



Instrumentation for Nuclear Applications

Delta Mobrey - more than just a name, it's a heritage!

As experts within the field of process instrumentation we have a range of products and services designed and approved for the nuclear sector. All of which can be specifically customised to meet the exact requirements of your plant. Our staff are experts in their field and are available to provide consultancy and assistance where needed.

Our expertise is garnered from over 100 years of experience within process instrumentation. Whilst our name Delta Mobrey may be new, our heritage certainly isn't. Reflecting back, we have been known as Bestobell Mobrey or Rosemount Measurement, part of the Emerson Group, before merging product ranges.

The Mobrey range of products was assigned to Delta Controls in 2019. As part of the merger and to reflect the product brands we became Delta Mobrey in 2019. So whilst the company name is new, the industry expertise and understanding isn't. Our product range is enhanced as is our level of expertise and customer experience.

A Century of Process Solutions

- 1904** Ronald Trist patented the "SEA Ring" gland packing ring for boiler house steam engines.
- 1928** Founding of Ronald Trist Co. Ltd.
- 1947** Chief Engineer Leonard Bomyer develops a magnetic level switch, named the Mobrey (an anagram of his name).
- 1950** Delta Controls founded with the development of Pressure & Temperature switches.
- 1956** Delta Controls chosen for first commercial nuclear reactor.
- 1975** Development of classified and non-classified nuclear instrumentation.
- 1976** Acquisition of Meterflow and Sparling flow meters.
- 1980** Smart HART pressure transmitters developed.
- 1988** Meggit plc acquires KDG Instruments Ltd.
- 1990** KDG Mobrey formed.
- 1991** World's first Smart Ultrasonic Level Transmitter developed.
- 1999** Flow, Density, Viscosity, Hydrastep™ and Hydratect™ products added via acquisition by Roxboro Group.
- 2000** Global expansion of offices across Europe, USA, Middle East and Asia.
- 2005** Mobrey brand becomes part of Emerson Process Management.
- 2019** Delta Mobrey formed with the acquisition of Mobrey products and technologies from Emerson.



Introduction

Delta Mobrey has been designing and manufacturing instrumentation for the nuclear industry for over 60 years, beginning with the world's first commercial reactor Calder Hall at the UK's Sellafield site.

As specialists in pressure, temperature and flow instrumentation, Delta Mobrey has provided a range of generic and bespoke instruments to the industry across all the UK Nuclear Fleet including Magnox, AGR, PWR and PFR.

Delta Mobrey has also worked extensively on decommissioning projects, fuel processing and reprocessing, working with Sellafield (formerly BNFL), Westinghouse and the UKAEA.

Available instruments include products that meet the RCC-E and IEEE Class 1E requirements for seismic and radiation endurance, the IEEE tests are equivalent to RCC-E level K2. Many products also meet SIL 2 requirements and numerous international Hazardous Area approvals.

Products are used within containment, in the nuclear island, in safety shut down applications, critical areas of process control, alarm and general process monitoring.

Delta Mobrey has worked on many international projects for over 40 years in locations including China, Sweden, Finland, South Korea, the USA, Canada, India and Spain on PWR, BWR and CANDU reactor types.

Microswitches

Delta Mobrey's own design of the Hermetically Sealed Microswitch has been tested and passed the DBE LOCA event after thermal and radiation aging.

Housings

Our all stainless steel construction provides the highest quality enclosures for all the nuclear qualified products.

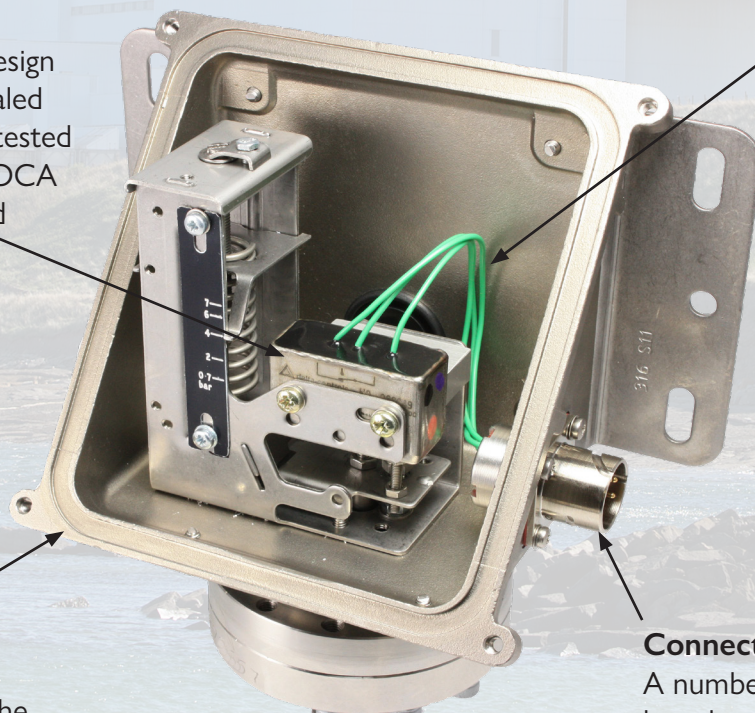
Wires

All wires used are Habia with radiation resistant sleeving (actual wires may have a different colour).

