

SIEMENS

SITRANS F

Ultrasonic flowmeters SITRANS FSS200

Installation Manual


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FSS200 sensors
7ME3950
7ME3951


Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

 DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.

 WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.

 CAUTION
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.


If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

 WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction

Note

This manual applies to the SITRANS FSS200 ultrasonic clamp-on sensors only.

Use the device to measure process media in accordance with the information in the Operating Instructions.

In order to operate an ultrasonic flowmeter, you need both transmitter Operating Instructions and sensor Installation Instructions, see Flow documentation (<https://support.industry.siemens.com/cs/products?pnid=17317&lc=en-WW>).

1.1 Purpose of this documentation

These instructions contain all information required to commission and use the device. Read the instructions carefully prior to installation and commissioning. In order to use the device correctly, first review its principle of operation.

The instructions are aimed at persons mechanically installing the device, connecting it electronically, configuring the parameters and commissioning it, as well as service and maintenance engineers.

1.2 Document history

The following table shows major changes in the documentation compared to the previous edition.

Edition	Note
09/2021	Nameplate correction
05/2021	Added support for FST030 industrial enclosure
12/2019	<ul style="list-style-type: none"> • Support for external DSL functionality: path 3 and path 4, CH5 analog input. • Support for gas installations.
08/2017	<ul style="list-style-type: none"> • Added FST020 sensor installation procedures, Dry Film Couplant/Damping and Dry Coupling Pad installation procedures.
03/2017	<ul style="list-style-type: none"> • Second edition <ul style="list-style-type: none"> – Various Warning updates to meet FM/ATEX approval – Sensor name plate label
02/2017	First edition

1.3 Preliminary Information

The following information is specifically for the FSS200 sensors.

Clamp-on ultrasonic flowmeters can accommodate a wide range of fluid flow applications.

These instructions expect that only a technically instructed person will be installing these flowmeters. Knowledge about process conditions and application parameters are prerequisite, including knowledge of the functional principles of these flowmeters.

Further information:

Siemens provides special training and other information via the Internet, including helpful installation videos. Helpful links will be listed inside this manual separately.

1.4 Items supplied

Note

Scope of delivery may vary, depending on version and add-ons.

Note

Handle with care!

Impact and shock can damage the sensor connector or decouple the piezoelectric crystal located within the sensor.

- SITRANS FSS200 sensors with selected mounting hardware
- Sensor cables. One pair per sensor.
- Transmitter (not shown)
- Siemens Process Instrumentation documentation disk containing certificates, and manuals
- Mounting hardware

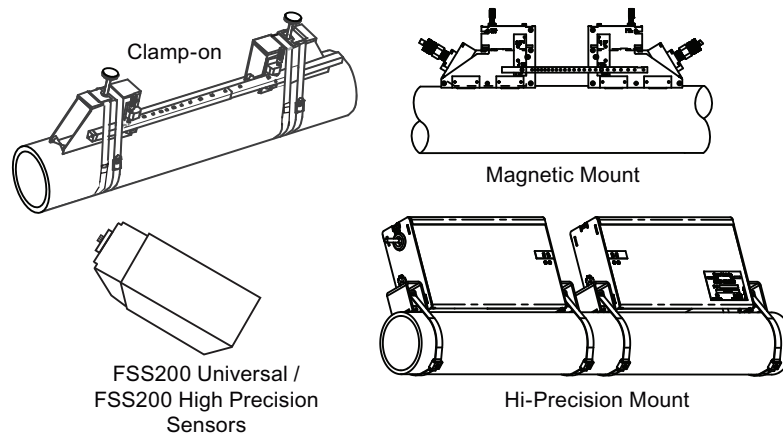


Figure 1-1 Mounting frames

1.5 Required tools

It is helpful to have common electric and hand tools available for installation of the sensors.

- For easy programming, a PC is helpful and can later be used for diagnostics and documentation.
- Sensor cables are normally preassembled at the transmitter end.
- Hot-air gun if shrink sleeves are needed.
- A plastic hammer and bubble level for sensor mounting and vernier adjustment of sensor frames.
- For preparing irregular pipe surfaces that have old paint, corrosion, etc. use electric hand sander .
- An optional circumference tape measure for pipe and sensor installation.

Note

Important

Never use an electric hand grinder or angle grinder when preparing pipe surfaces.

Incorrect bevel and chamfer angles at the pipe surface can disturb clear signal transmission.


- Use a thickness gauge to measure pipe wall thickness. If not available use pipe class tables or call technical support.
- Assorted sizes of screwdrivers, nut drivers and wrenches.

Optional mounting compounds

- P/N 7ME39600UC40 Dry couplant pads (Liquid installation only)
- P/N 7ME 39600UC20 Super Lube
- P/N 7ME39600UC32 Krytox GPL207

1.6 Checking the consignment

1. Check the packaging and the delivered items for visible damages.
2. Report any claims for damages immediately to the shipping company.
3. Retain damaged parts for clarification.
4. Check the scope of delivery by comparing your order to the shipping documents for correctness and completeness.

 WARNING
Using a damaged or incomplete device
Risk of explosion in hazardous areas.
<ul style="list-style-type: none">• Do not use damaged or incomplete devices.

1.7 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit

<https://www.siemens.com/industrialsecurity>.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under


<https://www.siemens.com/industrialsecurity>.


Safety notes

2.1 Precondition for safe use

This device left the factory in good working condition. In order to maintain this status and to ensure safe operation of the device, observe these instructions and all the specifications relevant to safety.

Observe the information and symbols on the device. Do not remove any information or symbols from the device. Always keep the information and symbols in a completely legible state.

Symbol	Explanation
	Consult operating instructions

 WARNING
<p>Improper device modifications</p> <p>Risk to personnel, system and environment can result from modifications to the device, particularly in hazardous areas.</p> <ul style="list-style-type: none"> • Only carry out modifications that are described in the instructions for the device. Failure to observe this requirement cancels the manufacturer's warranty and the product approvals.

2.2 Laws and directives

Observe the safety rules, provisions and laws applicable in your country during connection, assembly and operation. These include, for example:

- National Electrical Code (NEC - NFPA 70) (USA)
- Canadian Electrical Code (CEC Part I) (Canada)

Further provisions for hazardous area applications are for example:

- IEC 60079-14 (international)
- EN 60079-14 (EU and UK)

US Installations only: Federal Communications Commission (FCC) rules

Note

- This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.
 - This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the operating instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference to radio communications, in which case the user will be required to correct the interference at his own expense.
-

2.2.1 Conformity with European directives

The CE marking on the device symbolizes the conformity with the following European directives:

Electromagnetic compatibility EMC 2014/30/EU	Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to electromagnetic compatibility
Low voltage directive LVD 2014/35/EU	Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits
Atmosphère explosive ATEX 2014/34/EU	Directive of the European Parliament and the Council on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres
RoHS directive 2011/65/EU	Directive of the European Parliament and the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

The applicable directives can be found in the EU declaration of conformity of the specific device.

Note

CE declaration

The CE declaration certificate is available on the SensorFlash SD card delivered with the device.

2.3 Use in hazardous locations

Qualified personnel for hazardous area applications

Persons who install, connect, commission, operate, and service the device in a hazardous area must have the following specific qualifications:

- They are authorized, trained or instructed in operating and maintaining devices and systems according to the safety regulations for electrical circuits, high pressures, aggressive, and hazardous media.
- They are authorized, trained, or instructed in carrying out work on electrical circuits for hazardous systems.
- They are trained or instructed in maintenance and use of appropriate safety equipment according to the pertinent safety regulations.

WARNING

Use in hazardous area

Risk of explosion.

- Only use equipment that is approved for use in the intended hazardous area and labeled accordingly.
- Do not use devices that have been operated outside the conditions specified for hazardous areas. If you have used the device outside the conditions for hazardous areas, make all Ex markings unrecognizable on the nameplate.

WARNING

Loss of safety of device with type of protection "Intrinsic safety Ex i"

If the device or its components have already been operated in non-intrinsically safe circuits or the electrical specifications have not been observed, the safety of the device is no longer ensured for use in hazardous areas. There is a risk of explosion.

- Connect the device with type of protection "Intrinsic safety" solely to an intrinsically safe circuit.
- Observe the specifications for the electrical data on the certificate and/or in Technical specifications (Page 85).

2.3.1 Special conditions for safe use


Specific conditions of use - US and Canada


1. Potential risk of sparking from aluminum alloy enclosure. In Division 1 or Zone 0 installations, equipment shall be installed in such manner as to prevent the possibility of sparks resulting from friction or impact against the enclosure.
2. Sensor surfaces shall be protected from side impact by using available mounting tracks, frames, mounting enclosures or other means. 7ME3950*LS0* Doppler sensors only require mounting straps.
3. Potential risk of electrostatic sparking. Clean only with a damp cloth.
4. The maximum permitted ambient temperature of the very high temperature sensor's terminal box is +60 °C. To avoid the effects of process temperatures and other thermal effects, care shall be taken to ensure the surrounding ambient temperature does not exceed +70 °C. Adherence to the manufacturer's installation manual shall be followed for fulfillment of this requirement.
5. Shall be used with a galvanically isolated transmitter.
6. Refer to installation drawing A5E37305975A and certificate for temperature classes and ambient temperature ranges

Specific conditions of use - ATEX & IEC


1. Potential risk of sparking from aluminum alloy enclosure. In Zone 0 installations, equipment shall be installed in such manner as to prevent the possibility of sparks resulting from friction or impact against the enclosure.
2. Sensor surfaces shall be protected from side impact by using available mounting tracks, frames, mounting enclosures or other means. 7ME3950*LS0* Doppler sensors only require mounting straps.
3. Potential risk of electrostatic sparking. Clean only with a damp cloth.
4. The maximum permitted ambient temperature of the very high temperature sensor's terminal box is +60 °C. To avoid the effects of process temperatures and other thermal effects, care shall be taken to ensure the surrounding ambient temperature does not exceed +70 °C. Adherence to the manufacturer's installation manual shall be followed for fulfillment of this requirement.
5. Shall be used with a galvanically isolated transmitter.
6. Refer to Document A5E36255466 and certificate for temperature classes and ambient temperature ranges.


Further information and instructions including approval-specific special conditions for safe use in Ex applications can be found in the certificates on the accompanying documentation disk and at Certificates.


 WARNING
<p>Laying of cables</p> <p>Risk of explosion in hazardous areas. May cause death or serious injury.</p> <p>Cable for use in hazardous areas must satisfy the requirements for having a proof voltage of at least 500 V AC applied between the conductor/ground, conductor/shield and shield/ground.</p> <p>Connect the devices that are operated in hazardous areas as per the stipulations applicable in the country of operation.</p>

 WARNING
<p>Field wiring installation</p> <p>Risk of explosion in hazardous areas. May cause death or serious injury.</p> <p>Ensure that the national requirements of the country in which the devices are installed are met.</p>

2.4 Installation in hazardous areas

 WARNING
<p>Equipment used in hazardous areas</p> <p>Risk of explosion in hazardous areas. Death or serious injury may occur.</p> <p>Equipment used in hazardous areas must be Ex-approved for the region of installation and marked accordingly. It is required that the special conditions for safe use provided in the manual and in the Ex certificate are followed!</p>

 WARNING
<p>Dust layers above 5 mm</p> <p>Explosion Hazard - Can cause death or serious injury</p> <p>Device may overheat due to dust build up. Remove dust layers in excess of 5 mm.</p>

 WARNING
<p>Electrostatic Sparking</p> <p>Explosion Hazard - Can cause death or serious injury</p> <p>Clean only with a damp cloth.</p>

Note

Important

The FST020 flowmeter is not suitable for use in hazardous areas.

Hazardous area approvals

The device is approved for use in hazardous area according to the lists below. Specific conditions of safe use specified by each approval authority are included in the relevant certificate.

"Intrinsic safety" type of protection	
Canada, USA • FM16CA0142X • FM16US0280X • CSA 80083297X	Class I, Division 1, Groups A, B, C, D Class II, Division 1, Groups E, F, G Class III Class I, Zone 0, AEx/ Ex ia IIC T6 ... T4 Ga Class II, Zone 21 AEx/ Ex ib IIIC T70°C ... T110°C Db
ATEX, UKEx, IECEx • IECEx FMG 17.0004X • FM 16ATEX0090X • FM21UKEX0057X	II 1G Ex ia IIC T6...T4 Ga II 2D Ex ib IIIC T70 – 110 °C Db
EAC Ex	0Ex ia IIC T6...T4 Ga X Ex ia IIIC T70°C...T110°C Da
Temperature code	Varies by sensor and ambient temperature (see tables below)
Dust Temperature class	T _{dust} = T _a max + 10 °K (T70 °C for T _a = 60 °C, T110 °C for T _a = 100 °C)

Table 2-1 FSS200 Size A and B High Precision Sensor; Entity Parameters: U_i = 17.44 V, I_i = 461 mA, P_i = 1.00 W

MLFB Number	Type	C _i (nF)	L _i (uH)	Temperature code
7ME3950aLbcd	Liquid	4.4	16	T5 for T _a ≤ 85 °C T4 for T _a ≤ 100 °C
7ME3950aGbcd	Gas	1	50	T5 for T _a ≤ 85 °C T4 for T _a ≤ 100 °C

Where,

a = Approval: 5 (FM/CSA/ATEX/IECEX)

b = G,H,J,K,L,or T

c = Temperature 0 (normal), 2 (104°C) or 3 (121°C)

d = Corrosion Protection: 0 (Standard) or 1 (Corrosion Resistant)

Table 2-2 FSS200 Size C and D High Precision Sensors; Entity Parameters: $U_i = 17.44 \text{ V}$, $I_i = 461 \text{ mA}$, $P_i = 1.00 \text{ W}$

MLFB Number	Type	Ci (nF)	Li (uH)	Temperature code
7ME3950aLbcd	Liquid	3.4	0	T5 for $T_a \leq 85 \text{ }^\circ\text{C}$ T4 for $T_a \leq 100 \text{ }^\circ\text{C}$
7ME3950aGbcd	Gas	56	0	T5 for $T_a \leq 85 \text{ }^\circ\text{C}$ T4 for $T_a \leq 100 \text{ }^\circ\text{C}$

Where,

a = Approval: 5 (FM/CSA/ATEX/IECEX)

b = M,N,P,Q,U or R

c = Temperature 0 (normal), 2 (104 °C) or 3 (121 °C)

d = Corrosion Protection: 0 (Standard) or 1 (Corrosion Resistant)

Table 2-3 FSS200 Size A,B,C, D, and E Universal Sensors; Entity Parameters: $U_i = 17.44 \text{ V}$; $I_i = 461 \text{ mA}$, $P_i = 1.00 \text{ W}$

MLFB Number	Type	Ci (nF)	Li (uH)	Temperature code
7ME3950aLbc	Liquid	8.1	28.4	T5 for $T_a \leq 60 \text{ }^\circ\text{C}$ T4 for $T_a \leq 100 \text{ }^\circ\text{C}$
7ME3950aGbc	Gas	55	0	T5 for $T_a \leq 60 \text{ }^\circ\text{C}$ T4 for $T_a \leq 100 \text{ }^\circ\text{C}$

Where,

a = Approval: 5 (FM/CSA/ATEX/IECEX)

b = Size: B0,B1,C0,C1,C2,D0,D1,D2,E0,E1,E2,F0,F1,F2

c = Corrosion Protection: 0 (Standard) or 1 (Corrosion Resistant)

Table 2-4 FSS200 Doppler Sensors; Entity Parameters: $U_i = 17.44 \text{ V}$, $I_i = 461 \text{ mA}$, $P_i = 1.00 \text{ W}$

MLFB Number	Ci (nF)	Li (uH)	Temperature code
7ME3950aLS0b	123	0	T6 for $T_a \leq 60 \text{ }^\circ\text{C}$ T5 for $T_a \leq 100 \text{ }^\circ\text{C}$

Where,

a = Approval: 5 (FM/CSA/ATEX/IECEX)

b = Corrosion Protection: 0 (Standard) or 1 (Corrosion Resistant)

Table 2-5 FSS200 Very High Temperature Sensors; Entity Parameters: $U_i = 17.44 \text{ V}$, $I_i = 461 \text{ mA}$, $P_i = 1.00 \text{ W}$

MLFB Number	Ci (nF)	Li (uH)	Temperature code
7ME3950aLAb	0	0	T5 for $T_a \leq 85 \text{ }^\circ\text{C}$ T4 for $T_a \leq 100 \text{ }^\circ\text{C}$

Where,

a = Approval: 5 (FM/CSA/ATEX/IECEX)

b = Size: 13,23,33,43,63,73,83

2.4 Installation in hazardous areas

Note

Control drawing

* See Control drawing A5E37305975A

Installation variations

Note

Requirements for safe installation

- The sensors can be installed in Zone 0, Div. 1 as Intrinsically Safe.
 - Standard remote installation with FST030 because the connection is certified Intrinsically Safe.
-

Note

FST020 is not suitable for hazardous locations.

Installation overview

FST020 system

The illustration below shows a typical transmitter and clamp-on sensor flowmeter configuration.

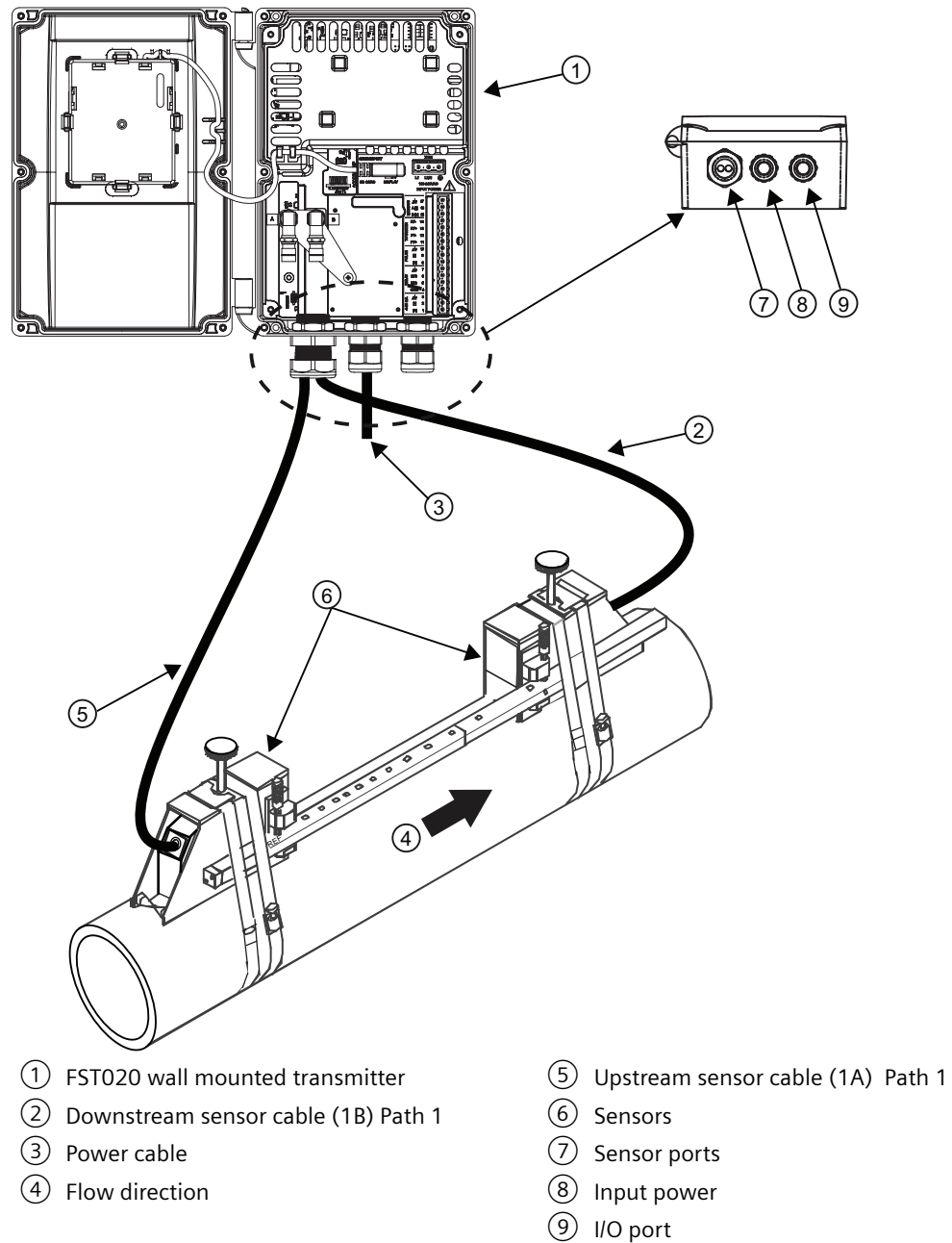
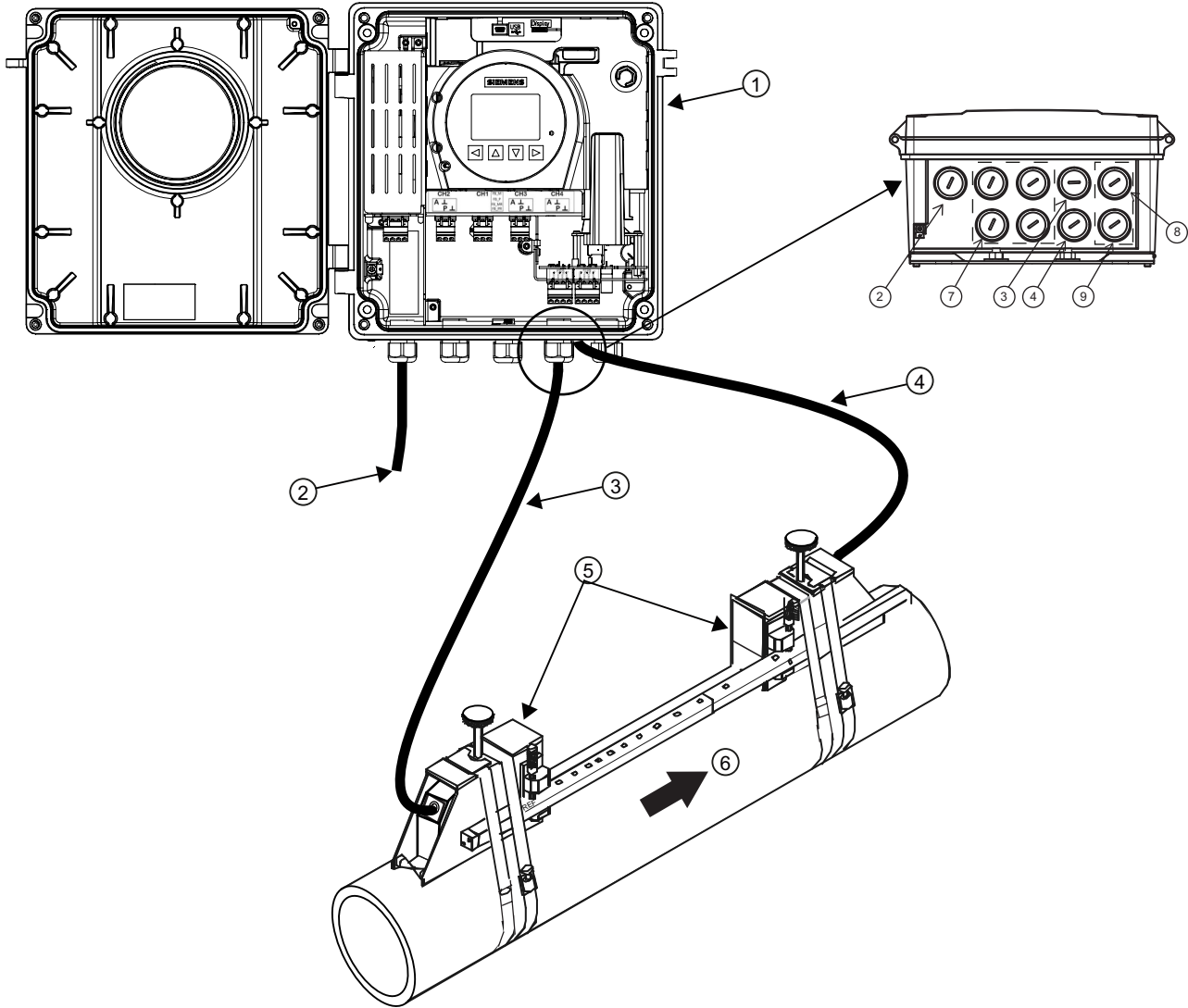


Figure 3-1 Wall mount transmitter overview (Reflect mount)

System overview with internal DSL

The illustration below shows a typical transmitter and clamp-on sensor flowmeter configuration. You can also connect the transmitter to other ultrasonic flow sensors.



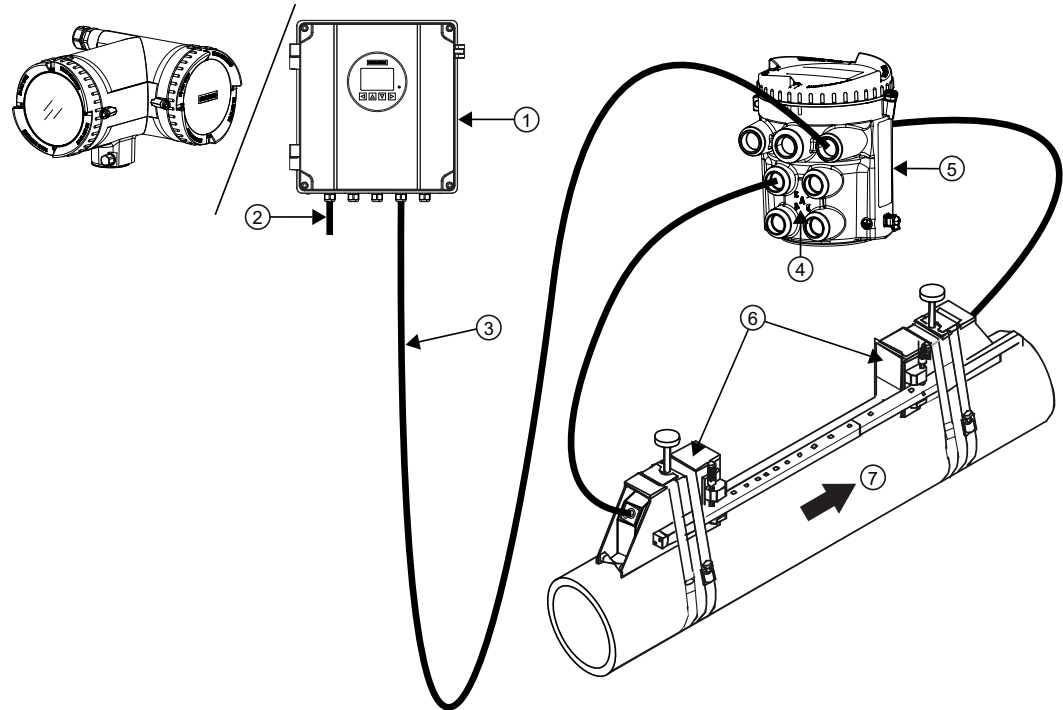
- ① FST030 wall mount enclosure transmitter
- ② Power cable
- ③ Path 1 - upstream sensor cable (1A)
- ④ Path 1 - downstream sensor cable (1B)
- ⑤ Sensors
- ⑥ Flow direction
- ⑦ Ports for I/O, Communications, RTDs
- ⑧ Path 2 - upstream (2A)
- ⑨ Path 2 - downstream (2B)

Figure 3-2 Wall mount transmitter overview (reflect mount)

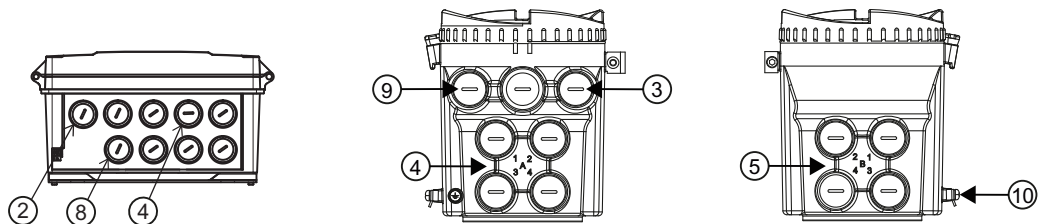
3.1 FST030 system overview with external DSL

System overview with external DSL

The illustration below shows a typical transmitter and clamp-on sensor flowmeter configuration with external DSL. You can also connect the transmitter to other flow ultrasonic sensors.



Wall mount transmitter overview with external DSL, example for FSS200



Transmitter bottom view

External DSL side view A

External DSL side view B

- | | | | |
|---|---------------------------------------------------------------|---|--------------------------------|
| ① | FST030 wall mount or industrial enclosure transmitter | ⑥ | Sensors |
| ② | Power cable | ⑦ | Flow direction |
| ③ | Cable connection between FST030 and external DSL, up to 150 m | ⑧ | Ports for I/O, Communications |
| ④ | Path 1-4 upstream (A) | ⑨ | Ports for analog input or RTDs |
| ⑤ | Path 1-4 downstream (B) | ⑩ | Protective earth |

3.2 System configuration

Generally after deciding on the necessary flow measurements an evaluation should be done. In this way, the best economical solution can be obtained since configurations and accuracy measurement requirements can be in conflict with the overall system costs. In particular when using Clamp-on systems it's important to perform a very detailed evaluation. Later this will result in smooth installations and the highest customer satisfaction.

For example, a poor accuracy may result if the installed pipe size is different than actual pipe size. Although operation may still be achieved, accuracy can be compromised due to incorrect volume calculation.

3.2 System configuration

The SITRANS F US ultrasonic flowmeter systems consist of a transmitter, one or two sensor pairs and the connecting cables. The following table lists process temperatures for the available combinations of sensors and transmitters.

Transmitter	Sensor type	Temperature range
FST030	FSS200 Hi Precision - T1	-40°C to +65°C (-40°F - +149°F)
FST020	FSS200 Hi Precision - T2	0°C to +120°C (32°F - +248°F)
	FSS200 Universal	-40°C to +120°C (-40°F - +248°F)
	FSS200 High Temperature	-40°C to +230°C (-40°F to +446°F)

Installing/mounting

This chapter describes how to install the sensors. The following installation steps must be carried out:

- Determine a suitable installation location for the sensors and transmitter. See Determining a location (Page 25).

Note

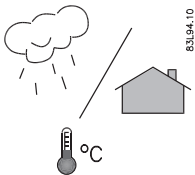
IMPORTANT

This step should have been done prior to ordering the clamp-on system

- Collect all relevant fluid and pipe data (pipe material and dimensions, fluid type or approximate sound speed, viscosity, etc.).
- Install and apply power to the transmitter, then follow the sensor setup wizard to determine the recommended sensor orientation and spacing. See Orienting the sensors (Page 27)
- Install the sensors using the supplied mounting hardware. See Mounting the sensors (Page 24)
- Connect the sensor cables.
- Complete the sensor setup wizard to begin measuring flow. See Installation instructions (Page 28)

4.1

Environment



SITRANS F flowmeters with minimum IP66/IP67/NEMA 4X enclosure rating are suitable for indoor and outdoor installations.

Process medium temperature

If applicable, make sure that specifications for rated medium temperature (TS) plus ambient temperature that are indicated on the device nameplate / label will not be exceeded.

Aggressive atmospheres

Ensure that the device is suitable for the application and that it is installed where there is no risk of penetration of aggressive vapors.

Direct sunlight

Prevent the device from overheating or materials becoming brittle due to UV exposure by protecting it from direct sunlight. Make sure that the maximum permissible ambient temperature is not exceeded. Refer to the information in Technical specifications (Page 85).



WARNING

Installation in hazardous location

Risk of explosion in hazardous areas

Special requirements apply to the location and installation of the device. See Installation in hazardous areas (Page 15).

4.2 Installation safety precautions

Special precautions must be taken when the flowmeter is mounted in applications with working pressures/media that can be dangerous to people, surroundings, equipment or others in case of pipe fracture.

- Take appropriate protective measures to avoid contact with surfaces with temperatures above 70 °C (155 °F).
- Prevent severe external stresses and loads from acting on the device.
- Do not install the flowmeter in the vicinity of strong electromagnetic fields, for example near motors, variable frequency drives, transformers etc.

Note

Material compatibility

Siemens can provide you with support concerning selection of sensors. However, you are responsible for the selection of components. Siemens accepts no liability for faults or failures resulting from incompatible materials.

4.3 Sensor installation parameters

The following parameters are required for a correct sensor installation, ensuring the best possible flow measurement accuracy:

- **Pipe data:** material, outer diameter, wall thickness, Liner material and thickness (if applicable), pipe roughness, upstream and downstream straight run (in pipe diameters).
- **Process conditions:** Type of fluid, fluid sound speed (if known), process temperature, fluid viscosity, positive flow direction.
- **Sensor data:** Sensor type and size (indicated on label), length of sensor cable pair.
- **Environment conditions:** Mounting location transmitter/sensors, distance and required cable lengths, temperature, sun protection/rain, protection against dirt, vibrations, corrosion, easy access for maintenance: ladder or scaffolding, below ground or submersible.

4.4 Determining a location

Introduction

There are a number of factors to consider when deciding on an installation location for the clamp-on sensors and transmitter. Primarily, the pipe section should remain completely full during normal operation and be in reasonable condition, without excessive corrosion (or scaling) which can interfere with ultrasound transmission into the fluid. Available straight pipe run and installation in hazardous areas are also important points to consider when selecting a location.

Hardware considerations

The following hardware characteristics need to be considered:

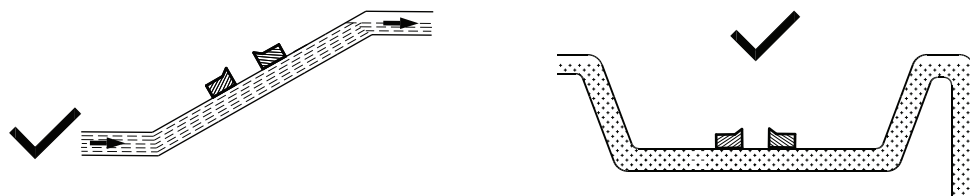
- **Transmitter:** Ingress protection rating, Hazardous area rating, ambient temperature range, maximum allowed sensor cable length. (Refer to appropriate transmitter Operating Instructions manual for details.)
- **Sensor:** Ingress protection rating, Operating temperature range, compatibility with pipe material and dimensions.
- **Mounting:** Corrosion resistance, vibration tolerance, direct burial, submersibility.
- **Sensor cables:** Ingress protection rating, temperature rating, electromagnetic compatibility.

