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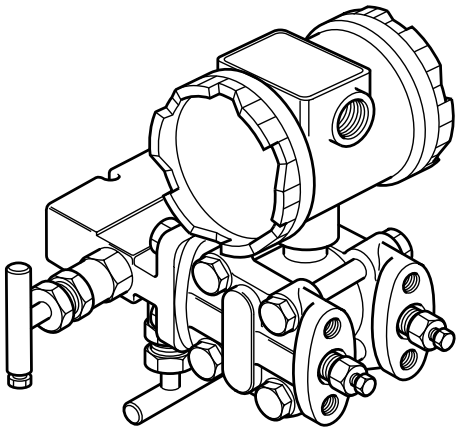
MI Issue 5

spirax sarco

M640
Steam Mass Flow Transmitter
Installation and Maintenance Instructions



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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.

Warning:

Do not attempt to install, maintain, or remove a steam mass flow transmitter unless the pipeline has been depressurised and vented to atmosphere. The fluid remaining in the pressure element of the steam mass flow transmitter may be hazardous or toxic. This should be considered when handling and storing the pressure sensor. The pressure range of the transmitter, must be compatible with the maximum pressure being measured.

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

- **BS EN 61326: 1997 A1 and A2 Table 4 (Emissions) and Annex A (Immunity).**

The following conditions should be avoided as they may create interference above the limits specified in BS EN 61326: 1997 A1 and A2 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.

Caution:

The steam mass flow transmitter will be irreparably damaged if the temperature limit is exceeded.

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 steam mass flow transmitter complies with the requirements of the European Pressure Equipment Directive 97/23/EC and falls within category 'SEP'. It should be noted that products within this category are required by the directive not to carry the CE mark.

i) **The products have been specifically designed for use on steam and water, which are in Group 2 of the above mentioned Pressure Equipment Directive. The products' use on other fluids may be possible but, if this is contemplated, Spirax Sarco should be contacted to confirm the suitability of the product for the application being considered.**

ii) **Check material suitability, pressure and temperature and their maximum and minimum values. 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.**

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.

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 350°C (662°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 Disposal

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.

1.16 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.

2. General product information

2.1 General description

The M640 measures the differential pressure and the static pressure from the Gilflo or orifice plate flowmeters using a single sensor. It uses this information to calculate the corrected mass flowrate of saturated steam. The result is transmitted via a single loop powered 4-20 mA output.

The M640 can also use the HART® protocol to transmit values of mass flow total, energy flow total and static pressure.

Caution: The M640 steam mass flow transmitter is uniquely configured at the factory to work with a defined Gilflo, ILVA or M410 orifice plate flowmeter for a specific flow application on saturated steam only. For correct operation the configured M640 transmitter must always be installed with its allocated flowmeter. Labels on the packaging give the serial numbers of the matched products.

Equipment delivery and handling

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 transmitter is to be stored for a period prior to installation, review the environmental specifications in 'Technical data'.

2.2 Electrical connections

Non approved and ATEX / CENELEC units	M20 x 1.5
FM / CSA units	½" NPT

2.3 Technical data

Span	Minimum 0-10 inches H_2O (24.9 mbar)
	Maximum 0-450 inches H_2O (1 122 mbar)
Output	4-20 mA dc (2 wire) Maximum loop impedance 600 Ω with 24 Vdc supply
Power supply	10 V to 45 Vdc
Pressure limits	0 to 74 bar g (saturated steam)
Temperature limits	-40°C to + 85°C (electronics)
	0°C to +125°C (diaphragm)
Accurancy	± 0.1% of calibrated span to include the effects of linearity, hysteresis and repeatability
Approvals	Standard unit not intrinsically safe
Enclosure rating	NEMA 4X / 6P (IEC IP66 / IP68)

2.4 Materials

Body	316 Stainless steel
Diaphragm	Hastelloy C
3-way manifold	Carbon steel (zinc plated)
Fluid fill	Silicone oil

3. Mechanical installation

3.1 General requirements

It is important that the M640 is installed with the correct pipeline unit. Please check that the serial number on the pipeline unit matches the one that is on the M640 application tag. The installation must conform to all relevant construction and electrical codes.

WARNING: The standard M640 is not approved for hazardous area applications.

CSA/FM and ATEX/CENELEC versions are available and should be installed in accordance with Appendix A.

3.1.1 Environmental conditions

The transmitter should be located in an environment that minimises the effects of heat, vibration, shock and electrical interference. (Specific limits are detailed in Section 2.3)

CAUTION: Exceeding the specified temperature limits will invalidate the warranty and can adversely effect the performance and may damage the M640.

3.1.2 Other considerations: Be sure to allow sufficient clearance for:

- Installation of the impulse piping.
- Installation of conduit/wiring.
- Removal of the enclosure end caps.
- Viewing of the optional display. **Note** Display can be rotated in 90° increments for easy viewing (see Section 8).

3.1.3 Mounting the transmitter

The M640 can be mounted using the bracket and U-bolts which are supplied. Mounting can be to a vertical or horizontal 2" (50 mm) pipe, or it can be surface mounted.