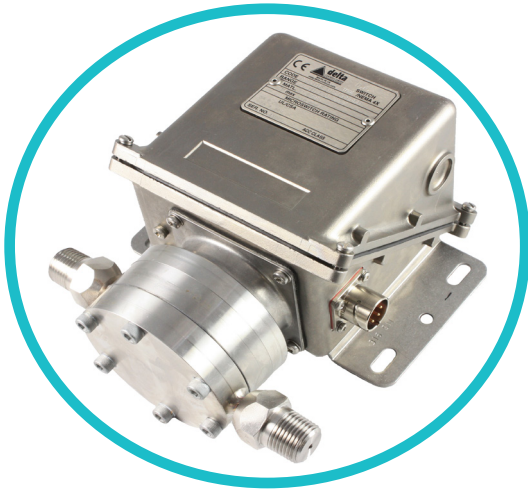
Connectors

A number of different connectors have been tested on our products including the Harting 7D, the Souriau 8N45S and the EGS Quick Disconnect Connector(QDC).

The inside of a nuclear switch showing the microswitch, mechanism, wires and connector.



Nuclear Instrumentation Overview



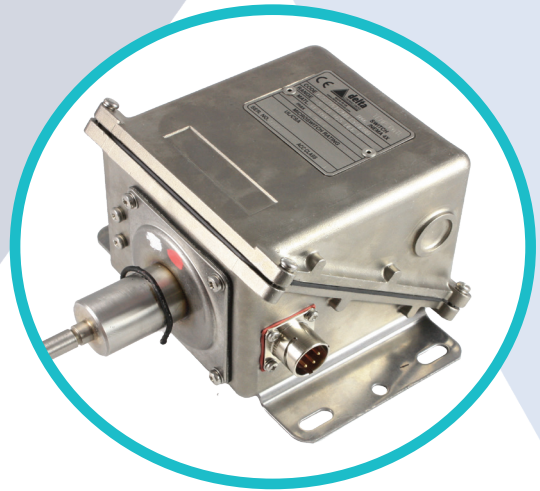
Nuclear 300 Series
Differential Pressure Switch



Nuclear S20 Series
Pressure Switch



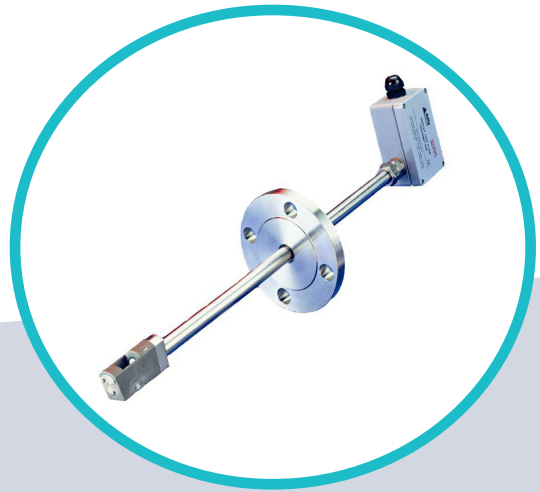
Nuclear 200 Series
Pressure Switch



Nuclear 700 Series
Temperature Switch



Fast Response
Temperature Switch



Air Flow Transmitter / Switch

Nuclear Switch Test Programme

Nuclear Product Qualification

The Instrumentation used in the Nuclear Island of the Power Plant is required to survive seismic and radiation exposure of different severity levels depending on the location of the plant and application.

Delta Mobrey has subjected various instruments to testing regimes that meet the requirements of IEEE Standard 323-1974, IEEE Standard 344-1975 and the RCC-E Code (Design and Construction Rules for Electrical Equipment of Nuclear Islands).