Typical sensor locations

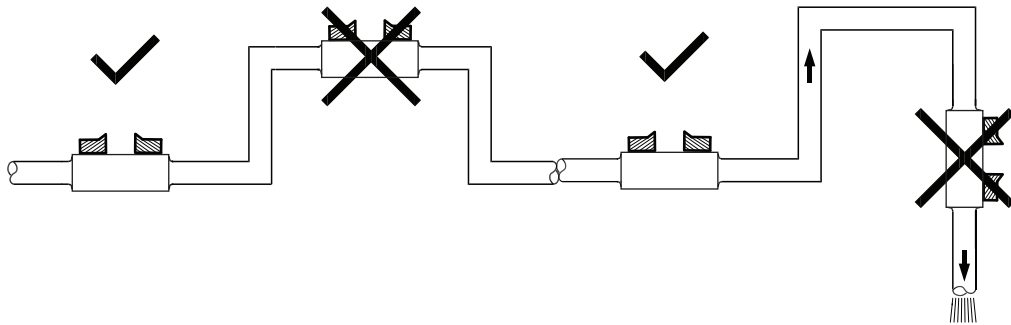
Note

The pipe should always be completely filled with liquid.

- Locate the sensors in U-shaped pipes if pipes are only partially filled or have free outlet.

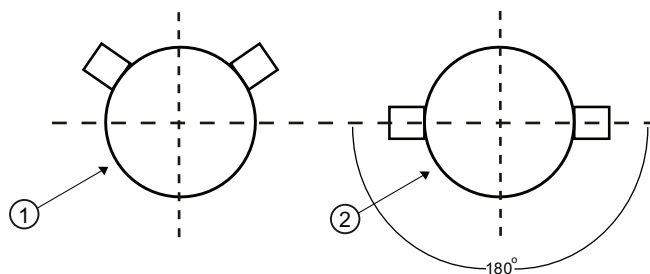


- Avoid, if possible, the following installations:
 - Installation at the highest point of the pipe system
 - Installation in vertical pipes with free outlet or downwards flow



Selecting a location for the sensors

1. Locate the sensors downstream from the center of the longest available straight run. A location ten pipe diameters or greater downstream from the nearest bend will provide adequate flow profile conditions.
2. Do not, if possible, install the sensors downstream from a throttling valve, a mixing tank, the discharge of a positive displacement pump or any other equipment that could possibly aerate the liquid. The best location will be as free as possible from flow disturbances, vibration, sources of heat, noise, or radiated energy.
3. Avoid mounting the sensors on a section of pipe with any external scale. Remove all scale, rust, loose paint, etc., from the location.
4. Do not mount the sensors on a surface aberration (pipe seam, etc.)
5. Do not mount sensors from different ultrasonic flowmeters on the same pipe. Also, do not run the sensor cables in common bundles with cables from other instrumentation. You can run these cables through a common conduit ONLY if they originate at the same flowmeter.
6. **Avoid mounting sensors on the top or bottom of a horizontal pipe.** The best placement on a horizontal pipe is either the ten o'clock and two o'clock position for Reflect mode, or one sensor at nine o'clock and one sensor at three o'clock for Direct Mode. Mounting on a vertical pipe is recommended only if flow is in the upward direction. When mounting on a vertical pipe flowing in a downward direction make sure there is sufficient back pressure in the system to maintain a full pipe.



- ① Dual path, Reflect mount
- ② Dual path, Direct mount

Figure 4-1 Sensor alignment (horizontal plane)

Transmitter mounting

Refer to the transmitter Operating Instructions for transmitter mounting.

Sensor mounting preparation

The transmitter independently calculates the best distance for the sensors on the pipe according to the selected parameters. A manual search for the best signal strength and signal quality is not necessary. To receive these calculations, certain parameters have to be programmed into the meter:

- Pipe outer diameter (e.g. selection by inside table > metric DIN100 -> 114.3 mm)
- Pipe wall thickness (DIN automatically 3.6 mm or by manual input)
- Pipe material - Steel or other materials from material tables
- Liner inside - (e.g. Cement - 5 mm)
- Medium settings - Liquid Class (Water 20°C or other kind of liquid by table or custom setting)
- Pipe Up- and Downstream conditions (only required if condition is not ideal)
- Sensor type - Sensor model (e.g. FSS200 Universal)
- Sensor size (e.g. C3 - see Sensor nameplate (Page 45))
- Automatic calculating for mounting and sensor distance (i.e. how many reflections, nominal distance, mounting frame index number (e.g. 16)).

4.5 Orienting the sensors

Flow direction

There are no flow direction symbols shown in the sensors. Positive flow is defined as the movement of fluid from the upstream "A" sensor to the downstream "B" sensor, whereas negative flow is in the reverse direction.

Orienting the sensors

Siemens recommends orienting the sensors in one of the following ways:

Note**IMPORTANT**

Avoid installing sensors on top or on the bottom of a horizontal pipe.

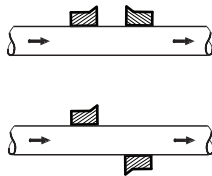
4.6 Installation instructions

1. Vertical orientation with an upwards flow in order to minimize the effect of gas / air bubbles in the media (sensors shown in Reflect Mount).



Figure 4-2 Vertical installation with an upwards flow

2. Horizontal orientation with sensors shown in Reflect Mount and Direct mount. Note that flow can move in either direction.



4.6 Installation instructions

4.6.1 Preliminary installation procedures

Introduction

To install the sensors these basic steps must be followed:

1. Program parameters into transmitter
2. Mount the sensors on pipe using parameters from transmitter
3. Connect sensor cables from sensor to transmitter

Clamp-on sensor mounting modes

All though the transmitter recommends a mounting mode after analyzing your pipe and liquid data entries you can still install clamp-on sensors in the way that best suits your application and the sensor type you have purchased.

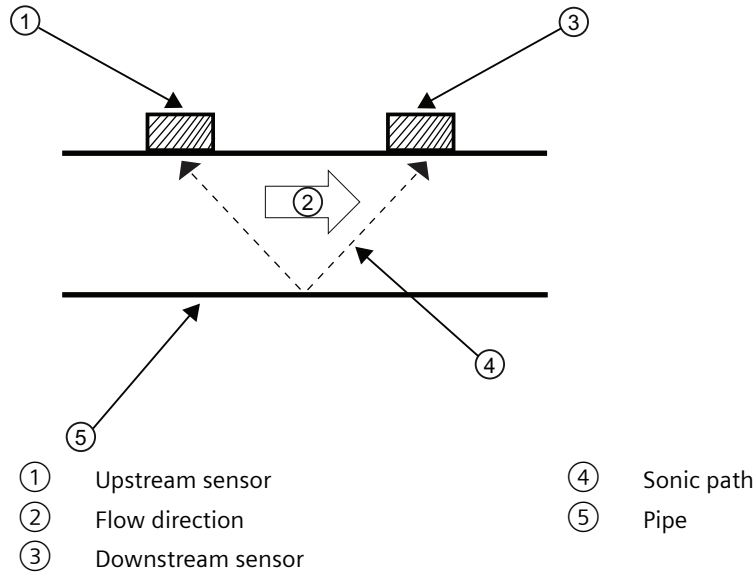


Figure 4-3 Reflect mount (Pipe shown from above in 12 o'clock position)

Reflect mount is recommended whenever possible. This is the simplest way to mount the sensors. Also, Reflect mount resists abnormal flow profile conditions such as cross-flow within the flow stream. In addition, Reflect mount may be the only possibility if conditions do not allow access to the opposite side of the pipe.

Direct mount provides a shorter sonic beam path. This usually improves performance with sonically attenuative liquids or pipe materials. Direct mount is recommended for plastic pipes. Compared to Direct mounting, Reflect mount requires almost double the amount of mounting length. Therefore, Direct mount may be the only option if the availability of mounting space is limited.

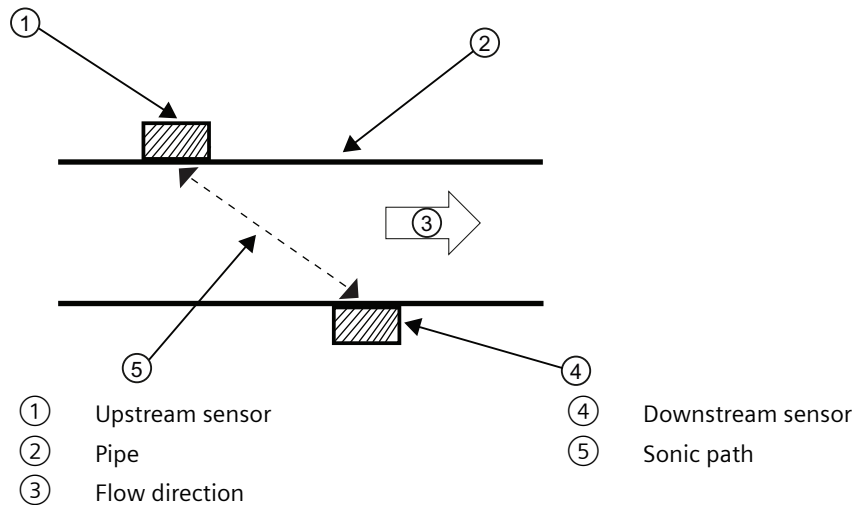


Figure 4-4 Direct mount (Pipe shown from above in 12 o'clock position)

Mounting supplies

The following items will be needed to mount the sensors (most materials are supplied):

- Flat blade screwdriver
- Mounting frames or mounting tracks
- Tape, chalk and a ruler or measuring tape
- Mounting straps
- Spacer bar
- Mounting guide (for Direct mount)
- Ultrasonic coupling compound and/or coupling pads
- Sensors (matched set)

Mounting strap kits

The available mounting strap kits are listed below. Each kit comes with up to two band sizes to cover its designated pipe diameter range and a spacing guide for Direct mount. In most cases, the kits come with the mounting hardware.

Mounting strap kits	Pipe diameter	SAE band sizes (Qty.)
7ME396000SM00	50.8 mm (2-inch) to 177.8 mm (7-inch)	#88 (2) #128 (2)
7ME396000SM10	50.8 mm (2-inch) to 330.2 mm (13-inch)	#88 (2) #152 (2)
7ME396000SM20	330.2 mm (13-inch) to 609.6 mm (24-inch)	#188 (2) #280 (2)
7ME396000SM30	609.6 mm (24-inch) to 1219.2 mm (48-inch)	#152 (4) #312 (4)

Preparing the pipe

Note

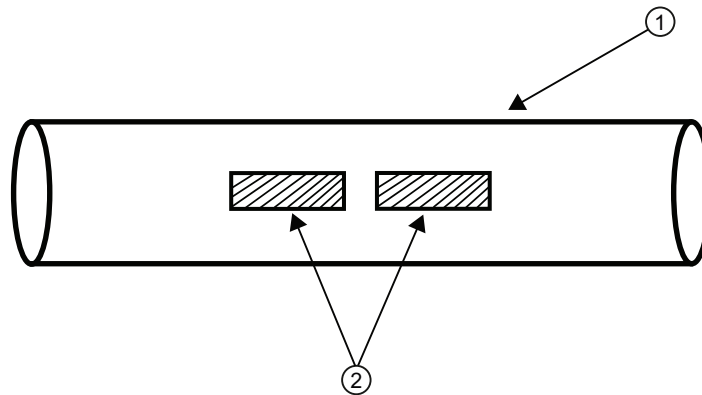
Make sure you picked a mounting location with the longest straight run. You must have easy access to at least one side of your pipe. **The pipe at the mounting location must remain full, even at zero flow.**

1. After establishing the sensor location begin to prepare the pipe.
2. Decide on your mounting mode (Direct or Reflect). Always use Reflect mode whenever possible. You may only need to use Direct mode if your pipe is plastic.

- After receiving the spacing dimensions from the Installation Menu, prepare the pipe surface. De-grease the surface, if necessary, and remove any grit, corrosion, rust, loose paint, etc. Use abrasive material provided to provide a clean contact surface for the sensors.

Note

Please note that the instructions show horizontal mounting for clarity purposes only. Do not install sensors on the top of a pipe.



- ① Pipe
- ② Cleaned areas

Figure 4-5 Pipe surface preparation

- Clean an area 13 mm (1/2-inch) on either side of the sensors.
- Clean an additional 13 mm (1/2-inch) along the length of the sensors.

4.6.2 Dry Film Couplant/Damping Material

⚠ WARNING

Explosion Hazard - Can cause death or serious injury

Damping foil has low electric conductivity, and therefore could lead to the buildup of electric charges. Explosion hazard in case of an electric discharge. Ensure that no explosive atmosphere is present during mounting of the couplant sheet to the pipe.

Siemens dry film couplant/damping material is an adhesive backed viscoelastic polymer sheet that provides excellent acoustic coupling without concern for couplant washout. For clamp-on gas applications this material effectively absorbs unwanted pipe noise to lower the minimum pressure required for flow measurement.

Note

In the following paragraphs, references to the 9 o'clock position indicate the section of horizontal pipe that is closest to you.

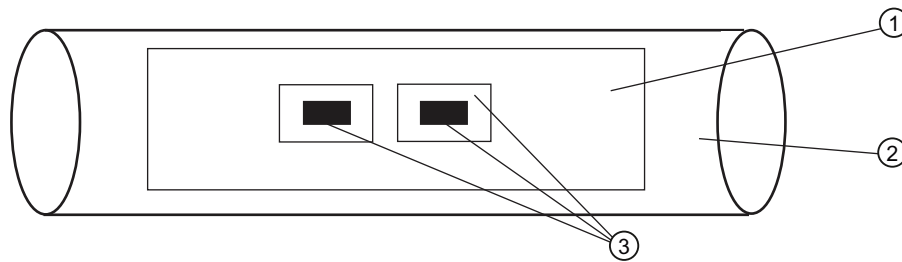
Preparing the pipe surface

1. Pick a mounting location with the longest straight run. You must have easy access to at least one side of your pipe. For uninterrupted operation the mounting location must remain fully pressurized, even at zero flow.
2. Decide on your mounting mode (direct or reflect). Always use Reflect Mode whenever possible or as recommended by the transmitter installation menu. You may only need to use Direct Mode if your pipe is plastic.
3. After receiving the spacing dimensions from the Installation Menu, prepare the pipe surface. Degrease the entire pipe surface where the damping material is to be applied and remove any grit, corrosion, rust, loose paint, etc.

Note

The effectiveness of the damping material is dependent on how well the adhesive bonds to the pipe surface.

4. If necessary, use the abrasive material provided to create a smooth contact surface for the sensors (see diagram below).



- ① Damping material
- ② Pipe
- ③ Smoothed Areas. If necessary, smooth an area large enough to accommodate sensors and also several centimeters (inches) around the locations where the sensors are to be mounted. Clean pipe again to remove any sanding residue.

Figure 4-6 Preparing the pipe surface

5. Make sure that you have a matched pair of sensors. They both should have the same S/N number but marked with either an "A" or "B" (e.g., 100A and 100B).

Dry film couplant/damping material

Each damping material kit contains one or more 229 mm x 914 mm (9" x 36") sheet(s) of film to be cut and applied to the surface of the pipe whose flow is to be measured.

Depending on the sensor size code multiple layers may be required for optimal damping. Refer to the table below for the correct kit P/N and final coating thickness specified for each sensor size.

Note

Each kit contains the correct number of damping sheets (packaged in a mailing tube) for the associated sensor size code.

Table 4-1 Damping material thickness for clamp-on gas systems

Sensor size	Kit P/N	Required layers	Final thickness (in)	Final thickness (mm)
B1H	7ME39600 DM10	1	0.027	0.69
B2H	7ME39600 DM10	1	0.027	0.69
B3H	7ME39600 DM10	1	0.027	0.69
C1H	7ME39600 DM10	1	0.027	0.69
C2H	7ME39600 DM10	1	0.027	0.69
D1H	7ME39600 DM20	2	0.054	1.37
D2H	7ME39600 DM30	3	0.081	2.06
D3H	7ME39600 DM20	2	0.054	1.37
D3H	7ME39600 DM40	4	0.108	2.74

Operating temperature range: -23 °C to 93 °C (-10 °F to 250 °F)
Installation temperature: 0 °C to 50 °C (32 °F to 120 °F)

Cutting and installing couplant sheets

Orientation of the damping material is not critical. Cut the sheet to achieve the best coverage and use of material. The full size (229 mm x 914 mm / 9" x 36") sheet may be difficult to apply. Cutting the sheet to manageable pieces will not affect efficiency. **DO NOT INSTALL SENSORS ON SEAMS.**

Sizing sheets for pipes 6 inches (15.24 cm) and under

1. Cut the 36-inch (91.44 cm) sheet length in half. The 18-inch (45.72 cm) length will be applied along the axis of the pipe.
2. Leave the sheet at the full 9-inch (22.86 cm) width for pipes over 3 inches (7.62 cm) in diameter. Cut width as needed to avoid significant overlap on pipes under 3 inches in diameter.
3. Cut any additional sheets as required (see table above for proper number of layers).

Sizing sheets for pipes over 6 inches (15.24 cm)

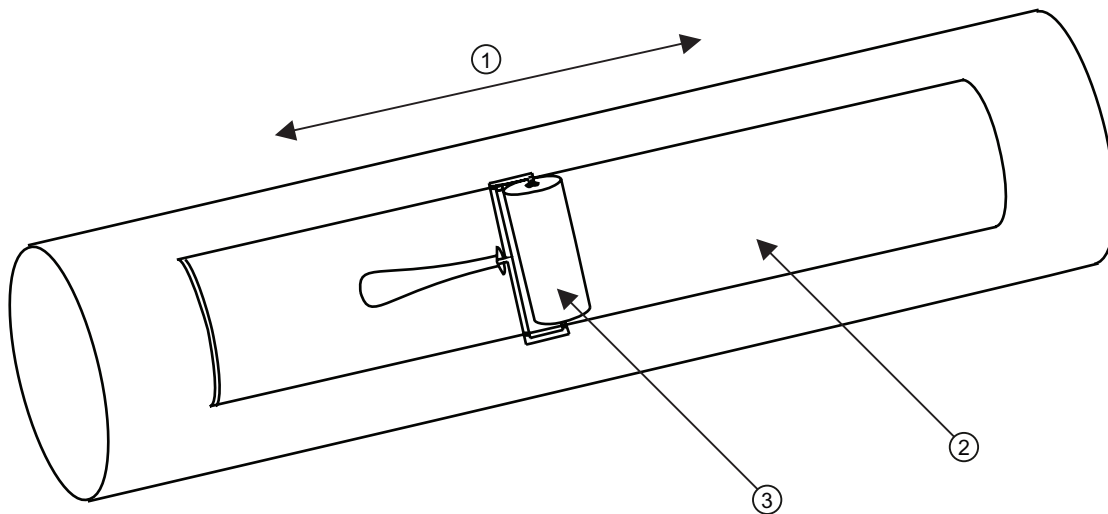
1. Use the full sheet dimensions. The 36-inch (91.44 cm) length will be applied along the pipe axis.
2. Depending on the sensor size code multiple layers may be required. Refer to table above for the correct number of layers to apply.

Applying couplant sheet to pipe

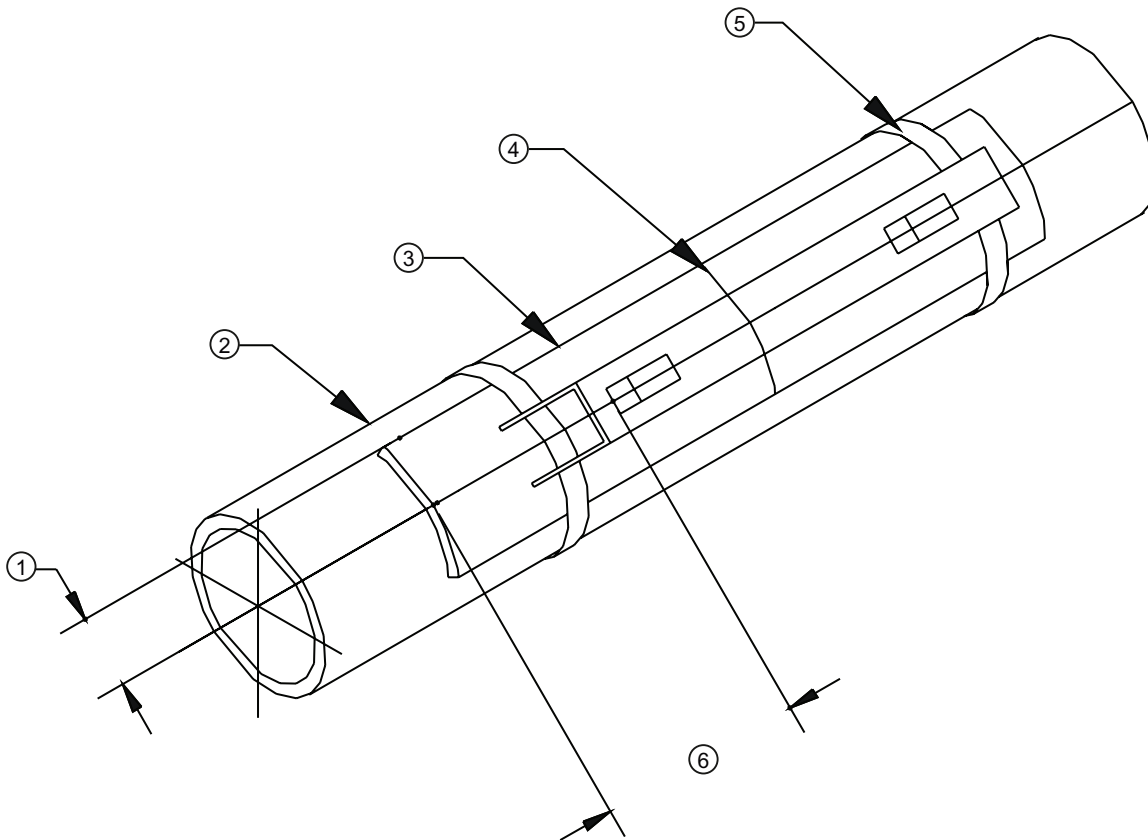
1. Verify that the ambient and pipe temperature fall within the temperature limits specified in table above. *Note that operating and installation temperatures are not the same.*
2. Determine the proper location of the sensors (refer to paragraph "Cutting and installing couplant sheets" above).

4.6 Installation instructions

3. Thoroughly clean and degrease the selected pipe area with a suitable solvent (see "Cautions on the use of dry film couplant" below).
4. After determining the best sheet cutting pattern from suggestions above, mark the pipe for the starting edge of the dry couplant sheet position.
5. Partially peel the sheet backing 1 inch (2.54 cm) to 2 inches (5.08 cm) from the starting edge, then carefully locate and press against the pipe surface.
6. While pressing firmly and sliding your hand against the sheet (along the pipe surface), slowly peel away the backing such that it prevents the trapping of air.
7. Apply the film slowly and carefully so that the sheet does not wrinkle, stretch or overlap, especially under the sensor contacting surfaces.
8. Use the supplied hand roller to smooth the film and assure adhesion to the pipe surface.
9. Apply additional layers (if required) while avoiding any seams under the sensors.
10. Use the wooden hand roller on each layer applied.



- ① Roll in line with pipe axis
- ② Damping material
- ③ Wooden roller



- | | |
|-------------------------------------------|-----------------------------------------------------------------------------|
| ① At least 4 inches (10.16 cm) both sides | ④ If film is applied in pieces, seam may be between, BUT NOT UNDER SENSORS. |
| ② Flowing pipe | ⑤ Mounting assemblies and straps are installed after the film |
| ③ Damping film | ⑥ At least 2 inches (5.08 cm) both sides |

Mounting sensors

Install the mounting assemblies and sensors directly on top of the damping material. Use liquid couplant (7ME396000UC20) for all clamp-on gas installations or if signal amplitude is low or marginal.

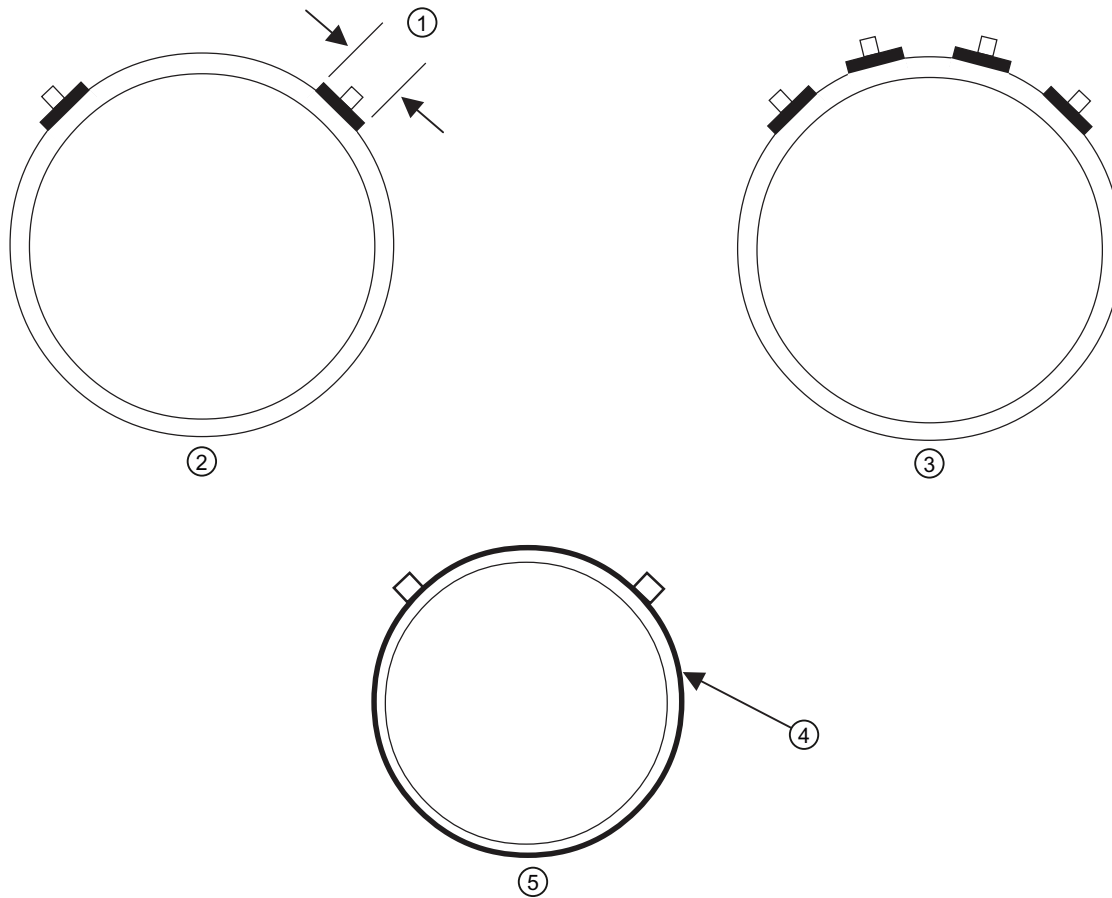
Follow the instructions in the manual for installing the sensors into the mounting assemblies and securing (see Installing sensors in Reflect mode (Page 40)).

1. Connect sensor cables.
2. Return to the transmitter and complete installation process.

Cautions on the use of dry film couplant

- **Don't** clean the sensors or pipe surface with MEK, acetone, trichloroethane, trichloroethylene, toluene, freon (and its vapors), chloroform, and xylene.
- **Don't** use on oily or greasy pipe surfaces. It will interfere with adhesion.

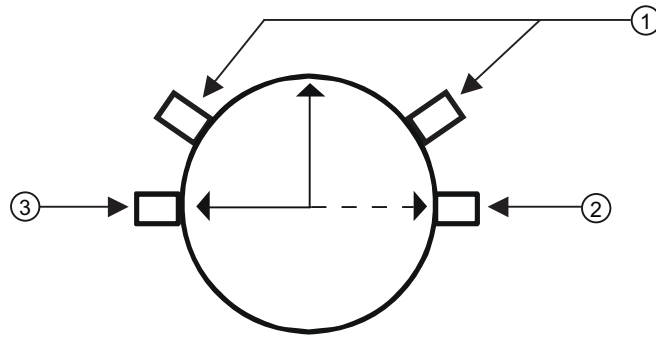
Multi-beam installations



- ① Minimum 8 inches (20.32 cm) wide dry film
- ② 2-Beam
- ③ 4-Beam
- ④ Wrap damping material all around pipe
- ⑤ Small pipes

Note

Contact Siemens Technical Services Group (1 800 275-8480) for additional recommendations on use of Dry Film Couplant/Damping Compound.



- ① Recommended sensor placement for Dual Beam Reflect mount
- ② Sensor located at 3 o'clock
- ③ Sensor located at 9 o'clock

Figure 4-7 End view (Horizontal plane)

Grace ice and water shield damping material

An alternate pipe damping material referred to as "Grace Ice and Water Shield" can be considered for use with clamp-on gas systems. This opaque material has a black tar like appearance with a very tenacious adhesive backing. Its lower operating temperature range and difficult removal from the pipe must be considered before installing this alternate material. Refer to the web site (www.graceconstruction.com) for a local distributors of this roofing underlayment material.

The installation and sizing of the Grace material is identical to that of Siemens damping material. Refer to table below for the recommended number in layers for each sensor size. (Operating / Installation temperature ranges can be found just below table.)

Table 4-2 Grace ice and water shield damping material thickness for clamp-on gas systems

Sensor size	Required layers of Grace	Final Thickness (in)	Final Thickness (mm)
B1H	1	0.038	0.97
B2H	1	0.038	0.97
B3H	1	0.038	0.97
C1H	1	0.038	0.97
C2H	1	0.038	0.97
D1H	1	0.038	0.97
D2H	2	0.076	2.93
D3H	1	0.038	0.97
D4H	3	0.114	2.90

Operating temperature range: -23 °C to 65°C (-10 °F to 150 °F)

Installation temperature: 0 °C to 50 °C (32 °F to 120 °F)

4.6.3 Sensor Dry Coupling Pad Installation Procedure

The following illustrates the proper procedure for installing a dry coupling pad between the sensor and pipe surface. The dry coupling pads replace the standard grease coupling supplied with the sensor.

Note

In some rare cases the dry pad may yield a lower than expected signal strength. If this occurs it is recommended to apply a small amount of grease coupling to both sides of the pad and re-install.

Note

Due to vendor supply differences the dry pads may be provided with a clear plastic backing. If plastic backing is present ensure removal before use.

Guidelines for Use

1. Intended for any liquid, clamp-on transit-time application where environmental conditions warrant use of more durable coupling material. Not for use outside temperature limits of material stated below, regardless of the sensor temperature range.
2. Temperature Range -34°C to +200°C (-30°F to +392°F).
3. Not intended for gas applications where CC129 pipe damping material is specified.

Required Mounting Items

1. Dry Coupling Pads - 7ME39600UC40 (Use one per sensor.)
2. Scissors or razor knife (not supplied)
3. Adhesive tape (not supplied)

Installation Procedure

Refer to the figure below during installation.

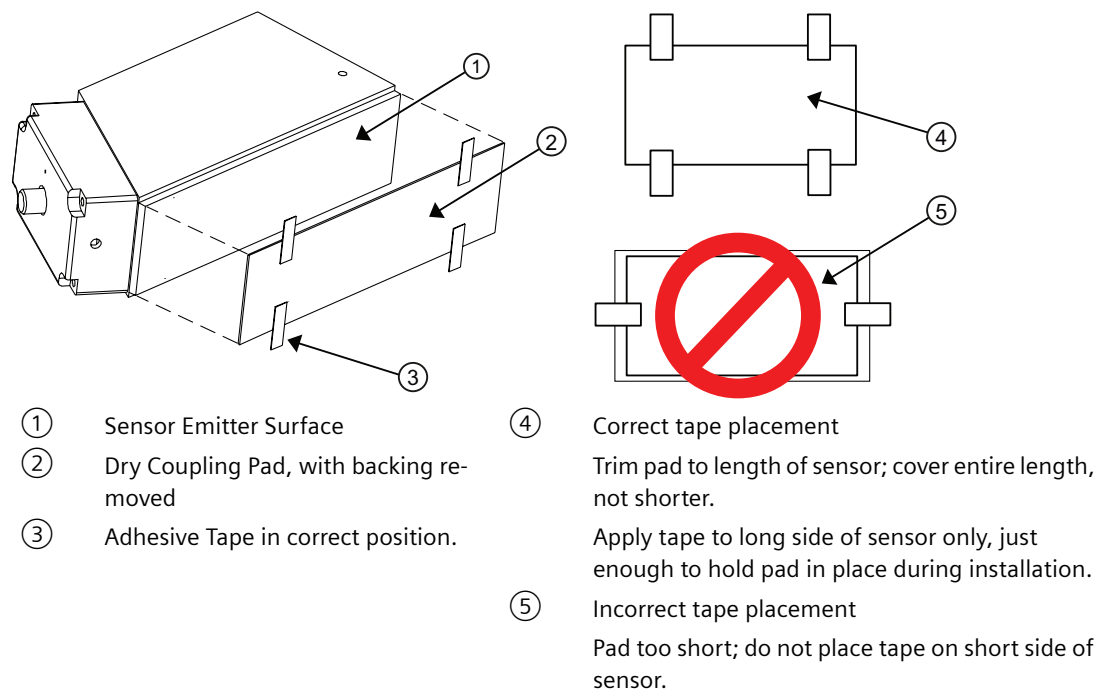


Figure 4-8 Dry Coupling Pad Installation

1. Before installation, remove clear backing from pads, if present.
2. Trim the pad to the size of the bottom dimensions of the sensor emitting surface. Use care not to exceed the length of the sensor.
3. Place one (1) dry coupling pad over the bottom surface of the sensor. Pad should be clean and dry during installation.
4. To secure dry coupling pad to sensor during mounting, attach the trimmed pad to the bottom of sensor using small pieces of tape on long side of sensor.
5. Install sensor on pipe, in accordance with operating instructions manual, with dry coupling pad in between sensor and pipe.

Note

Adhesive tape may remain on sensor and pipe after installation is complete. Tape should not protrude more than 6 mm (1/4-inch) from sensor sides.

Refer to the appropriate Operating Instructions manual for the final sensor installation procedure. For additional technical support: <http://www.siemens.com/automation/support-request>

4.6.4 Initial startup procedure

Refer to the Operating Instructions manual Initial startup procedure to setup the basic transmitter parameters before preceding to the Wizard sensor setup procedure.

