

Glossary of Terms

Absolute Pressure

Absolute pressure is pressure measured with reference to a **Perfect Vacuum**.

Absolute Zero

Absolute zero is the term used to define the pressure of a **Perfect Vacuum**.

Adjustable Differential

An Adjustable Differential is a term used to describe a switch option that allows the **Switching Differential** or **Dead-band** to be adjusted by the user.

Annealed

Annealing is a process of heat treatment that alters the microstructure of a material causing changes in properties such as strength, hardness and ductility. Delta anneals certain stainless steel **Wetted Parts** to improve their resistance to sour and corrosive services such as those common in the oil and gas industry.

Atmospheric Pressure

Atmospheric Pressure is the force per unit area exerted against a surface by the weight of air above that surface in the Earth's atmosphere. Atmospheric pressure varies widely on Earth, from as little as 830mbar to as much as 1085mbar, depending on elevation above sea level and climatic conditions. At Delta's factory, atmospheric pressures are typically in the region on 1012mbar. The relevance of atmospheric pressure on the instruments Delta makes is that when measuring gauge pressures there is a potential for an erroneous reading if the local atmospheric pressure, to which the measurement is referenced, differs from that at which the instrument was calibrated. These errors are usually small, however can become significant if the pressure range of the instrument is very low.

Buna-N

Buna-N, otherwise known as **Nitrile**, is a synthetic rubber copolymer and is the material of some of the o-rings Delta uses in its diaphragm operated pressure switches. Buna-N / Nitrile has an ability to withstand temperatures in the range of -40°C to 108°C. For higher process temperatures an alternative material such as **Viton** should be selected.

Chemical Seal

A Chemical Seal, or a **Diaphragm Seal** as they are sometimes known, is an accessory that is fitted to the process connection of an instrument to create a barrier between the process medium and the **Wetted Parts** of the instrument. They normally consist of a diaphragm behind which a suitable fill fluid is used to transfer pressure from the diaphragm of the Chemical Seal to the sensor of the instrument. They are typically used where there is a risk that the process medium may solidify inside an instrument's process connection and prevent it operating correctly or where hot or corrosive process mediums are used and it is desired to keep these away from the instrument.

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Deadband

Deadband or **Switching Differential** as it is sometimes known is a characteristic of all microswitches and describes the difference in value between the **Set-point** and the **Reset-point**. In a Pressure or Temperature Switch they are typically defined as a pressure or temperature value. The size of the Deadband is primarily a function of the microswitch itself, however other factors such as friction in the mechanism that links the sensor to the microswitch can add to the Deadband considerably. Deadbands can either be fixed or adjustable.

Diaphragm Seal

See **Chemical Seal**.

Differential Pressure

Differential Pressure is the difference between two pressures P1 and P2 independent of the local **Atmospheric Pressure**. When $P1 = P2$ the differential pressure = 0.

Environmentally Sealed

Environmental sealing is a method of sealing microswitches such that easy ingress of local atmosphere is prevented. In environmentally sealed microswitches, a sub-miniature microswitch is housed within a metal can with the microswitch plunger protruding through an elastomer seal. This elastomer seal helps keep out unwanted dirt and moisture but over prolonged periods of time or in particularly harsh environmental conditions can eventually degrade. For guaranteed ingress protection **Hermetically Sealed** microswitches can be used.

Explosion Proof

An Explosion Proof Switch is one that has been designed to operate safely within a Division 1 or 2 **Hazardous Area** as defined by the North American standard **NEC® 500**. The basic concept of protection is for the enclosure to contain the explosion and prevent flame propagation in the event that a flammable gas atmosphere became trapped inside and ignited by a spark from the microswitch.

The term Explosion proof is often used interchangeably with the term **Flameproof**, however Explosion Proof is a term unique to the **NEC® 500** whereas **Flameproof** is a term used by both **NEC® 500** and **IECEX** and **ATEX**.

Falling Set-point

A falling set-point is one that is reached from an operating value above the **set-point**.

Field Adjustable

Field adjustable means that the **Set-point** can be adjusted by a user 'out in the field' as opposed to needing to be returned to a calibration lab. All of Delta's switches are Field Adjustable.