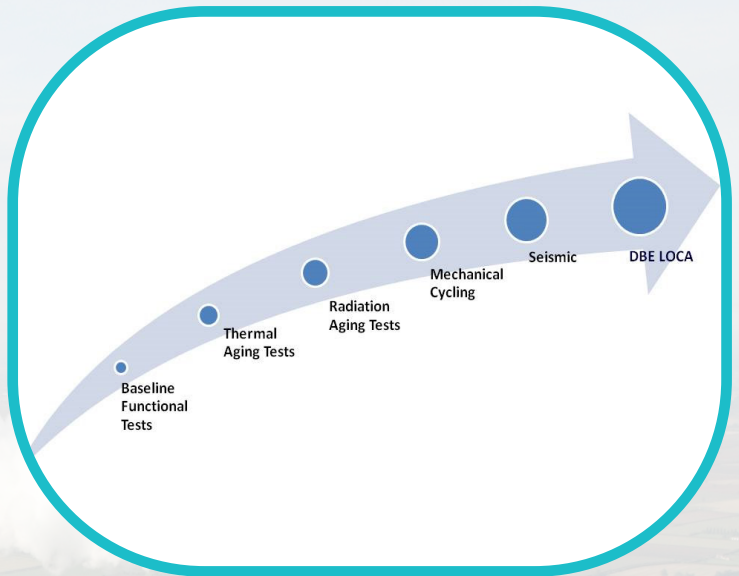
This qualification involves the accelerated ageing of the products (thermal aging, radiation aging, mechanical cycling) before subjecting them to SSE/DBE seismic profiles and finally a LOCA/HELB accident simulation. The product's performance was checked before and after each test, comparing the baseline functional tests conducted at the beginning of the programme.

Thermal Aging

The switches were thermally aged at 122°C for 1053 hours to simulate an end-of-life condition after 20 years. This accelerated aging is performed according to the Arrhenius model and based on the lowest activation energy of the non-metallic materials used in construction.

Radiation Aging

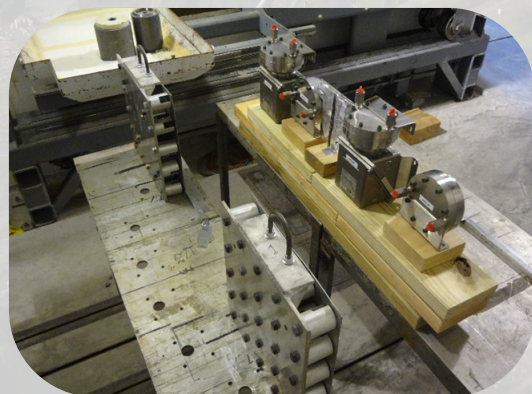
A number of the switches were exposed to a Total Integrated Dose (TID) of 17.82MRads at a rate of 0.25MRads/hr using Cobalt 60 gamma rays to achieve the end-of-life conditions expected after being exposed to both normal and accident conditions. Other switches were exposed to a TID of 27.5MRads.



Baseline Functional Testing

These tests, designed to establish baseline conditions prior to testing, included:

- Contact Rating
- Insulation Resistance
- Operability



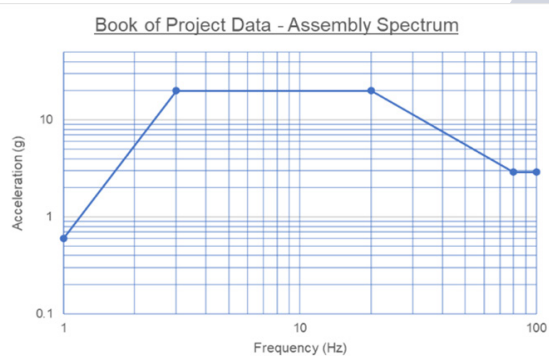
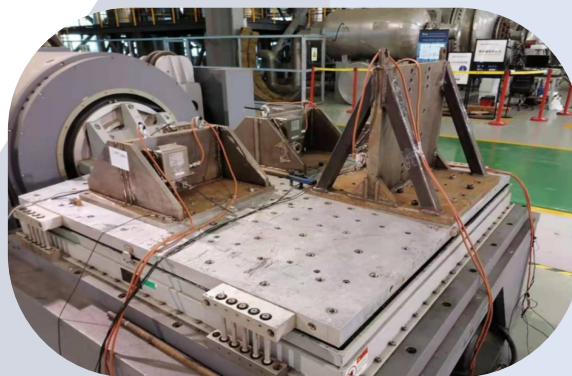
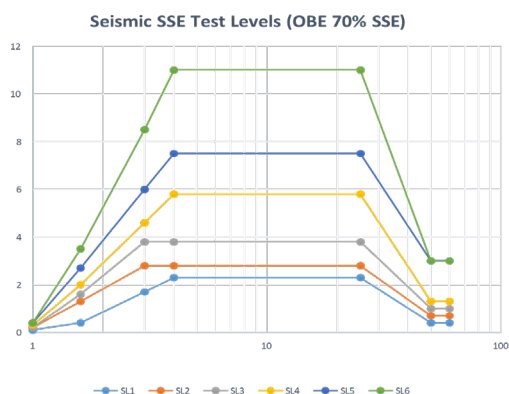
Delta Mobrey switches undergoing radiation testing