4.6.5 Wizard sensor setup procedure

Referring to the Operation Instruction manual for your transmitter, use the Wizard sensor setup procedure to set up the clamp-on sensors for your unit.

4.6.6 Installing sensors in Reflect mount

Reflect mount - Sensor installation using mounting frames and spacer bar

1. Use the Wizard setup procedure to program the transmitter for the sensors that were selected.
2. After receiving the spacing number index from the transmitter, make a note of the number displayed then prepare the pipe surface area where the sensors will be mounted.

Before continuing refer to the Reflect mount installation diagram example below.

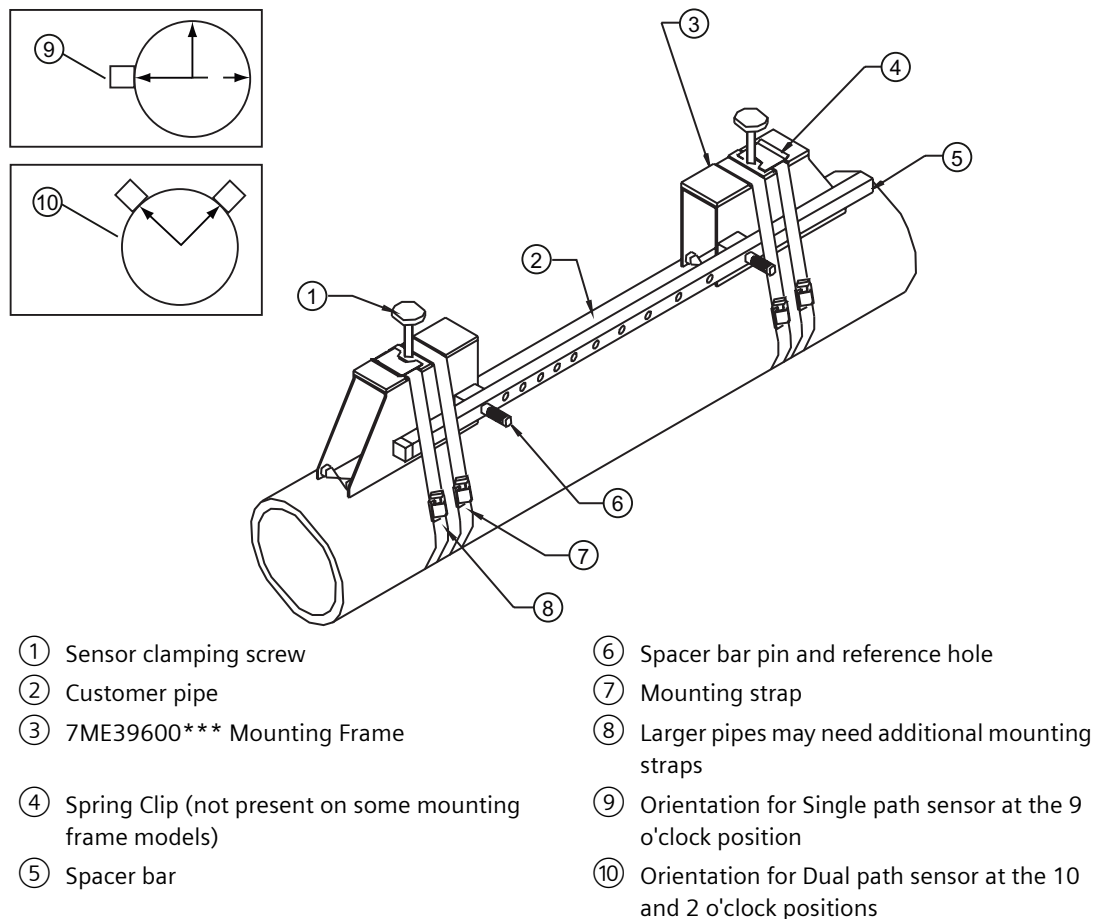
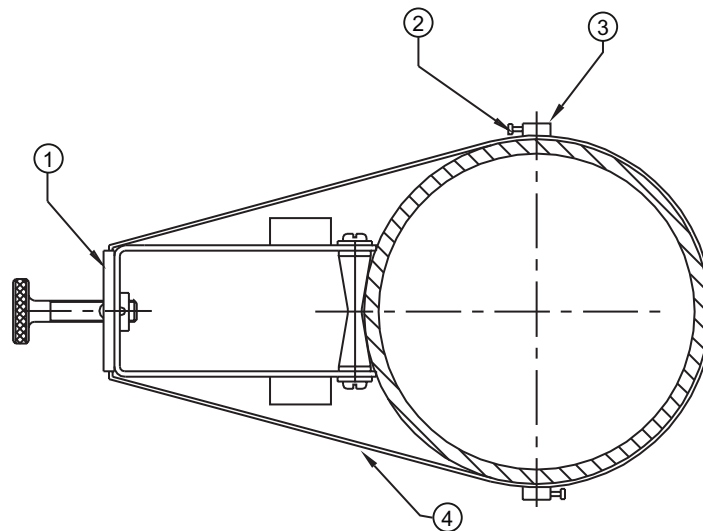


Figure 4-9 Reflect mount

Installing the mounting frames

1. On a flat surface, attach the spacer bar to a mounting frame so that the reference hole on the spacer bar aligns with the hole on the mounting frame and attach using supplied screw stored on end of spacer bar. Tighten the clamping screw.
2. Align second mounting frame with number on spacer bar that corresponds to the number index provided by transmitter and attach with second screw found on end of spacer bar. Then tighten the clamping screw. *Ensure that the angled sides of both frames face away from each other.*
3. Wrap a mounting strap around the pipe. Make sure to position it so there is easy access to the mounting strap adjusting screw.
4. At the mounting location, place the mounting frame/spacer bar assembly on the pipe so that it rests on the top of the pipe.
5. Engage the end of the mounting strap with the mounting strap adjusting screw.
6. Slide strap under the spring clip of one of the mounting frames.
7. Tighten the mounting strap screw enough to take up all of the slack, but not enough to prevent rotation of the assembly. *Repeat procedure for the other mounting frame.*
8. Rotate the assembly on the pipe to the final conditioned location, ensuring that it is straight along the pipe axis. (Refer to the sensor orientation diagram.)
9. Tighten the mounting straps to seat the assembly firmly on the pipe. Do not over tighten.



- ① Mounting frame and sensor (not shown)
- ② Mounting strap adjusting screw
- ③ Optional: On larger pipes multiple lengths of straps can be linked together
- ④ Mounting strap

Figure 4-10 Reflect mount with mounting frames

Installing the sensor

1. Take either sensor and apply a continuous lengthwise 3 mm (1/8-inch) bead of coupling compound across the center of the sensor emitting surface.

Note

Small diameter pipes

Use the tip of the finger to apply a light film of coupling compound on sensor emitting surfaces that are to be installed on small diameter pipes. Synchronous pipe noise is greatly increased when too much coupling compound is used for small pipes. This may result in a poor SNR (signal to noise ratio).

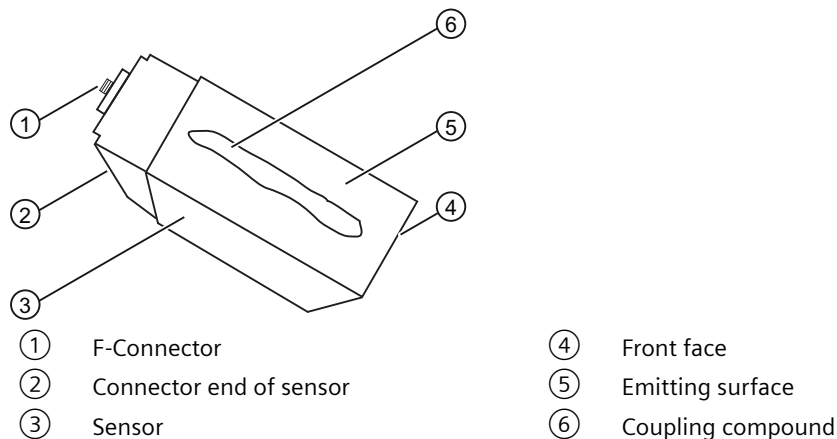


Figure 4-11 Sensor

2. Slide the sensor into the angled end of the mounting frame, with the sensor F-connector facing out. Keep sensor from making contact with the pipe until it butts up against the mounting frame stop. Push sensor down to mate with pipe.
3. Tighten the sensor clamping screws to hold the sensor firmly in place. *Repeat procedure for the other sensor.*
4. Proceed to Connecting (Page 43).

Additional installation instructions

For additional installation and sensor mounting instructions including direct mount, track mount, magnetic mount, Hi Precision mount and temperature sensor mounting refer to the Appendix - Additional installation instructions (Page 93).

Note

Temperature sensor mounting procedures are for FST030 only.

See also

- Mounting temperature sensors (Page 54)
- Preparing sensor cables (Page 47)


Connecting


5.1 Chapter overview


This chapter describes how to wire the sensors for operation with a wall mounted transmitter.


1. Sensor wiring (Page 47)
2. Connecting sensors to transmitter (Page 58)


5.2 Basic safety notes


 WARNING
<p>Unsuitable cables, cable glands and/or plugs</p> <p>Risk of explosion in hazardous areas.</p> <ul style="list-style-type: none"> • Use only cable glands/plugs that comply with the requirements for the relevant type of protection. • Tighten the cable glands in accordance with the torques specified in Finalizing cable wiring (Page 57). • Close unused cable inlets for the electrical connections. • When replacing cable glands, only use cable glands of the same type. • After installation, check that the cables are seated firmly.


 WARNING
<p>Lack of equipotential bonding</p> <p>Risk of explosion through compensating currents or ignition currents through lack of equipotential bonding.</p> <ul style="list-style-type: none"> • Ensure that the device is potentially equalized. <p>Exception: It may be permissible to omit connection of the equipotential bonding for devices with type of protection "Intrinsic safety Ex i".</p>

 WARNING
<p>Unprotected cable ends</p> <p>Risk of explosion through unprotected cable ends in hazardous areas.</p> <ul style="list-style-type: none"> • Protect unused cable ends in accordance with IEC/EN 60079-14.

 WARNING
Insufficient isolation of intrinsically safe and non-intrinsically safe circuits
Risk of explosion in hazardous areas.
<ul style="list-style-type: none">• When connecting intrinsically safe and non-intrinsically safe circuits ensure that isolation is carried out properly in accordance with local regulations for example IEC 60079-14.• Ensure that you observe the device approvals applicable in your country.

 WARNING
Connecting or disconnecting device in energized state
Risk of explosion in hazardous areas.
<ul style="list-style-type: none">• Connect or disconnect devices in hazardous areas only in a de-energized state.• Install a suitable switch-off device.
Exceptions:
<ul style="list-style-type: none">• Devices having the type of protection "Intrinsic safety Ex i" may also be connected in energized state in hazardous areas.

 WARNING
Incorrect selection of type of protection
Risk of explosion in areas subject to explosion hazard.
This device is approved for several types of protection.
<ol style="list-style-type: none">1. Decide in favor of one type of protection.2. Connect the device in accordance with the selected type of protection.3. In order to avoid incorrect use at a later point, make the types of protection that are not used permanently unrecognizable on the nameplate.

 WARNING
Incorrect conduit system
Risk of explosion in hazardous areas as result of open cable inlet or incorrect conduit system.
<ul style="list-style-type: none">• In the case of a conduit system, mount a spark barrier at a defined distance from the device input. Observe national regulations and the requirements stated in the relevant approvals.

Note**Electromagnetic compatibility (EMC)**

You can use this device in industrial environments, households and small businesses.

For metal enclosures there is an increased electromagnetic compatibility compared to high-frequency radiation. This protection can be increased by grounding the enclosure.

See also

Connecting sensor cables to transmitter (Page 58)

Hazardous area applications**Note****Important**

For FST030 transmitter only.

Sensors must be connected to a transmitter suitable for hazardous area locations.

Special requirements apply to the location and interconnection of sensor and transmitter. See Preparing sensor cables (Page 47).

 WARNING**Transmitter housing**

Risk of explosion in hazardous areas. Death or serious injury may occur.

Before opening the terminal box check that:

- No explosion hazard exists
- All connection leads are potential free

 WARNING**Grounding**

The mains protective earth wire must be connected to the PE terminal.

Death or serious injury may occur.

5.3 Sensor nameplate

Clamp-on sensors have one nameplate that shows the following information:

- product identification
- product specifications
- certificates and approvals

The transmitter is identified as "Ultrasonic transmitter SITRANS FST030 or FST020" and the sensors as "Ultrasonic sensor SITRANS FSS200".

Sensor nameplate

Note

Make sure that the sensors are a matched set, by verifying that both sensors have the same serial number.

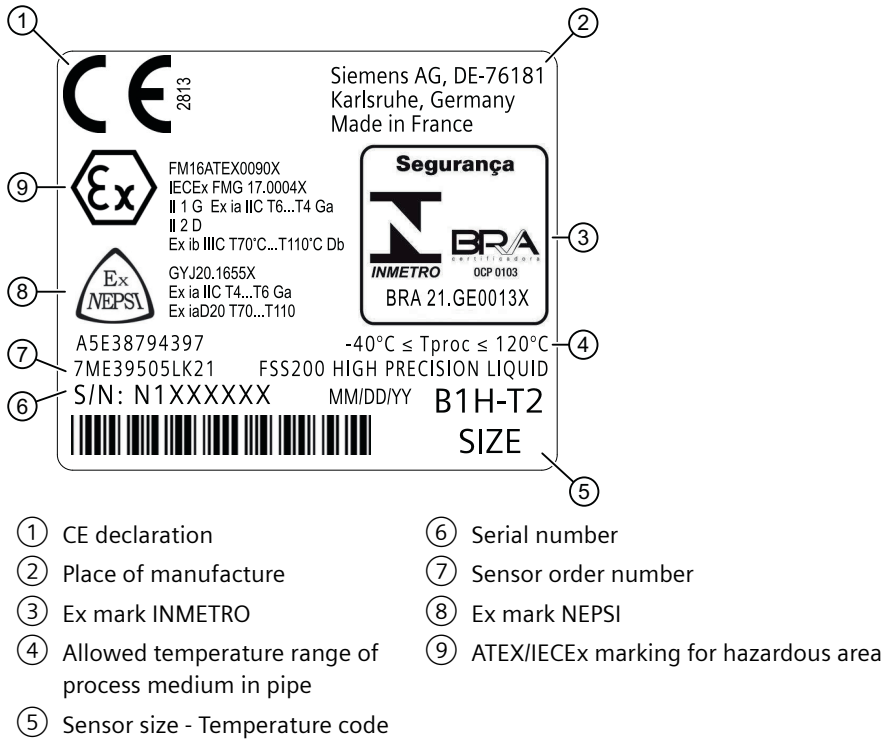


Figure 5-1 Sensor identification nameplate, example

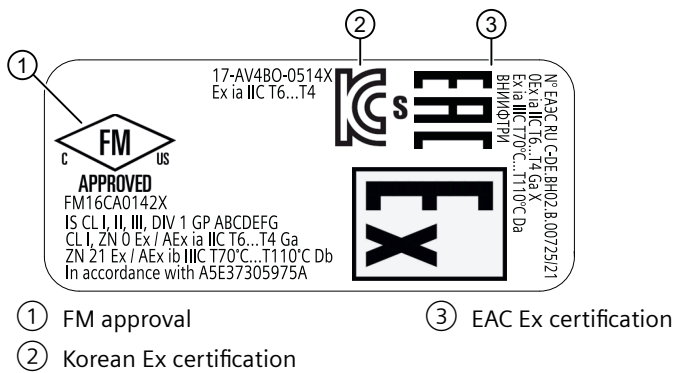


Figure 5-2 Specification nameplate, example

5.4 Preparing sensor cables

The sensor wiring steps depend on the configuration.

- Sensor cable types (Page 47)
- Coaxial cables (Page 48)
- Triaxial cable (Page 50) (for FST030 only)
- RTD Sensor cables (Page 53) (for FST030 only)
- Finalizing cable wiring (Page 57)

5.4.1 Sensor cable types

For the system to function properly the coaxial or optional triaxial sensor cables must be prepared and connected correctly. Please note that both sensors (A and B) for each path must be connected to the same port numbers (e.g. 1A and 1B or 2A and 2B).

Note

Important

The sensor cables are supplied with only one F-connector attached. The F-connector at the opposite end of each cable must be installed.

Note

Shortening sensor cables

If sensor cables are to be shortened they must be cut and stripped to approximately the same length, to minimize any zero flow offset.

Note

Important

When cables are installed with cable glands, glands must be threaded onto the cable from the unterminated end prior to the assembly of the F-connector. If cables are ordered without cable glands, user supplied glands must also be installed onto the cable from the unterminated end prior to the assembly of the F-connector.

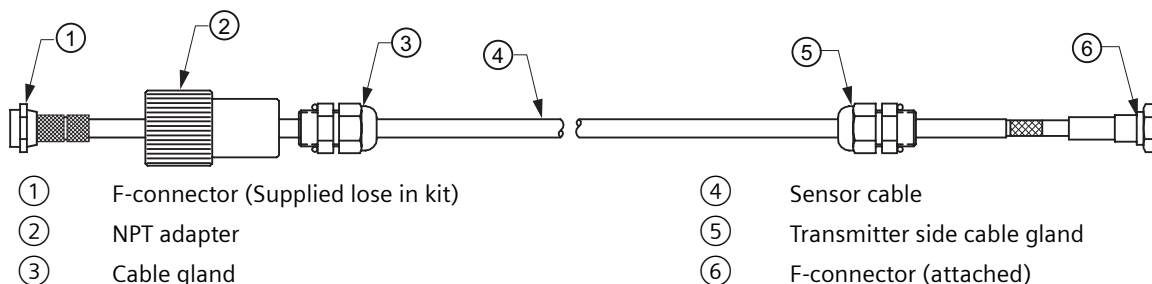


Figure 5-3 Typical Sensor cable assembly

5.4.2 Coaxial cable

5.4.2.1 Preparing coaxial sensor cable

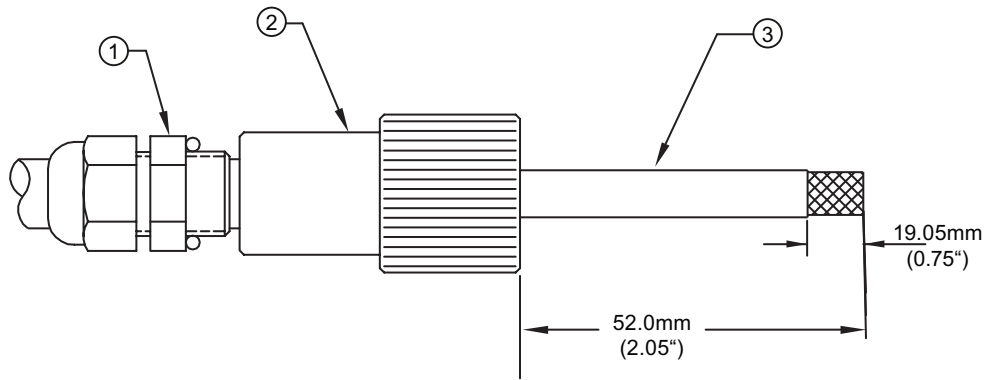
Note

IMPORTANT

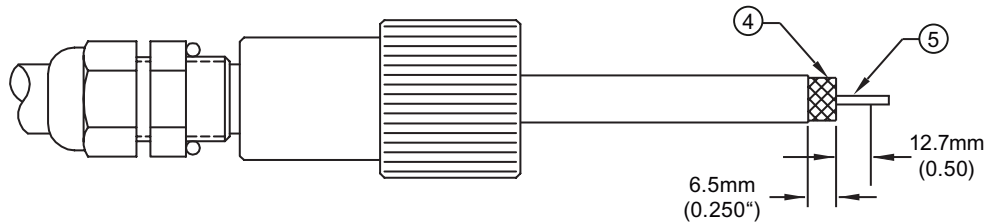
Make sure the cable gland ① and NPT Adapter ② have been threaded onto the sensor cable BEFORE beginning to strip cable.

Prepare unterminated coaxial cable ends as follows:

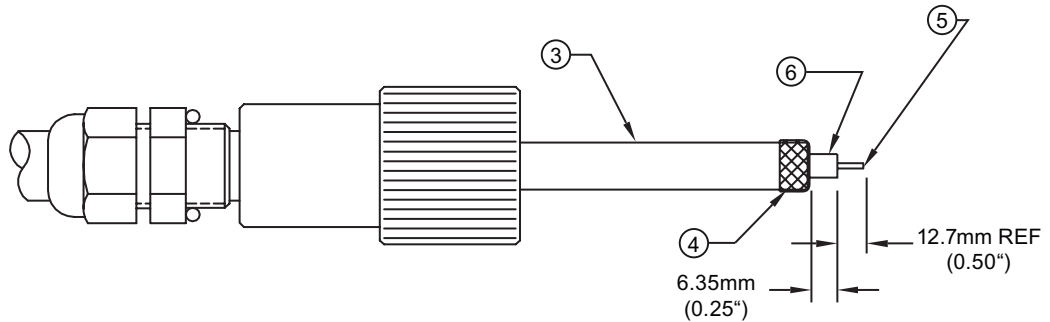
1. Strip unterminated outer jacket ③ to shown lengths (mm/in).



2. Trim exposed inner shield ④ and dielectric to shown length (mm/in) to expose the center conductor ⑤.

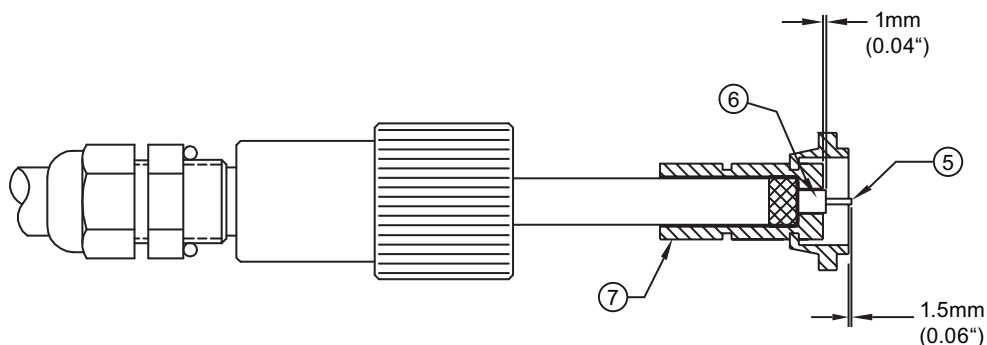


3. Fold back exposed inner shield ④ over outer jacket ③ and trim dielectric ⑥ and center conductor ⑤ to shown lengths (mm/in).



Assemble the cable and F-connector as follows:

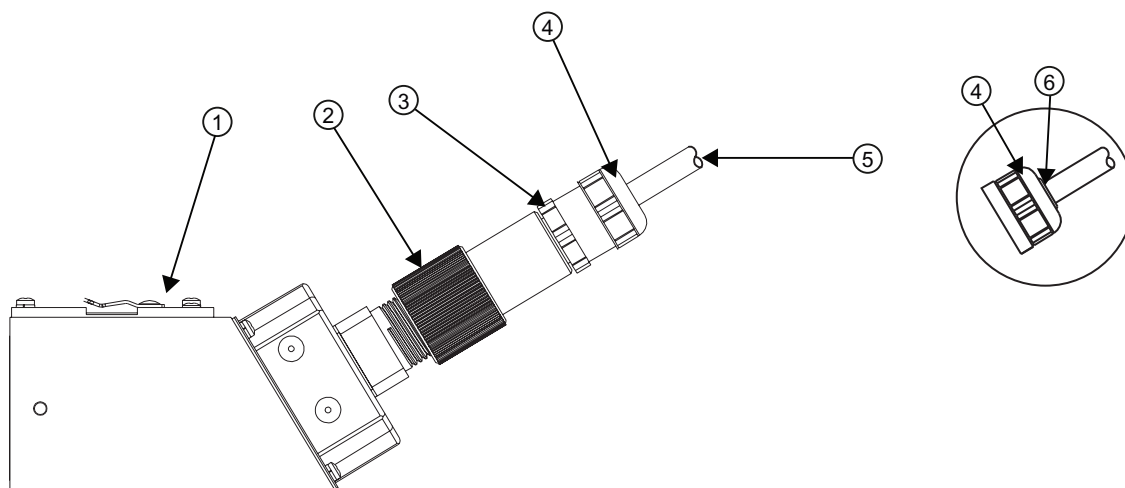
4. Push and twist the F-connector ⑦ on the cable until secure.



5. Ensure the dielectric ⑥ is flush to 1mm (.04 in) beyond barrel end and that the center conductor ⑤ is 1.5mm (0.06 in) beyond the F-connector body ⑦.

5.4.2.2 Connecting coaxial cable

1. Take the prepared sensor cable end and fill the F-connector with Super Lube coupling compound, then screw it onto the sensor ① and hand tighten.
2. Coat the NPT Adapter ② with Super Lube coupling compound, screw it onto the sensor ① and hand tighten.
3. Screw the cable gland body hex into the NPT Adapter. Tighten the Gland body hex ③ until it butts up against the NPT Adapter end (approx. 4 Nm).
4. Using an adjustable wrench, screw on the gland cap nut ④ and tighten to obtain optimum sealing. The gasket ⑥ must protrude along the cable as shown.



5.4.3 Triaxial cable

5.4.3.1 Preparing Triaxial sensor cable

Note

Triaxial cables are optionally available for the FST030 only.

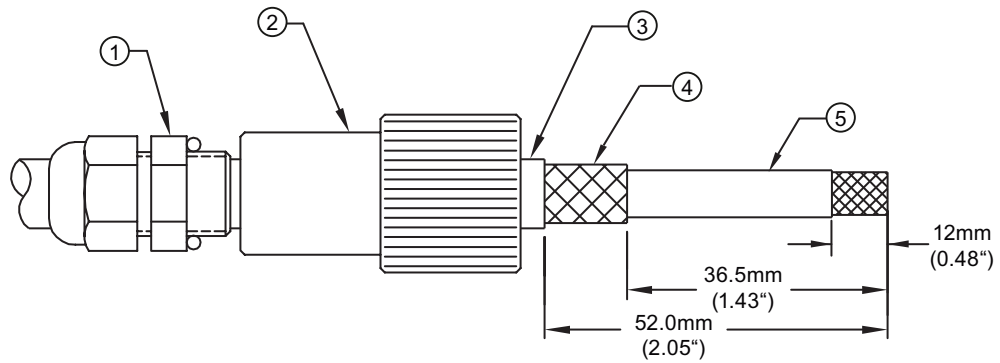
Note

IMPORTANT

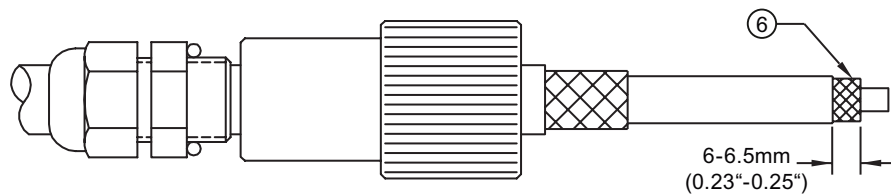
Make sure the cable gland (1) and NPT Adapter (2) have been threaded onto the sensor cable BEFORE beginning to strip cable.

Prepare unterminated cable ends as follows:

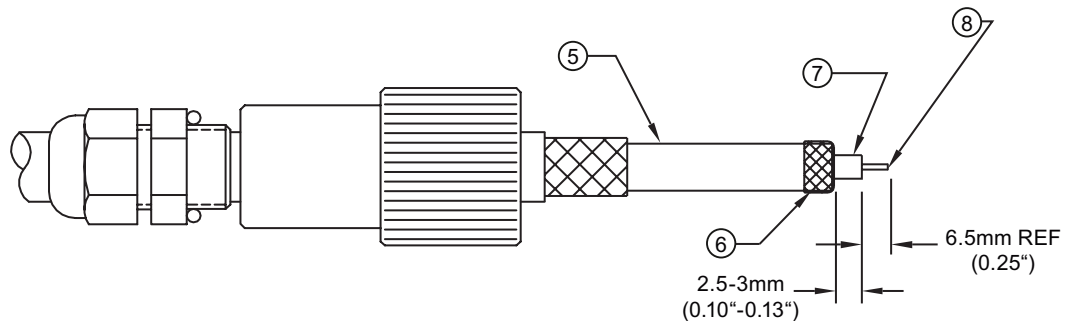
1. Strip unterminated outer jacket (3), outer shield (4), and inner jacket (5) to shown lengths (mm/in).



2. Trim exposed inner shield (6) to shown length (mm/in).



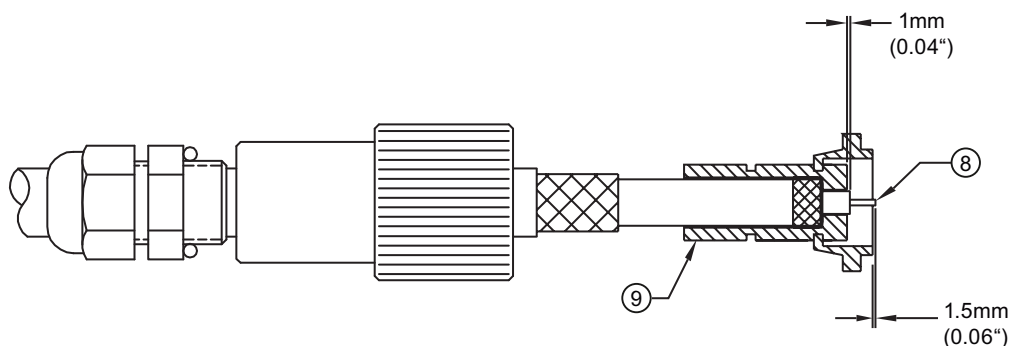
3. Fold back exposed inner shield (6) over inner jacket (5) and trim dielectric (7) and center conductor (8) to shown lengths (mm/in).



Triaxial cable and F-connector assembly

Assemble the cable and F-connector as follows:

1. Push and twist the F-connector ⑨ on the cable until secure.



2. Ensure the dielectric ⑦ is flush to 1mm (.04 in) beyond barrel end and that the center conductor ⑧ is 1.5mm (0.06 in) beyond the F-connector body ⑨.

5.4.3.2 Connecting triaxial cables

Sensor grounding wire clamp components

Note

Triaxial cables are optionally available for the FST030 only.

The triaxial sensor cable must have a grounding connection from the cable gland to earth ground. The cable is shipped with the grounding clamp parts and instructions sealed in a separate plastic bag.

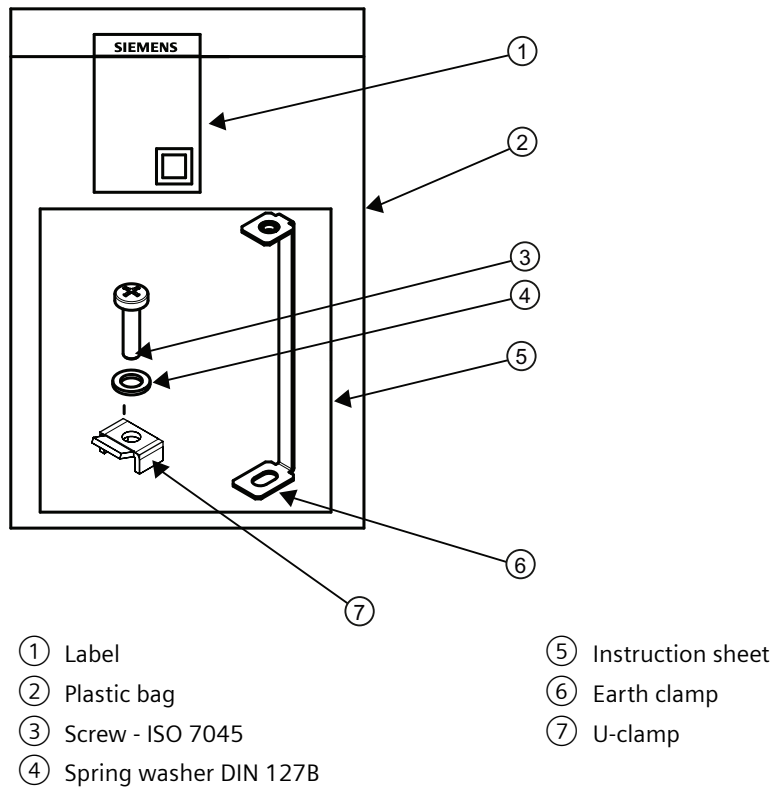


Figure 5-4 Triaxial ground wire clamp parts

Ground wire clamp assembly

1. Take the prepared sensor cable end and fill the F-connector with Super Lube coupling compound, then screw it onto the sensor ① and hand tighten.
2. Coat the NPT Adapter ⑮ with Super Lube coupling compound, screw it onto the sensor ⑧ and hand tighten.
3. Screw the cable gland body hex ⑭ into the NPT Adapter. Tighten the gland body hex until it butts up against the NPT Adapter end (approx. 8 Nm).
4. Using an adjustable wrench, screw on the gland cap nut ⑨ and tighten to obtain optimum sealing. The gasket ⑪ must protrude along the cable as shown.
5. Form the Earth clamp ⑥ around the gland cap nut ⑨ as shown.