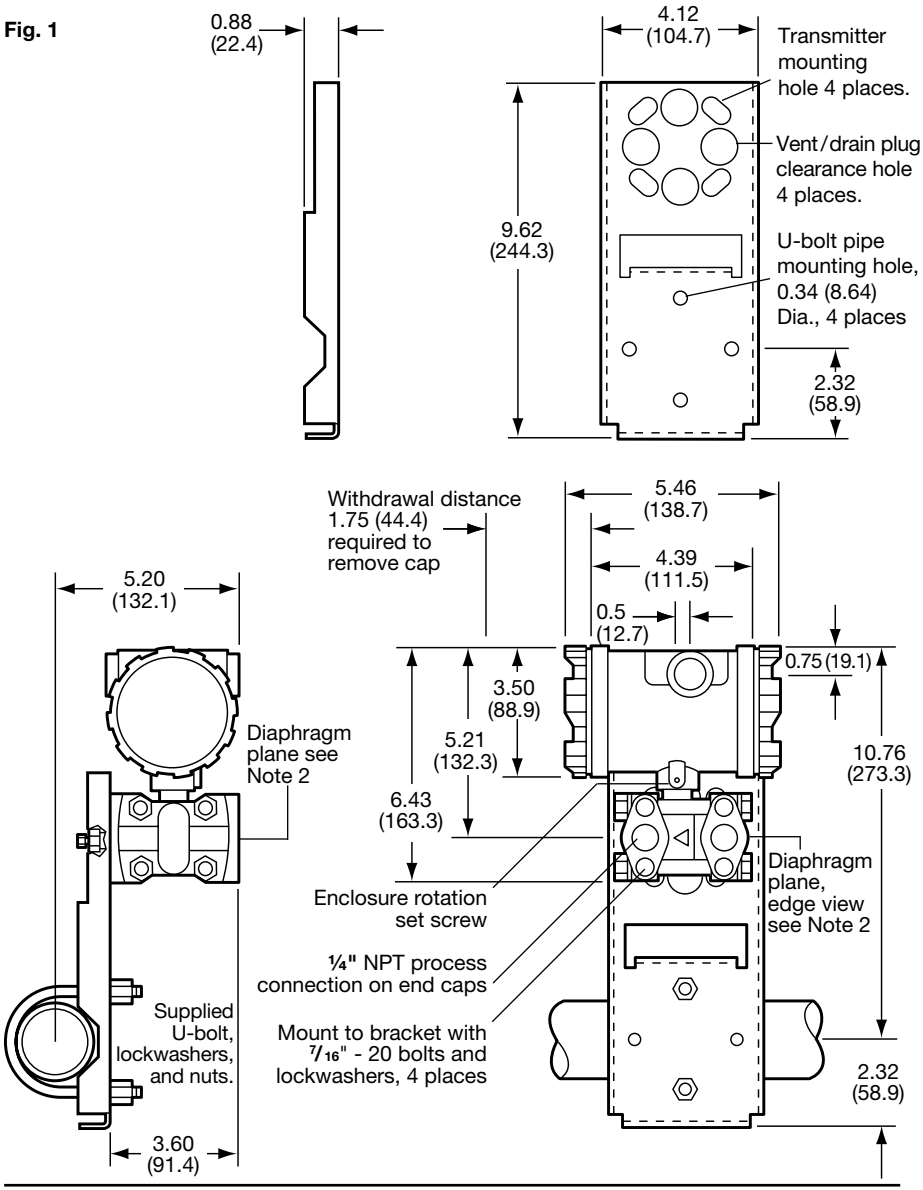
2" (50 mm) pipe mounted bracket **Dimensions are in inches (millimetres)**

Notes:

1. The M640 is supplied with a 2" (50 mm) pipe mounting bracket.

2. The M640 should be mounted with its diaphragm in a vertical plane i.e. the covers to the electronics enclosure should be withdrawn from the side.

Fig. 1



3.1.4 Routing of impulse pipework

The M640 is supplied with a 3-way manifold to permit servicing and zeroing. The piping between the transmitter's 3-way manifold and the pipeline unit is called the impulse pipework, and is supplied by the user.

When planning and installing impulse piping, locate the transmitter far enough away from the steam line to keep it within the ambient temperature specifications. Impulse piping should have an internal diameter of 9.5 mm (0.375") or larger.

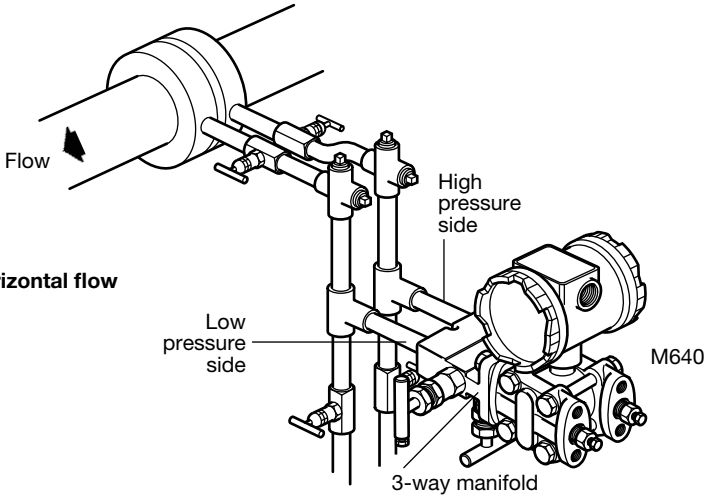


Fig. 2 Horizontal flow

Use the least number of pipe fittings and valves as possible to minimize leakage problems. PTFE tape is the recommended thread sealant for process connections at the transmitter. The transmitter should be below the steam line and the impulse piping should slope at least 83 mm/m (1"/ft) up to the steam main.

Protect the impulse pipes (by shielding if necessary) from objects or equipment that may bend or kink them. Protect pipes from extremes of ambient temperature by lagging and heat tracing if there is a possibility of freezing. The isolation valves used in the impulse piping must be suitable for the pressure and temperature of the steam.

