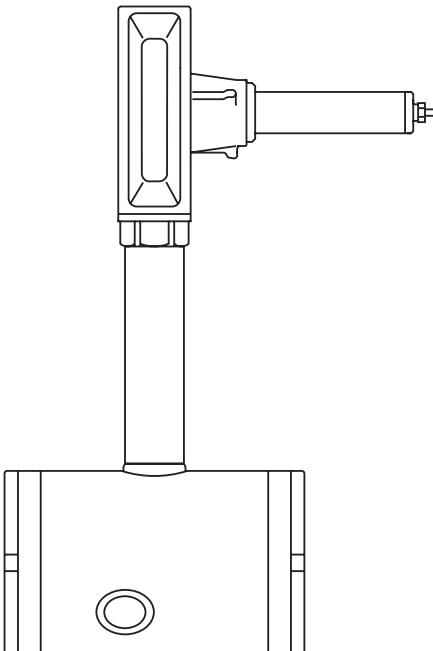


**DIVA**  
**Saturated Steam Flowmeter**  
**Installation and Maintenance Instructions**

---

---



- 1. General safety information*
- 2. General product information*
- 3. Installation*
- 4. Commissioning*
- 5. Operation*
- 6. Maintenance*
- 7. Spare parts*
- 8. Fault finding*
- 9. Settings table*

# — 1. *General safety information* —

Your attention is drawn to the relevant Supplementary Safety Information sheet supplied with the product as well as to any National or local regulations.

Safe operation of the product depends on it being properly installed, commissioned and maintained by a qualified person in compliance with the operating instructions.

It is essential to comply with general installation and safety instructions for pipeline and plant construction, as well as to make proper use of tools and safety equipment.

The product is designed and constructed to withstand the forces encountered during normal use. Use of the product for any other purpose, or failure to install the product in accordance with these Installation and Maintenance Instructions, could cause damage to the product, will invalidate the CE marking, and may cause injury or fatality to personnel.

## **Warning**

This product complies with the requirements of Electromagnetic Compatibility Directive 89/336/EEC by meeting the standards of:

EN 61326: 1997 Electrical equipment for measurement, control and laboratory use - EMC requirements. Immunity to industrial locations annex A - Table A1. Emissions to domestic locations Table 4.

The following conditions should be avoided as they may create interference above the limits specified in EN 61326: 1997 if:

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

If this product is not used in the manner specified by this IMI, then the protection provided may be impaired.

## — 2. General product information —

This manual explains how to install, commission and maintain the Spirax Sarco Direct In-line Variable Area (DIVA) flowmeter for use on saturated steam.

### 2.1 Product description

The Spirax Sarco DIVA flowmeter is designed to reduce the cost of flowmetering and is used as an accurate means to measure saturated steam flowrates.

The DIVA is a stand alone device and requires no other equipment, such as differential pressure transmitters, pressure sensors, etc. to calculate mass flowrates of saturated steam.

### 2.2 Equipment delivery and handling

#### Factory shipment

Prior to shipment, the Spirax Sarco DIVA is tested, calibrated and inspected to ensure proper operation.

#### Receipt of shipment

Each carton should be inspected at the time of delivery for possible external damage. Any visible damage should be recorded immediately on the carrier's copy of the delivery slip. Each carton should be unpacked carefully and its contents checked for damage.

If it is found that some items have been damaged or are missing, notify Spirax Sarco immediately and provide full details. In addition, damage must be reported to the carrier with a request for their on-site inspection of the damaged item and its shipping carton.

#### Storage

If a flowmeter is to be stored for a period prior to installation, the environmental storage conditions should be at a temperature between 0°C and 70°C (32°F and 158°F), and between 10% and 90% relative humidity (non-condensing).

### 2.3 Sizes and pipe connections

DN50, DN80 and DN100

The DIVA is of a wafer design, suitable for fitting between the following flanges:

EN 1092 PN16, PN25 and PN40

BS 10 Table H

ANSI B 16.5 class 150 and 300

Japanese Industrial Standard JIS 20

Korean Standard KS 20.

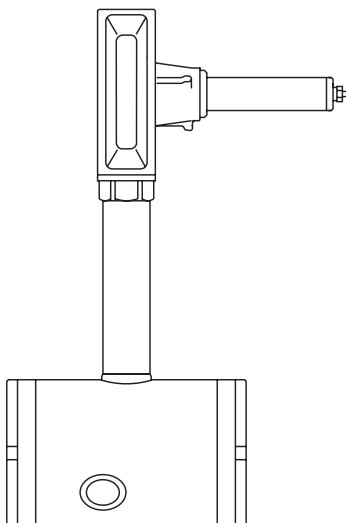
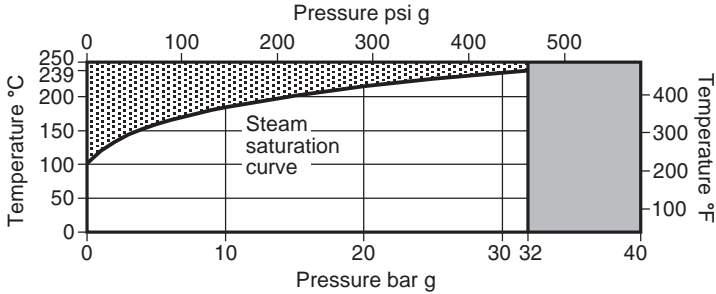




Fig. 1

## 2.4 Pressure/temperature limits



 The product **must not** be used in this region.

 The product should not be used in this region due to the limitations of the software.

PMA	Maximum allowable pressure @ 239°C (460°F)	Saturated steam 32 bar g (464 psi g) otherwise as the specified flange rating	
TMA	Maximum allowable temperature	250°C	(482°F)
	Minimum allowable temperature	0°C	(32°F)
PMO	Maximum operating pressure for saturated steam service	Horizontal flow	32 bar g (464 psi g)
		Vertical flow	11 bar g (160 psi g)
	Minimum operating pressure	0.6 bar g	(8.7 psi g)
TMO	Maximum operating temperature	239°C	(460°F)
	Minimum operating temperature	0°C	(32°F)
	Maximum electronics ambient temperature	55°C	(130°F)
	Maximum electronics humidity level	90% RH (non-condensing)	
$\Delta$ PMX	Maximum differential pressure	The pressure drop across the DIVA flowmeter at the maximum rated flow is nominally 750 m bar (300 inches wg) for the DN50, and 500 m bar (200 inches wg) for the DN80 and DN100	
	Designed for a maximum cold hydraulic test pressure of	52 bar g	(754 psi g)

## 2.5 Technical data

IP rating	IP65 with correct cable glands.		
Power supply	Loop powered nominal 24 Vdc		
Outputs	4-20 mA (proportional to mass flow)		
	Pulsed output $V_{max}$ 28 Vdc, $R_{min}$ 10 k $\Omega$		
Communication port	EIA 232C		
Performance	System uncertainty to ISO 17025 (95% confidence to 2 STD)	$\pm$ 2% of reading over the range of 10% to 100% of maximum rated flow	
		$\pm$ 0.2% FSD from 2% to 10% of maximum rated flow	
	Turndown: up to 50:1		

