IMPRESS
SENSORS & SYSTEMS

Unit 6 Mercury House, Calleva Park
Aldermaston, Berkshire, RG7 8PN
Tel: +44 (0)118 981 7980
Fax:+44 (0)118 981 7990
e-mail: sales@impress-sensors.co.uk
Website: www.impress-sensors.co.uk

Transducer and Transmitter Installation

App Note: IN 01

General points to consider

All Ashdown transmitters are designed to withstand the conditions normally found in process applications, however, for maximum instrument life and ease of maintenance the following guidelines should be observed.

1. If possible the transmitter should be mounted at ground or walk way level to ease access for installation, maintenance and calibration.

2. When the process conditions allow, transmitters should always be connected to the measurement point by suitable isolation valves at the process tapping point and also have isolation valving such as a directly mounted three-valve manifold for DP cells terminating the impulse pipe work to the transducer.

3. Do not mount transmitters in locations subject to vibration.

4. Ensure that the thermal operating limits of the measurement transducer and transmitter electronics are not exceeded and, for the longest life and highest stability, run the transducer/transmitter well within its rated temperature limits. Use unlagged impulse pipe work as thermal barriers to provide either cooling or heating to the ambient operating temperature.

5. Ensure that the wetted parts of the transmitter (including 'O' ring seals and gaskets) are chemically and thermally compatible with the process.

6. Any impulse piping between the process and the transmitter must accurately transfer the pressure present at the process taps to the transducer. Possible sources of error in this transfer are leaks; friction losses (especially in purged systems); trapped gas in a liquid line, or trapped liquid in a gas line causing a head error; and temperature induced density variations between impulse line legs causing a head error in DP applications.

The following recommendations are made to minimise possible errors:

a) Make the impulse piping as short as possible, taking into account the temperature limitations of the transmitter when used with very hot or very cold processes.

b) Piping should have a slope of at least 1 in 12 up towards the process connection for liquid and steam service and down towards the process connection for gas service. Avoid high points in liquid lines and low points in gas lines. On initial commissioning ensure all gas is vented from liquid impulse legs and all liquid is drained from gas impulse piping legs. On steam service, fill the impulse lines with water to prevent damage to the transmitter from live steam causing the thermal operating limits of the transmitter to be exceeded.

c) For DP applications keep both impulse pipe legs at the same temperature.

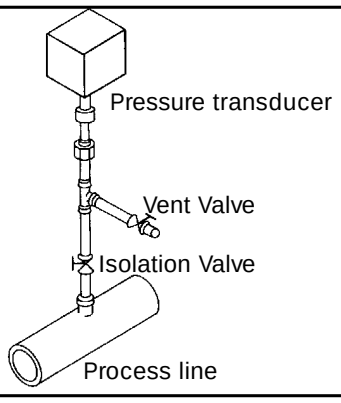
d) When a sealing fluid is used, ensure that the system is installed such that both piping legs for DP applications may be filled to the same level and will stay at the same level under operational conditions.

e) Use impulse piping of sufficient diameter to avoid frictional losses and if purging is used, make the purge connection close to the process taps and for DP measurements purge through equal lengths of the same pipe size. Do not purge through the transmitter.

Absolute and Gauge Pressure Measurement

Application Note: PM 01

There are three recommended installation arrangements for Absolute and Gauge measurement to cover gasses, liquids and vapours such as steam.



Gas Pressure Measurement

For non-condensing gasses, the tapping point should be made to the side or upper quadrant of the process line and fitted with a suitable process isolation valve.

The pressure transducer (transmitter) should be positioned above the tapping point with its process connection downwards to allow any condensate that may form to drain back into the process without blocking the impulse line.

