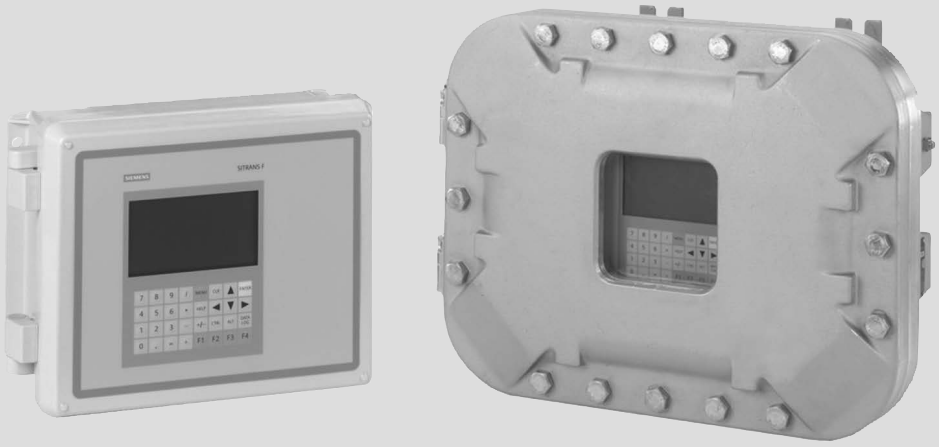
SIEMENS



SITRANS F

Ultrasonic Flowmeters

SITRANS FUG1010 IP65 NEMA 4X & IP66 NEMA 7 7ME361x, x=0, 3

Operating Instructions

Edition 6/2014

Answers for industry.

SIEMENS

SITRANS F

Ultrasonic Flowmeters FUG1010 IP65 NEMA 4X

Operating Instructions

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06/2014

A5E02951519-AD

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

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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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Industry Sector
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GERMANY

Order number: A5E02951519
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Introduction

1

These instructions contain all the information you need for using the device.

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 in the manual are read, understood and followed by the relevant personnel before installing the device.

1.1 Items supplied

- SITRANS FUG1010 IP65 (NEMA 4X) Transmitter
- SITRANS F Literature CD

Note

For additional items refer to your packing slip.

Inspection

1. Check for mechanical damage due to possible improper handling during shipment. All claims for damage are to be made promptly to the shipper.
2. Make sure the scope of delivery, and the information on the type plate corresponds to the ordering information.

1.2 History

The contents of these instructions are regularly reviewed and corrections are included in subsequent editions. We welcome all suggestions for improvement.

The following table shows the most important changes in the documentation compared to each previous edition.

Edition	Remarks
07/2010	First Edition of Operating Instructions for SITRANS FUG1010 IP65 NEMA 4X flow meter.
01/2011	Second Edition of Operating Instructions for SITRANS FUG1010 IP65 NEMA 4X flow meter.
01/2013	Third Edition of Operating Instructions for SITRANS FUG1010 IP65 NEMA 4X flow meter. The most important changes are as follows: • To use Si-Ware download the program at [http://s13.me/ns/cv] • Expanded I/O Module Installation Wiring Diagram 1010N-7-7 has been updated to Revision 08. • I/O Module Installation Wiring Diagram 1010N-2-7 has been updated to Revision 05. • Analog Input Module Installation Drawing 1010N-5DS2-7 has been updated to Revision 06.
06/2014	Fourth Edition of Operating Instructions for SITRANS FUG1010 IP65 NEMA 4X flow meter. This document replaces all previous instructions for use. The most important changes are as follows: • Elimination of all references to liquid flow. Where applicable, menus were replaced with correct gas menus. • Hi Precision sensor label illustration was replaced with latest label graphics. • Si-Ware link was updated: Download the program at [http://www.siemens.com/siware] • High Pressure and Low Pressure menu items were added to the Relay Option List table and the menu software.

1.3 Further Information

Product information on the Internet

The Operating Instructions are available on the CD-ROM shipped with the device and on the Internet on the Siemens homepage, where further information on the range of SITRANS F flow meters may also be found: Product information on SITRANS F in the Internet (http://www.siemens.com/sitransf)

Worldwide contact person

If you need more information or have particular problems not covered sufficiently by the operating instructions, please get in touch with your contact person. You can find contact information for your local contact person on the Internet: www.siemens.com Local contact person (http://www.automation.siemens.com/partner)

Safety notes

2

⚠ CAUTION
Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance. Only qualified personnel should install or operate this instrument.