## 2.6 Electrical connections

Standard	M20 x 1.5
Available to order	½" NPT

## 2.7 Materials

<b>Body</b>	Stainless steel S.316
<b>Internals</b>	431 S29/S303/S304/S316
<b>Spring</b>	Inconel® X750 or equivalent
<b>Stem</b>	Stainless steel 431 S29
<b>Housing</b>	Aluminium HE30

## 2.8 Dimensions/weights (approximate) in mm and kg

Size	A	B	C	D	E	Weight
<b>DN50</b>	35	103	265	155	145	3.35
<b>DN80</b>	45	138	285	150	145	5.25
<b>DN100</b>	60	162	315	205	145	8.20

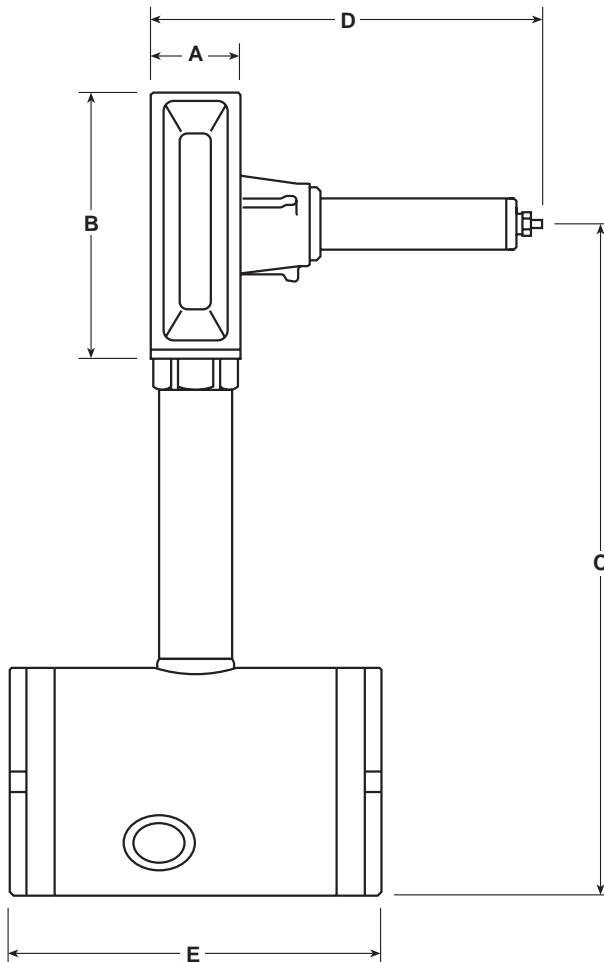


Fig. 2

# 3. Installation

**Note:** Before actioning any installation observe the 'Safety information' in Section 1. To meet its specified accuracy and performance it is essential that the following installation guidelines are followed carefully. For steam applications sound steam engineering practices should be followed, including the use of separators. The installation must conform to all relevant construction and electrical codes.

## 3.1 Environmental conditions

The flowmeter should be located in an environment that minimises the effects of heat, vibration, shock and electrical interference. (Pressure/temperature limits are detailed in Section 2.4).

**CAUTION:** Do not lag the DIVA or mating flanges as this may result in excessive temperatures in the electronics. Exceeding specified temperature limits will invalidate the warranty and can adversely effect the performance and may damage the DIVA.

### Other considerations

Be sure to allow sufficient clearance for:

- Installation of conduit/wiring.
- Removal of the enclosure end caps.
- Viewing of the display. **Note** electronics housing and display can be rotated.

**Warning:** Do not install the flowmeter outdoors without additional weather protection to prevent damage due to freezing.

## 3.2 Mechanical installation

**Warning:** Do not alter the adjustment nut at the back of the DIVAs shaft, as this will affect the flowmeters calibration.

### Orientation

The DIVA can be installed in any orientation when the pressure is below 11 bar g (160 psi g), see Figures 3 and 4.

When the pressure is above 11 bar g the DIVA must be installed in a horizontal pipe, with the electronics housing below the body, see Figure 4.

Ideally in any horizontal orientation, the DIVA should be installed with the electronic housing below the body. Where this is not possible, the DIVA can be installed with the electronics enclosure above the body. However, the pressure of the saturated steam must be below 11 bar g (160 psi).

**Note:** The DIVA operates with flow in one direction only. It is not intended for use with bi-directional flow. The DIVA is clearly marked with a direction of flow arrow.

### Rotating the electronics enclosure

The electronics housing can be rotated 270° to enable sufficient clearance for installation. To rotate the display loosen the grub screw immediately below the enclosure, rotate the enclosure and tighten the grub screw. **Warning:** Do not untighten stem from the main body of the unit.

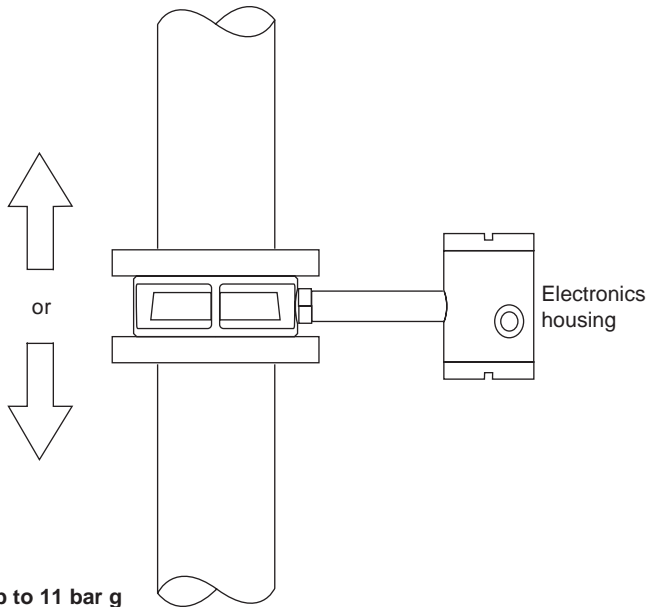
### Upstream/downstream pipework

The DIVA flowmeter should be installed in pipework manufactured to BS 1600 or ANSI/ASME B 36.10 Schedule 40, which corresponds to the following pipeline internal diameters.

