spirax sarco

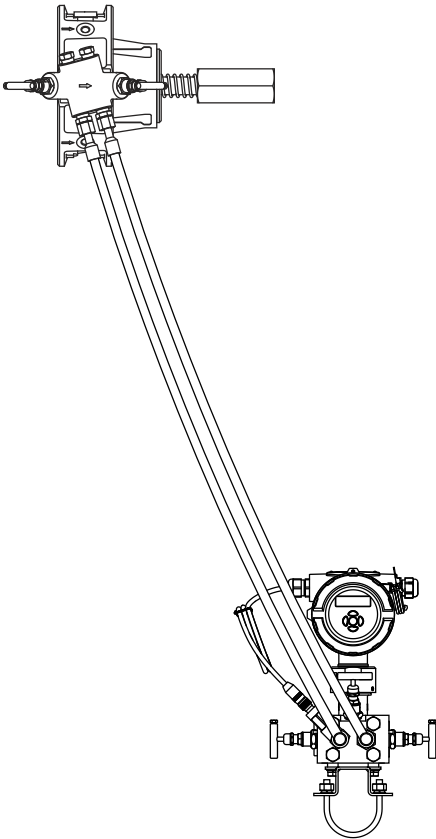## ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

Installation and Maintenance Instructions

Abbreviations

First for Steam Solutions

EXPERTISE | SOLUTIONS | SUSTAINABILITY

Contents

Abbreviations

MVT	Multi-variable transmitter
EMC	Electromagnetic compatibility
ESD	Electrostatic discharge
ASME	American Society of Mechanical Engineers
NPT	National Pipe Thread
IEEE	Institute of Electrical and Electronic Engineers
IP	Ingress protection
ILVA	InLine Variable Area
EIA/TIA-485	Electronic/Telecommunication Industrial Association (formally EIA/TIA 485)
AWG	American wire gauge
DP	Differential pressure
BTU	British thermal unit
DMM	Digital multimeter

1. Safety information

Safe operation of these products can only be guaranteed if they are properly installed, commissioned, used and maintained by qualified personnel (see Section 1.11) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

Adverse operation to these guidelines can cause damage to the product or connected equipment.

All wiring materials and methods shall comply with relevant EN and IEC standards where applicable.

1.1 Intended use

Referring to the Installation and Maintenance Instructions, name-plate and Technical Information Sheet, check that the product is suitable for the intended use/application.

The products listed below comply with the requirements of the European Pressure Equipment Directive 2014/68/EU and carry the $C\in$ / UKCA mark.

The products fall within the following Pressure Equipment Directive categories:

Product		Group 2 Gases	Group 2 Liquids
ILVA20	DN150 - DN200	3	SEP
	DN250 - DN300	3	1

i) The products have been specifically designed for use on steam which is in Group 2 of the above mentioned Pressure Equipment Directive.

ii) Check material suitability, pressure and temperature limits, are correct prior to installation. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous overpressure or overtemperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.

iii) Determine the correct installation situation and direction of fluid flow.

iv) Spirax Sarco products are not intended to withstand external stresses that may be induced by any system to which they are fitted. It is the responsibility of the installer to consider these stresses and take adequate precautions to minimise them.

v) Remove protection covers from all connections and protective film from all name-plates, where appropriate, before installation on steam or other high temperature applications.

These instructions must be stored in a safe place near the product installation at all times.

spirax sarco

Warning

This product complies with Electromagnetic Compatibility Directive 2014/30/EU and the UK Electromagnetic Compatibilty Regulations 2016 and all their requirements.

The product may be exposed to interference above the limits of Heavy Industrial Immunity if:

- The product or its wiring is located near a radio transmitter

- Excessive electrical noise occurs on the supply. Line protectors can be used with combine filtering, suppression, surge and spike arrestors.

- Cellular telephones and mobile radios may cause interference if used within approximately 1 metre (39") of the product or its wiring. The actual separation distance necessary will vary according to the surroundings of the installation and the power of the transmitter.

Electrostatic Discharge (ESD) precautions
Static precautions must be observed at all times to avoid damage to the product.

1.2 Access
Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product. Arrange suitable lifting gear if required.

1.3 Lighting
Ensure adequate lighting, particularly where detailed or intricate work is required.

1.4 Hazardous liquids or gases in the pipeline
Consider what is in the pipeline or what may have been in the pipeline at some previous time. Consider: flammable materials, substances hazardous to health, extremes of temperature.

1.5 Hazardous environment around the product
Consider: explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

1.6 The system
Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk?
Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

1.7 Pressure systems
Ensure that any pressure is isolated and safely vented to atmospheric pressure.
Consider double isolation (double block and bleed) and the locking or labelling of closed valves.
Do not assume that the system has depressurised even when the pressure gauge indicates zero.

1.8 Temperature
Allow time for temperature to normalise after isolation to avoid danger of burns.

1.9 Tools and consumables

Before starting work ensure that you have suitable tools and/or consumables available. Use only genuine Spirax Sarco replacement parts.

1.10 Protective clothing

Consider whether you and/or others in the vicinity require any protective clothing to protect against the hazards of, for example, chemicals, high/low temperature, radiation, noise, falling objects, and dangers to eyes and face.

1.11 Permits to work

All work must be carried out or be supervised by a suitably competent person.
Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions.
Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety.
Post 'warning notices' if necessary.

1.12 Handling

Manual handling of large and/or heavy products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

Safe lifting of Spirax Sarco products

Please note that the Spirax Sarco ILVA20 is supplied with the provision for eyebolts to BS 4278 (to be supplied by others), with tapped holes located in the body. These may be used for lifting purposes at the sole risk and responsibility of the purchaser.

The purchaser is responsible for all lifting operations and operator competency at their location. The are also responsible for the use of the correct eyebolt and shackle. Combination eyebolts MUST NOT be used.

Spirax Sarco will accept no responsibility for loss or damage, caused by incorrect or inappropriate lifting of our products.

1.13 Residual hazards

In normal use the external surface of the product may be very hot. If used at the maximum permitted operating conditions the surface temperature of some products may reach temperatures of 239 °C (462 °F).
Many products are not self-draining. Take due care when dismantling or removing the product from an installation (refer to 'Maintenance instructions').

1.14 Freezing

Provision must be made to protect products which are not self-draining against frost damage in environments where they may be exposed to temperatures below freezing point.

1.15 Returning products

Customers and stockists are reminded that under EC Health, Safety and Environment Law, when returning products to Spirax Sarco they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

1.16 Hot Surfaces

On completing the installation its recommended the installer high light potential hot surfaces on the ILVA20 body, these are likely to be the 2-way manifold and the needle valves located on the unit.

1.17 Replacement parts

Only use Spirax Sarco recommend parts as functionality / operation of the unit may otherwise be impaired

1.18 Disposal

On disposal of the unit or component, appropriate precautions should be taken in accordance with Local/National regulations.
Unless otherwise stated in the Installation and Maintenance Instructions this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

Please visit the Spirax Sarco product compliance web pages
https://www.spiraxsarco.com/product-compliance
for up to date information on any substances of concern that may be contained within this product. Where no additional information is provided on the Spirax Sarco product compliance web page, this product may be safely recycled and/or disposed providing due care is taken. Always check your local recycling and disposal regulations.

2. General system information

2.1 Introduction

This booklet gives full details of the recommended procedures for the installation, maintenance and use of the Spirax Sarco ILVA20 flowmeter with MVT10. Abbreviated details of how to install the EL2270 temperature sensor are also given and full details are supplied with the product.

Initial start-up procedures as well as fault finding guidelines are also included.

Description

The Spirax Sarco ILVA20 flowmeter and MVT10 are a calibrated system that is designed for use on saturated and superheated steam, it can also operate as a heat meter. It operates on the spring loaded variable area principle and produces a differential pressure related to the rate of flow. The electronics provide current loop, pulsed output and Modbus EIA/TIA485 outputs. Steam flow is density corrected. Pipeline pressure is also measured.

2.2 The Spirax Sarco ILVA20 flowmetering system consists of 3 major elements:

2.2.1 The ILVA20 pipeline unit

This is installed in the line where the flow is to be measured. Using impulse pipework, this is connected to:

2.2.2 The MVT10 assembly

The MVT10 assembly measures the differential pressure and static pressure across the ILVA20 pipeline unit and converts this to a 4-20 mA output signal or EIA/TIA 485 Modbus proportional to mass flow or power.
Registered EU Design Application No. 005832607.

2.2.3 Additional equipment required for super heat applications (sold separately)

EL2270 temperature transmitter (Pt100 to EN60751: Class A) which is installed directly in the pipework upstream of the ILVA20 pipeline unit, enables the unit to measure superheated steam or operate as a net heat meter.

With the ILVA20 and MVT10 being a calibrated system, ensure the correct MVT10 is fitted to the ILVA20. Otherwise the calibration becomes void.

ILVA20

EMS/BEMS and PLC, Chart
recorders, DAQ etc

MVT10
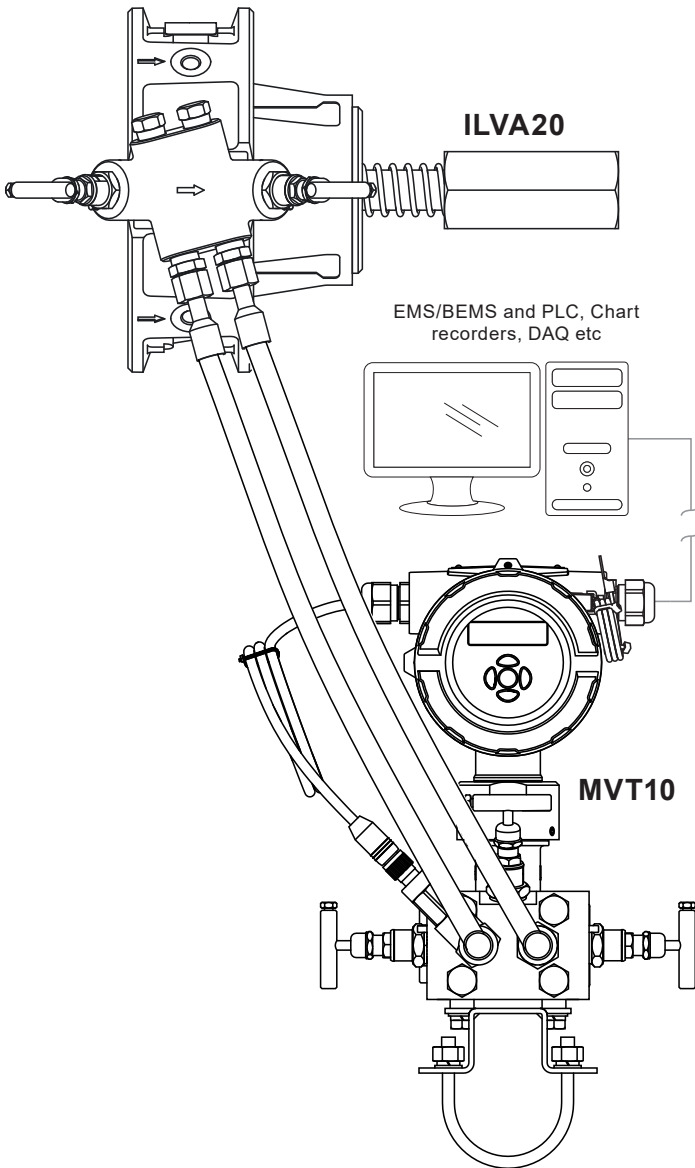
Fig. 1 ILVA20 system installation

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

3. General product information

3.1 Sizes and pipe connections

ILVA20: DN150, DN200, DN250 and DN300.
Suitable for fitting between the following flanges:
EN 1092-1 PN16, PN25 and PN40
BS 10 Table H
ASME B16.5 Class 150 and 300
JIS B2220 20K
KS B1503 20K.

3.2 Materials - see Figure 2

No.	Part	Material	
1	Flowmeter body	Stainless steel	1.4408 CF8M
2	Internals	Stainless steel	316
3	2 way manifold	Stainless steel	1.4408 CF8M
4	3 way manifold	Stainless steel	316
5	Impulse hoses	Stainless steel	316L
6	MVT housing	Aluminium	Copper free aluminium, max 0.5 mg
7	Pressure sensor	Stainless steel	
8	Spring	Inconel X750	
9	Seals	Graphite/stainless steel	Graphite faced 316L
10	Screws	Stainless steel	ASME SA-193 B8M Class 2

3.3 Technical data

Power supply	24 Vdc if it is loop powered (absolute max voltage 28V, 24V +/- 10%)
	24 Vdc, 250 mA max when using an EIA/TIA 485 (absolute max voltage 28V, 24V +/- 10%)
Outputs	4-20 mA loop (proportional to mass flow or power), 250 Ω load max
Pulsed output	V max. 28 Vdc, R min. 10 kΩ
Communications port	EIA/TIA 485/Modbus
Fuse type	T1A, To be installed externally of the MVT10 unit, in-line with the 24 Vdc power supply

---

Fig. 2

DN150 shown

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

spirax **sarco**
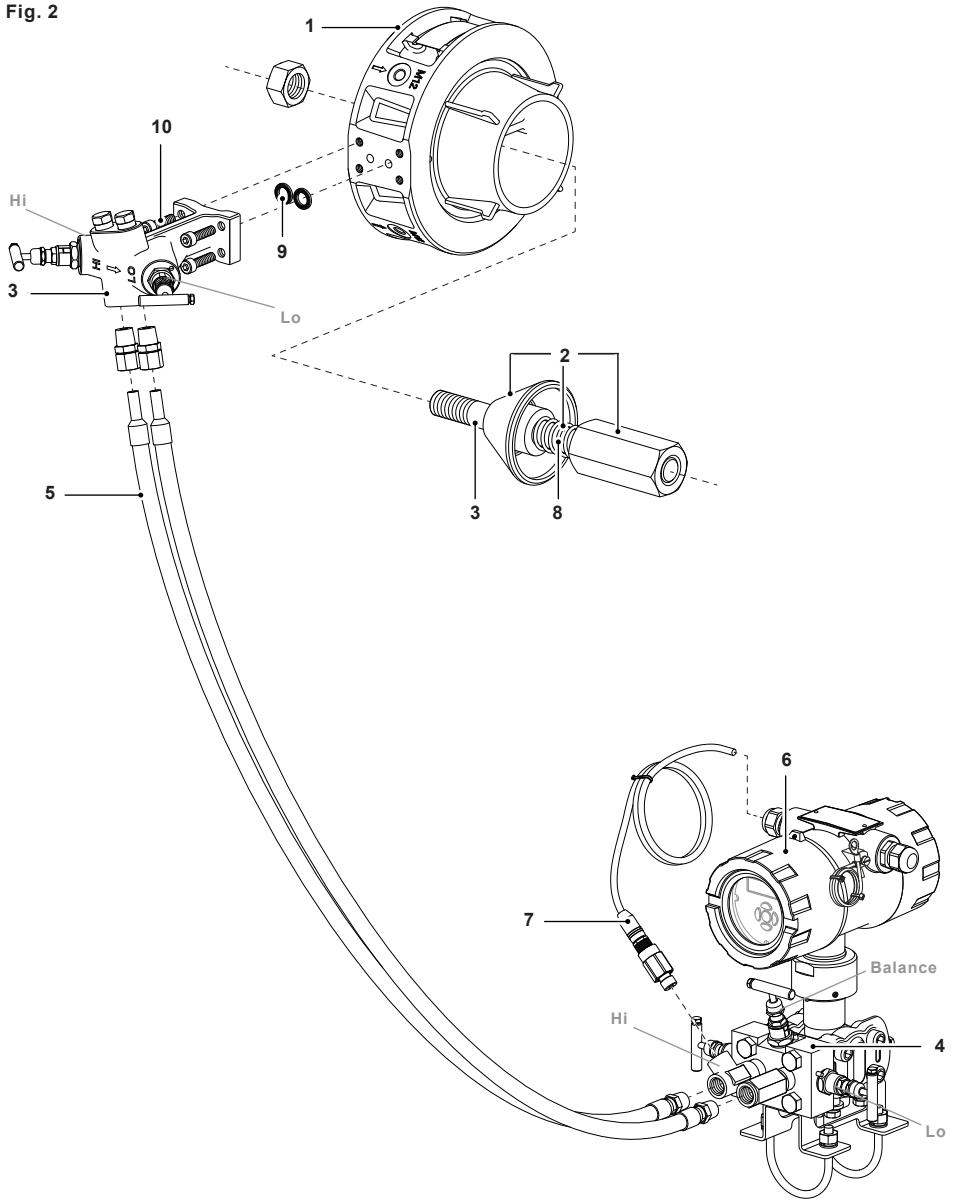
3.4 Pressure/temperature limits
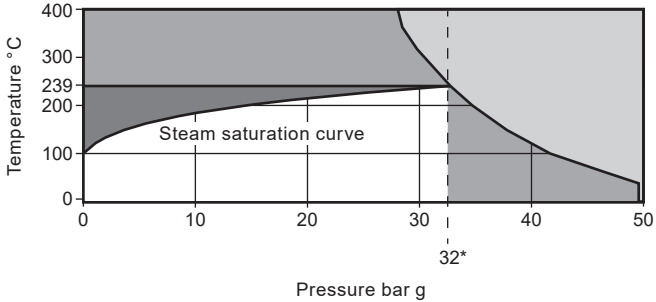
The product **must not** be used in this area.

Outside of operating range.

Steam is superheated in this area.

Maximum design pressure	49.6 bar g @ 21 °C
Maximum design temperature	400 °C @ 29.4 bar g
Minimum design temperature	0 °C (non-freezing)
Maximum operating pressure	* 32 bar g @ 239 °C
Minimum operating pressure	0.6 bar g
Maximum operating temperature (saturation)	239 °C
Minimum operating temperature	0 °C (non-freezing)
Maximum electronics ambient temperature	55 °C
Minimum electronic ambient temperature	0 °C
Maximum electronics humidity level	90% RH (non-condensing)
Designed for a maximum cold hydraulic test pressure of:	50 bar g
Glass on the display is rated for impact of maximum	4J
Environment Protection	IP65

3.5 ILVA20 Dimensions/weights (approximate) in mm and kg

Size	A	B	C	D	E	F	Weight
DN150	75	134	293	218			17.74
DN200	85	161	354	273	193	221	27.94
DN250	104	204	443	330			46.54
DN300	120	250	540	385			69.94
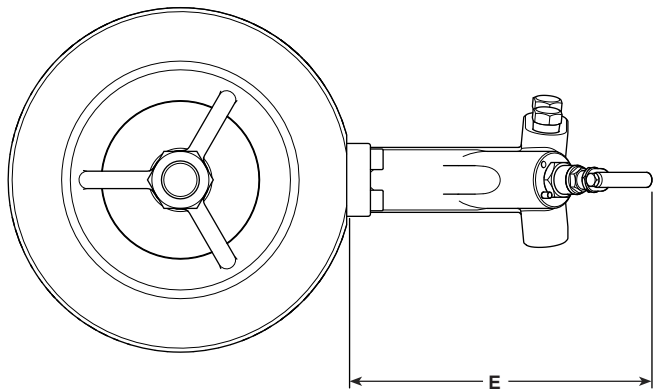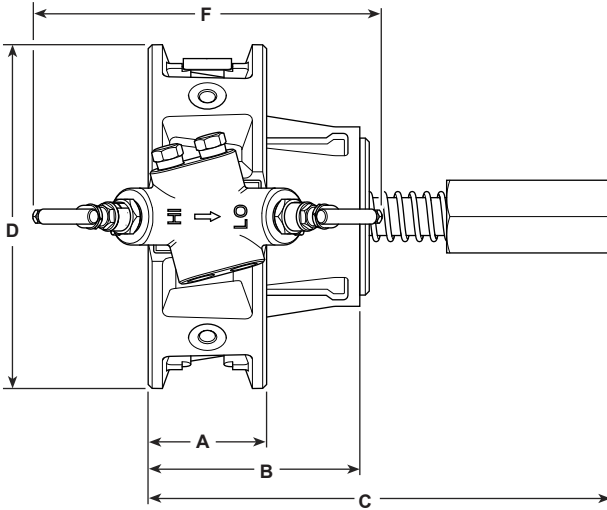
3.6 MVT10 Dimensions/weights (approximate) in mm and kg

MVT10 mass flow transmitter, manifold and impulse hoses and fixing clamp

A	B	C	Weight
209	264	220	8

The ILVA20/MVT10 can be supplied with either 1 m or 2 m long impulse hoses, with ⅜" NPT screwed ends.