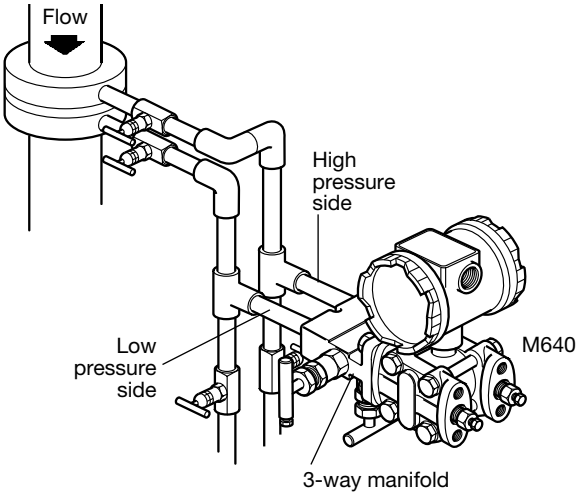


Fig. 3 Vertical flow

3.2 ILVA mechanical installation

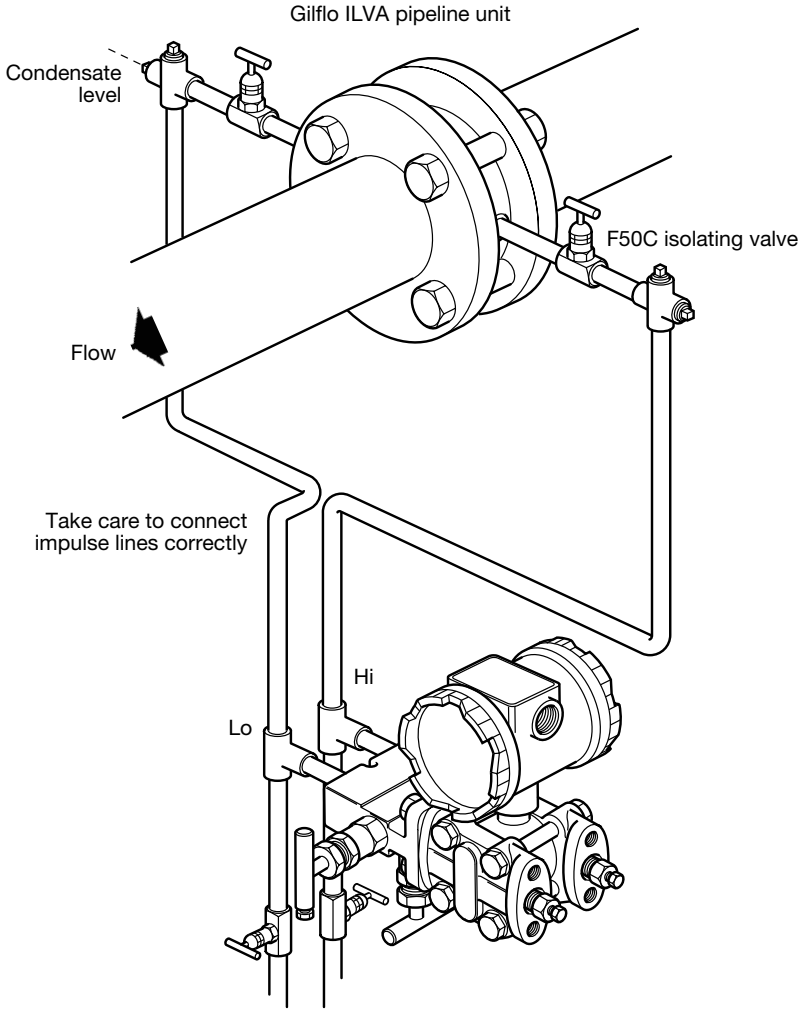


Fig. 4

Installation points to watch:-

1. Ensure all pipework is adequately supported and properly aligned.
2. The **minimum** recommended lengths of straight pipe are 6 D upstream and 3 D downstream. For full details please see the ILVA Installation and Maintenance Instructions.
3. Ensure correct direction of flow as indicated by the arrow on the flowmeter body.
4. Avoid reverse flow through the flowmeter.
5. Do not install the flowmeter downstream of a pressure reducing valve as this may cause inaccuracies and/or damage. Avoid installing the flowmeter downstream of a partially open valve.
6. Actuated valves may cause rapid pressure fluctuations which could cause damage.
7. Provide adequate line drainage upstream of the flowmeter for all steam applications.

3.3 Gilflo mechanical installation

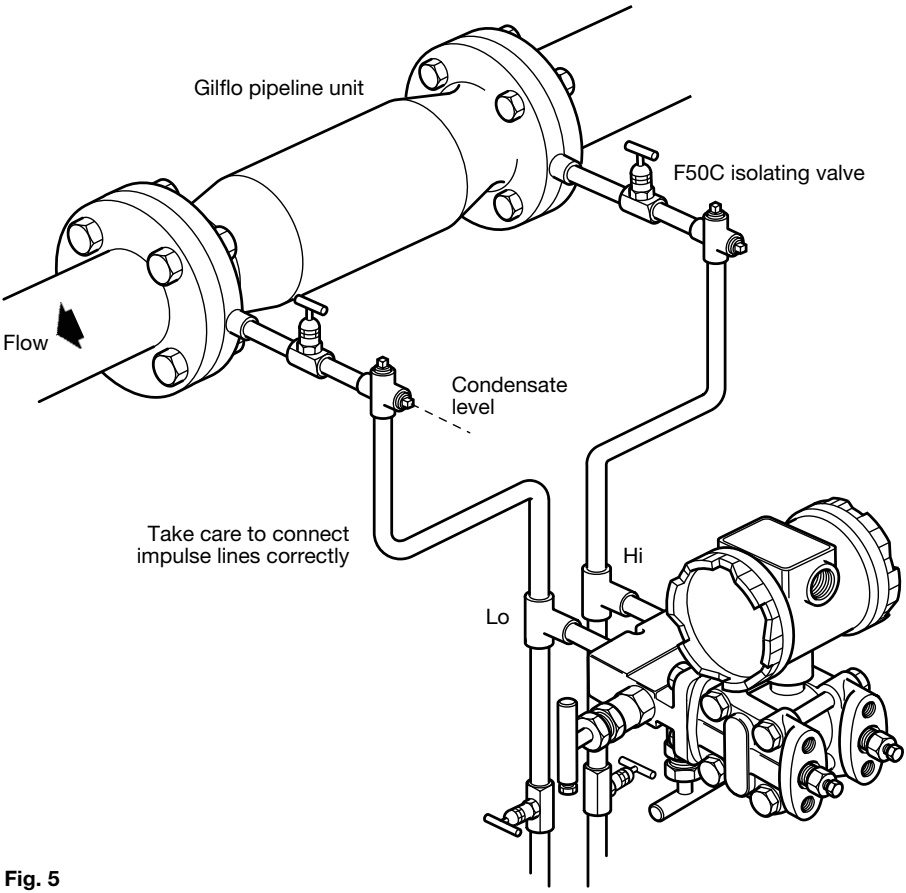


Fig. 5

Installation points to watch:-

1. Ensure all pipework is adequately supported and properly aligned.
2. The **minimum** recommended lengths of straight pipe are 6 D upstream and 3 D downstream. For full details please see the Gilflo Installation and Maintenance Instruction.
3. Ensure correct direction of flow as indicated by the arrow on the flowmeter body.
4. Avoid reverse flow through the flowmeter.
5. Do not install the flowmeter downstream of a pressure reducing valve as this may cause inaccuracies and/or damage. Avoid installing the flowmeter downstream of a partially open valve.
6. Actuated valves may cause rapid pressure fluctuations which could cause damage.
7. Provide adequate line drainage upstream of the flowmeter for all steam applications.