Note

Alterations to the product, including opening or improper repairs of the product, are not permitted.

If this requirement is not observed, the CE mark and the manufacturer's warranty will expire.

2.1 Warning Symbols

Symbol	Explanation
	Consult operating instructions
	Hot surface
	Dangerous electrical voltage
	Corrosive materials
	Toxic materials
	Isolate the device from power using a circuit-breaker
	Protect the device from impact otherwise loss of degree of protection
	Protective insulation; device in protection class II

2.2 Laws and directives

General requirements

Installation of the equipment must comply with national regulations. For example, the National Electrical Codes.

Instrument safety standards

The device has been tested at the factory, based on the safety requirements. In order to maintain this condition over the expected life of the device the requirements described in these Operating Instructions must be observed.

NOTICE
Material compatibility Siemens can provide assistance with the selection of sensor parts. However, the full responsibility for the selection rests with the customer and Siemens can take no responsibility for any failure due to material incompatibility.

CE marked equipment

The CE-mark symbolizes the compliance of the device with the following Directives:

- EMC-Directive 2004/108/EC
- Low voltage Directive 2006/95/EC
- ATEX Directive 94/9/EC

2.3 Lithium batteries

Lithium batteries are primary power sources with high energy content designed to represent the highest possible degree of safety.

⚠ WARNING
Potential hazard Lithium batteries may present a potential hazard if they are abused electrically or mechanically. This is in most circumstances associated with the generation of excessive heat where internal pressure may cause the cell to rupture. Thus the following basic precautions should be observed when handling and using lithium batteries: • Do not short-circuit, recharge or connect with false polarity. • Do not expose to temperature beyond the specified temperature range or incinerate the battery. • Do not crush, puncture or open cells or disassemble battery packs. • Do not weld or solder to the battery's body. • Do not expose contents to water.

2.4 Installation in hazardous area

⚠ WARNING

Explosion Hazard

Equipment used in hazardous areas must be Ex-approved and marked accordingly.

It is required that the special conditions for safe use provided in the manual and in the Ex certificate are followed!

Hazardous area approvals

The device is approved for use in hazardous area and has the following approval:

- FM and CSA certified

- Class I, Division 1, Groups ABCD

- Class II, Division 1, Groups EFG

- ATEX

⚠ WARNING

Explosion Hazard

Devices without the correct hazardous area approval create dangerous environments.

Make sure the hazardous area approval is suitable for the environment in which the device will be installed.

Intrinsically safe data

⚠ WARNING

Explosion Hazard

User must install unit with Siemens drawings. With intrinsically safe circuits, use only certified meters appropriate for the transmitter.

If a non-conforming supply unit is used, the "fail-safe" type of protection will no longer be effective and the approval certification will be invalid.

Hazardous area safety requirements

It is required that:

- Electrical connections are in accordance with EN60079-14 (Installing Electrical Systems in Explosion Hazardous Areas).
- The protective cover over the power supply is properly installed. For intrinsically safe circuits the connection area can be opened.
- Appropriate cable connectors are used for the output circuits:
  - Intrinsically safe: blue
  - Non-intrinsically safe: black
- Sensor and transmitter are connected to the potential equalization.
  For intrinsically safe output circuits potential equalization must be maintained along the entire connection path.
- When protective earth (PE) is connected, no potential difference between the protective earth (PE) and the potential equalization (PA) can exist, even during a fault condition.

⚠ WARNING

Explosion Hazard

"Flameproof enclosure" type of protection

Only open devices with type of protection "Flameproof enclosure" (e.g. FUT1010 NEMA 7) in hazardous areas when the power to the device is turned off, otherwise there is a risk of explosion.

⚠ WARNING

Explosion Hazard

Laying Cables

Cable for use in zone 1 and 2 must satisfy the requirements for having a proof voltage < AC 500 V applied between the conductor/ground, conductor/shield and shield/ground.