It can also be supplied without hoses, where the intention is to hard pipe the assembly (hard pipe supplied by others).

Impulse hoses

		Weight
⅜" NPT	1 m	0.5 (pair)
⅜" NPT	2 m	1 (pair)

'U' bolts to suit DN50 pipe

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

spirax sarco
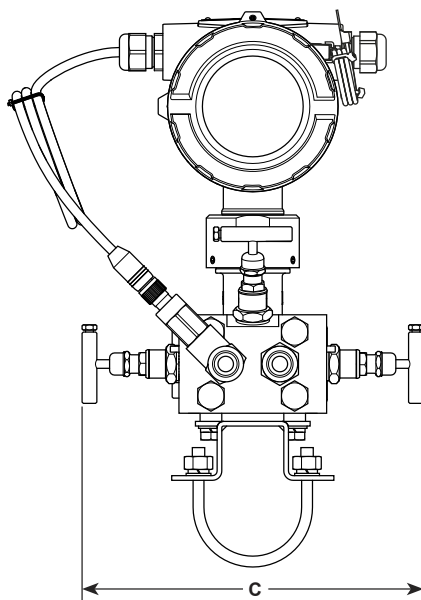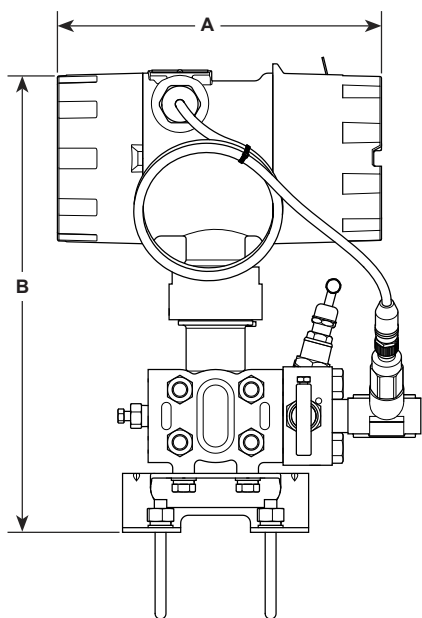
4. Mechanical installation of ILVA20 pipeline unit

4.1 Environmental conditions

Install the product in an environment that minimises the effects of heat, vibration, shock and electrical interference (see Section 1 - 'Safety information').

Do not install the product outdoors without additional weather protection.

Caution: In order for the ILVA20 flowmeter to meet its specified accuracy and performance, it is essential that the following guidelines for installation are followed carefully. For steam flow measurement, good basic steam engineering practices should be followed as detailed in this manual.

Before lifting the ILVA20/MVT10, refer to Section 1.12, safe lifting of Spirax Sarco products.
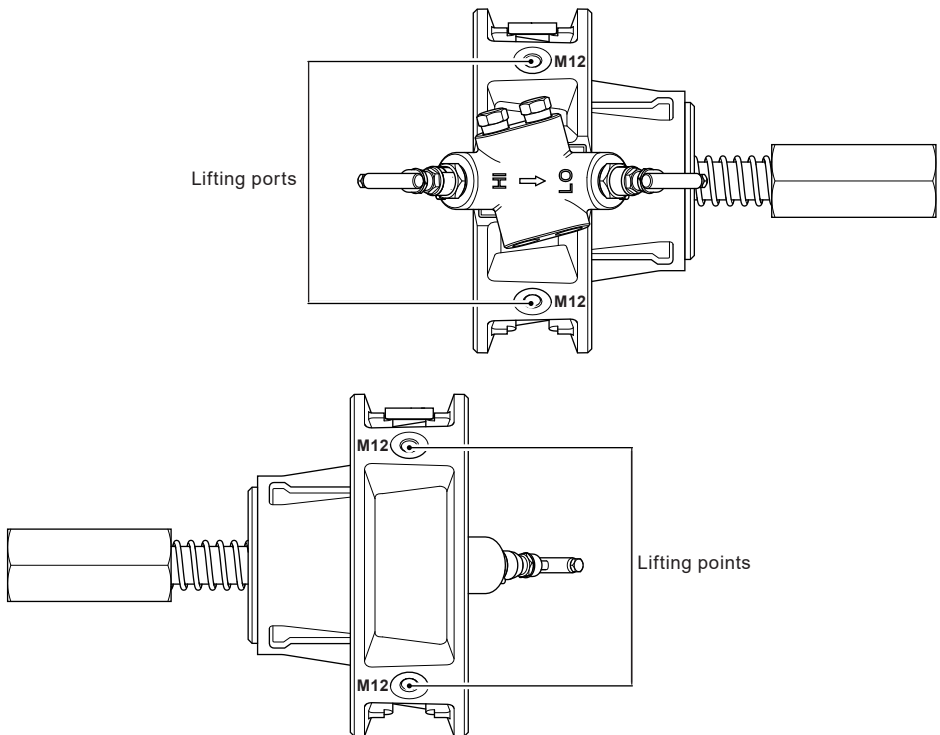
Fig. 3 Top views showing lifting ports

See Section 1.12 for handling and lifting procedure

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

spirax sarco

Required installation

Fig. 4a

Strainer Separator Isolation valve 6D minimum 3D minimum Minimum 100 mm

Fig. 4b

Minimum 100 mm
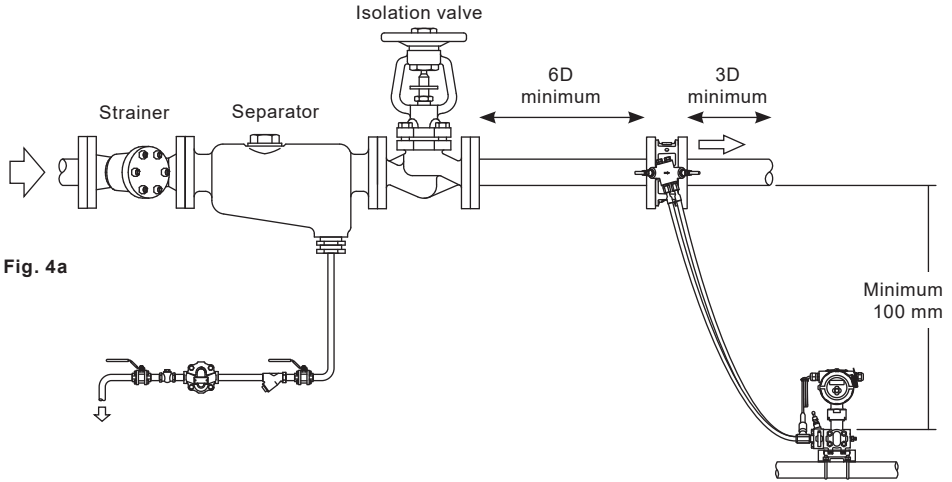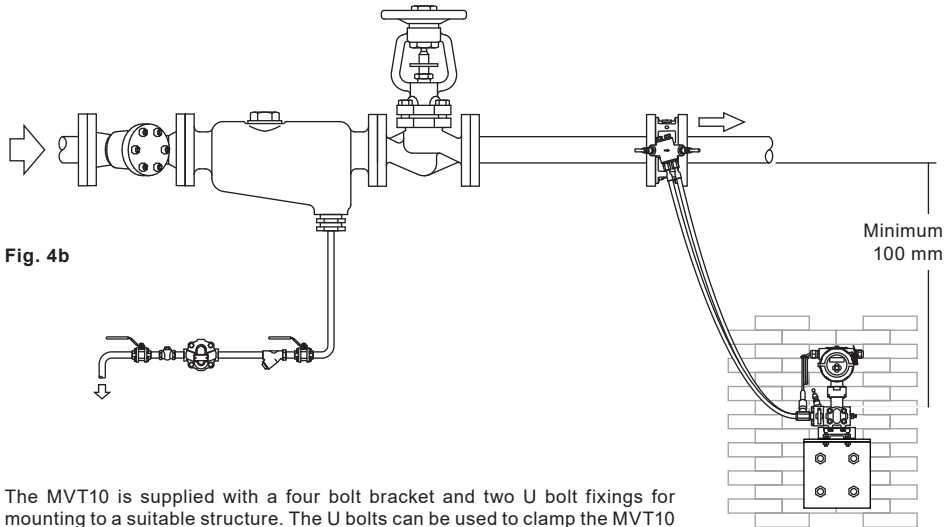
The MVT10 is supplied with a four bolt bracket and two U bolt fixings for mounting to a suitable structure. The U bolts can be used to clamp the MVT10 to a suitably located pipe or bar up to 60 mm diameter, see Figure 4a.

⚠ **Caution!**
Do not clamp the MVT to another steam pipe. The pipe surface temperature must not exceed 60 °C.

Alternatively, the U bolts can be removed and the four bolt bracket can be directly mounted to a wall or purpose made bracket, see Figure 4b.

4.2 Orientation

The ILVA20 should be installed in a horizontal line. As it has been calibrated in a horizontal attitude, mounting it in a vertical line (flow downwards) may introduce a small flow measurement error. If installation with flow vertically downwards is unavoidable, please consult Spirax Sarco for advice. The flowmeter should not be installed with flow vertically upwards (see Figure 8).

Minimum 100 mm below steam line

Fig. 5

Fig. 6

Kinked
Minimum bend radius for DN10 braided hose as per BS EN ISO 10380-2012 is 38mm.
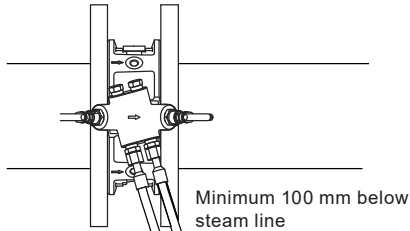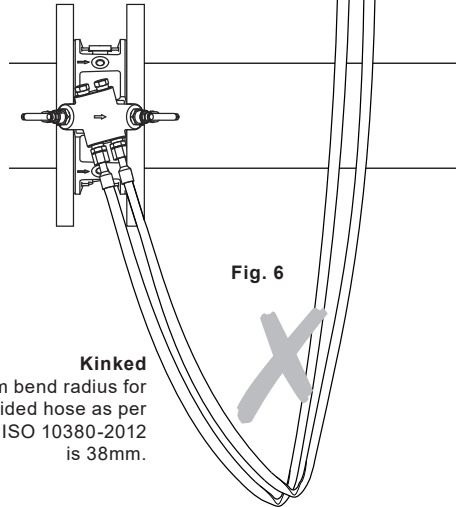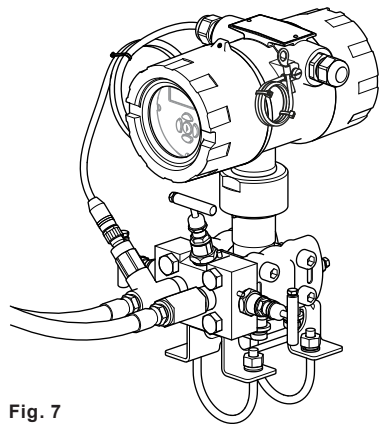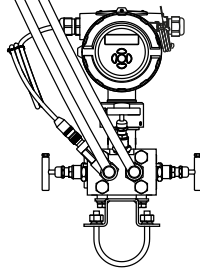
The MVT10 must be placed below the steam pipe (minimum of 100 mm) to aid the filling of the impulse hoses and ensure correct operation of the system. Ensure that the impulse hoses do not become 'kinked' or their route does not have sharp bends.

Fig. 7

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

spirax sarco
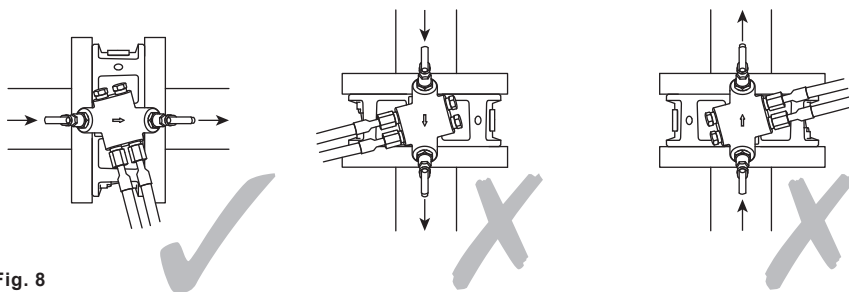
Fig. 8

The ILVA20 must be installed into a horizontal line only.

Maximum 45°   Maximum 45°
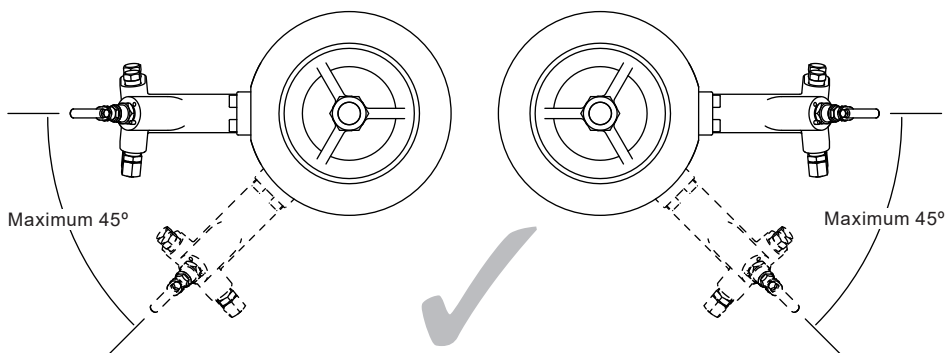
Fig. 9

The ILVA20 can be rotated in a horizontal line by up to 45° (downwards only), see Figure 9.

The filling and hose connector plugs are supplied loose and thus need to be fitted to suit the orientation of the 2 way manifold.

The hose connectors need to be fitted to allow for draining downwards. The filling plugs must then be used on the opposite or upwards side to plug the remaining holes.

Filling plug

Hose connector

Fig. 10

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

spirax sarco
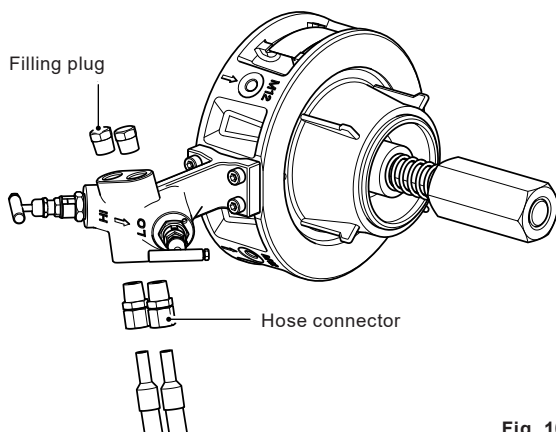
4.3 Upstream/downstream pipework

The ILVA20 flowmeter should be installed in pipework manufactured to BS 1600 or ASME B16.19M Schedule 40, which corresponds to the following pipeline internal diameters.

Nominal diameter	Nominal internal diameter
150 mm	154 mm
200 mm	202 mm
250 mm	254 mm
300 mm	303 mm

For different pipe standards/schedules, if the flowmeter is being operated at the extreme of its published maximum range, downstream spool pieces manufactured from BS 1600 or ASME B16.19M Schedule 40 must be used.

It is important that the internal upstream and downstream diameters of pipe are smooth. Ideally seamless pipes should be used and there should be no intrusive weld beads on the internal diameter. It is recommended that slip-on flanges be used to avoid any intrusive weld beads on the internal diameter of the pipe.

The ILVA20 normally only requires a minimum of 6 pipe diameters upstream and 3 downstream of clear straight pipe. These dimensions assume a measurement from a single 90° bend.
See Figure 11.

Fig. 11

6 D minimum

3 D minimum

Flow
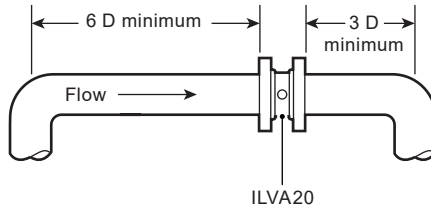
ILVA20

D = Pipe inside diameter

If any of the following configurations are present upstream of the ILVA20, then it is recommended that the minimum upstream clear pipework is doubled to 12 diameters.

Two right angled bends in two planes.
Pressure reducing valve.
Partly open valve.

Avoid installing the ILVA20 flowmeter downstream of an actuated valve as rapid cycling of the valve could give rise to inaccurate results or damage the flowmeter.
See Figure 12.

ILVA20

Flow

12 D minimum

Note: D = Pipe inside diameter

ILVA20

Flow

12 D minimum

Fig. 12

ILVA20

Flow

12 D minimum
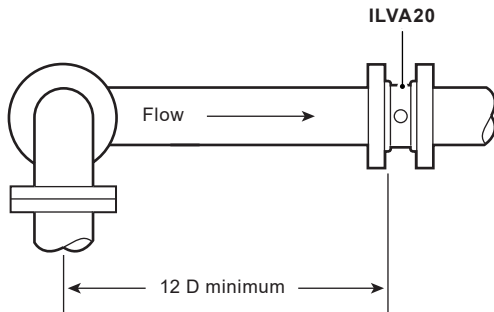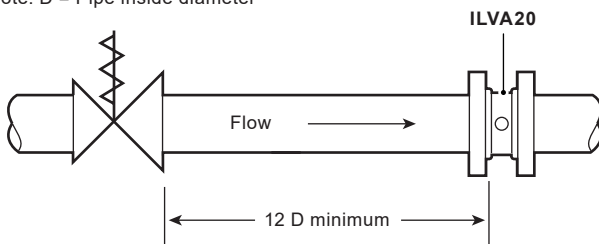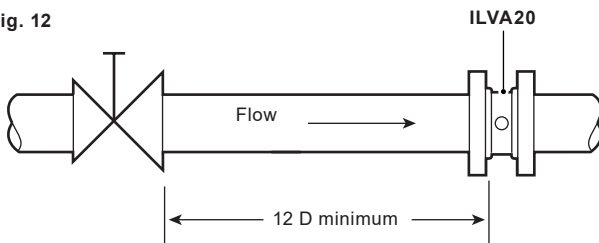
We recommend that a spool piece is used to aid installation and removal (see Figure 13).

Flow

Fig. 13   ILVA20   Spool piece
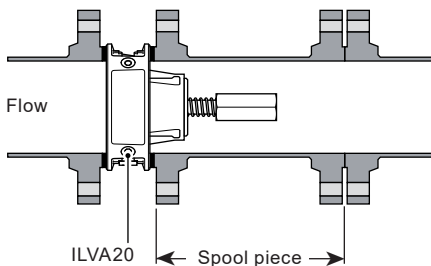
See Section 3.5 for dimensions for manufacturing a spool piece.

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

IM-P337-69 EMM Issue 7

4.4 Location in pipework

Bolt ring gaskets having the same internal diameter of the pipework are recommended. This will prevent possible inaccuracies being created by the gasket protruding into the pipe.
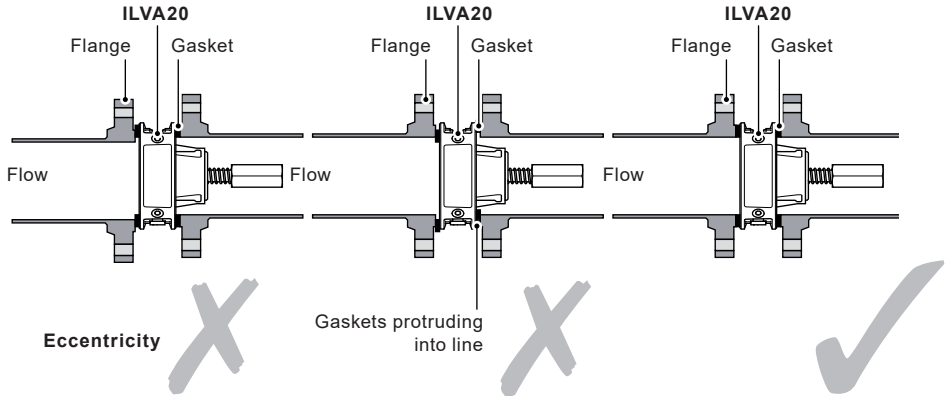
Fig. 14

It is important that the ILVA20 is located centrally in the pipework as any eccentricity may cause inaccurate readings. The ILVA20 has been designed with integral centering webs which locate on the internal diameter of the pipework.