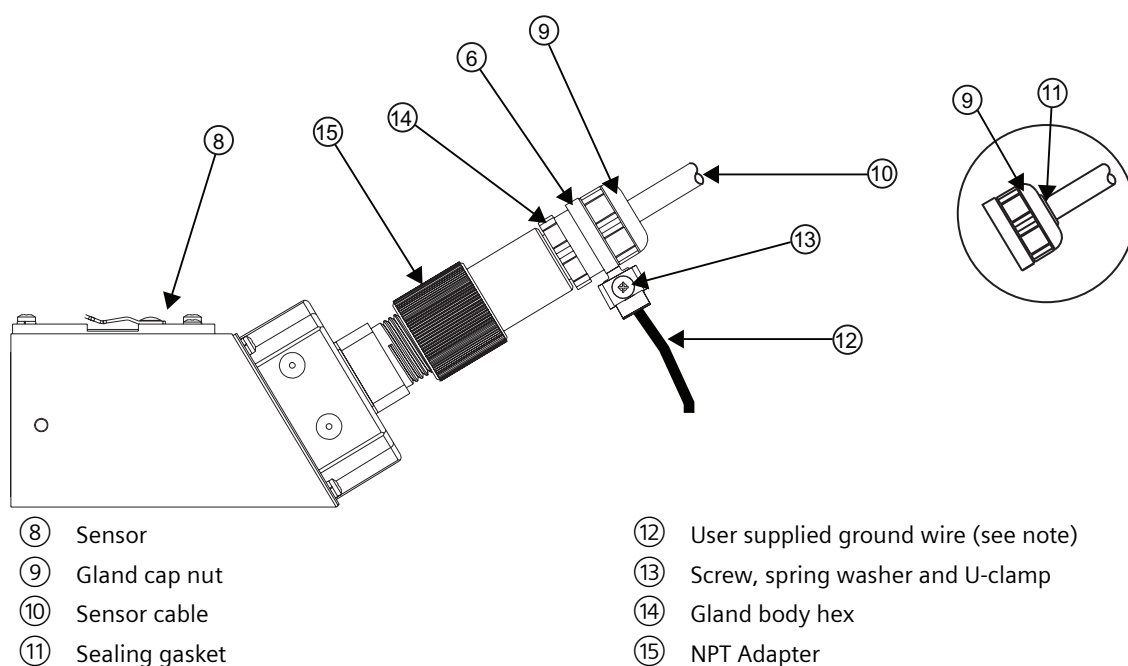


Figure 5-5 Cable gland clamp and ground wire

Note**Important**

The user supplied grounding wire that is connected to earth ground must be 4 mm² (10 AWG) or larger.

5.4.4 Preparing RTD sensor cables

RTD Sensor Cable

Note

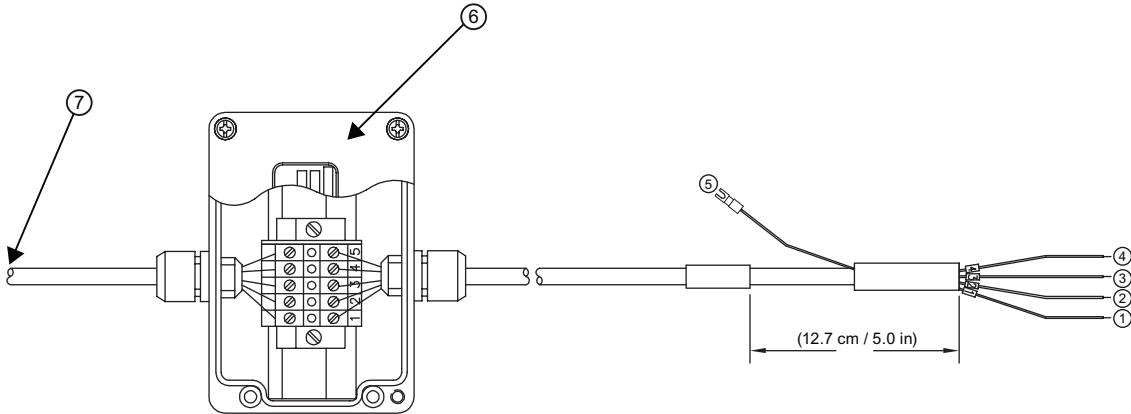
RTD temperature sensor cables are only available for the FST030.

The temperature sensor cable includes the following:

- Optional cable lengths include: 6.1m (20 ft), 15.24m (50ft), 30.48m (100ft), 45.72m (150ft), 60.96m (200ft) and 91.44m (300ft).
- A sealed parts bag that includes an insulating sleeve (15.24cm / 6.0in), crimp lug (for wall mount RTD ground wire) and 5 crimp lugs for assembling legacy RTD cables, if needed.

Preparing the cable

1. Slide the insulated sleeve onto the cable over wires ①, ②, ③ and ④ but NOT the blue wire ⑤. Fold back the blue wire.
2. Attached the wall mount RTD crimp lug to the blue wire ⑤ on the cable using a crimping tool or equivalent.
3. Set aside all remaining parts left in the parts bag.



- | | |
|-------------------------------|---------------------------------------------------------|
| ① Black (I+) RTD current high | ⑤ Blue - Ground (add crimp lug - A5E39272102) |
| ② White (V+) RTD voltage high | ⑥ Junction box |
| ③ Green (I-) RTD voltage low | ⑦ To sensor with BNC connector or to submersible sensor |
| ④ Red (V-) RTD current low | |

Figure 5-6 RTD sensor cable

4. Proceed to the Mounting temperature sensor (Page 54) section.

5.4.5 Mounting temperature sensors

Note

RTD temperature sensors are for the FST030 transmitter only.

FST020 transmitter does not accommodate temperature sensors.

Temperature is used to normalize the liquids sonic velocity in order to properly determine interfaces and for density determination. Temperature sensors are available in clamp-on style or in insert (Thermowell) style. Refer to the table below. Both styles incorporate 1000 ohm platinum RTD's for high precision.

Note

Optional equipment

Temperature sensors are optional equipment. After installation proceed to Commissioning in the transmitter Operating Instructions.

Table 5-1 Temperature sensors

Description	Part number
Standard clamp-on RTD	7ME39501TA00
Submersible clamp-on RTD	7ME39501TB00
Standard clamp-on RTD pair for energy system	7ME39501TA10
Insertion style RTD (size 1): 140 mm (5.5 in)	7ME39501TJ00
Insertion style RTD (size 2): 216 mm (8.5 in)	7ME39501TJ01
Insertion style RTD (size 3): 292 mm (11.5 in)	7ME39501TJ02
Insertion style RTD (size 4): 368 mm (14.5 in)	7ME39501TJ03
Insertion style RTD pair (size 1), 140 mm (5.5 in)	7ME39501TJ10
Insertion style RTD pair (size 2), 216 mm (8.5 in)	7ME39501TJ11
Insertion style RTD pair (size 4), 368 mm (14.5 in)	7ME39501TJ13

Clamp-on temperature sensors (RTDs)

Note

RTD temperature sensors are for the FST030 only.

Clamp-on style temperature sensors are mounted on the surface of the monitored pipe using mounting assemblies. Apply a generous quantity of the thermal couplant provided to the tip of the sensor and attach it securely to the cleaned pipe surface with the proper mounting assembly. Temperature measurement anomalies resulting from variations in the ambient conditions can be minimized by insulating the pipe and sensor after installation.

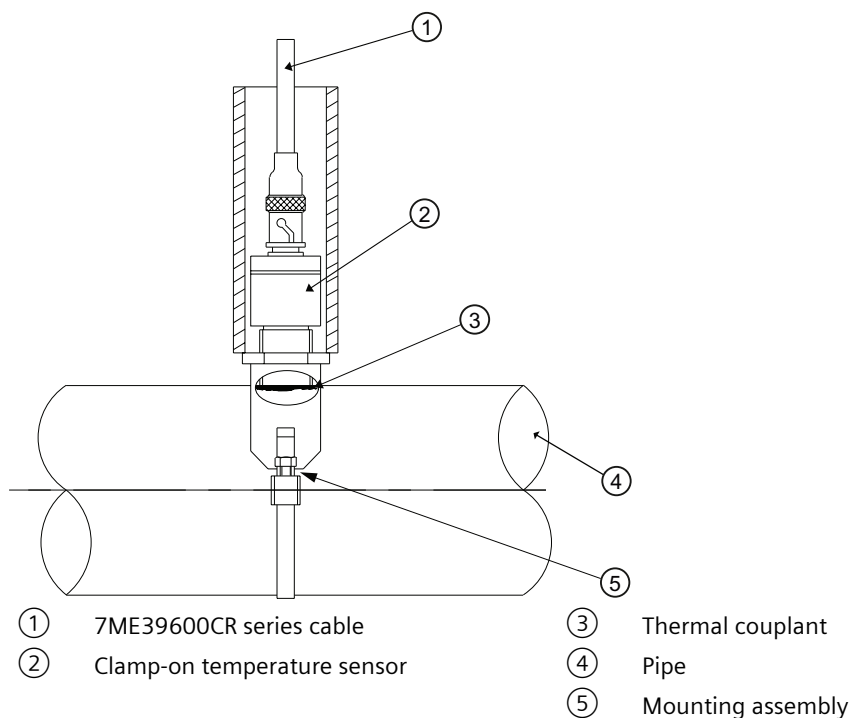


Figure 5-7 Clamp-on temperature sensor

RTD cable to wall mount transmitter wiring

Note

RTD temperature sensor are for the FST030 only.

Note

RTD Channels 5 and 6

RTD sensors can be connected to Channel 5, Channel 6 or to both channels depending on the application. The following example shows the RTD sensor connections to Channel 6.

1. Prepare the RTD cable. Make sure that the insulated sleeve is placed over the cable and the correct crimp lug (A5E39272102) is connected to the blue ground wire.
2. Attach the wires of the cable to the RTD connector to the transmitter as shown.

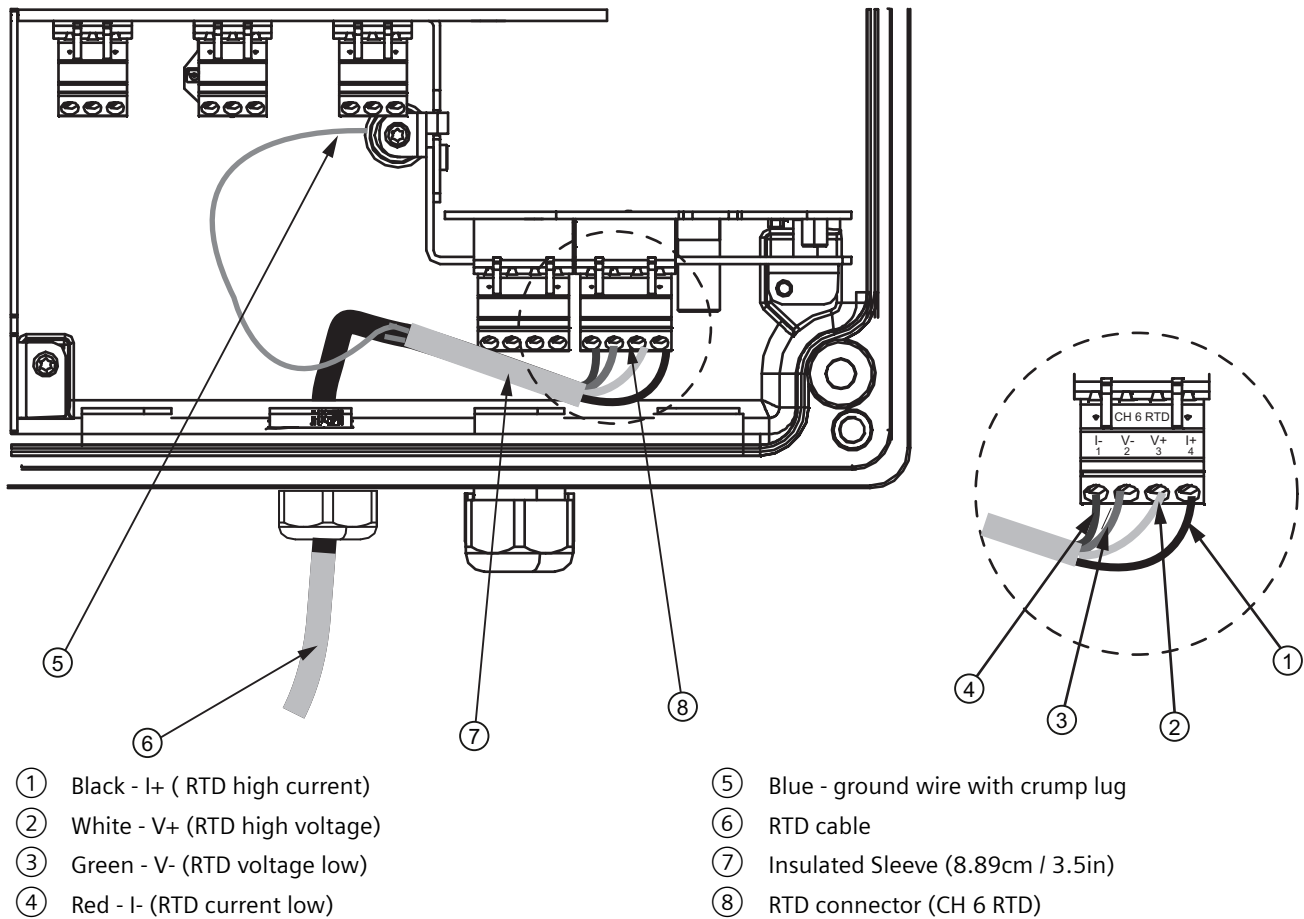


Figure 5-8 RTD connections

3. Connect the wires at the other end of the RTD cable to the appropriate connections on temperature sensor that has been selected.
4. Proceed to I/O Wizard in the transmitter FST030 Operating Instructions for enabling temperature functions.

Insert temperature sensors

Note

RTD temperature sensors are for the FST030 only.

Insert sensors are designed to be used in pipes equipped with Thermowells. These are spring-loaded, 6.35 mm (1/4") diameter sensors with 12.7 mm (1/2") NPT integral connection heads, available in several lengths to accommodate a range of pipe sizes.

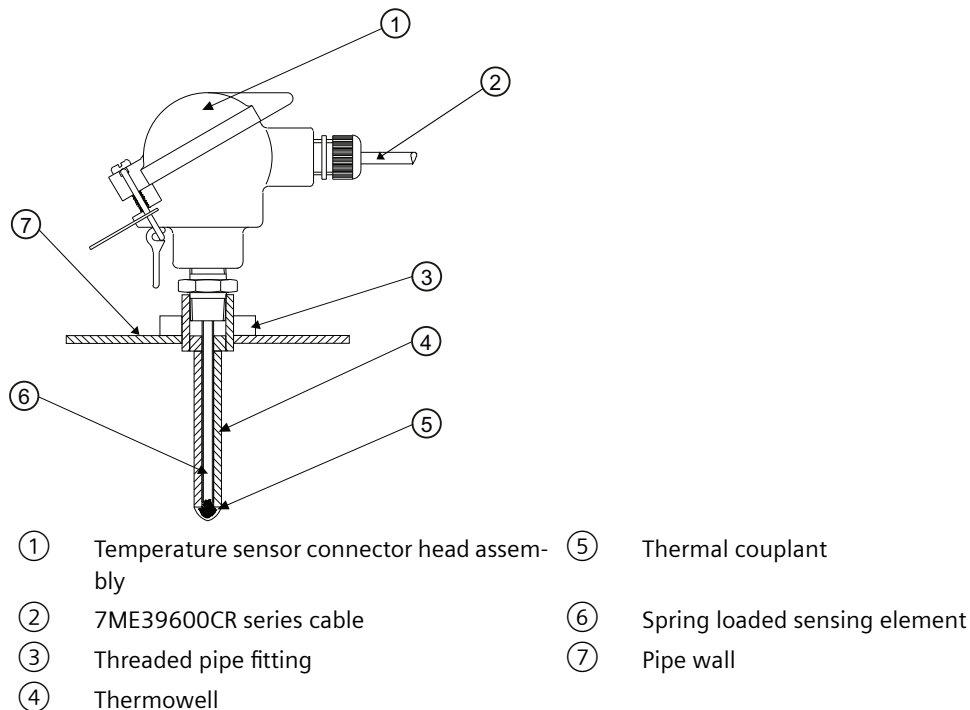


Figure 5-9 Insert temperature sensor

5.4.6 Finalizing cable wiring

Tighten the cable glands to obtain optimum sealing. The gaskets must protrude along the cable as shown.

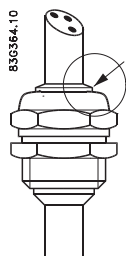
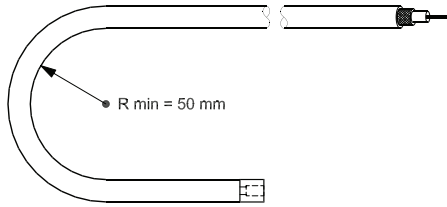


Figure 5-10 Correct cable sealing

Ensure that sensor cables are not overbent. Minimum cable bend radius is 50 mm (1.9 inches).



5.5 Connecting sensor cables to transmitter

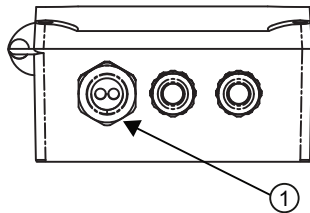
5.5.1 Transmitter FST020

Preparing for the connection

1. Loosen the six lid screws.
2. Open the lid.

Connecting the flow sensor cables

For the system to function properly, the sensor cables must be connected correctly. The sensor cables should be connected as upstream 1A and downstream 1B.



① Sensor I/O port

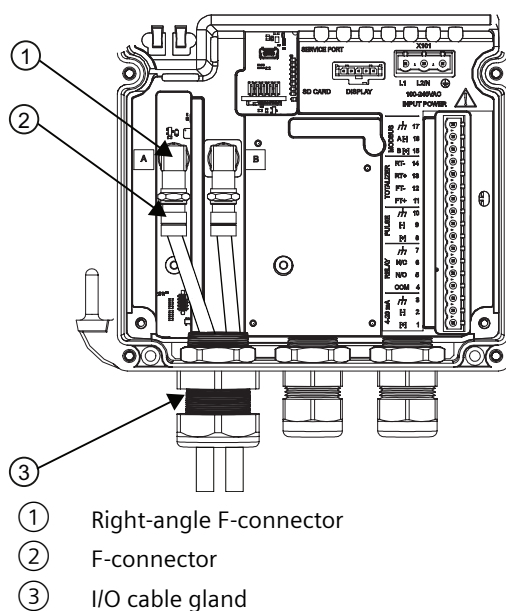
The sensor cables are delivered with a premounted F-connector at the transmitter end.

1. Remove the sensor blind plug from wall mount housing.
2. Feed the unterminated end of the cables through the two holes in the gland until 100mm of cable with the F-connector is remaining.
3. Feed the the cables though the hole in the transmitter case and then through the gland nut.
4. Screw the cable end into the right-angle F-connector (supplied with the transmitter).

5. Push the right-angle F-connector onto to the connector on the transmitter PC board.
6. Screw the gland and nut together to secure the cables.

Note

Sensor ports are labeled A and B.



5.5.2 Transmitter FST030

Preparing for the connection

1. Loosen the four lid screws.
2. Open the lid.
3. Remove F-connector tool from wall mount enclosure.

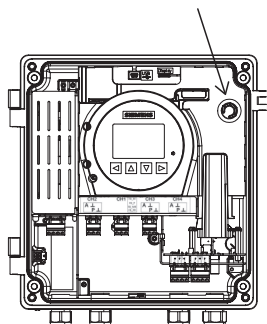
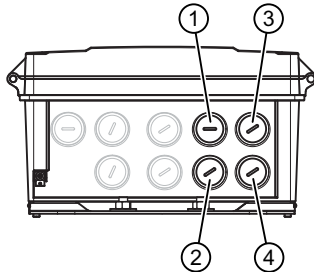


Figure 5-11 F-connector tool location

Connecting the flow sensor cables

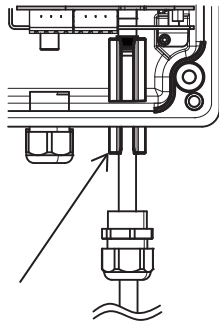
When connecting the sensors it is required for the system to function that the sensor cables are connected correctly. Both sensor cables for each path must be connected to the same port numbers (1A and 1B or 2A and 2B) on the transmitter.



- ① Path 1 - Upstream sensor cable (1A)
- ② Path 1 - Downstream sensor cable (1B)
- ③ Path 2 - Upstream (2A)
- ④ Path 2 - Downstream (2B)

The sensor cables are delivered with a premounted F-connector at the transmitter end.

1. Remove the blind plug from the wall mount enclosure.
2. Slide the cable gland back onto the cable and allow access for the F-connector tool.
3. Place F-connector tool around cable and slide up to engage F-connector nut.
4. Push cable through the gland opening. Ensure that the center lead is aligned with connector port in the transmitter.
5. Tighten the F-connector using the tool until you meet a mechanical stop.



6. Remove the F-connector tool.
 7. Mount and tighten the cable gland.
- Repeat these steps for each sensor cable.

5.6 Connecting sensor cables to sensor

5.6.1 Wall mount FST020

Connecting to FST020 transmitter

Note

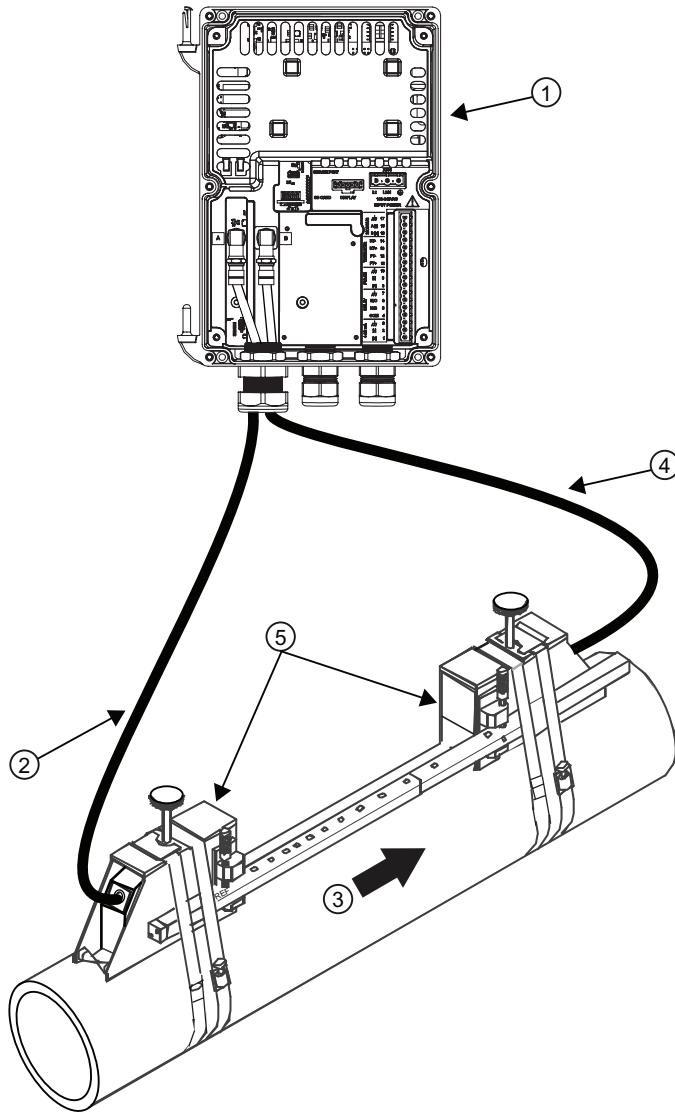
The following example is shown in the Reflect mount sensor configuration.

Connect sensor cables to the wall mounted transmitter as follows:

1. Refer to Transmitter FST020 (Page 58) sensor cable preparation and connections.
2. To connect the sensor cables to the sensors, fill sensor connector end with Super Lube prior to connecting.
3. Apply Super Lube to the internal threads at the large end of the thread connector.
4. Observing the upstream and downstream orientation ③, connect upstream sensor cable ④ from the transmitter port (1A) and make connection snug.

5.6 Connecting sensor cables to sensor

- 5. Connect the downstream sensor cable ② from the transmitter port (1B) and make connection snug.



- ① Wall mounted transmitter
- ② Upstream sensor cable (1A) Path 1
- ③ Flow direction
- ④ Downstream sensor cable (1B) Path 1
- ⑤ Sensors

Figure 5-12 Wall mount housing with transmitter-to- sensor cable connections

- 6. Tighten all cable glands to obtain optimum sealing.
- 7. Refer to transmitter FST020 Operating Instructions to program transmitter.

5.6.2 HI Precision mount FST020

Single enclosure Reflect mount wiring

Connect sensor cables to the transmitter as follows:

1. Refer to Transmitter FST020 (Page 58) sensor cable preparation and connections.
2. To connect the sensor cables to the sensors, fill connector end with Super Lube prior to connecting.
3. Apply Super Lube to the internal threads at the large end of the thread connector.
4. Observing the upstream and downstream orientation ③, connect upstream sensor cable ② from transmitter port (1A) and make connection snug.

5.6 Connecting sensor cables to sensor

- 5. Connect downstream sensor cable ④ from the transmitter port (1B) and make connection snug.

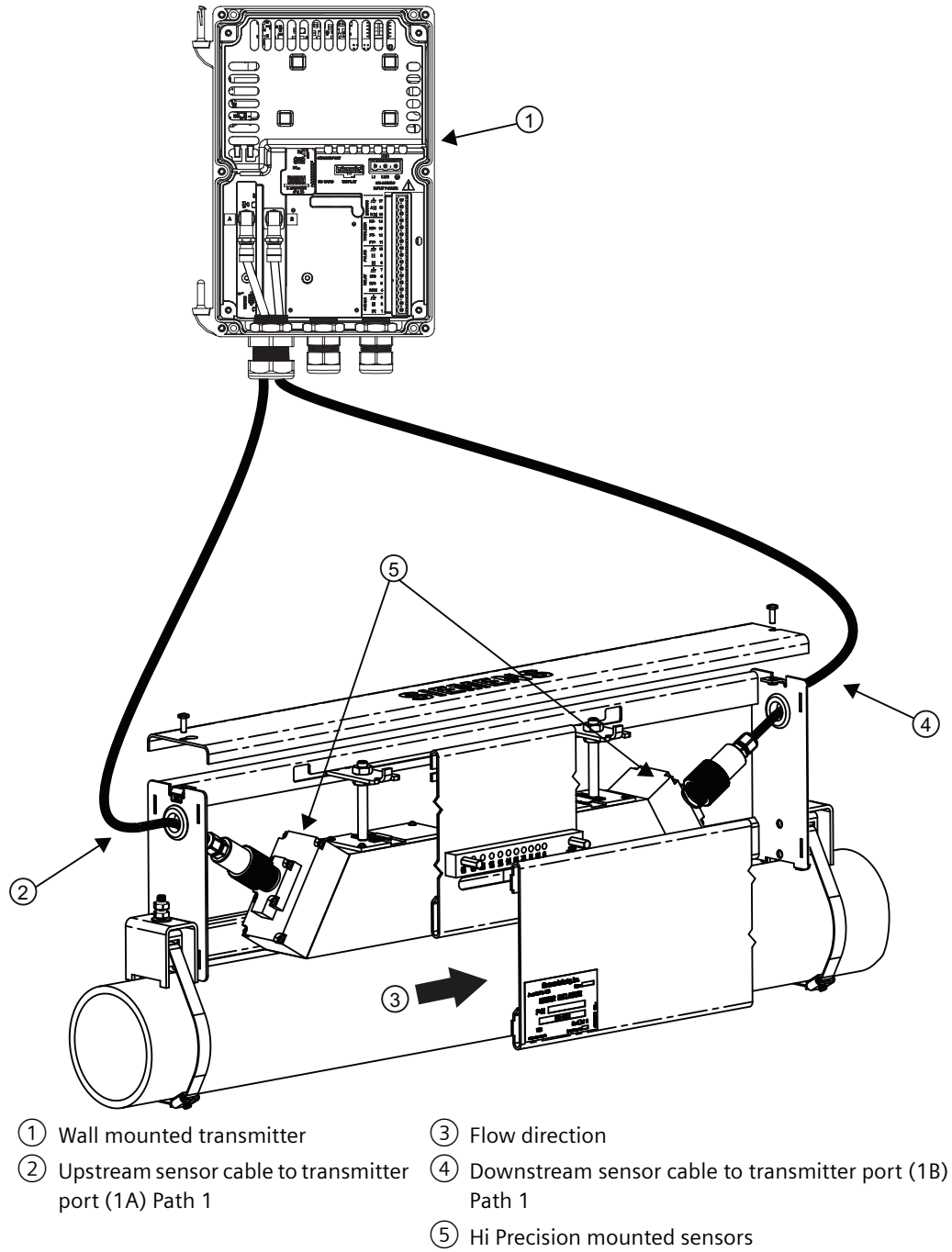


Figure 5-13 Hi Precision Reflect mount single enclosure wiring

- 6. Tighten all cable glands to obtain optimum sealing.
- 7. Refer to transmitter FST020 Operating Instructions to program transmitter.

Dual enclosure Reflect mount wiring

Referring to the Hi Precision single enclosure reflect mount figure above, connect the Hi Precision mount reflect Dual enclosure sensor cables from the transmitter ports as follows:

1. Observing the upstream and downstream orientation ③, connect sensor cables from transmitter ports.
2. Tighten all cable glands to obtain optimum sealing.
3. Refer to transmitter FST020 Operating Instructions to program transmitter.

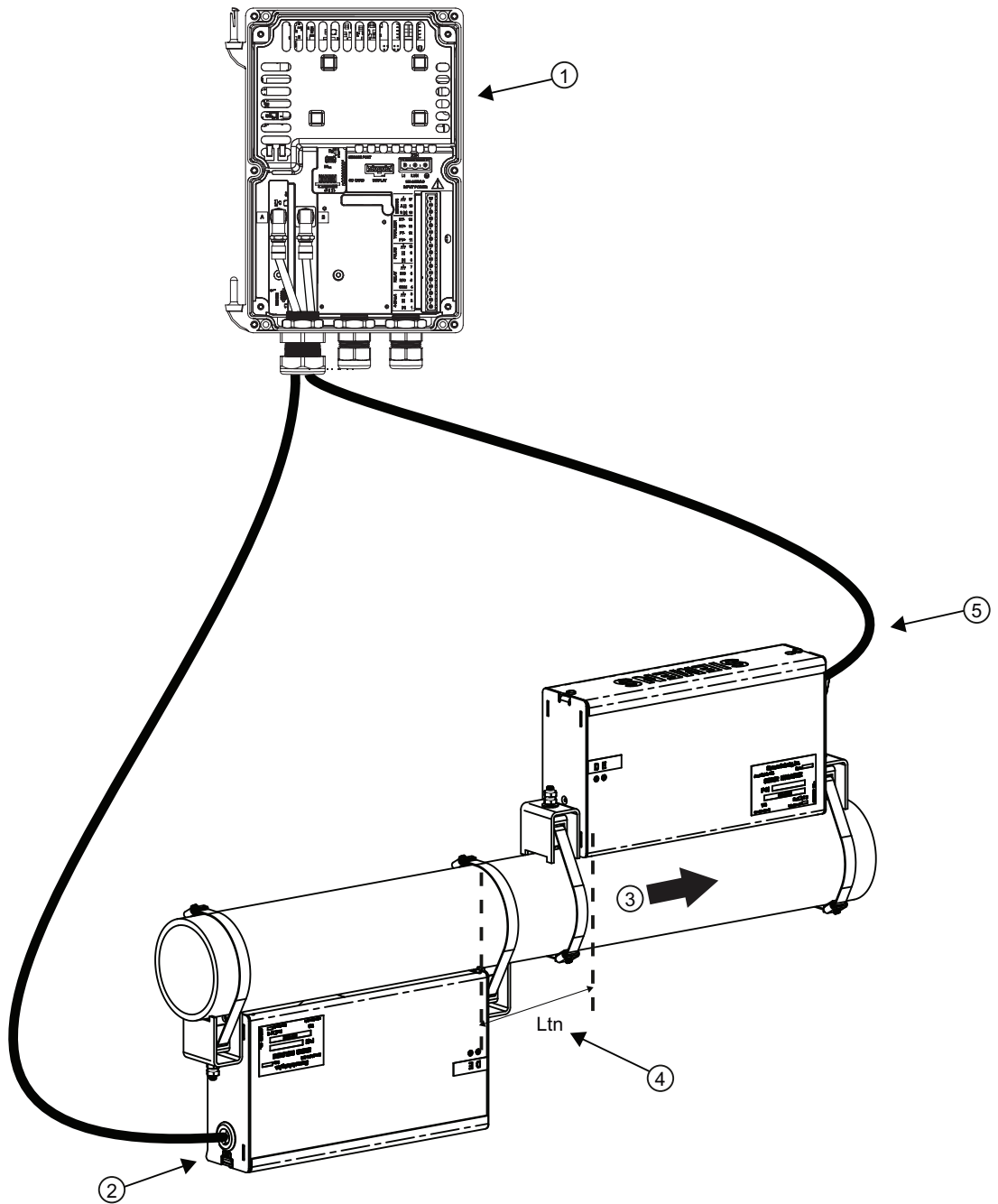
Dual enclosure direct mount wiring

Connect sensor cables to the transmitter as follows:

1. Refer to Transmitter FST020 (Page 58) sensor cable preparation and connections.
2. To connect the sensor cables to the sensors, fill connector end with Super Lube prior to connecting.
3. Apply Super Lube to the internal threads at the large end of the thread connector.
4. Observing the upstream and downstream orientation ③, connect upstream sensor cable ② from transmitter port (1A) and make connection snug.

5.6 Connecting sensor cables to sensor

5. Connect downstream sensor cable ⑤ from transmitter port (1B) and make connection snug.



- ① Wall mounted transmitter
- ② Upstream sensor cable to transmitter port (1A) Path 1
- ③ Flow direction
- ④ Ltn (spacing distance between sensors)
- ⑤ Downstream sensor cable to transmitter port (1B) Path 1

Figure 5-14 HI Precision Direct mount Dual enclosure sensor wiring

- 6. Tighten all cable glands to obtain optimum sealing.
- 7. Refer to transmitter FST020 Operating Instructions to program transmitter.