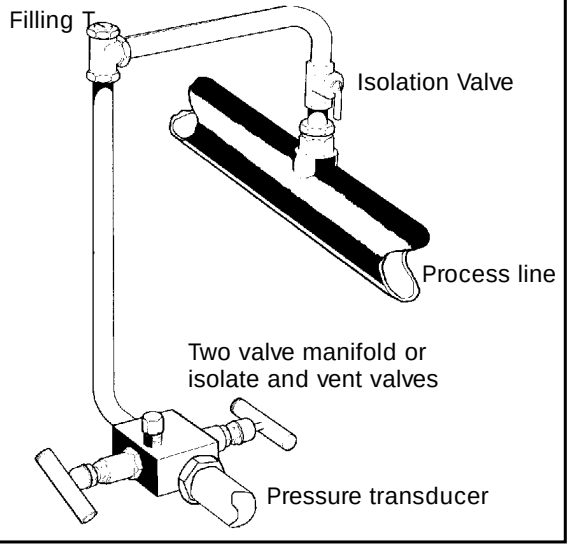
To ease service and commissioning the transducer should be fitted with an isolation valve and vent (or vent valve).

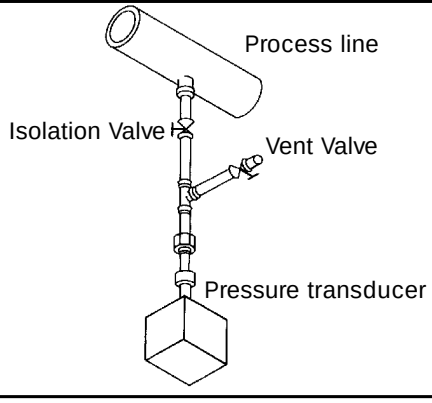
Vapour (Steam) Pressure Measurement

For vapour or steam service, the tapping point should be made to the side or upper quadrant of the process line and fitted with a suitable process isolation valve. The pressure transducer (transmitter) should be positioned below the tapping point so that the impulse line will stay filled with condensate in service. The distance below the impulse line should be chosen to ensure that adequate cooling occurs to prevent thermal damage to the transducer.

For steam service the impulse line **must** be filled with water prior to startup to prevent possible thermal damage to the transducer by live steam.

To ease service and commissioning the transducer should be fitted with an isolation valve and vent (or vent valve).





Liquid Pressure Measurement

For liquids, the tapping point should be made to the side or lower quadrant of the process line and fitted with a suitable process isolation valve. If sediments may be present, do **not** fit to the bottom of the process line.

The pressure transducer (transmitter) should be positioned below the tapping point with its process connection upwards (if possible) to allow any gasses that may form to vent back into the process.

To ease service and commissioning the transducer should be fitted with an isolation valve and vent (or vent valve).

Transducer and Transmitter Selection chart (Absolute and Gauge Pressure)

Gauge and Absolute pressure	Transducer Type	Transducer Series	Transmitter Series
Clean liquids and gasses.	BA-type, absolute pressure	RPT	APX, BPX, FPX
	BG-type, gauge pressure	RPT	APX, BPX, DSX, CSX, FPX
High viscosity liquids, liquids with solids in suspension.	FG-type, gauge pressure	RHT	AHX, BHX, FHX
	TG & TP-type, gauge pressure	RST	ASX, BSX, FSX, DSX, CSX
Food, brewing & dairy industries and other hygienic applications.	DG & FG-types, gauge pressure	RHT	AHX, BHX, FHX

