

MULTIPOINT

PERMANENT & REPLACEABLE MULTIPOINT SENSOR DESIGNS AVAILABLE

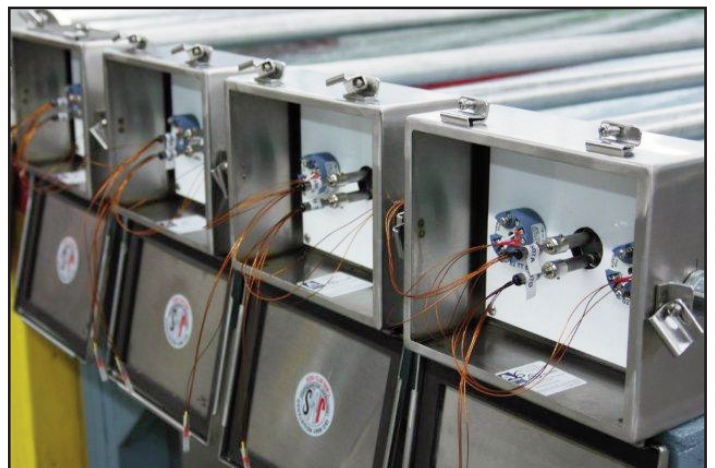
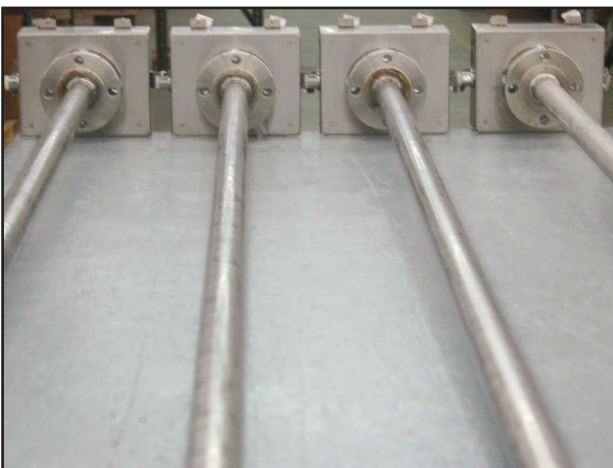
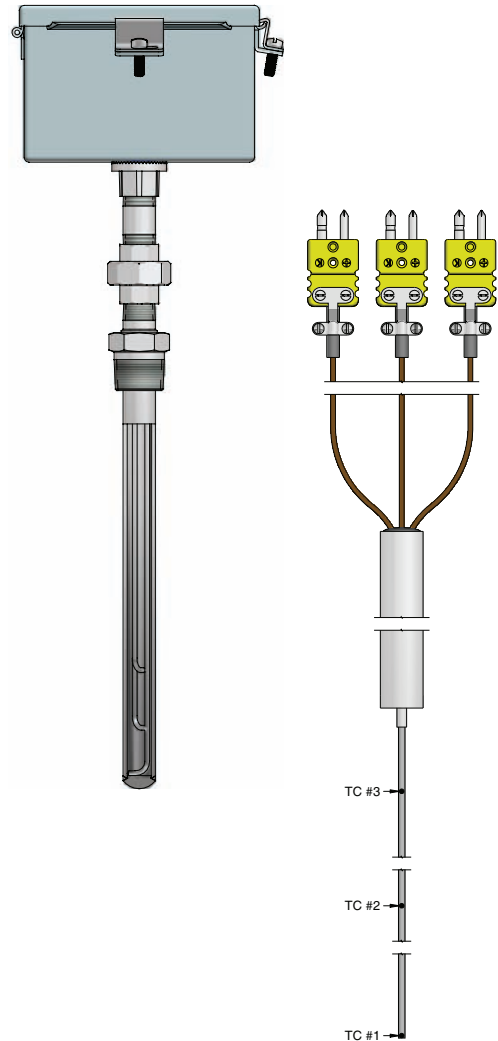
Note: For flexible high temperature reactor design see next two pages.

