SIEMENS

SITRANS F

Ultrasonic Flowmeters

SITRANS FST020 IP65 NEMA 4X - 7ME3570

Quick Start

Edition 2/2014

Answers for industry.

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SITRANS F

Ultrasonic Flowmeters FST020 IP65 NEMA 4X Quick Start

Operating Instructions

To retrieve latest FST020 Operating Instructions manual go to: http://sie.ag/1lE9cny

2/2014

A5E03086489-AH

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.

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Order number: A5E03086489
℗ 02/2014 Technical data subject to change

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Introduction 1

This Quick Start is for Siemens SITRANS F flow meters.

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.

Note

It is the responsibility of the customer that the instructions and directions provided are read, understood and followed by the relevant personnel before installing the device.

Note

For complete Safety Considerations and Ratings, refer to the Operating Instructions manual included with the unit.

1.1 Items supplied

- SITRANS FST020 IP65 (NEMA 4X) Transmitter
- SITRANS F Literature CD
- Quick Start Guide

Note

For additional items refer to your packing slip.

Installing/Mounting 2

2.1 Application Guidelines

Basic Requirements

- Determine pipe material and dimensions.
- Avoid vertical pipes flowing in a downward direction.
- Avoid installation of sensors on the top and bottom of horizontal pipes, where possible.
- Select a location with the longest straight run of pipe.
- Identify upstream piping configuration (elbow, reducer, etc.).
- Pipe surface should be smooth and, if necessary, free of dirt and grease.
- Avoid pressure reduction components upstream, where possible.
- Avoid mounting on or near weld seams.
- Pipe must be full during set-up.

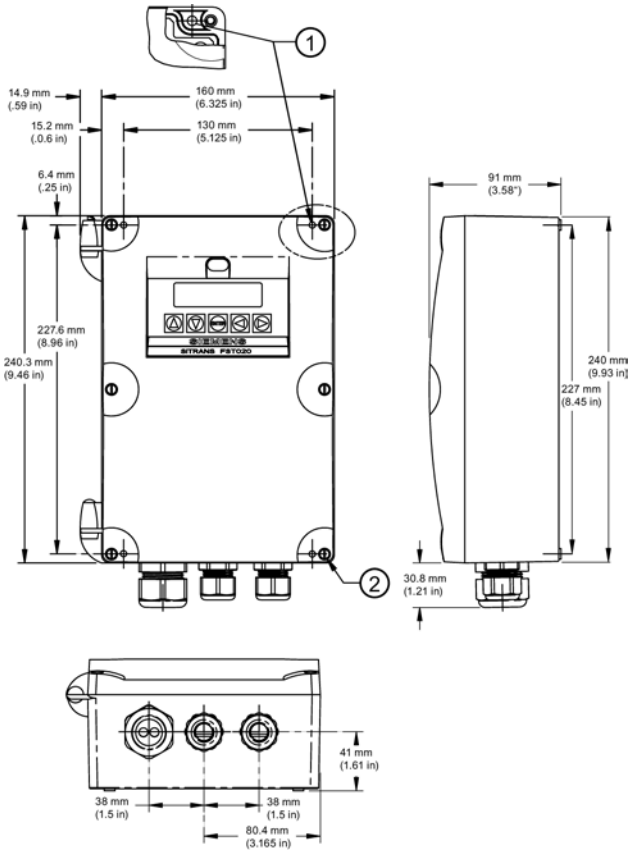
2.2 Mounting the Transmitter

⚠ WARNING
Hazardous Voltage May cause death or serious personal injury. Disconnect power before working on this product.

Wall Mounting

The transmitter can be mounted on any wall surface including wood, metal or concrete. Use the appropriate bolts and screws as needed for your mounting application and adhere to local codes.

- Recommended mounting: directly to wall or to electrical cabinet back panel.
- If alternate mounting surface is used it MUST support four times the weight of the unit.



① Mounting holes
② Enclosure cover screws

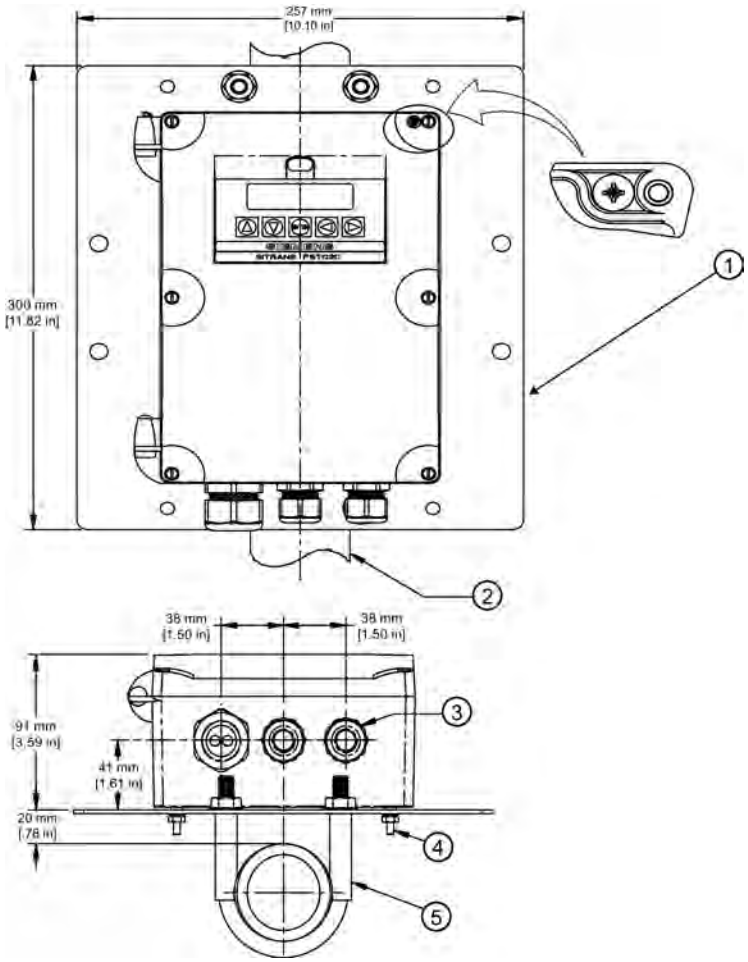
Figure 2-1 Wall Mounting

Mounting the Enclosure

1. Loosen the Enclosure cover screws and open the cover to reveal the mounting screw holes.
2. Mark and drill four holes in the mounting surface for the four #8 screws (supplied).
3. Fasten with a long flat-blade screwdriver.

Pipe Mounting

For installation on 2-inch standpipe use Pipe Mounting Kit CQO:1012NMB-1 (optional - see catalog). See figure below.



① Mounting Plate
② 2 1/4" (57.1mm) to 2 3/8" (60.3mm) O.D standpipe
③ Cable Entry Ports
④ Mounting Hardware (see table below)
⑤ U-Bolt Assembly (see table below)

Figure 2-2 Pipe Mounting

Table 2- 1 CQO:1012NMB-1 Mounting Kit

Description	Qty
Mounting Plate	1
U-Bolt Assembly including Bracket & Nuts	2
8-32 x 5/8 LG Cross Round Head screws	4
#8 Flat Washer	4
#8 Split Lock Washers	4
8-32 Hex Nut	4

Pipe Mounting Installation

1. Affix Mounting Plate to standpipe using the U-bolt assemblies.
2. Secure transmitter to Mounting Plate using #8-32 screws, washers and nuts.
3. Refer to Connecting Power (Page 11) and Sensor Installation (Page 27) to complete installation.

Note

Use conduit fittings or cable glands on all cables.

Connecting

3

Note

If the transmitter is not already mounted and cabling has not been run, proceed to Mounting the Transmitter (Page 7) before connecting power.

⚠ DANGER

Hazardous Voltage

Will cause death or serious personal injury.

Disconnect power before working on this product.

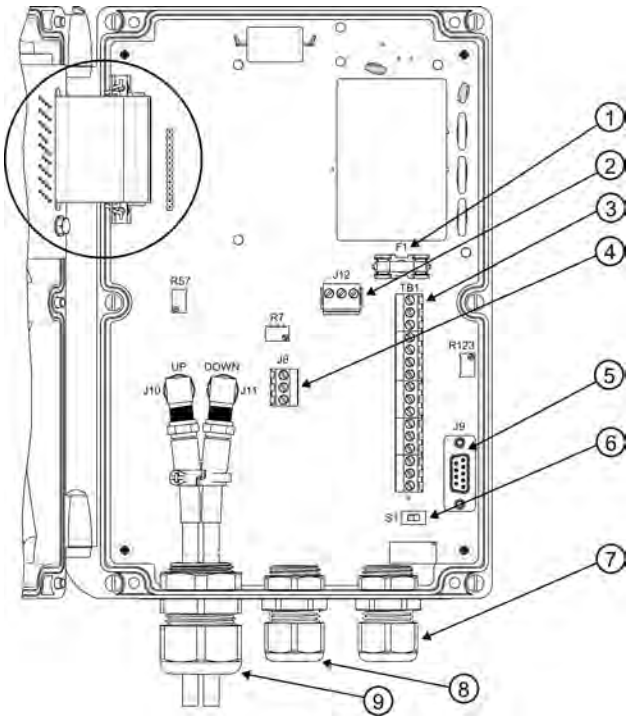
1. Using a flat-head screwdriver, loosen the six securing screws from the Keypad Enclosure Cover and open cover.
2. To determine type of power connection refer to the following part numbers:
   - 7ME3570-1HA3 = AC Power
   - 7ME3570-1HB3 = DC Power

Note

The product nameplate also lists the actual power that can be applied to the unit.

3. Pull either the AC or DC wires through transmitter case cable gland and into the transmitter case before wiring power connector.

NOTICE
Do not use a screwdriver to pry up the Display board connector (circled in the figure below). Damage to the unit may occur.



① Fuse F1 Type GMA, 2A
② Input Power Connector P12
③ I/O Terminals TB1
④ J8 RS-485 Port Connector - 30m (98 ft) max length
⑤ J9 RS-232 Port DB9 Connector - 15m (50 ft) max length
⑥ S1 Keypad Enable Switch
⑦ I/O Input Cables - 30m (98 ft) max length
⑧ Input Power Cables
⑨ Sensor Cables - 90m (300 ft) max length

Figure 3-1 Input Power Wiring

Note

Refer to figure above, callouts ④, ⑤, ⑦ and ⑨.

Maximum cable lengths cited may be extended with factory approval, if necessary.

4. Locate power plug P12 and loosen P12 connector screws.

5. As per local electric codes, wire input power connector P12 for AC or DC power depending on power supply provided.

Connector P12	AC	DC	Wire Color
1	L1	POS +	Black
2	L2/N	NEG -	White
3	GND	GND	Green

Note

Dress cables and make sure cable length is not excessive as to impede proper replacement of access cover.

6. Insert AC or DC power wires into wire entry holes and secure by tightening wire clamp screws.

Note

Power supply connector wires should be stripped stranded or solid conductors AWG 12 - 18.

7. Pull sensor cables through transmitter case cable gland and connect to the appropriate UP and DOWN sensor connectors.
8. Connect the power cables to the appropriate power source (100-240 VAC @ 50/60 Hz or 11.5-28.5 VDC) and power up unit.

⚠ WARNING

Circuit limited to 20 Amps

The branch circuit must be limited to 20A or damage to the unit and personnel injury will result.

It is recommended that the circuit breaker be located near the transmitter.

⚠ DANGER

Shock Hazard

Will cause death or serious personal injury.

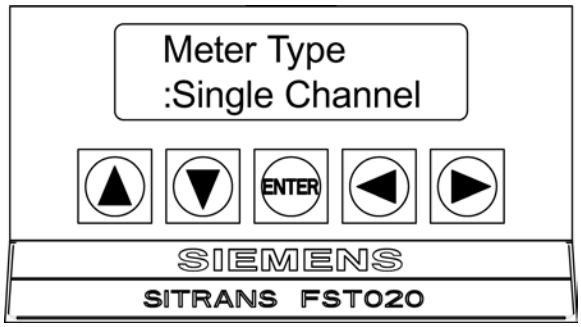
Disable power before servicing fuse F1.

9. If unit is operational, turn power off, close Keypad Enclosure Cover and secure the six cover screws (torque to 6 in-lbs).

Note

Do not position the transmitter in such a way that it is difficult to operate the circuit breaker or the disconnection device.

10. Turn power on. Within 10 seconds of power-up the transmitter 2-line LCD display screen will appear.



① Power-up 2-Line LCD Display Screen

Display Screen Activation

At power-up the FST020 display screen will display one of the following:

- The scrolling Siemens Welcome Screen (i.e., if no channel had been previously activated), or
- The active channel's last data screen displayed prior to turning off the instrument.

The alphanumeric LCD display screen of the FST020 provides visual access to all system variables and conditions. During initial power-up the 2 x 16 character alphanumeric display only allows access to the numerous installation menus offered by the FST020 system. Once a measurement channel is activated and begins operation it can display a wide variety of meter data.