Fixed Differential

A fixed differential is one in which the **Switching Differential** cannot be adjusted. The value of the differential will be a function of the microswitch and the parts used to build the Switch and the actual value achieved at calibration recorded on the Certificate of Test and Conformity.

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Flamepath

A flamepath is the term used to describe any potential route that a flame could take to exit a **Flameproof** or **Explosion proof** enclosure. Examples include: the electrical entry thread, lid thread, range adjuster thread, reamed holes through which the push rod passes, etc. The number of threads, the fit of male and female threads, the fits of shafts and bushes and the wall thickness of the enclosure are all critical for maintaining safety and are often defined as 100% inspection features on the manufacturing drawings such that their effectiveness as a **Flamepath** can be guaranteed.

Flameproof

A Flameproof switch is one that has been designed to operate safely within a Zone 1 or 2 Hazardous Area as defined by **ATEX**, **IECEX** and the **NEC® 505**. The basic concept of protection for ATEX and IECEX is to contain the explosion and quench the flame, whereas in **NEC® 505** it is to contain the explosion and prevent flame propagation.

Practically this means designing enclosures that have thick enough walls and suitably specified **Flamepaths** in order that the explosion can be contained.

Gapped Switching

Gapped switching is a method of adjusting a DPDT switch's synchronisation such that a small gap of about 2 to 5% of the span exists between the set point of each of the two microswitches.

Gauge pressure

Gauge pressure is pressure as measured with respect to atmospheric pressure. It is generally assumed to have a positive value. Negative values, for example pressures that are lower than atmospheric pressure are referred to as **Negative Gauge Pressure**.

Hastelloy

Hastelloy is the registered trademark of Haynes International and is the prefix name of range of highly corrosion-resistant metal alloys. The predominant alloying ingredient is typically nickel, the high cost of which makes Hastelloy an expensive material when compared to the more commonly used stainless steels used in the wetted parts of Delta Switches.

Hastelloy is chosen where the process medium is severely corrosive or contains a high hydrogen sulphide content that can cause problems with stainless steel. It is often used in applications where **NACE** compliance is required.

Hermetically Sealed

A hermetically sealed microswitch is one in which ingress of local atmosphere is guaranteed to be prevented. Hermetically sealed microswitches consist of a sub-miniature microswitch housed in a metal can that has been welded closed and then had the air inside removed and replaced with an inert gas. Being welded, there is no possibility of local atmosphere entering and the inert gas inside prevents corrosion of the switch contacts.

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HI/LO or High / Low switching

Hi/Lo switching involves having two independent Set-points in one enclosure, one set to a High value and one set to a Low value.

Intrinsically Safety

An Intrinsically Safe Switch is one that has been designed to operate safely within a Zone 0, 1 or 2 Hazardous Area as defined by **ATEX**, **IECEX** and the **NEC® 505**. The basic concept of protection for ATEX and IECEx is to contain the explosion and quench the flame, whereas in **NEC® 505** it is to contain the explosion and prevent flame propagation.

Practically this means designing enclosures that have thick enough walls and suitably specified **Flamepaths** in order that the explosion can be contained.

Kapton

Kapton is a polyimide film developed by DuPont that is used as a diaphragm material in Delta Switches. It is usually used behind the process diaphragm and reduces friction as the process diaphragm flexes against the collector plate or piston.

Lower Range Limit (LRL)

The Lower Range Limit is the lowest value at which a **Set-point** can be set. At the LRL, only a falling **Set-point** can be set. The lowest value a rising **Set-point** can be set is a value equal to the LRL plus the Deadband. However, in both cases it is not recommended to place a **Set-point** this close to the LRL as while the life will be excellent, the accuracy will be poor.

Maximum Working Pressure (MWP)

The Maximum Working Pressure (MWP) is the maximum pressure to which the instrument can be exposed without any shift in the **Set-point**. Other terms that mean the same, include **P_{max}**, Overpressure, Overload.

Midscale Fall

Midscale fall is the term used to describe the default **Set-point** applied to a Switch when the customer has not defined any specific requirement. As the name suggests this **Set-point** is in the middle of the range and calibrated as a **Falling Set-point**.