Note: The ILVA20 is calibrated using schedule 40 pipework at the factory.

If the ILVA20 is installed into a system using other schedule pipework (including schedule 80) the calibration will be affected.

4.5 Pressure tappings

The ILVA20 has a two way manifold with integral pressure tappings for connection to the MVT10 mass flow transmitter assembly using impulse lines. These are threaded ⅜" NPT and are clearly marked HI (upstream) and LO (downstream). Care should be taken to ensure that these are correctly connected. It also has filling points to commission the assembly.

The ILVA 20 is supplied with flexible impulse hoses as standard, either 1m or 2m in length (preference should be made at time of order).
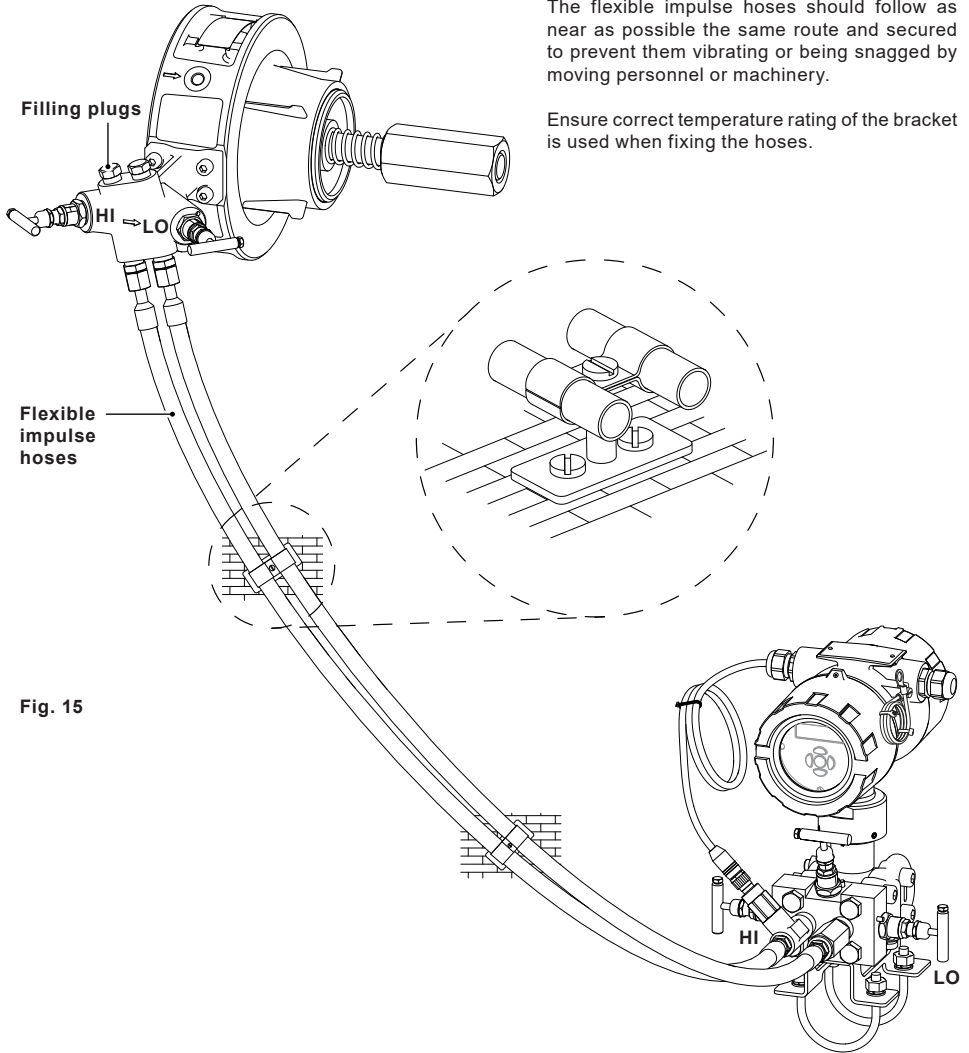
The flexible impulse hoses should follow as near as possible the same route and secured to prevent them vibrating or being snagged by moving personnel or machinery.

Ensure correct temperature rating of the bracket is used when fixing the hoses.

Filling plugs

HI ⇨ **LO**

Flexible impulse hoses

Fig. 15

HI

LO

4.6 Hard piped impulse lines

The ILVA20 and MVT10 can be installed with hard piping for impulse lines (supplied by others). The general arrangement should be as shown opposite.

Hi

Lo

Hard piping for impulse lines
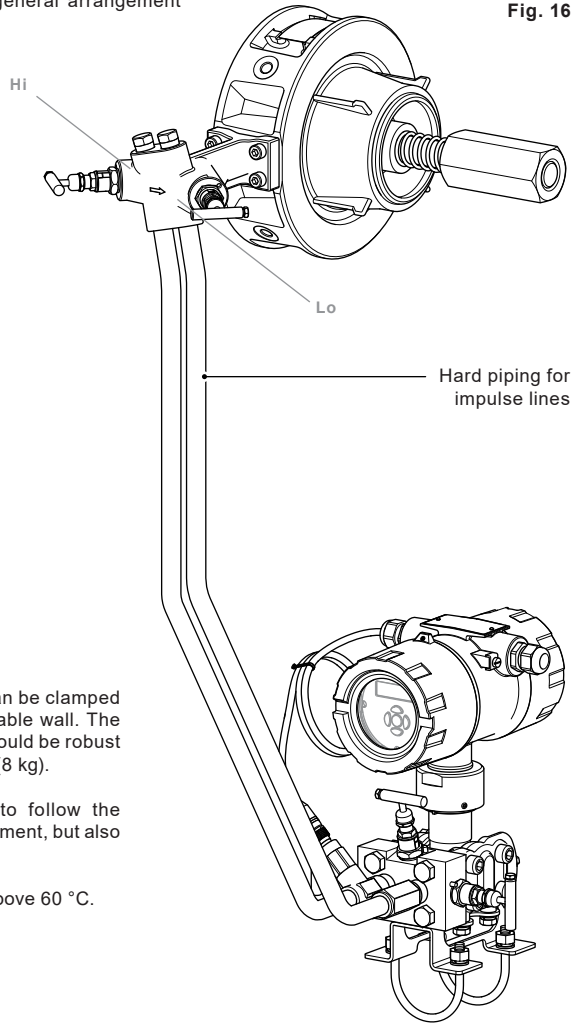
4.7 How to fit the MVT10

MVT10 is supplied with a bracket which can be clamped to small pipe (Ø60 mm), or fixed to a suitable wall. The structure to which the MVT10 is fixed to should be robust enough to carry the weight of the MVT10 (8 kg).

It is the responsibility of the installer to follow the necessary safety requirements in this document, but also specific site safety policies.

Do not attach to a pipe with temperature above 60 °C.

Fig. 17

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

spirax /sarco
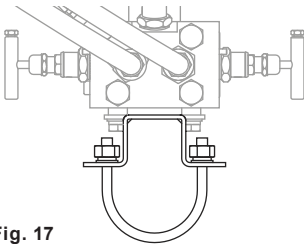
5. Electrical installation

Caution!
Only one power source can be applied at any one time. Applying both the 4-20 mA loop and a external 24 Vdc source can cause irretrievable damage to the electronics.

Caution!
The Earth wire of the unit has to be connected to a clean earthing point in order to reduce interference from the environment the MVT10 is operating in.

Caution!
The wire insulation temperature rating must meet or exceed 85 °C (185 °F).

Caution!
All cables must be screened.

Caution!
Only connect one power source at a time.

Caution!
For 24 Vdc power supply. This must be approved to local legislation.

Fuse:
- The MVT10 shall be equipped with an external fuse. See Section 3.3 for details.
- Make sure the correct type of fuse is used before powering up the unit.
- Make sure correct fuse rating type is used when replacing the fuse.
- If the fuse blows, make sure the problem is understood and corrected before replacing the fuse and powering up the unit.

5.1 General wiring

Warning!
To avoid potential electric shock, follow National Electric Code safety practices or your local code when wiring this unit to a power source and to peripheral devices. Failure to do so could result in injury or death. All wiring procedures must be performed with the power off.

Warning!
All wiring procedures must be performed with the power off.
Use only the connectors supplied with the product, or spares obtained from Spirax Sarco. Use of different connectors may compromise product safety and approvals.
Ensure there is no condensation within the unit before installing and connecting the power.

Wiring compartment and cable entry

The MVT10 contains an integral wiring compartment, located at the rear of the enclosure. To access the compartment, loosen the small grub screw and unscrew the rear cover.

A M20 x 1.5 female conduit entry is available for power and signal wiring. The product comes fitted with a cable gland which is suitable for one cable with a 5-12 mm diameter.

Two or more cables can be installed into this gland, but will compromise the products IP65 ingress protection. Unused apertures shall be closed with suitable blanking plugs. If conduit seals are used, they must be installed within 457 mm (18") of the enclosure.

Cable gland

Grub screw

Cover
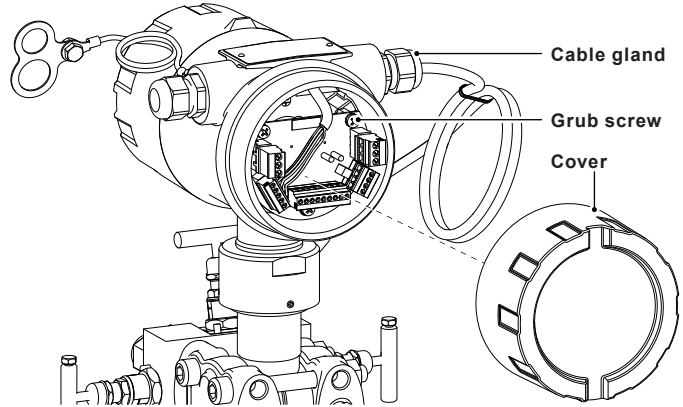
Fig. 18

Terminals specification:

All cables must be screened and terminated as per wiring diagram.
Wire gauge/type: 0.25 – 1 mm^2 (24 to 16 AWG), stranded
Terminal torque rating: 0.2 - 3 Nm (2 - 3 lb/in)
Number of wires per terminal: 1
Wire stripped length: 0.7 mm (0.25 in)
The wiring connections are identified beside the terminal plugs.

Install wiring in accordance with:

IEC 60364 - Low-voltage electrical installations.
BS 6739 - Instrumentation in Process Control Systems: Installation design and practice or local equivalent.
National and Local Electrical Code (NEC) or Canadian code (CEC) for the US and Canadian markets.
Note: use NEC Class 1 wire with a temperature rating greater than 75 °C. If the cable is to be exposed to a higher temperature, then a higher temperature rating needs to be selected.
It is important that the cable screens are connected as shown in order to comply with the electromagnetic compatibility requirements.
All external circuits must meet and maintain the requirements of double/reinforced installation as stated in IEC 60364 or equivalent.

Earthing note:

An earth current loop is created if a wire or screen is connected between two earth points that are at different potential (voltage). If the wiring diagram is followed correctly, the screen will only be connected to the earth at one end.

The earth terminal is a functional earth rather than a protective earth.

A protective earth provides protection from electric shock under a single fault condition. This product has double insulation and therefore does not require a protective earth. A functional earth is used in order for the product to operate. In this application, the earth is used as a sink or drain for any electrical interference. The earth terminal must be connected to a local earth in order to conform to the EMC directive.

RS 485 Connection   24V Power connection

Temperature

Pressure

Loop input

Pulse

SEE INSTALLATION MANUAL FOR WIRING INFORMATION

Fig. 19 Wiring terminals

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service
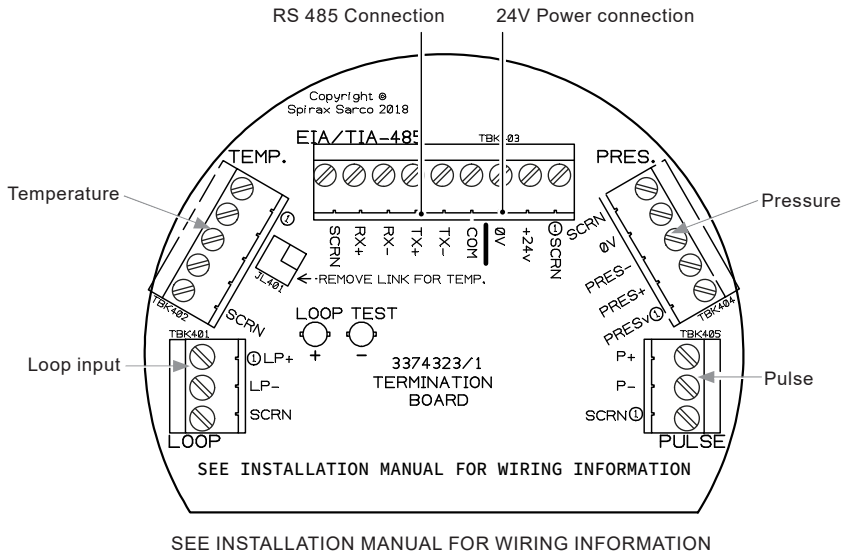
5.2 Loop power wiring

Connect 4-20 mA loop power (24 Vdc +/-10% at 25 mA, 1W max.) to the +Loop Power and Loop Power terminals on the terminal block.

⚠️ **WARNING**

Ensure the EIA/TIA 485 power connection is not wired up if connecting a power supply to the loop input.

Fig. 20 Loop powered connections

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

spirax sarco
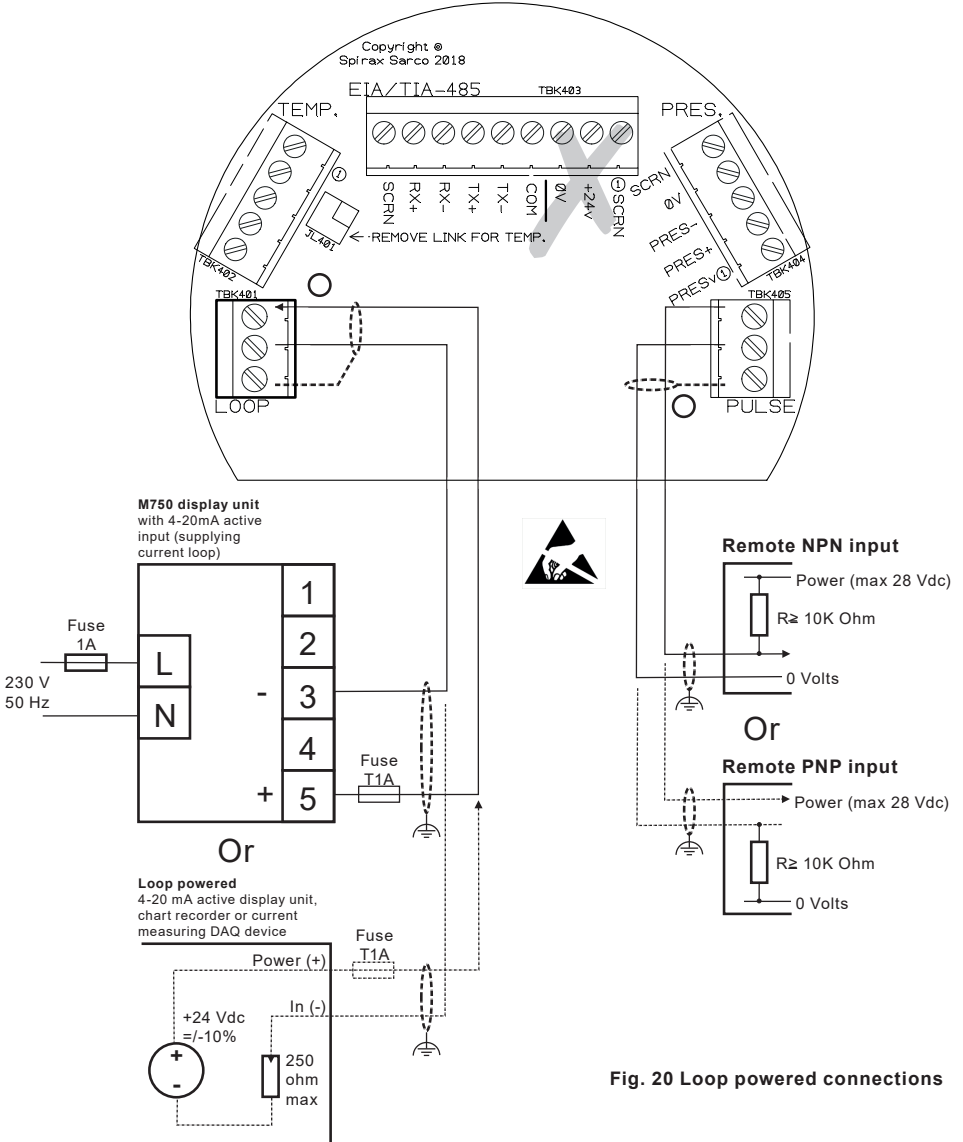
Testing the 4-20mA loop current:

The 4-20mA loop current can be tested without having to disconnecting the wiring. This enables the user to verify the correct signal is being transmitted for the corresponding flow rate, for fault finding and for calibrating the 4 and 20mA output signal. Simple connect a Digital Multimeter (DMM) across the "LOOP TEST" terminals (TBK401) whilst the MVT10 is powered up. The DMM does not affect or interfere with the transmitted signal. For calibrating or fault finding, selected the commissioning menu using the MVT10 front keypad. Use "Output / 4-20mA / Check 4mA or 20mA" to calibrate the 4-20mA signal and "Test – 4-20mA Out" set the loop to a value between 4 and 22mA to aid in fault finding. See section 7.

Digital Multimeter settings:

Connect the test leads to DMM's "mA" or "A" terminal (if applicable).
Select the appropriate dc current range, to measure 4-20mA accurately.
With the MVT10 powered, connect the DMM test leads to the "LOOP TEST" terminals, ensuring the correct polarity.
Note: If the DMM reads zero, recheck the setting above and check the internal fuse in the DMM itself has not blown.
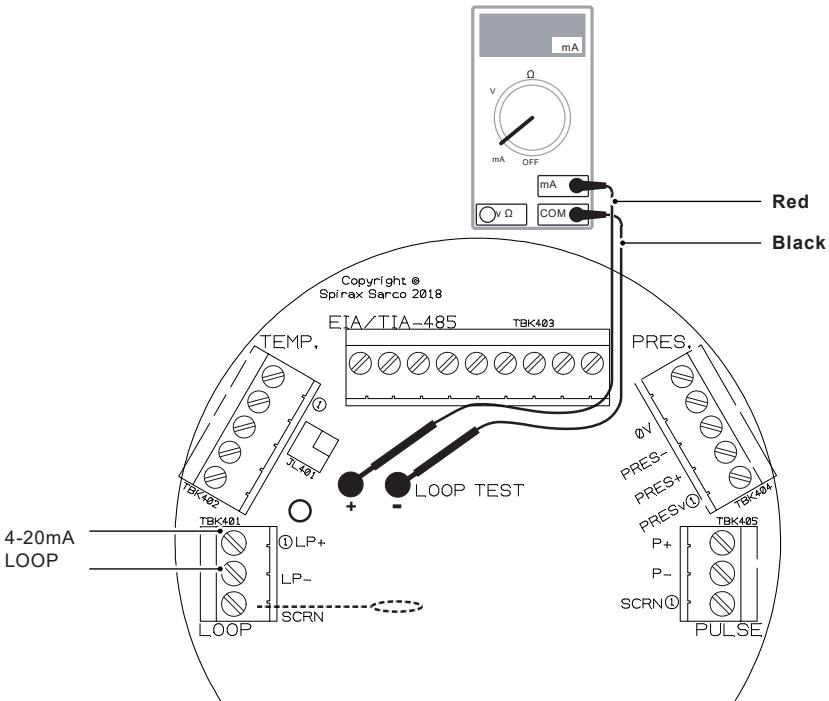
Fig. 21 4-20 mA loop power wiring - testing

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

IM-P337-69 EMM Issue 7

5.3. EIA/TIA-485 communication wiring

dc power wiring
Connect a 24 Vdc supply (+/-10%, 250 mA min) to the +24V and 0V terminals on the terminal block.
The supply must be fitted with a T1A fuse.