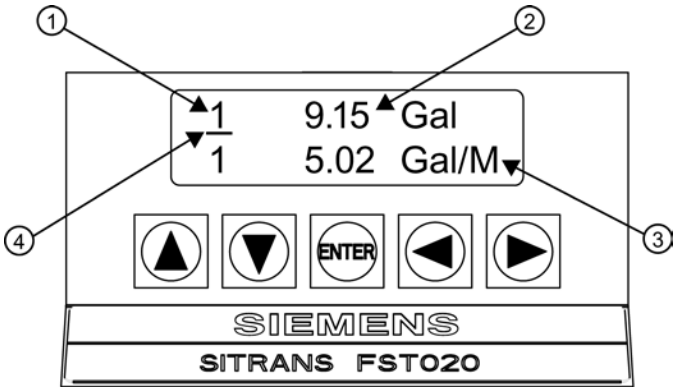
After successful channel installation, use the Keypad and repeatedly press the <Left Arrow> until the display indicates flow data.

Note

Repeatedly press the <Left Arrow> key from any location within the Installation Menus to return to the flow display.

Default Flow Display Screen

The default display screen shows two lines of flow rate data (see figure below):



① Channel Number
② Numeric Data
③ Units
④ Selection Cursor

Figure 3-2 Display Screen

- First Character Field - Displays the channel number.
- Middle Character Field - Displays the numeric value of the data item selected.
- Last Character Field - Provides a mnemonic of the data type currently displayed.

Selecting Display Data Items

The arrow keys are used to select the data items that are shown on each display line as follows:

Right Arrow

- Upon pressing the <Right Arrow> key, a selection cursor will appear under the channel indicator numeral (i.e., 1).
- Pressing the <Right Arrow> key once again will cause the selection cursor to move to the other display line and so forth.

Note

The selection cursor will turn off after a period of inactivity.

Up/Down Arrows

- Once a display line is selected as described above, use the <Up or Down Arrow> keys to scroll through the available data items at the selected display line. These measuring parameters may include Vs M/S, Velocity F/S, Signal mV, Valc, Aeration, Flow, Total Flow, etc.

When satisfied with the item currently displayed, stop scrolling and use the <Right Arrow> key to move to the other display line. Once the display is set up in the desired configuration, execute no further commands and the selection cursor will eventually turn off.

Note

The System Menu can be invoked at any time by pressing the <ENTER> key.

Serial Interface Display

The data menu displays provided via the FST020 serial interface mimic the more complex SITRANS F 1010 graphic displays. Display and data item selection in these menus are accessed via the <Up/Down Arrow> keys only.

Note

The 2 x 16 alphanumeric display is not available via the serial port.

3.1 Navigating the Menu

Installation Menu Navigation

The Installation Menu Chart is a multi-level structure divided into three columns from left to right		
Level A - lists the major menu categories.		
Level B - list the menu cells associated with Level A. You can enter data into Level B menu cells		
Level C - lists the Level B data		
Level A	**Level B**	**Level C**
	Recall Site Setup	**Pump 1** **Pump 2**
	Channel Enable	
	Create/name Site	
	Site Security	
	Delete Site Setup	
	Save/Rename Site	

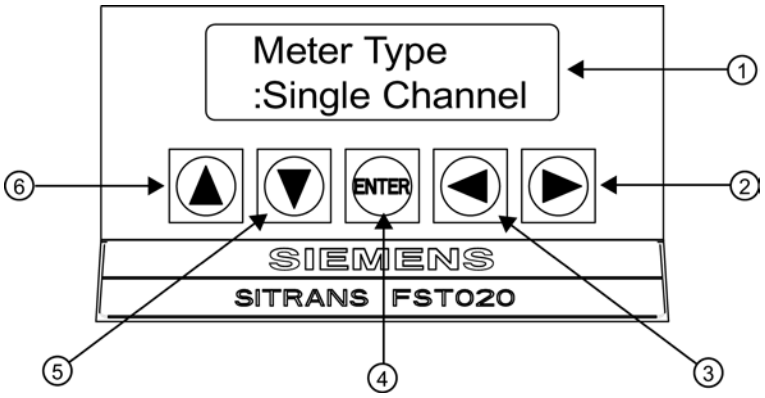
Table 3- 1 5-Key Touch Keypad and PC Keyboard Function Chart

Sensor	Description
ENTER Key	Store numeric data, select from option lists, etc.
Left / Right Keys	Menu navigation keys move cursor.
Up / Down Keys	Same as <Left> and <Right> keys. Scrolls option lists and graphic display screen.

Note

Use Left Key to return to previous menu.

Typical Installation Menu Screen Example



① 2-Line LCD Display
② Right Arrow Key
③ Left Arrow Key
④ ENTER Key
⑤ Down Arrow Key
⑥ Up Arrow Key

Figure 3-3 5-Key Touch Keypad

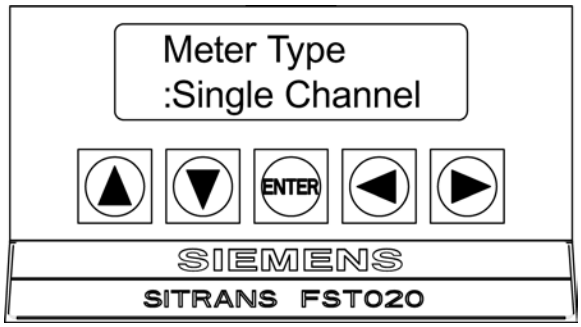
3.2 Programming the Transmitter

Note

Before creating a site select English or metric units from the Meter Facilities menu.

Select a Meter Type

1. After power-up, press <ENTER> key to access the top level of the Installation Menu.
2. [Single Channel] meter type appears.
3. Press <Right Arrow> key twice to select [Channel Setup] menu.



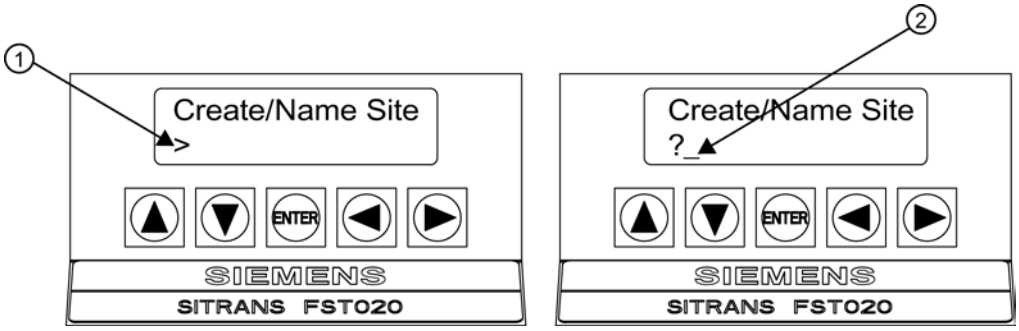
Note

IMPORTANT: Colon appears when menu item is selected for entry.

Create a Site

1. Press <Right Arrow> key and then <Up/Down Arrow> keys to select [Create/Name Site].
2. **Press<Right Arrow> key to select the "?" symbol (see figure below).**
3. To create site name use the <Up/Down Arrow> keys and <Right Arrow> keys to select a name.

4. Press <ENTER> key to save the Site name.



① Site name filed is initially blank

② (?) indicates cell is ready to accept data. Cursor shown in first character position.

Note

To set English or Metric units: In [Meter Type] menu, scroll to [Meter Facilities] menu. Press <Right Arrow> and select desired units. Press <ENTER> to select. Press <Left Arrow> and <Up Arrow> keys to return to [Meter Type] menu.

Note

To select alphanumeric characters: Press <Right Arrow> key to cursor and then press <Up/Down Arrow> keys to select letters and numbers.

5. Press <Left Arrow> key and return to [Channel Setup]. Press <Down Arrow> key to select [Pipe Data].

Note

After the site configuration procedures that follow are complete the newly created site must be saved again to retain the new site data. Refer to the Save/Rename Site procedure below.

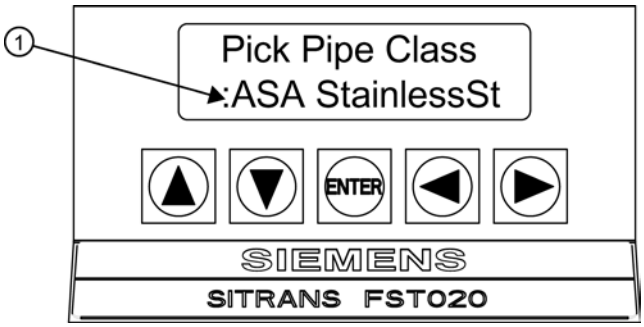
Save/Rename Site procedure

Whenever new site configurations are added to an existing site that site must be saved again to retain the new site changes.

1. **To save all programmed data to site**, press <Left Arrow> key and then scroll up to [Channel Setup].
2. Press <Right Arrow> key and scroll to [Save/Rename Site].
3. Press <Right Arrow> key and then <ENTER> to save all programmed data to site.
4. To return to the top menu level, continue to press the <Left Arrow> key.

Select Pipe Class

1. Press <Right Arrow> key to select [Pick Pipe Class].
2. **Press <Right Arrow> key again**. Press the <Up/Down Arrow> keys to scroll to desired Pipe Class.
3. Press <ENTER> key to select Pipe Class.



① Colon must appear first before Pipe Class can be selected.

4. **Press <Right Arrow> key.** Press <Up/Down Arrow> keys to scroll to select desired Pipe Size.

Note

Pre-programmed Pipe Size and relevant pipe parameters will appear in menu cells. Enter dimensions manually if pre-programmed dimensions do not match application.

Note

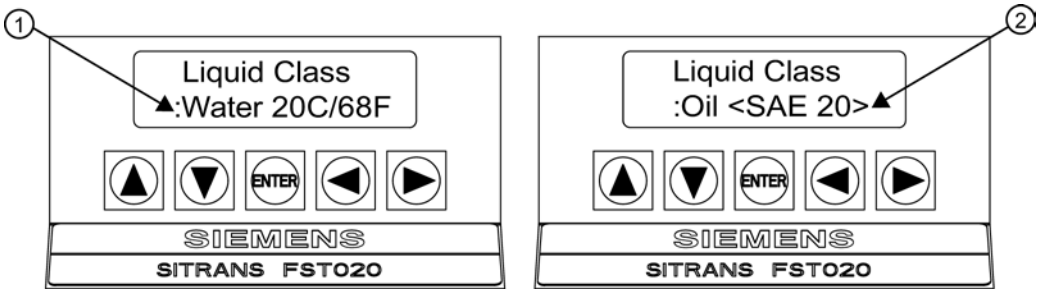
The DN sizes listed in the [Select Pipe Size] menu option list are referenced to DIN Table 2448. After selecting pipe size, check pipe OD and wall thickness for correct dimensions.

5. Press <ENTER> key to save Pipe Size selection.

Select Liquid Class

1. Press <Left Arrow> key to select [Pipe Data] and then press <Down Arrow> key to select [Application Data].
2. Press <Right Arrow> key to select [Liquid Class].
3. Press <Right Arrow> key again to select [Select Liquid]. **Press <Right Arrow> key again.**

4. Press <Up/Down Arrow> keys to scroll to desired liquid.
5. Press <ENTER> key to save selection.

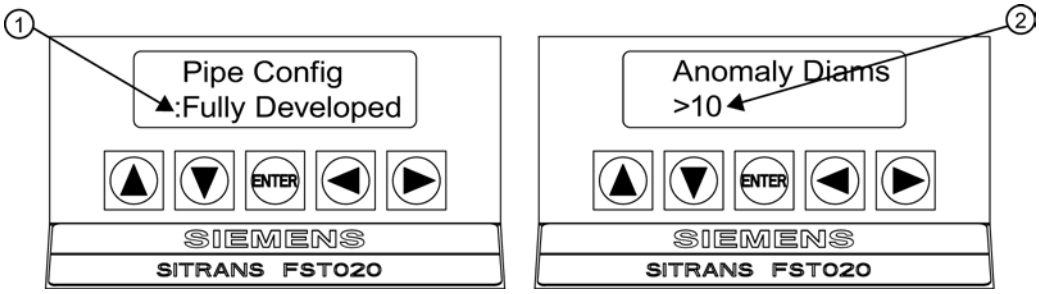


① Colon appears.

② Select new liquid from option list.

Select Pipe Configuration

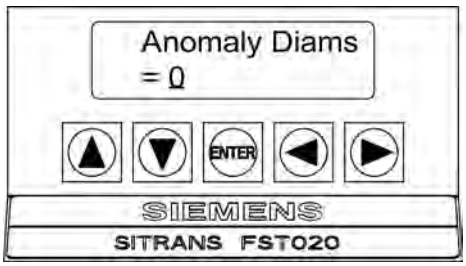
1. Press <Left Arrow> key and then <Down Arrow> key to select [Pipe Config].
2. **Press <Right Arrow> key.**
3. Press <Up/Down Arrow> keys to select a configuration that approximates the conditions upstream of your sensor mounting location. (Refer to the definitions below.)
4. Press <ENTER> key to save selection. The [Anomaly Diams] menu will appear.



① Use this menu cell to select the pipe configuration that most accurately represents the upstream pipe condition.

② Use this menu cell to enter the number of pipe diameters between the upstream configuration and the sensor installation.