5.6.3 Wall mount FST030

Note

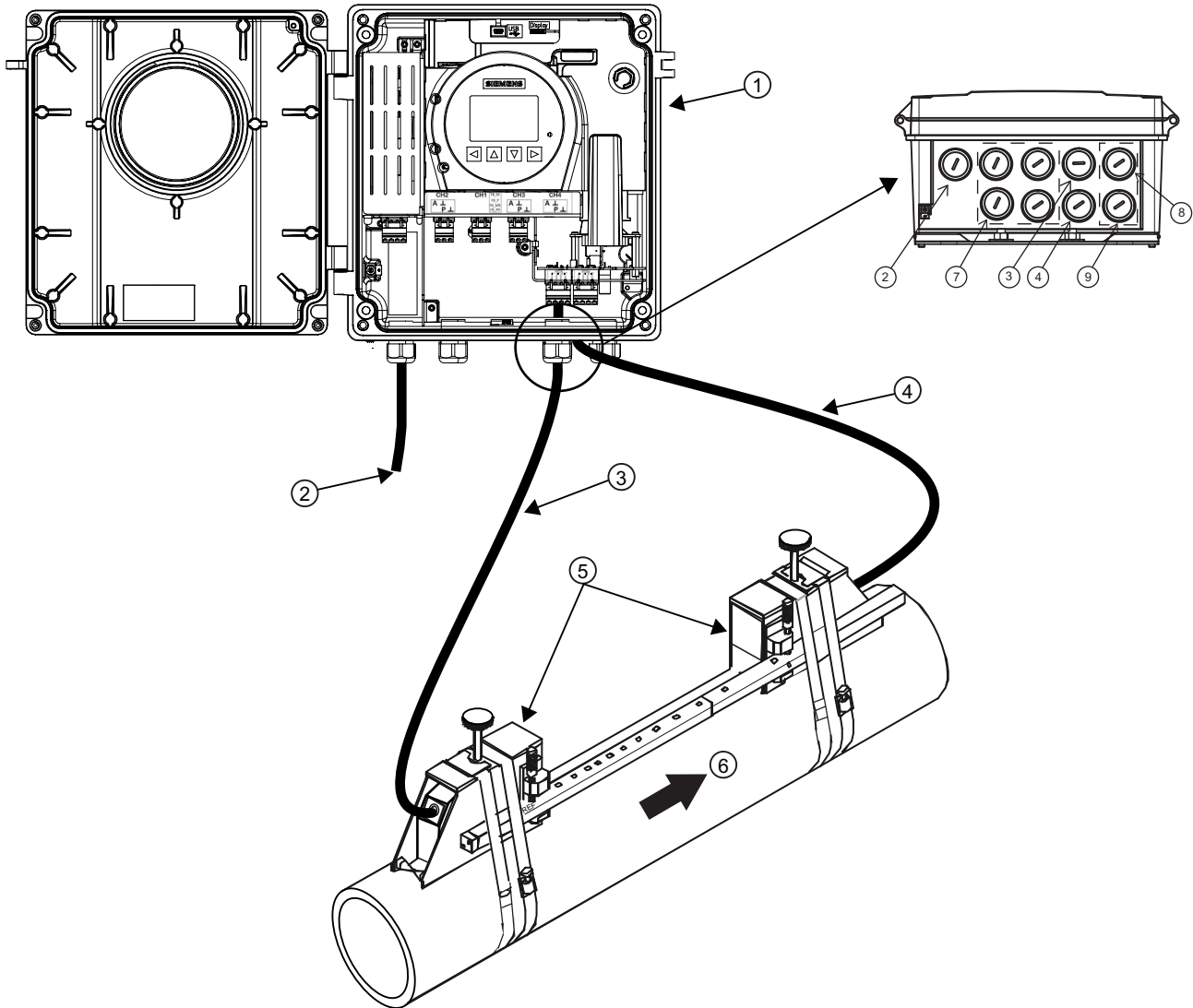
The following example is shown in the Reflect mount sensor configuration.

Connect sensor cables to the sensor as follows:

1. Fill connector end with the supplied grease prior to connecting.
2. Apply the supplied grease to the internal threads at the large end of the thread connector.
3. Observing the upstream and downstream orientation ⑥, connect upstream sensor cable ③ from the transmitter port (1A) to the sensor ⑤ and make connection snug.

5.6 Connecting sensor cables to sensor

4. Connect the downstream sensor cable (4) from the transmitter port (1B) to the sensor (5) and make connection snug.



- ① Wall mounted transmitter
- ② Power cable
- ③ Path 1 - Upstream sensor cable (1A)
- ④ Path 1 - Downstream sensor cable (1B)
- ⑤ Sensors
- ⑥ Flow direction
- ⑦ Ports for I/O, Communications, RTDs
- ⑧ Path 2 - Upstream (2A)
- ⑨ Path 2 - Downstream (2B)

Figure 5-15 Wall mount enclosure with transmitter-to- sensor cable connections

5. Tighten all cable glands to obtain optimum sealing.

5.6.4 HI Precision mount FST030

Single enclosure Reflect mount wiring

Connect sensor cables to the sensor as follows:

1. Fill connector end with Super Lube prior to connecting.
2. Apply Super Lube to the internal threads at the large end of the thread connector.
3. Observing the upstream and downstream orientation ③, connect upstream sensor cable ④ from transmitter port (1A) and make connection snug.

4. Connect downstream sensor cable ② from transmitter port (1B) and make connection snug.

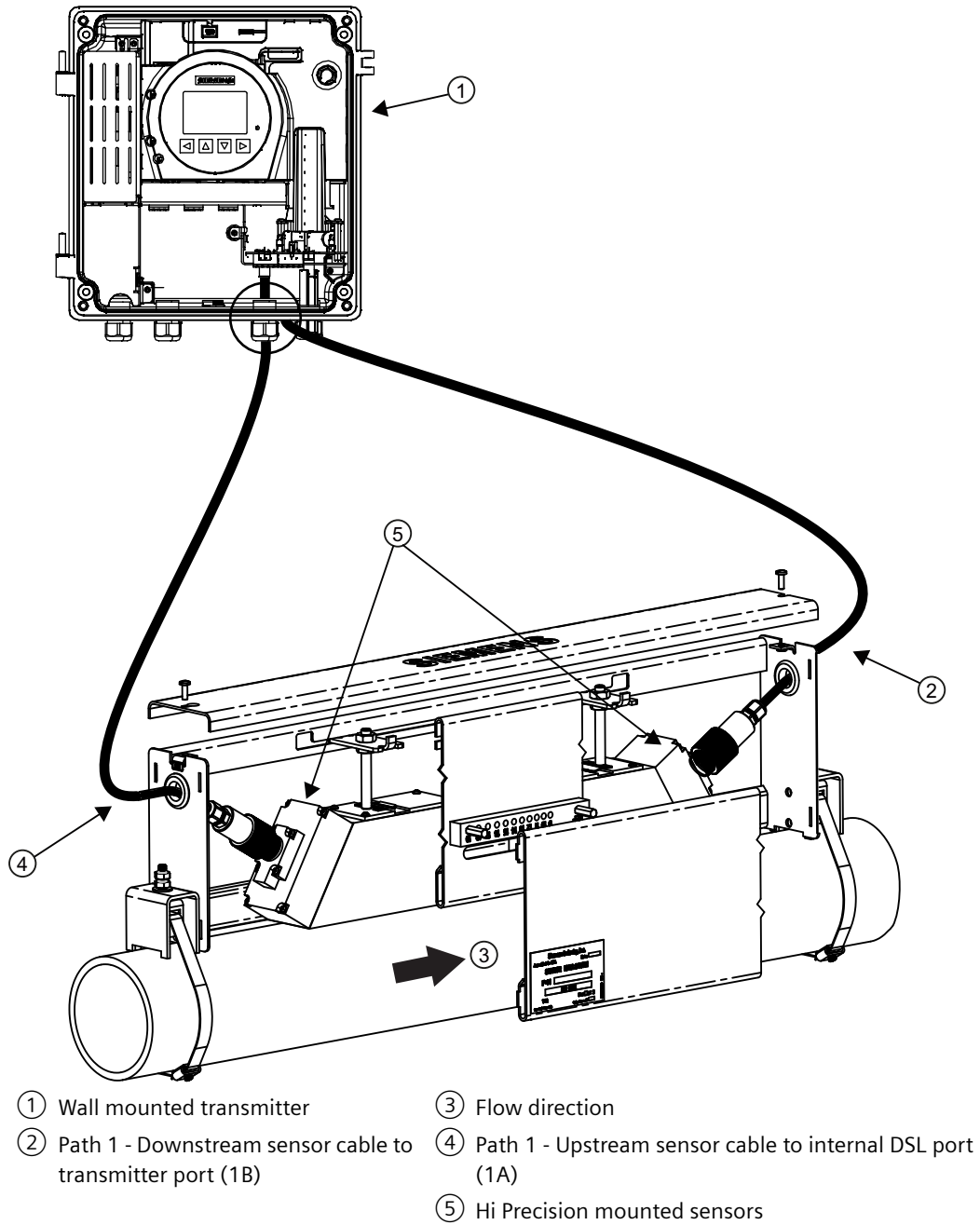


Figure 5-16 Hi Precision Reflect mount single enclosure wiring

5. Tighten all cable glands to obtain optimum sealing.

Dual enclosure Reflect mount wiring

Referring to the Hi Precision single enclosure reflect mount figure above, connect the Hi Precision mount reflect Dual enclosure sensor cables from the transmitter ports as follows:

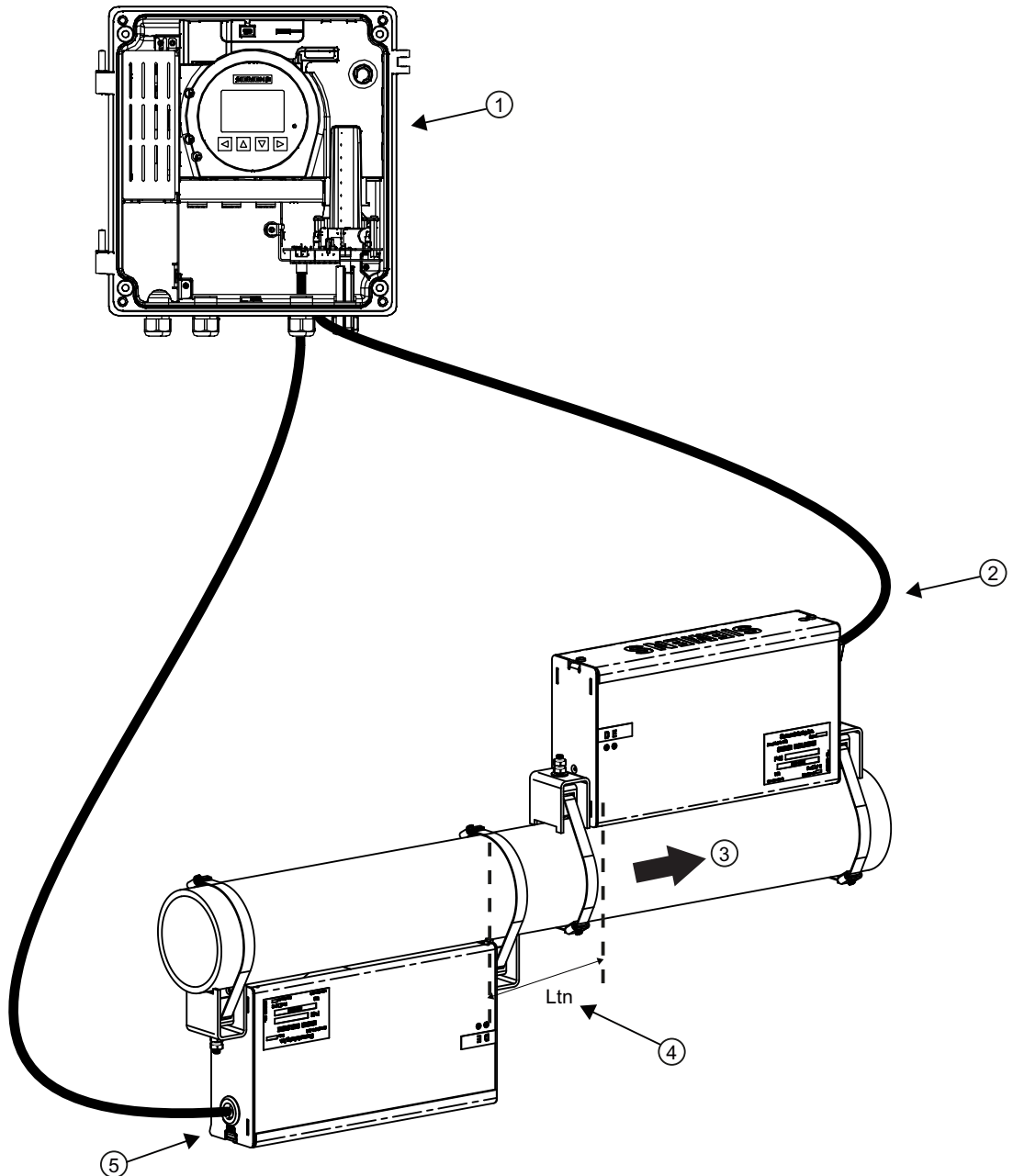
1. Observing the upstream and downstream orientation ③, connect sensor cables from transmitter ports.
2. Tighten all cable glands to obtain optimum sealing.
3. Refer to transmitter FST030 Operating Instructions to program transmitter.

Dual enclosure direct mount wiring

Connect sensor cables to the DSL and transmitter as follows:

1. Fill connector end with Super Lube prior to connecting.
2. Apply Super Lube to the internal threads at the large end of the thread connector.
3. Observing the upstream and downstream orientation ③, connect upstream sensor cable ⑤ from transmitter port (1A) and make connection snug.

4. Connect downstream sensor cable ② from transmitter port (1B) and make connection snug.



- ① Wall mounted transmitter
- ② Path 1 - Downstream sensor cable to transmitter port (1B)
- ③ Flow direction
- ④ Ltn (spacing distance between sensors)
- ⑤ Path 1 - Upstream sensor cable to internal DSL port (1A)

Figure 5-17 HI Precision Direct mount Dual enclosure sensor wiring

5. Tighten all cable glands to obtain optimum sealing.

6. Refer to transmitter FST030 Operating Instructions to program transmitter.

5.7 Connecting the external DSL

For configurations with external DSL first prepare the connections in the external DSL enclosure. Afterwards proceed with the connections in the FST030 transmitter enclosure.

In the external DSL it is possible to connect sensor cables from up to four measurement paths.

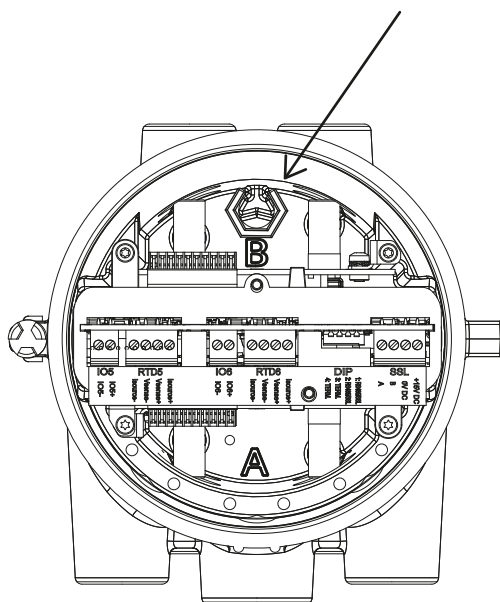
Furthermore, external measurements from up to two optional devices can be connected: 4 to 20 mA current input (passive) and/or resistive temperature device (RTD)

The DSL wiring comprises the following steps:

1. Preparing for the external DSL connections (Page 73)
2. Connecting the sensor cables (Page 74)
3. Channel 5 and 6 input configuration (Page 75)
4. Connecting the SSL cable (Page 79)
5. Finishing the DSL connection (Page 80)

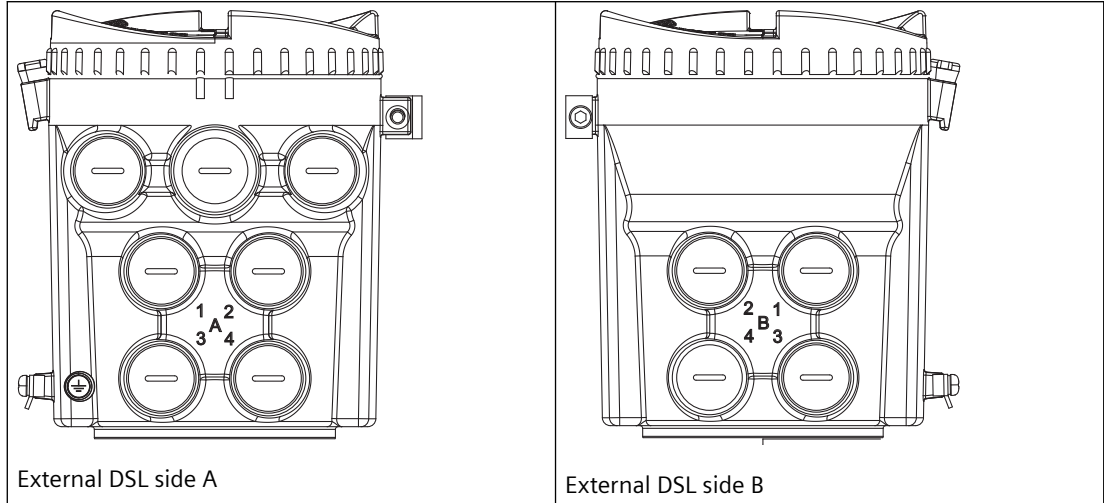
5.7.1 Preparing for the external DSL connections

1. Remove lid from DSL
2. Remove F connector tool from DSL and use it to connect the sensor cables.



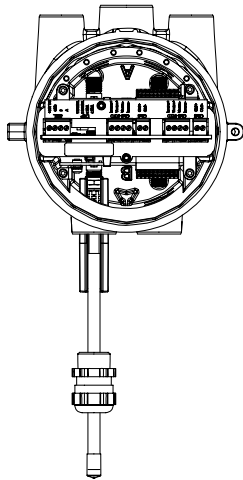
5.7.2 Connecting the sensor cables

When connecting the sensor to the DSL make sure that you connect the sensor cables for each path to the corresponding numbers on the DSL (A and B).



The sensor cables are delivered with a pre-mounted F-connector at transmitter end.

1. Remove blind plug from external DSL enclosure.
2. Slide the cable gland back onto the cable and allow access for the F-connector tool.
3. Place F-connector tool around cable and slide up to engage F-connector nut.
4. Push cable through gland opening. Ensure that center lead is aligned with connector port in external DSL.
5. Tighten F-connector using tool until you meet mechanical stop.



6. Remove F-connector tool.
7. Mount and tighten cable gland.

Repeat these steps for each sensor cable.

5.7.3 Channel 5 and 6 input configuration

Note**Connection of optional devices**

The external DSL provides the option of connecting two additional devices to channels 5 and 6. Do not connect two devices to one channel.

Note**Analog input on channel 6**

Hardware version 2 and below does not support analog input on channel 6.

Input configuration

Connect the two, three or four wires to the terminal block as shown below. Short-circuit terminals as required.

Note**The terminal connector is detachable**

For easier access unplug the terminal connector. After connecting the wires, plug the terminal connector back in.

Note**RTD shield grounding**

Make sure that the RTD cable shield is properly grounded. Consult the FSS200 Installation Manual on how to ground the RTD cable shield.

5.7 Connecting the external DSL

Table 5-2 Channels 5 and 6 configuration

Configuration	Software configuration	Connection diagram
Input Passive	Current input	
RTD input	Pt100 Pt500 Pt1000	<p>---- Short</p> <p>2-wire RTD configuration</p>
		<p>---- Short</p> <p>3-wire RTD configuration</p>
		<p>4-wire RTD configuration</p>

Connecting 4 to 20 mA current input cable (passive)

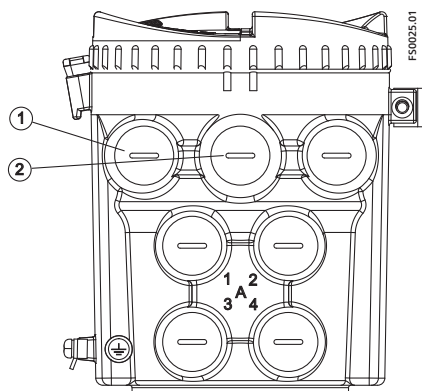
Note

Connection of optional devices

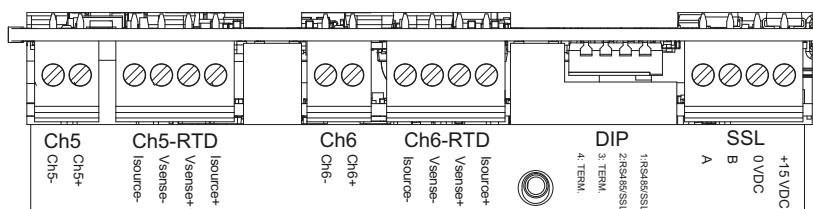
The DSL provides the option of connecting two additional devices to channels 5 and 6. Do not connect two devices to one channel.

Perform the following steps for each current input cable.

1. Remove cap and ferrule from cable gland and slide onto cable.
2. Remove one of the blind plugs (① or ②) and fit cable gland.



3. Push cable through gland opening.
4. Ground current input cable shield using the ground clamp inside the external DSL.
5. Connect the two wires to two-terminal block (Ch5+ and Ch5-, or Ch6+ and Ch6-).

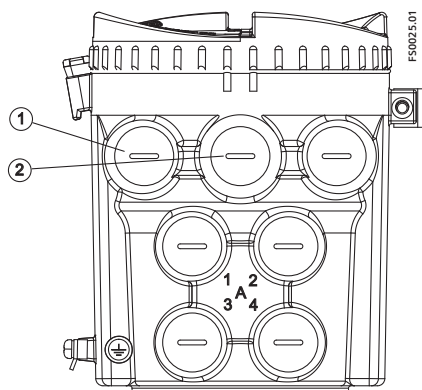


6. Assemble and tighten cable gland.

Connecting RTD cable

Perform the following steps for each RTD cable.

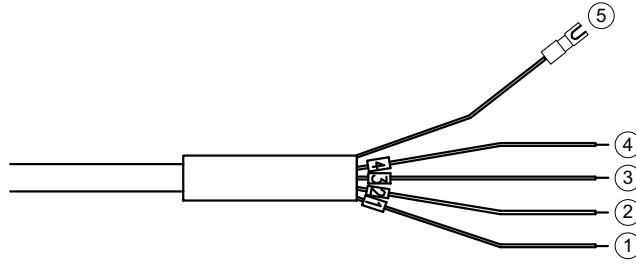
1. Remove cap and ferrule from cable gland and slide onto cable.
2. Remove one of the blind plugs (① or ②) and fit cable gland.



3. Push cable through gland opening.

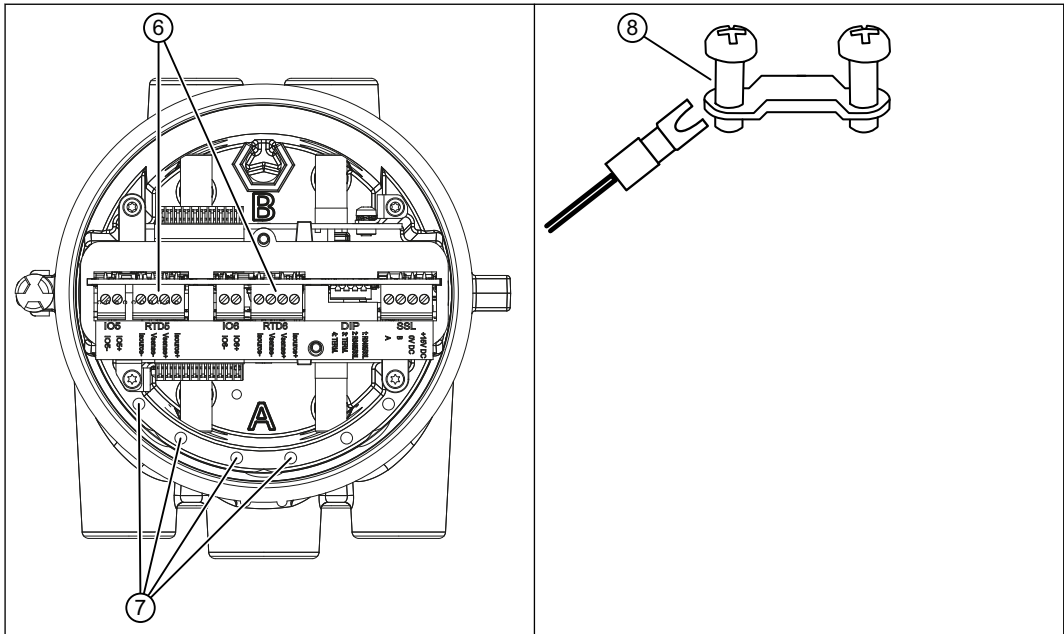
5.7 Connecting the external DSL

- 4. Attach an RTD cable crimp lug on the blue wire ⑤ of the cable by using a crimp tool or equivalent.

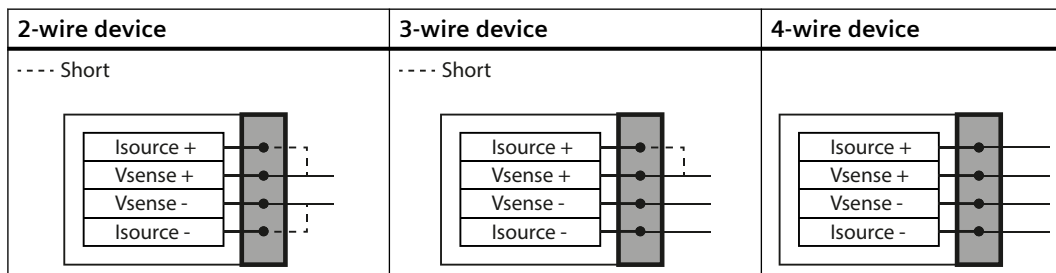
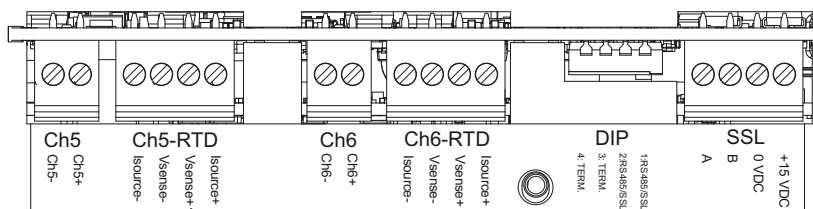


- ① Wire to Isource + (black)
- ② Wire to Vsense + (white)
- ③ Wire to Isource - (green)
- ④ Wire to Vsense - (red)
- ⑤ Wire to ground (blue)

- 5. Ground the RTD cable shield in the external DSL ⑦ by sliding the crimp lug on wire ⑤ onto one of the installed strain reliefs screws ⑧.



6. Connect the two, three or four wires to four-terminal block (Ch5-RTD or Ch6-RTD) ⑥. Short-circuit terminals as required.



7. Assemble and tighten cable gland.

5.7.4 Connecting the SSL cable

M12 connector version

The SSL cable is provided with M12 style stainless steel plugs.

The cable shield is physically and electrically terminated within the body of the plug.

Note

Never pull the cable by the plug - only by the cable itself.

1. Connect DSL using the supplied 4-wire cable with M12 connectors to both the external DSL and the transmitter.

Note

Grounding

The SSL cable shield is only mechanically connected to the grounding terminal (PE), when the M12 plug is correctly tightened.

M20 connector version

1. Prepare SSL cable by stripping it at both ends.

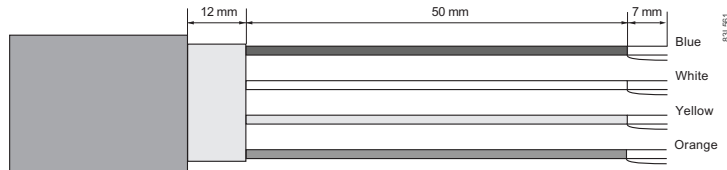
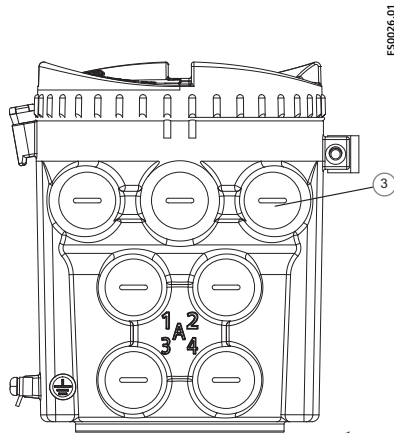
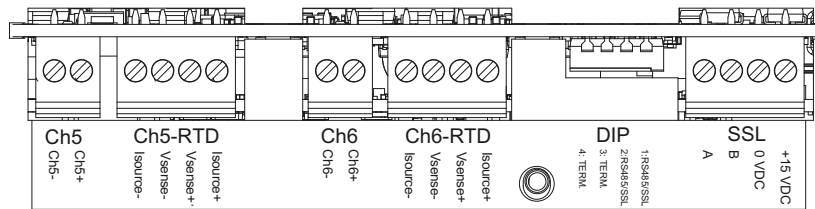


Figure 5-18 Cable end

2. Remove cap and ferrule from cable gland and slide onto cable.
3. Remove blind plug (3) and fit cable gland.



4. Push cable through gland opening.
5. Connect the four wires according to list below.



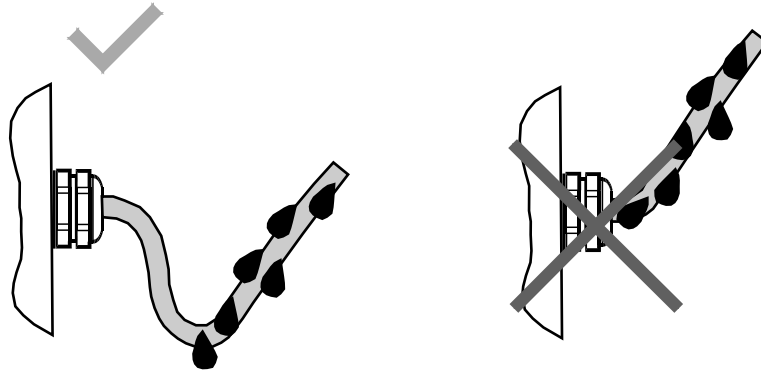
Terminal connector	Description	Wire color
SSL	+15 V DC	Orange
	0 V DC	Yellow
	B	White
	A	Blue

6. Assemble and tighten cable gland.

5.7.5 Finishing the DSL connection

1. Place F connector tool in DSL.
2. Firmly tighten cable glands and insert blanking plugs in unused cable entries.

3. Check individual wire installation by tugging firmly.
4. Remove O-ring from lid.
5. Reinstall lid and screw in until mechanical stop. Wind back lid by one turn.
6. Mount O-ring by pulling it over the lid and tighten lid cover until you feel friction from the O-ring on both sides. Wind lid further by one quarter of a turn to seal on the O-ring.
7. Ensure that moisture does not penetrate to inside of DSL enclosure by creating a drip loop (bend cables downward) immediately before cable glands.



Note**Protection class**

The DSL is IP68 only if the lid is properly mounted and all M20 holes are closed with appropriate blind plugs or cable glands.


Service and maintenance

6.1 Basic safety instructions

 WARNING

Impermissible repair of the device

- | |
|----------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • Repair must be carried out by Siemens authorized personnel only. |
|----------------------------------------------------------------------------------------------------------------------|

 WARNING

Impermissible repair of explosion protected devices

Risk of explosion in hazardous areas

- | |
|----------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • Repair must be carried out by Siemens authorized personnel only. |
|----------------------------------------------------------------------------------------------------------------------|

6.2 Recalibration

Siemens offers to recalibrate the system. The following calibrations are offered as standard:

- Standard intrinsic calibration
- Accredited flow calibration

Note

For recalibration the transmitter must always be returned with the sensors.

6.3 Maintenance and repair work

6.3.1 Maintenance

The device is maintenance-free. However, a periodic inspection according to pertinent directives and regulations must be carried out.

An inspection can include, for example, check of:

- Ambient conditions
- Seal integrity of the process connections, cable entries, and cover
- Reliability of power supply, lightning protection, and grounds

6.4 Return procedures

6.4.1 Return procedure

To return a product to Siemens, see AUTOHOTSPOT.

Contact your Siemens representative to clarify if a product is repairable, and how to return it. They can also help with quick repair processing, a repair cost estimate, or a repair report/cause of failure report.

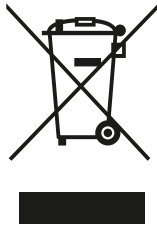
NOTICE
Decontamination
The product may have to be decontaminated before it is returned. Your Siemens contact person will let you know for which products this is required.

See also

Return goods delivery note (<https://www.siemens.com/processinstrumentation/returngoodsnote>)

Decontamination declaration (<https://www.siemens.com/sc/declarationofdecontamination>)

6.5 Disposal



Devices described in this manual should be recycled. They may not be disposed of in the municipal waste disposal services according to the Directive 2012/19/EC on waste electronic and electrical equipment (WEEE).

Devices can be returned to the supplier within the EC and UK, or to a locally approved disposal service for eco-friendly recycling. Observe the specific regulations valid in your country.

Further information about devices containing batteries can be found at: Information about battery / product return (WEEE) (<https://support.industry.siemens.com/cs/document/109479891/>)

Technical specifications

7.1 Sensor specifications

Note

Based on pipe wall thickness (steel pipes only)

Note

All sensors are stainless steel construction.

Table 7-1 Hi Precision sensors

Sensor Size	Pipe wall (mm)		Pipe wall (inch)	
	min.	max.	min.	max.
A1H	0.64	1.02	0.25	0.04
A2H	1.02	1.52	0.04	0.06
A3H	1.52	2.03	0.06	0.08
B1H	2.03	3.05	0.08	0.12
B2H	3.05	4.06	0.12	0.16
B3H	2.7	3.3	0.106	0.128
C1H	4.06	5.84	0.16	0.23
C2H	5.84	8.13	0.23	0.32
D1H	8.13	11.18	0.32	0.44
D2H	11.18	15.75	0.44	0.62
D3H	7.4	9.0	0.293	0.354
D4H	15.75	31.75	0.62	1.25

7.2 Sensor markings

Ratings FSS200 sensor

"Intrinsic safety" type of protection	
Canada, USA	Class I, Division 1, Groups A, B, C, D
• FM16CA0142X	Class II, Division 1, Groups E, F, G
• FM16US0280X	Class III
• CSA 80083297X	Class I, Zone 0, AEx/ Ex ia IIC T6 ... T4 Ga Class II, Zone 21 AEx/ Ex ib IIIC T70'C ... T110'C Db
ATEX, UKEx, IECEx	II 1G Ex ia IIC T6...T4 Ga
• IECEx FMG 17.0004X	II 2D Ex ib IIIC T70 – 110 °C Db
• FM 16ATEX0090X	
• FM21UKEX0057X	
EAC Ex	OEx ia IIC T6...T4 Ga X Ex ia IIIC T70°C...T110°C Da
Temperature code	Varies by sensor and ambient temperature (see Installation in hazardous areas (Page 15))
Dust Temperature class	Tdust = Ta max + 10 °K (T70 °C for Ta = 60 °C, T110 °C for Ta = 100 °C)

7.3 Rated operating conditions

Table 7-2 Ambient temperatures

Version	FSS200
Operation	
• Transmitter	-40 to +60 °C (-40 to +140 °F) (humidity max. 95 %)
• Display	-20 to +60 °C (-4 to +140 °F)
• Sensors	T1 usable from -40 to +120 °C (-40 to +248 °F), but best for Ø temperature < 80 °C (< 176 °F) T2 usable -40 to +120 °C (-40 to +248 °F), but best for Ø temperature > 80 °C (> 176 °F) High temperature usable above -40 to +120 °C (-40 to +248 °F) to max. temperature 232 °C (450 °F) Sensors for use in Hazardous locations / Explosive Atmospheres shall not be used above 100°C (212 °F)
Storage	
• Transmitter	-40 to +70 °C (-40 to +158 °F) (humidity max. 95 %)

Table 7-3 Environment

Version	FSS200
Environmental conditions acc. to IEC/EN/UL 61010-1	<ul style="list-style-type: none"> • Altitude up to 2000 m • Pollution degree 2 • Overvoltage category II

7.4 Coaxial cable specifications

Submersible coaxial cable	
Cable (93 Ω)	Coaxial cable terminated at both ends with F connectors
Outside diameter	Ø 10 mm (0.24")
Length	10m (32.81 ft), 20m (65.62 ft)
Material (outside jacket)	HDPE - High Density Polyethylene
Ambient temperature	-55 - +80 °C (-67 - +176 °F)

Plenum high temperature coaxial cable	
Cable (93 Ω)	Coaxial cable terminated at both ends with F connectors
Outside diameter	Ø 5.18 mm (0.204")
Length	20 m (65.62 ft)
Material (outside jacket)	FEP - Fluorinated Ethylene Propylene
Ambient temperature	-70 - +200 °C (-94 - +400 °F)

Armored coaxial cable	
Cable (93 Ω)	Coaxial cable terminated on both ends with F connectors
Outside diameter	Ø 10 mm (0.24")
Length	1, 3, 5, 10, 20 m (3.28, 9.84, 16.40, 32.81, 65.62 ft) between sensor and transmitter.
Material (outside jacket)	Black LSZH jacket
Ambient temperature	-25 - +80 °C (-13 - +176 °F)

7.5 Triaxial cable specifications

Note

Important

Triaxial cables are for FST030 only.