A multipoint sensor allows the measurement of a temperature profile across a large area. Thermocouples or RTDs are arranged with measuring junctions at various points along a pipe, allowing the measurement of various points from a complete assembly. Many elements can be spaced along a probe.

This opens up possibilities for improved profiling in reactors, for example, where flow interference prevents inserting large numbers of individual probes. Multipoint probes can also be used to give a temperature profile where stratification of a tanks contents may be of concern. JMS will custom design your assembly to give you the most accurate temperature measurement for your process.

The following information and/or drawing is needed to properly design your assembly.

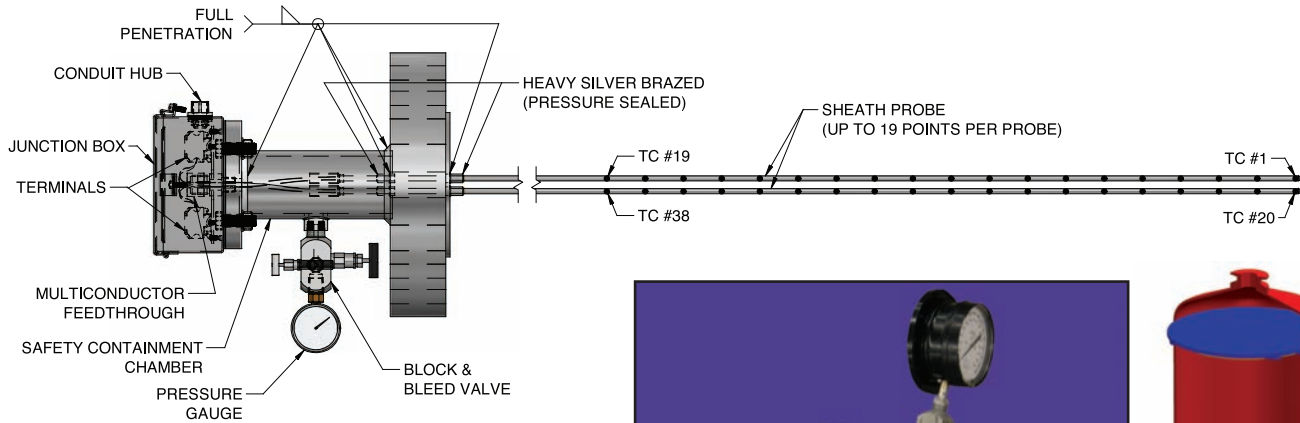
- Thermocouple calibration or RTD element type,
- Outside diameter of pipe and pipe material,
- Junction style of thermocouple,
- Sensor material (bare wire, 316 SS tubing, or sheath material),
- Overall length of the entire assembly,
- Process connection,
- Accuracy required,
- Cold-end termination,
- Maximum operating temperature.



Averaging or discrete point measurement available upon request.

JMS will generate a drawing for your assembly.

CENTERPOINT



MI CABLE DESIGN AND CONSTRUCTION

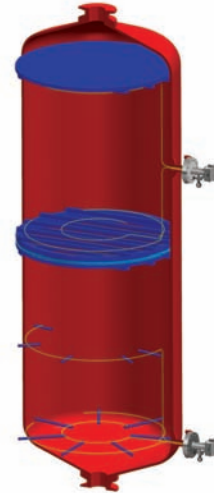
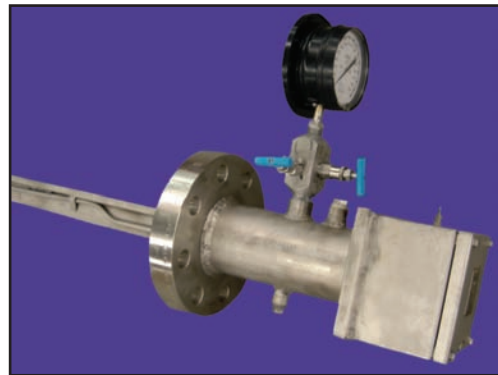
DESIGN