5. **Press <Right Arrow> key twice. = 0 will appear.**



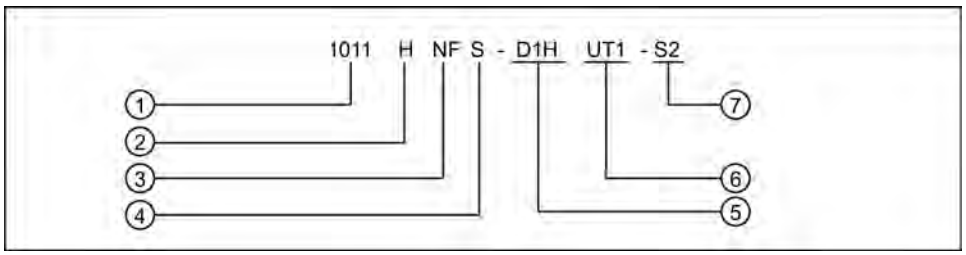
6. Press <Right Arrow> and then the <Up/Down Arrow> keys to select number of pipe diameters.
7. Press <ENTER> key to save selection.

Table 3- 2 Pipe Configuration Option List Definitions

Options	Definitions
Fully Developed	Fully developed flow, as would be expected for very long straight pipe runs or installation downstream of a flow condition.
1 Elbow	Single 90 degree Elbow upstream of sensor installation.
Dble Elbow+	Double out-of-plane Elbows upstream of sensor installation.
Dble Elbow-	Double in-plane Elbows upstream of sensor installation.
Valve	Consult factory.
Expander	Pipe expansion upstream of sensor installation.
Reducer	Pipe reduction upstream of sensor installation.
Norm Entry	Consult factory.
Header Inlet	Header or pipe manifold upstream of sensor installation.
Intrusions	Consult factory.

Sensor Identification

The sensor part number located on the front face provides a detailed identification. For example, the Part Number: *1011HNFS-D1H-UT1-S2* means:



① Model
② Hi Precision
③ NEMA w/F-Conn
④ Pipe Material
⑤ Size
⑥ Temperature
⑦ Agency Approved

Note

Check to make sure that the sensors are a matched set with the same serial numbers and marked with an "A" and "B" (e.g., 19256A and 19256B).

Table 3- 3 Universal Sensor Selection Chart

Sensor Size	Order Code	Outer Diameter Range (mm)		Outer Diameter Range (inches)	
		Min.	Max.	Min.	Max.
A2	**B**	12,7	50,8	0.5	2
B3	**C**	19	127	0.75	5
C3	**D**	51	305	2	12
D3	**E**	203	610	8	24
E2	**F**	254	6096	10	240

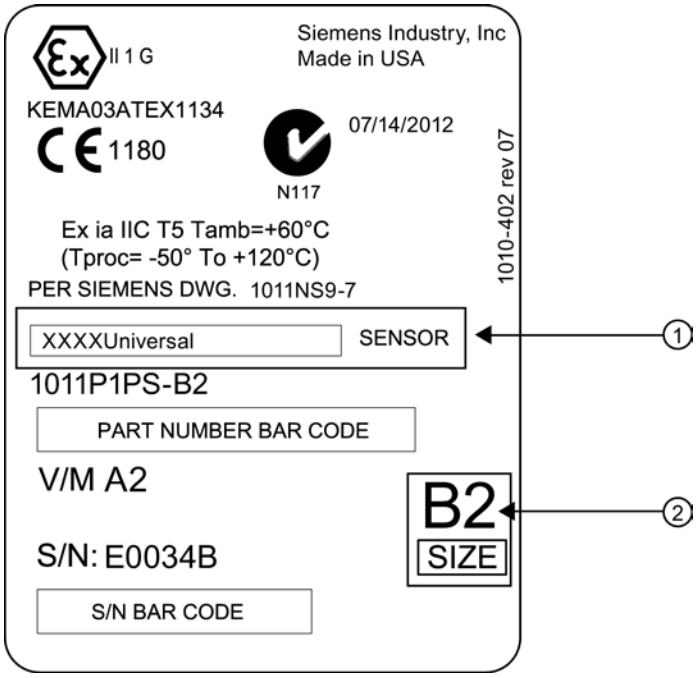
Chart based on pipe size (pipes other than steel)

Table 3- 4 High Precision Sensor Selection Chart

Sensor Size	Order Code	Pipe Wall (mm)		Pipe Wall (inches)	
		Min.	Max.	Min.	Max.
A1H	**G**	0,64	1,02	0.025	0.04
A2H	**H**	1,02	1,52	0.04	0.06
A3H	**J**	1,52	2,03	0.06	0.08
B1H	**K**	2,03	3,05	0.08	0.12
B2H	**L**	3,05	4,06	0.12	0.16
C1H	**M**	4,06	5,84	0.16	0.23
C2H	**N**	5,84	8,13	0.23	0.32
D1H	**P**	8,13	11,18	0.32	0.44
D2H	**Q**	11,18	15,75	0.44	0.62
D4H	**R**	15,75	31,75	0.62	1.25

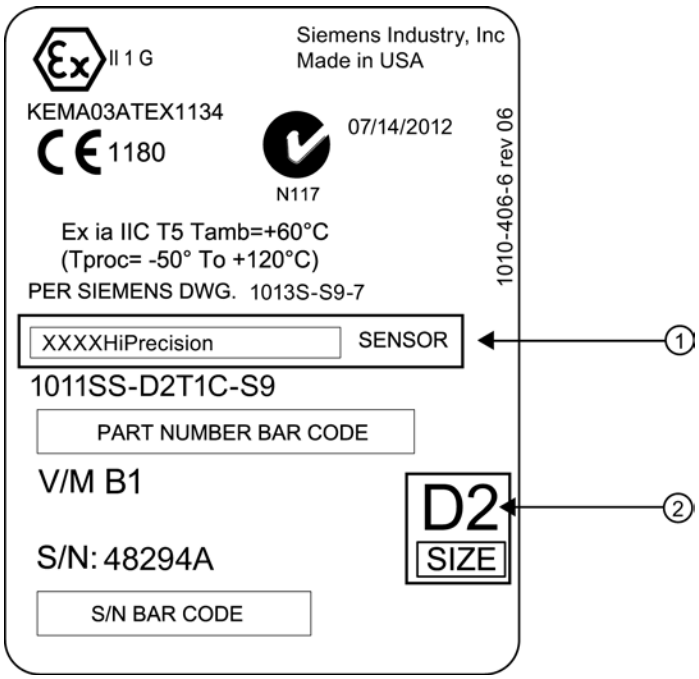
Chart based on pipe wall thickness (steel pipes only)

Typical Sensor Labels



① Universal sensor model number
② Sensor size

Figure 3-4 Sample Universal Sensor Label



① Hi Precision sensor model number
Sensor size

Figure 3-5 Sample Hi Precision Sensor Label

Sensor Selection

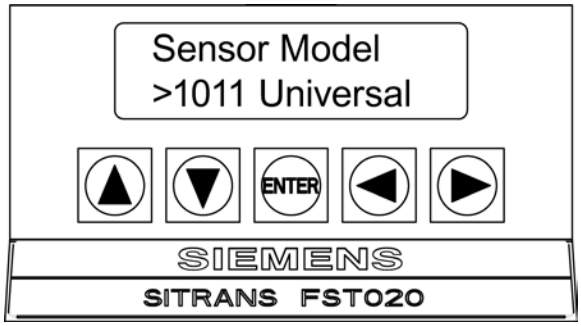
The following is a typical sensor selection procedure.

Note

The transmitter must be powered up before you can select a sensor model. Refer to Connecting (Page 11).

1. Press the <Down Arrow> key to select [Install Sensor].
2. Press <Right Arrow> key to [Sensor Model]. Press <Right Arrow> key and scroll to select the sensor model found on the sensor label.

3. The drop down menu lists the following sensor selections:
   - 7ME39501G
   - 1011 Universal - Usable -40 to 120°C
   - 1011HP-T1 - Usable -40 to 120°C, recommended for Ø Temperature <40°C; Standard.
   - 1011HP-T2 - Usable -40 to 120°C, recommended for Ø Temperature >40°C - <80°C; Named as high temperature.
   - 1011HP-T3 - Usable -40 to 120°C, recommended for Ø Temperature >80°C <120°C; special request.
   - 1021 Sensor
   - 991 Universal
4. For this example, select the sensor model that appears on the sensor label then press <ENTER>.



5. Press <Down Arrow> key to select [Sensor Size]. Press <Right Arrow> key and scroll to select the sensor size that matches the size indicated on the sensor label.
6. At [Sensor Mount Mode] press <Right Arrow> key. Scroll to select [Reflect] or [Direct] mount then press <ENTER>.
7. **IMPORTANT: Press the <Up/Down Arrow> keys to scroll to [Spacing Method] and [Number Index]. Record these numbers. They will be used to mount the sensors.**
8. Sensors can now be mounted. Proceed to Sensor Installation (Page 27) mounting procedures and select the mounting mode desired.
9. Once sensor mounting is complete proceed to Commissioning (Page 33).

3.3 Installing the Sensor

Reflect and Direct Mounting Modes

Reflect and Direct mounting modes are supported for clamp-on sensors. The transmitter recommends a mounting mode after analyzing your pipe and liquid data entries. This Quick Start illustrates a typical sensor setup using the Reflect Mode.

Note

For Direct Mount refer to the Operating Instructions manual.

Mounting Supplies

The following items will be needed to mount the sensors (most 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
- Sensors (matched set)

3.3.1 Reflect Mount using Spacer Bar

The spacer bar eliminates manual spacing measurements and provides rigidity for mounting the sensors while maintaining axial alignment. Refer to Programming the Transmitter (Page 18) before proceeding.

1. Perform all required menu steps taking note of the sensor model and size designation. The transmitter then issues the number index and prompts you to press <ENTER> to finish the sensor install routine. Stop at this point.

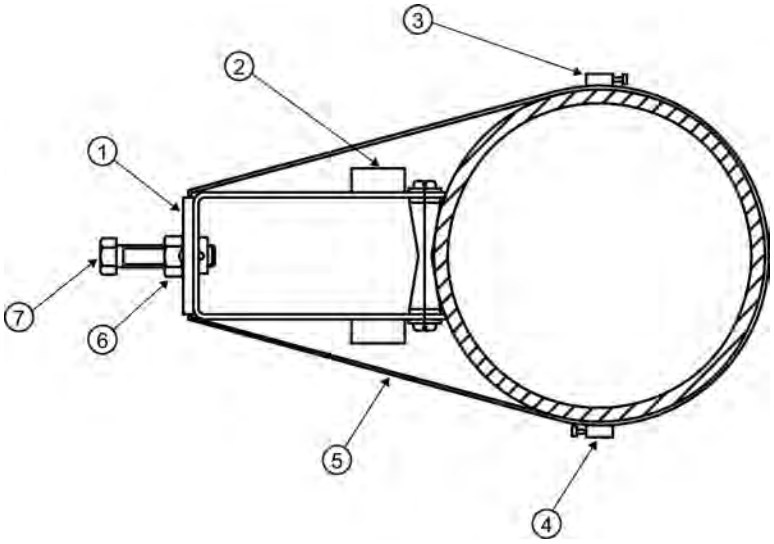
Note

Note the number index value displayed in the [Install Sensor] menu. You will use this index to properly space the sensors. 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., 19256A and 19256B).

2. Prepare the pipe surface area where the sensors will be mounted. Degrease the surface and remove any grit, corrosion, rust, loose paint, etc.

Note

Before beginning refer to the Reflect Mount sensor installation diagram below.



① Mounting Frame
② Spacer Bar Screw Hole
③ Mounting Strap Adjusting Screw
④ Optional: On larger pipes, multiple lengths of straps can be linked together to surround pipe
⑤ Mounting Strap positioned around Mounting Frame
⑥ Locking Nut
⑦ Sensor Clamping Screw

Figure 3-6 Reflect Mount with Mounting Frames and Spacer Bar

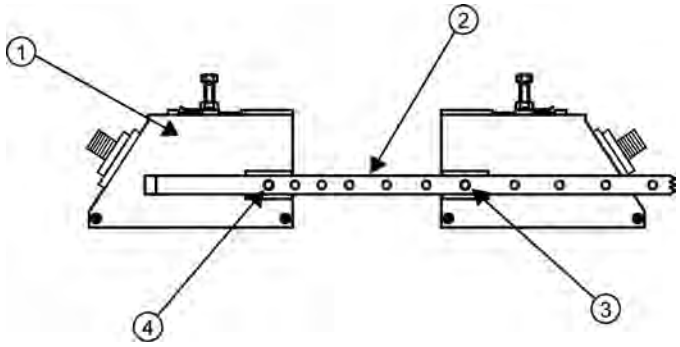
Ltn Menu Cell

This view only menu cell shows the distance in inches or millimeters between the front faces of the sensors along the axis of the pipe. If you are mounting the sensors without a track or spacer bar, you have to space them according to this value. Note that Ltn may be a negative number for direct mount on very small pipes where the sensor spacing overlaps.

3.3.2 Installation Procedure

Preparing the pipe

1. Assemble the mounting frames and sensors, with the sensor cable connectors facing away from each other as shown below. The spacer bar is attached to each sensor using a sensor Reference Index screw. One sensor is attached using the "REF" hole on the spacer bar. The second sensor is attached to the spacer at the Number Index hole.