WARNING:
Ensure the 4-20mA loop is not wired up, if connecting power to the DC power input.

Signal wiring
The product can be connected as a slave to a two or four-wire EIA/TIA-485 multi-drop network.
Note: EIA/TIA-485 symbols are used (A = Tx-, B = Tx+ and A' = Rx-, B' = Rx+)
The signal direction is relative to the product being the Modbus slave, i.e. Tx+ from the product (slave) is to be connected to the Rx+ of the master.

Twisted pair cable should not be required for short lengths of cable < 1.5 m (< 5 ft). Standard screened cable should suffice.

Cable specification:

Type:	Screened EIA RS485 Twisted pair
Number of pairs:	2 or 3
Gauge:	0.23mm² (24 AWG)
Maximum length:	1 200m (4 000ft)
Recommended type:	Alpha Wire 6413 or 6414

Note: Note: LAN Category 5 or Category 5E ScTP (screened), FTP (foil) or STP (shielded) cable can be used, but limited to 600 m.

The bus common must be connected directly to protective ground/earth at one point only. Generally this point is at or near the master device.

Consider terminating the two furthest ends of the bus to match the transmission line impedance.
A 150 ohm (0.5 W) resistor or a 120 ohm (0.25 W) resistor, in series with a 1 nF (10 V) capacitor is commonly used, but ideally the line impedance should be matched to each individual installation. Termination for short lengths of cable should not be necessary < 300 m (< 1 000 ft) @ 9 600 Baud.
Termination resistors should not be necessary for 1200 Baud.
For two wire communications ensure the terminals Rx+ to Tx+ are linked and terminal Rx- to Tx- are liked.
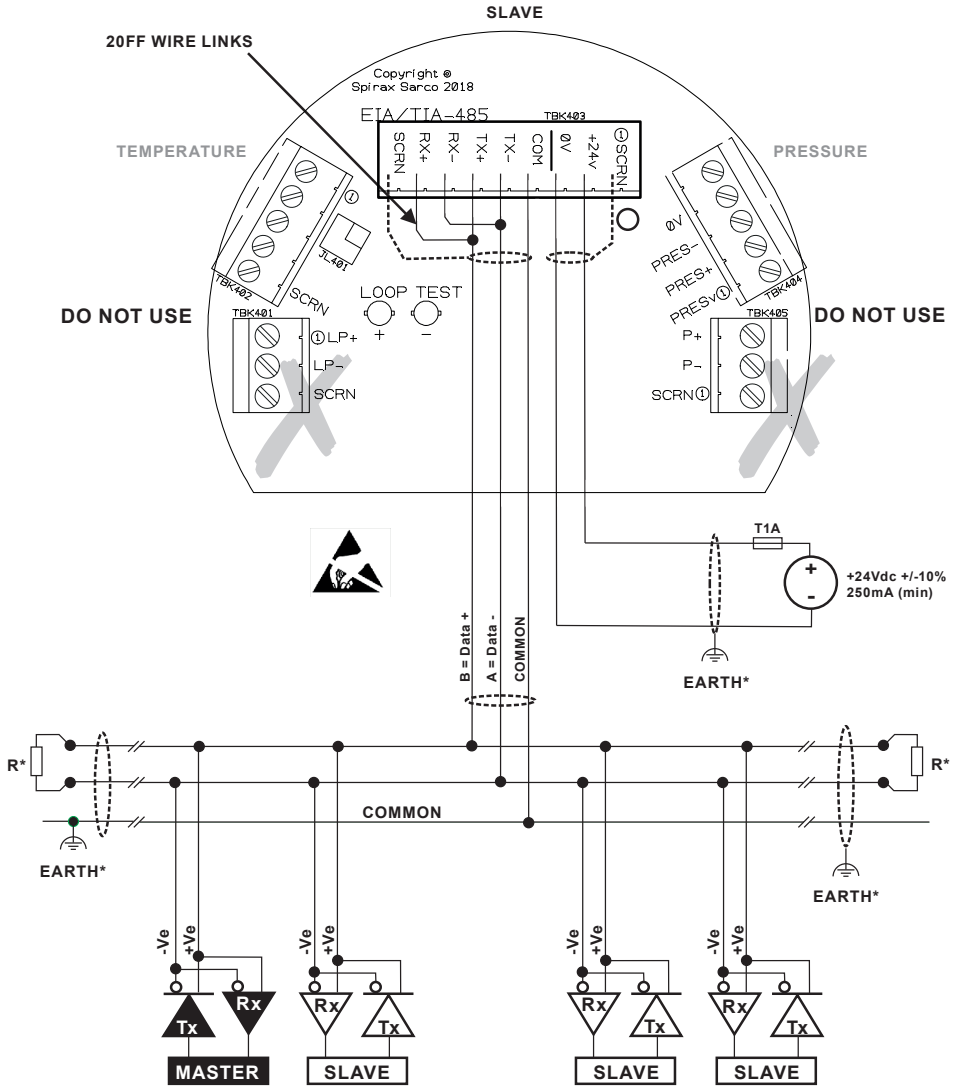
Fig. 22 2 wire dc wiring terminals
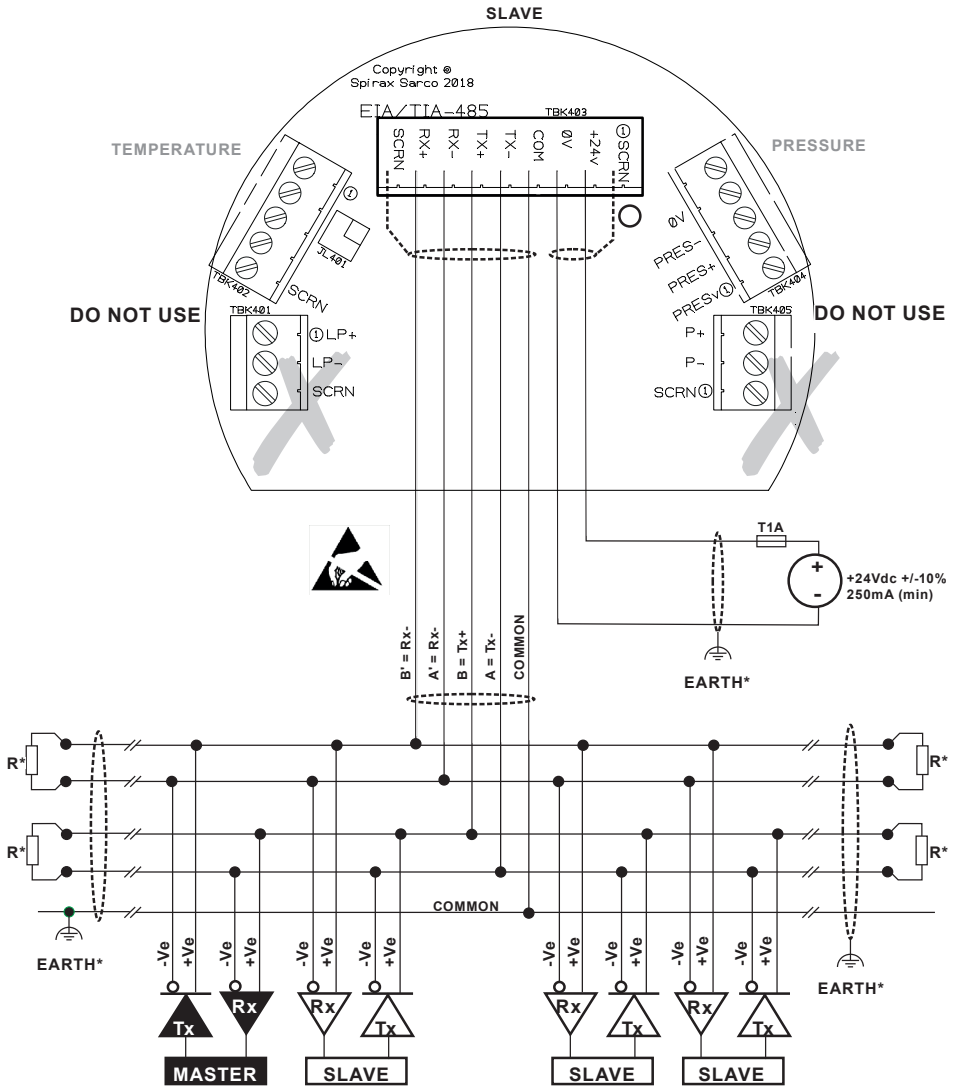
Fig. 23 4 wire dc wiring terminals

5.4 External Temperature sensor wiring

⚠ **Caution!**
Only connect one power source at a time.

Maximum cable length for this installation is recommended to be as short as possible, but no more then 3 m.
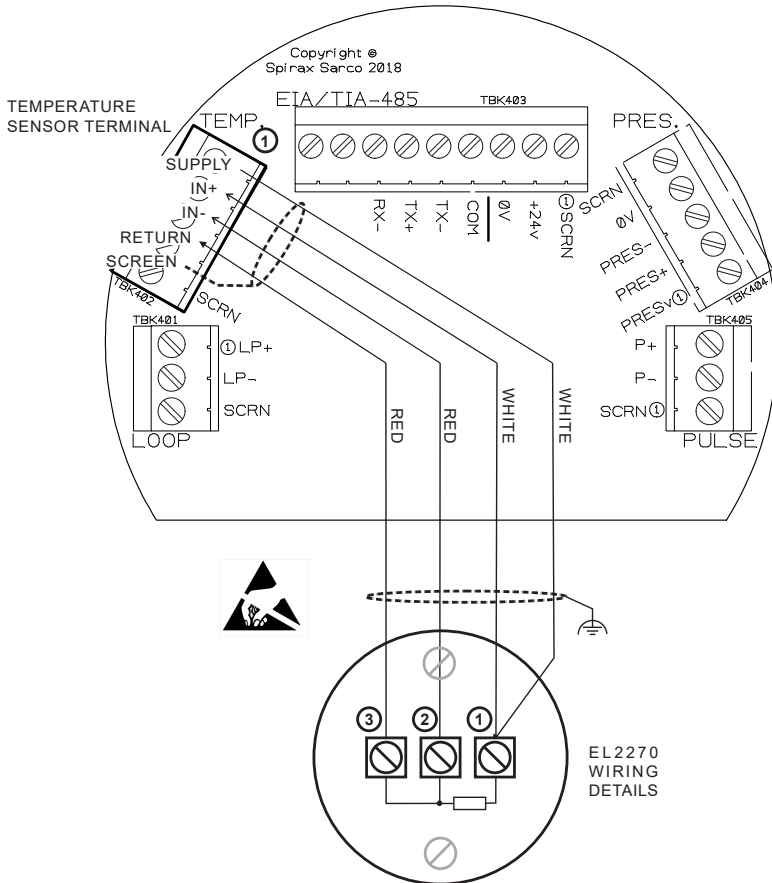
Fig. 24 Temperature terminal block

5.5 Pressure sensor wiring

If it is necessary to replace the pressure sensor cable assembly, the following details the wiring connections:
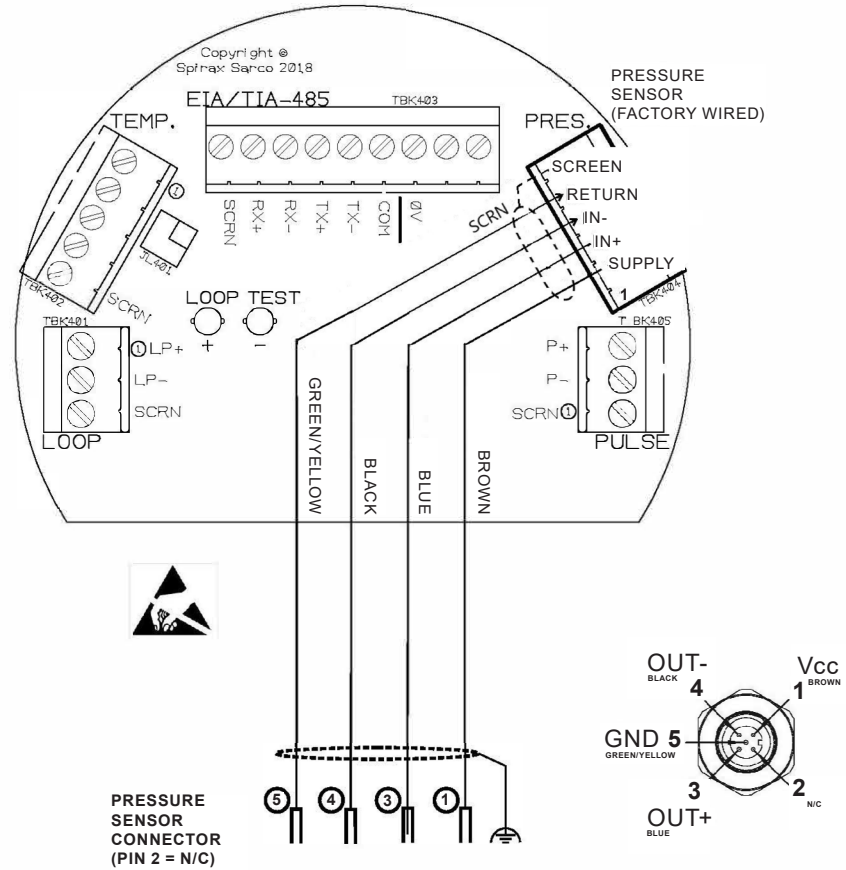
Fig. 25 Pressure sensor wiring (factory wired)

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

6. Commissioning

After all mechanical and electrical work has been completed, the initial start-up procedures should be followed.

Impulse hose filling ports

MVT10 rear view

Bleed ports

3-way manifold

Balance

Hi

Lo

2 way manifold

HI

LO
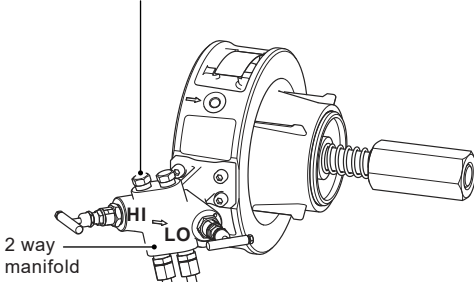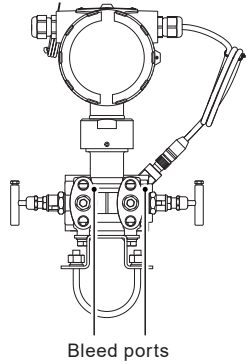
Fig. 26
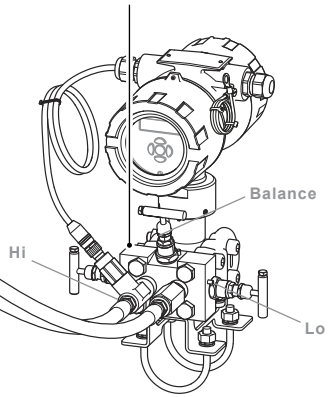
To put the MVT10 into operation:

Step 1
Make sure that all valves on the 3-way manifold and bleed valves are in the closed position.

3-way manifold

MVT10

Closed

Closed   Closed

Bleed valve   **Bleed valve**
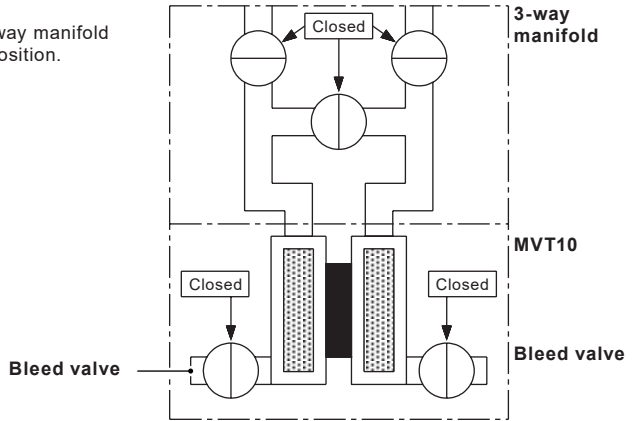
Step 2
Fill the impulse hoses/lines with cold water or uncontaminated condensate (no dirt or debris entrained in the condensate) as this will have been chemically treated and reduce the formation of air bubbles through the 2 way manifold filling ports.

Step 3
Open the Hi and Lo isolation valves on the 3 way manifold along with the bleed valves on the MVT10. Purge until a constant stream of fluid can be seen.

2-way manifold

HI   LO

Open

3-way manifold

Open

Closed

MVT10

Open   Open

Bleed valves   **Bleed valve**
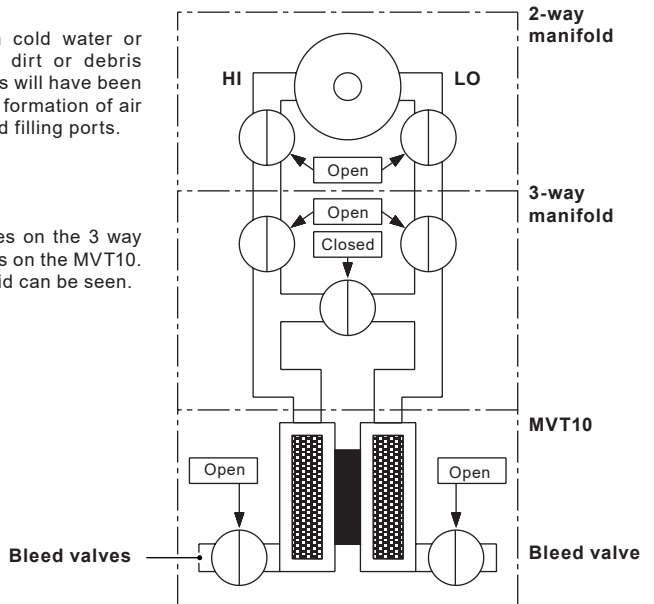
Step 4

Shut off bleed valves and refill the impulse lines through the 2 way manifold filling port.

2-way manifold

HI   LO

Open

3-way manifold

Open

Closed

MVT10

Closed   Closed

Bleed valves

Bleed valve
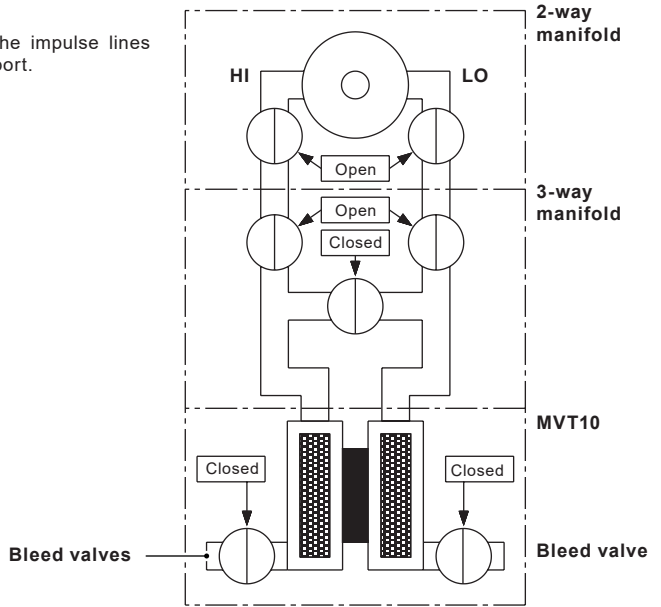
Step 5

Shut off the isolation valves at the 2-way manifold.