Nominal diameter	Nominal internal diameter
50 mm	52 mm
80 mm	77 mm
100 mm	102 mm

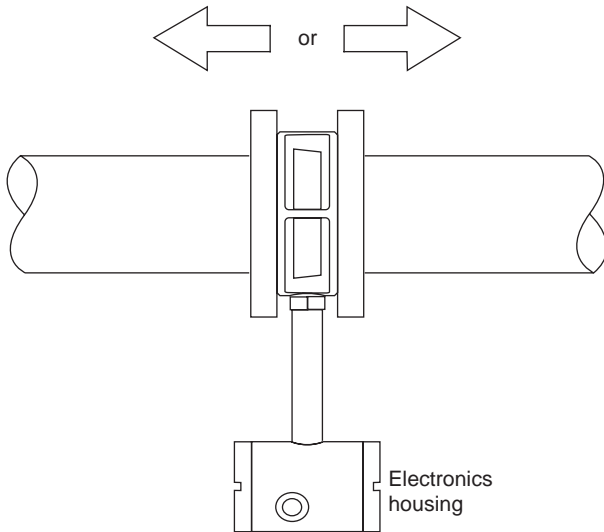
For different pipe standards/schedules, if the flowmeter is being operated at the extreme of its published maximum range, and maximum accuracy is required, downstream spool pieces manufactured from BS 1600 or ANSI/ASME B 36.10 Schedule 40 pipe should be used. It is important that the internal upstream 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.

**Note:** See pages 8 and 9, Figures 5 to 8 for other considerations which need to be noted before determining the correct installation location.



**Fig. 3 Vertical flow up to 11 bar g**

**Note: The DIVA operates with flow in one direction only. It is not intended for use with bi-directional flow. The DIVA is clearly marked with a direction of flow arrow.**



**Fig. 4 Horizontal flow up to 32 bar g**

The DIVA 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 5).

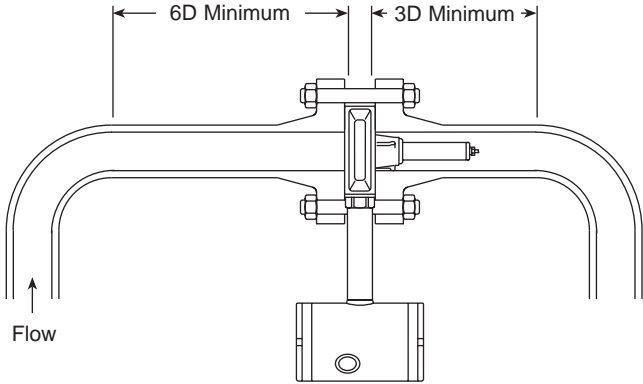


Fig. 5

If any of the following configurations are present upstream of the DIVA:

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

Then it is recommended that the minimum upstream clear pipework is doubled to 12 diameters (See Figure 6).

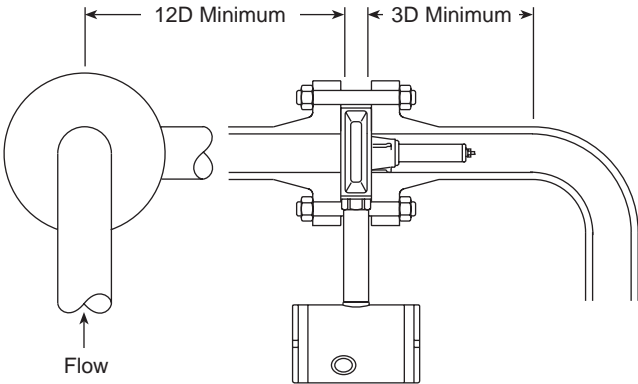


Fig. 6



Avoid installing the DIVA flowmeter downstream of an actuated valve as rapid cycling of the valve could give rise to inaccurate results or damage the flowmeter. See Figure 7. In configurations where there is more than one rapid acting pressure reducing valve close coupled, the DIVA flowmeter should be installed with a minimum of 25 upstream and 3 downstream pipe diameters away from the valves.

Safety valves should also be as far away as possible from the flowmeter - at least 25D.

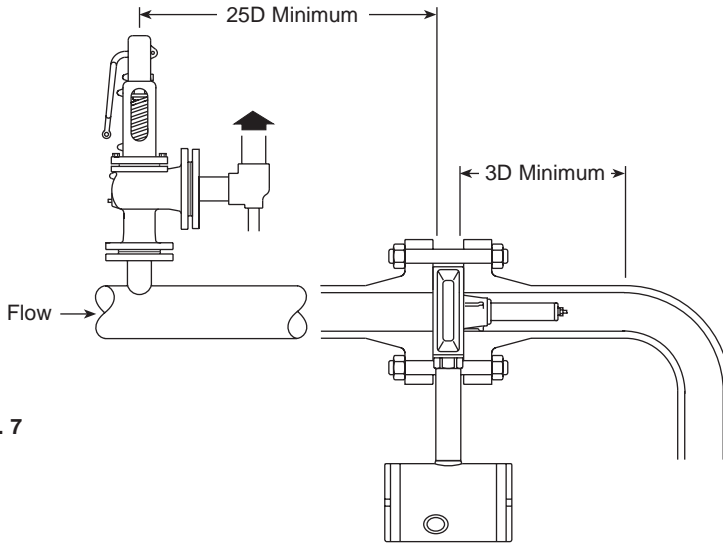


Fig. 7

To install the DIVA pipeline unit into existing pipework and for aiding possible flowmeter removal, it may be necessary to use a spool piece to ease installation (see Figure 8).