- CenterPoint MI cables are 0.070" thick, double-wall design with a 5/16" sheath O.D.
- First wall is 0.035" overlapping second wall of 0.035"
- Second wall acts as a flexible protective Thermowell wrapped around a flexible heavy walled thermocouple
- Single CenterPoint MI cable can house 19 points of temperature indication, greatest in the industry
- CenterPoint sheath materials are available in any metallurgy
- Thermocouples are available in any calibration
- A single CenterPoint assembly can be designed for complete coverage of a single catalyst bed

Each CenterPoint assembly is custom designed to meet the specification of the Process Licensor, Engineering Company and End User

CONSTRUCTION

- Double wall construction allows the MI cable to be welded to the flange face without damage to the cable caused by localized heat buildup during the welding procedure
- Drawing and Annealing sheath material provides a flexible housing for the thermocouples
- Restricting process flow (should the sheath integrity become breached) is tightly packed Magnesium Oxide insulation
- No special tools necessary for making long bends
- Tubing benders required for tight radius bends



COLD END DESIGN

- Pressure gauge directly tied to flange penetration creating secondary safety system
- Eliminates the need for additional welded or flanged safety chamber
- Reduced flange face penetrations maintains flange integrity
- Double block and bleed valve designed to bleed off trapped hydrogen or process fluids
- Each junction is equipped with a 10,000 psi pressure fitting,
- All welds are full penetration welds

CenterPoint provides optional secondary containment chambers available to meet the design needs and specifications of the customer

DIAGNOSTIC SYSTEMS

- Is process flow distribution a problem?
- Are quench zones working properly?
- Are new distribution trays necessary?
- Is process channeling occurring?
- Does the reactor exhibit areas of localized catalyst coking?
- Are heat related problems causing out-of-specification products?

SAFETY BENEFITS

- *Rapid Speed of Response time: Real time temperature measurements*
- *96% of a 100 degree step change in 3 to 8 seconds*
- *Eliminate temperature excursions on high temperature, high pressure*
- *Radial spread determines "hotspot" locations near reactor walls*
- *Reduce/ replace many reactor skin thermocouples*
- *Can be tied into the EMS system*
- *Redundancy – A duplicate sheath can be installed alongside the original at time of installation*

Can put as many temperature sensors into the reactor bed at any discreet point location in the catalyst bed where you want "real-time" temperature indication.

PROCESS BENEFITS

- *Greater process control*
- *Increased productivity on conversion reactors*
- *Flow distribution monitoring*
- *Creating a complete horizontal and vertical temperature profile*
- *Determining any process channeling*
- *Eliminating "blind spots"*
- *Eliminates low pressure areas around pipewells*
- *"Mirror image" thermocouple pattern creates a complete horizontal & vertical temperature profile*
- *Help determine the necessity of new reactor internals (i.e. distribution trays, quench zones)*
- *Monitoring optimum regeneration on naphtha reforming catalyst*
- *Finding localized "hotspots" in the catalyst bed*
- *Monitoring catalyst temperature during critical Startup Procedures*

Greater temperature control means increased production on conversion units such as Hydrocrackers, Naphtha Reformers, Dewaxing Units and Styrene Monomer Units

PROCESS LICENSORS

- Reduced number of nozzles and size
 - Reduces cost of manufacturing
 - Reduced number of penetrations
 - Less Exposure risks
 - Increased structural integrity of reactor
 - 1" nozzle: 48 temperature indication points
- Enhanced operational information and process control of unit
- Eliminates large bundles of Thermo-couple cables and pathways for process flow that they can create

ENGINEERING COMPANIES

- Reduced number of nozzles
- Reduces cost of thermometry and maintenance platforms
 - Locate nozzles on one side of reactor for ease of design and maintenance
- Reduced cost compared to flexible thermocouple technology
 - Increased number of temperature points
 - Reduced installation cost
 - Eliminates expensive cranes used to install pipewells
 - Reduced number of MI cable reduces assembly cost

END USERS

- Reduces the overall cost of building
- Often times can install 3 times as many TI points for the same cost as using traditional thermometry
- Ease of catalyst loading and unloading, system stays in place and will not interfere with dense loader
 - No removal / replacement of horizontal pipewells when loading catalyst
 - Will not create a "shadow" side on back of pipewell when loading catalyst