2-way manifold

HI   LO

Closed

3-way manifold

Open

Closed

MVT10

Closed   Closed

Bleed valves

Bleed valve

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

spirax sarco
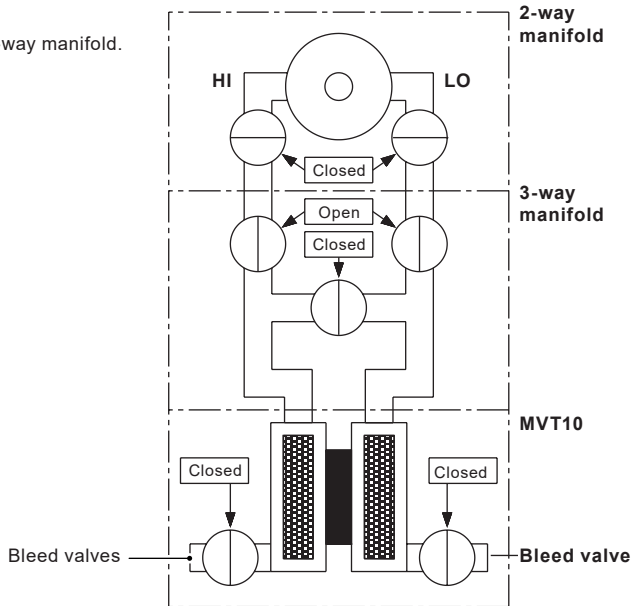
Step 6
Turn the system pressure on (optional but recommended).

Step 7
Open equalization valve.

2-way manifold

HI   LO

Closed

3-way manifold

Open

Open

Equalization valve

MVT10

Closed

Closed

Bleed valves

Bleed valve
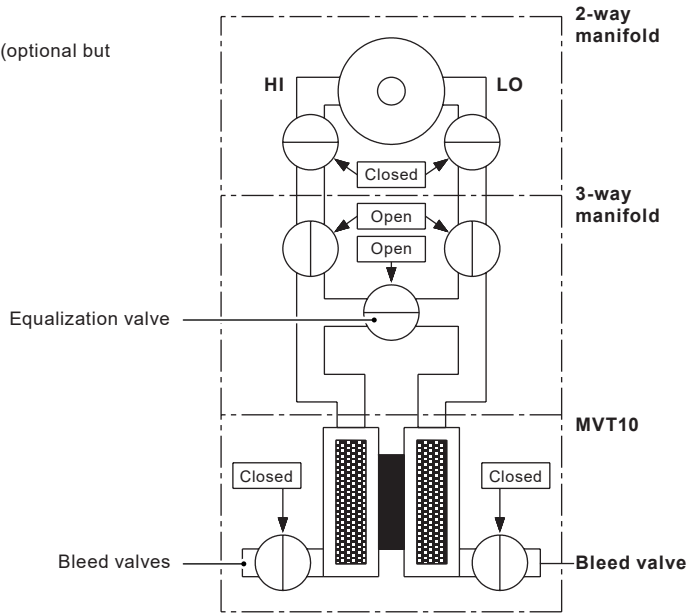
Step 8
Check the DP sensor output and zero if required. Follow procedure in Section 7.4.1 and 7.4.2.

Step 9
Open HI isolation valve on the 2-way manifold.

2-way manifold

HI   LO

Open   Closed

3-way manifold

Open

Equalization valve open

MVT10

Closed

Closed

Bleed valves

Bleed valve
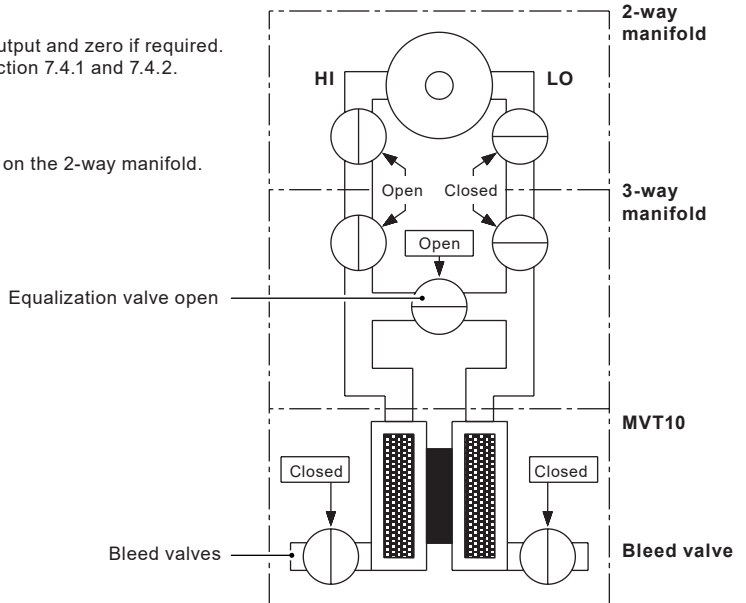
Step 10
Close equalization valve.

2-way manifold

HI   LO

3-way manifold

Open   Closed

Closed

Equalization valve

Closed

Closed

MVT10

Bleed valves

Bleed valve
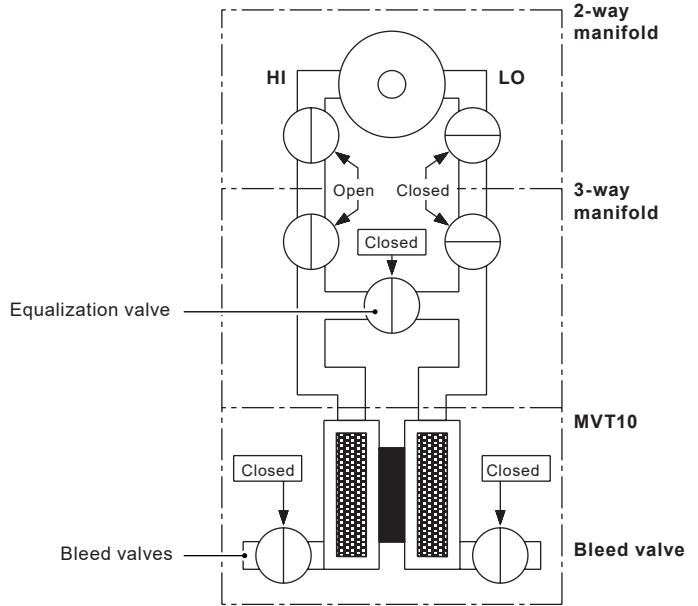
Step 11
Open the LO isolation valve on the 2-way manifold.

2-way manifold

HI   LO

Open

3-way manifold

Open

Closed

Closed

Closed

MVT10

Bleed valves

Bleed valve

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

spirax sarco
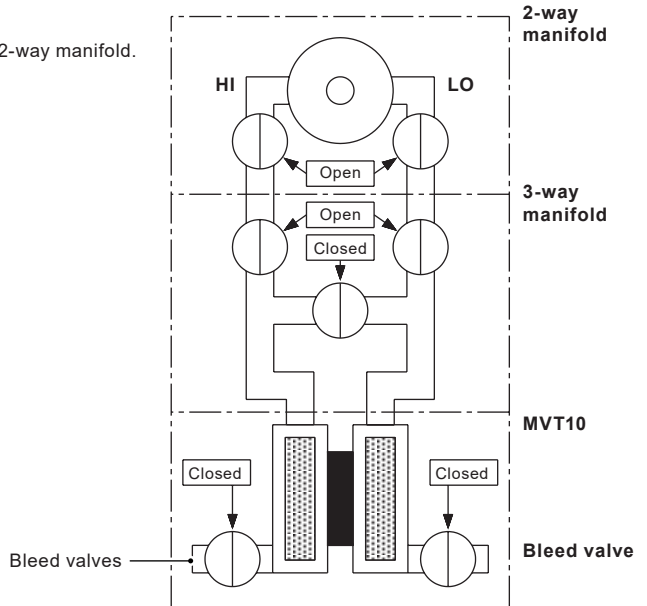
7. MVT10 and menu structure

After all mechanical and electrical work has been completed, the following commissioning instructions should be followed.

The MVT10 should be commissioned with the flow through the ILVA20 isolated.

The MVT10 can not be used with ILVA or Gilflo products, as they are sold paired with a ILVA20.

Note: The MVT10 is factory set to display data in metric units. To commission the MVT10 to display imperial units see Section 7.3.2.
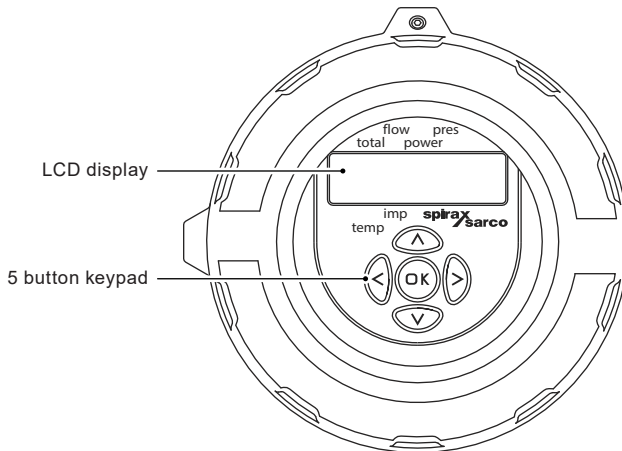
Fig. 27 MVT10 Display

All commissioning of the MVT10 is carried out through the housing end screw caps. Power and communication connections (termination board) are accessed through the rear screw cap and configuration commissioning is done via the display keypad accessed through the front screw cap (with glass). The display assembly consists of a small LCD display and a five button key pad.

As all commissioning settings are stored in a non-volatile memory. If using the MVT10 for a superheated steam application (with a temperature sensor), the sensor must be connected before powering up the MVT10. Otherwise the pressure channel calibration will be affected. A M750 display unit can be used to provide a remote display function if required.

Rotating the display

The display can be rotated through +/- 180 degrees. Do not rotate more then 360 degrees, to aid reading and commissioning. To rotate the display, first disconnect the power supply to the MVT10. Unscrew the front housing screw cap (with glass). Unscrew the three display retaining screws and rotate the complete display cassette to the required position. Refit the retaining screws and front housing screw cap.

⚠ **Caution!**
Do not unplug the cables from the display cassette and ensure that the cables are not strained or trapped whilst carrying out this procedure.

⚠ **Caution!**
Electrostatic discharge (ESD) procedures should be followed whilst rotating the display.

Fig. 28

Fixing screws
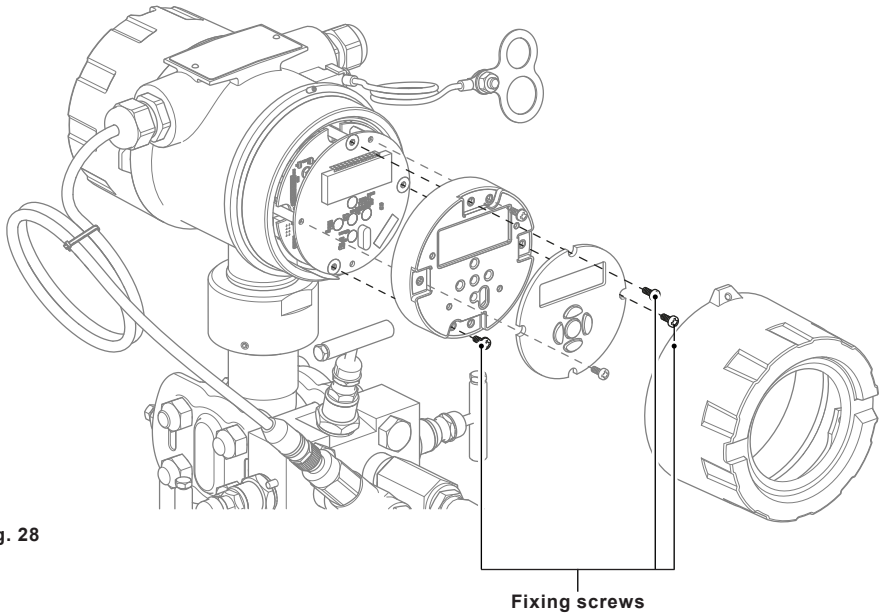
7.1 Run mode

Normally, the MVT10 flowmeter will operate in the run mode, displaying the total flow, flow, power, pressure or temperature of the fluid passing through the pipeline.

After initial power up, the MVT10 flowmeter will automatically enter the run mode and all commissioning menus can be accessed from this mode. (See Section 7.2, Commissioning mode, for details on how to commission). In the run mode the fluid data is displayed on several screens which can be accessed by pressing the up or down keys.

The display shows a numeric value and an arrow indicating the reading type, i.e. total flow, flow, power, pressure or temperature. All units (except °C) are implied with imperial or metric units being indicated by pressing the left arrow. The value of total flow is shown in two parts. The first five digits of the total flow will be displayed and after 10 seconds the following five digits will be displayed. To access the first five digits of total flow again it will be necessary to scroll up or down and return to the total flow display.
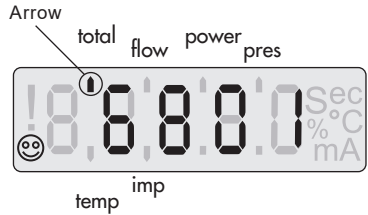
To obtain display units, press left on the key pad

Fig. 29

7.1.1 Run mode data sequence

Screen	Units
Total high	**kg or lb**
Total low	**kg or lb**
Flow	**kg/h or lb/h**
Power	**Power** kW or kBtu/h
Pressure	**Pressure** bar g or psi g, depending if metric or imperial units are selected
Temp	**Temperature** °C or °F

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service
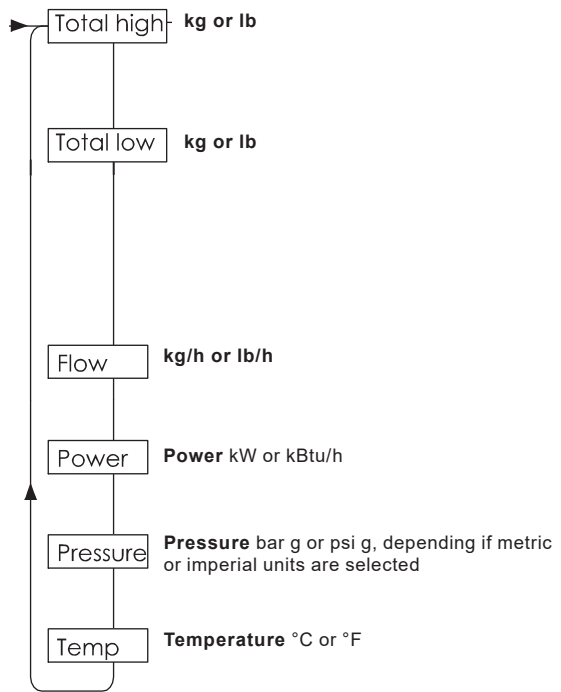
The following chart indicates the run mode data display sequence. Depending on the configuration, the flow units will be:

	Metric		Imperial	
	Large	**Small**	**Large**	**Small**
Total flow	Tonne	kg	Ton	lb
Total energy	MWh	kWh	MBtu	kBtu
Flow rate	Tonne/h	kg/h	Ton/h	lb/h
Power	MW	kW	MBtu/h	kBtu/h
Pressure	bar g	bar g	psi g	psi g
Temperature	°C	°C	°F	°F

The MVT10 flowmeter is factory set to display steam data in metric units and pressing the up or down keys will scroll through the following data.
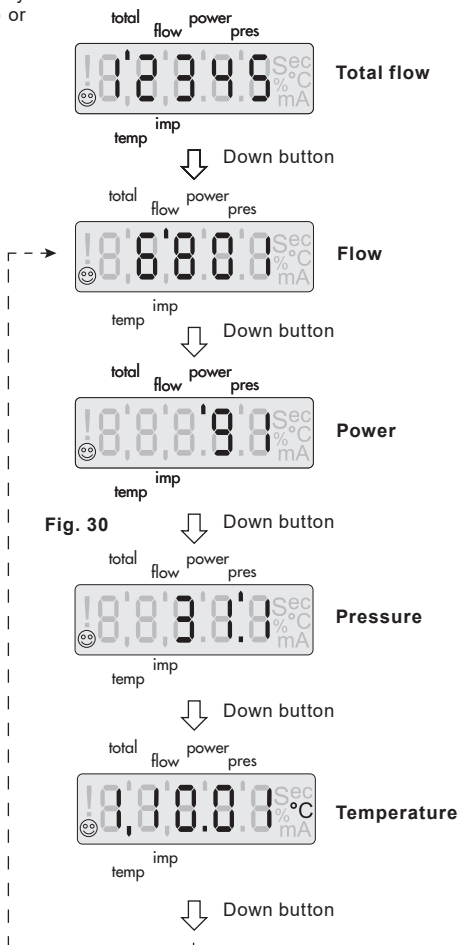
Fig. 30

7.1.2 Error display messages

Any errors that occur will be displayed in the run mode. The errors will alternate with the normal run mode display and will be prioritised. The errors will be latched and can only be cancelled by pressing the 'OK' button. Once the error message has been cancelled the display will show the next (if any) error.

Any continuous error will reinstate itself 2 seconds after it has been cancelled, and will be indicated by a flashing exclamation mark (**!**).

Certain errors will also cause the 4-20 mA alarm signal to be initiated.

The error messages are displayed over two screens and are:

| POWER OUt | = Power interrupted. |

| NO SIGNL | = No signal from sensor. (This can also activate the 4-20 mA alarm). |

| HIGH FLOW | = Flow above the maximum. |

| HIGH PRES | = The pressure is above the rated maximum. |

| HIGH tEMP | = The temperature is above the rated maximum. |

| SUb SAt | = Line conditions have changed from saturated steam to condensate (only when pressure sensor enabled). |

| PAR ERROR | = Parity Error on the EIA/TIA 485 communications link. In a bus configuration this could be triggered by communications to a third party device. |

7.2 Commissioning mode

The commissioning mode is used to zero the pressure sensor and DP sensor, enable the temperature sensor (for superheat/heat metering applications), set and test the outputs and change the pass code.

All data entry is performed via a menu and sub menu configuration with the key pad buttons used for navigation, i.e. to go deeper into the menu the right hand key is pressed, to scroll up and down the menu the up and down keys are pressed and to exit from a sub-menu the left key is pressed. Any data is entered using the OK button. The previously entered selection will flash. After a period of five minutes without any keys being pressed the MVT10 flowmeter will automatically default to the run mode.

To enter the commissioning mode press and hold down the 'OK' key for 3 seconds. The display then shows 8888.

Followed by:

ENTER PASS ➝ 8888
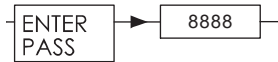
The leading digit will flash indicating that this is the position of the cursor.

The default factory set pass code is 7452. (This can be changed from within the commissioning mode). The pass code can be entered by using the up and down keys to increment the flashing value and the left and right keys to move the cursor. Pressing 'OK' will enter the pass code.
If an incorrect pass code is used the display will automatically return to the run mode.

After the correct pass code is entered the display shows: bASIC dAtA

ENTER PASS ➝ 8888 ➝ bASIC dAtA

In-PUtS

OUt - PUtS

ALARM

tESt

MEtER
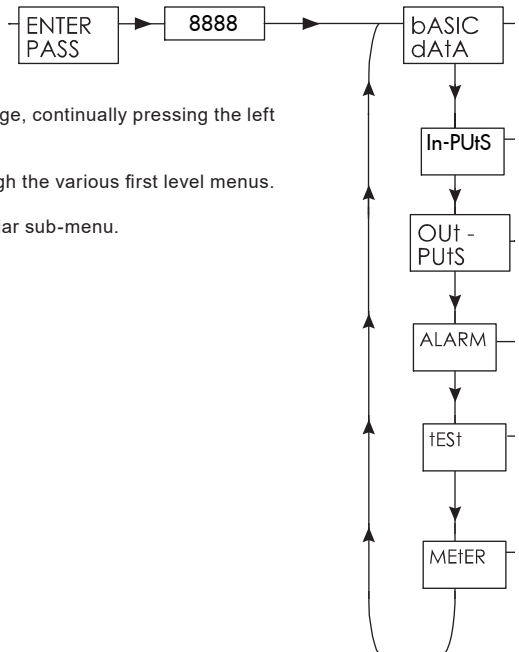
To exit from the commissioning mode at any stage, continually pressing the left key will return to the run mode.