Mechanical Cycling

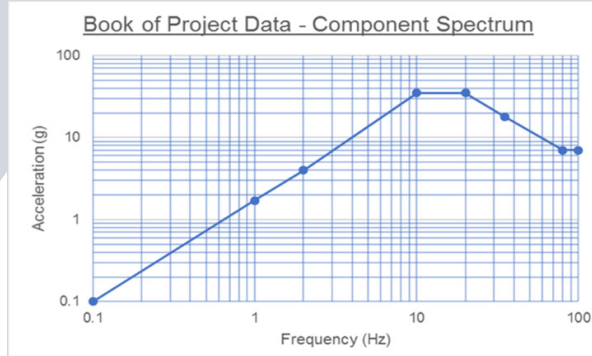
The Switches were cycled a minimum of 1000 times, actuating the switches for 15 seconds then de-actuating them for 15 seconds, while monitoring and recording the current across a precision resistor throughout the test to ensure correct operation. The purpose was to mechanically age the product by simulating the typical number of actuations over a 20 year period for a specific alarm application.

Seismic Qualification

In separate test programmes Delta Mobrey's products were seismically tested using the random multi-frequency (RMF) test requirements of Standard IEEE 344-1975/1987 and were subjected to triaxial RMF test levels as shown below, and also to the spectra as defined in the RCC-E Code.



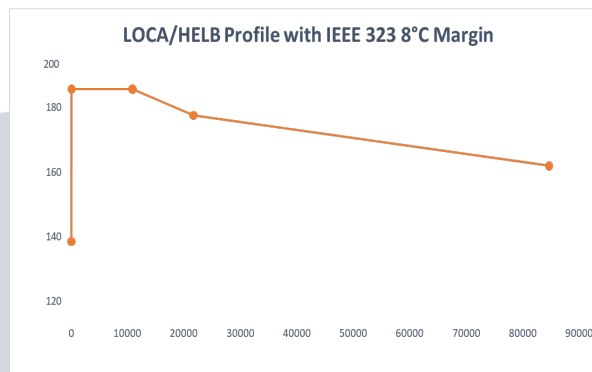
RRS for Assemblies Horizontal & Vertical Spectrum



RRS for Components Horizontal & Vertical Spectrum

LOCA/HELB Accident Simulation

Following the aging programme and the seismic tests the products were subjected to a HELB (High Energy Line Break) / LOCA (Loss of Coolant Accident) simulation. This exposed the products to 173°C superheated steam for 3 hours at 550KPa abs, and 160°C for 6 hours and 24 hours at 120°C with saturated steam.