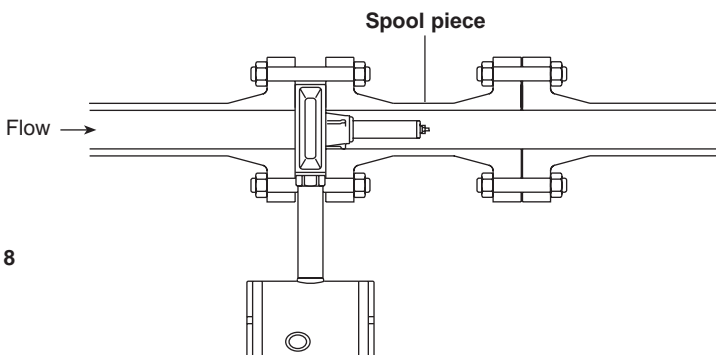


Fig. 8

---

## 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.

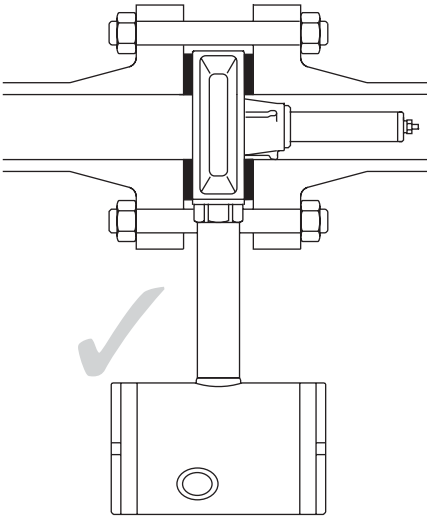


Fig. 9 Gaskets fitted correctly

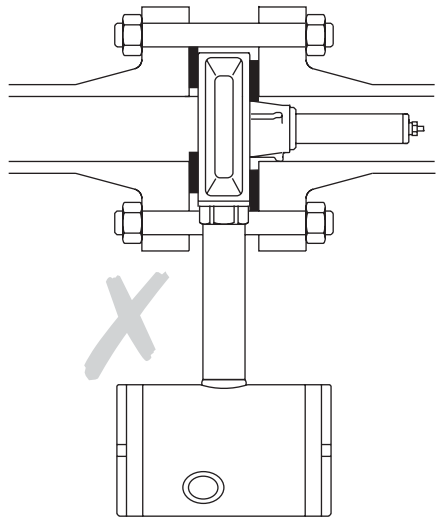


Fig. 10 Gaskets fitted incorrectly

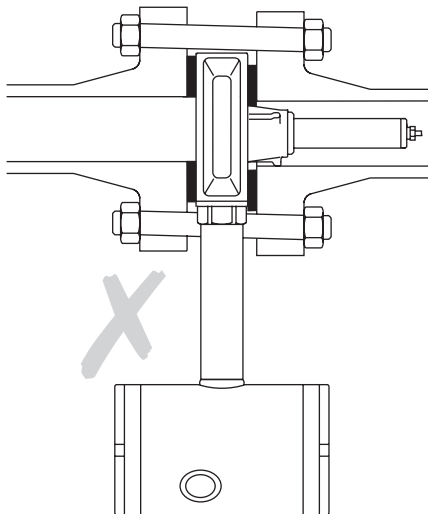


Fig. 11 Gaskets and pipe offline, fitting incorrectly

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

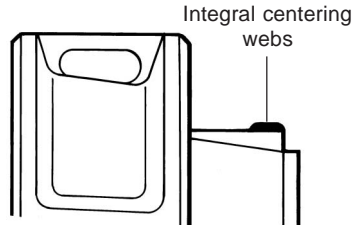


Fig. 12

### 3.3 Electrical installation

The DIVA is a loop powered device. This Section describes loop wiring and shows typical conductor terminations (The EIA 232C (RS232) wiring is discussed in Section 4.11, page 22). It also considers the effect of connecting additional equipment (e.g. recorder, loop powered display) to the loop.

#### Wiring the DIVA

The wiring terminals can be accessed by removing the end cap of the enclosure. A typical loop wiring diagram is shown in Figure 13.

If an M750 display unit is purchased from Spirax Sarco for use with the DIVA, the M750 must be configured to the flow of the DIVA @ 20 mA. If the DIVA 4 - 20 mA output is rescaled (see Section 4.6.1), it is important that the 20 mA input valve on the M750 is also rescaled.

#### Notes:

**The flowmeter must be correctly earthed by the external clamp type terminal on the outside of the enclosure.**

**After commissioning the end caps must be replaced.**

**Remove the silica gel bag from the termination board end of the enclosure.**

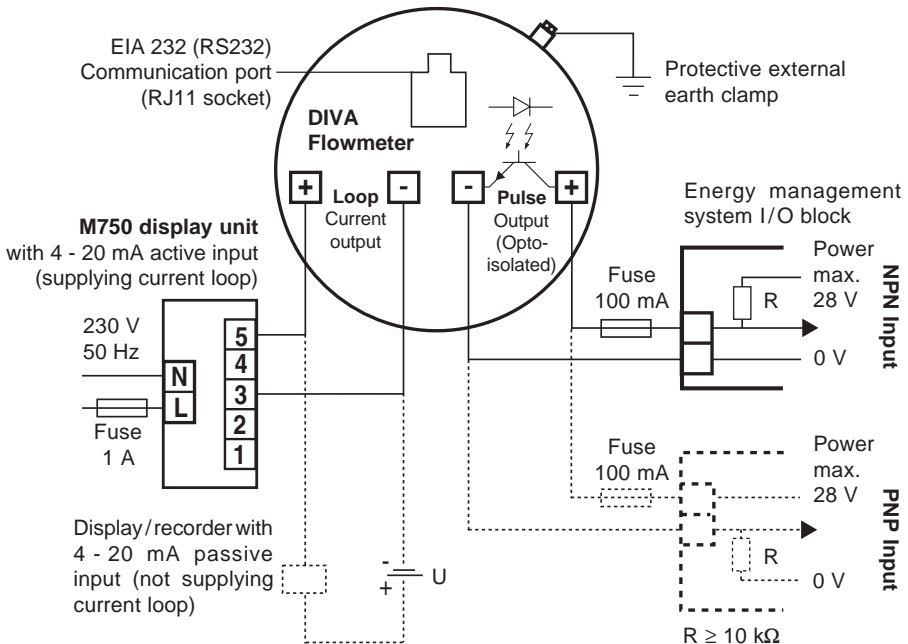


Fig. 13 Wiring diagram

---

## Power supply requirements

A nominal 24 Vdc is needed to power the flowmeter. However, the DIVA will operate correctly as long as the power supply is in the range shown in Figure 14. A single, stand-alone, supply may be capable of powering several transmitters. It can be mounted in a control room or in the field, but cannot be on the same loop. Follow the power supply manufacturer's recommendations with regard to mounting and environmental considerations.

The graph (Figure 14) shows the range of power supply voltages and loop resistances over which the DIVA is capable of operating. The loop resistance includes all the wiring.

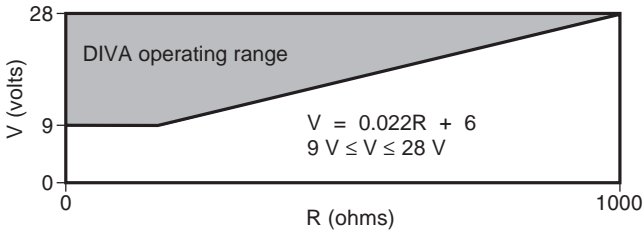


Fig. 14

## Cable length

Generally the maximum cable length between the DIVA and the power supply is 3 000 m. However the actual cable length is governed by the number of network devices, the total resistance of the network and the cable capacitance.

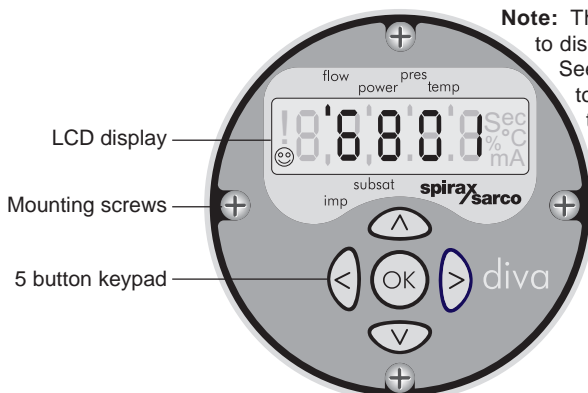
**Suggested cable type:** for both loop and pulse should be unshielded twisted pairs such as Belden 8205 (20 Awg), seven stranded wire with cross sectional area of 0.5 mm<sup>2</sup>.

