Absolute, gage, or differential
- Pressure range: 10" H_2O to 100 psi

APPLICATIONS
- Respiratory & sleep apnea
- Process control
- Non-invasive blood pressure

NPA Series Pressure Sensors

Product / Description

GE's NPA series pressure sensors combine our SenStable® silicon fusion bonded sensor die with packaged electronics to provide a highly stable, amplified and calibrated measurement in a cost effective surface mount package.

Manifold Gauge/Absolute

Barbed Fitting Gauge/Absolute/Diff

No Fitting Gauge/Absolute/Diff

Preliminary Specifications

Pressure ranges:	**0 to 10" H_2O up to 30 psi**
Temp compensation:	**0°C to 70°C**
Operating temp:	**-40°C to 125°C**
Accuracy:	**±1.5% full scale output**
Pressure overload:	**60x @ <1psi FSO / 2x @ > 5psi FSO**
Digital output:	**14 bit**
Digital power supply:	**5Vdc standard** (3 to 5Vdc optional)
Analog power options:	3.3Vdc supply 0.5-3.0Vdc output 5.0Vdc supply 0.5-4.5Vdc output 5.0Vdc or 1.5mA 100mV output (typ) 2.7 to 5.5Vdc 0-1Vdc output

Benefits

- ✓ Analog, Amplified analog or Digital output options
- ✓ Temperature measurement available with digital output
- ✓ Temperature compensated from 0°C to 70°C
- ✓ Flexible pressure ranges
- ✓ Large overpressure capabilities
- ✓ Excellent long term stability (SenStable® technology)
- ✓ Accuracy: Better than 1.5% full scale output
- ✓ Surface mount SOIC-14 package

Configurability

- ✓ Optional pressure port configurations give superior design flexibility
- ✓ Gage, differential or absolute pressure options
- ✓ Multiple power supply and output voltage options
- ✓ Extended temperature compensation ranges can be accommodated

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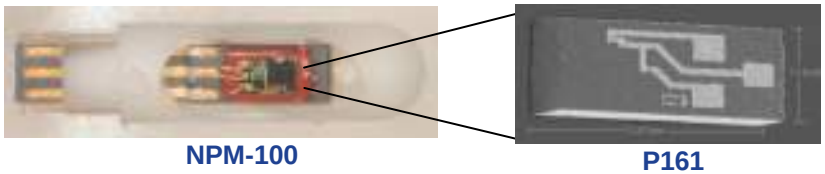
Smart, versatile pressure sensing to meet stringent design standards

Medical Catheter Pressure Sensors

Product Description

GE Sensing's Catheter Pressure sensors are fast response, ultra-stable and accurate piezo-electric MEMS based devices specifically designed to provide excellent pressure measurement within the very small space and harsh environments of catheter applications.



NPM-100 P161

Technical Specifications

• Pressure Range	-50 to 300 mmHg
• Operating Temp	10°C to 50°C
• Excitation	1 to 8 Volts AC or DC
• Zero Offset	±12.5 mV/V
• Sensitivity	12 to 24 μV/V/mmHg
• Linearity	±1mmHg
• TcZ	±40 μV/V/°C
• Bridge Resistance	800 ±20% Ohms
• Burst Pressure	4000 mmHg

Benefits

- ✓ Real time (beat-by-beat) pressure monitoring
- ✓ Very small, fits standard catheter sizes
- ✓ Fast response optimized for catheters
- ✓ Stable accurate pressure measurement
- ✓ AC or DC excitation
- ✓ Gage (P161) and Absolute (P165) die versions
- ✓ Custom sub-assemblies with temp option

Typical Applications

- ✓ Intracranial
- ✓ Intrauterine
- ✓ Disposable catheters
- ✓ Urinary catheters
- ✓ Ablation
- ✓ Research