3.4 M410 orifice plate mechanical installation

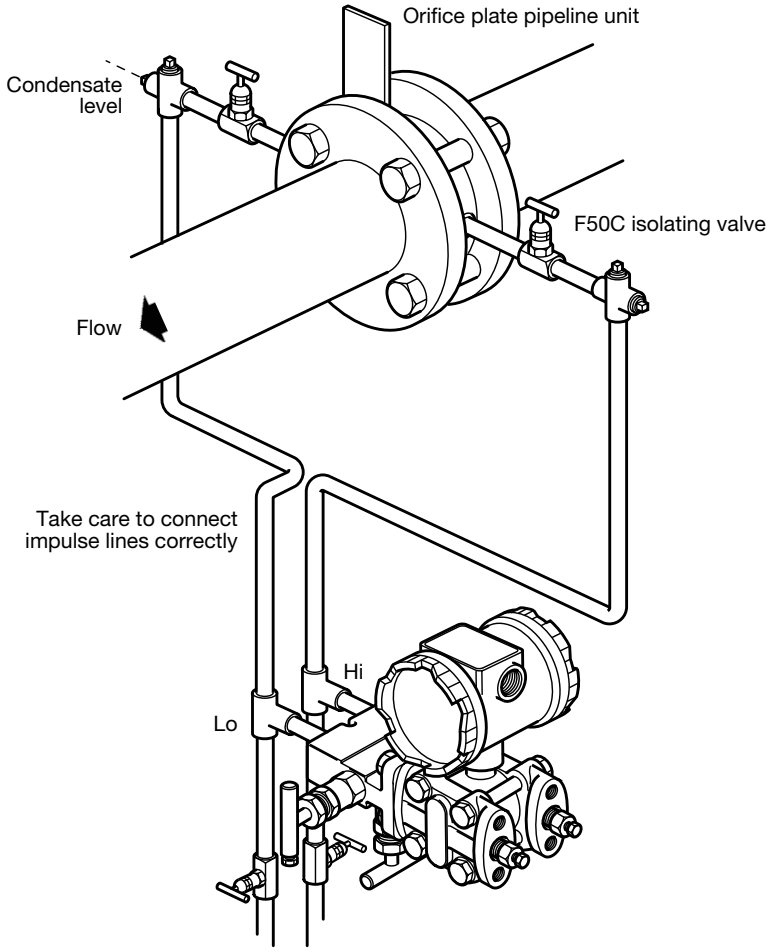


Fig. 6

Installation points to watch:-

1. Ensure all pipework is adequately supported and properly aligned.
2. The **minimum** recommended lengths of straight pipe are 10 D upstream and 5 D downstream. For full details please see the M410 orifice plate Installation and Maintenance Instructions or BS 1042 / ISO 5167.
3. Ensure the correct direction of flow is as indicated by the arrow on the flowmeter body. Ensure that the 45° chamfer on the orifice plate is facing downstream and that the drain hole is at the bottom.
4. Do not install the flowmeter downstream of a pressure reducing valve as this may cause inaccuracies and/or damage. Similarly, avoid installing the flowmeter downstream of a partially open valve.
5. Provide adequate line drainage upstream of the flowmeter for all steam applications.

4. Electrical installation

Cabling should be installed in accordance with BS 6793 - Instrumentation process control systems: Installation design and practice or local equivalent.
This Section describes loop wiring and shows typical conductor terminations. It also considers the effect of connecting additional equipment (e.g. recorder, loop powered display) to the loop. Prepare installation site drawings showing the following:

- Location and identification of each transmitter.
- Routing plan of signal cable(s).
- Location of any signal cable junctions for connecting the HART® communicator.
- Location of the master device (e.g. HART® communicator or controller)

4.1 Power supply requirements

A nominal 24 Vdc is needed to power the transmitter. However, the M640 will operate correctly as long as the power supply is in the workable range shown in Fig. 7. A single, stand-alone, supply may be capable of powering several transmitters. It can be mounted in a control room or in the field. Follow the power supply manufacturer's recommendations with regard to mounting and environmental considerations.
Note: If HART® communication is to be used there must be a minimum loop resistance of 250 Ω. In all cases the maximum acceptable loop resistance is 1100 Ω.

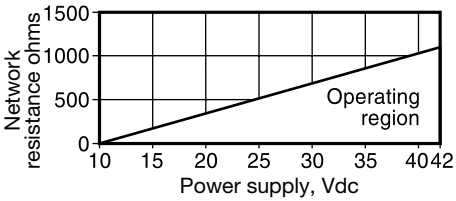


Fig. 7 Maximum cable resistance

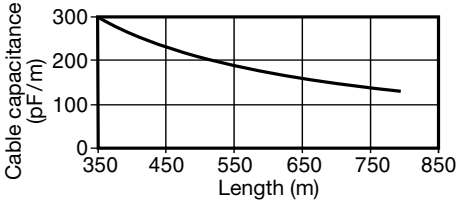


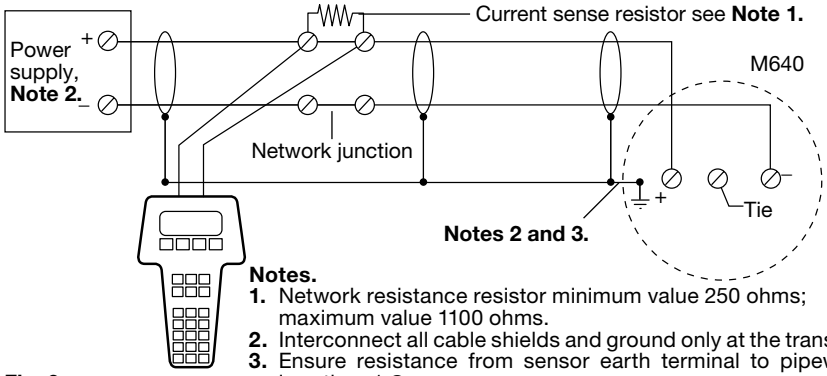
Fig. 8 Maximum cable length

4.2 Cable length

Generally the maximum cable length between the M640 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.
The graph (Fig. 8) shows the effect of increasing the number of network devises when the cable capacitance is 130 pF/m.
A cable length calculation is necessary when HART® communication is to be employed. (see HART® communications, Section 9, for details).

4.3 Wiring the M640

A typical loop wiring diagram is shown below. Junctions in the transmitter loop are a convenient way of connecting test equipment without disconnecting the transmitter. The location of these junctions should be considered when routing the cable.



Notes.
1. Network resistance resistor minimum value 250 ohms; maximum value 1100 ohms.
2. Interconnect all cable shields and ground only at the transmitter.
3. Ensure resistance from sensor earth terminal to pipework is less than 1 Ω.

Fig. 9

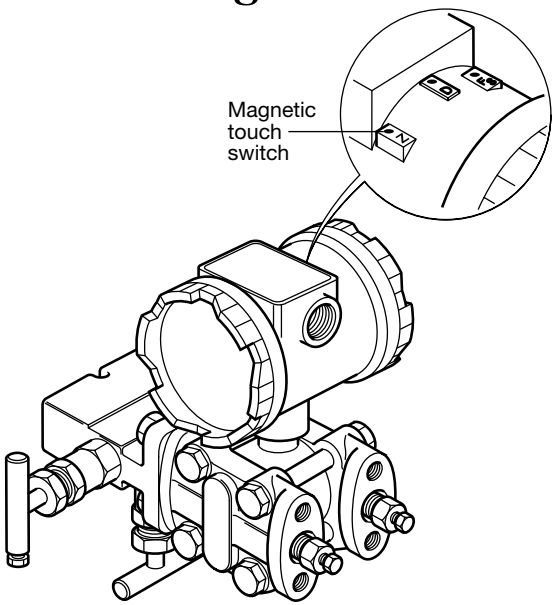


Fig. 10

5.1 Commissioning

The 4-20 mA output from the M640 represents the steam mass flowrate in the pipe. It is despatched fully configured for a specific flow application, using either a pipeline unit from the Spirax Sarco Gilflo family, or a Spirax Sarco M410 orifice plate. The specific application information is detailed on the M640 application label and may be changed by either returning the M640 to Spirax Sarco, or by using a HART® 5.2 communication device. To ensure that the correct M640 is connected to the pipeline unit check the pipeline unit serial number is the same as the one on the M640 application label.