Cable glands suitable for M20 x 1.5 to EN 50262/IP68 are recommended.

## 4. Commissioning

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

**The DIVA flowmeter should be commissioned with the flow through the unit isolated.**



**Note:** The DIVA is factory set to display data in metric units. See Section 4.4.2, page 18, to commission the DIVA to display imperial units.

Fig. 15 DIVA display unit

All commissioning is carried out through the display unit installed behind the front end cap of the DIVA enclosure. The display unit consists of a small LCD display and a 5 button key pad. The display is not designed to be used as a permanent flow indicator and does not record total flows. If a permanent indicator is required an additional display/flow indicator is required. These are available from Spirax Sarco Ltd.

As all the commissioning settings are stored in a non-volatile memory, it is possible to connect a 9 V PP3 battery to the DIVA's 4 - 20 mA loop power supply and commission the unit uninstalled. However, the DIVA should still be zeroed in-line (see Section 4.5.3) and its operation checked.

### Rotating the display

The display can be rotated through 180° to enable ease of commissioning. To rotate the display disconnect the power supply, remove the mounting screws on the display unit, carefully remove the display unit and rotate. Carefully replace the display unit and replace mounting screws. Do not force the display unit into position. Reconnect the power supply.

**Note:** Electrostatic discharge (ESD) procedures should be followed while rotating the display.

### 4.1 Run mode

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

After initial power up, the DIVA will automatically enter the run mode and all commissioning menus can be accessed from this mode. (See Section 4.2, 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. flow, power, pressure or temperature. All units (except °C) are implied with imperial or metric units being indicated by another arrow.

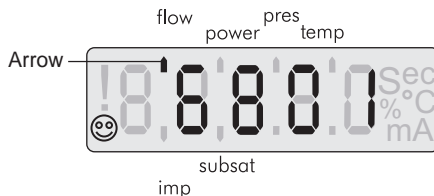
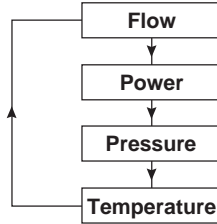


Fig. 16

### 4.1.1 Run mode data sequence



The following chart indicates the run mode data display sequence. Depending on the configuration, the flow units will be:

Units	Steam
Metric	Kg/h, KW, bar g, °C
Imperial	lb/h, MBtu/h, psi g, °F

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

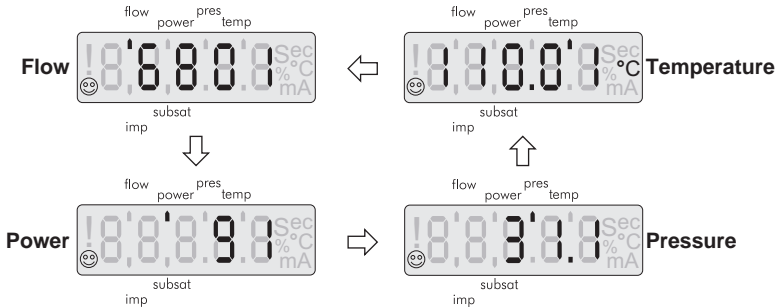


Fig. 17

### 4.1.2 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:

<b>POWER Out</b>	= Power interrupted.
<b>NO SIGNL</b>	= No signal from sensor. (This can also activate the 4-20 mA alarm).
<b>SENSR CONST</b>	= Signal from sensor constant. (This can also activate the 4-20 mA alarm).
<b>HIGH FLOW</b>	= Flow above the maximum.

## 4.2 Commissioning mode

The commissioning mode is used to zero the flowmeter, re-range, 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 DIVA will automatically default to the run mode.

For a full commissioning flow chart see Section 4.3.

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



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.

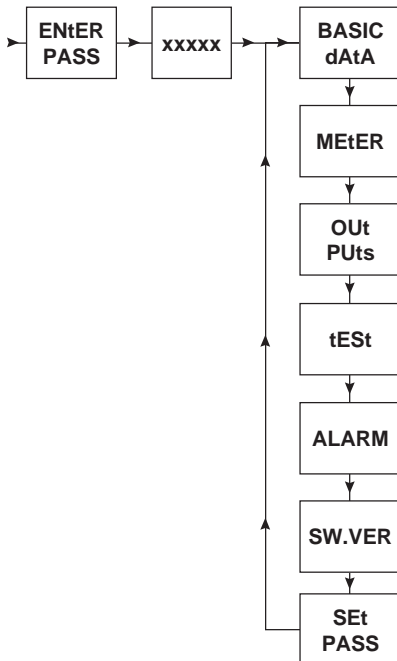
After the correct pass code is entered the display shows:



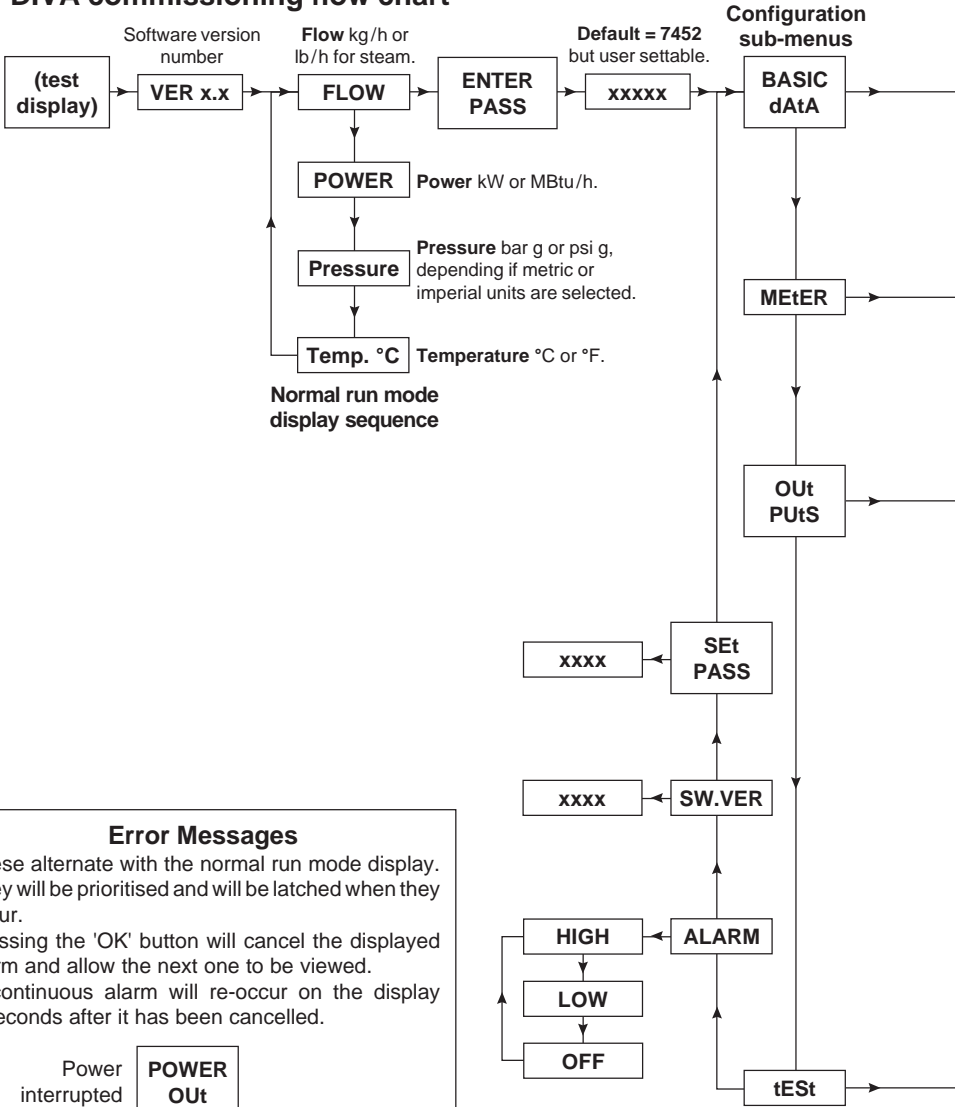
To exit from the commissioning mode at any stage, continually pressing the left key will return to the run mode.