Pressing the up and down buttons scrolls through the various first level menus.

Pressing the right arrow button enters a particular sub-menu.

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

7.3 bASIC DAtA Sub menu
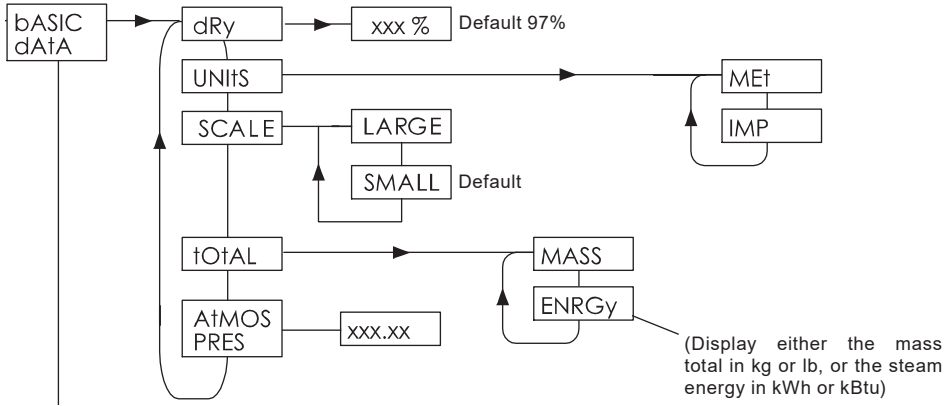
7.3.1 dRy
Pressing the right key will display the dryness fraction. This is the dryness fraction of the saturated steam being measured. This can then be edited to suit the application. Press the 'OK' button to confirm the selection. After the dryness fraction is entered the display will automatically step to the next sub menu and show 'UNItS'.

7.3.2 UNItS
The units displayed and transmitted can be selected between metric (MEt), and imperial (IMP).
A summary of the units is detailed in the Table opposite.

Select either 'MEt' or 'IMP' and press the 'OK' button to confirm.

	Metric		Imperial	
	Large	**Small**	**Large**	**Small**
Total flow	Tonne	kg	Ton	lb
Total energy	MWh	kWh	MBtu	kBtu
Flow rate	Tonne/h	kg/h	Ton/h	lb/h
Power	MW	kW	MBtu/h	kBtu/h
Pressure	bar g	bar g	psi g	psi g
Temperature	°C	°C	°F	°F

7.3.3 SCALE
This works in conjunction with UNItS detailed above (7.3.2).
By selecting LARGE, only large scale units will be shown i.e. Tons/Tonnes or MW.

By selecting SMALL, only small scale units will be shown i.e. kg.

7.3.4 tOtAL
The function is used to select whether the total displayed shows the total in mass flow or energy.
Select mass or energy using the up or down arrow and press 'OK' to confirm.

7.3.5 AtMOS PRES
This value compensates the flowrates for atmospheric pressure. It should be used if an improved degree of accuracy is required or when the MVT10 flowmeter is installed high above sea level.
Note: Values up to two decimal places can be entered.
If metric units are selected pressure units are bar absolute, for imperial units psi absolute.

7.4 InPUtS

In-PUtS

ZERO PRES — Press and hold 'OK' for 3 seconds to zero pressure sensor

ZERO DP — Press and hold 'OK' for 3 seconds to zero DP sensor

PRES SENSR → PRES 0 CAL → XXXXX (Bits)
PRES 25 CAL → XXXXX (Bits)

tEMP SENSR → ON / OFF (Default) → STEAM / HEAT → XXXX% (Default is 100%)
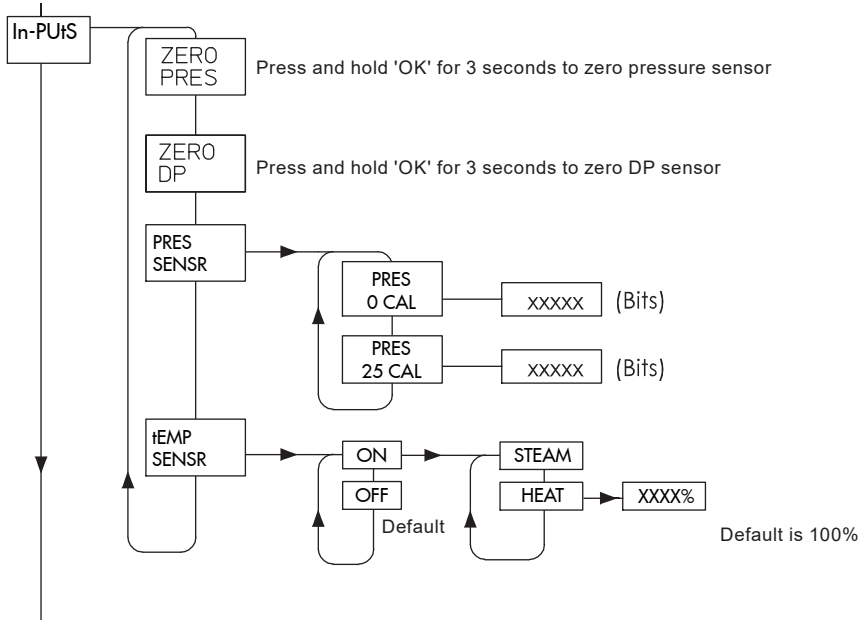
7.4.1 ZERO PRES
This enables the pressure sensor to be zeroed.
Press and hold the 'OK' button for 3 seconds to zero the pressure sensor.

7.4.2 ZERO DP
This enables the DP (Differential Pressure) sensor to be zeroed.
Press and hold the 'OK' button for 3 seconds to zero the DP sensor.

7.4.3 PRES SENSOR sub-menu

PRES SENSR → PRES 0 CAL → XXXXX (Bits)
PRES 25 CAL → XXXXX (Bits)
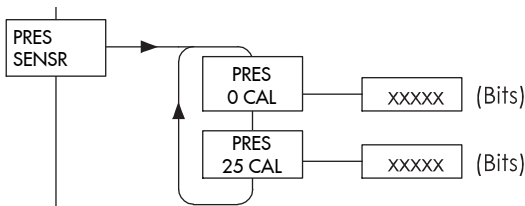
Selecting 'OK' at the PRES SENSR menu will enable the pressure sensor option.

Note: ZP and EP values are shown on the label attached to the body of the pressure sensor.

ZP (Zero Point) = 0 CAL
EP (End Point) = 25 CAL

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

spirax sarco

7.4.3.1 PRES 0 CAL (ZP)
When entering the PRES SENSR menu the 0CAL menu will be displayed. Pressing the right arrow key (>) will display the 0CAL bits values.

When the bits values for the 0 CAL have been entered press the OK button to confirm.

7.4.3.2 PRES 25 CAL (EP)
Pressing the down arrow key (v) will display the 25CAL bits values. The calibration certificate supplied with every pressure sensor kit lists the 25CAL bits values that are required to be entered into this menu.

When the bits values for the 25CAL have been entered press the OK button to confirm.

7.4.4 tEMP SENSR
This allows the user to add an external temperature sensor, which in turn will enable two modes of operation, steam and heat.

7.4.4.1 StEAM
When in steam mode the MVT10 will operate seamlessly between saturated and superheated steam.

7.4.4.2 HEAt
When configured in the heat mode, the MVT10 will display the net energy usage of the process. It assumes by default that 100% of the steam is converted to condensate, but can be configured.

7.5 OutPutS Sub-menu

This sub-menu allows the 4-20mA, Modbus and pulsed outputs of the flowmeter to be configured.

(If heat metering and 'POWER' are selected, the 4-20mA output will give the net power in kW, MW, kbtu/h and Mbtu/h)

OUt - PUtS

4-20 mA

(If heat metering and 'ENRGy' are selected, the pulsed output will give the net energy in kW, MW, kbtu/h, and Mbtu/h)

SORCE → FLOW / POWER

SEt 4mA → XXXXX (In kg/h, lb/h, Mwh or Mbtu)
SEt 20mA → XXXXX

CHECK 4mA → OP=4mA
CHECK 20mA → OP=20mA

(Connect a DMM and use the up and down keys to set 4 or 20mA)

PULSE → yES / NO

SORCE → tOtAL / ENRGy

NUM / PULSE → XXXXX (in kg or lb, Mwh or Mbtu)

PULSE WIdtH → x.xxSec (Must not exceed 4 pulses/sec)

COMMS → bAUd → 1200 / 9600 DEFAULT / 19200

Add → XXX

PAR → NONE DEFAULT / Odd / EVEN

dELAy → XXXX

7.5.1.1 4-20 mA Output sub-menu
The 4-20 mA sub-menu allows re-ranging and re-calibrating of the 4-20 mA output.

If heat metering and 'POWER' are selected, the 4-20mA output will give the net power in MWh or MBtu.

7.5.1.2 SORCE
This changes the source data for the 4-20 mA between FLOW and POWER.

7.5.1.3 SEt4 mA
This sets the value for the flowrate or power, which is equivalent to 4 mA. The minimum value that can be set as 4 mA is 0 and the maximum is the 20 mA equivalent value less one.

7.5.1.4 SEt20 mA
This sets the value for the flowrate or power, which is equivalent to 20 mA. The minimum value that can be set as 20 mA is the 4 mA equivalent value plus one and the maximum is the meters rated maximum at 32 bar g. The 20 mA value must always be a minimum of one greater than the 4 mA value.

For larger size ILVA20's where the maximum flowrate exceeds the SMALL scale range of 99999, the scale will need to be changed to LARGE to entre the desired value. See 7.3.3.

7.5.1.5 CHECK 4 mA
This allows the 4 mA value to be re-calibrated. A digital volt meter/multimeter should be connected to the "LOOP TEST" terminals. See section 5.2 Testing the 4-20mA Output. Pressing the right arrow button will display OP = 4 mA and the MVT10 will output a steady 4 mA. If the multimeter does not read 4 mA the up and down arrow buttons can be pressed to alter this current until 4 mA exactly is indicated. Pressing the 'OK' button confirms the setting.

7.5.1.6 CHECK 20 mA
This allows the 20 mA value to be re-calibrated. A digital volt meter/multimeter should be connected to the "LOOP TEST" terminals. See section 5.2 Testing the 4-20mA Output. Pressing the right arrow button will display OP = 20 mA and the MVT10 will output a steady 20 mA. If the multimeter does not read 20 mA the up and down arrow buttons can be pressed to alter this current until 20 mA exactly is indicated. Pressing the 'OK' button confirms the setting.

7.5.2 Pulse Output
This sub-menu allows the pulsed output to be configured.
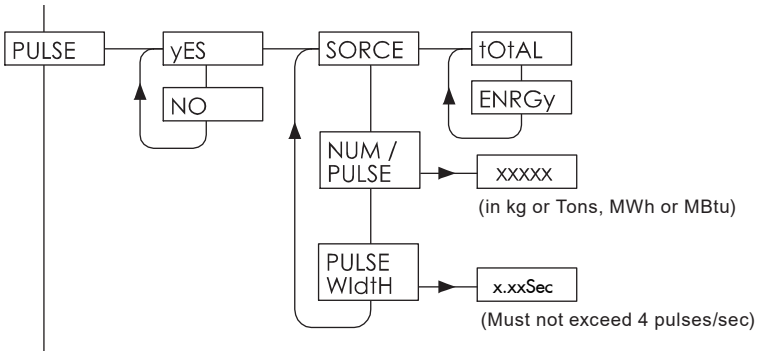
7.5.2.1 PULSE
This enables or disable the pulsed output, by selecting yes or no.

7.5.2.2 SORCE
This selects the source data for the pulsed output.
The source data can be either unit mass per pulse (tOtAL) or unit energy per pulse (ENRGy).

7.5.2.3 NUM/PULSE
This allows the total mass, or energy, which is equivalent to one pulse to be configured. Units are dependent on the UNIt setting. (Metric or Imperial).

7.5.2.4 PULSE WIDTH
This allows the width of the pulse to be set. The width can be set in 0.01 second increments from 0.02 seconds to a maximum of 0.2 seconds.

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

spirax sarco

7.5.3 Communications

The MVT10 has a MODbus EIA 485 compatible communications protocol. This enables users to interrogate the MVT10 for steam data using a MODbus Master (e.g. PC, PLC, BMS etc).
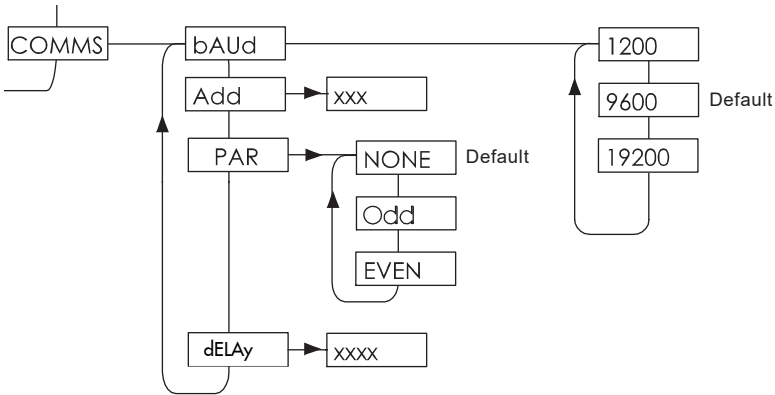
7.5.3.1 bAUD

This allows the communication speed to be set to either 1200, 9600 or 19200.
This must match the rate set within the device it is communicating to.

7.5.3.2 Add

For Modbus communications you must add an address. This is a three digit number between 001 - 247. Again this must match the address that the device that you are communcating to is set to.

7.5.3.3 PAR

This is the parity check added to the serial data. This must be configured the same on both the meter and the controller system. In a bus configuration other units on the bus may use a different parity. In this case the meter will see a parity/overrun error and discard the data. The display may show PAR ERROR when this occurs.

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

7.5.3.4 DELAY

Response Time and Delay Time:
The response time of the MVT10 is between 0 and 0.25 seconds. This is the time the MVT10 can take to reply to a request from the master. This takes into account time the master sends a request and when the MTV10 is ready to return a reply.

Fig. 28 Response time with no delay

	0.25 seconds

REQUEST

MASTER

Instant response — REPLY

SLAVE - MVT10
EXAMPLE 1

RESPONSE | REPLY — 0.2 seconds response

EXAMPLE 2

RESPONSE | REPLY

EXAMPLE 3   Max

The response time can be extended using the delay function. This adds a fixed time to the response time to guarantee a minimum response time. The delay time can be set between 0 and 1 second, in 0.25 second steps.

Fig. 29 Response time with 0.5 second delay

0.25 seconds	0.25 seconds	0.25 seconds

REQUEST

MASTER

The delay function is useful to prevent the MVT10 from replying too quickly.

Instant response — DELAY = 0.5 seconds

SLAVE - MVT10
EXAMPLE 3

RESPONSE | DELAY = 0.5 seconds | REPLY — 0.2 seconds response + 0.5 second delay

EXAMPLE 4

RESPONSE | DELAY = 0.5 seconds | REPLY — 0.25 second response + 0.5 second delay

EXAMPLE 5   Max

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

spirax sarco

7.6 ALARM sub-menu

This sub menu where the alarm functions can be set.
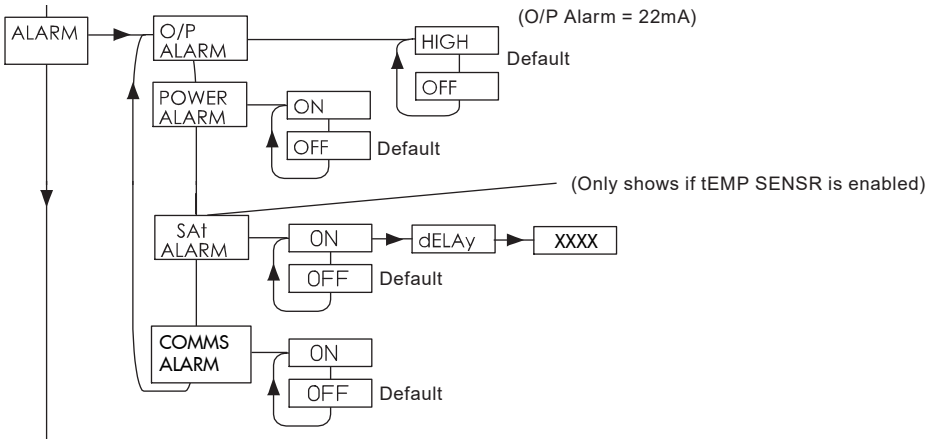
7.6.1 O/P (output) Alarm ALARM

HIGH	This enables the 4-20 mA alarm function.	If the self-diagnostic electronics determine that the sensor output has been constant for a period of time, or is not giving out a signal, it will set the 4-20 mA output to 22 mA.
OFF	This disables the 4-20 mA alarm function.	

7.6.2 POWER ALARM

OFF	This disables the power alarm function.	The power alarm indicates that the power supply to the MVT10 has been interrupted at some point.
ON	This enables the power alarm function.	

7.6.3 SAt ALARM

On	Enables the Sub Saturation Alarm.
Off	Disables the Sub Saturation Alarm.
dELAy	This sets the time duration before alarm is displayed. Can be zero.

This allows the Sub Saturation Alarm to be enabled or disabled.
The Sub Saturation alarm is switched off by default. If set it will alarm if the steam temperature drops 2 °C below saturation temperature.

7.6.4 COMMS ALARM

The comms alarm or communication alarm can be switched either ON or OFF.
Modbus communication errors can be caused by incompatible baud rates, incorrect parity settings or poor cabling in noisy environments. MVT10 can detect when communications errors occur and alert the user via the display. If the comms alarm is enabled and a communication error occurs "PAR ERROR" will be displayed for 3 seconds.

7.7 tESt sub-menu

The tESt sub-menu allows access to the MVT10 flowmeter's diagnostic tools. From here the display, 4-20 mA and pulse outputs can be tested.
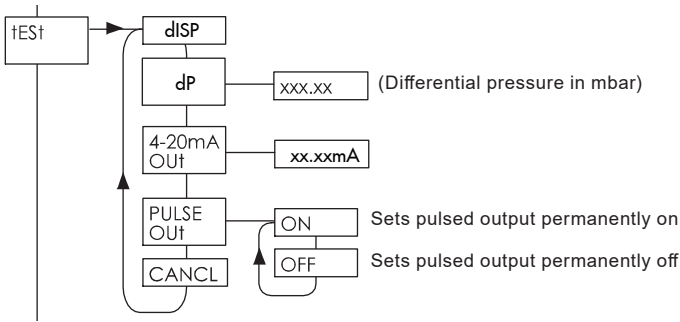
7.7.1 dISP

This allows the display to be tested. Pressing the right button will cause all the segments on the display to be turned on. Pressing the left button cancels the test and steps to the next stage.

7.7.2 dP

Displays the differential pressure from the DP sensor in mbar.

7.7.3.3 4-20 mA Out

This allows the 4-20 mA output to be tested. By editing the value and pressing the 'OK' button the output can be set to the selected output. This current will continue to be transmitted for five minutes unless the cancel option is chosen.

7.7.3 PULSE OUt

This allows the pulsed output to be tested. By selecting 'ON' or 'OFF' the desired test state of the pulsed output can be selected. Once the 'OK' button is pressed the pulsed output will remain in the selected state for five minutes or until the cancel option is chosen.

7.7.5 CANCEL

This allows the 4-20 mA output and pulsed output test signal selected above to be cancelled before the five minutes duration has expired. Press OK to cancel test signals.