The Model M640 has three built-in magnetic switches for local commissioning. They are located on the electronics module and are actuated through the wall of the transmitter enclosure using the Spirax Sarco magnetic screwdriver (Fig. 11) supplied with each unit. The three switch targets (Fig. 10) are labeled 'Z' (zero), 'FS' (full-scale), and 'D' (damping) on the electronics enclosure and can be used to perform the following functions.

- **Setting zero on the M640**

This sets the output to 4 mA when the differential representing zero steam mass flowrate is applied to the transmitter.

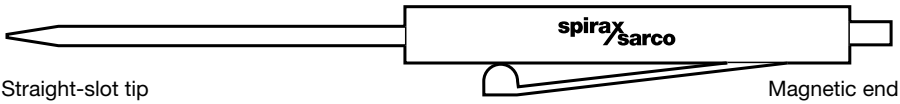
- **Setting full-scale on the M640**

This sets the output to 20 mA when the differential representing maximum flowrate is applied to the transmitter. This is factory set and should not normally require adjustment.

- **Setting the damping on the M640**

The D switch is used to change the amount of damping that is applied to the transmitter output. The factory setting is suitable for all steam metering applications.

WARNING:
If the M640 is connected to a control system, valves should be disconnected to prevent possible hazards during the adjustment.



IMPORTANT
Use only the Spirax Sarco magnetic screwdriver to actuate the magnetic switches. Other magnets can cause inconsistent behaviour of one or more switches.

Fig. 11

5.2 Adjusting zero (4 mA)

1. Close both F50C isolation valves adjacent to the pipeline unit.
2. Open all three valves on the 3-way valve manifold.
3. De-pressurise the transmitter using the bleed valves.
4. Remove the plugs at the top of the impulse lines.
5. Fill the impulse lines with clean water.
6. Close the equalising valve on the 3-way valve manifold.
7. Check that no air is trapped in the impulse pipework and that the impulse lines are full of water.
8. Hold the magnetic end of the screwdriver on the 'Z' switch for at least 8 seconds. (This activates the zero setting mode).
9. Set the zero value by momentarily pressing the magnetic end of the screwdriver on the 'Z' switch for a second time. **(The differential pressure that is applied to the transmitter has now been stored as the 4 mA point)**.
10. Replace the plugs at the top of the impulse lines.
11. Open both F50C isolation valves.
12. The zero adjustment is now complete.

Notes:

A. The zero setting mode times-out after one minute of inactivity. If the zero is not set within this time the procedure will need to be repeated from Step 8.

B. Zero setting mode can be cancelled by momentarily holding the magnetic screwdriver on the 'D' switch or by waiting one minute for the automatic time-out to occur.

C. When a new zero value is set, the transmitters will shift the full-scale value to maintain the original span. If the process is out of range of the transmitter, then no new zero value is stored.

D. If the new zero value would shift the full-scale past the sensor limit, the new full-scale value is automatically set to the appropriate sensor limit (except when this would produce a span that is too small, in which case neither zero nor full-scale value are stored).

5.3 Set local full-scale

1. Close both F50C isolation valves adjacent to the pipeline unit.
2. Close the high pressure isolating valve on the 3-way valve manifold.
3. Equalise the differential pressure by opening the equalising valve on the 3-way valve manifold.
4. Isolate the transmitter by closing the low pressure valve on the 3-way valve manifold.
5. Depressurise the transmitter using bleed valves.
6. Remove both the bleed valves.
7. Connect a pressure pump to the high pressure bleed tapping.
8. Close the equalising valve.
9. Adjust the pump pressure to full-scale value differential.
10. Hold the magnetic end of the screwdriver on the 'FS' switch for 7 or 8 seconds. (This activates the full-scale setting mode).
11. Set the full-scale value by momentarily pressing the magnetic end of the screwdriver on the 'FS' switch for a second time. **(The differential pressure that is applied to the transmitter has now been stored as the 20 mA point).**
12. Disconnect the pressure pump and replace the bleed screws.
13. Open the equalising valve on the 3-way valve manifold.
14. Open the high pressure isolating valve on the 3-way valve manifold.
15. Open the high pressure F50C.
16. Close the equalising valve on the 3-way valve manifold.
17. Open the low pressure isolating valve on the 3-way valve manifold.
18. Open the low pressure F50C.
19. The full-scale setting is now complete.

Notes:

A. The full-scale setting mode times out after 1 minute of inactivity. If the 'FS' switch is not set within this time the procedure will need to be repeated from Step 9.

B. Full-scale setting mode can be cancelled by momentarily holding the magnetic screw driver on the 'D' switch or by waiting 1 minute for automatic time-out to occur.

C. Changing the full-scale value of the transmitter does not affect the zero value. If the input value is either smaller than the minimum span or larger than the maximum span allowed by the transmitter, then no new full-scale value is stored.

D. The custom tag should be changed to reflect the new full scale setting. Consult Spirax Sarco for details

5.4 Adjust local damping

Adjusting the damping changes the value of the digital-filter time constant. The 'D', 'Z', and 'FS' switches are used to select one of 10 damping values.

1. Hold the magnetic end of the screwdriver on the 'D' switch for at least 8 seconds to be sure the damping setting mode is activated.

2. To remove all the damping by momentarily touching the 'Z' switch with the magnetic end of the screwdriver 10 times. This establishes a known starting point (0 sec).

3. Damping can now be increased by following Step 4 below or decreased by following Step 5.

4. To increase the damping, momentarily touch the 'FS' switch with the magnetic end of the screwdriver once for each step of increased damping that is required.

5. To decrease the damping, momentarily touch the 'Z' switch with the magnetic end of the screwdriver once for each step of decreased damping that is required.

Step	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
DV Damping valve (seconds)	0.1	0.2	0.5	1	2	5	10	20	30

Notes:

A. The damping setting mode times-out after 1 minute of inactivity. If the damping is not set within this time, the procedure will need to be repeated from Step 1.