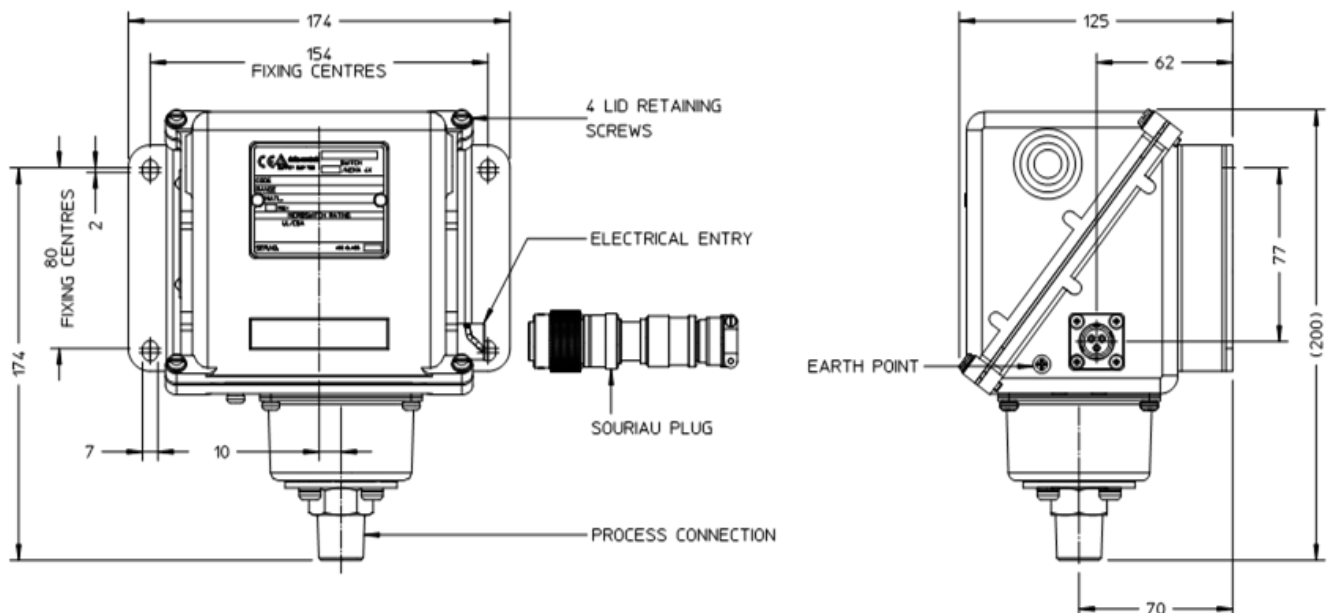
200 Series

- Qualified Harting 7D, EGS QDC and Souriau connectors available
- Delta Mobrey Microswitch tested to meet requirements of RCC-E K2
- Best in class accuracy of $\pm 0.5\%$
- FEP and EPDM seals and gaskets suitable for exposure to radiation
- Weatherproof and Flameproof models Ex d IIC - ATEX
- Ranges available up to 75 Bar (1,000 psi)
- Precision stainless steel mechanism for arduous atmospheres and high humidity
- Set point adjustable over whole range against calibrated scale with tamperproof adjustment
- Precise and accurate operation guaranteed by use of hydraulic formed bellows or capsule stack
- Models for fixed and adjustable switching differential
- Safety vented or blow out device as standard