7.8 MEtER Sub-menu
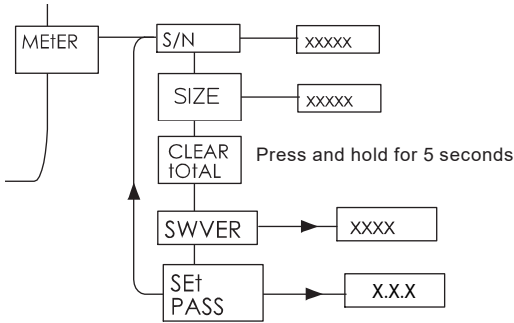
This sub-menu contains information about the flowmeter and is used to zero the total.

7.8.1 S/N
This is the factory set serial number of the ILVA20/MVT10 paired assembly and is displayed by pressing the right key.

7.8.2 SIZE
This is factory set to match the size of the paired ILVA20, and is displayed by pressing the right key (150-300).

7.8.3 CLEAR tOtAL
This function is used to clear the total by pressing and holding the OK key for 5 seconds.
Note: The total is backed-up every 8 minutes in the MVT10 flowmeter's non-volatile memory. If power is lost the MVT10 flowmeter could lose up to 8 minutes worth of totalised steam.

7.8.4 SWVER
This allows the software version to be viewed.

7.8.5 SEt PASS
This allows the default pass code to be changed to a user defined value.
It is important that if the default pass code is changed that the new value is noted and kept safe.
The new pass code can be recorded on the Table in Section 12.

---

8. Maintenance

There are some basic checks that can be carried out during plant a shutdown.

⚠️ **Caution!**
Before carrying out any maintenance on the ILVA20/MVT10 refer to the safety information in Section 1.

8.1 Impulse hoses
Spirax Sarco recommend periodic cleaning of the impulse lines to prevent excessive build-up of sludge or deposits.

8.1.1 Cleaning impulse hoses
It is recommended that the impulse lines are periodically cleaned to prevent the excessive build-up of sludge or deposits.

1. Ensure that the steam flow through the ILVA is isolated and the line pressure has returned to atmospheric pressure and the temperature cooled.

2. Close the isolation valves on the two way manifold and open the bleed valves on the MVT10 to allow the condensate to drain. (Consider where the condensate is going to drain to. A container placed under the bleed valves to catch the condensate may be advisable).

3. Loosen the hose lock nuts and unscrew the hoses from both manifolds.

4. The hoses can then be cleaned by blowing air through them from an airline and rodded with a dedicated pipe cleaner/brush. Be careful not to damage the hose. Replace any damaged hoses (see spares).

5. Ensure that the MVT10 ports are clean and free of debris. Carefully remove debris if required, but do not subject the DP cell to high pressure, temperatures above 60°C and be careful not to damage the cell with cleaning utensils.

6. Refit the hoses and tighten the lock-nuts using good engineering practice.

7. Close the bleed valves on the MVT10.

8. To recommission, follow steps in Section 6.

---

2 way manifold isolation valves

Impulse hoses

Bleed valves
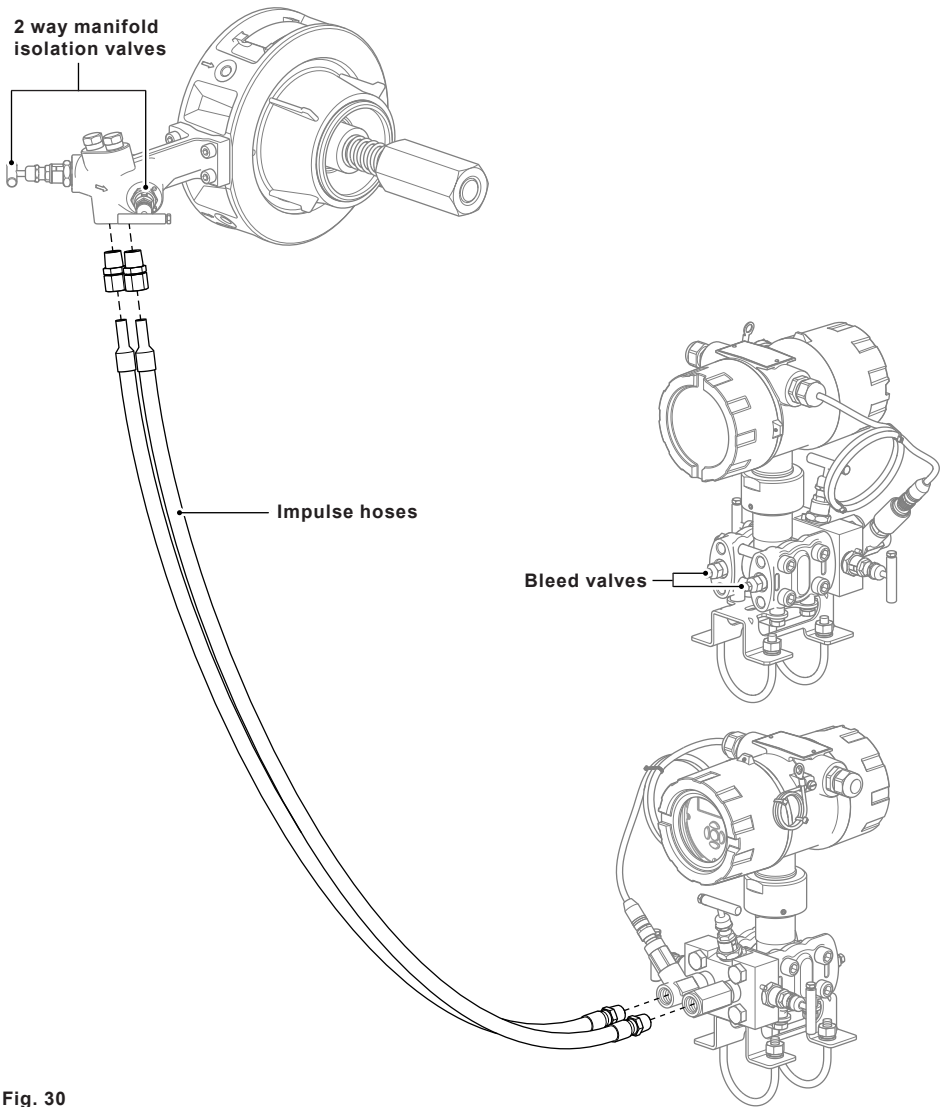
Fig. 30

8.1.1.2 Visual checks of ILVA20

It is also possible to carry out some simple checks on the ILVA20, though to do so the ILVA20 would need to be removed from the line.

Checks possible:

1. With the ILVA20 held in a vice (with soft jaws) with the cone and shaft below, check that the cone is free to move up and down on the shaft. It should have a smooth action with no 'sticking' points across the full movement.

2. Check that the spring is not cracked or broken. DO NOT loosen the nuts at either end of the shaft or dismantle the ILVA20, or the calibration will be affected.

3. Check that the differential pressure ports are clear and free of debris. Clean if necessary with an airline or appropriate tool.

Fig. 31

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service
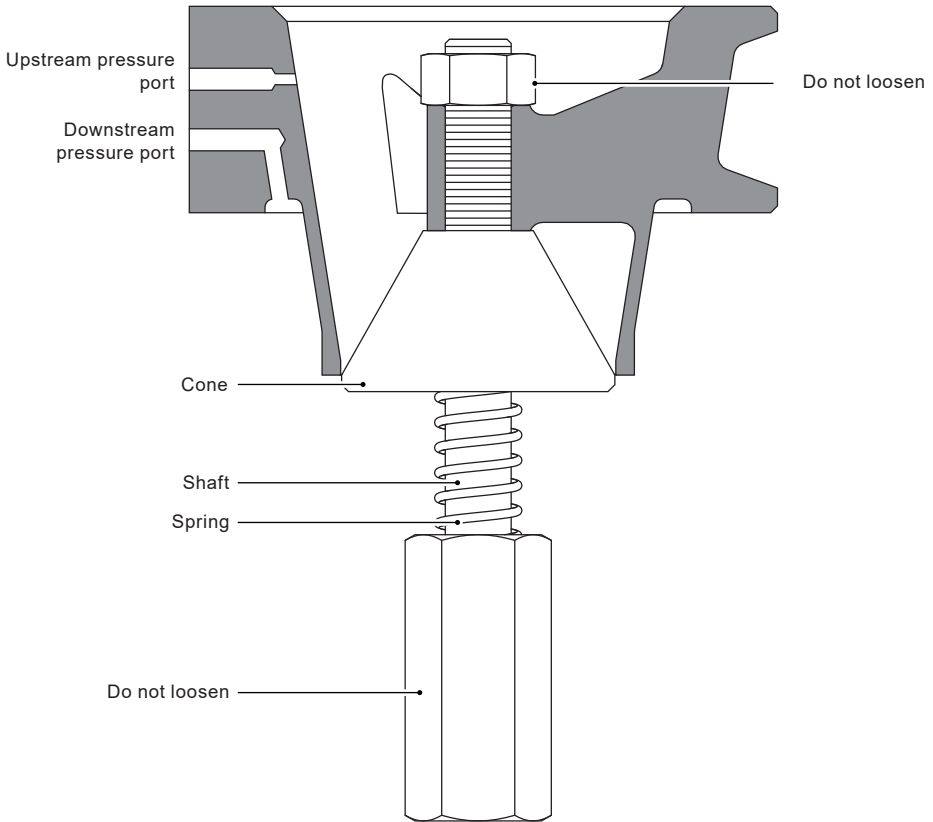
8.2 Replacing spare parts.

There are some spare parts available for the ILVA20/MVT10.

These are shown in Section 10.

8.2.1 How to replace the impulse hoses

Follow the procedure as per Section 8.1.1, but replacing the hoses with new ones.

8.2.2 Replacing the two way manifold seals.

1. Ensure that the steam flow through the ILVA is isolated and the line pressure has returned to atmospheric pressure and the temperature cooled.

2. Close the isolation valves on the two way manifold and open the bleed valves on the MVT10 to allow the condensate to drain. (Consider where the condensate is going to drain to. A container placed under the bleed valves to catch the condensate may be advisable).

3. Loosen the hose lock nuts and unscrew the hoses from the two way manifold.

4. Loosen and remove the four screws connecting the two way manifold to the ILVA20 body.

5. Carefully remove the manifold from the ILVA20.

6. Remove the old seals and clean surfaces, including the surface of the two way manifold.

7. Refit the two way manifold ensuring new seals are used. **CAUTION: Do not use old seals.**

8. Refit or replace the four screws and tighten incrementally in a diagonal sequence. Finish by going round each screw anti-clockwise to tighten each to 20 Nm.

9. Refit the hoses and tighten using good engineering practice. Tighten the lock nuts.

10. Close the bleed valves on the MVT10.

11. To recommission, follow steps in Section 6.

Fig. 32

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

spirax sarco
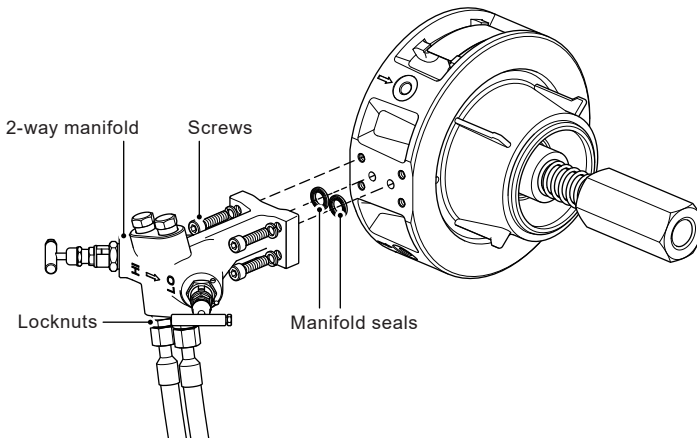
8.2.3 How to replace the MVT10 pressure sensor.

1. Ensure that the steam flow through the ILVA is isolated and the line pressure has returned to atmospheric pressure and the temperature cooled.

2. Close the isolation valves on the two way manifold and open the bleed valves on the MVT10 to allow the condensate to drain. (Consider where the condensate is going to drain to. A container placed under the bleed valves to catch the condensate may be advisable). See Figure 33.

3. Turn off/Disconnect the electric power supply and the communications.

4. Unscrew the rear electronic housing end cap.

5. Disconnect the sensor cable from the terminal block. See Figure 31.

6. Loosen the cable gland on the electronics housing and withdraw cable. See Figure 33.

7. Feed the new sensor cable through the cable gland and reconnect the the cable to the terminal block.

8. Tighten the cable gland and refit the electronic housing end cap.

9. Unscrew the pressure sensor from the MVT10 body and remove old seal.

10. Replace seal and screw in new pressure sensor and tighten to 24 to 26 N m.

11. Reconnect cable to new pressure sensor.

12. Close bleed valves on the MVT10.

13. Recommission (mechanically) as per Section 6.

14. Recommission the new pressure sensor as per Section 7.4.3.

Note: The ZP and EP values are shown on the label fitted to the body of the pressure sensor.

ZP = 0 CAL
EP = 25 CAL

Fig. 33

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

IM-P337-69 EMM Issue 7

Brown   Vcc   1

Blue   IN+   2

Black   IN-   3

Green/Yellow   GND   4

Screen   5

Cable gland

Pressure sensor
calibration data
shown on label
ZP = 0 CAL
EP = 25 CAL

Fig. 34

Bleed valves
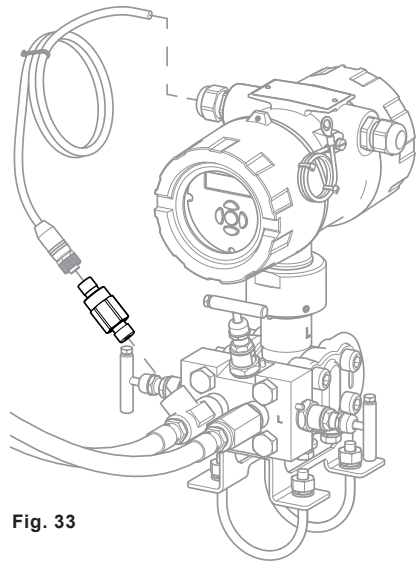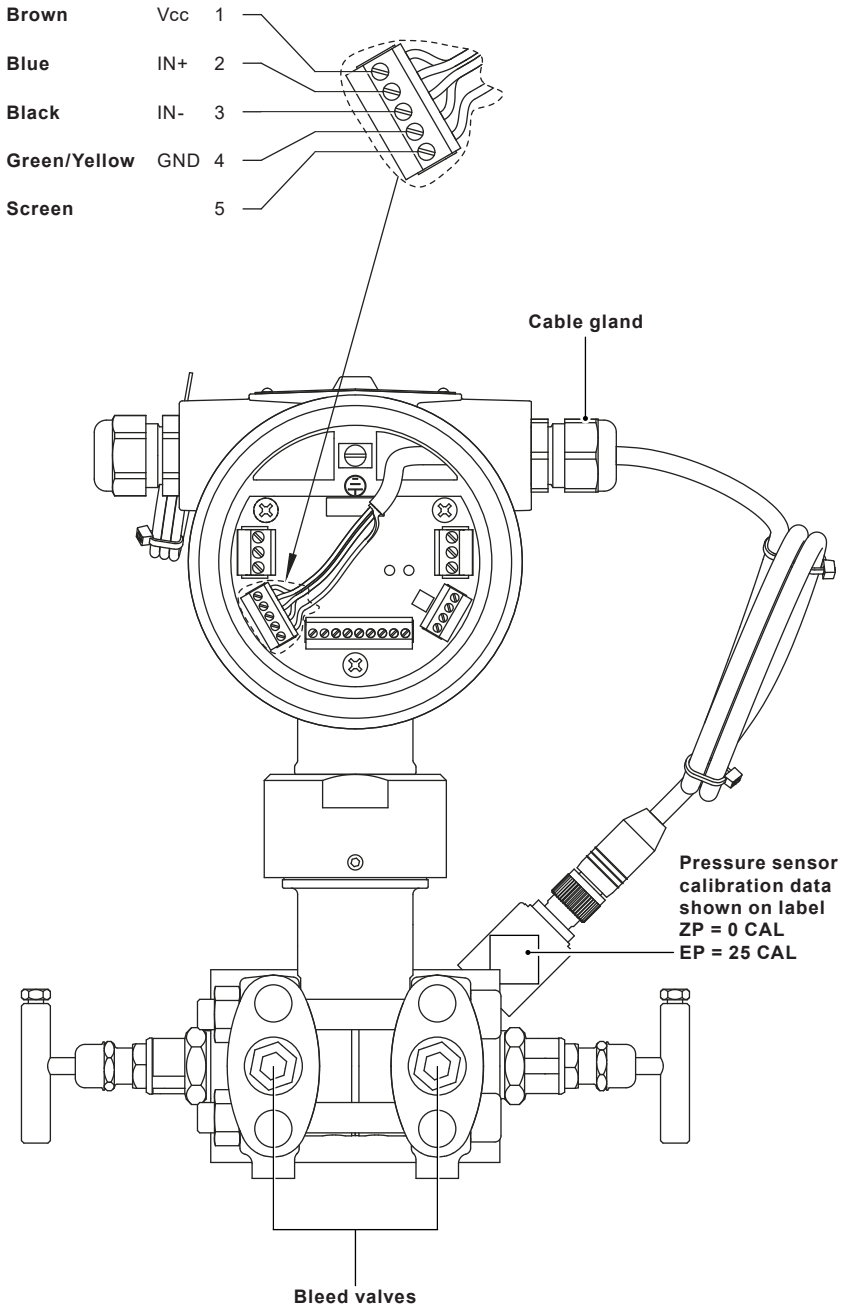
9. Spare parts

Spare parts

The spare parts available are detailed opposite. No other parts are supplied as spares.

3374380 - Gasket and fastener spares kit	**10**
3374381 - 2 way manifold and fastener spares kit	**11 and 12**
3374382 - Pressure sensor and cable spares kit	**8**
3374383 - Electronics spares kit	**13**
3374384 - MVT10 spares kit (Option 1) A new MVT10 with the original ILVA20 calibration data downloaded. **Note:** The system accuracy cannot be guaranteed.	
3374385 - MVT10 spares (Option 2) Full Recalibration (DN150)	**14**
3374485 - MVT10 spares (Option 2) Full Recalibration (DN200)	
3374585 - MVT10 spares (Option 2) Full Recalibration (DN250)	
3374685 - MVT10 spares (Option 2) Full Recalibration (DN300)	

The original ILVA20 returned for recalibration and a new MVT10 supplied with recalibration data.

How to order spares
Always order spares by using the description given in the column headed 'Available spares' and state the size and type of equipment.