B. Change to a new damping value by momentarily touching the 'FS' switch 'N' times to step to the value nearest the desired damping value (DV, in seconds) as shown above. If the desired damping value is exceeded, lower the damping value by momentarily touching the magnetic screwdriver to the 'Z' switch for each step.

6. Maintenance

The M640 employs the latest in capacitive and digital technology to ensure long term stability. Maintenance checks are limited to those shown below. The length of time between these checks will vary but it is recommended that they should be carried out at least once per year. This may need to be more often if the steam system suffers from carryover or amine contamination.

1. The impulse pipework should be drained, checked for blockage, leaks and then refilled with clean water.
2. The M640 zero trim should then be re-set. (see Section 5, Commissioning, for details).

7. Fault finding

Fault finding is best carried out with a HART® communicator.
If this is not available then the following symptoms and checks can be used to help locate faults:

Symptom	Possible fault	Check
0 mA output	No dc power at the transmitter.	Check the power supply at the transmitter is within the limits quoted.
Constant 4 mA output	Equalising valve left open.	Recommission the transmitter.
	Impulse lines blocked or isolated.	Recommission the transmitter.
	Transmitter in digital mode?	Contact Spirax Sarco.
Constant 3.85 mA output	This is the default output when a fault has occurred in the M640's software.	Return the transmitter to Spirax Sarco Ltd.
Output between 4-20 mA	Output does not represent flow.	Recommission the transmitter.
		Check the installation and operation of the pipeline unit.

If the fault is still present after the above checks have been carried out then please return the M640 steam mass flow transmitter to Spirax Sarco with a report detailing the fault.

8. Local display options

An optional local display can be purchased to indicate either the steam values or % output as shown in the following table (This should be installed by a suitably qualified person).

Steam values	Mass flow, energy flow, mass total, energy total
% output	% output

The optional display includes a jumper which allows the magnetic switches to be disabled which adds security by preventing local calibration of the transmitter (see Figure 13).
Please note: if the M640 power supply is interrupted the totalizer will revert to zero and will not operate until reset using HART® Communications.

The local display includes an installation kit - Order:

Description: M640 local indicator and cover with sight glass **Part number:** 3352079

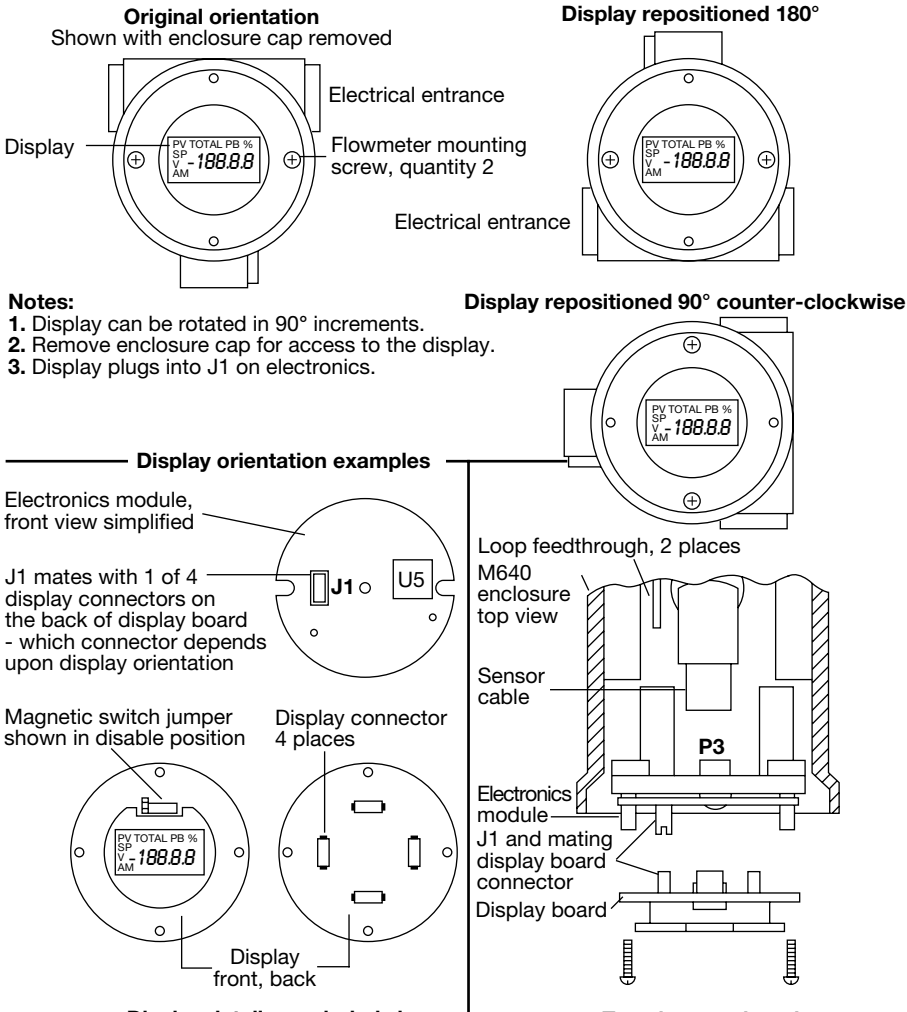


Fig. 12 Display removal and repositioning

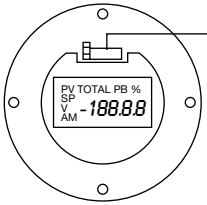


Fig.13 Magnetic switch disable

8.1 Display installation, repositioning, and removal

This Section describes field installation and orientation of a display for easiest viewing. The display can be rotated in increments of 90°.

8.1.1 Installing a display:

1. Turn off power to the transmitter.
2. Remove the enclosure cap by turning counter-clockwise.
3. Remove the display from its packaging.
4. While holding the display in front of the transmitter enclosure, rotate it in quarter turns to find the viewing position where reading is easiest. (Four positions, 90° apart, are possible).
5. Remove 2 screws at the perimeter of the electronics module inside the transmitter enclosure. Insert these screws in the display so that the screws align with the holes in the electronics module. (See Fig. 12).
6. Bring the display close to the transmitter until the screws can be inserted loosely into the module. Without tightening the screws, press gently on the display until it engages connector J1 on the electronics module and can be pushed no further.
7. Use a flat blade screwdriver to tighten the screws fully.
8. Screw on the enclosure cap with sight glass by turning clockwise. Hand tighten cap to compress the 'O' ring. Turn on power to the transmitter.

8.1.2 Rotating the display:

The optional display may be rotated so that it is easier to read.