Fast Response, Accurate & Stable Pressure Measurement

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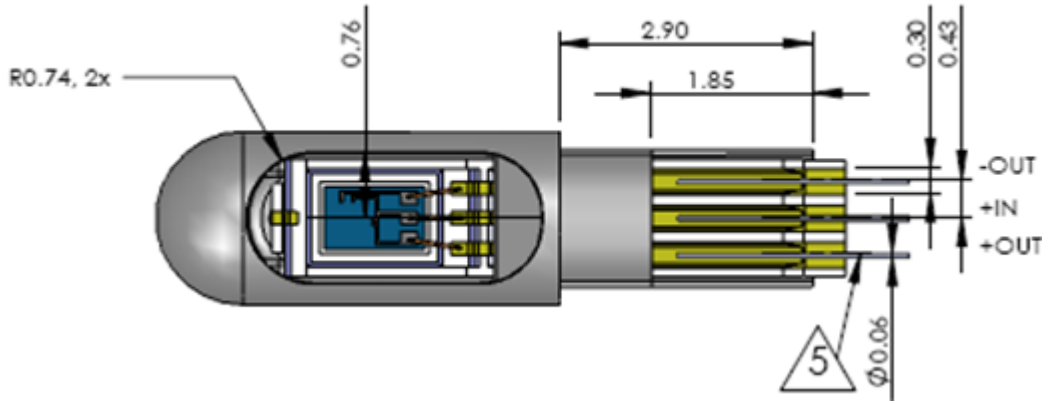
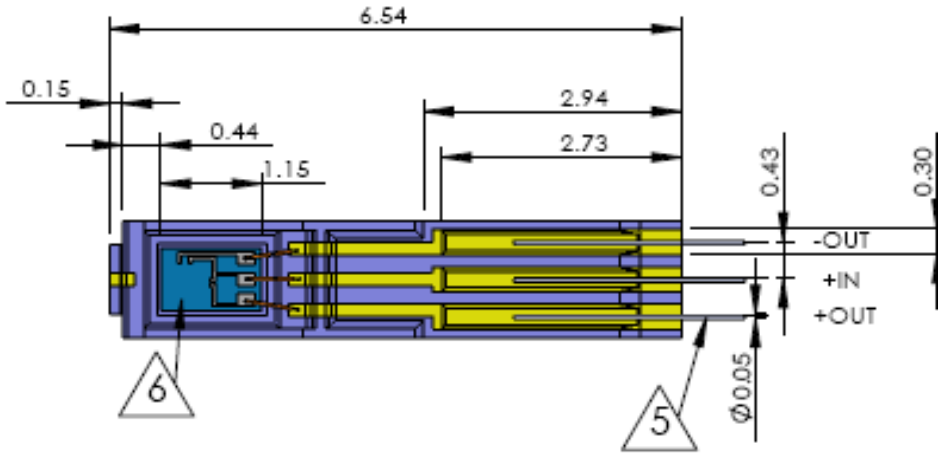
Excellent for minimally invasive applications where small size is

Product Configurations

NPM-100G-XL: 6F Catheter Tip Pressure, Gage
(Leads Optional: 2, 4 or 6 foo



NPM-050A/G-XL: 6F Die on Carrier, Absolute or Gage
(Leads Optional: 2, 4 or 6 foot)



Note: Units in mm

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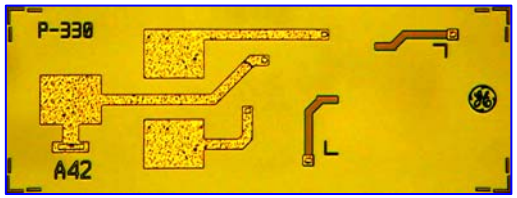
P330 Medical Pressure Die

MEMS Pressure

Product Description

GE Sensing's Catheter Pressure sensors are fast response, ultra-stable and accurate piezoresistive MEMS based devices specifically designed to provide excellent pressure measurement within the very small spaces and harsh environments of catheter applications.