Submersible triaxial cable	
Cable (75 Ω)	Triaxial cable terminated on one end with F connector
Outside diameter	Ø 7.5 mm (0.295")
Length	1, 3, 5, 10, 20m (3.28, 9.84, 16.40, 32.81, 65.62 ft) between sensor and transmitter.
Material (outside jacket)	Black Polyethylene (PE) jacket
Ambient temperature	-55 - +80°C (-67 - +176°F)

7.5 Triaxial cable specifications

High Temperature triaxial cable	
Cable (75 Ω)	Triaxial cable terminated on both ends with F connectors
Outside diameter	Ø 7.0 mm (0.276")
Length	5, 20m (16.40, 65.62 ft) between sensor and transmitter.
Material (outside jacket)	Yellow FEP Perfluorethylenpropylen jacket
Ambient temperature	-55 - +204°C (-67 - +400°F)

Dimensions and weight

8.1 Sensor dimensions

Note

Sensors are supplied in matched pairs. Each sensor in a matched pair has the same serial number and is marked with an "A" and "B" (e.g., 19256A and 19256B).

Part Number *	Length		Width		Height		Weight
	mm	inch	mm	inch	mm	inch	Net Weight (Pair)
1011HNFS - A1 / A2 / A3 1011GCHNFS - A1 / A2 / A3 7ME39505LB* 7ME39505LG* 7ME39505LH* 7ME39505LJ*	56	2.2	28	1.1	43	1.7	0.23 kg (0.5 lbs)
1011HNF - B1 / B2 / B3 1011GCHNF - B2 / B3 7ME39505LC* 7ME39505LL* 7ME39505LT*	84	3.3	28	1.7	43	1.7	0.36 kg (0.8 lbs)
1011GCHNFS - B1 7ME39505LK*	66	2.6					0.32 kg (0.7 lbs)
1011HNFS - C1 / C2 1011GCHNFS - C2 7ME39505GN* 7ME39505LD* 7ME39505LM* 7ME39505LN*	127	5.0	33	1.3	56	2.2	0.86 kg (1.9 lbs)
1011GCHNFS - C1 7ME39505GM*	104	4.1					0.64 kg (1.4 lbs)

Dimensions and weight

8.1 Sensor dimensions

Part Number *	Length		Width		Height		Weight
	mm	inch	mm	inch	mm	inch	Net Weight (Pair)
1011HNFS - D1 / D2 / D3 / D4 1011GCHNFS - D2 / D4 7ME39505GQ* 7ME39505GR* 7ME39505GU* 7ME39505LE* 7ME39505LP* 7ME39505LQ* 7ME39505LR* 7ME39505LU*	191	7.5	51	2.0	84	3.3	2.2 kg (4.9 lbs)
1011GCHNFS - D1 / D3 7ME39505GP* 7ME39505GU*	173	6.8					1.9 kg (4.2 lbs)

* Sensor part numbers vary with the operating frequency and application temperature.

Product documentation and support

A.1 Product documentation

Process instrumentation product documentation is available in the following formats:

- Certificates (<http://www.siemens.com/processinstrumentation/certificates>)
- Downloads (firmware, EDDs, software) (<http://www.siemens.com/processinstrumentation/downloads>)
- Catalog and catalog sheets (<http://www.siemens.com/processinstrumentation/catalogs>)
- Manuals (<http://www.siemens.com/processinstrumentation/documentation>)
You have the option to show, open, save, or configure the manual.
 - "Display": Open the manual in HTML5 format
 - "Configure": Register and configure the documentation specific to your plant
 - "Download": Open or save the manual in PDF format
 - "Download as html5, only PC": Open or save the manual in the HTML5 view on your PC

You can also find manuals with the Mobile app at Industry Online Support (<https://support.industry.siemens.com/cs/ww/en/sc/2067>). Download the app to your mobile device and scan the device QR code.

Product documentation by serial number

Using the PIA Life Cycle Portal, you can access the serial number-specific product information including technical specifications, spare parts, calibration data, or factory certificates.

Entering a serial number

1. Open the PIA Life Cycle Portal (<https://www.pia-portal.automation.siemens.com>).
2. Select the desired language.
3. Enter the serial number of your device. The product documentation relevant for your device is displayed and can be downloaded.

To display factory certificates, if available, log in to the PIA Life Cycle Portal using your login or register.

Scanning a QR code

1. Scan the QR code on your device with a mobile device.
2. Click "PIA Portal".

To display factory certificates, if available, log in to the PIA Life Cycle Portal using your login or register.

A.2 Technical support

Technical support

If this documentation does not completely answer your technical questions, you can enter a Support Request (<http://www.siemens.com/automation/support-request>).

For help creating a support request, view this video here.

Additional information on our technical support can be found at Technical Support (<http://www.siemens.com/automation/csi/service>).

Service & support on the Internet

In addition to our technical support, Siemens offers comprehensive online services at Service & Support (<http://www.siemens.com/automation/service&support>).

Contact

If you have further questions about the device, contact your local Siemens representative at Personal Contact (<http://www.automation.siemens.com/partner>).

To find the contact for your product, go to "all products and branches" and select "Products & Services > Industrial automation > Process instrumentation".

Contact address for business unit:

Siemens AG
Digital Industries
Process Automation
Östliche Rheinbrückenstr. 50
76187 Karlsruhe, Germany

Additional Installation Instructions

Additional installation and sensor mounting instructions including direct mount, track mount, magnetic mount, Hi Precision mount and temperature sensor mounting are listed in this appendix.

B.1 Direct mount

Sensor installation using mounting frames, spacer bar and spacing guides

The combination of mounting frames, spacer bar and spacing guides is the recommended way to mount Direct mode sensors. The mounting frame establishes the axial alignment of the sensors and allows you to remove and replace either sensor while preserving their exact mounting location.

For Direct mode mounting, a spacer bar is used to establish the distance between sensors and a spacing guide to locate the sensors at the nine o'clock and three o'clock positions. Should the distance between sensors be beyond the span of a spacer bar, a measuring tape can be used. The Mylar spacing guide comes in various lengths and widths to accommodate most pipe sizes.

Spacing Guide Sizes	
Metric	English
5.08 cm x 66.04 cm	2" x 26"
5.08 cm x 114.3 cm	2" x 45"
10.16 cm x 393.7 cm	4" x 155"
15.2 cm x 497.8 cm	6" x 196"

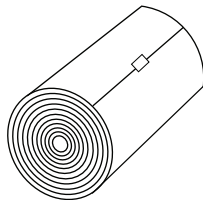
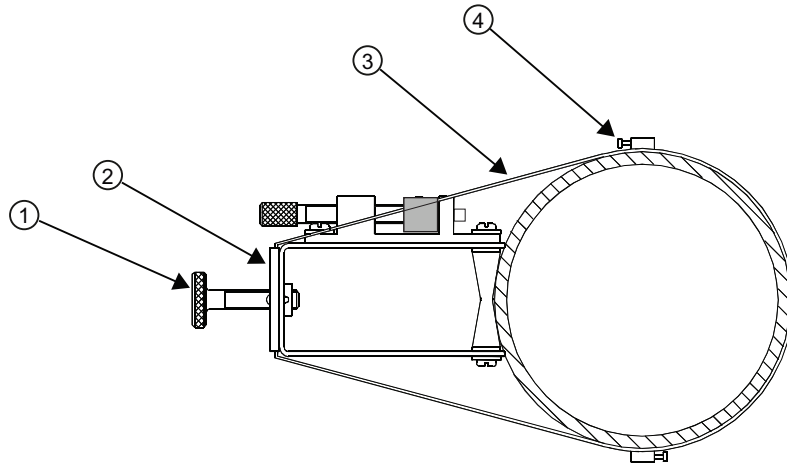


Figure B-1 Mylar spacing guide

1. Use the Wizard setup procedure to program the transmitter for the sensors that were selected.
2. After receiving the spacing number index from the transmitter, make a note of the number displayed then prepare the pipe surface area where the sensors will be mounted.
3. Degrease the surface and remove any grit, corrosion, rust, loose paint, etc.
4. Check to ensure that you have a matched set of sensors. They both should have the same S/N number but marked with either an "A" or "B" (e.g., 100A and 100B).

B.1 Direct mount

5. Temporarily position one of the frames on the pipe where you will be mounting it. Ensure that this is a smooth area without any raised areas (seams, etc.). With a pencil or chalk, mark a generous area of 13 mm (1/2") all around the frame. Remove the assembly.
6. Prepare the area you marked by de-greasing surface, if needed, and removing any grit, corrosion, rust, loose paint or surface irregularities with the abrasive material provided.
7. Put a mounting strap around the pipe and engage an end into adjusting screw (screw should be pointing up). Position frame in the middle of area you have cleaned and centered on the pipe with its angled end facing away from where the other frame will sit.

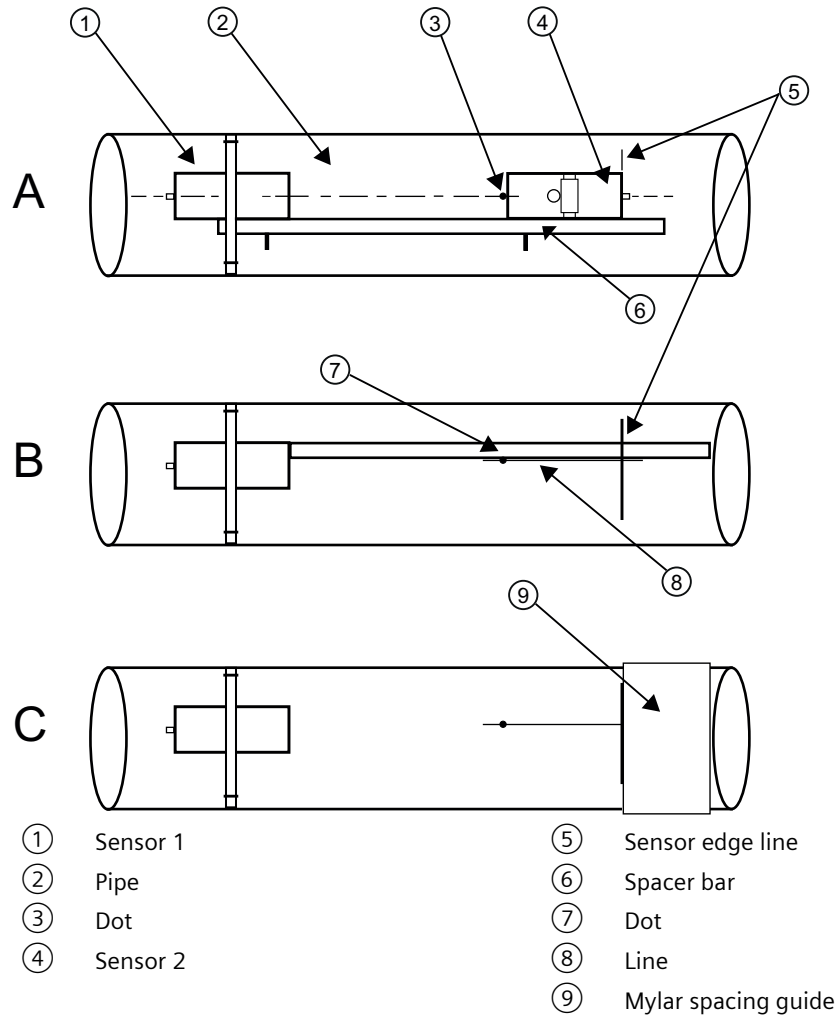


- | | | | |
|---|-----------------------|---|--------------------------------|
| ① | Sensor clamping screw | ③ | Mounting strap |
| ② | Spring clip | ④ | Mounting strap adjusting screw |

Figure B-2 Wrap strap under pipe and attach to adjusting screw

8. Slide the mounting strap over it (and under the clip if there is one) and tighten with a screwdriver. While tightening, check to ensure that the center of the tapered roller is centered on the pipe.
9. Attach the second frame to the spacer bar with an index spacer screw placed into the index hole specified in Step 2. The angle on the frame should be facing away from the direction that the length of the bar is going.

10. Now attach the free end of the spacer bar by inserting an index spacer screw through the REF hole on the spacer bar and then into the hole on the mounted frame. Tighten. Sight to ensure that this frame is lined up in center of pipe and while holding alignment, place a dot (with pencil or chalk) in the center of the tapered roller at the bottom of the frame (see A below). While holding, also mark along the front edge of the frame with pencil or fine chalk line (see B below).



B.1 Direct mount

- Disassemble the spacer bar and the unmounted frame. Use the bar as a straight edge and, with one edge against the mounted frames tapered roller center and the other crossing the dot you drew, draw a line crossing the dot (see "B" above). Set the bar aside.

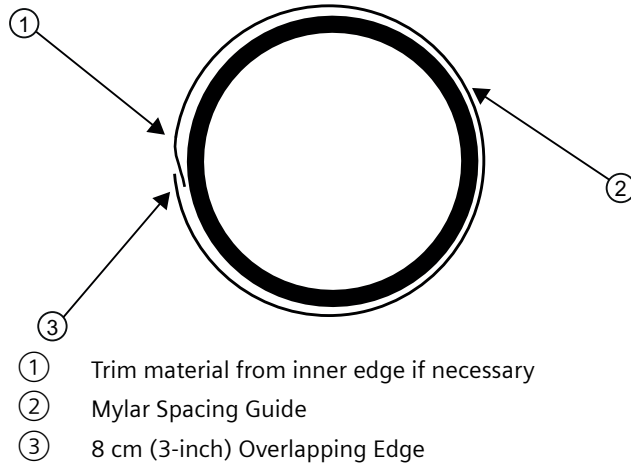


Figure B-3 Wrapping the Mylar spacing guide around the pipe (end view)

- Wrap the Mylar spacing guide around the pipe so that the left edge is against the sensor edge mark (see "C" above). Arrange so that one end overlaps the other by at least three inches. Trim to fit if necessary, but be sure not to trim at the overlapping end in order to keep it square.
- Realign left edge of the guide with the sensor edge mark. Line up both vertical edges of the guide and ensuring that it is snug around the pipe, mark along the overlapping edge.
- Remove Mylar spacing guide and lay it out on a flat surface. Either measure the exact distance half-way between the overlap edge and the mark at the overlap, or fold the guide from the overlap edge to overlap mark and draw a line at the fold or halfway point.

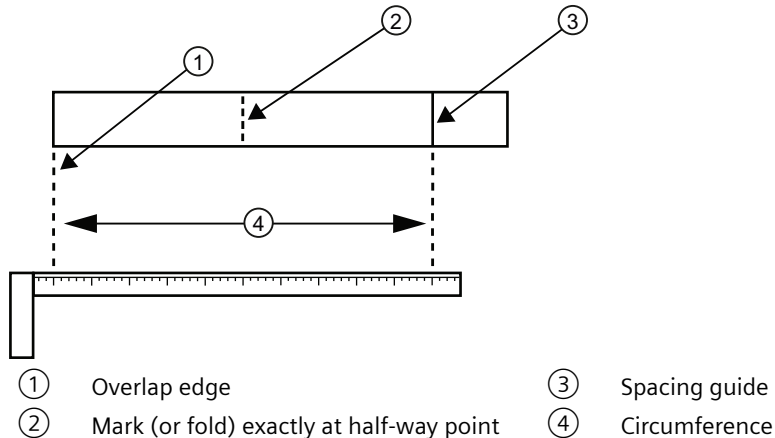
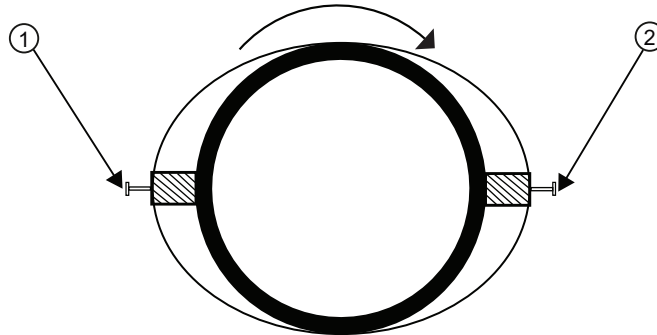


Figure B-4 Finding the halfway distance

- Reinstall the spacing guide; its left edge abutting the sensors edge mark on the pipe and the overlapping edge in line with the dot (now a line) on the pipe (see "C"). Tape it in this position on the pipe. Take the second frame and place it against the edge of the guide with its tapered roller centered on the center mark on the guide.

16. Temporarily position the frame (in the 3 o'clock position opposite the mounted frame - see below) where it will be mounted. Ensure that this is a smooth area without any raised spots (seams, etc.). Mark a generous area of 13 mm (1/2-inch) all around the mounting frames with a pencil or chalk. Remove the frame and the Mylar guide.



- ① 9 o'clock sensor
 ② 3 o'clock sensor

Figure B-5 Aligning the sensors for Direct Mode operation (end view)

17. Prepare the area you marked by de-greasing the surface, if needed, and removing any grit, corrosion, rust, loose paint or surface irregularities with the abrasive pipe conditioning material provided. Clean the pipe of any debris and abrasive particles.
18. Replace the Mylar guide back in the same position it was in and retape it to the pipe
19. Put a mounting strap around the pipe and engage an end into adjusting screw (screw should be pointing up).
20. Position frame in the middle of area you have cleaned and centered on the pipe with its angled end facing away from where the other frame will sit and aligned with the edge and center marks on the guide. Slide the mounting strap over it (and under the clip if there is one) and tighten with a screwdriver. While tightening, check to ensure that the center of the tapered roller is centered on the pipe.
21. Take either sensor and apply a continuous lengthwise 3 mm (1/8-inch) bead of coupling compound across the center of the sensor emitting surface.
22. Tighten the sensor clamping screws to hold the sensor firmly in place. *Repeat procedure for the other sensor.*
23. Slide sensor into the angled mounting frame with the sensor F-connector facing out.
24. Keep sensor from making contact with the pipe until it butts up against the mounting frame stop. Push sensor down to mate with pipe.
25. Proceed to Sensor wiring (Page 47).

B.2 Mounting tracks for Size A and B sensors

Using sensor mounting tracks

The FSS200 Universal and Hi Precision mounting tracks provide a rigid mounting platform for Series 1011 Universal or Hi Precision size A or B sensors. The mounting tracks service pipe sizes up to a maximum of 140 mm (5.00") outer diameter. The mounting tracks support both Direct and Reflect mounting modes. The transmitter recommends the appropriate sensors, mounting track and mounting mode, based on the pipe data entries.

Installing a mounting track in Reflect mode

1. Use the Wizard setup procedure to program the transmitter for the sensors that were selected.
2. After receiving the spacing number index from the transmitter, make a note of the number displayed.
3. Prepare the pipe surface. De-grease the surface, if necessary, and remove any grit, corrosion, rust, loose paint, etc. Use abrasive material provided to provide a clean contact surface for the sensors.

4. Check to ensure that you have a matched set of sensors. They both should have the same serial number but marked with either an "A" or "B" (e.g. 100A and 100B).

Note

Index pins are used as stops against each sensor inserted at the reference hole for one sensor and the number index hole for the other sensor (see ⑪ in figure below).

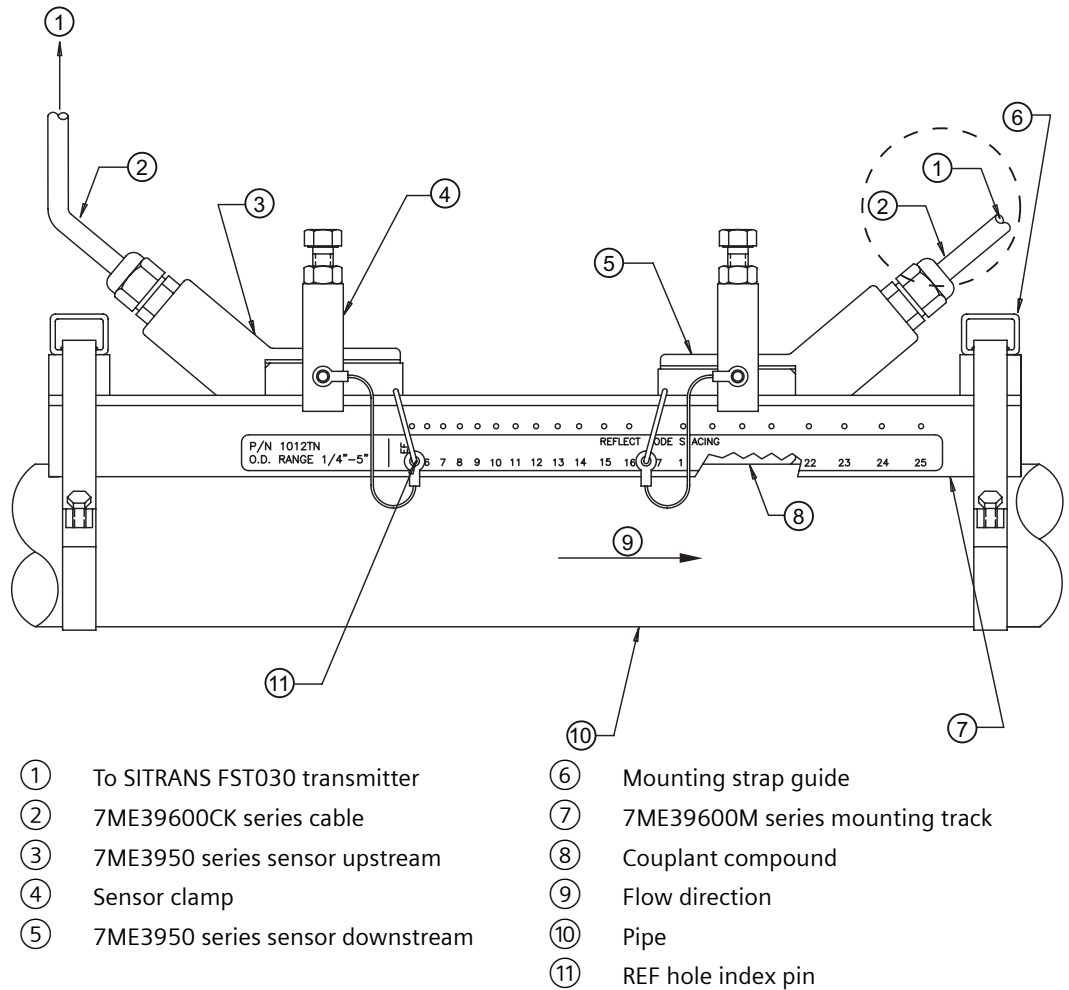


Figure B-6 Reflect mount with mounting track (side view)

5. Place the track rail assembly on the top surface of the pipe at the location where you have determined it would be mounted. Ensure that it is a smooth area without any raised spots or seams.
6. Holding the mounting track assembly in place, loop one of the strap clamps under the pipe, pull it around and maintain tension while slipping a link over the tension screw hook. Tighten the tension screw enough to hold the assembly on the pipe, but still allow rotation. Repeat for the other mounting strap.
7. Rotate the track rail assembly to the intended mounting position on the pipe, then tighten both tension screws just enough to prevent rotation. Do not over tighten.
8. With a pencil or chalk mark a generous area around the perimeter of the track assembly. Loosen and move the assembly away from marked area.

B.2 Mounting tracks for Size A and B sensors

9. Prepare the area you marked by degreasing the surface, if needed, and removing any grit, corrosion, rust, loose paint or surface irregularities with the abrasive pipe conditioning material provided. Clean the pipe of all debris and abrasive particles.
10. Rotate the track into the position that was just cleaned. Insert the index pin into the REF hole.
11. Insert the index pin into the reference hole.
12. Select a sensor and apply a thin band of couplant compound to the sensor's emitting surface.
13. Place the sensor between the track rails, slightly behind the pin and under the clamping screw assembly. Slide it forward until it butts up firmly against the reference pin.
14. Once the sensor is in place secure it with the sensor clamping screw. Do not over tighten.
15. Repeat the procedure for the number index sensor making sure to insert an index pin into the correct number index hole. Refer to the mounting track (side view) figure above.
16. Fill connector end with Super Lube prior to connecting.
17. Apply Super Lube to the internal threads at the large end of the thread connector.
18. Observing the upstream and downstream orientation, attach the 1A (upstream) and 1B (downstream) cables to the sensors and make snug. Attach other ends of cables to the transmitter at 1A and 1B terminals of the transmitter.

Installing a mounting track in Direct mode

The sensor installation procedures show how the automatic selection of sensors, mounting mode and spacing method are established. Note the automatic assignment of model numbers for the sensor and mounting track, plus the designation of the number index.

The combination of two mounting tracks and a spacer guide is the recommended way to mount sensors in the Direct mode. This method ensures that sensors will align exactly 180° from each other and remain spaced the proper distance apart.

The Direct mount configuration uses a set of two track rail assemblies; one for each sensor, installed 180° apart on the pipe. The set includes:

- Reflect mode track assembly - This track rail includes the tension screw and REF hole to position one sensor.
- Direct mode track assembly - This track rail has number index holes for inserting an index pin to position the other sensor.

Note

A pin will be inserted into the hole designated by the number index on the Direct mode track rail to position one of the sensors (see ⑩ in figure below).

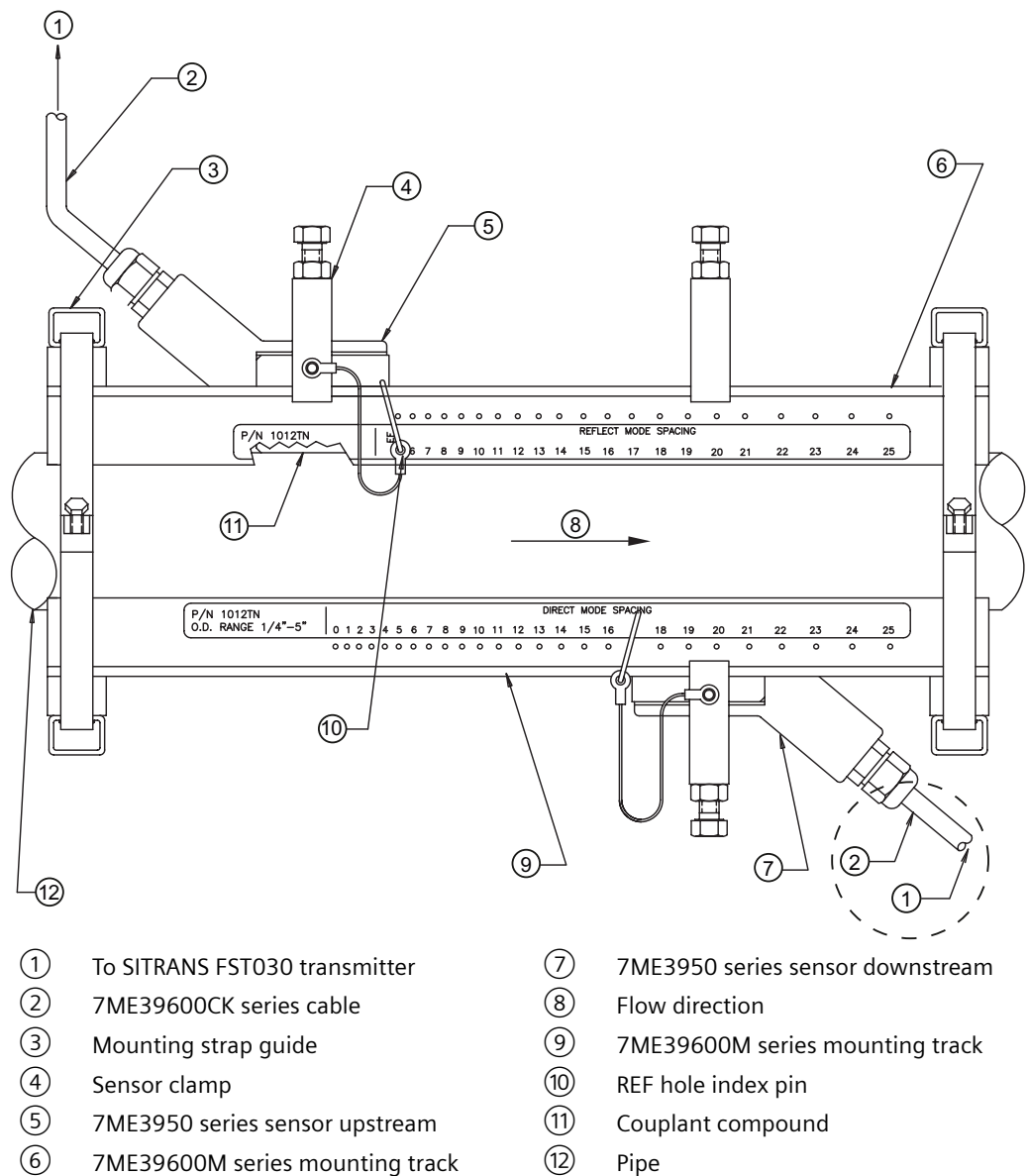


Figure B-7 Direct Mount 180° opposed with Mounting Tracks

B.2 Mounting tracks for Size A and B sensors

1. Use the Wizard setup procedure to program the transmitter for the sensors that were selected.
2. After receiving the spacing number index from the transmitter, make a note of the number displayed.
3. Check to ensure that you have a matched set of sensors. They both should have the same serial number but marked with either an "A" or "B" (e.g. 100A and 100B).

Note

Some sensors require a right-angle adapter. This adapter should be installed before placing the sensors in the tracks.

4. Prepare pipe for the track mounts by degreasing the surface, if needed, and removing any grit, corrosion, rust, loose paint or surface irregularities with the abrasive pipe conditioning material provided.
5. If this is a horizontal pipe, place the track rail assembly against the pipe. While holding track, place second track on pipe directly underneath (180°) and hold together in place.
6. Wrap the mounting strap around the pipe and through the strap guide.

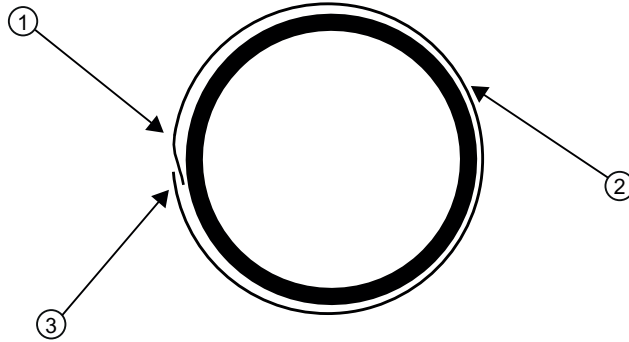
Note

For a vertical pipe installation, use a tie, tape or bungee cord to hold the two tracks in place while mounting.

7. Finger-tighten the Tension Screw to secure the strap and tracks to the pipe.

Positioning track assemblies

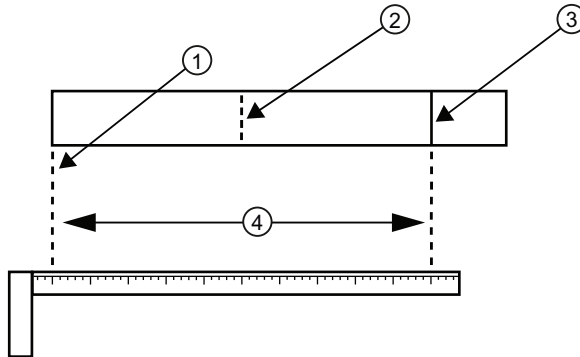
1. Wrap a length of the Mylar spacing guide around the pipe and against the end of the track assemblies. Ensure that the spacer guide edges on both sides align. Arrange so that one end overlaps the other by at least 8 cm (3 inches). Trim to fit if necessary, but in order to keep the end square, be sure not to trim at the overlapping end.



- ① Trim material from inner edge if necessary
- ② Mylar Spacing Guide
- ③ 8 cm (3-inches) Overlapping Edge

Figure B-8 Wrapping the Mylar spacing guide around the pipe (end view)

2. Remove the spacer guide. Measure or fold spacer guide to find its halfway distance. Mark a center line and then tape spacer guide to pipe.