Level measurement

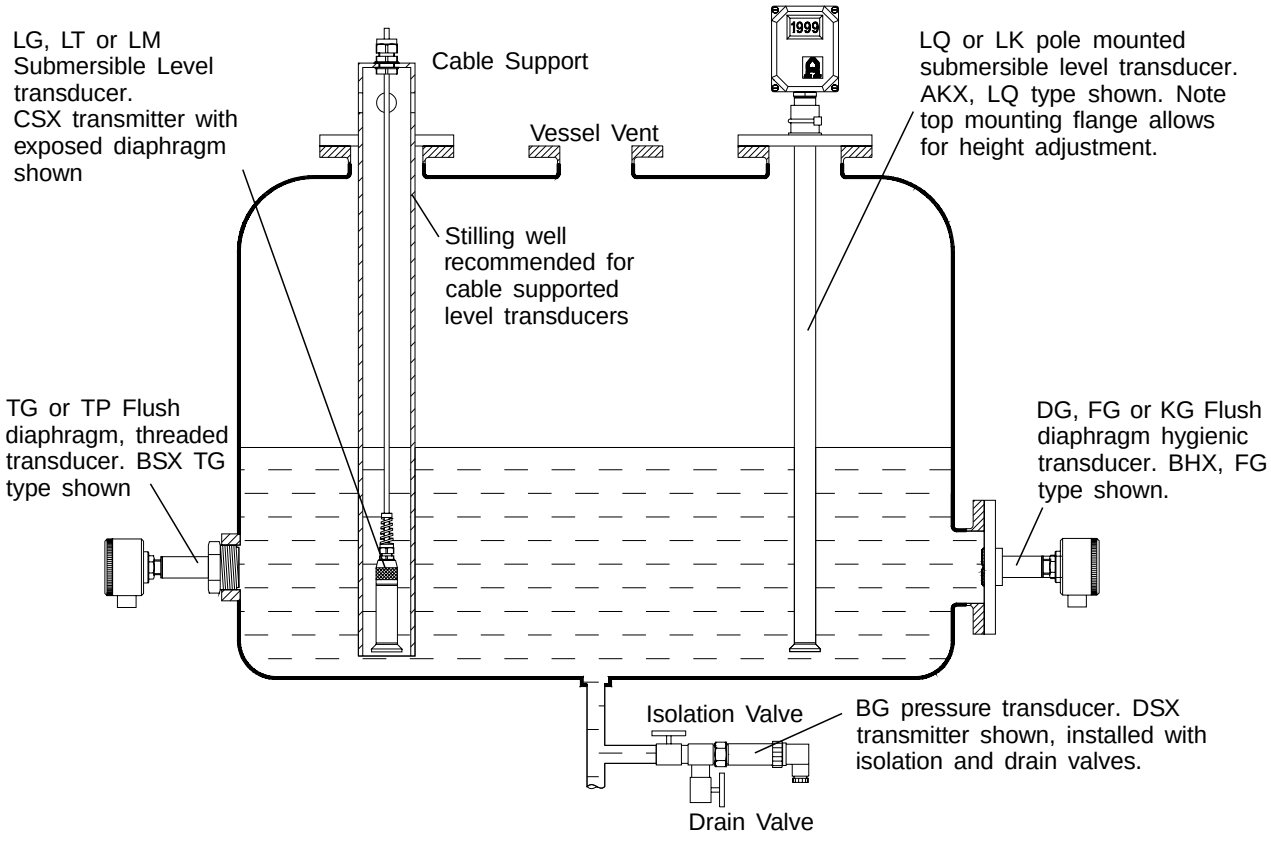
Application Note: G_L 01

Vented Vessels, Reservoirs and Bore-holes

The schematic illustrates a vented vessel fitted with typical examples of the various level transducer types available. The selection chart identifies suitable transducer types and relevant transmitter series to allow selection of an appropriate measurement solution. The M90 or S90 series of indicators can be used with either remote transducers ('R' Series) or any of the loop powered transmitters to form a complete cost effective measurement and control package where a system solution is required.

Transducer and Transmitter Selection Chart (Vented Vessels)

Measurement	Process Application	Transducer Type	Transducer Series	Transmitter Series
Vessels with external tapping points.	Clean Liquids.	BG	RPT	APX, BPX, DSX, FSX
	High viscosity liquids, or solids in suspension.	FG	RHT	AHX, BHX, FHX
		TG, TP	RST	ASX, BSX, DSX, FSX
	Food, brewing & dairy or hygienic applications	DG, FG, KG	RHT	AHX, BHX
Vessels without external tapping points.	Clean liquids.	LT	RLT	ALX, BLX, CSX
		LK	RKT	AKX, BKX
	High viscosity liquids, or solids in suspension.	LG	RLT	ALX, BLX, CSX
		LQ	RKT	AKX, BKX
	Food, brewing & dairy or hygienic applications.	LQ	RKT	AKX, BKX
	Bore-holes	LT, LM	RLT	ALX, CSX