Example:
3374380 - Gasket and fastener spares kit for an ILVA20 flowmeter

---

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

spirax **sarco**
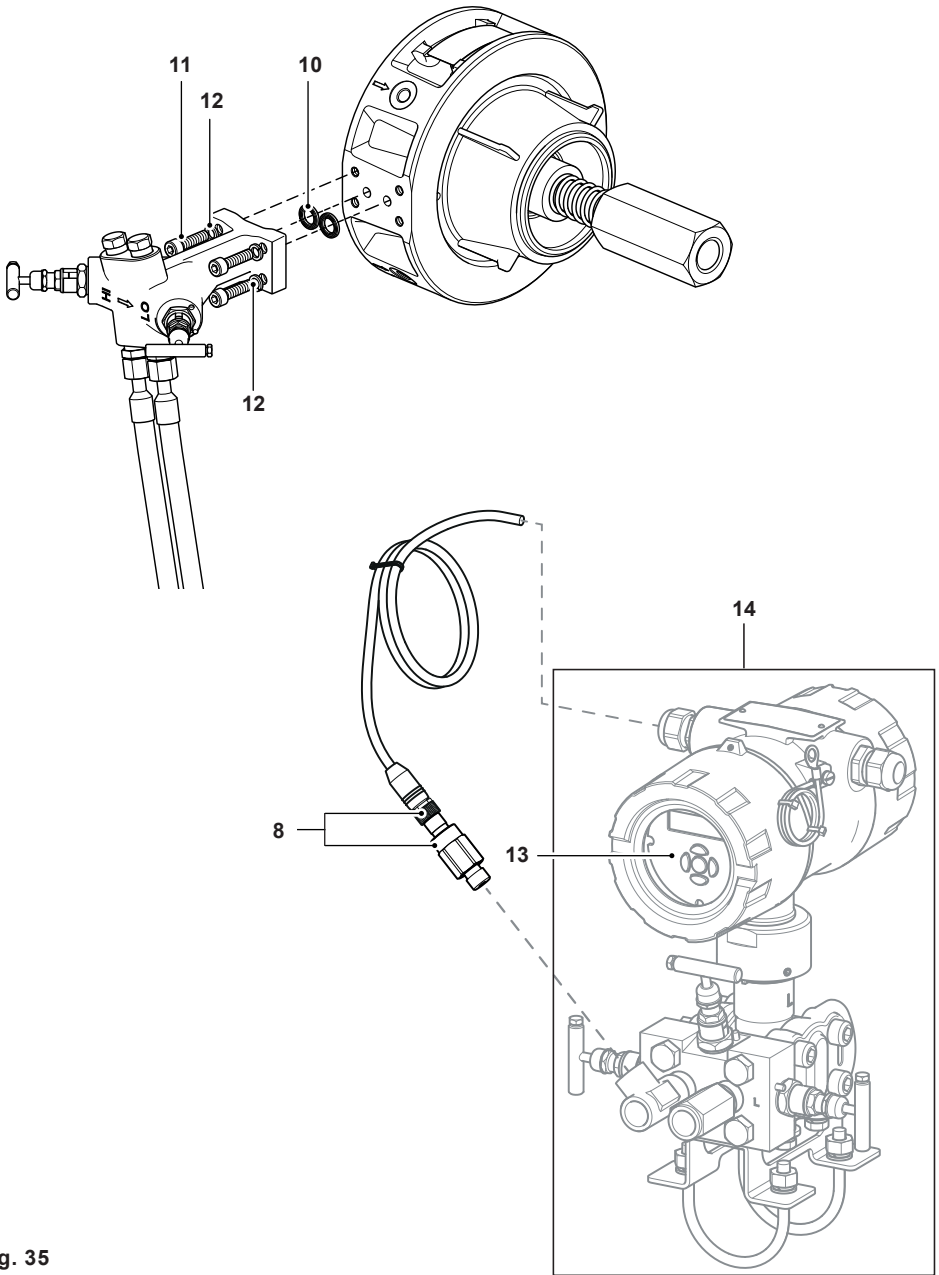
Fig. 35

10. Fault finding

10.1 Fault Findings on MVT10

Symptom	Possible Cause	Action
Unit is reading no flow or very little flow	Check that the pressure sensor is operating correctly.	Ensure correct bits values have been entered for the 0 and 25 cal points. See section 7.4 for further details.
	Check impulse lines, manifold isolation and equalization valves.	Ensure Impulse lines aren't blocked and that the correct isolation valves are open and the equalization valve is closed. See section 6.
No communication with the unit	Confirm the modbus interface has been wired up correctly.	See Section 5.3 for wiring details.
Unit is providing incorrect data over the Modbus interface	Check correct baud rate is used.	See Section 7.5.3 for wiring details.
Pulse output is incorrect	Pulse output incorrectly set	Check programming of pulse output. See Section 7.5.2.
	Pulse width incorrectly set	Check maximum pulse width of counter electronics.
	Pulse output overloaded	Check load rating.
	Pulse output electronics faulty	Test pulse output, in the test mode. See Section 7.7.3.
Non zero flow indicated when no actual flow is in the pipe	Unit not zeroed at comissioning	Zero unit. See Section 7.8.
	4 mA output not calibrated	Calibrate 4 mA output. See Section 7.5.
	4 mA transmission set to a value higher than zero.	Reset 4 mA.
	Interference	Check earthing.

10.2 Fault Findings on ILVA20

Symptom	Possible Cause	Action
The meter is reading a constant flow, although the flow is known to be fluctuating	Cone is stuck due to debris in the pipe line.	Take the the meter body out to see if any debris can be cleared. If the shaft is severily scratched, the ILVA20 will need to be replaced.
The unit is reading maximum flow	1) Ensure the two needle vales on the body are fully open. 2) Ensure the needle valve on the three way manifold is fully open. 3) Make sure there is no debris in the hoses or any other steam path.	
The unit is reading no flow	Ensure the equalization valve on the three way manifold is closed and that the impulse lines have been piped up so that the HI side of the 2-way manifold is connected to the HI side of the 3-way manifold.	
ILVA20 Produces large amount of noise (Banging and clattering)	Upstream/downstream installation lengths incorrect. Water hammer caused be entrained condensate in the steam.	Re-install following the installation guidelines. See Section 4.

11. Settings table

Menu		Default		Range, options	
Basic Data	**Dryness fraction**	97	%	Range 70 to 100 %	
	Units	Metric		Metric, imperial	
	tOtAL	Mass		Mass, ENRGy	
	Atmospheric pressure	1.01	bar a	0.7 - 1.10 bar a	*
Scale	**Large/small**	Small			
Input					
OUtPUtS	4-20 mA				
	Source	FLOW		FLOW, POWER	
	Set 4 mA	0		0 to one below max value	
	Set 20 mA	Max		MAX - flow a @ 32 bar g (Tonne/h) DN150: 22.38 DN200: 43.99 DN250: 60.14 DN300: 85.37 MAX - Power @ 32 bar g (MW) DN150: 17.43 DN200: 34.26 DN250: 46.83 DN300: 66.48	*
	Pulse	yES		yES, NO	
	Source	tOtAL		ToTal, ENRGy	
	NUM/PULSE	0.01		In (default) small units this is 1, 10, 100, 1 000, 10 000.	
	PULSE WidtH	0.2	Sec	Range: 0.02 -0.2 Sec	
	COMMS				
	Baud	9600	baud	1 200, 9 600, 19 200	
	Add	001		Range: 001 to 247	
	Parity	None		None, Even, Odd	
	Delay	0.00	Sec	Values: 0.00, 0.25, 0.50, 0.75, 1.00	
Alarm	**O/P Alarm**	OFF		High, OFF	
	POWER ALARM	OFF		ON, OFF	
	Sat ALARM	OFF		ON, OFF	
	dELAy	20	Sec	Range: 0 -3600Sec	
	COMMS ALARM	ON		ON, OFF	
Meter	**Pass Code**	7452		Range: 0000 to 9999	

For imperial figures, see the table on the following page *

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

spirax sarco

Setting table: Imperial figures

Menu		Default		Range, options
Basic Data	**Dryness fraction**	97	%	Range 70 to 100 %
	Units	Metric		Metric, imperial
	tOtAL	Mass		Mass, ENRGy
	Atmospheric Pressure	14.64	psi	10.5 - 15.95 psi
OUtPUtS	Set 20 mA	Max		MAX - flow @ 32 bar g (Ton/h) DN150: 24.67 DN200: 48.50 DN250: 66.29 DN300: 94.11 MAX - Power @ 32 bar g (MBtu/h) DN150: 59.47 DN200: 116.89 DN250: 159.79 DN300: 226.83

12. Appendix

12.1 Read Holding Registers

The following Read Holding Registers are supported by the MVT10:

Table 1 Register Groups

Register	Functionality
40,010 to 40,014	Read basic diagnostics
40,101 to 40,114	Read flow meter values in metric units
40,201 to 40,214	Read flow meter values in imperial units

Table 2 Basic Diagnostics

Address	Parameter	Units	Notes
40,010	Alarm status	Bit field	Refer to Table 7 - Alarm Status
40,011	SxS Device ID	N/A	0x0000 – RESERVED
			0x0001 – RESERVED
			0x0002 – RESERVED
			0x0004 – RESERVED
			0x0100 – ILVA20 50mm
			0x0101 – ILVA20 80mm
			0x0102 – ILVA20 100mm
			0x0103 – ILVA20 150mm
			0x0104 – ILVA20 200mm
			0x0105 – ILVA20 250mm
			0x0106 – ILVA20 300mm
40,012	Software Version	N/A	18 is sw version 0.1.8
			200 is sw version 2.0.0
40,013	Test value low 16 bits	1234.0F	Single Precision IEEE 754 This register returns a fixed value to allow the correct format of register reads to be checked.
40,014	Test value high 16 bits		

Table 3 Flow Meter Values

Address	Parameter	Units	Notes
40,101	Total low 16 bits	kg Tonne	Single Precision IEEE 754
40,102	Total high 16 bits		
40,103	Flow low 16 bits	kg/hour Tonne/hour	Single Precision IEEE 754
40,104	Flow high 16 bits		
40,105	Pressure low 16 bits	bar g	Single Precision IEEE 754
40,106	Pressure high 16 bits		
40,107	Line Temperature low 16 bits	°C	Single Precision IEEE 754
40,108	Line Temperature high 16 bits		
40,109	Water Equivalent Flow Rate low 16 bits	L/minute	Single Precision IEEE 754
40,110	Water Equivalent Flow Rate high 16 bits		
40,111	Energy low 16 bits	kWh MWh	Single Precision IEEE 754
40,112	Energy high 16 bits		
40,113	Power low 16 bits	kW MW	Single Precision IEEE 754
40,114	Power high 16 bits		
40,201	Total low 16 bits	lb Short Ton	Single Precision IEEE 754
40,202	Total high 16 bits		
40,203	Flow low 16 bits	lb/hour Short Ton/hour	Single Precision IEEE 754
40,204	Flow high 16 bits		
40,205	Pressure low 16 bits	psi g	Single Precision IEEE 754
40,206	Pressure high 16 bits		
40,207	Line Temperature low 16 bits	°F	Single Precision IEEE 754
40,208	Line Temperature high 16 bit		
40,209	Water Equivalent Flow Rate low 16 bit	cubic foot/minute	Single Precision IEEE 754
40,210	Water Equivalent Flow Rate high 16 bit		
40,211	Energy low 16 bits	kBtu MBtu	Single Precision IEEE 754
40,212	Energy high 16 bits		
40,213	Power low 16 bits	kBtu/hour MBtu/hour	Single Precision IEEE 754
40,214	Power high 16 bits		

12.1.2 Floating Point Format

IEEE-754-1985 standard for 32-bit (single precision) floating point values are stored in adjacent registers with the low 16 bits on an even address and the high 16 bits on the following odd address. The floating point value is store in the registers as follows:

Register	High 16 bits (Address XXX1)				Low 16 bits (Address XXX0)	
Byte	4		3		2	1
Bit	31	30..24	23	22..16	15..8	7..0
IEEE-754	Sign	Exponent (8 bits)			Mantissa (23 bits factional part)	

The floating point value 1234.0 (sign, 0; exponent, 0x89, mantissa 0x1A4000) will have a low 16 bits of 0x4000 and high 16bits 0x449A. **Both parts of the floating point value must be read in a single transfer to ensure the correct value is read.**

Deprecated Read Holding Registers

The following deprecated registers are supported for backwards compatibility with previous products:

Table 1 Register Groups

Register	Functionality
40,001 to 40,009	Read flow meter values in metric units. DEPRECATED.
40,001 to 40,029	Read flow meter values in imperial units. DEPRECATED.

Table 2 Flow Meter Values

Address	Parameter	Units	Notes
40,001	Total low 16 bits	kg	Total = (Total high x 65536) + Total low
40,002	Total high 16 bits	Tonne x 100	
40,008	Energy low 16 bits	kWh	Energy = (Energy high x 65 536) + Energy low
		MWh x 100	
40,009	Energy high 16 bits		
40,021	Total low 16 bits	lbs	Total = (Total high x 65 536) + Total low
		Ton x 100	
40,022	Total high 16 bits		
40,028	Energy low 16 bits	kBTU	
40,029	Energy high 16 bits	MBTU x 100	Energy = (Energy high x 65 536) + Energy low

---

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

spirax sarco

12.2 ILVA20/MVT10 Configuration menu

(Normal run mode display sequence)

(test display)

(Power on sequence; turn on all segments, then show the software version no.)

VER x.x

Total high

Total low

(Shows the total high 5 digits for 10 secs, then the low 5 digits. In Tonne/h (metric), Tons/h (imperial), Mwh or Mbtu

Flow — Tonne/h (metric) Tons/h (imperial)

Power — (Mwh or Mbtu)

Pressure — (Bar g or psi g, depending if metric or imperial units are selected)

Temp — (If heat is selected, alternates between steam and condensate temp, otherwise shows steam temp. In C or F)

(Press the > key and hold for 5 secs.)

ENTER PASS

8888

8888 is display
Default password = 7452

(Configuration sub-menus)

bASIC dAtA

dRy
— xxx %
UNItS — MEt / IMP

SCALE — LARGE / SMALL

tOtAL — xxx.xx
AtMOS PRES

MASS / ENRGy

(Display either the mass total in kg or lbs, or the steam energy in Mwh or Mbtu)

In-PUtS

ZERO PRES — Press and hold 'OK' for 3 seconds to zero pressure sensor

ZERO DP — Press and hold 'OK' for 3 seconds to zero DP sensor

PRES SENSR — PRES 0 CAL — xxxxx (Bits) / PRES 25 CAL — xxxxx (Bits)

(When either of these parameters are exited, the unit will display 'WAit' for 10 seconds)

tEMP SENSR — ON / OFF

STEAM / HEAT — XXXX%

Continued on the next page

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

12.2 ILVA20/MVT10 Configuration menu (continued)
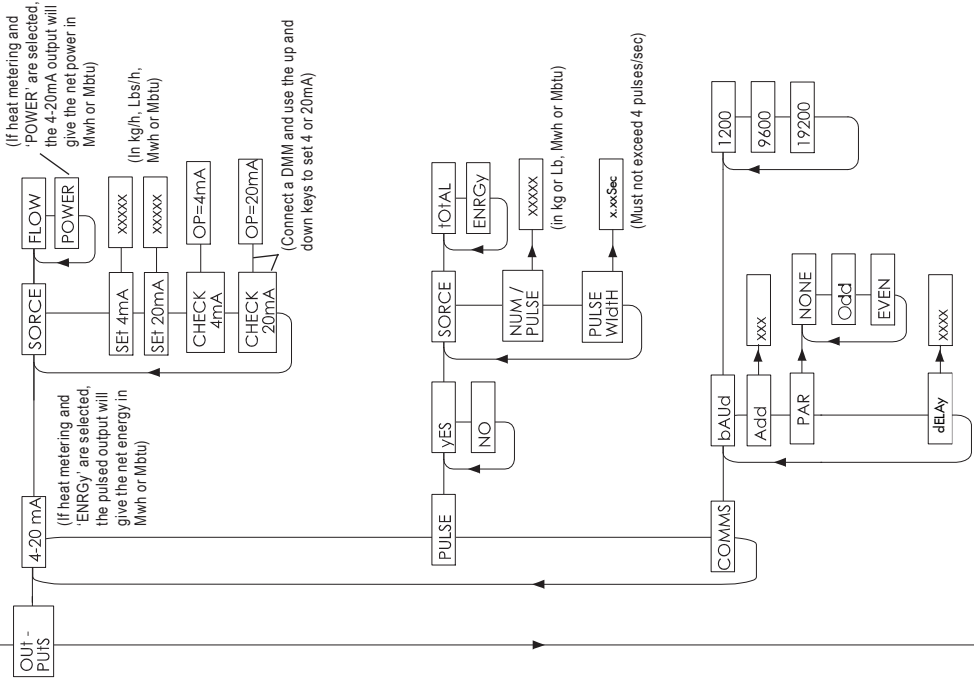
Error messages
(These alternate with the normal run mode display. They are prioritised and are latched. Pressing 'OK' cancels the displayed alarm & allows the next one to be viewed).

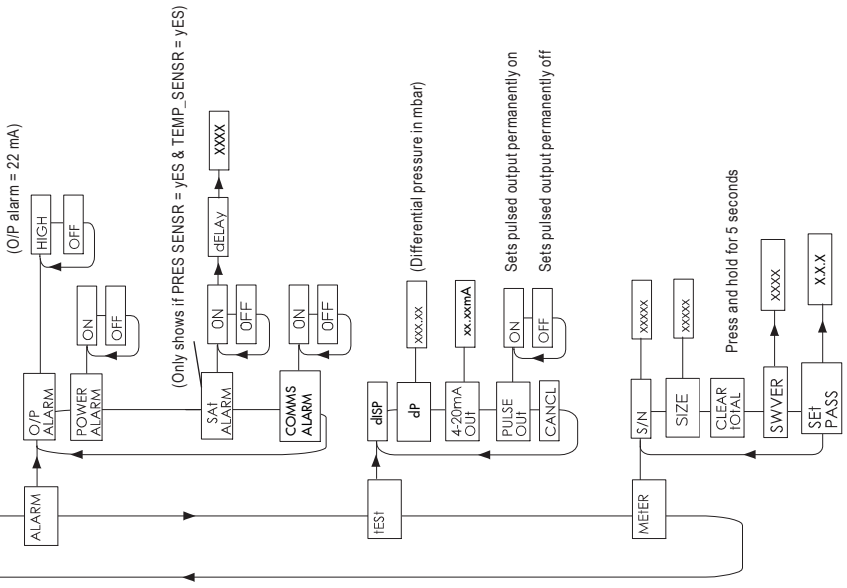(A continuous alarm will re-occur on the display 2 seconds after it has been cancelled).

POWER OUt	Power interrupted.	
NO SIGNL	No signal from temp sensors	(Shows when a sensor is outside its limits. The 4-20mA alarm will also activate)
HIGH FLOW	Flow above the aximum.	(Shows when the flow i/p is exceeded)
HIGH PRES	Pressure above maximum	(Shows when the pres i/p limit is exceeded)
HIGH tEMP	The temperature is above the rated maximum	
SUb SAt	Line conditions have changed from superheat to saturation (only when pressure sensor enabled).	
PAR ERROR	Parity Error on the EIA/TIA 485 communications link. In a bus configuration this could be triggered by communications to a third party device.	

Diagram labels: OUt-PUlS, 4-20 mA, SORCE, FLOW, POWER (If heat metering and 'POWER' are selected, the 4-20mA output will give the net power in Mwh or Mbtu), SEt 4mA xxxxx, SEt 20mA xxxxx (In kg/h, Lbs/h, Mwh or Mbtu), CHECK 4mA OP=4mA, CHECK 20mA OP=20mA (Connect a DMM and use the up and down keys to set 4 or 20mA)

(If heat metering and 'ENRGy' are selected, the pulsed output will give the net energy in Mwh or Mbtu)

PULSE, yES, NO, SORCE, tOtAL, ENRGy, NUM/PULSE xxxxx (in kg or Lb, Mwh or Mbtu), PULSE WidtH x.xxSec (Must not exceed 4 pulses/sec)

COMMS, bAUd 1200/9600/19200, Add xxx, PAR NONE/Odd/EVEN, dELAy xxxx

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

74   spirax sarco   IM-P337-69 EMM Issue 7

(O/P alarm = 22 mA)

(Only shows if PRES SENSR = yES & TEMP_SENSR = yES)

(Differential pressure in mbar)

Sets pulsed output permanently on

Sets pulsed output permanently off

Press and hold for 5 seconds

ALARM

- O/P ALARM → HIGH / OFF
- POWER ALARM → ON / OFF
- SAt ALARM → ON / OFF
- COMMS ALARM → ON / OFF
- dELAy → XXXX

tESt

- dISP
- dP → xxx.xx
- 4-20mA OUt → xx.xxmA
- PULSE OUt → ON / OFF
- CANCL

MEtER

- S/N → xxxxx
- SIZE → xxxxx
- CLEAR tOtAL
- SWVER → xxxx
- SEt PASS → XX.X

ILVA20 Flowmeter and MVT10 Differential Pressure Transmitter for Saturated and Superheated Steam Service

www.spiraxsarco.com