Connect the devices that are operated in hazardous areas as per the stipulations applicable in the country of operation, e.g. for Ex "d" and "nA", permanent cables must be laid.

⚠ WARNING

Explosion Hazard

Devices with the common approval "Intrinsically safe" and "Flameproof"

The following is applicable for devices with the common approval "Intrinsically safe" and "Flameproof" (Ex ia + Ex d): Before commissioning, make sure that the type of protection that is not suitable is permanently defaced on the nameplate to avoid improper use.

If a non-conforming infeed is used, the "fail-safe" type of protection will no longer be effective.

2.5 Safety Notes

Safety Information for Hazardous Areas



DANGER

Explosion Hazard

Will Cause Death, Serious Injury or Property Damage

Restrict use and repair to qualified personnel.

DANGER

Explosion Hazard

Death or severe personal injury and/or equipment and property damage will result if proper Hazardous (Classified) Locations installation precautions are not taken.

Restrict use and repair to qualified personnel.

DANGER

Explosion Hazard

The use of unauthorized parts in the repair of the equipment, tampering by unqualified personnel, or operation with the cover open in a Hazardous (Classified) Location will result in dangerous conditions which will cause death, serious injury, and/or equipment and property damage.

Restrict use and repair to qualified personnel.

Follow all safety instructions contained or referenced herein.

DANGER

Explosion Hazard

Death or severe personal injury and/or equipment and property damage will result due to improper installation or use of this equipment when located in a Hazardous (Classified) Location.

- Install as directed.
- Disconnect power source before servicing.
- Keep cover closed when equipment is operating.

⚠ WARNING

Qualified personnel

This flowmeter system may only be set up and used in conjunction with this manual and the instructions on the electronic media provided. Installation, maintenance and operation of the flowmeter system may only be performed by qualified personnel. Within the context of this Manual, qualified persons are defined as persons who have the skills and knowledge related to the construction and operation of the electrical equipment and installations and have received safety training to recognize and avoid the potentially explosive hazards involved.

Qualified personnel possess the following qualifications

1. Is trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety practices.
2. Is trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with established safety practices.
3. Is trained in rendering first aid

Note

This Manual does not purport to cover all details or variations in equipment, or to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise, which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Siemens sales office (www.siemens.com). The contents of this manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contact between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.

Safety Information for Hazardous Areas

Note

Ratings under this heading apply to specific model families

Check Your Model Number:
FUG1010, 7ME3610 only

FM-CSA installation

Read, understand and follow all safety instructions on the electronic media provided. This equipment is rated for use in hazardous (classified) locations as stated below and must be installed according to the 1010-304 installation drawing provided on the media. Failure to install the equipment in the prescribed manner will result in unsafe operation. Follow all local jurisdictional safety codes when operating this equipment. When properly installed the equipment meets the following FM – CSA ratings.

Transmitter

- Intrinsically safe connections Class I and II, Division 1, Groups A, B, C, D, E, F and G;
- Nonincendive for Class I, Division 2, Groups A, B, C and D;
- Suitable for Class II Division 2, Groups E, F and G outdoor (Type 4X), Class III (CSA only)
- Temperature code T5 at an ambient of 40°C

Sensors

- Intrinsically safe Class I and II, Division 1, Groups A, B, C, D, E, F and G;
- Nonincendive for Class I, Division 2, Groups A, B, C and D;
- Suitable for Class II, Division 2, Groups E, F and G outdoor (Type 4X), Class III (CSA only)
- Temperature code T6 at an ambient of 40°C

ATEX installation

Read, understand and follow all safety instruction on the electronic media provided. This equipment complies with Directive 94/9/EC and is rated for use in potentially explosive atmospheres. The equipment markings are shown and explained below. Equipment must be installed according to the 1010-389 installation drawing provided on the media. Failure to install the equipment in the prescribed manner will result in unsafe operation. Follow all regional safety laws when operating this equipment. When properly installed the equipment meets the following ATEX ratings as stated in EC-Type Examination Certificate KEMA03ATEX1134