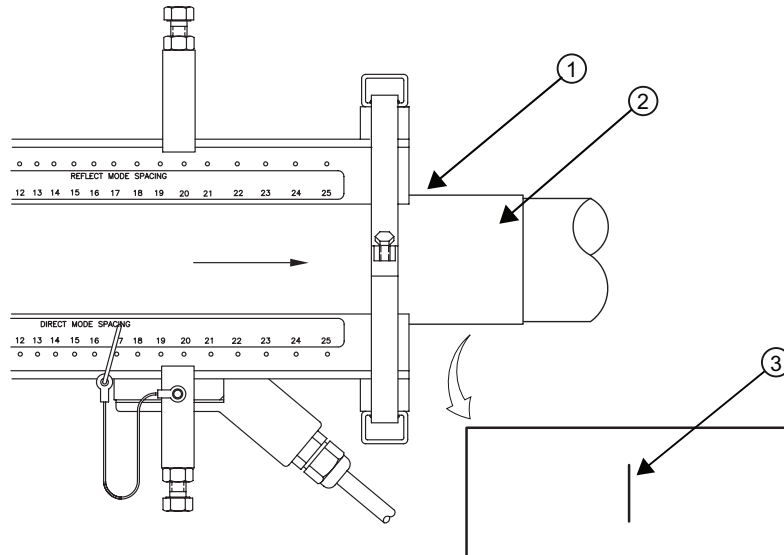


- ① Overlap Edge
- ② Mark (or fold) exactly at half-way point
- ③ Mark on Spacing Guide
- ④ Circumference

Figure B-9 Finding the halfway distance

B.2 Mounting tracks for Size A and B sensors

3. Use the edge of the spacer guide as a stop for both tracks to keep them parallel. Adjust tracks as necessary.



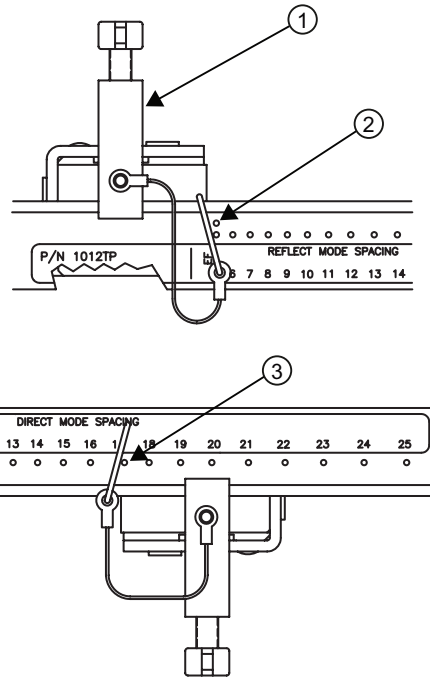
- ① Align tracks with spacer guide edge
- ② Mylar spacer guide
- ③ Halfway distance of spacer guide

Figure B-10 Track rail alignment

4. Loosen the mounting straps enough to allow you to rotate the track assembly until the center of one track aligns with the center line on the spacer guide and the center of the other track aligns at the point where the spacer guide ends meet. The tracks should now be 180° apart. Tighten both chains but not too tight.

Sensor installation

1. Insert an index pin into the REF hole of the track marked "Reflect Mode Spacing."
2. Take one of the sensors and insert it between the track rails and to the left of the index pin with the cable connector pointing away from the pin. Move the sensor until the pin stops it. Hold sensor in place. Move sensor clamping screw over the sensor and tighten.



- ① Sensor clamping screw
- ② REF hole
- ③ Number Index hole

Figure B-11 REF and Number Index pin locations

3. Insert the other index pin into the correct Number Index hole on the other track marked "Direct Mode Spacing."
4. Insert the second sensor into the track rail with its cable connector pointing away from the pin. Move the sensor until it's stopped by the pin. Move sensor clamping screw over the sensor and tighten.
5. Using a pencil or chalk, mark a generous area around where the sensors contact the pipe.
6. Release the tension on the sensors and remove them.
7. Loosen the mounting straps and rotate the track assembly on the pipe so you can gain access to the areas marked.
8. Prepare the areas you marked by degreasing the surface, if needed, and removing any grit, corrosion, rust, loose paint or surface irregularities with the abrasive pipe conditioning material provided.
9. Rotate the track assemblies into their original position on the pipe. Use the edge of the Mylar guide as a stop for both tracks and keep them parallel. Align each track with the "center line" you previously marked on the Spacing Guide. Tighten tracks securely.

B.3 Magnetic mounting

10. This time, before installing each sensor, apply a 3mm (1/8-inch) continuous bead of couplant compound along the center (the long way) of the contact surface of the sensor. Also, keep the sensors lifted slightly from the pipe when installing until the sensor is against the pin; then push down against the pipe.

Note

Remember to install the sensors with the cable connectors facing away from each other.

11. Once the sensors are in place, secure with its clamping screws. Do not over tighten.
12. Fill connector end with Super Lube prior to connecting.
13. Apply Super Lube to the internal threads at the large end of the thread connector.
14. Observing the upstream and downstream orientation, attach the upstream (1A) and downstream (1B) cables to the other sensors and make snug. Attach the other ends to the transmitter at the 1A and 1B terminals of the transmitter.
15. Proceed to Sensor wiring (Page 47).

B.3 Magnetic mounting

B.3.1 Pre-assembly procedures

The following instructions are for installing the Magnetic mounting frames on 8-inch (DN200) or larger size carbon steel pipes in the Reflect and Direct modes. The mounting frames are compatible with all Siemens SITRANS F clamp-on C, D and E FSS200 Universal and FSS200 Hi Precision sensors.

Unpacking

Note

Refer to Figure 1-1 when unpacking unit, if necessary.

 **WARNING**

Strong magnetic fields present

Magnetic fields may cause death or serious injury.

Do not locate near pacemakers or equipment that is sensitive to magnets.


1. Unpack and disassemble the Magnetic mounting frames.

 **WARNING**

Impact hazard

Magnets may shatter during installation and may cause injury.
KEEP FRAMES SEPARATED (until installation) in order to prevent the magnets from colliding with excessive force. This may cause the magnets to shatter.

2. The box should contain two Magnetic mounting frames, two sensor clamp plate assemblies and four C-size sensor spacer plates.
3. Retain all additional sensor spacer plates and their retaining screws, if not used.

 **WARNING**

Pinch hazard

Frame installation may cause Injury to hands.
Exercise CAUTION to avoid pinching hands and fingers when installing the frames in the desired location, as the frame magnets are very strong.

Required tools

1. Felt marker or grease pencil
2. Tape measure

B.3.2 Preliminary procedures

Pipe and flowmeter setup

1. **Use the Wizard setup procedure to program the transmitter for the sensors that were selected.**
2. After receiving the spacing number index from the transmitter, make a note of the number displayed.
3. Referring to the transmitter Operating Instructions manual, confirm that the appropriate sensor settings have been selected for operation on the chosen pipe.
4. Select the mounting location on the pipe.
5. Choose a pipe location that remains full at zero flow.
6. Where possible, locate enclosure housing 10 pipe diameters or more from elbow or valve to ensure fully developed and stable flow profile.
7. On horizontal pipe sections, select a horizontal plane to avoid sediment or gas blockage of ultrasonic signal path.

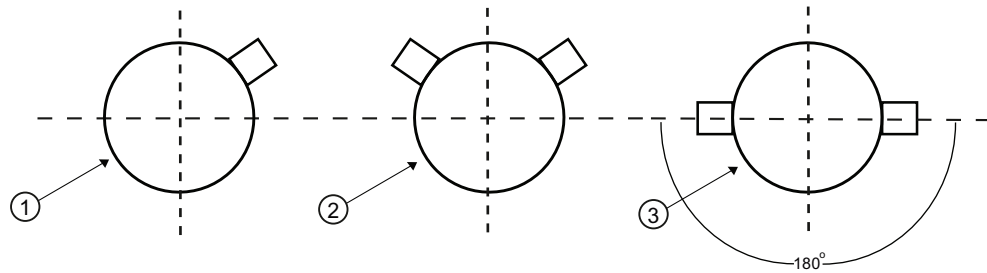
B.3 Magnetic mounting

8. Prepare the surface of the pipe. De-grease the surface, if necessary, and remove any grit, corrosion, rust, loose paint, etc. Use abrasive material provided to provide a clean contact surface for the sensors.
9. Mounting mode applications - see figures below.

Note

Do not mount frames over frost.

Do not mount frames on the seam of pipe.



- ① Single path, Reflect mode
- ② Dual path, Reflect mode
- ③ Single and Dual path Direct X mode

Figure B-12 Horizontal sensor mounting

B.3.3 Reflect mount

B.3.3.1 Magnetic mounting frame procedures

Reflect mount

The Magnetic mounting frames establish the axial alignment of the sensors and allow the removal and replacement of either sensor while preserving their exact mounting location.

1. Use the Wizard setup procedure to program the transmitter for the sensors that were selected.
2. After receiving the spacing number index from the transmitter, make a note of the number displayed.

- Determine which sensor type will be installed into the magnetic mounting frame.

Note

C and D-size FSS200 Universal sensor mounting

To mount C or D-size FSS200 Universal sensors the spacer plates must be attached to the side panels of the mounting frames. The Clamp Plate Assembly has to be placed in the C-ALL slot for C-size FSS200 Universal sensors and in the D-ALL slot for D-size FSS200 Universal sensors. Refer to figure for spacer plate locations and figures below for Clamp Plate slot and optional Clamp-on mounting strap slot locations.

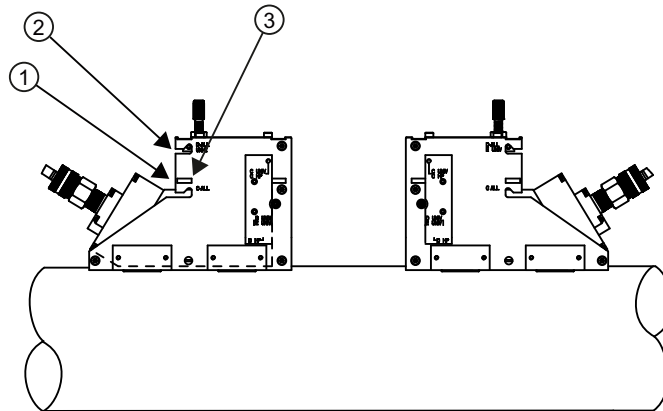


Figure B-13 Sensor clamp plate assembly location

①	Insert Clamp Plate assembly in the C-ALL slot for C-size FSS200 Universal and Hi Precision sensors.
②	Insert Clamp Plate assembly in the D-ALL/UNI-E slot for D-size FSS200 Hi Precision, Universal and E-size FSS200 Universal sensors.
③	Slots for optional clamp-on mounting straps.

- Check to ensure that you have a matched set of sensors. They both should have the same serial number but marked with either an "A" or "B" (e.g., 100A and 100B).
- The sensor selection will determine which Spacer Bar mounting frame holes will be used when attaching the spacer bar. Refer to the table below for selecting the appropriate spacer bar sensor positioning hole.

For C-size FSS200 Universal or C-size FSS200 Hi Precision sensors	Select hole marked C UNIV / C HP
For D-size FSS200 Universal and E-size FSS200 Universal sensors	Select hole marked D UNIV / E UNIV
For D-size FSS200 Hi Precision sensors	Select hole marked D HP

Mounting frame assemblies without a spacer bar

The recommended procedure to mount the frame assemblies is by using a spacer bar. If this is not available you can mount the Magnetic frame assemblies using the following method.

1. **Use the Wizard setup procedure to program the transmitter for the sensors that were selected.**
2. After receiving the spacing number index from the transmitter, make a note of the number displayed.
3. Select a mounting location on the pipe for the Reference frame assembly. (Refer to the sensor orientation diagram below.)

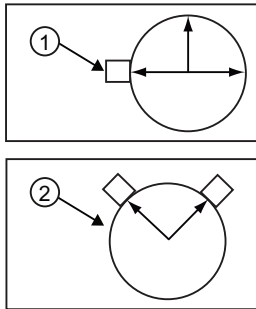


Figure B-14 Sensor orientation diagram

①	Single Channel sensors at 9 o'clock position.
②	Dual Path sensors at 10 and 2 o'clock positions.

4. At the desired mounting location, carefully place the frame assembly so that it rests on the pipe and is straight along the axis of the pipe.
5. With a pencil or marker, mark a generous area of 13 mm (1/2") all around the frame. Remove the frame assembly.
6. Prepare the area you marked by de-greasing surface, and if needed, by removing any grit, corrosion, rust, loose paint or surface irregularities with the abrasive material provided.

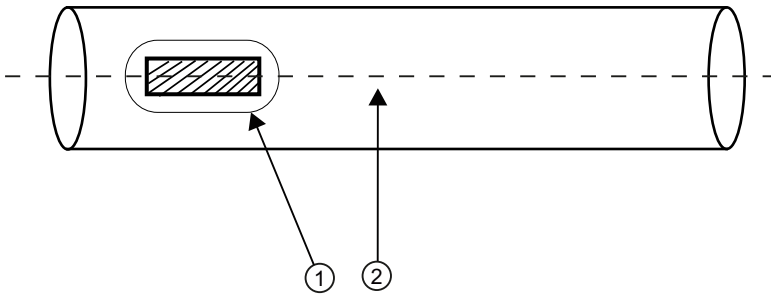


Figure B-15 Pipe preparation and frame alignment

①	Clean area of the pipe
②	Center line of horizontal pipe axis

7. Carefully place the frame assembly on the cleaned pipe location. Ensure that the frame assembly is straight along the pipe axis.

- Temporary insert a sensor into the frame assembly and push it up to the frame stop.

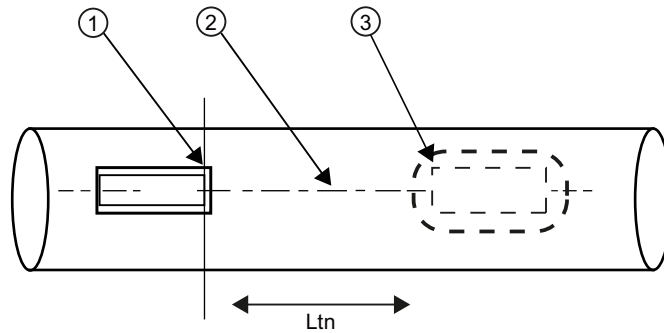


Figure B-16 Finding the second frame location

①	Measure from front of sensor
②	Horizontal pipe axis
③	Approximate location of second frame and sensor assembly

- With a measuring tape, measure the length of the Ltn from the inside edge of the sensor to an approximate location for the second frame assembly.

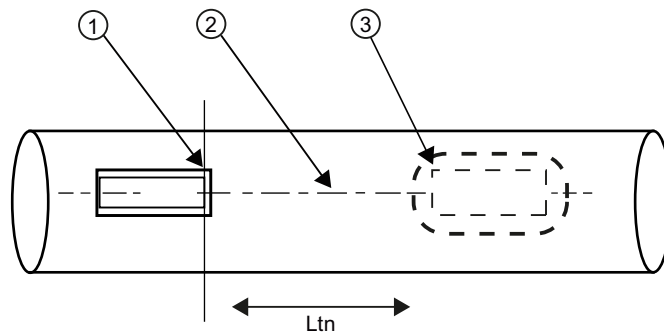


Figure B-17 Finding the second frame location

①	Measure from front of sensor
②	Horizontal pipe axis
③	Approximate location of second frame and sensor assembly

- Carefully place the second frame assembly on the pipe in the approximate location and align it with the axis of the pipe.
- With a pencil or marker, mark a generous area of 13 mm (1/2") all around the frame. Remove the frame assembly.
- Prepare the area you marked by de-greasing surface, if needed, and by removing any grit, corrosion, rust, loose paint or surface irregularities with the abrasive material provided.
- Carefully place the second frame assembly on the pipe. Temporarily insert the sensor into the frame and push it up to the frame stop.
- If feasible, use a non-metallic straight edge (length of wood, plastic ruler) to adjust the two mounting frames so they are aligned with each other and the horizontal axis of the pipe.

B.3 Magnetic mounting

15. Using a measuring tape, measure the Ltn distance from sensor to sensor.

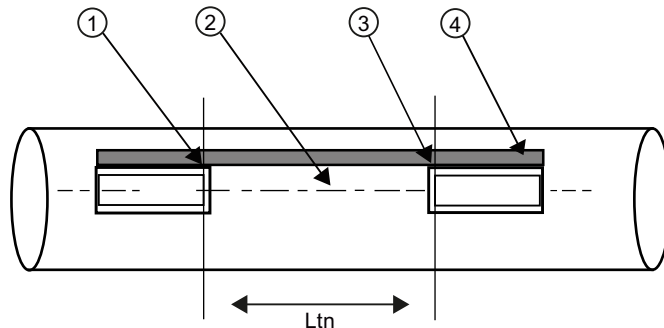


Figure B-18 Side view of pipe

①	Front of the Reference sensor
②	Horizontal axis line of the pipe
③	Front of the second sensor
④	Straight edge used for aligning frame assemblies

16. Adjust the second frame assembly as needed.

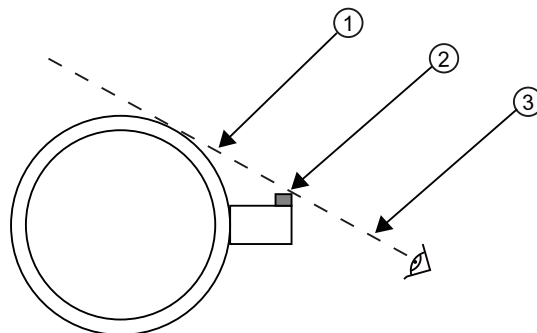


Figure B-19 Aligning frames with horizontal pipe axis

①	Aligning sensors with pipe
②	Straight edge used for aligning frame assemblies
③	Line of sight

17. If optional clamp-on mounting straps are needed install them now or proceed to Installing the sensors (Page 114).

Optional clamp-on mounting straps

Note

IMPORTANT

If magnetic mounting frames are to be used in temperatures above 100°C (212°F) clamp-on mounting straps are recommended.

The use of clamp-on mounting straps to mount the frames to the pipe is optional. Their use is dependent upon the environment and location of the pipe.

Note

Only use worm-gear style mounting straps.

1. Once the mounting frames are at the final mounting location, slide the mounting straps through the strap slots on the frame and then around the pipe.

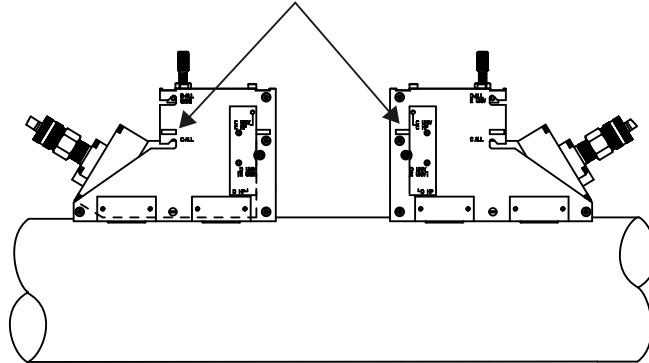


Figure B-20 Mounting strap slots

2. Tighten the mounting straps to seat the mounting assembly firmly on the pipe. Do not over tighten.

Mounting with spacer bar

Magnetic frames can be installed with a spacer bar, if available. Refer to Reflect mount (Page 40) for installation instructions.

B.3.4 Direct mount

B.3.4.1 Installation instructions

The Magnetic mounting frames establish the axial alignment of the sensors and allow the removal and replacement of either sensor while preserving their exact mounting location.

For Direct mount installation instructions refer to Direct mount (Page 93).

B.3.5 Installing the sensors

Sensor installation

1. Take either sensor and apply a continuous lengthwise 3 mm (1/8-inch) bead of coupling compound across the center of the sensor emitting surface

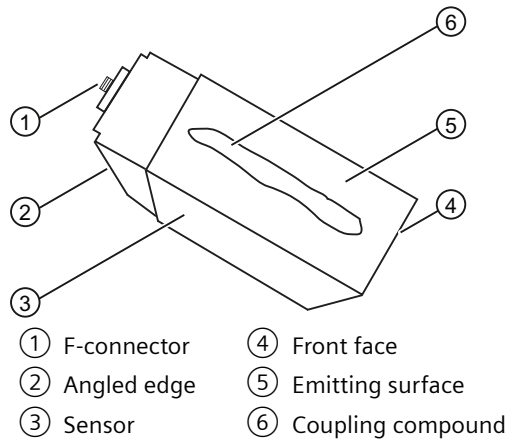


Figure B-21 Sensor

2. Slide sensor into the angled end of the Reference mounting frame, with the sensor F-connector facing out. Keep sensor from making contact with the pipe until it butts up against the mounting frame stop. Push sensor down to mate with pipe.

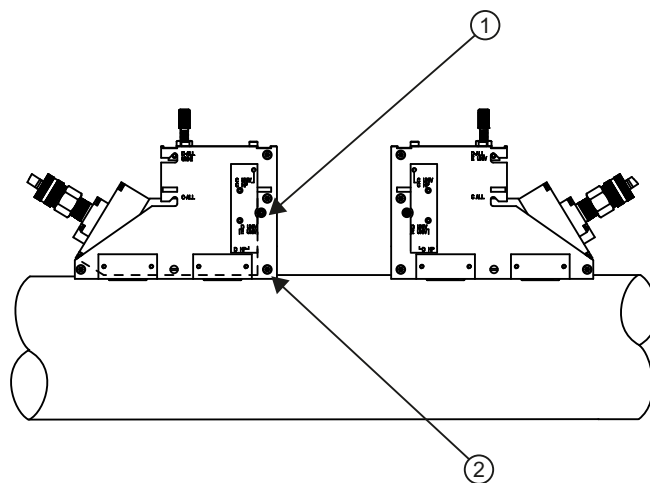


Figure B-22 Sensor mounting top locations

①	Stop location for D and E-size FSS200 sensors
②	Stop location for C-size FSS200 sensor

3. Align the mounting pins of the clamp plate assembly with the frame and insert into the frame.

- Select the desired sensor hole and screw in the Clamping Screw.

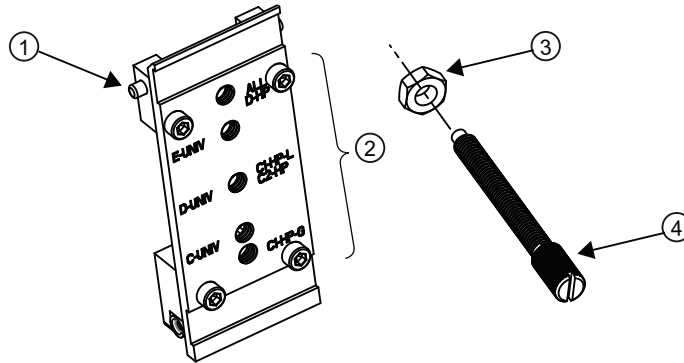


Figure B-23 Clamp plate assembly

①	Mounting pins
②	sensor selection positioning holes
③	Locking nut
④	Clamping screw

- Tighten the sensor clamping screw to hold the sensor firmly in place. Tighten the clamping screw locking nut but not so tight that the magnetic frame lifts off the pipe. *Repeat procedure for the other sensor.*
- Fill connector end with Super Lube prior to connecting.
- Apply Super Lube to the internal threads at the large end of the thread connector.
- Observing the upstream and downstream orientation, attach the upstream (1A) and Downstream (1B) cables to the sensors and make snug. Attach other ends to the transmitter at 1A and 1B terminals of the transmitter.
- Proceed to Sensor wiring (Page 47).

See also

Mounting temperature sensors (Page 54)

B.4 Hi Precision mount

B.4.1 Pre-assembly procedures

The following instructions are for installing Hi Precision mounts on various size pipes in the Reflect and Direct modes.

Note

It is recommended that two persons be available to perform these installation procedures.

Unpacking

Note

Refer to Figure 2-1 when unpacking unit, if necessary.

1. Unpack and disassemble the clamp-on sensor enclosure(s). Cut away plastic tie-wraps using a pair of cutting pliers.
2. Remove enclosure housing covers. To remove covers, loosen screws then lift and slide covers through keyways. The screws do not need to be removed.
3. Loosen the sensor Clamp Plate nut and set screws.
4. Remove Strap Retainer nuts and washers from enclosure housing(s) stand offs and lift off housing(s).
5. Retain all removed hardware.

Required tools

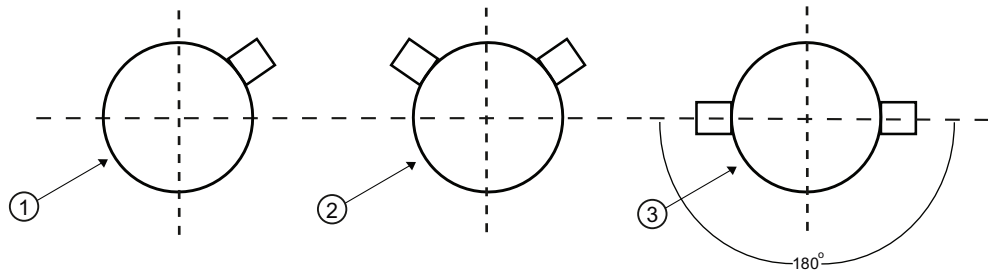
- Hex Key set S.A.E 5/32 and 1/8-inch
- Phillips Head #2 screwdriver
- 7/16-inch deep socket
- 7/16-inch open end wrench
- Flat blade screwdriver
- Torque limiting drive/wrench (in/lbs)
- Cutting pliers
- Felt marker or grease pencil
- Mylar template material (for Direct mounting)
- Masking tape (for Direct mounting)
- Tape measure

B.4.2 Pipe preparation and flowmeter setup

Preliminary pipe and flowmeter setup

1. **Use the Wizard setup procedure to program the transmitter for the sensors that were selected.**
2. Refer to the transmitter to confirm that the appropriate sensors and enclosure settings have been selected for operation on the chosen pipe.
3. Select the mounting location on the pipe.
4. Choose a pipe location that remains full at zero flow.

5. Where possible, locate enclosure housing 10 pipe diameters or more (20 diameters for gas applications) from elbow or valve to ensure fully developed and stable flow profile.
6. On horizontal pipe sections, select a horizontal plane to avoid sediment or gas blockage of ultrasonic signal path.
7. Mounting mode applications - see figures below.



- ① Single path, Reflect mode
- ② Dual path, Reflect mode
- ③ Single and Dual path direct X mode

Figure B-24 Horizontal sensor housing mountinging

8. Prepare pipe for mounting the enclosure housing by removing grit, corrosion, coating or heavy paint. Avoid grinding which can cause distortion of the pipe surface.
9. Clean and degrease pipe surface.

Note

Do not mount enclosure housings over frost.

Do not mount enclosure housings on the seam of pipe.

10. Smooth the surface to accept sensors by using the supplied abrasive pad.

B.4.3 Reflect mount

B.4.3.1 Reflect mount installation

Overview

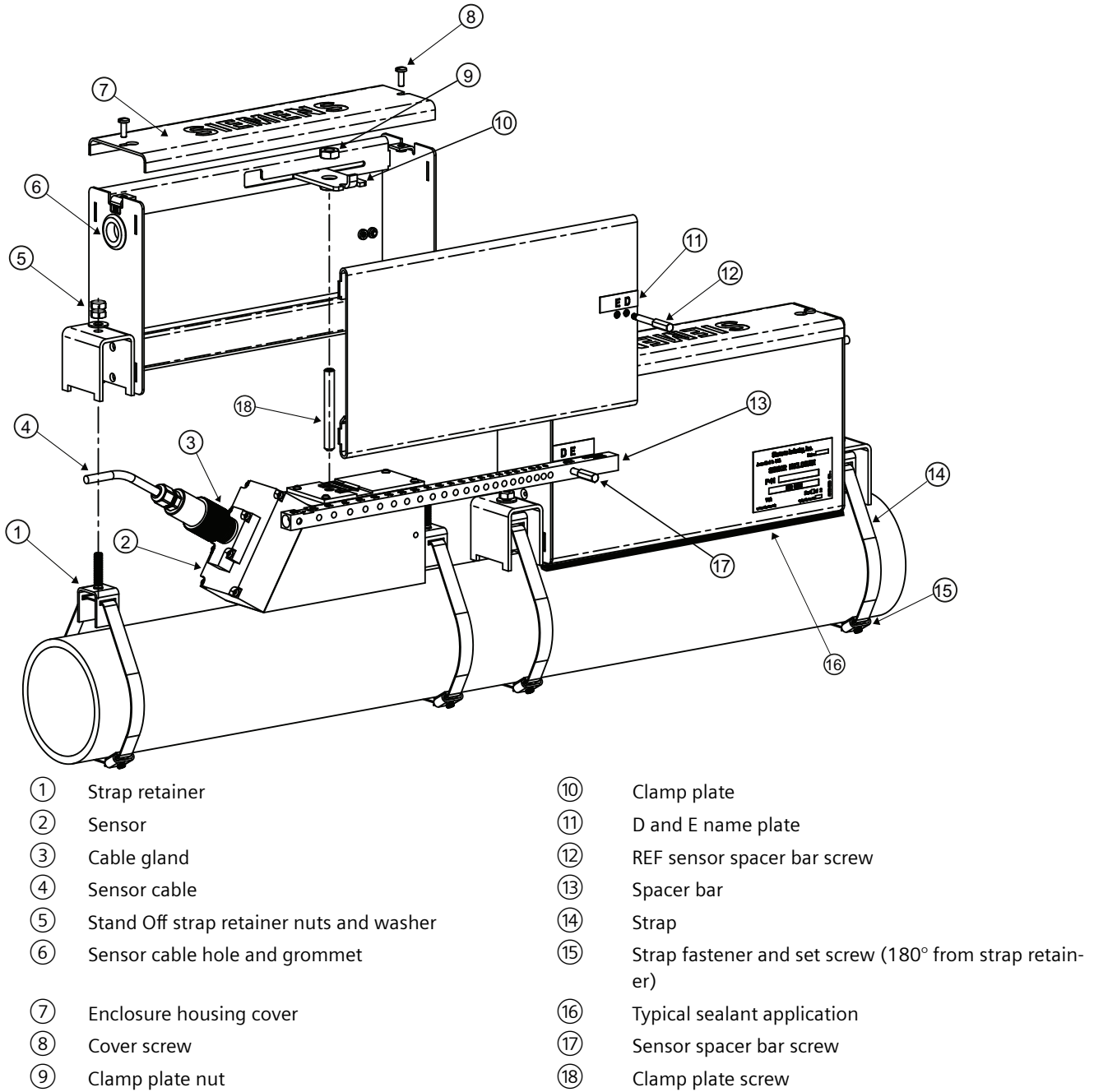


Figure B-25 Overview - Dual enclosure Reflect mount

Note

Applying sealant - Refer to ⑩ in figure above.

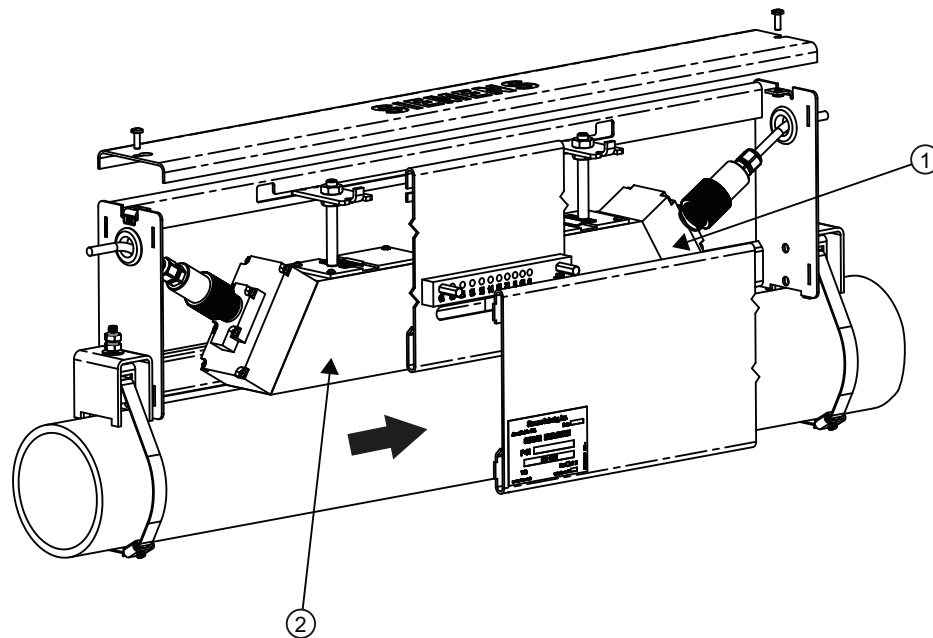
In environmentally challenging conditions it is an accepted practice to apply a heavy bead of sealant material such as silicone caulking or other environment appropriate material between the enclosure and the pipe surface that leaves an area at the lowest elevation free for drainage.

Note

Always mount sensors above the horizontal plane of the pipe. Avoid mounting directly on top or bottom of horizontal pipes.

Single enclosure Reflect mount

Sensor locations



- ① Downstream sensor
- ② Reference sensor (REF) or fixed sensor

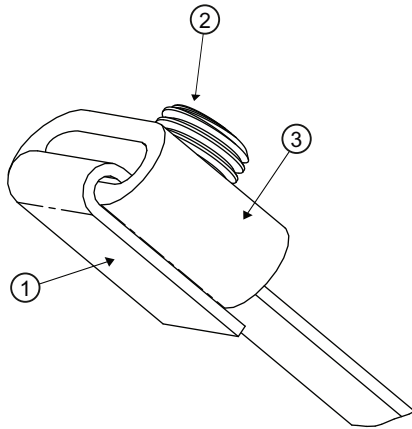
Figure B-26 Single enclosure - Reference sensor location

Mounting straps for Reflect mount - Single enclosure

1. Use the Wizard setup procedure to program the transmitter for the sensors that were selected.
2. Determine the correct sensor spacing as indicated by the transmitter.
3. Place the enclosure housing on the pipe and mark pipe at each strap location using chalk or a grease pencil.

B.4 Hi Precision mount

4. Prepare straps for mounting by cutting to required length. Strap length should be twice the pipe circumference plus 15.24 cm (6 inches).
5. Remove set screw from strap fastener. Retain set screw.
6. After strap is cut to correct length feed strap into strap fastener (small set-screw clamp). Bend 2.54 cm (1-inch) of the end lip around the strap fastener.



- ① Bend strap over
- ② Set screw
- ③ Strap fastener

Figure B-27 Bending strap end

Note

For Reflect mount, install strap retainer for each path (i.e. Single path Reflect mount will have one strap retainer, Dual path Reflect mount will have two strap retainers at each strap location). For Direct mount, install two strap retainers at each strap location.

7. Mount the straps at the previously marked locations. Loop strap around pipe and feed the open end of the strap through the strap fastener and strap retainer. Pull loose end of strap to remove slack.

- Repeat for second strap by looping strap around pipe and feeding open end through strap fastener and strap retainer. Pull loose end of strap tight to remove slack.