Level Measurement

Application Note: DP-L 01

Pressurised Vessels

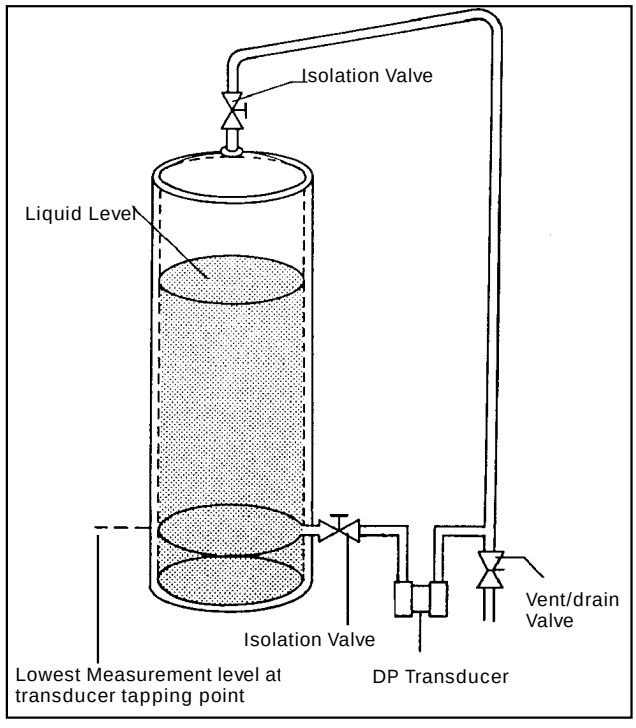
Non-VolatileFluid

In closed vessels any pressure at the top of the vessel will affect the pressure at the bottom. To measure the true level, the vessel top pressure must be subtracted from the pressure reading taken at the bottom of the vessel.

The level may be measured by taking a pressure tap from the top of the vessel to a differential pressure transducer which is also connected to a pressure tap at the low point of the vessel. The vessel pressure is now applied to both the measurement and reference sides of the transducer. The resulting differential pressure is proportional to the liquid height multiplied by the specific gravity of the liquid.

A typical installation arrangement for low viscosity liquids using a standard DP transducer is shown in the diagram.

If a high viscosity or liquid with solids in suspension is to be measured, a standard DP transmitter cannot be used as the process port connected to the bottom of the vessel could become blocked. A flanged DP or a transmitter with a remote seal should be used in these circumstances.



Pressurised Vessel Level - Non Volatile Fluid

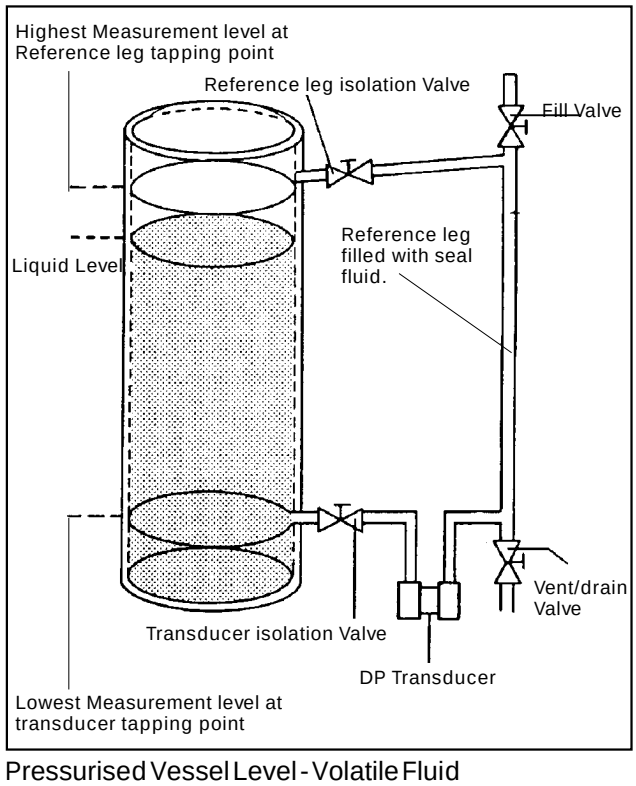
VolatileFluid

The basic measurement configuration is similar to the non-volatile fluid arrangement described above, however if the gas above the liquid condenses at the system operating temperature, the piping to the reference side of the transducer will slowly fill up with liquid creating a measurement error. To eliminate this potential error, the impulse pipe to the transducer reference port should be filled with condensate or a compatible fluid which has a specific gravity at least as high as the process fluid. This provides a reference port pressure that varies only with the top pressure of the vessel.