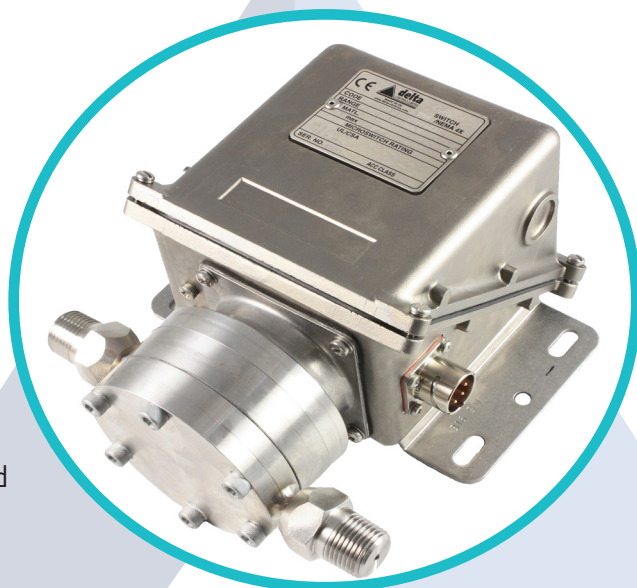
*Nuclear 200 Series
Pressure Switch*

Dimensions



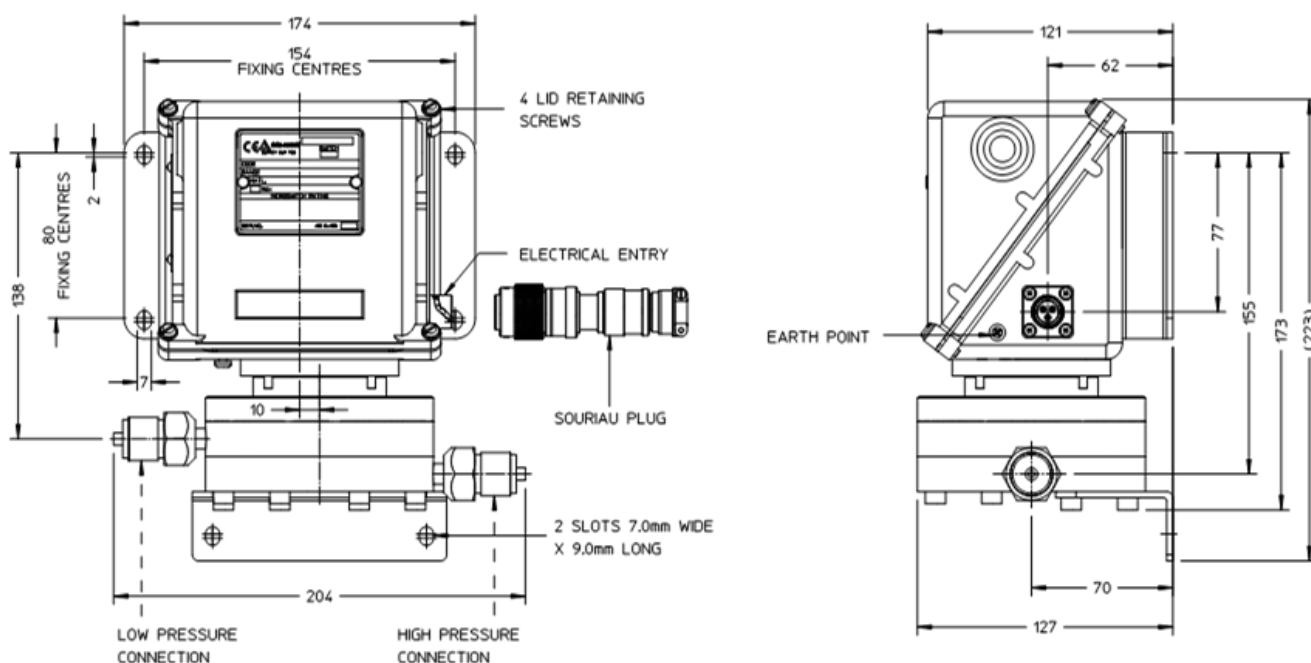
300 Series

- Qualified Harting 7D, EGSQDC and Souriau connectors available
- Delta Mobrey Hermetic Microswitch tested to meet requirements of RCC-E K2
- Best in class accuracy of $\pm 1\%$
- FEP and EPDM seals and gaskets suitable for exposure to radiation
- Weatherproof and Flameproof models EEx d IIC - ATEX
- Static pressure up to 250 bar (3500 psi)
- Precision stainless steel mechanism for arduous atmospheres and high humidity
- Set point adjustable over whole range against calibrated scale with tamperproof adjustment
- Models for fixed and adjustable switching differential
- Safety vented orblow out device as standard 300



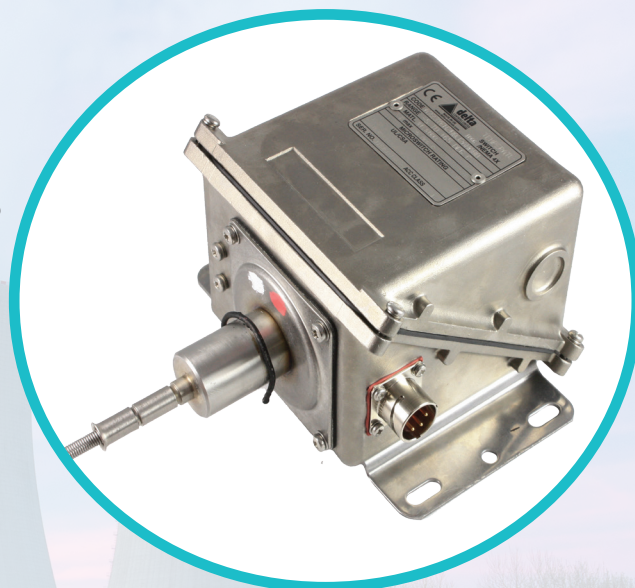
*Nuclear 300 Series
Differential Pressure Switch*