P330 Die

Technical Specifications

- **Pressure Range** -710 to 1600 mmHg A @ 1 atm
- **Operating Temp** 10°C to 50°C
- **Excitation** 1 to 5 Volts DC
- **Zero Offset** ±12.5 mV/V
- **Sensitivity** 5 to 25 μV/V/mmHg
- **Linearity (TBNL)** ±1.5 mmHg
- **TCZ** ±40 μV/V/°C
- **Bridge Resistance** 3K ± 1K Ohms
- **TCR** 0.04+/-0.02 %/°C
- **Burst Pressure** 3000 mmHg
- **330 x 180 micron cross section (width x height)**

Benefits

- ✓ Real time (beat-by-beat) pressure monitoring
- ✓ Very small, fits standard catheter sizes
- ✓ Low power consumption
- ✓ Fast response optimized for catheters
- ✓ Stable accurate pressure measurement
- ✓ Gauge and Absolute die versions
- ✓ High volume OEM quantities available

Targeted Catheter Applications

- ✓ Intracranial
- ✓ Intrauterine
- ✓ Urinary
- ✓ Ablation
- ✓ Catheter Navigation
- ✓ Research

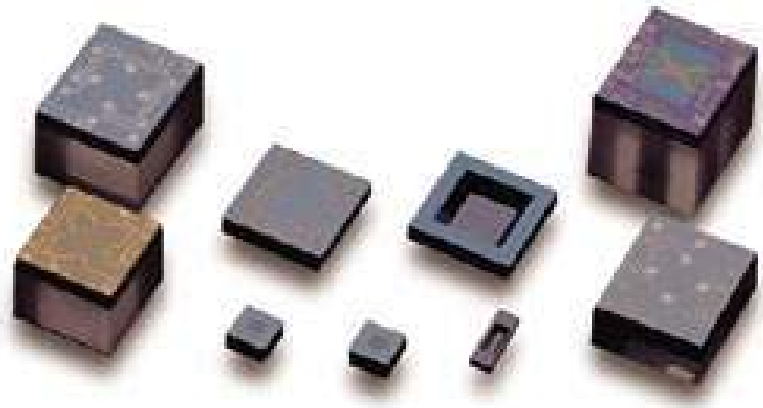
Fast Response, Accurate & Stable Pressure Measurement

Excellent for invasive applications where small size is

Pressure Sensors Die

Sizes range from 0.3 mm to 3.2 mm

Pressure ranges from 10” H_2O to 5000 psi (35K kPa)



Silicon MEMS Fabrication

Lithography

- Steppers, contact aligners
- Double Sided Lithography
- Thick resist

Thin Film Deposition

- Standard: Oxide, LTO, Nitride, Poly, Al
- Special: Au, SiCr, Ta, Ni, Cr, Pt….

Etch

- Standard IC wet etch benches
- Electrochemical (KOH, TMAH, EDP)
- Plasma, RIE and DRIE

Bonding

- Aligned silicon fusion and anodic bonding
- Selective and controlled medium

3/4 million dice produced weekly

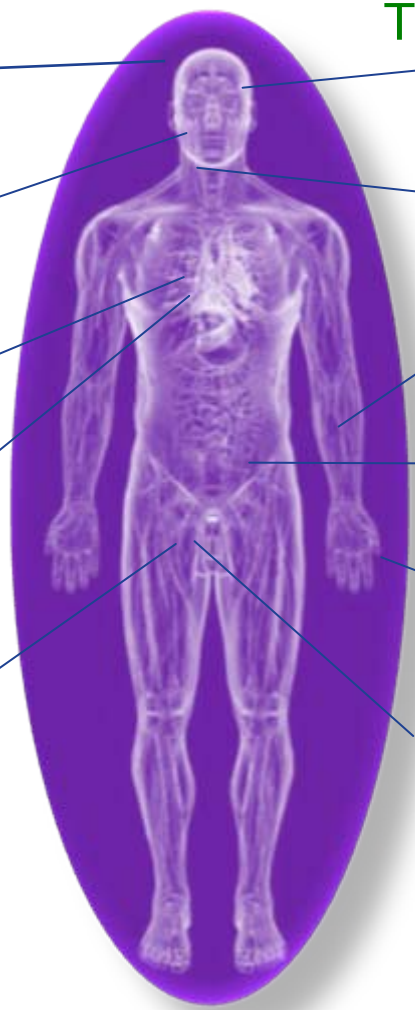
Class 100: 5500 sq ft (511 sq. m)