1. Turn off power to the transmitter.
2. Remove the enclosure cap with sight glass by turning counter-clockwise.
3. Using a flat blade screwdriver, loosen the two screws holding the display. Lift the display, loosening the screws further if necessary, until it can be separated from the electronics module.
4. While holding the display in front of the transmitter enclosure, rotate it in quarter turns to find the viewing position where reading is easiest. (Four positions, 90° apart, are possible).
5. Observe the positions of the holes in the electronics module inside the transmitter. Depending on the mounting position chosen, it may be necessary to move the screws so they will line up with these holes.
   - **A.** Bring the display close to the transmitter until the screws can be inserted loosely into the holes in the electronics module. Without tightening the screws, press the display gently until it engages connector 'J1' on the electronics module and can be pushed no further.
   - **B.** Use a flat blade screwdriver to tighten the screws fully.
   - **C.** Replace the enclosure cap by turning clockwise. Hand tighten cap to compress the 'O'ring. Turn on power to the transmitter.

8.1.3 Removing the display:

1. Turn off power to the transmitter.
2. Remove the glass-faced enclosure cap by turning counter-clockwise.
3. Using a flat blade screwdriver, loosen the two screws holding the display. Lift the display, loosening the screws further if necessary, until it can be separated from the electronics module.
4. Use the screws to secure the electronics module.
5. Place the display in an electrostatic protective container.
6. Replace the enclosure cap by turning clockwise. Hand tighten cap to compress the 'O' ring. Turn on power to transmitter.

9. HART® Communications

IMPORTANT

The M640 is normally configured to transmit its output via a 4-20 mA output. If it is reconfigured to operate in its HART® communications mode the 4-20 mA signal is disabled.

9.1 Connecting network devices

Miscellaneous network devices (e.g., recorders, current meters) may be connected to a point-to-point network in accordance with the following conditions.

- Devices may be series or parallel connected to the network according to its function.
- Devices must be passive two-terminal devices.
- Devices may not generate any type of noise or signals, other than noise that is inherent in resistive components.
- Individual devices must meet the following requirements:
  - Capacitance to ground .....50 pF maximum
  - Resistance to ground ..... 1 m minimum
  - Impedance if series connected.....<10 Ω
  - Impedance if parallel connected.....> 50 k
- The maximum number of devices per network is 16.
- The combined electrical characteristics may not exceed the following:
  - Maximum capacitance to ground ..... 800 pF
  - Minimum resistance to ground .....62.5 kΩ
  - Maximum series impedance .....160 Ω
  - Minimum parallel impedance .....3125 Ω

9.2 M640 identification

The M640 can be configured with unique identification information which is stored in the transmitter memory. This area of memory is called the transmitter's ID block. The information that can be stored in the ID block should follow the following format.

Tag (Defines serial number of flowmeter, i.e. SN H0255)..... **8-character ASCII**

Descriptor (Pipeline flowmeter in greater detail, i.e. SRG S.DN50..06/96).**16-characterASCII**

Message (Customer details) .....**32-character ASCII**

Date(Date of manufacture) ..... **DD/MM/YY**

Device serial number (On name-plate) ..... **0 to 16777215**

Polling address (0 unless networked)..... **0-15**

9.2.1 Tag, descriptor, and message

These three parameters are ASCII text and have no bearing on transmitter output. Up to an 8-character tag, 16-character descriptor and 32-character message may be entered for the transmitter.

9.2.2 Date

The Date parameter uses the international DD/MM/YY format. This date can be selected by the user to indicate any date or event, such as date of installation or last date of service.

9.2.3 Device serial number

The 8-digit device serial number is factory configured to match the serial number on the transmitter name-plate. It should not be changed.

9.2.4 Polling address

The polling address is used to place the transmitter in either analogue or digital mode. A polling address of 0 indicates that the transmitter is in analogue mode and will output a 4-20 mA current according to its calibrated range. In analogue mode, a single transmitter is connected to a point-to-point network.

A polling address between 1 and 15 indicates the transmitter is in digital mode and will output a constant 4 mA current. In digital mode, up to 15 transmitters can be connected in a multi-drop network using a single twisted pair cable.

Parameter	Range of values	Factory configured value	Field configured value
Write protect	Disable, enable	Disable	—
Sensor input block			
Measured variable units	in H_2O, inHg, ft H_2O, mm H_2O, mm Hg, psi, bar, mbar, g/sq cm, kg/sq cm, Pa, kPa, Torr, ATM	in H_2O	—
Measured variable range Lo	-999999 to 999999	0	—
Measured variable range Hi	-999999 to 999999	200 Std	—
Damping time constant	0 to 30 seconds	1	—
Transfer function	Linear, square root	Linear	—
Transfer function cut-off	0 to 30%	4%	—
Zero dropout	0 to 30%	0.5%	—
Active input	—	—	Non-configurable
Totalizer block			
Full-scale value	199999984	199999984	Non-configurable
Time base	Hour	Hour	Non-configurable
Multiplier	0.001 to 19999	1.0	—
Zero dropout	0 to 30%	0.5%	—
Operator display block			
Raw flow units	4-character ASCII	kg/h	—
Raw flow range Lo	-19999 to 19999	0	—
Raw flow range Hi	-19999 to 19999	Specified with order	—
Steam units	English / metric	Specified with order	—
Steam flow range Lo	-999999997952 to 999999995904	0	—
Steam flow range Hi	-999999997952 to 999999995904	—	—
Local display code	Steam units,% output	Steam units	—
Auto toggle	Off, on	On	—
Toggle time	1 to 30 Seconds	5	—
Transmitter ID			
Tag	8-character ASCII	Flowmeter serial no.	—
Descriptor	16-character ASCII	Flowmeter details	—
Message	32-character ASCII	Customer	—
Date	—	(Date transmitter manufactured)	—
Device serial number (8-digit)	0 to16777215	(Device S/N on name-plate)	Do not change
Polling address	0 to 15	0	—