Dimensions



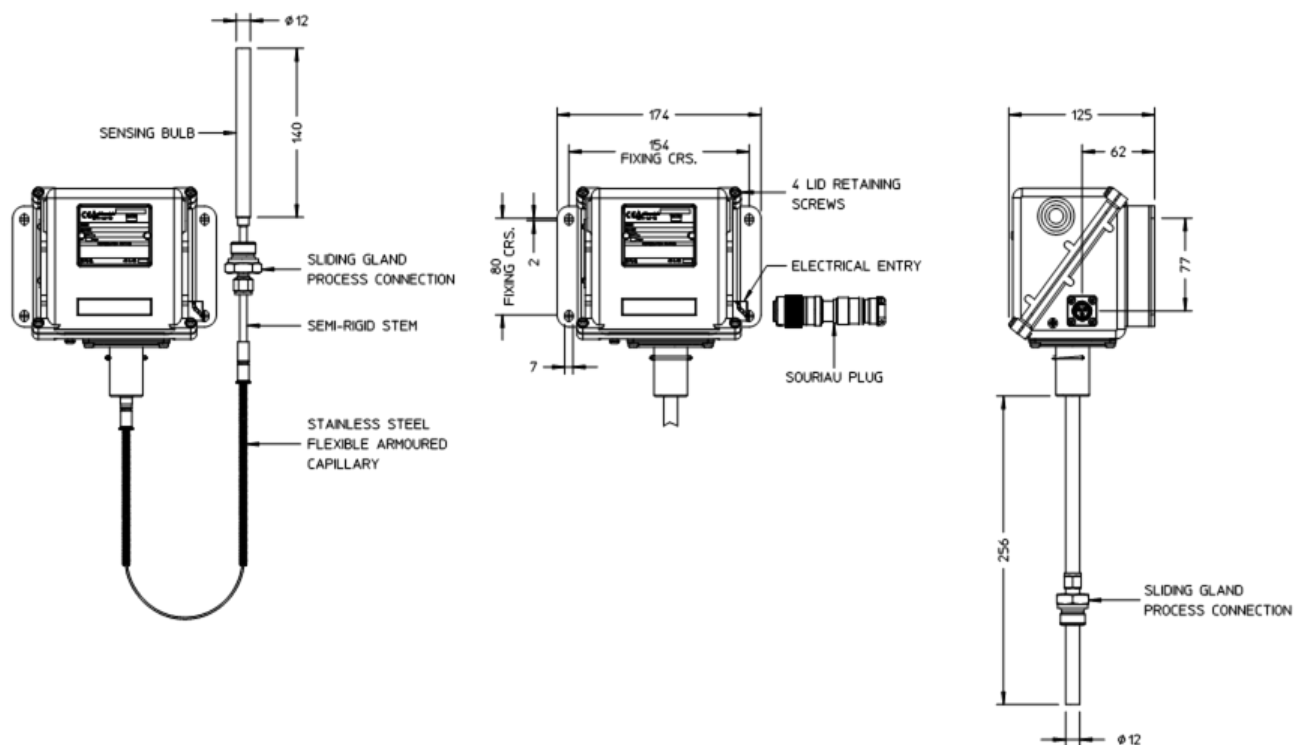
700 Series

- Qualified Harting 7D, EGSQDC and Souriau connectors available
- Delta Mobrey Microswitch tested to meet requirements of RCC-EK2
- Best in class accuracy of $\pm 0.5\%$
- FEP and EPDM seals and gaskets suitable for exposure to radiation
- Weatherproof and Flameproof models EEx d IIC -ATEX
- Set point ranges up to 300°C (580°F)
- Rigid and semi-rigid thermal system options
- Precision stainless steel mechanism for arduous atmospheres and high humidity
- Set point adjustable over whole range against calibrated scale with tamperproof adjustment
- Models for fixed and adjustable switching differential
- Safety vented or blow out device as standard



*Nuclear 700 Series
Temperature Switch*

Dimensions



720 Series

Fast reaction air temperature switches are used throughout a nuclear powerplant to detect sudden rises in ambient temperature. Delta Mobrey has optimised the design of this product to react very quickly to temperature change and provide fast early warning of possible problems in the plant.

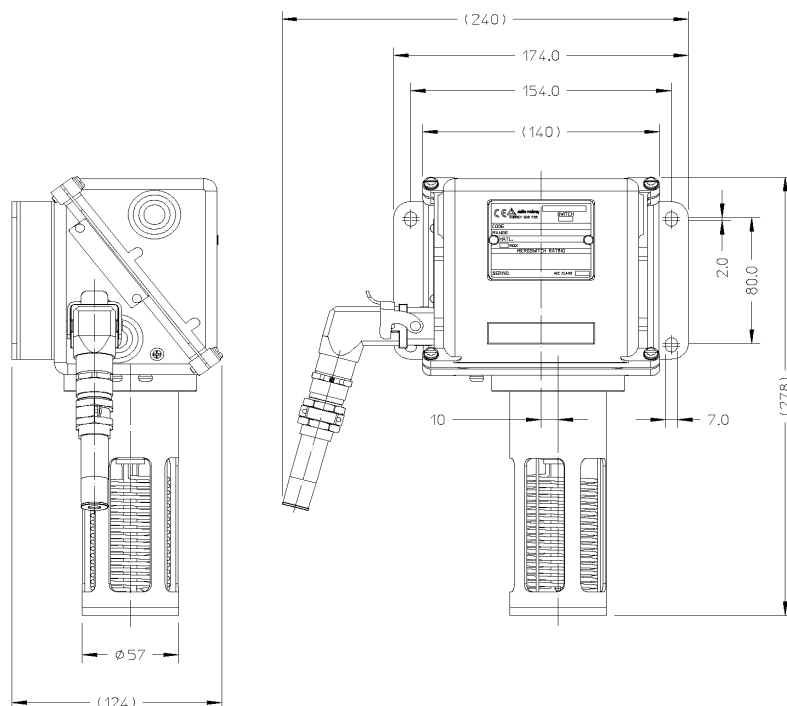
This model consists of a sensing element manufactured from thin walled copper tube, filled with a volatile fluid. By keeping the length-to-diameter ratio high, the surface area of the sensing element is maximised, achieving a faster response to temperature changes than more traditional types.

The element is coiled into a helix and mechanically supported and protected by a shroud without impairing sensitivity to changes in ambient temperature. Response times will vary depending on the movement of the surrounding atmosphere. Depending on the location, air movement and ambient temperature, response times can be expected within seconds.