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

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



### 4.3 DIVA commissioning flow chart



#### Error Messages

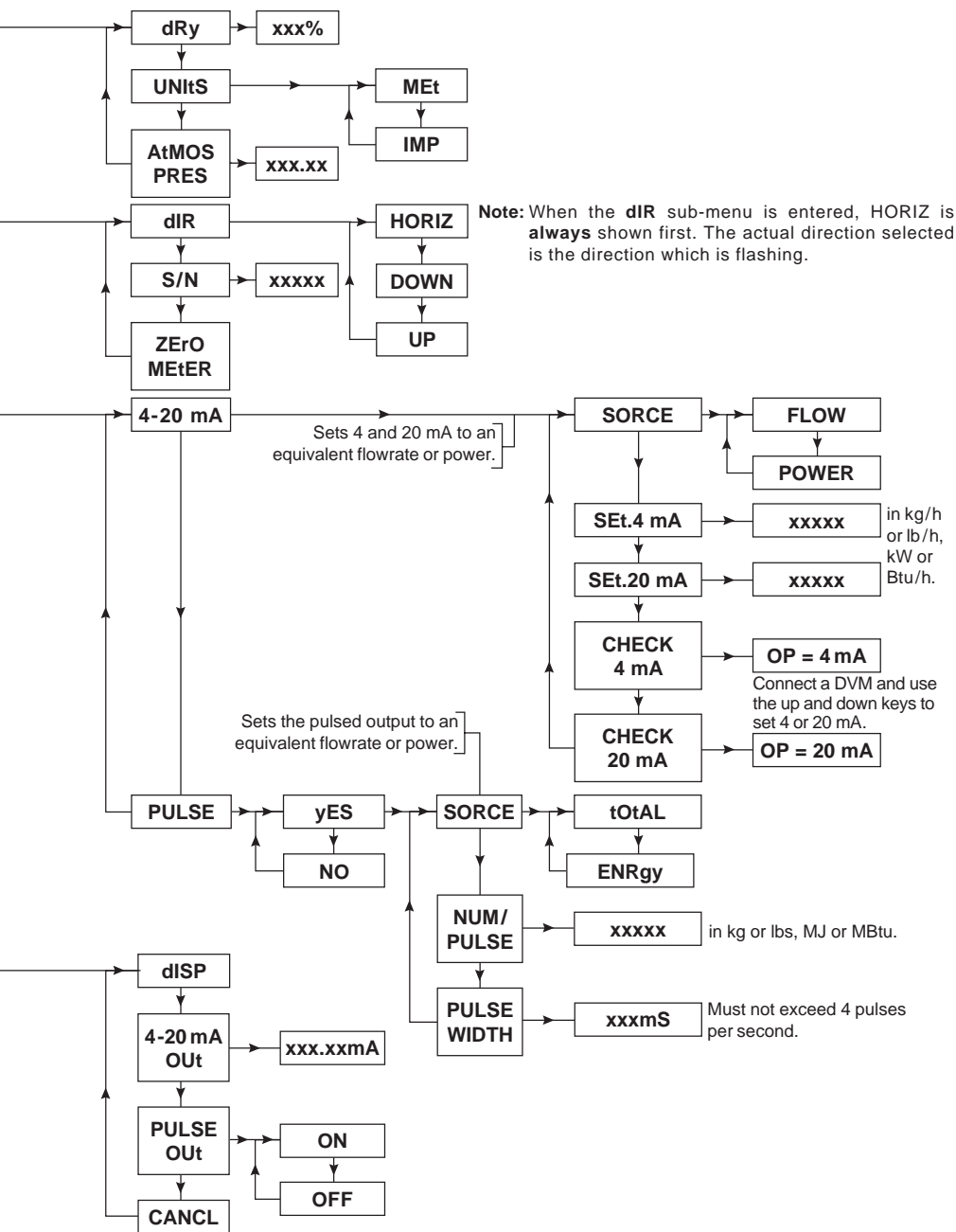
These alternate with the normal run mode display. They will be prioritised and will be latched when they occur.

Pressing the 'OK' button will cancel the displayed alarm and allow the next one to be viewed.

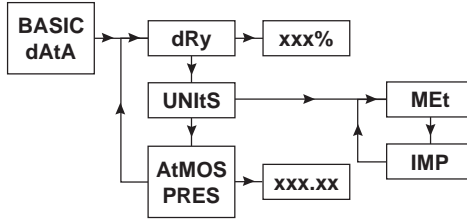
A continuous alarm will re-occur on the display 2 seconds after it has been cancelled.

Power interrupted	<b>POWER OUt</b>	
No signal from sensor	<b>NO SIGNL</b>	The 4-20 mA alarm can also be activated
Signal from sensor constant	<b>SENSR CONST</b>	The 4-20 mA alarm can also be activated
Flow above maximum	<b>HIGH FLOW</b>	Shows when flow exceeds maximum





## 4.4 BASIC dAtA Sub menu



### 4.4.1 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'

### 4.4.2 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 below.

Units	Steam
Metric	Kg/h, KW, bar g, °C
Imperial	lb/h, MBtu/h, psi g, °F

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

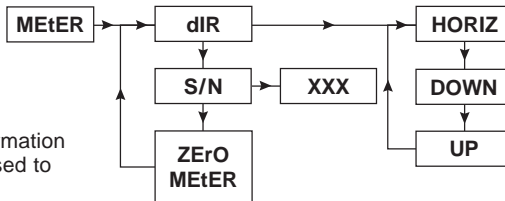
### 4.4.3 AtMOS PRES

This value compensates the flowrates for atmospheric pressure. It should be used if a high degree of accuracy is required or when the DIVA 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.