Transmitter Markings and Explanations

- ⟨Ex⟩II (1) G [Ex ia] IIC – Transmitter located in the non-hazardous area with intrinsically safe circuits of category Ex ia, which can be connected to Category 1 Sensors
- ⟨Ex⟩II 3 (1) G Ex nC [ia] IIC T5 – Category 3 Transmitter located in Zone 2 potentially explosive atmosphere with intrinsically safe circuits of category Ex ia, which can be connected to Category 1 Sensors in Zone 0
- IP65 – Ingress protection against solid bodies, rating of dust-tight and against liquid, rating of water jets

Sensors Markings and Explanations

- ⟨Ex⟩II 1 G Ex ia IIC T5 – Category 1 Sensors located in Zone 0 potentially explosive atmosphere with intrinsically safe circuits of category Ex ia for use in potentially explosive atmosphere containing gases

Safety Information for Hazardous Areas

Note

Ratings under this heading apply to specific model families

Check Your Model Number: FUG1010, 7ME3613 only

FM-CSA installation

Read, understand and follow all safety instruction on the electronic media provided. This equipment is rated for use in hazardous (classified) locations as stated below and must be installed according to the 1010-443 installation drawing provided on the media. Failure to install the equipment in the prescribed manner will result in unsafe operation. Follow all local jurisdictional safety codes when operating this equipment. When properly installed the equipment meets the following FM – CSA ratings:

Transmitter

- Explosionproof for Class I, Division1, Groups B, C, D;
- Dust-ignitionproof for Class II, Division 1, Groups E, F and G
- Intrinsically safe connections for Class I and II, Division 1, Groups A, B, C, D, E, F and G;
- Nonincendive for Class I, Division 2, Groups A, B, C and D;
- Suitable for Class II, Division 2, Groups E, F and G outdoor (Type 4X), Class III (CSA only)

Sensors

- Intrinsically safe Class I and II, Division 1, Groups A, B, C, D, E, F and G;
- Nonincendive for Class I, Division 2, Groups A, B, C and D;
- Suitable for Class II, Division 2, Groups E, F and G outdoor (Type 4X), Class III (CSA only)
- Temperature code T6 at an ambient of 40°C

ATEX installation

Read, understand and follow all safety instruction on the electronic media provided. This equipment is rated for use in explosive atmospheres as stated below and must be installed according to the 1010-464 installation drawing provided on the media. Failure to install the equipment in the prescribed manner will result in unsafe operation. Follow all regional safety laws when operating this equipment. When properly installed the equipment meets the following ATEX ratings as stated in EC-Type Examination Certificate KEMA03ATEX1134

Transmitter Markings and Explanations

- ⟨Ex⟩II (1) G [Ex ia] IIC– Transmitter located in the non-hazardous area with intrinsically safe circuits of category Ex ia, which can be connected to Category 1 Sensors for use in potentially explosive atmosphere containing gases
- ⟨Ex⟩II 3 (1) G Ex nC [ia] IIC T5 (Tamb = 0° To + 60°C) – Category 3 Transmitter located in Zone 2 potentially explosive atmosphere with intrinsically safe circuits of category Ex ia, which can be connected to Category 1 Sensors in Zone 0 potentially explosive atmosphere containing gases
- ⟨Ex⟩II 2 (1) G Ex d [ia IIC] IIB+H2 T5 (Tamb = 0° To + 50°C) – Category 2 Transmitter located in Zone 1 potentially explosive atmosphere with intrinsically safe circuits of category Ex ia, which can be connected to Category 1 Sensors for use in potentially explosive atmosphere containing gases
- IP66 – Ingress protection against solid bodies, rating of dust-tight and against liquid, rating of heavy seas

Sensors Markings and Explanations

- ⟨Ex⟩II 1 G Ex ia IIC T5 – Category 1 Sensors located in Zone 0 potentially explosive atmosphere with intrinsically safe circuits of category Ex ia for use in potentially explosive atmosphere containing gases

Safety Information for Hazardous Areas

Note

Ratings under this heading apply to specific model families

Check Your Model Number:
FUG1010, 7ME3611 only

FM-CSA installation

Read, understand and follow all safety instruction on the electronic media provided. This equipment is rated for use in hazardous (classified) locations as stated below and must be installed according to the 1010-341 installation drawing provided on the media. Failure to install the equipment in the prescribed manner will result in unsafe operation. Follow all local jurisdictional safety codes when operating this equipment. When properly installed the equipment meets the following FM–CSA ratings:

Transmitter

- Explosionproof for Class I, Division1, Groups B, C, D;
- Dust-ignitionproof for Class II, Division 1, Groups E, F and G
- Intrinsically safe connections for Class I and II, Division 1, Groups A, B, C, D, E, F and G;

- Nonincendive for Class I, Division 2, Groups A, B, C and D;
- Suitable for Class II, Division 2, Groups E, F and G outdoor (Type 4X), Class III (CSA only)

Sensors

- Intrinsically safe Class I and II, Division 1, Groups A, B, C, D, E, F and G;
- Nonincendive for Class I, Division 2, Groups A, B, C and D;
- Suitable for Class II, Division 2, Groups E, F and G outdoor (Type 4X), Class III (CSA only)
- Temperature code T6 at an ambient of 40°C

ATEX installation

Read, understand and follow all safety instruction on the electronic media provided. This equipment is rated for use in explosive atmospheres as stated below and must be installed according to the 1010-422 installation drawing provided on the media. Failure to install the equipment in the prescribed manner will result in unsafe operation. Follow all regional safety laws when operating this equipment. When properly installed the equipment meets the following ATEX ratings as stated in EC-Type Examination Certificate KEMA03ATEX2133

Transmitter

- II 2 (1) G Ex d [ia] IIB+H2 – Category 2 Transmitter located in Zone 1 potentially explosive atmosphere with intrinsically safe circuits of category Ex ia, which can be connected to Category 1 Sensors for use in potentially explosive atmosphere containing gases
- IP65 – Ingress protection against solid bodies, rating of dust-tight and against liquid, rating of water jets

Sensors

- II 1 G Ex ia IIC T5 – Category 1 Sensors located in Zone 0 potentially explosive atmosphere with intrinsically safe circuits of category Ex ia for use in potentially explosive atmosphere containing gases

2.6 Certificates

Certificates are posted on the Internet and on the documentation CD-ROM shipped with the device.

See also

Troubleshooting (Page 139)

Certificates on the Internet (http://www.siemens.com/processinstrumentation/certificates)

Description

3

3.1 FUG1010 features

Description

The Siemens SITRANS FUG1010 IP65 NEMA 4X & IP66 NEMA 7 flow meters achieve highly accurate flow measurement owing to the WideBeam ultrasonic transit-time technology. The sensors are mounted on the outside of the pipe, preventing contact with the medium.

The sensor construction makes installation and commissioning of even the largest sizes very straight forward and easy. The sensors deliver true multi-parameter measurements i.e. volume flow, density and temperature.

Note

This operating instructions manual applies to the following FUG1010 IP65 NEMA 4X and IP66 NEMA 7 operating systems: Version 3.02.00 and later and version 5.03.00 and later.

3.2 NEMA 4X & NEMA 7 Transmitters

SITRANS FUG1010 Transmitters

The SITRANS FUG1010 IP65 NEMA 4X and IP66 NEMA 7 series transmitters are available in Single Channel, Dual Path and Quad-Path versions. The transmitters include a graphic display providing flow rate, diagnostics data and keypad interface to access on-screen software setup menus. Safety agency approved SITRANS FUG1010 series transmitters have hazardous area certification as indicated in the label examples below.

SITRANS FUG1010 NEMA Transmitter Labels

The transmitter label is located on the right side panel of the unit. The illustration shows a typical label but labels vary depending upon model and installation location.



Figure 3-1 Typical Transmitter Label

SITRANS FUG1010 Model Numbers

The SITRANS FUG1010 NEMA 4X model numbers:

- Single Channel - 7ME3610-1
- 2 Path - 7ME3610-2
- 4-Path - 7ME3610-9 (Wall Mount only)

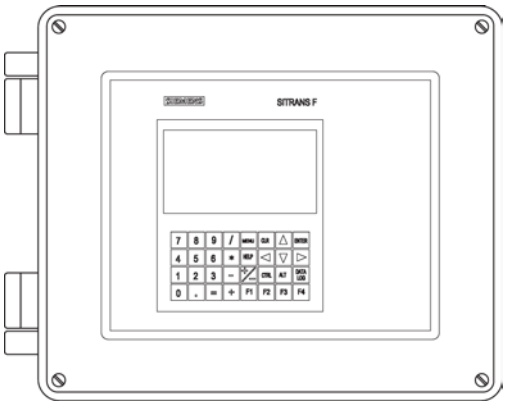


Figure 3-2 NEMA 4X Transmitter Case

Note

The NEMA 4X Quad-Path transmitter case is slightly larger.