Class 1000: 5500 sq ft (511 sq. m)

Temperature Sensors

……..In Healthcare

TEMPERATURE – HEALTHCARE PRODUCTS



Cranial Catheter
Catheter Tip Pressure Die

Oral Temperature
MA200 NTC Temp Assembly

Thermal Dilution Catheter (Heart)
AB6 Catheter Assembly

RF Ablation
AX Thermocouple assemblies

Foley Catheter
MA100 Temp Assembly

Tympanic Temperature
ZTP-135 IR Temp Assembly

Esophageal Catheter
MA100 NTC Temp Assembly

Skin Temperature
MA300 NTC Temp Assembly

Kidney Dialysis
MEMS NPC

Glucose Monitoring
NTC Temp Assembly

Rectal Temperature
MA100 NTC Temp Assembly

- Thermistor Temp.
- Thermopile IR sensor
- Fine-wire Thermocouple
- Pressure

- Anesthesia
- Blood/Fluid Heaters
- Humidifiers
- Oxygen Tents
- Clinical Mattress
- Sleep Apnea

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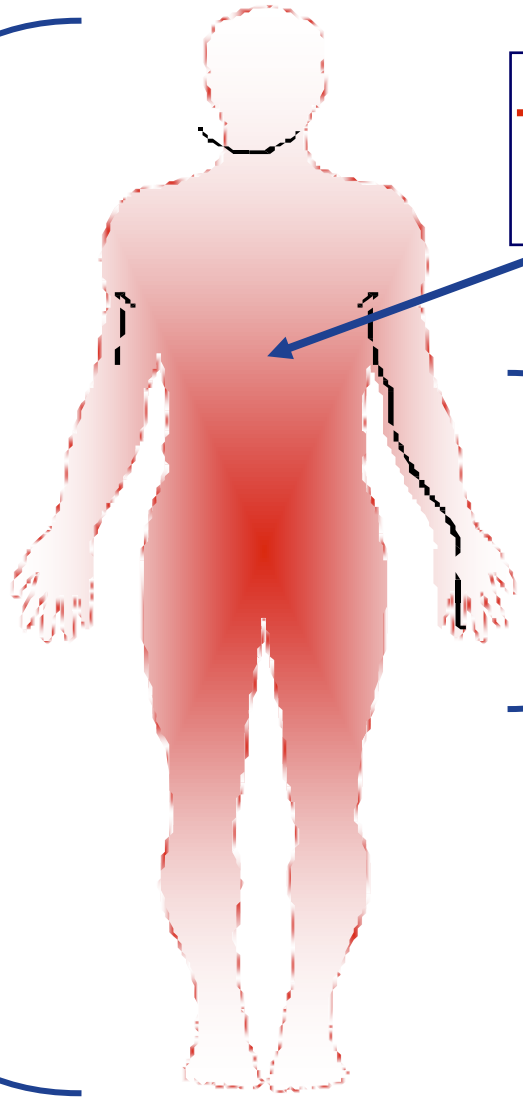
MEDICAL TEMPERATURE TARGETS



+/- 0.05C
37C
Body Core

+/- 0.2
20C - 45C

+/- 0.1C
34C - 39C

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GE – THERMISTOR ELEMENT TYPES