*Fast Response
Temperature Switch*

Dimensions

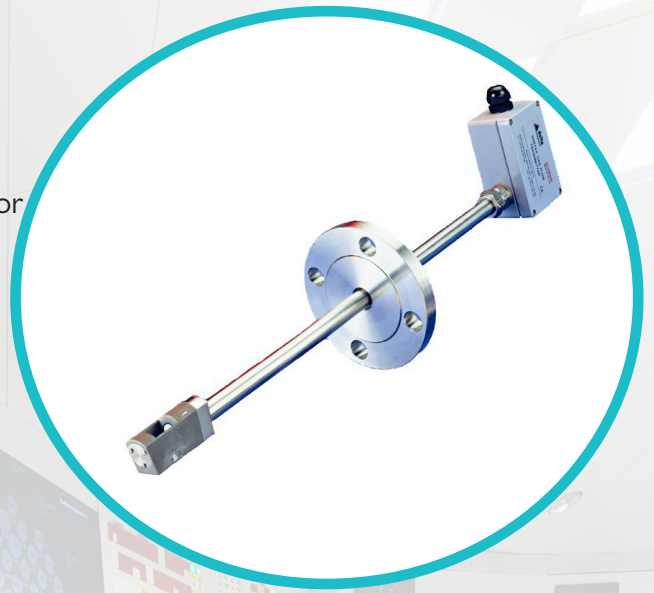


588 Series – EMPHASIS Assessed – Smart Instrument

The 588 Series of Flow Transmitters and Switches have been used in a variety of applications in the nuclear industry including HVAC systems and other air flow ducting where positive measurement of Flow is critical for plant and personnel safety. The 588 has also undergone EMPHASIS Assessment for use in the UK Nuclear Industry.

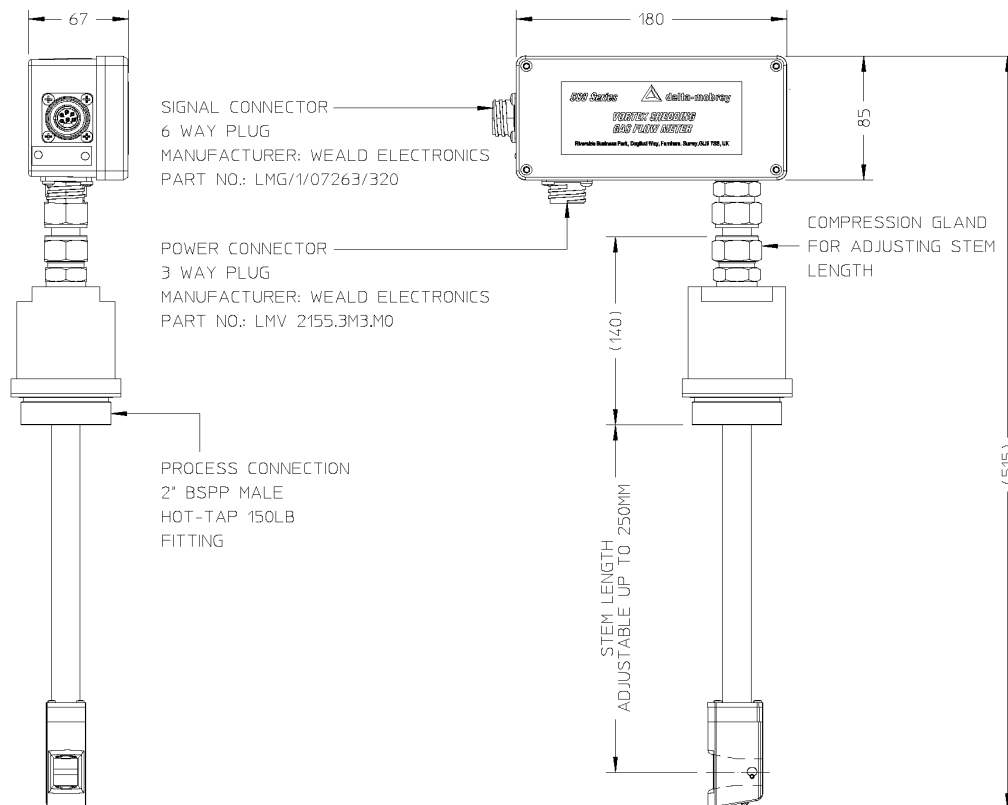
The latest variant of the Flow Transmitter has an integrated switch for simple alarm applications:

- The Transmitter is SIL 1 Level certified.
- Flow rates from 0.8 m/s and up to 38.5 m/s
- Small bore diameter flow transmitters are also available



Air Flow Transmitter / Switch

Dimensions



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Delta Mobrey has a worldwide network
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For more information...

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