Parameter	Range of values	Factory configured value	Field configured value
Output block			
Fail safe	Lo, Hi, last value	Lo	—
Output switch	Raw flow, mass flow, energy flow	Mass flow	—
Steam settings			
Reference volume	0.00001 to 10.0	0.0010018	—
Quality (dryness factor)	0.7 to 1.0	1.0	—
Thermal factor	—	0.0019%	—
Steam units	English/metric	Metric	—
Characterizer block			
Characterizer	Off, on	As Gilflo calibration documentation	—
X0	0.0 to 100.0%	As Gilflo calibration documentation	—
Y0	0.0 to 100.0%	As Gilflo calibration documentation	—
X1	0.0 to 100.0%	As Gilflo calibration documentation	—
Y1	0.0 to 100.0%	As Gilflo calibration documentation	—
X2	0.0 to 100.0%	As Gilflo calibration documentation	—
Y2	0.0 to 100.0%	As Gilflo calibration documentation	—
X3	0.0 to 100.0%	As Gilflo calibration documentation	—
Y3	0.0 to 100.0%	As Gilflo calibration documentation	—
X4	0.0 to 100.0%	As Gilflo calibration documentation	—
Y4	0.0 to 100.0%	As Gilflo calibration documentation	—
X5	0.0 to 100.0%	As Gilflo calibration documentation	—
Y5	0.0 to 100.0%	As Gilflo calibration documentation	—
X6	0.0 to 100.0%	As Gilflo calibration documentation	—
Y6	0.0 to 100.0%	As Gilflo calibration documentation	—
X7	0.0 to 100.0%	As Gilflo calibration documentation	—
Y7	0.0 to 100.0%	As Gilflo calibration documentation	—
X8	0.0 to 100.0%	As Gilflo calibration documentation	—
Y8	0.0 to 100.0%	As Gilflo calibration documentation	—
X9	0.0 to 100.0%	As Gilflo calibration documentation	—
Y9	0.0 to 100.0%	As Gilflo calibration documentation	—
X10	0.0 to 100.0%	As Gilflo calibration documentation	—
Y10	0.0 to 100.0%	As Gilflo calibration documentation	—
X11	0.0 to 100.0%	As Gilflo calibration documentation	—
Y11	0.0 to 100.0%	As Gilflo calibration documentation	—
X12	0.0 to 100.0%	As Gilflo calibration documentation	—
Y12	0.0 to 100.0%	As Gilflo calibration documentation	—
X13	0.0 to 100.0%	As Gilflo calibration documentation	—
Y13	0.0 to 100.0%	As Gilflo calibration documentation	—
X14	0.0 to 100.0%	100.00	—
Y14	0.0 to 100.0%	100.00	—

10.1 Hazardous area installation

This appendix presents wiring and barrier selection information for installation of an M640 transmitter in a hazardous location. Refer to the barrier list below, the barrier manufacturer's installation instructions, and the following pages when installing or servicing a transmitter in a hazardous location.

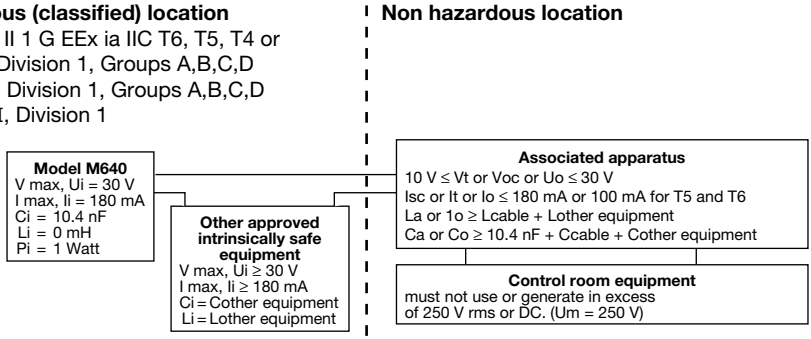
The following barriers have been tested with the M640:

Barrier manufacturer and model	Barrier type	For use with
Stahl 9001/51-280-091-14	Active/dual channel	XTC to LIL or HFM*
Stahl 9001/01-280-100-10	Passive/dual channel	XTC to SAM*
MTL 787S	Dual channel	XTC to LIL or HFM*
MTL 728	Dual channel	XTC to SAM*

*LIL - Local Instrument Link station (e.g., Model 352, Model 385), HFM - APACSTM HART® Fieldbus Module, SAM - APACS Standard Analogue module.

Other barriers from these and other manufacturers can provide the required protection. The installer should carefully select barriers based on the required protection, loop wiring, manufacturer's barrier performance data, and the data in the figures on the next page.

10.2 Barrier information



General notes:

- All equipment in the loop must be approved by an organization acceptable to the authority having jurisdiction.
- Associated apparatus and control room equipment may be located in Division 2 if so approved.
- The installation must be in accordance with the National Electrical Code or Canadian Electrical Code and ANSI/ISA - RP12.6.

Model M640:

- Up to 15 different model M640s may be connected to each associated apparatus in multi-drop mode.

Associated apparatus:

- Positive or negative, dual channel or supply return barrier may be used. Dual channel or supply - return barriers combinations must be approved by the authority having jurisdiction. See Table 1 opposite for acceptable combinations of barrier parameters. Stahl series 8903 (active current limiting) barriers must be used alone. They **cannot** be combined with any other barrier.

Table 1 Combinations of barrier parameters:

	Barrier 1		Barrier 2		Combined		Resistance parameters			Acceptable groups	
Groups	**Volts**	**Ohms**	**Volts**	**Ohms**	**Volts**	**Ohms**	**Voc Volts**	**Isc (mA)**	**1.5 x Isc (mA)**	**Groups A, B, C, D**	**Groups C, D**
A, B, C, D	28	300	28	300	28.0	150	28.0	187	280	No	Yes
			23	150	24.6	100	24.6	246	369	No	Yes
			15	100	18.2	75	18.2	243	364	Yes	Yes
			10	50	12.3	42	12.3	293	439	Yes	Yes
A, B, C, D	23	150	23	150	23.0	75	23.0	307	460	No	Yes
			15	100	18.2	60	18.2	303	455	Yes	yes
			10	50	13.1	37	13.1	354	531	Yes	Yes
A, B, C, D	15	100	15	100	15.0	50	15.0	300	450	Yes	Yes
			10	50	11.5	33	11.5	249	523	Yes	Yes
A, B, C, D	10	50	10	50	10.0	25	10.0	400	600	Yes	Yes
C, D	28	175	28	175	28.0	87	28.0	322	483	No	Yes

CSA Parametric Approval Parameters:

Groups A,B,C,D

V max = 10 V, R min = 50 Ohms
V max = 15 V, R min = 100 Ohms
V max = 23 V, R min = 150 Ohms
V max = 28 V, R min = 300 Ohms
or Stahl series 8903: 68 mA, 31.5 Vmax

Groups C,D only

V max = 28 V, R min = 175 Ohms
or Stahl series 8903: 54.4 mA, 52.5 V max

Wiring:

Wiring must be twisted, shielded pairs, 20 AWG or larger, solid or stranded.
If the inductance and capacitance of the wiring are not known then the following parameters may be used:
Capacitance = 60 pF per foot.
Inductance = 0.20 uH per foot.