Beads	Chips	GC
• .003” to .100” dia • stability up to 300°C • 5 ms response time	• .020” to .100” dia • stability up to 105°C • Interchangeable to .05°C tol	• .011” to .055” dia. • stability up to 250°C • 12 ms Response time
• Fast response, size restricted sensors • Sensors for extreme temp (-200K to 450°C) • Probe sub assemblies • High reliability/Mil sensors • Flow, gas, liquid level sensing	• General purpose sensors • Medical disposable products • Probe sub assemblies	• Fast response, size restricted sensors • Sensors for extreme temp (-200K to 450°C) • Probe sub assemblies • Medical disposables

Type "P" Glass bead probe

GCP probe

Type "R" Glass bead Red

Welded GC14 catheter sub assembly

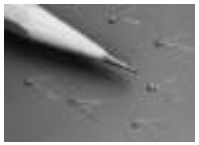
Type "FP" "Fastip" Glass bead probe

GC14 catheter sub assembly with epoxied sleeve

Medical Catheter Temperature Sensors

Product Description

GE Sensing's Catheter Temperature sensors are NTC thermistors sealed in glass and packaged to provide very fast response time and excellent point isolation of the temperature measurement.



NTC bead elements in assembly tip

AB6 sensor assembly (on shipping spool)

Technical Specifications

- Resistance at 37°C 14004 Ω ± 0.5%
- Beta 3482 ± 5%
- Ratio R(298°K)/R(310°K) 1.572 ± 0.036
- Time Constant (still air) 1.2 seconds
- Time Constant (H_2O) 16 mS
- Sleeve Diameter 0.020" ± 0.002"
- Sleeve Material Kapton (polyimide)
- Max. Power Rating 15mW
- Bead Dissipation:
  - Still Air @ 25°C 0.12 mW/°C
  - Still H_2O @ 25°C 0.60 mW/°C

* Contact GE Sensing for information on other catheter product specifications

Benefits

- ✓ Small packages to fit standard lumens
- ✓ Very fast response time
- ✓ Excellent point isolation of measurement
- ✓ Insulated sub assembly with proven reliability
- ✓ Tight resistance–temperature (±0.5%) characteristics
- ✓ Various lead lengths available
- ✓ Extensive qualification & validation data available

Typical Applications

- ✓ Continuous Cardiac Output
- ✓ Thermodilution
- ✓ Foley
- ✓ Esophageal
- ✓ Disposable catheters

Fast Accurate Temperature Measurement in a very small package

Excellent for catheter applications where fast response time is

Precision Temperature Sensors for Surgical Procedures

Product Description

Miniature, precision temperature sensors for surgical and other medical procedures.

Applications include Ablation procedures, Open heart surgery (Myocardium) temperature, Brain tissue profiling, Cancer treatment, IV fluid temperature, Cosmetic surgery, etc.

Designs are customer and application specific utilizing flexible tubing, stainless steel probes, hypodermic needles, or other fittings/fixtures.

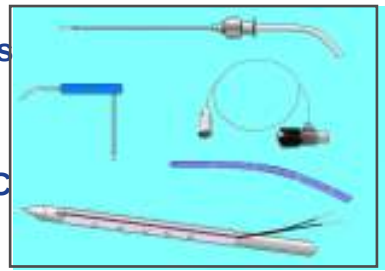
Technical Specifications

Miniature NTC chip or glass bead thermistors and fine wire thermocouples assembled into insertion probes, fittings, or tubing for measuring and controlling temperature during critical procedures.