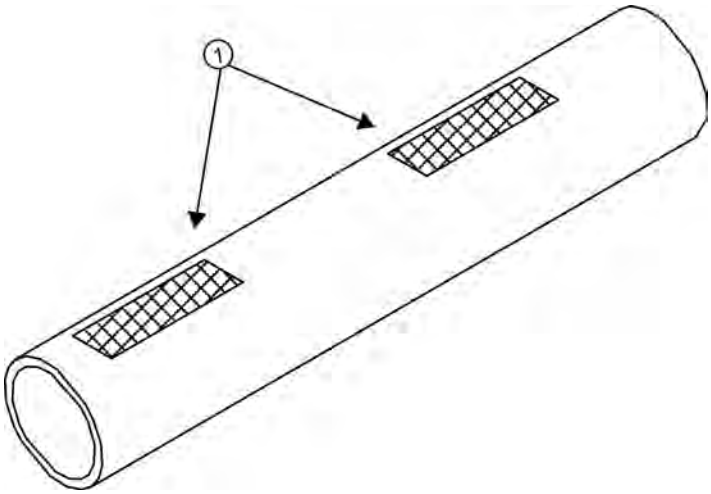


① 1012FNFS Mounting Frame & Sensor
② 1012BN Spacer Bar
③ Number Index Hole
④ REF hole

Figure 3-7 Reflect Mount, Spacer Bar-Side View

2. Temporarily position the assembly at the location where you have determined it would be mounted. Ensure that it is a smooth area without any raised spots or seams.
3. Mark a generous area around the sensors (13mm / 1/2" on either side) with a pencil or chalk. Remove the assembly.

4. Prepare the two 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. Clean the pipe of all debris and abrasive particles.



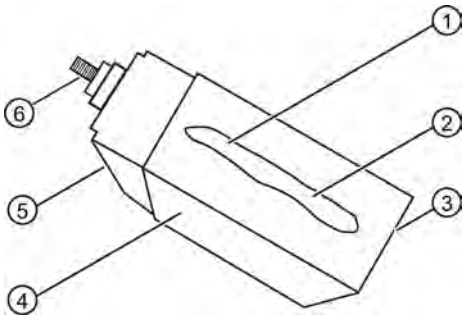
① Clean areas

Figure 3-8 Preparing the Pipe

5. Wrap a Mounting Strap around the pipe. Make sure to position strap so there is easy access to the Mounting Strap Adjusting Screw.
6. Place the assembled Mounting Frame so that it rests on the top of the pipe.
7. Engage the end of the Mounting Strap with the Mounting Strap Adjusting Screw.
8. Slide Mounting Starp under the spring clip of one of the Mounting Frames.
9. Tighten the Mounting Strap Screw enough to take up all the slack, but not enough to prevent rotation of the Frame Assembly. Repeat Mounting Strap procedure for the other Mounting Frame.
10. Rotate and align the Mounting Frame assembly to the final conditioned pipe surface location, ensuring that the assembly is straight along the pipe axis. (Refer to the sensor orientation in the Sensor Installation figure below.)
11. Tighten the Mounting Straps to seat the assembly firmly on the pipe. Do not over tighten.

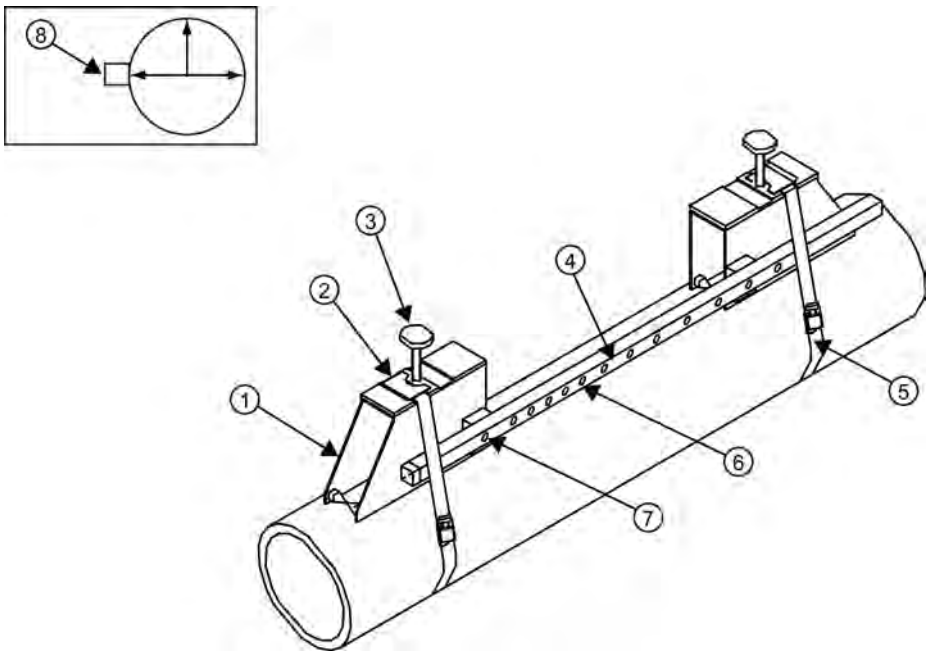
Installing the Sensor

1. Apply a continuous 3mm (1/8-inch) bead of couplant compound across the center (the long way) of the sensor emitting surface.



① Coupling Compound
② Emitting Surface
③ Back End
④ Sensor
⑤ Angled Edge
⑥ F-Connector

Figure 3-9 Sensor



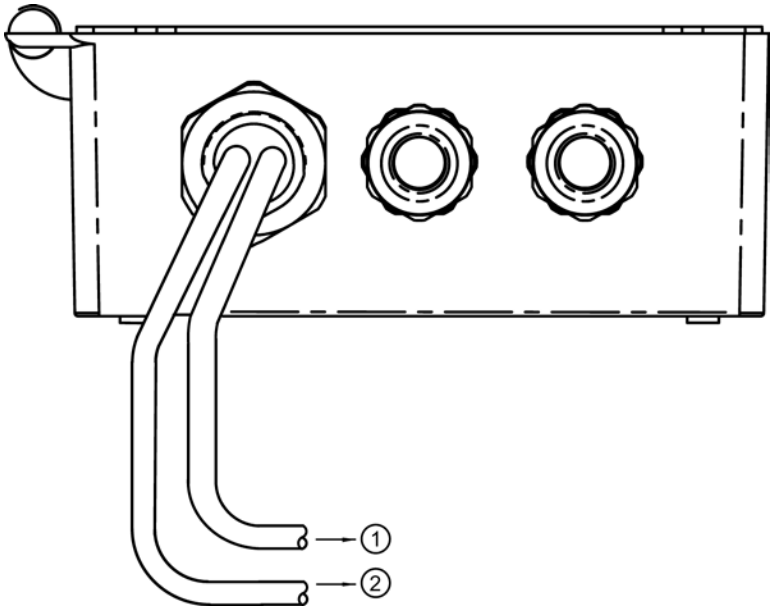
① 7ME39600M Mounting Frame
② Spring Clip (not present on all models)
③ Sensor Clamping Screw
④ 1012BN Spacer Bar
⑤ Mounting Strap. Note: Optional 2nd Mounting Strap may be needed for additional support on larger pipes, over 76cm (30 inches).
⑥ Index holes
⑦ Spacer Bar REF hole
⑧ Orientation of sensor at 9 o'clock position

Figure 3-10 Sensor Installation

2. Slide sensor into a Mounting Frame back end first aligning the angled edge of the sensor with the angled edge of the Mounting Frame. 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 Sensor Cables.

Connecting Sensor Cables

1. Observing the upstream/downstream orientation, attach the UP (upstream) and DOWN (downstream) cables to the sensors and finger tighten.
2. Attach the other ends to the UP and DOWN terminals of the transmitter and finger tighten.
3. Close top cover and tighten securing screws.



① To Downstream Sensor
② To Upstream Sensor

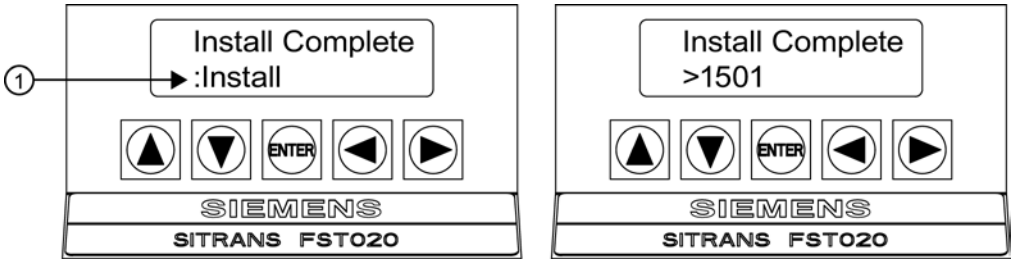
Figure 3-11 Connecting Sensor Cables to Transmitter

Commissioning

4

4.1 Commissioning

1. Scroll down to [Install Complete]. Press the <Right Arrow> key.
2. Press the <Down Arrow> key and select [Install].
3. Press <ENTER> key. The flow meter will go through drives.
4. Observe the Measured Vs window and verify a correct sound velocity measurement (if known).
5. Press the <Down Arrow> key to accept sound velocity value. Auto Zero will follow.



① Select [Install].

Note

Save and Rename Procedure

Whenever new site configurations are added to an existing site that site must be saved again to retain the new site changes.

1. **To save all programmed data to site**, press <Left Arrow> key and then scroll up to [Channel Setup].
2. Press <Right Arrow> key and scroll to [Save/Rename Site].
3. Press <Right Arrow> key and then <ENTER> to save all programmed data to site.
4. To return to the top menu level, continue to press the <Left Arrow> key

---

6. **The flow meter is now ready to report flow.**

7. Press the <Left Arrow> key until the screen displays flow data or press <ENTER>.

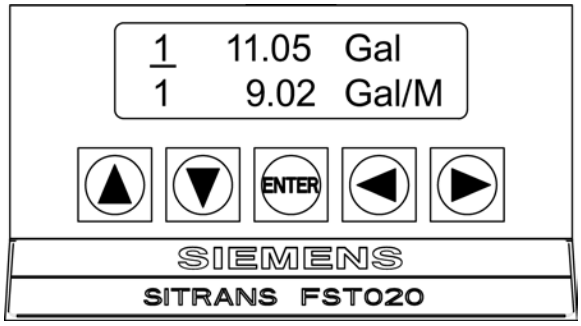


Figure 4-1 Measuring Flow

8. Use the <Right Arrow> and <Up/Down Arrow> keys to switch between display lines and to select flow data items.

See also

Refer to I/O Connection and Wiring (Page 39) for input/output wiring and data spanning procedures.

Troubleshooting/FAQs

5

5.1 Troubleshooting

The following is list of troubleshooting tips and messages that you may encounter. They include explanations and, in some cases, a recommended action. If a problem seems unsolvable, contact your local Siemens office or regional Ultrasonic Flow Representative for expert help at Services & Support (http://www.siemens.com/automation/service&support).

Table 5- 1 Troubleshooting Tips

Error or Message	Probable Cause	Solution
Memory Full!	Response to an attempt to save site data, when data memory is full.	Delete an obsolete site or clear Datalogger memory to make room for the new data.
Memory Corrupted!	Memory read error occurred while accessing the active site data.	Refer to F4 reset procedure in the Operation Instructions manual.
Chan Not Setup	Response to an attempt to invoke an operation that requires a channel to be enabled.	Enable the channel [Channel Setup - Channel Enable - Yes]. Note that a channel cannot be enabled until an "Install" operation is completed.
Clr Active Memory?	Response to pressing and holding <ENTER> key during power-up.	Use this function to restore operation if a severe event (e.g. a violent power surge) disrupts the system operation.
Clr Saved Data?	[Clr Saved Data?] only appears after pressing the <Down Arrow> in response to [Clr Active Memory?].	Answering Yes to [Clr Saved Data?] will erase **ALL** saved data. To invoke in RS-232 serial mode, type @@@ and then press <ENTER> key.
<EOT>	Response to a request to output Datalogger data to the printer or the Graphics screen when no Datalogger data exists or at the end of a transmitted file..	Set up the Datalogger.
No Sites - Press <ENTER>	Response while trying to recall/delete a site setup when no sites are stored.	Create a site.
Security	Response upon changing previously entered data when security switch is in [Disable] position or security code has been entered.	• Change switch position to [Enable]. • Enter previously set security code.
RTC Error	Component level problem.	• Meter requires service. Request RMA.
- - -F- - - Fault Alarm	• Loss of signal strength (ALC) • Change of Rx signal location (Beam Blowing)	• Recouple sensors with fresh couplant. • Install sensors in Direct mount mode. • Note: If problem persists call Tech support.
Re-space #	The measured liquid sonic velocity (Vs) is more than +/- 25% of the average Vs range.	• Assure proper pipe dimensions and/or Liquid data entries are correct. • Properly enter correct Sensor Size into the meter [Install Sensor] menu. • Confirm sensor spacing is correct by checking [Install Sensor] menu spacing parameters.