## 4.5 MEtER Sub-menu



This sub-menu contains information about the flowmeter and is used to zero the flowmeter.

### 4.5.1 dIR

dIR is the orientation that the DIVA is installed in. The DIVA can be installed with horizontal flow up to a pressure of 32 bar g (464 psi g). For installations that require vertical flow either up or down the maximum pressure must not exceed 11 bar g (160 psi g). By selecting down or up the effect of gravity on the cone is taken into account.

**Note:** Upon entering the **dIR** sub-menu, **HORIZ** is **always** shown first. The actual direction selected is the one which is flashing.

### 4.5.2 S/N

This is the factory set serial number of the DIVA and is displayed by pressing the right key.

### 4.5.3 ZEROMETER

This function is used to zero the DIVA manually to compensate for any electronic drift. The procedure for zeroing the flowmeter is as follows:

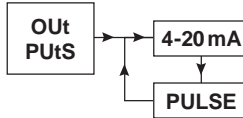
- Isolate the pipeline where the flowmeter is installed and ensure that there is no flow. The line temperatures should be above 5°C (41°F) and below 30°C (86°F).
- Press and hold the 'OK' button for three seconds.

On completion the display will step back to S/N.

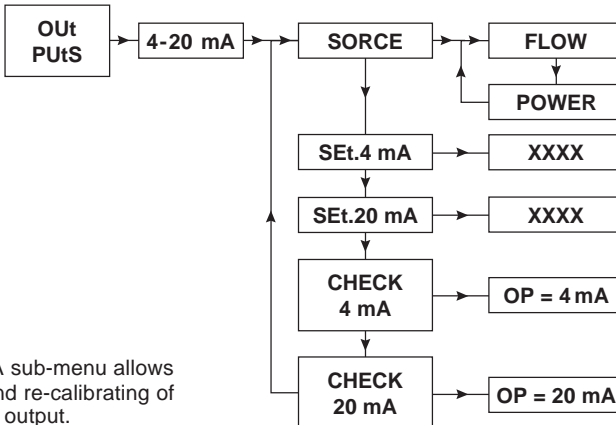
If 'ZERORr' is displayed, check to ensure that the line is isolated with no flow. If 'tEMP Error' is displayed the line temperature is below 5°C (41°F). Allow the temperature to move above 5°C (41°F) and re-zero. **Note: The flowmeter should ideally be zeroed once every 12 months.**

## 4.6 OutPutS Sub-menu

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



### 4.6.1 4-20 mA Output sub-menu



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

### 4.6.2 SOURCE

This changes the source data for the 4-20 mA between flow and power.

### 4.6.3 SEt 4 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.

### 4.6.4 SEt 20 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.

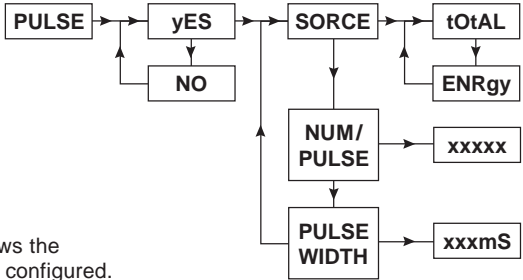
### 4.6.5 CHECK 4 mA

This allows the 4 mA value to be re-calibrated. A digital volt meter/multimeter should be connected in series with the 4-20 mA output. Pressing the right arrow button will display OP = 4 mA and the DIVA 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.

### 4.6.6 CHECK 20 mA

This allows the 20 mA value to be re-calibrated. A digital volt meter/multimeter should be connected in series with the 4-20 mA output. Pressing the right arrow button will display OP = 20 mA and the DIVA 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.

### 4.6.7 Pulse Output



This sub-menu allows the pulsed output to be configured.

### 4.6.8 PULSE

This selects whether the pulsed output is to be used or disabled.

### 4.6.9 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).

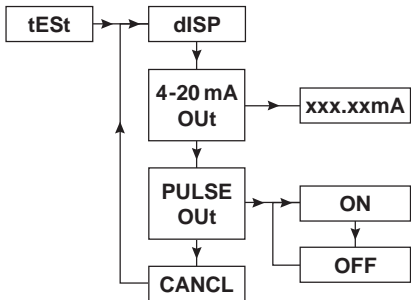
### 4.6.10 NUM/PULSE

This allows the total mass, or energy, which is equivalent to one pulse to be configured. Units are dependent on the UNIt setting. Metric units will be kg for total or MJ for energy, imperial units will be lb for total or MBtu for energy.

### 4.6.11 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.

## 4.7 tEst sub-menu



The tEst sub-menu allows access to the DIVAs diagnostic tools. From here the display, 4-20 mA and pulse outputs can be tested.

---

### 4.7.1 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.

### 4.7.2 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.

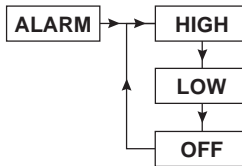
### 4.7.3 PULSE Out

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.

### 4.7.4 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.

## 4.8 ALARM sub menu



This sub-menu gives access to setting the action that is required on the 4-20 mA output when an error is detected by the DIVA electronics.

### 4.8.1 HIGH

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.

### 4.8.2 LOW

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 3.8 mA.

### 4.8.3 OFF

This disables the 4-20 mA alarm function.

## 4.9 SW.VER



This allows the software version to be viewed.

## 4.10 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 9, page 26.

## 4.11 EIA 232C (RS232) Communications

The DIVA flowmeter has an EIA 232C compatible communications link. This enables users to easily interrogate the DIVA for steam data using either a dumb terminal or a P.C. loaded with a simple terminal emulation program.

The DIVA communication protocol is set up as follows and is fixed.:-

DIVA UART set up	
<b>Baud rate</b>	1200
<b>Data bits</b>	7
<b>Stop bits</b>	One
<b>Parity</b>	None
<b>Echo</b>	Off

The response time of the DIVA is less than 0.5 seconds. If the PC asks for data faster than this (i.e. twice per second), the DIVA will answer the first request it received, any later requests will be ignored.

### 4.11.1 Using the EIA 232C communications

It is assumed that:

- The electrical wiring for the EIA 232C communications has been carried out in accordance with the EIA 232C standard. Please note the DIVA EIA 232C connection requires a RJ11 connector linked to a 9 way D-type adaptor. Figure 18 shows the DIVA's RJ11 socket from the front.

The table below lists the RJ11 socket's pin connections. The signals are named from the PC (or data terminal) end.

RJ11 pin	9-way D-type	Signal
1		Not used
2	—* 4	DTR
3	—* 5	GND
4	—* 2	RX
5	—* 3	TX
6	—* 8	CTS



6 5 4 3 2 1  
Pin numbers

**Fig. 18 RJ11 socket**

- The communications protocol has been set up on the communicating device as described earlier in this Section. The following is a Table of operating codes in ASCII characters:-

User transmits	Note: [LF] means line feed	DIVA responds by transmitting
AR[LF]		Flowrate in kg/h [LF]
AB[LF]		Pressure in bar g [LF]
AC[LF]		Line temperature in Celsius [LF]
AP[LF]		Power in KW [LF]
AE[LF]		Water equivalent flowrate in l/min [LF]

## 4.12

After installation or maintenance ensure that the system is fully functioning. Carry out tests on any alarms or protective devices.