In this configuration the fluid-fill in the reference leg will exert a head pressure on the reference side of the transducer causing the output to be negative when the vessel is empty. This should be considered when selecting the FSD range of the DP transducer as DP transducers by design will only respond to a maximum negative pressure input of 50% FSD. It should also be remembered that the transmitter electronics will need to be have a zero offset applied to provide zero output at minimum vessel level.

If a high viscosity or liquid with solids in suspension is to be measured, a standard DP transmitter cannot be used as the process port connected to the bottom of the vessel could become blocked. A flanged DP or a transmitter with a remote seal should be used.

Alternatively a DP transmitter with two remote seals can be used. Whilst the initial transmitter cost is greater, the installation costs and long term costs of ownership are lower as the installation and maintenance of the fluid-filled reference leg is no longer required.



Pressurised Vessel Level - Volatile Fluid

Transducer and Transmitter Selection Chart (Pressurised Vessels)

Measurement	Application	Transducer (RDT Series)	Transmitter
Level measurement pressurised vessels	Clean liquids including cryogenic.	HS-Type (HF Oxygen service)	ADX ,BDX
	High viscosity liquids, liquids with solids in suspension.	HS-type or HS-type with a remote seal on high port.	ADX
	Food, brewing & dairy industries or other hygienic applications.	HS-type with remote seals on both high and low ports.	ADX

Closed Pipe Flow Measurement

Application Note: CP_F 01

Principle of Measurement

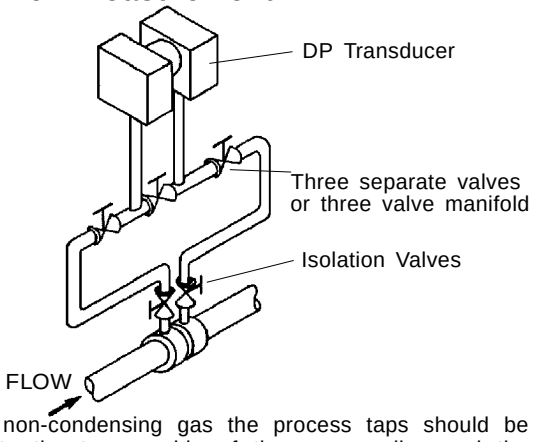
All pressure based closed pipe flow measurement systems use either an Orifice Plate, Pitot Tube, Venturi or Nozzle, to produce a differential pressure which is linearly proportional to the square of the flow. In order to obtain a linear to flow signal, a square root function must be applied either in the DP transmitter itself or to the output signal from the transmitter.
To meet basic accuracy requirements British and International standards specify a minimum straight pipe length both before and after the flow meter. Most general industrial applications this can be approximated to a minimum of 10 times pipe diameter upstream and 6 times pipe diameter downstream.

Design Information Required

In order to specify a complete flow measurement system the following information needs to be established.
1. Internal diameter of system pipe work at the point of measurement.
2. Flowing media.
3. Maximum and minimum flow rates.
4. Media temperature and pressure.
5. Flange details for mounting of Orifice plate, Nozzle or Venturi or any special boss details for a Pitot tube assembly.