Error or Message	Probable Cause	Solution
Invalid Setup (use Direct Mode)	• During the Initial Makeup the system detects invalid sensor spacing, erroneous liquid pipe parameters, or some other factor that prevents it from completing the Initial Makeup.	This may be due to one of the following: • An out-of-range data entry. • An invalid condition (e.g., overlapping sensors in Reflect Mode). If selecting Direct Mode does not resolve, review all site setup and sensor installation choices particularly data entered for pipe and liquid. • In Reflect Mode the flow meter detects that the pipe wall signal may infringe upon the liquid signal. Use Direct Mode instead. Press <ENTER>, <Up Arrow>, <Down Arrow>, or <Left Arrow> to abort install routine. Continue programming other site data in anticipation of resolving the difficulty later. Call technical support for help if necessary
Low Signal - Press <ENTER>	During the Initial Makeup the flow meter decides that the level of the receive signal is insufficient for proper operation.	Some reasons for low signal are: • Invoking [Install completed?] on an empty pipe. • Coupling compound insufficient; not applied or evaporated. • A disconnected or broken sensor cable. • The pipe needs to be conditioned at the mounting location. • Flush out large air bubbles. • The sensor cables are defective or not connected to the correct channel. • The Set Empty routine performed when pipe was NOT actually empty. If you locate and correct the improper condition immediately, press <ENTER> to resume the installation procedure. Otherwise, press the <Left Arrow> to abort the installation and conduct a thorough investigation.
Detection Fault	If it appears that the flow meter cannot complete an Initial Makeup it means that the pipe and/or liquid conditions do not permit a receive signal that meets the flow detection standards. The system will not operate.	Attempt to improve operating conditions by reinstalling the sensors at a different spacing offset, or even at a different location on the pipe. Switching from Reflect to Direct Mount may solve the problem. However, operation may not be possible if there is poor liquid or pipe wall sonic conductivity.

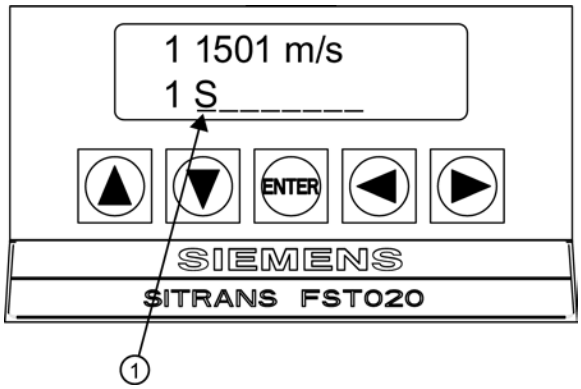
Note

If you receive a Detection Fault message, it is strongly recommended that the Partner (http://www.automation.siemens.com/partner) be contacted.

5.2 Alarm Codes

Letter Code	Alarm	Description
S	Spacing	Sensor spacing may need readjustment.
Z	ZeroMatic	ZeroMatic signal fault.
E	Empty	Pipe is empty.
R	Rate	Flow above High setting or below Low setting.
F	Fault	Three continuous seconds without new data update.
A	Aeration	Current aeration percentage exceeds the alarm set point.
M	Memory	Last valid reading for a selected interval during Fault condition.
K	Makeup	In-Process Makeup occurred.
I	Interface	Liquid Vs exceeds interface alarm set point.

The display shown below indicates where the Alarm Codes appear on the LCD display screen.



① Alarm Code

Appendix

A

A.1 I/O Connections and Wiring

Terminal Block Wiring - FST020 Flow Meter

These connection diagrams apply to the part numbers listed below.

Table A- 1 Part Numbers and Connection Diagrams

SITRANS FST020	
FST020	7ME3570-*****

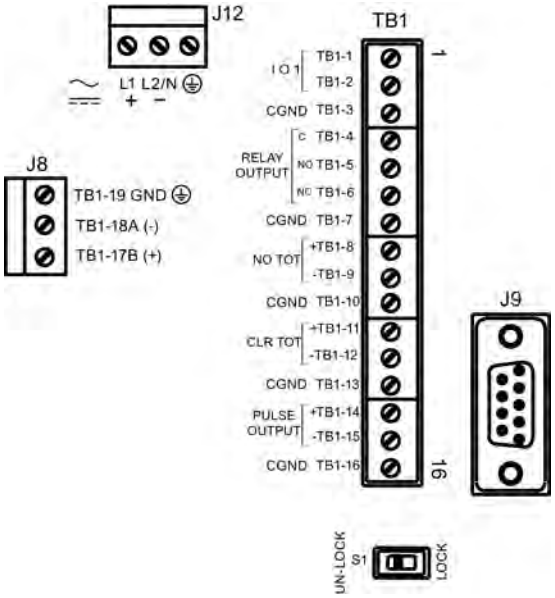


Figure A-1 Terminal TB1 including J8 Connector, DB9 Connector (J9), Power Connector (J12) and Menu Lockout Switch (S1)

Table A- 2 J8 Connector

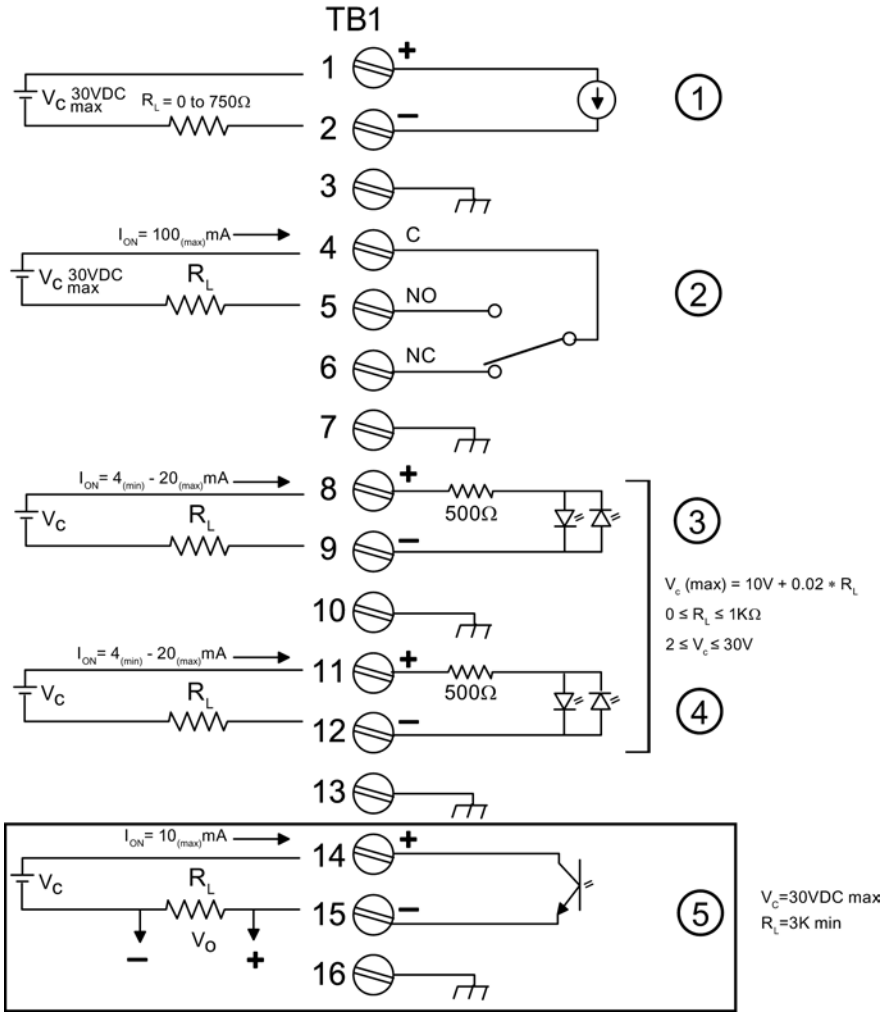
Pin#	Signal	Function	Description
TB1-19	GND	GND	Reference Ground
TB1-18	A (-)	RS-485	RS-485 Serial Communications Port
TB1-17	B (+)	RS-485	RS-485 Serial Communications Port

Table A- 3 J9 Connector (DB9)

Pin #	Signal
1	N/C
2	RxD
3	TxD
4	DTR
5	Ground
6	N/C
7	RTS
8	CTS
9	N/C

Table A- 4 Input/Output Wiring (TB1)

Pin#	Signal	Function	Description
1	Io1+	Isolated Loop Supply	Spannable 4-20mA output (Loop Powered) This output also provides a fault indication by dropping to 2mA if assigned to flow rate and under fault conditions.
2	Io1-	Isolated Loop Return	
3	GND	Ground	Ground
4	C	Closed	Relay Output
5	NO	Normally Open	Relay Output
6	NC	Normally Closed	Relay Output
7	GND	Ground	Ground
8	NO TOT +	DIGITAL INPUT +	Stops Totalizer from incrementing.
9	NO TOT -	DIGITAL INPUT -	
10	GND	Ground	Ground
11	CLR TOT +	DIGITAL INPUT +	Clears Totalizer
12	CLR TOT -	DIGITAL INPUT -	
13	GND	Ground	Ground
14	PULSE OUTPUT +	Isolated Transistor	Menu selection: PGEN, POS TOTAL, NEG TOTAL
15	PULSE OUTPUT -	Isolated Transistor	
16	GND	Ground	Ground



① 4 - 20mA Output (current source)
② Relay Output
③ Digital Input (NO TOT)
④ Digital Input - (CLR TOT)
⑤ Pulse Output

Figure A-2 Typical TB1 Wiring

Isolated 4-20mA Output TB1-1/2	
R	= 250 Ω typical, 750 Ω maximum
V_C	= 24 VDC typical / 30 VDC maximum
I	= 4-20mA
R_L	= Loop wire resistance (both ways) plus User's input load resistance.

PULSE OUTPUT TB1-14 / TB1-15	
V_C	= +30 VDC max.
R_L	= 3K Ω minimum

Relay TB1-4 / TB1-5 / TB1-6	
R_L	= 300 Ω minimum

Digital Inputs TB1-8 / TB1-9 and TB1-11 / TB1-12	
V_c	= (10V + 0.02 x RL) max. 2 ≤ Vc ≤ 30 VDC
0 ≤ R_L ≤ 1000 Ω	

A.2 BACnet/ModBus Communications

A.2.1 Introduction

The Siemens SITRANS FST020 Flow Meter firmware version 2.04.06 and later includes ModBus and BACnet communication selectable during the configuration of the meter.

Note

IMPORTANT

To invoke BACnet or ModBus communications, RS-485 setup parameters must be enabled.

A.2.2 BACnet

BACnet Communication Protocol

BACnet is a standard communication protocol for **B***uilding* **A***utomation and* **C***ontrol* **Net***works* developed by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). BACnet provides the communication infrastructure needed to integrate products made by different vendors. BACnet communication is based on standard objects. Each BACnet Device includes a Device Object and other optional objects within the device. Each object has associated properties. This document defines the FST020 BACnet objects and its properties. The FST020 includes (1) Device Object, (29) Analog Value Objects, and (11) Binary Value Objects.

The FST020 functions as a BACnet slave device on a BACnet MSTP RS485 network. A typical illustration of how this might be configured in a plant network is illustrated in the figure below.

Note

IMPORTANT

The BACnet proxy router is not included and must be supplied by the user.

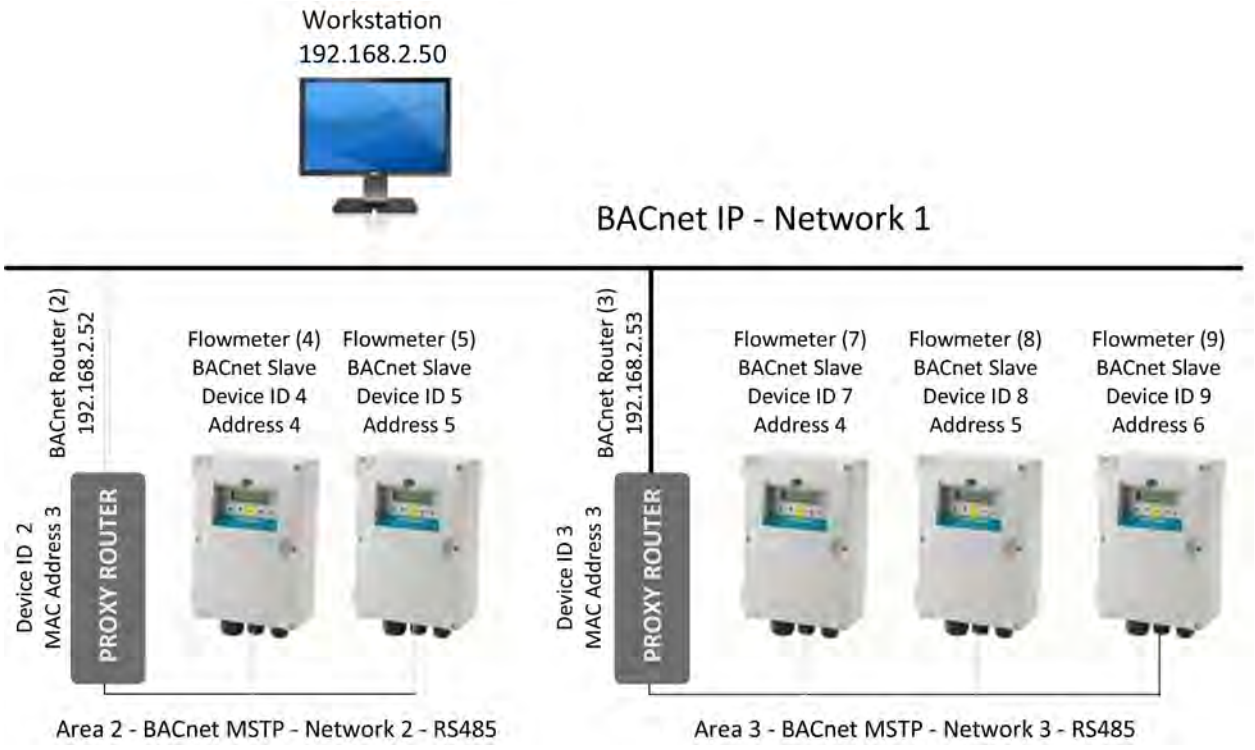


Figure A-3 Typical FST020 BACnet Application

Device Object

Property Identifier	Description and/or Example Value	R/W
Object_Identifier	BACnetObjectIdentifier	W
Object_Name	*Entered during FST020 Configuration* (15 characters)	W
Object_Type	DEVICE (8)	R
System_Status	OPERATIONAL (0)	R
Vendor_Name	Siemens Industry, Inc.	R
Vendor_Identifier	313	R
Model_Name	FST020	R
Firmware_Revision	2.04.06 (or later)	R
Application_Software_Version	012813-1338	R