Monel

Monel is a trademark of Special Metals Corporation for a series of nickel alloys. This material is often used as a **Wetted Parts** option due to its high corrosion resistance and in Delta Switches is often chosen where compliance with **NACE** is required or in applications using sea water.

Negative Gauge Pressure

Negative Gauge Pressure is pressure measured with respect to, and below, **Atmospheric Pressure**.

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Nitrile

See **Buna-N**.

Normal Pressure

Normal Pressure or **Operating Pressure** is generally defined as the pressure in a particular application that can be expected under normal operating conditions. It is from this point that a **Set-point** would usually be reached. If the normal pressure is above the **Set-point**, then the **Set-point** would be said to be a **Falling Set-point**. Conversely, if the Normal or **Operating Pressure** was below the **Set-point**, then the **Set-point** would be said to be a **Rising Set-point**.

Operating Pressure

See **Normal Pressure**

Partial Vacuum

A partial vacuum is the term used to describe any practically achievable vacuum above the, impossible to achieve, **perfect vacuum**.

Perfect Vacuum

A vacuum is a volume of space that is empty of matter. A perfect vacuum is one in which there are no particles at all, which is impossible to achieve in practice. When Delta manufacturers instruments to measure **absolute pressure**, a reference chamber is added to the instrument on the side of the sensor normally exposed to atmospheric pressure. Air is removed from this chamber to create a **partial vacuum**. While it is impossible to create a perfect vacuum, the **partial vacuum** we can create is close enough for the difference to be negligible.

P_{max}

See **Maximum Working Pressure (MWP)**.

Proof Pressure

The proof pressure is typically defined as being $1.5 \times P_{max}$ and is the pressure up to which the instrument can be exposed without catastrophic failure of any of the pressure containing parts. At pressures above P_{max} and up to Proof Pressure there may be a shift in the **Set-point**. At pressure above Proof Pressure, catastrophic failure is possible.

Range

The range of an instrument is the range of values between which a **Set-point** can be placed. While a **Set-point** can be set anywhere within the range, for best balance of accuracy and life, it is preferable to select a range such that the **Set-point** can be set within the middle third of the range.

Reset-point

The rest point is the point at which the microswitch returns to its original state prior to the **Set-point** having been reached.

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Rising Set-point

A rising set-point is one that is reached from an operating value below the **Set-point**.

Set-point

The set-point is the value at which a Switch is set to actuate the microswitch. Set-points are defined as either a **Rising Set-point** or a **Falling Set-point** depending on the application.

SMART

The term SMART refers to any instrument that contains a microprocessor and therefore has computational capabilities.

Span

The span is defined as the difference between the **Upper Range Limit** and the **Lower Range Limit**.

Switching Differential

See **Deadband**.

Turndown

Turndown is a term specific to transmitter products and describes the ability of the instrument to be adjusted such that the output is scaled to a desired range by a turndown factor. Delta manufactures loop powered transmitters which give an output of between 4 and 20mA where the 4mA output normally corresponds with the **Lower Range Limit** and the 20mA corresponds to the **Upper Range Limit**. The **Upper Range Limit** can be reduced by 'turning down' the instrument by any amount up to the maximum amount defined by the 'turndown ratio'. The purpose of this is to increase the 'resolution' of the output for any measurement range less than the standard range of the instrument.

For example; a standard model 387 pressure transmitter has a turndown ration of 4:1. For a model with a standard range of 0 to 10 bar, the output can be adjusted such that it reads 4mA at 0 bar and 20mA at 2.5bar.

Upper Range Limit

The Upper Range Limit is the highest value at which a Set-point can be set. At the URL, only a rising set- point can be set. The highest value a falling set-point can be set is a value equal to the URL less the Deadband. However, in both cases it is not recommended to place a Set-point this close to the URL as while the accuracy will be very good, the life of the sensor will be adversely affected.

Viton

Viton is a registered trademark of DuPont and is a synthetic rubber commonly used in o-rings. Viton o-rings typically have a temperature range of -29°C to 204°C and so are usually selected for higher process temperatures applications where **Nitrile / Buna-N** would not be suitable.

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Wetted Parts

Wetted Parts are all the parts of an instrument that come into contact with the process medium. Parts include; process connections, process diaphragms, o-rings, process flanges, etc.

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