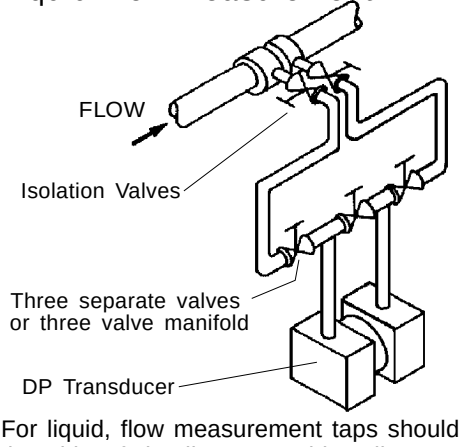
ORIFICE PLATE, VENTURI & NOZZLE INSTALLATION ARRANGEMENTS

Gas Flow Measurement



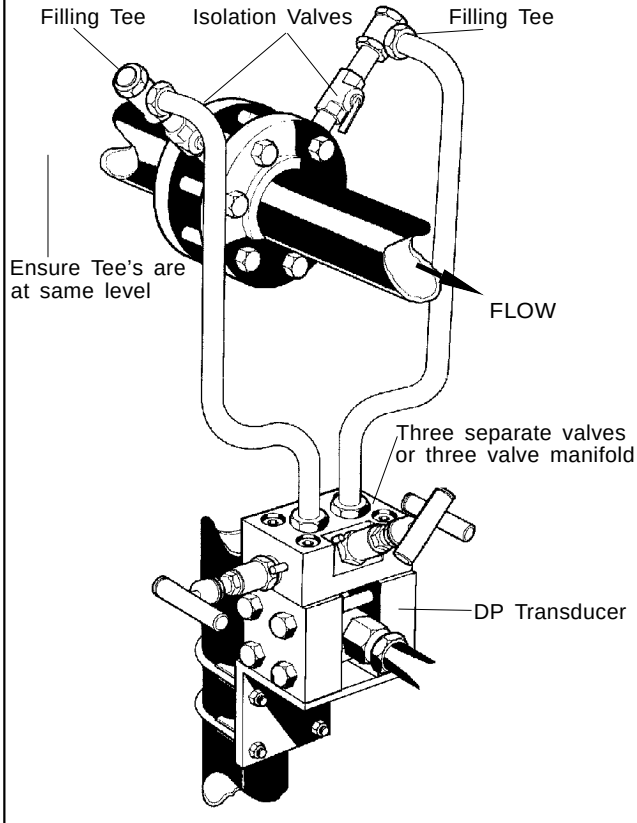
For a non-condensing gas the process taps should be made to the top or side of the process line and the differential transducer should be mounted above the tapping points so that any liquid will drain into the process line.

Liquid Flow Measurement



For liquid, flow measurement taps should be made to the side of the line to avoid sediment deposits and the transducer should be mounted below the tapping points so that any gasses will vent into the process line.

Steam Flow (Condensing Vapour)



For steam flow or vapour service, taps should be made to the side or towards the top of the process line and the differential transducer should be mounted below the tapping points such that the impulse lines will stay filled with condensate. For steam service the impulse lines should be filled with water to prevent damage to the transducer caused by live steam on start up.

Open Channel Flow Measurement Application Note: OC_F 01

Principle of measurement

Open channel flow is undertaken by measuring the height of liquid flowing over a weir or through a flume.

The level can be measured by a low range submersible transducer immersed either directly up stream off the flow centre line or in a stilling well formed to the side of the channel. Alternatively a bubbler system can be used.

Weirs are most often employed for clean water applications or on large flows such as rivers of culverts. For a weir two types are normally employed;

Rectangular (including full channel width) in which the flow is proportional to head generated raised to the power of 3/2.

90°V-notch in which the flow is proportional to head generated raised to the power of 5/2.

Flumes are most often used for dirty liquids with solids in suspension as their smooth shape minimises solid build up. The detail design of flumes can vary but generally the flow is proportional to the head generated raised to the power 3/2 approximately.

The selection chart identifies suitable transducer types and relevant transmitter series to allow selection of an appropriate measurement solution.

The M90 or S90 series of indicators can be used with remote transducers ('R' Series) or any of the loop powered transmitters to form a complete cost effective measurement and control package where a system solution is required to give an output linear to flow.

Submersible Transducer and Transmitter Selection Chart (Open Channel Flow)

Measurement	Application	Transducer	Transmitter
High Ranges More than 1600mm	Clean liquids <than 5% solids	LT or LK-type	ALX, AKX, BLX, BKX, CSX
	High viscosity liquids, liquids with solids in suspension.	LG or LQ-type	
Low Ranges Less than 1600mm	Clean liquids <than 5% solids	LG or LQ-type	ALX, AKX, BLX, BKX, CSX
	High viscosity liquids, liquids with solids in suspension.	LG or LQ-type	

Company Reg. No.: 4346738, VAT No.:786 6596 54, Reg Address: Impress Sensors & Systems Ltd, Unit 6 Mercury House, Calleva Park, Aldermaston, Berkshire, RG7 8PN