Property Identifier	Description and/or Example Value	R/W
Protocol_Version	1	R
Protocol_Revision	10	R
Protocol_Services_Supported	read property, read property multiple , write property	R
Protocol_Object_Types_Supported	Device , Analog Value, Binary Value	R
Object_List	Dx, AV0…AV28, BV0…BV10	R
Max_APDU_Length_Accepted	480	R
Segmentation_Supported	3 – no segmentation	R
Local_Time	10:36:13	R
Local_Date	1/21/2013	R
APDU_Timeout	0	R
Number_Of_ADPU_Retries	0	R
Device_Address_Binding	0	R
Database_Revision	2	R

Analog Value Object

Property Identifier	Description and/or Example Value	R/W
Object_Identifier	Unique Identifier (e.g. 8388608)	R
Object_Name	*(see Analog Value Object List)* (e.g. Flow)	R
Object_Type	2 – Analog Value	R
Present_Value	REAL (e.g. 402.3467)	R
Description	Character String (e.g. GAL/MIN)	R
Status_Flags	IN_ALARM,FAULT,OVERRIDDEN,OUT_OF_SERVICE (e.g. 0000)	R
Event_State	0 - Normal	R
Out_Of_Service	0 - False	R

Binary Value Object

Property Identifier	Description and/or Example Value	R/W
Object_Identifier	Unique Identifier (e.g. 20971525)	R
Object_Name	*(see list of Binary Value object s* (e.g. Aeration Alarm	R
Object_Type	5 – Binary Value	R
Present_Value	Binary (e.g. 1)	R
Description	Character String (e.g. Aeration Alarm)	R
Status_Flags	IN_ALARM,FAULT,OVERRIDDEN,OUT_OF_SERVICE (e.g. 0000)	R
Event_State	0 - Normal	R
Out_Of_Service	0 - False	R

Object List

Analog Value Objects		Binary Value Object	
AV0	Flow	BV0	Totalizer Reset
AV1	Average Flow	BV1	Spacing Alarm
AV2	Raw Flow	BV2	Empty Alarm
AV3	Liquid Total	BV3	Rate Alarm
AV4	Sonic Velocity	BV4	Fault Alarm
AV5	Delta Time	BV5	Aeration Alarm
AV6	Valc	BV6	Memory Alarm
AV7	Aeration	BV7	Makeup Alarm
AV8	Deadband Control	BV8	Interface Alarm
AV9	Batch/Sample Total	BV9	Pig Alarm
AV10	High Flow Alarm Level	BV10	Zeromatic Alarm
AV11	Low Flow Alarm Level		
AV12	Vs Alarm Level		
AV13	Flow Velocity		
AV14	Signal		
AV15	Highest Expected Flow		
AV16	Lowest Expected Flow		
AV17	Aeration alarm Level		
AV18	Slew Mode Selection		
AV19	Time Averaging Period		
AV20	Smart Slew Seed		
AV21	Device Status		
AV22	Site Name		
AV23	Version Information		
AV24	Date/Time Last Reset		
AV25	Op Sys PN		
AV26	Firmware Checksum		
AV27	Compile Time Info		
AV28	System Date/Time		

A.2.3 BACnet Protocol Implementation Conformance Statement

Typical BACnet Conformance Statement

Date: April 13, 2012
Vendor Name: Siemens Industry, Inc.
Product Name: SITRANS FST020 Ultrasonic Flowmeter
Product Model Number: FST020
Application Software Version: 012813-1338
Firmware Revision: 2.04.06
BACnet Protocol Revision: 1
Product Description:
Clamp-on ultrasonic flowmeter for liquids
BACnet Standardized Device Profile (Annex L):
☐ BACnet Operator Workstation (B-OWS)
☐ BACnet Advanced Operator Workstation (B-AWS)
☐ BACnet Operator Display (B-OD)
☐ BACnet Building Controller (B-BC)
☐ BACnet Advanced Application Controller (B-AAC)
☐ BACnet Application Specific Controller (B-ASC)
☑ BACnet Smart Sensor (B-SS)
☐ BACnet Smart Actuator (B-SA)
List all BACnet Interoperability Building blocks Supported (Annex K):
☑ K.1.2 BIBB – Data Sharing – ReadProperty-B (DS-RP-B)
☑ K.1.4 BIBB – Data Sharing – ReadPropertyMultiple-B (DS-RPM-B)
☑ K.1.8 BIBB – Data Sharing – WriteProperty-B (DS-WP-B)
Segmentation Capability:
Segmented is not supported
Standard Object Types Supported:
☑ Device Object
☑ Binary Value Object
☑ Analog Value Object
Dynamically Creatable Object:
None
Dynamically Deletable Object:
None
Optional Properties Supported:

Device Object:

PROP_LOCAL_TIME

PROP_LOCAL_DATE

PROP_DESCRIPTION

Binary Value Object:

PROP_DESCRIPTION

Analog Value Object:

PROP_DESCRIPTION

Operational Writable Properties:

None

Operational Conditional Writable Properties:

None

Proprietary Properties:

None

Range Restrictions:

None

Data Link Layer Options:

☐ BACnet IP, (Annex J)

☐ BACnet IP, (Annex J), Foreign Device

☐ ISO 8802-3, Ethernet (Clause 7)

☐ ATA 878.1, 2.5 Mb. ARCNET (Clause 8)

☐ ATA 878.1, EIA-485 ARCNET (Clause 8), baud rate(s)

☐ MS/TP master (Clause 9), baud rate(s):

☑ MS/TP slave (Clause 9), baud rate(s): 300, 1200, 2400, 4800, 9600, 38400

☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s):

☐ Point-To-Point, modem, (Clause 10), baud rate(s):

☐ LonTalk, (Clause 11), medium:

☐ BACnet/ZigBee (ANNEX O)

☐ Other:

Device Address Binding:

Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices. ☐ Yes ☑ No

Networking Options:

☐ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.

☐ Annex H, BACnet Tunneling Router over IP

☐ BACnet/IP Broadcast Management Device
(BBMD)

Network Security Options:

☐ Non-secure Device - is capable of operating without BACnet Network Security

☐ Secure Device - is capable of using BACnet Network Security (NS-SD BIBB)

☐ Multiple Application-Specific Keys:

☐ Supports encryption (NS-ED BIBB)

☐ Key Server (NS-KS BIBB)

Character Sets Supported:

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

☐ ISO 10646 (UTF-8) ☐ IBM™ / Microsoft™ DBCS ☐ ISO 8859-1
☐ ISO 10646 (UCS-2) ☐ ISO 10646 (UCS-4) ☐ JIS X 0208 ☑ ANSI X3.4

If this product is a communication gateway, describe the types of non-BACnet equipment/networks(s) that the gateway supports:

This product is not a communications gateway.

A.2.4 ModBus

ModBus is an open protocol that has been in existence since 1980 and has become a de facto standard for communication in supervisory and data acquisition applications. It uses registers to address data which can be formatted in various types including, REAL, INTEGER, & BOOL (coils).

The following ModBus Function Codes are supported:

1	READ COIL	ReadCoil()
2	READ INPUT STATUS	ReadCoil()
3	READ HOLDING REGISTER(S)	ReadRegister()
4	READ INPUT REGISTER(S)	ReadRegister()
5	FORCE SINGLE COIL	WriteCoil()
6	PRESET SINGLE REGISTER	WriteRegister()
15	FORCE MULTIPLE COILS	WriteCoil()
16	PRESET MULTIPLE REGISTERS	WriteRegister()

Alarm Status Input Register (Read Only)

Description	Address	Register Type	Bytes	Data Type	Example
Alarm Status	295	3xxxx Input Register	16	STRING	__ERF____

Data Entry Holding Registers (Read & Write)

Description	Address	Register Type	Bytes	Data Type	Example
Aeration Alarm Level	1115	4xxxx Holding Register	2	INTEGER	50
Batch Sample Total	1107	4xxxx Holding Register	4	REAL	10.0
Deadband Control	1105	4xxxx Holding Register	4	REAL	0.0
Hi Flow Alarm Level	1109	4xxxx Holding Register	4	REAL	100.0
Lo Flow Alarm Level	1111	4xxxx Holding Register	4	REAL	10.0
Slew Mode Selection	1101	4xxxx Holding Register	2	INTEGER	1
Smart Slew	1104	4xxxx Holding Register	2	INTEGER	6
Time Average	1102	4xxxx Holding Register	4	REAL	10.0
Vs Alarm Level	1113	4xxxx Holding Register	4	REAL	2100.0

Holding Registers (Read Only)

Description	Address	Register Type	Bytes	Data Type	Example
Aeration	1015	4xxxx Holding Register	4	REAL	0.0
Average Flow	1003	4xxxx Holding Register	4	REAL	89.657
Delta Time	1011	4xxxx Holding Register	4	REAL	191.114
Liquid Flow	1001	4xxxx Holding Register	4	REAL	89.723
Liquid Total	1007	4xxxx Holding Register	4	REAL	5436.23
Raw Flow	1005	4xxxx Holding Register	4	REAL	1587.675
Signal Strength	1013	4xxxx Holding Register	4	REAL	73.0
Sonic Velocity	1009	4xxxx Holding Register	4	REAL	1495.36

Input Registers (Read Only)

Description	Address	Register Type	Bytes	Data Type	Example
Alarm Status	107	3xxxx Input Register	2	INTEGER	28
Day	103	3xxxx Input Register	2	INTEGER	13
Flow Velocity	1001	3xxxx Input Register	4	REAL	29.165
Highest Expected Flow	1005	3xxxx Input Register	4	REAL	260.368
Hour	104	3xxxx Input Register	2	INTEGER	16
Lowest Expected Flow	1007	3xxxx Input Register	4	REAL	-260.368
Minute	105	3xxxx Input Register	2	INTEGER	13
Month	102	3xxxx Input Register	2	INTEGER	7
Second	106	3xxxx Input Register	2	INTEGER	47
Signal	1003	3xxxx Input Register	4	REAL	195.1
Year	101	3xxxx Input Register	2	INTEGER	32 (+1980)

Coil Status

Description	Address	Register Type	Bytes	Data Type	Example
Reset Totalizer	1	0xxx Coil	1	BOOL	0

Input Status (Read Only)

Description	Address	Register Type	Bytes	Data Type	Example
Aeration	5	1xxxx Input Register	1	BOOL	1
Empty	2	1xxxx Input Register	1	BOOL	1
Fault	4	1xxxx Input Register	1	BOOL	1
Interface	8	1xxxx Input Register	1	BOOL	1
Makeup	7	1xxxx Input Register	1	BOOL	1
Memory	6	1xxxx Input Register	1	BOOL	1
Pig	9	1xxxx Input Register	1	BOOL	1
Rate	3	1xxxx Input Register	1	BOOL	1
Spacing	1	1xxxx Input Register	1	BOOL	1
Zeromatic	10	1xxxx Input Register	1	BOOL	1

Strings (Read Only)

Description	Address	Register Type	Bytes	Data Type	Example
Aeration Units	225	3xxxx Input Register	8	STRING	%
Checksum	261	3xxxx Input Register	8	STRING	09ACF200
Code Compile Info	265	3xxxx Input Register	16	STRING	050412-0724
Date Time Last Reset	241	3xxxx Input Register	20	STRING	05.04.12.08.39.57
Delta Time Units	229	3xxxx Input Register	8	STRING	nSec
Flow Units	205	3xxxx Input Register	8	STRING	CU M/HR
Flow Velocity Units	287	3xxxx Input Register	8	STRING	Feet/Sec
Liquid Total Units	213	3xxxx Input Register	8	STRING	LTR
Op Sys PN	251	3xxxx Input Register	20	STRING	FST020-2.04.06
Raw Flow Units	209	3xxxx Input Register	8	STRING	Culn/Sec
Signal Units	221	3xxxx Input Register	8	STRING	mV
Site Name	201	3xxxx Input Register	8	STRING	Chiller1
Slew Mode Units	303	3xxxx Input Register	16	STRING	Time Average
Sonic Velocity Units	217	3xxxx Input Register	8	STRING	M/S
System Time	273	3xxxx Input Register	20	STRING	07.20.12.16.48.34
Time Averaging Units	291	3xxxx Input Register	8	STRING	Sec
Valc Units	283	3xxxx Input Register	8	STRING	S
Version Info	233	3xxxx Input Register	16	STRING	2.04.06

A.2.5 ModBus/BACnet Setup

Introduction

Enter the FST020 configuration mode using either the display panel controls on the flow meter or via an RS-232 interface. The following configuration procedures are detailed in the programming section of the standard FST020 Operating Instructions.