Note

Keep strap fastener in the center between the two strap retainers. See figure below.

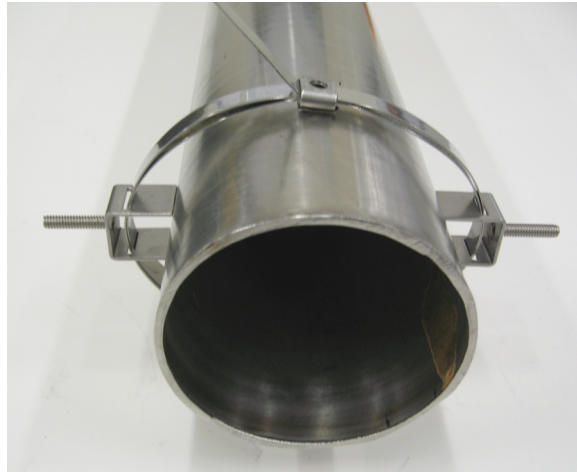


Figure B-28 Typical strap and strap retainer setup

- Take up the slack in the strap and position the strap retainer(s) at the selected plane(s); either single or dual path.
- Position the strap fastener away from the strap retainer for single path or at the best location.
- Bend the loose end of the strap to prevent it from loosening. Retrieve the strap fastener set screw and install and tighten the set screw using the hex key.
- Recheck alignment. Strap retainers should be aligned with each other and inline with the pipe axis. The straps should now be mounted correctly for the selected path.

Mounting straps for Reflect mode - Dual enclosure

Note

Refer to Reflect mount overview figure as needed.

Follow the same mounting strap procedures used above for a Single enclosure housing but add two more straps and two more strap retainers per strap.

B.4.3.2 Single enclosure - Reflect mount

Installation procedure

1. Place the enclosure housing over the strap retainers and slip into place. It may be required to align or adjust the strap retainer studs to fit into their respective stand off holes. Be aware of the flow direction and the upstream side (reference) and downstream side (adjustable).



Figure B-29 Stand off adjustment

Note

When more than one path is installed, position the enclosure housing so the Reference sensor (REF) of each path is on the same end of the pipe. Sensor ends should be facing each other.

2. Install strap retainer nuts and washers at every stand off location.
3. Tighten one end of the enclosure housing just enough to keep housing from moving. Continue to reposition the other end of the enclosure housing until the housing is centered.
4. Tighten the other strap retainer nut just enough to keep enclosure housing from moving while maintaining alignment of stand offs.
5. Visually verify that the enclosure housing is in line with the pipe axis by comparing the top edge of the housing to the linear axis of the pipe. Adjust if necessary.
6. Repeat above steps for all remaining paths.

7. Fully tighten and torque all stand off strap retainer nuts to approximately 2.25 - 2.8 newton/meters (20-25 in/lbs). **Lock stand offs in place with second nut.**



Figure B-30 Installed Hi Precision mount single enclosure housing

8. Proceed to installing Sensors - Single enclosure. (Page 125)

B.4.3.3 Dual enclosure - Reflect mount

Installation procedure

1. Install strap retainers and straps on pipe as shown.

Note

Where possible adjust the strap retainers in the 10 and 2 o'clock positions. See figure below.



Figure B-31 Strap retainer and strap installation

2. Place the first enclosure housing stand offs over the strap retainers and slip into place. It may be required to align or adjust the strap retainer studs to fit into their respective stand off holes. Be aware of the flow direction and the upstream side (reference) and downstream side (adjustable).

Note

When mounting enclosures maintain alignment of strap retainers. When more than one path is installed, position the enclosure housing so the Reference sensor (REF) of each path is on the same end of the pipe. Sensor ends should be facing each other.

B.4 Hi Precision mount

3. Install strap retainer nuts and washers at every stand off location.
4. Tighten one end of the enclosure housing just enough to keep housing from moving. Continue to reposition the other end of the enclosure housing until the housing is centered.
5. Tighten the other strap retainer nut just enough to keep enclosure housing from moving.
6. Visually verify that the enclosure housing is in line with the pipe axis by comparing the top edge of the housing to the linear axis of the pipe. Adjust if necessary.
7. Repeat above steps for all remaining paths.
8. Tighten and all stand off strap retainer nuts.
9. **Repeat installation for second enclosure housing.**
10. Attach spacer bar by inserting reference sensor pin into the REF hole. Insert Index Number pin into appropriate Index Number hole.

Note

There are two threaded holes in each enclosure housing, labeled "D" and "E". Use the hole that matches the sensor size.

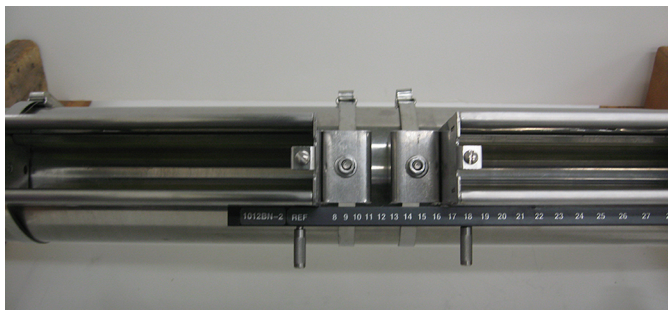


Figure B-32 Spacer bar setup

11. Fully tighten and torque all stand off strap retainer nuts to approximately 2.25 - 2.8 newton/ meters (20-25 in/lbs). **Lock stand offs in place with second nut.**
12. Proceed to installing Sensors - Dual enclosure (Page 128).

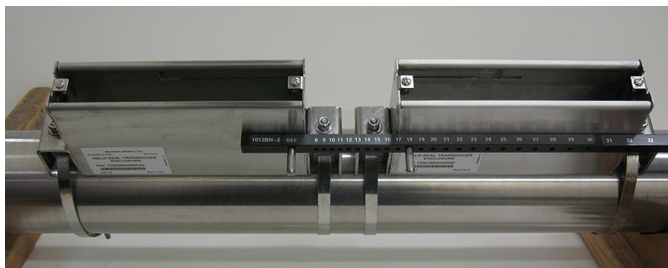


Figure B-33 Installed Hi Precision mount dual enclosure housings

B.4.3.4 Sensors - Single enclosure

Installation procedure

Note

In the following procedure use the coupling compound that is supplied with your sensor.

1. Thread unterminated sensor cable through enclosure housing grommet and terminate cable end with F-connector and cable gland assembly. For sensor cable selection refer to Technical data (Page 85). For sensor assembly instructions refer to Sensor wiring (Page 47).
-

Note

If required, replace supplied grommet with conduit fitting on cable gland.

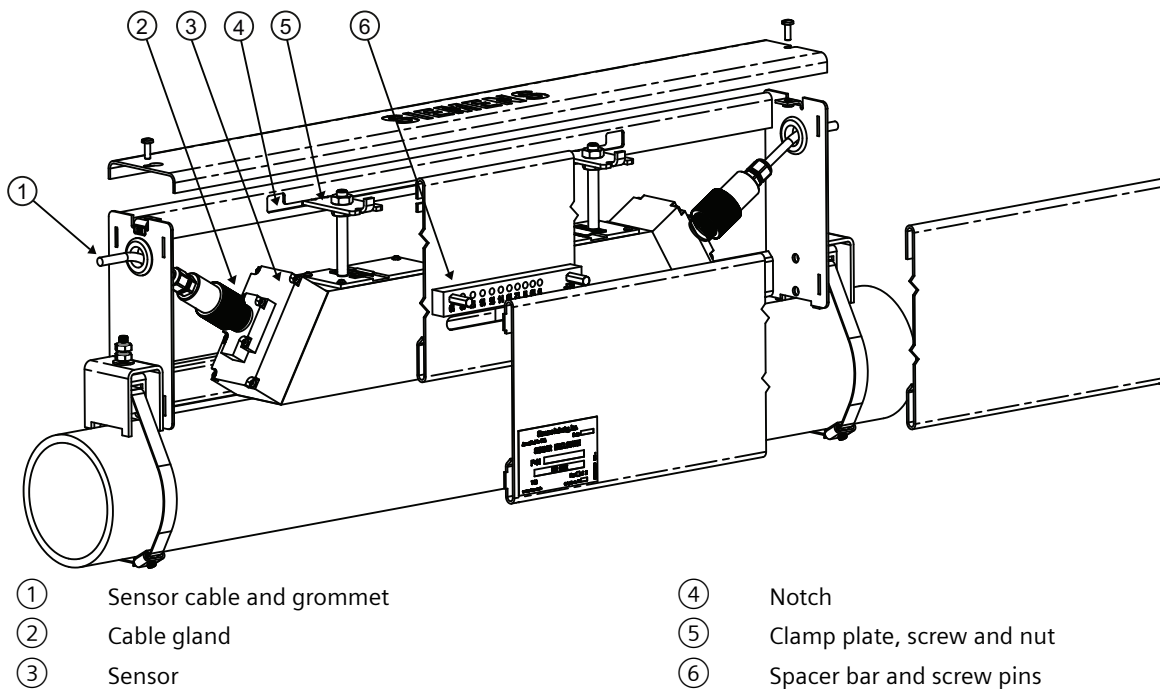


Figure B-34 Hi Precision mount Single enclosure sensor installation

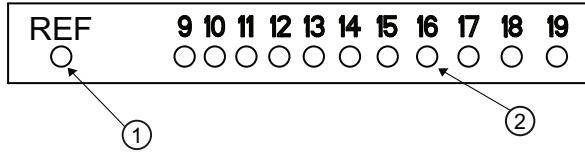
2. Fill connector end with Super Lube prior to connecting.
 3. Apply Super Lube to the internal threads at the large end of the thread connector.
 4. Connect cable to sensor and then thread cable gland on to sensor.
 5. Take either sensor and apply a continuous lengthwise 3 mm (1/8-inch) bead of coupling compound across the center of the sensor emitting surface.
-

Note

Within the side walls of the enclosure housing there is a short vertical slot and a long horizontal slot. The short vertical slot is the reference sensor position (REF).

B.4 Hi Precision mount

- 6. Place the spacer bar on the enclosure side wall and insert the screw pin through the REF hole of the spacer bar.
- 7. Lower the fixed reference sensor into the enclosure housing with one hand and then, with the other hand, insert the threaded end of the screw pin through the REF slot and into the sensor. Make sure sensor does not make contact with the pipe at this time.



- ① Reference hole (REF)
- ② Index numbers

Figure B-35 Spacer bar

Note

Be careful not to catch or compromise the yellow insulating tape while inserting the sensor. The insulating tape is used to insulate metal components of the sensor for cathodically protected pipe.

- 8. Mate the sensor to the pipe.

Note

Do not smear couplant while mating sensor to pipe.

- 9. Position clamp plate screw assembly into notch and slide over sensor.

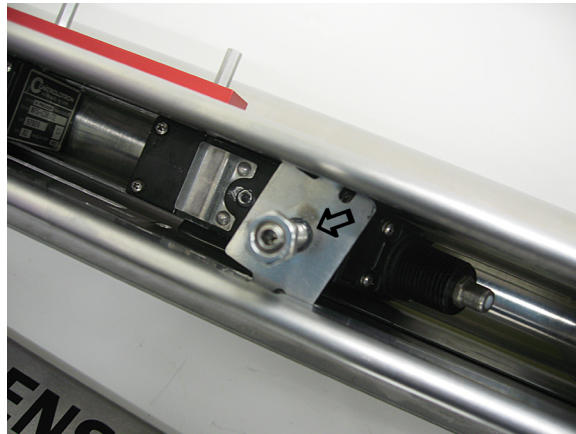


Figure B-36 Sensor clamp plate screw and locking nut

Note

Each enclosure will have one sensor from each opposing sensor set; i.e. The enclosure housing at path 1 will have the "A" sensor from set 1 mounted in the upstream location and the "B" sensor from set 2 will be mounted in the downstream location. The enclosure housing for path 2 will have the "A" sensor from set 2 mounted in the upstream location and the "B" sensor from set 1 will be mounted in the downstream location.

10. Tighten clamp plate screw to secure sensor and torque to 1.7 newton/meters (15 in/lbs). Ensure plate screw aligns with detent in top of sensor. Secure with locking nut.

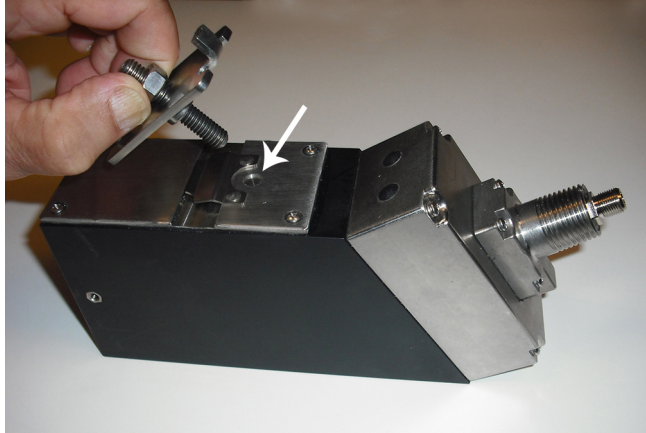


Figure B-37 Sensor detent

11. Insert second unterminated sensor cable through other enclosure housing grommet and terminate cable. (Refer to previous cable instructions.)
12. Insert the second sensor into the enclosure housing and align with the spacing number index hole on the spacer bar. Correct index hole will be provided by transmitter during install process.
13. Insert the index pin into the proper hole in the spacer bar, align the sensor with the hole and screw in pin.



Figure B-38 Spacer bar

14. Mate the sensor to the pipe.

Note

Do not smear couplant while mating sensor to pipe.

15. Position clamp plate screw assembly into notch and slide over sensor.
16. Tighten clamp plate screw to secure sensor and torque to 1.7 newton/meters (15 in/lbs). Secure clamp plate screw with locking nut.

17. Install enclosure housing cover using a flat blade screwdriver and cover screws.

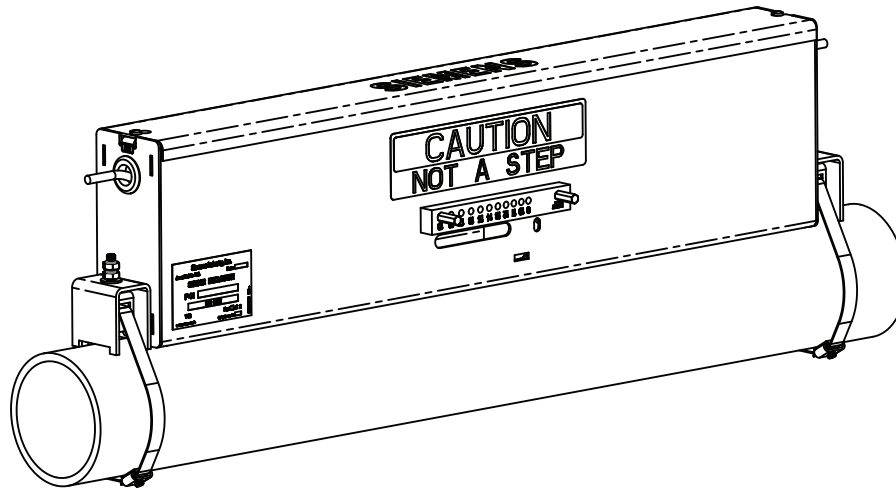


Figure B-39 Installed Hi Precision mount single enclosure

18. Proceed to Sensor wiring (Page 47) to connect sensor cables to the transmitter.
19. Complete the flowmeter make-up process and verify that the sensor installation is complete before continuing to the final step. Adjustment of the index pins may be required.
20. The installation of the sensors is now complete.
21. Return to transmitter and finalize programming.

B.4.3.5 Sensors - Dual enclosure

Installation procedure

Note

In the following procedure use the coupling compound that is supplied with your sensors.

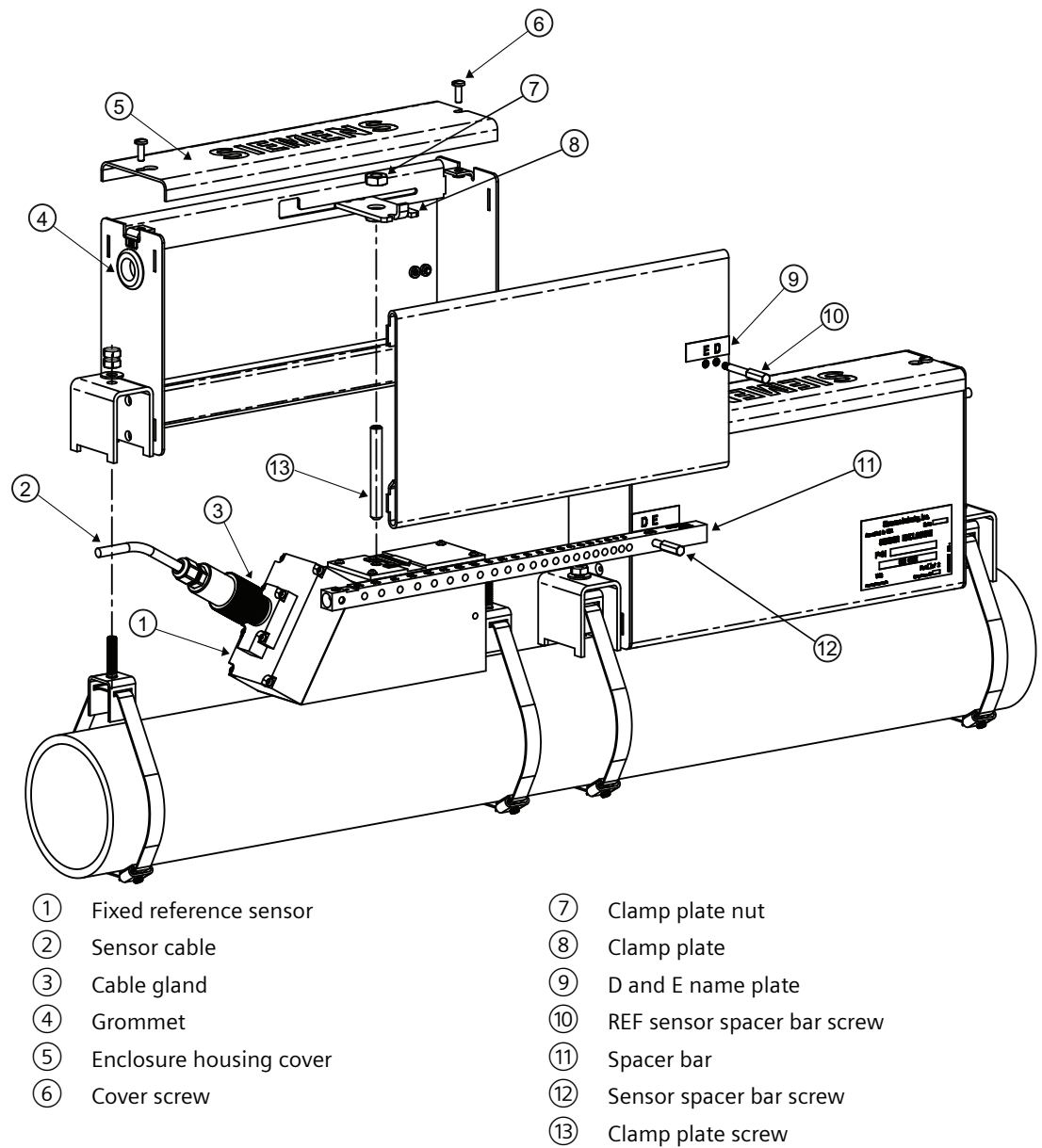


Figure B-40 Sensor installation - Hi Precision mount dual enclosure

1. Thread unterminated cable through enclosure housing grommet and terminate cable end with F-connector and cable gland assembly. For sensor cable selection refer to Technical data (Page 85). For sensor assembly instructions refer to Sensor wiring (Page 47).

Note

If required, replace supplied grommet with fitting on cable gland.

2. Fill connector end with Super Lube prior to connecting. Install sensor cable.
3. Apply Super Lube to the internal threads at the large end of the thread connector.
4. Attach cable to sensor and then attach cable gland and screw on.

B.4 Hi Precision mount

5. Take either sensor and apply a continuous lengthwise 3 mm (1/8-inch) bead of coupling compound across the center of the sensor emitting surface.

Note

Within the side walls of the enclosure housing there is a short vertical slot and a long horizontal slot. The short vertical slot is the reference sensor position (REF).

6. Place the spacer bar on the enclosure side wall and insert the screw pin through the REF hole of the spacer bar.
7. Lower the fixed reference sensor into the enclosure housing and push the sensor back against the end plate. Then insert the threaded end of the screw pin through the REF hole in the spacer bar and into the enclosure housing. Make sure sensor does not make contact with the pipe at this time.

Note

Make sure to align sensor in enclosure housing flush against alignment dimple in end plate opposite cable end.

Note

Be careful not to catch or compromise the yellow insulating tape while inserting the sensor. The insulating tape is used to insulate metal components of the sensor for cathodically protected pipe.

8. Mate sensor with pipe.

Note

Do not smear couplant while mating sensor to pipe.

9. Position clamp plate screw assembly into notch and slide over sensor.

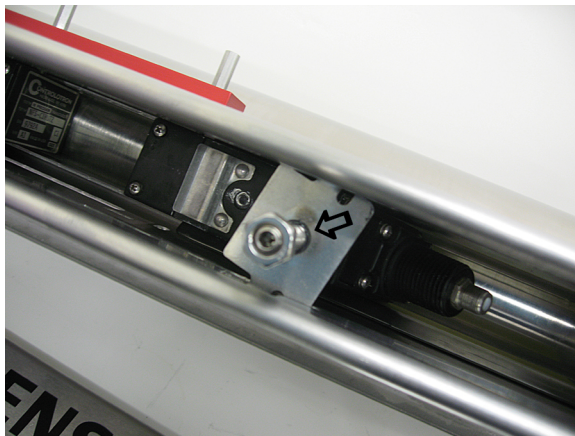


Figure B-41 Sensor clamp plate screw and locking nut

10. Tighten clamp plate screw to secure sensor and torque screw to 1.7 newton/meters (15 in/lbs). Ensure plate screw aligns with detent in top of sensor. Secure with locking nut.

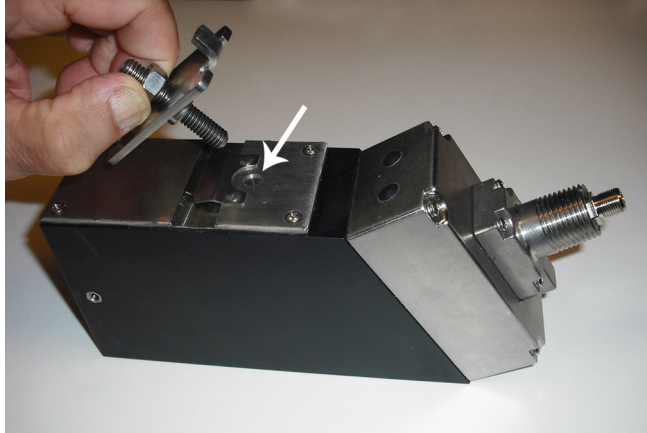


Figure B-42 Sensor detent

11. Thread second unterminated sensor cable through enclosure housing grommet and terminate cable. (Refer to previous cable instructions.)
12. Install second sensor as described above.
13. Install enclosure housing covers using a flat blade screwdriver and cover screws.

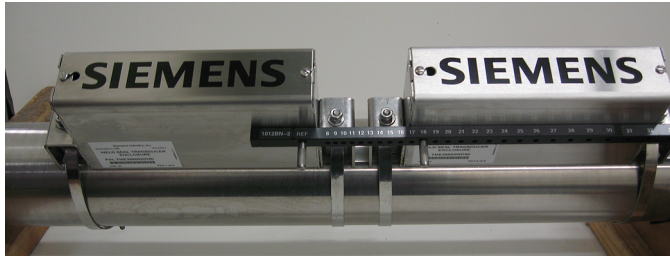


Figure B-43 Installed Hi Precision mount dual enclosure

14. Proceed to Sensor wiring (Page 47) to connect the sensor cables to the transmitter.
15. Complete the flowmeter make-up process and verify that the sensor installation is complete before continuing to the final step. Adjustment of the index pins may be required.
16. Installation of the sensors is now complete.
17. Return to transmitter and finalize programming.

B.4.4 Direct mount

B.4.4.1 Direct mount installation

Direct mode - Dual enclosure

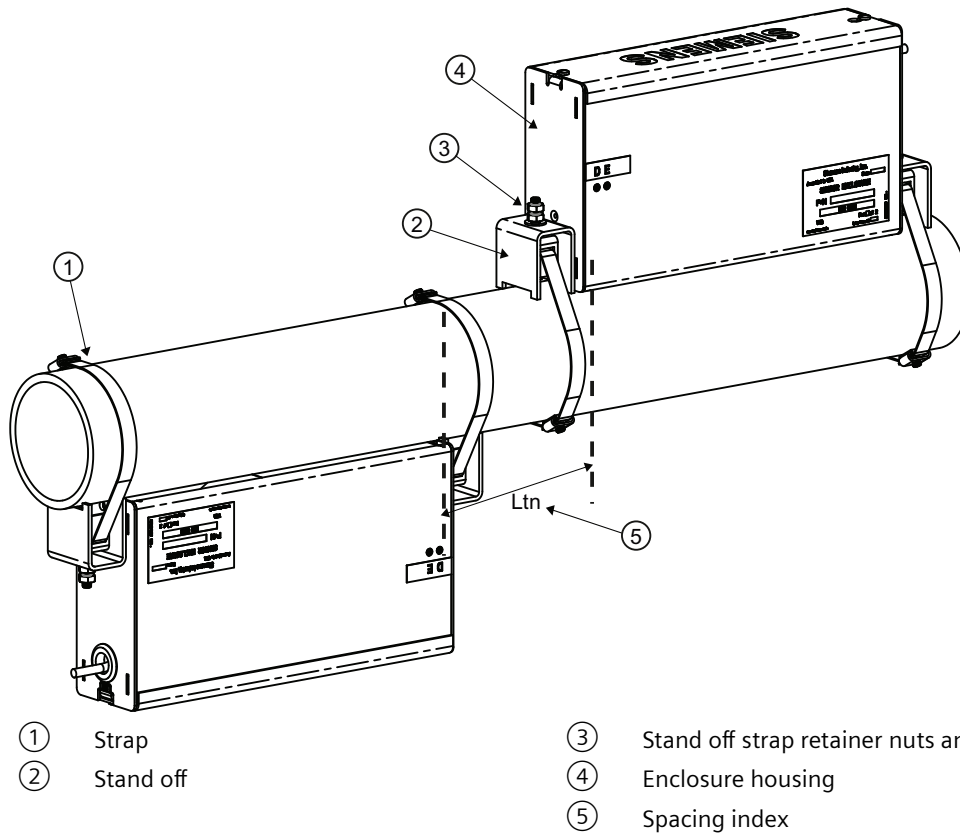
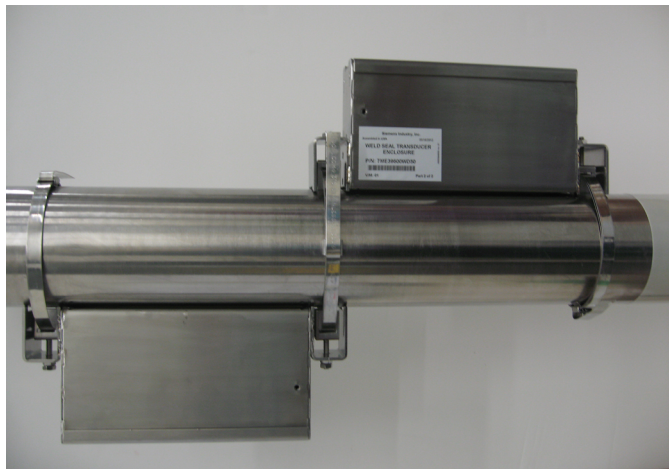


Figure B-44 Hi Precision mount Direct mode Dual enclosure (for index spacing greater than minimum values)



B.4 Hi Precision mount

8. Align the marks on the template with the horizontal plane of the pipe. Align the strap retainers, on center, with the marks on the Mylar template.



Figure B-47 Mylar template

9. Use the Wizard setup procedure to program the transmitter for the sensors that were selected.
10. Check index spacing on the flowmeter and adjust strap retainers for the correct spacing between the sensors.

B.4.4.3 Direct mount enclosure housings

Installation procedure

1. Install the first enclosure housing and align it with the center line of the Mylar template.
2. Fully tighten and torque all stand off strap retainer nuts to approximately 2.25 - 2.8 newton/meters (20-25 in/lbs). **Lock stand offs in place with second nut.**

Note

Maintain the alignment of the stand offs throughout the remaining installation procedures. This is the reference point used when mounting the sensor housing and aligning the remaining stand offs and strap retainers.

3. Loosely install the second enclosure housing. Position it 180° from the Mylar template center line.
4. Fully tighten and torque all stand off strap retainer nuts to approximately 2.25 -2.8 newton/meters (20-25 in/lbs). **Lock stand offs in place with second nut.**

B.4.4.4 Sensor installation - Dual enclosure direct mount

Installation Procedure

1. Thread unterminated cable through first enclosure housing grommet and terminate cable end with F connector and cable gland assembly. For sensor cable selection refer to Technical data (Page 85). For sensor assembly instructions refer to Sensor wiring (Page 47).
2. Fill connector end with Super Lube prior to connecting. Install sensor cable.
3. Apply Super Lube to the internal threads at the large end of the thread connector.
4. Attach cable to sensor and then attach cable gland and screw on.
5. Take either sensor and apply a continuous lengthwise 3 mm (1/8-inch) bead of coupling compound across the center of the sensor emitting surface.

Note

Be careful not to catch or compromise the yellow insulating tape while inserting the sensor. The insulating tape is used to insulate metal components of the sensor for cathodically protected pipe.

6. Align sensor in enclosure housing flush against alignment dimple in end plate opposite the cable end.
7. Mate sensor with pipe.

Note

Do not smear couplant while mating sensor to pipe.

8. Position clamp plate assembly into notch and slide over sensor.

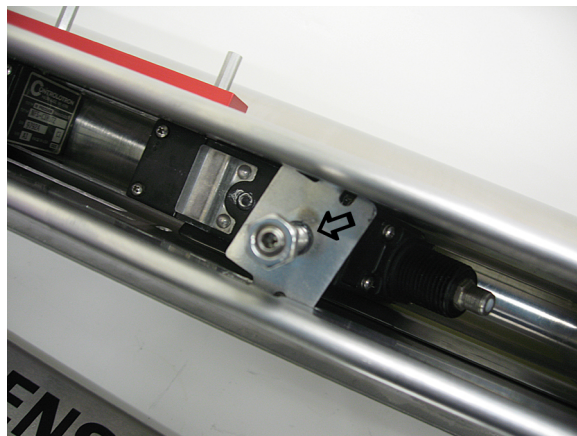


Figure B-48 Sensor clamp assembly screw and locking nut

B.4 Hi Precision mount

- Using the hex key tighten clamp plate screw to secure sensor and torque screw to 1.7 newton/meters (15 in/lbs). Ensure that center plate screw is aligned with the sensor detent. Secure with locking nut.

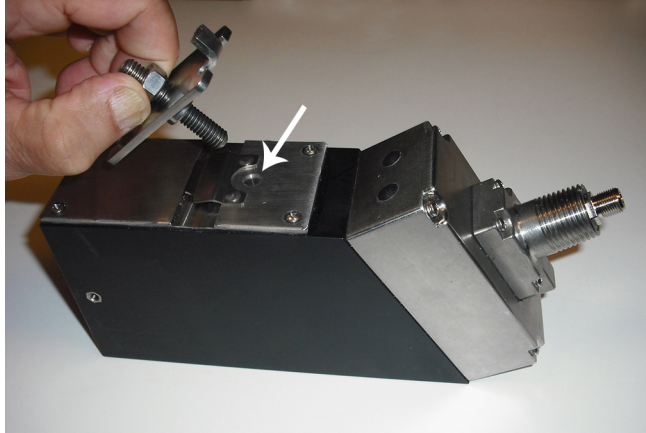


Figure B-49 Sensor detent

- Fully tighten and torque all stand off strap retainer nuts for second enclosure housing to approximately 2.25 - 2.8 newton/meters (20-25 in/lbs). **Lock stand offs in place with second nut.**
- Repeat sensor installation procedure for second sensor.
- Install enclosure housing covers using a flat blade screwdriver and cover screws.
- Proceed to Sensor wiring (Page 47) to connect sensor cables to the transmitter.
- Complete the flowmeter make-up process and verify that the sensor installation is complete before continuing to the final step.
- Return to transmitter and finalize programming.

B.4.4.5 Direct-X mount - Dual enclosure

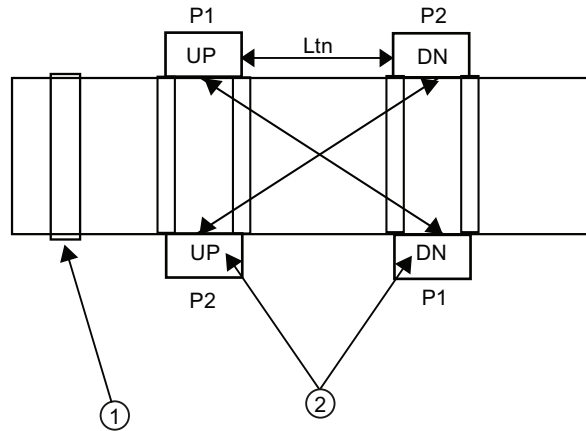
Installation procedure

Note

Hi Precision mount Direct-X mode can only be used for installations when the spacing index is greater than 7.62 cm (3 inches).

- Use the Wizard setup procedure to program the transmitter for the sensors that were selected.**
- After receiving the spacing number index from the transmitter, make a note of the number displayed.

- Referring to figure below, install straps for UP/DN path and then set the second set of straps for the DN/UP path. Refer to the index spacing to space the second set of straps.



- ① Mylar strip
- ② Paths

Figure B-50 Direct-X paths

- Using a marker, mark locations for placing all four straps.
- Place enclosure housing over the UP/DN path straps. Install the enclosure housing and tighten straps.
- Loosely install second enclosure housing.
- Check the index spacing and move enclosure housing to index spacing mark on the pipe.
- Remove the enclosure housing and tighten straps and then re-install enclosure housing.
- Check index spacing and ensure enclosure housing is axially aligned with the pipe.
- Proceed to Sensor wiring (Page 47).

B.4 Hi Precision mount

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