---

## 5. Operation

---

The DIVA flowmeter operates by measuring the strain produced on a moving cone by an instantaneous flowrate. This strain is then converted into a density compensated mass flowrate and is transmitted via a single loop powered 4 - 20 mA output and pulsed output. Due to the unique design of the DIVA the flowmeter produces the high turndowns and high accuracy, which are required in process applications.

---

## 6. Maintenance

---

The DIVA should be zeroed using the zero meter sub-menu at least once a year. This will remove any electronic long term drift that may occur. Frequency of re-calibration depends upon the service conditions experienced by the meter and the application. Re-calibration frequency can be typically between 2 and 5 years.

### Replacement of the DIVA display and analogue electronics

#### To replace the electronics:

- Disconnect the power supply.
- Remove the display end cap.
- Remove the mounting screws on the display unit and carefully remove the electronics.
- Carefully unplug the ribbon cable and sensor connection block.
- Reconnect the ribbon cable and sensor connection block to the new electronics and carefully replace.
- Replace the mounting screws and reconnect the power supply.

### Replacement of the DIVA termination board

#### To replace the termination board:

- Remove the termination end cap from the enclosure.
- Disconnect the power supply.
- Disconnect the pulse output (if connected).
- Remove the central mounting screw.
- Carefully unplug the ribbon cable.
- Remove the termination board.
- Replace with the new termination board. Reconnecting the ribbon cable.
- Replace the mounting screw.
- Reconnect the power supply and pulse output if applicable.

**Note:** Electrostatic discharge (ESD) procedures should be followed while installing the new electronics.

**Do not force the electronics/display unit into position.**

---

## 7. Spare parts

---

Spare electronics for the DIVA flowmeter are available from Spirax Sarco and consist of:

- DIVA replacement display and analogue electronics.
- DIVA termination board.
- Enclosure window end cap.

For the DIVA replacement display and analogue electronics it is important that the serial number of the DIVA flowmeter is given at the time of ordering.

**Example:** 1 off Spirax Sarco DIVA display and analogue electronics for a DN100 flowmeter. Serial number D\_\_\_\_.

## 8. *Fault finding*

Many faults, which occur on commissioning, are found to be due to incorrect wiring or setting up, therefore it is recommended that a thorough check is carried out should there be a problem. The DIVA display has in-built diagnostic features and will indicate a number of errors on the display and via the 4-20 mA output.

The errors will alternate with the normal run mode display and will be shown according to priority. 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 re-instate itself 2 seconds after it has been cancelled, and will be indicated by a flashing exclamation mark (!).

Symptom	Possible cause	Action
<b>Display is blank</b>	dc voltage is not within the range of 9-28 Vdc Supply connected with reverse polarity Electronics faulty	Check power supply/current connections. See Section 3.3 Change polarity Refer to: Spirax Sarco Ltd
<b>Display shows: NO SIGNL</b>	Insufficient supply voltage Current loop resistance is greater than Rmax Electronics faulty	Check supply voltage is between 9 and 28 Vdc Check current loop resistance and reduce if necessary Check current output electronics (refer to Sections 4.6 and 4.7) Refer to: Spirax Sarco Ltd
<b>Display shows: POWER Out</b>	Power supply interrupted	Ensure power supply is secure and cancel error using the OK key. Totals transmitted may not be valid.
<b>Display shows: SENSR CONST</b>	Cone jammed Electronics Faulty	Remove unit from pipeline and check cone movement. Check current output electronics (refer to Sections 4.6 and 4.7) Refer to: Spirax Sarco Ltd
<b>Display shows: HIGH FLOW</b>	Meter undersized	Check sizing and replace if necessary.
<b>Constant 3.8 mA</b>	Error signal set to Low	Check display for errors and rectify as above Check current output electronics (refer to Sections 4.6 and 4.7)
<b>Constant 22 mA</b>	Error signal set to High	Check display for errors and rectify as above. Check current output electronics (refer to Sections 4.6 and 4.7)



<b>Symptom</b>	<b>Possible cause</b>	<b>Action</b>
<b>Flow indicated responds to changes in actual flow but value indicated does not correspond to actual flowrate</b>	<p>Flowmeter not properly centred in the pipeline</p> <p>Gaskets at the flowmeter protrude into the pipe bore</p> <p>Irregularities on the surface of the pipe bore</p> <p>Signal falsified due to bi-phase medium</p> <p>Insufficient upstream/ downstream pipe lengths</p> <p>Flow direction reversed</p>	<p>The axis of the flowmeter bore should be aligned with that of the pipe</p> <p>See Section 3, Figs 9, 10 and 11 for proper installation of gaskets</p> <p>Pipe bore should be free of irregularities</p> <p>Bi-phase media are not permitted. Use a separator for wet steam applications to remove moisture droplets from the steam</p> <p>See Section 3 for correct lengths of upstream and downstream pipes.</p> <p>Check flow direction arrow on primary</p>
<b>Pulse output is incorrect</b>	<p>Pulse output incorrectly set</p> <p>Pulse width incorrectly set</p> <p>Pulse output is overloaded</p> <p>Pulse output electronics faulty</p>	<p>Check programming of pulse output, Section 4.6.7</p> <p>Check maximum pulse width of counter electronics</p> <p>Check load ratings</p> <p>Test pulse output. If faulty replace unit.</p>
<b>DIVA produces large amount of noise (banging and clattering)</b>	<p>Upstream/downstream installation lengths incorrect.</p>	<p>Re-install following the installation guidelines (Section 3)</p>
<b>Non zero flow indicated when no actual flow is in the pipe.</b>	<p>Unit not zeroed at commissioning</p> <p>4 mA output not calibrated</p> <p>4 mA retransmission set to a value higher than zero</p> <p>Interference</p>	<p>Zero unit.</p> <p>Calibrate 4 mA output (Section 4.6.5)</p> <p>Reset 4 mA</p> <p>Check earthing</p>

## 9. Settings table

This Table shows all changeable options, and enables records to be made of any changes made to the pass code or other settings. It provides a convenient reference should future changes be required.

Sub-menu	Changeable settings	Factory set settings	Customer settings	Further changes
<b>Basic data</b>	Dryness fraction	1.0		
	Units	Metric		
	Nominal pressure			
	Atmospheric pressure	1.01 bar a		
<b>Outputs</b>	4-20 mA			
	Source data	Flow		
	4 mA setting	0		
	20 mA setting	Flowmeter maximum @ 32 bar g		
	Pulse	On		
	Source data	Total		
	Number of pulses	1		
	Pulse width	50 mS		
<b>Error</b>		High		
<b>Pass code</b>		7452		