BACnet

Select

[Meter Facilities] >>RS-485 Setup >>Protocol: *BACnet*

Under BACnet Protocol enter the following:

1. Baud Rate: *300, 1200, 2400, 4800, 9600, 38,00 (9600 is default)*
2. Address: *1-254* (devices on each RS-485 network should be limited for best communication update times e.g. <10)
3. Device Number: *1- 4194300* (must be unique system wide)
4. Network Number: *1-65530* (must be unique system wide)
5. Device Name: *xxxxxxxxxxxxxxx* up to 15 ASCII characters)

ModBus

Select

[Meter Facilities] >>RS-485 Setup >>Protocol: *Modbus*

Under ModBus Protocol enter the following:

1. Baud Rate: *300, 1200, 2400, 4800, 9600, 38,00 (9600 is default)*
2. Parity: None, *Odd, Even* (None is default)
3. Word Format: *Normal, Reversed* (Normal is default)
4. Address: *1-254* (devices on each RS-485 network should be limited for best communication update times e.g. <10)

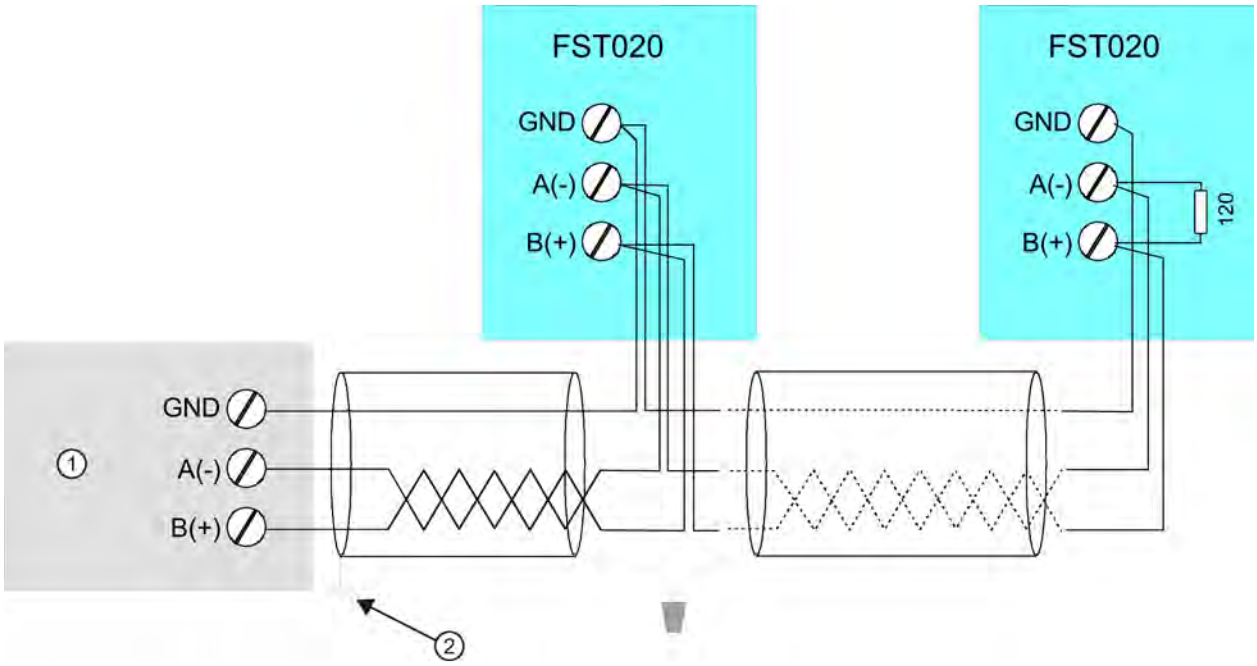
RS-485 Wiring

Use a recommended cable for RS-485 wiring such as Belden 9842 or Belden 3106. The two recommended BACnet routers for use with the FST020 are:

- Contemporary Controls BASRTLX-B High Performance BACnet router
- MBS GmbH UBR-01 Universal BACnet Router

Note

See manufacturer's manual for complete details on the Conversion Device wiring.



① Conversion Device (e.g. BACnet Router).
② Connect shield to chassis at one point only.

Figure A-4 RS-485 Wiring Diagram

A.3 Technical Data

Input

- Flow Range: ± 12 m/s (± 40 ft/s) bi-directional
- Flow Sensitivity: 0.0003 m/s (0.001 ft/s) flow rate independent

Digital Inputs

- Totalizer Hold Optically isolated diode
  Input voltage: 2-10 VDC
- Totalizer Reset Optically isolated diode
  Input voltage: 2-10 VDC

Output

- Current 4-20mA (Isolated)
  externally powered 10-30 VDC
- Relay Programmable Form C
  250mA, 30 VDC, 3 VA max
- Pulse Rate Optically isolated transistor
  10mA, 30 VDC, max

Accuracy

- Flow, 0.5 - 1.0% for velocities ≥ 0.3 m/s (1 ft/s)
- 4...20mA ± 1.0% - 2.0% of span for assigned parameters
- Pulse, relay output ±0.5% - 1.0% of flow
- Batch repeatability: ± 0.15%
- Zero Drift: 0.1% of rate: 0.0003 m/s (0.001 ft/s)
- Data refresh rate: 5 Hz

Transmitter Operating Conditions

- Operating Temperature: -10 to 50°C (14°F to 122°F)
- Storage Temperature: -20°C to 60°C (-4°F to 140°F)
- Degree of Protection: IP65/Type 4X/NEMA 4X

Design

- Weight 1.4 kg (3 lbs)
- Dimensions (WxHxD) 175.7 mm x 240.3 mm x 91.1 mm (6.92 in x 9.46 in x 3.59 in)
- Enclosure Material: Polycarbonate

Power Supply

- AC Version 100 - 240 VAC, 50/60 Hz, 20 VA max.
- DC Version 11.5 - 28.5 VDC, 10 watts max.

Certifications and approvals

Unclassified locations only UL Listing
ULc Listing

CE:

- EMC EN 61000-6-2,-4
  C-TICK

FST020 IP65 (NEMA 4X) Installation Menu Chart

LEVEL A	LEVEL B	LEVEL C	LEVEL D (see manual)	LEVEL E	LEVEL F
Meter Type ①	**Single Channel**	**Channel Setup**	Recall Site	Enter From List	
		②	**Channel Enable**	**No/Yes**	
			Create/Name Site	**Enter Site Name**	
			Site Security	On/Off	
			Delete Site	Enter From List	
			Save/Rename Site	Enter Name	
		③ **Pipe Data**	**Pick Pipe Class**	**Enter From List**	
			Select Pipe Size	**Enter From List**	
			Pipe OD (in)	**Numeric Entry**	
			Pipe Material	**Enter From List**	
			Wall Thickness	**Numeric Entry**	
			Liner Material	Enter From List	
			Liner Thickness	Numeric Entry	
		④ **Application Data**	**Liquid Class**	**Select Liquid**	**Enter from List**
				Estimated Vs M/S	Numeric Entry
				Viscosity (cS)	Numeric Entry
				Density S.G.	Numeric Entry
			Pipe Config	Enter From List	
			Anomaly Diams	Numeric Entry	
		⑤ **Install Sensor**	**Sensor Model**	**Enter From List**	
			Sensor Size	**Enter From List**	
			Sensor Mount Mode	**Enter From List**	
			Spacing Offset	**Enter From List**	
			Number Index	**View Only**	
			Spacing Method	**View Only**	
			Ltn Value (in)	**View Only**	
			Install Complete	**No/Install**	**Select Install**
			Empty Pipe Set	Enter From List	
			Zero Flow Adjust	Enter From List	
		Operation Adjust	Damping Control	Time Average / SmartSlew	
			Deadband Control	Numeric Entry	
			Memory/Fault Set	Fault/Memory	
			Memory Delay (s)	N/A	
		Flow/Total Units	Flow Vol. Units	Enter From List	
			Flow Time Units	Enter From List	
			Flow Disp. Range	Enter From List	
			Flow Disp. Scale	Enter From List	
			Total Vol. Units	Enter From List	
			Totalizer Scale	Enter From List	
			Total Resolution	Numeric Entry	
			Totalizer Mode	Enter From List	
			Batch/Sample Tot	Numeric Entry	
			Reset Totalizer	No/Yes	
		Span/Set/Cal	Span Data	PGEN P/	Numeric Entry
				Max Flow	
				Min Flow	
				Max Vs M/S	
				Min Vs M/S	
			Set Alarm Levels	Hi Flow	
				Low Flow	
				Interface Vs M/S	
				Aeration	
				Makeup Latch	
			Calibrate Flowrate	Intrinsic	
				Kc	
				MultiPoint	

This Menu Chart applies to:
MLFB - 7ME3570

SIEMENS
Siemens Industry, Inc.
Industry Automation Division
CoC Ultrasonic Flow
Hauppauge, New York
USA
Web: www.usa.siemens.com

FST020 IP65 (NEMA 4X) Installation Menu Chart

LEVEL A	LEVEL B	LEVEL C	LEVEL D (see manual)	LEVEL E	LEVEL F
		Logger Setup	Logger Mode	Enter From List	
			Logger Data	Enter From List	
			Log Interval	Enter From List	
			Logger Events	Enter From List	
		I/O Data Control	Analog Out Setup	Io1	Enter From List
			Relay Setup	Enter From List	
			Pulse Out Setup	Po	Enter From List
		Diagnostic Data	Flow Data	View Only	
			Application Info	View Only	
			Liquid Data	View Only	
			Site Setup Data	View Only	
			Test Facilities	Enter From List	
			Print Site Setup	No/Yes	
			Site Created:	View Only	mm.dd.yy hh.mm.ss
Meter Facilities	Preferred Units	English/Metric			
	Table Setups	Pipe Table	Create/Edit Pipe	Enter From List	
			Delete Pipe	Enter From List	
		Sensor Type	Enter From List		
	Logger Control	Output Logger	No/Yes		
		Est LogTime Left	View Only		
		Clear Logger	No/Yes		
	Memory Control	Log Memory Left	View Only		
		Defragment	No/Yes		
	Analog Out Trim	Trim Io1	Operate / Trim @ 4mA		
	Clock Set	Date (MM.DD.YY)	ENTER/Clear Date Format		
		Time ((HH.MM)	ENTER/Clear Time Format		
	RS-232 Setup	Baud Rate	Enter From List		
		Parity	Enter From List		
		Data Bits	7		
		Line Feed	No/Yes		
		Network ID	Numeric Entry		
		RTS Key Time	Enter From List		
	RS-485 Setup	Protocol	Modbus	Baud Rate	Enter From List
				Parity	Enter From List
				Word Format	Enter From List
				Address	Enter From List
			BacNet	Baud Rate	Enter From List
				Address	Enter From list
				Device Number	Numeric Entry
				Network Number	Numeric Entry
				Device Number	Enter
	System Info	Version	View Only		
		Reset Data/Time	View Only	mm.dd.yy hh.mm.ss	
		Op System P/N	View Only		
		Checksum	View Only		
		Code	View Only		
		System Time	View Only	mm.dd.yy hh.mm.ss	
Language	Enter From List				

SIEMENS

Siemens Industry, Inc.
Industry Automation Division
CoC Ultrasonic Flow
Hauppauge, New York 11788 USA
Web: www.usa.siemens.com