- Temperature range: 0°C to 70°C (others available)
- R-T curves: Standard curves available (400 series, etc.)
- Accuracy & Interchangeability: down to ±0.05°C
- Sizes: down to 0.005" diameter (NTC only)
- Response times: down to < 10 milliseconds, H2O
- Can be ETO, autoclaved, or e-beam sterilized

Benefits

- ✓ Extremely small size, fast respons time
- ✓ Reliable performance
- ✓ Temperature accuracies to ±0.05C
- ✓ Designed for Sterilization
- ✓ Wide range of custom packaging
- ✓ Complete design support
- ✓ Interchangeable for single use (optional)



Typical Applications

- ✓ Ablation exposure control
- ✓ Core temperature during surgery
- ✓ Cancer research and treatment
- ✓ Cranial temperature
- ✓ Laser surgery
- ✓ Cosmetic surgery
- ✓ IV fluid temperature

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Improving the success of patients outcomes through reliable measurements

Humidity Sensors

.....for Healthcare

COMBINED HUMIDITY & TEMPERATURE SENSOR

The ChipCap series sensor offers a new standard for relative humidity measurement

- ✓ Simultaneous analog and digital outputs for %RH and Temperature
- ✓ Fully calibrated with no additional calibration required or needed
- ✓ No additional temperature compensation required or needed
- ✓ Absolutely NO further correction of %RH, or calculations are necessary
- ✓ Does not need regulated power supply
- ✓ Virtually “Design Free”
- ✓ True interchangeability
- ✓ Significant price vs performance characteristics

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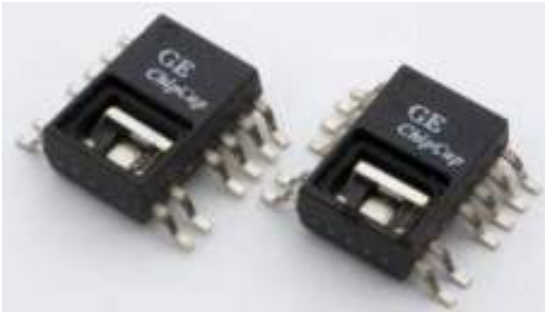
ChipCap
Integrated Humidity & Temperature

Product / Description

Relative Humidity and Temperature with Integrated signal conditioning ASIC. Compact SOIC (System-on-Chip) package. ChipCap provides either analog or digital interfaces on a single 5 VDC-powered chip. Dual outputs provide humidity and temperature.



Specifications

Power:	3-5.5 VDC unregulated
Consumption:	500 mA @ 5 VDC, 25°C
Analog Outputs:	0-1 VDC linear = 0-100% RH
	0-1 VDC = -50 TO 150°C
	0.5-4.5 Ratiometric
Digital:	Manchester Code - 8 Data Bits, 1 Parity
Accuracy:	±2% RH between 20-80% RH at 20-30°C
	±1°C drybulb
Operating Temp:	-50 to +150°C
RH Range:	1 to 99%

Benefits

- ✓ Accurate Measurements of %RH and Temperature
- ✓ Analog or Digital Humidity & Temperature Outputs
- ✓ Long-Term Stability of <± 1%RH per year
- ✓ Customized Package with Smaller SOP 14 Footprint
- ✓ Virtually "Design Free" Drop in part
- ✓ Discrete Signals
- ✓ Less Circuitry
- ✓ **Fully Factory Calibrated**

Applications

- ✓HVACR
- ✓Instrumentation
- ✓Cargo Storage
- ✓Humidifiers/Dehumidifier
- ✓Commercial Refrigeration
- ✓White Goods
- ✓Data Logger
- ✓Controls

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Reduces Design Cost
mproves Reliability & Performanc

GE MEASUREMENT & CONTROLS SOUTIONS DIFFERENTIATORS

- Brand recognition
- Strong customer base: Leaders in their market segments
- Traceability: ceramics to completed assembly
- Solutions: “Thinking outside the Box”
- Positioned globally with local resources
- 30+ years of applications experience
- World class R & D facilities (4 locations)
- Financial stability – we’ll be there tomorrow

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SUMMARY

GE Sensing offers precision instruments and systems that measure temperature, pressure, liquid level, humidity, gas concentration and flow rate. We provide customers sensor-based solutions that enable them to monitor, protect, control and validate their critical applications and processes.

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