DUCTILE IRON PIPE

Nominal Diameter	Actual O.D.	CLASS 50		CLASS 51		CLASS 52		CLASS 53		CLASS 54		CLASS 55		CLASS 56		Liner (Cement)	
		Wall	I.D.	Wall	I.D.	Wall	I.D.	Wall	I.D.	Wall	I.D.	Wall	I.D.	Wall	I.D.	Single	Double
3	3.96	N/A	N/A	0.25	3.46	0.28	3.40	0.31	3.34	0.34	3.28	0.37	3.22	0.40	3.16	0.125	0.250
4	4.80	N/A	N/A	0.26	4.28	0.29	4.22	0.32	4.16	0.35	4.10	0.38	4.04	0.41	3.98	0.125	0.250
6	6.90	0.25	6.40	0.28	6.34	0.31	6.28	0.34	6.22	0.37	6.16	0.40	6.10	0.43	6.04	0.125	0.250
8	9.05	0.27	8.51	0.30	8.45	0.33	8.39	0.36	8.33	0.39	8.27	0.42	8.21	0.45	8.15	0.125	0.250
10	11.10	0.29	10.52	0.32	10.46	0.35	10.40	0.38	10.34	0.41	10.28	0.44	10.22	0.47	10.16	0.125	0.250
12	13.20	0.31	12.58	0.34	12.52	0.37	12.46	0.40	12.40	0.43	12.34	0.46	12.28	0.49	12.22	0.125	0.250
14	15.30	0.33	14.64	0.36	14.58	0.39	14.52	0.42	14.46	0.45	14.40	0.48	14.34	0.51	14.28	0.1875	0.375
16	17.40	0.34	16.72	0.37	16.66	0.40	16.60	0.43	16.54	0.46	16.48	0.49	16.42	0.52	16.36	0.1875	0.375
18	19.50	0.35	18.80	0.38	18.74	0.41	18.68	0.44	18.62	0.47	18.56	0.50	18.50	0.53	18.44	0.1875	0.375
20	21.60	0.36	20.88	0.39	20.82	0.42	20.76	0.45	20.70	0.48	20.64	0.51	20.58	0.54	20.52	0.1875	0.375
24	25.80	0.38	25.04	0.41	24.98	0.44	24.92	0.47	24.86	0.50	24.80	0.53	24.74	0.56	24.68	0.1875	0.375
30	32.00	0.39	31.22	0.43	31.14	0.47	31.06	0.51	30.99	0.55	30.90	0.59	30.82	0.63	30.74	0.250	0.500
36	38.30	0.43	37.44	0.48	37.34	0.53	37.24	0.58	37.14	0.63	37.04	0.68	36.94	0.73	36.84	0.250	0.500
42	44.50	0.47	43.56	0.53	43.44	0.59	43.32	0.65	43.20	0.71	43.08	0.77	42.96	0.83	42.84	0.250	0.500
48	50.80	0.51	49.78	0.58	49.64	0.65	49.50	0.72	49.36	0.79	49.22	0.86	49.08	0.93	48.94	0.250	0.500
54	57.56	0.57	56.42	0.65	56.26	0.73	56.10	0.81	55.94	0.89	55.78	0.97	55.62	1.05	55.46	0.250	0.500

CAST IRON PIPE - AWWA STANDARD

Pipe Size	CLASS A			CLASS B			CLASS C			CLASS D			CLASS E			CLASS F			CLASS G			CLASS H		
	O.D	Wall	I.D.	O.D	Wall	I.D.	O.D	Wall	I.D.	O.D	Wall	I.D.	O.D	Wall	I.D.	O.D	Wall	I.D.	O.D	Wall	I.D.	O.D	Wall	I.D.
3	3.80	0.39	3.02	3.96	0.42	3.12	3.96	0.45	3.06	3.96	0.48	3.00												
4	4.80	0.42	3.96	5.00	0.45	4.10	5.00	0.48	4.04	5.00	0.52	3.96												
6	6.90	0.44	6.02	7.10	0.48	6.14	7.10	0.51	6.08	7.10	0.55	6.00	7.22	0.58	6.06	7.22	0.61	6.00	7.38	0.65	6.08	7.38	0.69	6.00
8	9.05	0.46	8.13	9.05	0.51	8.03	9.30	0.56	8.18	9.30	0.60	8.10	9.42	0.66	8.10	9.42	0.71	8.00	9.60	0.75	8.10	9.60	0.80	8.00
10	11.10	0.50	10.10	11.10	0.57	9.96	11.40	0.62	10.16	11.40	0.68	10.04	11.60	0.74	10.12	11.60	0.80	10.00	11.84	0.86	10.12	11.84	0.92	10.00
12	13.20	0.54	12.12	13.20	0.62	11.96	13.50	0.68	12.14	13.50	0.75	12.00	13.78	0.82	12.14	13.78	0.89	12.00	14.08	0.97	12.14	14.08	1.04	12.00
14	15.30	0.57	14.16	15.30	0.66	13.96	15.65	0.74	14.17	15.65	0.82	14.01	15.98	0.90	14.18	15.98	0.99	14.00	16.32	1.07	14.18	16.32	1.16	14.00
16	17.40	0.60	16.20	17.40	0.70	16.00	17.80	0.80	16.20	17.80	0.89	16.02	18.16	0.98	16.20	18.16	1.08	16.00	18.54	1.18	16.18	18.54	1.27	16.00
18	19.50	0.64	18.22	19.50	0.75	18.00	19.92	0.87	18.18	19.92	0.96	18.00	20.34	1.07	18.20	20.34	1.17	18.00	20.78	1.28	18.22	20.78	1.39	18.00
20	21.60	0.67	20.26	21.60	0.80	20.00	22.06	0.92	20.22	22.06	1.03	20.00	22.54	1.15	20.24	22.54	1.27	20.00	23.02	1.39	20.24	23.02	1.51	20.00
24	25.80	0.76	24.28	25.80	0.89	24.02	26.32	1.04	24.22	26.32	1.16	24.00	26.90	1.31	24.28	26.90	1.45	24.00	27.76	1.75	24.26	27.76	1.88	24.00
30	31.74	0.88	29.98	32.00	1.03	29.94	32.40	1.20	30.00	32.74	1.37	30.00	33.10	1.55	30.00	33.46	1.73	30.00						
36	37.96	0.99	35.98	38.30	1.15	36.00	38.70	1.36	39.98	39.16	1.58	36.00	39.60	1.80	36.00	40.04	2.02	36.00						
42	44.20	1.10	42.00	44.50	1.28	41.94	45.10	1.54	42.02	45.58	1.78	42.02												
48	50.50	1.26	47.98	50.80	1.42	47.96	51.40	1.71	47.98	51.98	1.96	48.06												
54	56.66	1.35	53.96	57.10	1.55	54.00	57.80	1.90	54.00	58.40	2.23	53.94												
60	62.80	1.39	60.02	64.40	1.67	60.06	64.20	2.00	60.20	64.82	2.38	60.06												
72	75.34	1.62	72.10	76.00	1.95	72.10	76.88	2.39	72.10															
84	87.54	1.72	84.10	88.54	2.22	84.10																		

STAINLESS STEEL, HASTELLOY “C” & TITANIUM△ PIPE

Sched.	Size	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	22	24
5S◇	O.D.	0.840	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.000	4.500	5.563	6.625	8.625	10.750	12.750	14.000	16.000	18.000	20.000	22.000	24.000
	I.D.	0.710	0.920	1.185	1.530	1.770	2.245	2.709	3.334	3.834	4.334	5.345	6.407	8.407	10.482	12.438	13.688	15.670	17.670	19.634	21.624	23.563
	Wall	0.065	0.065	0.065	0.065	0.065	0.065	0.083	0.083	0.083	0.083	0.109	0.109	0.109	0.134	0.156	0.156	0.165	0.165	0.188	0.188	0.218
10S◇	I.D.	0.674	0.884	1.097	1.442	1.682	2.157	2.635	3.260	3.760	4.260	5.295	6.357	8.329	10.420	12.390	13.624	15.624	17.624	19.564	21.564	23.500
	Wall	0.083	0.083	0.109	0.109	0.109	0.109	0.120	0.120	0.120	0.120	0.134	0.134	0.148	0.165	0.180	0.188	0.188	0.188	0.218	0.218	0.250
40S	I.D.	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	3.548	4.026	5.047	6.065	7.981	10.020	12.000						
	Wall	0.109⊗	0.113⊗	0.133⊗	0.140⊗	0.145⊗	0.154⊗	0.203⊗	0.216⊗	0.226⊗	0.237⊗	0.258⊗	0.280⊗	0.322⊗	0.365⊗	* .375						
80S	I.D.	0.546	0.742	0.957	1.278	1.500	1.939	2.323	2.900	3.364	3.826	4.813	5.761	7.625	9.750	11.750						
	Wall	^.147	^.154	^.179	^.191	^.200	^.218	^.276	^.300	^.318	^.337	^.375	^.432	^.500	^.500	* .500						

CARBON STEEL and PVC△ PIPE

Pipe	Size	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	42
	O.D.	0.840	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.000	4.500	5.563	6.625	8.625	10.750	12.750	14.000	16.000	18.000	20.000	22.000	24.000	26.000	28.000	30.000	32.000	34.000	36.000	42.000
Stand-ard	I.D.	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	3.548	4.026	5.047	6.065	7.981	10.020	12.000	13.250	15.250	17.250	19.250	21.250	23.250	25.250	27.250	29.250	31.250	33.250	35.250	41.250
	Wall	0.109	0.113	0.133	0.140	0.145	0.154	0.203	0.216	0.226	0.237	0.258	0.280	0.322	0.365	0.375	0.375	0.375	0.375	0.375	0.375	0.375	0.375	0.375	0.375	0.375	0.375	0.375	* .375
Extra Strong (XS)	I.D.	0.546	0.742	0.957	1.278	1.500	1.939	2.323	2.900	3.364	3.826	4.813	5.761	7.625	9.750	11.750	13.000	15.000	17.000	19.000	21.000	23.000	25.000	27.000	29.000	31.000	33.000	35.000	41.000
	Wall	0.147	0.154	0.179	0.191	0.200	0.218	0.276	0.300	0.318	0.337	0.375	0.432	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	* .500
Double Extra Strong (XXS)	I.D	0.252	0.434	0.599	0.896	1.100	1.503	1.771	2.300	2.728	3.152	4.063	4.897	6.875	8.750	10.750													
	Wall	0.294	0.308	0.358	0.382	0.400	0.436	0.552	0.600	0.636	0.674	0.750	0.864	0.875	1.000	1.000													
Sched. 10	I.D.																13.500	15.500	17.500	19.500	21.500	23.500	25.376	27.376	29.376	31.376	33.376	35.376	
	Wall																0.250	0.250	0.250	0.250	0.250	0.250	0.312	0.312	0.312	0.312	0.312	0.312	
Sched. 20	I.D.													8.125	10.250	12.250	13.376	15.376	17.376	19.250	21.250	23.250	25.000	27.000	29.000	31.000	33.000	35.000	41.000
	Wall													0.250	0.250	0.250	0.312	0.312	0.312	0.375⊗	0.375⊗	0.375⊗	^.500	^.500	^.500	^.500	^.500	^.500	^.500
Sched. 30	I.D.													8.071	10.136	12.090	13.250	15.250	17.124	19.000	21.000	22.876		26.750	28.750	30.750	32.750	34.750	40.750
	Wall													0.277	0.307	0.330	0.375⊗	0.375⊗	0.438	^.500	^.500	0.562		0.625	0.625	0.625	0.625	0.625	* .625
Sched. 40	I.D.	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	3.548	4.026	5.047	6.065	7.981	10.020	11.938	13.124	15.000	16.876	18.184		22.626							
	Wall	0.109⊗	0.113⊗	0.133⊗	0.140⊗	0.145⊗	0.154⊗	0.203⊗	0.216⊗	0.226⊗	0.237⊗	0.258⊗	0.280⊗	0.322⊗	0.365⊗	0.406	0.438	^.500	0.562	0.593		0.687							
Sched. 60	I.D.													7.813	9.750	11.626	12.814	14.688	16.500	18.376	20.250	22.064							
	Wall													0.406	^.500	0.562	0.593	0.656	0.750	0.812	0.875	0.968							
Sched. 80	I.D.	0.546	0.742	0.957	1.278	1.500	1.939	2.323	2.900	3.364	3.826	4.813	5.761	7.625	9.564	11.376	12.500	14.314	16.126	17.938	19.750	21.564							
	Wall	^.147	^.154	^.179	^.191	^.200	^.218	^.276	^.300	^.318	^.337	^.375	^.432	^.500	0.593	0.687	0.750	0.843	0.937	1.031	1.125	1.218							
Sched. 100	I.D.													7.439	9.314	11.064	12.126	13.938	15.688	17.438	19.250	20.938							
	Wall													0.593	0.718	0.843	0.937	1.031	1.156	1.281	1.375	1.531							
Sched. 120	I.D.										3.624	4.563	5.501	7.189	9.064	10.750	11.814	13.564	15.250	17.000	18.750	20.376							
	Wall										0.438	0.500	0.562	0.718	0.843	1.000	1.093	1.218	1.375	1.500	1.625	1.812							
Sched. 140	I.D.													7.001	8.750	10.500	11.500	13.124	14.876	16.500	18.250	19.876							
	Wall													0.812	1.000	1.125	1.250	1.438	1.562	1.750	1.875	2.062							
Sched. 160	I.D.	0.466	0.614	0.815	1.160	1.338	1.689	2.125	2.624		3.438	4.313	5.189	6.813	8.500	10.126	11.188	12.814	14.438	16.064	17.750	19.314							
	Wall	0.187	0.218	0.250	0.250	0.281	0.343	0.375	0.438		0.531	0.625	0.718	0.906	1.125	1.312	1.406	1.593	1.781	1.968	2.125	2.343							

NON-STANDARD CARBON

Size	10	20	24	24
O.D.	10.750	20.000	24.000	24.000
I.D.	10.192	19.375	23.375	22.126
Wall	0.279	0.312	0.312	0.937

The above sizes are produced by pipe mills but dimensions do not conform to any regular standard or schedule.

△ These materials are generally available in Schedules 40 and 80 only.

◇ Wall Thickness of Schedule 5S & 10S does not permit threading in accordance with the American Standard for Pipe Threads (ASA No. B2.1)

⊗ Wall thickness identical with thickness of “Standard Weight” pipe.

^ Wall Thickness identical with thickness of “Extra-Heavy” pipe.

* These do not conform to American Standard B36. 10.

PIPE WEIGHT FORMULA FOR STEEL PIPE (lbs per foot)
10.68 (D-t) t, where D=Outside Diameter and t=Wall Thickness

SIEMENS

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