The SITRANS FUG1010 NEMA 7 model numbers:

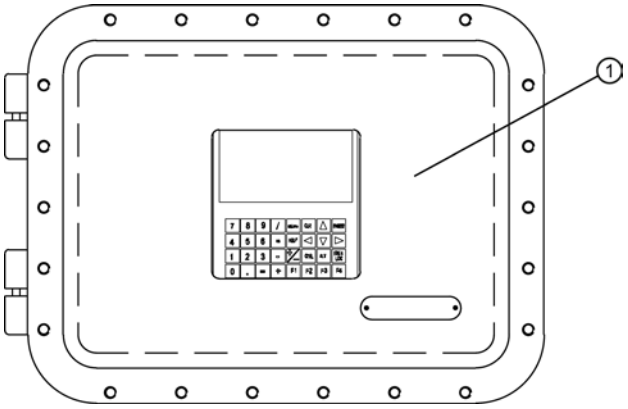
- Single Channel - 7ME3613-1 (Wall Mount -H2 rated with display window)
- 2 Path - 7ME3613-2 (Wall Mount -H2 rated with display window)
- 4-Path - 7ME3613-9 (Wall Mount -H2 rated with display window)

⚠ WARNING

Electrical Shock Hazard

Access to the Graphic display and keypad setup must be done with cover opened exposing high voltage connections.

Consult local codes for permit needed to setup FUG1010 NEMA 7 units using the graphic display and local keypad to avoid injury.



① Standard Case Enclosure

Figure 3-3 NEMA 7 Case with graphic display and keypad.

3.3 Applications

Measurement of media

SITRANS FUG1010 gas flow meters are designed for measurement of a variety of gases. The transmitters are multi-parameter devices offering accurate measurement of mass flow, volume flow, density, and temperature.

Typical Applications

The typical applications of the flowmeter are:

- Lost and unaccounted for (LAUF) analysis
- Allocation measurement
- Flow survey verification
- Production well testing

- Underground storage applications
- Gas fired power stations

Typical Industries Serviced

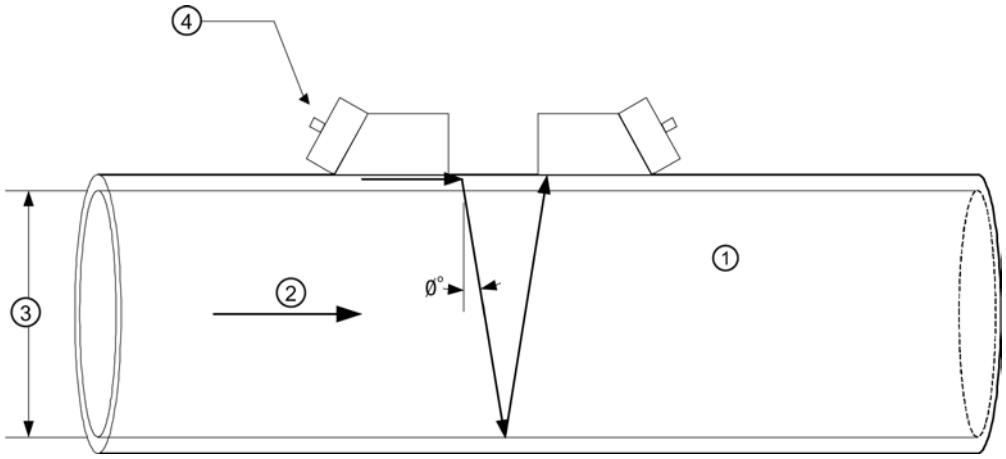
- Power Generation (Nuclear, Fossil, and Hydro)
- Chemical Processing
- Hydrocarbon Industries
- Hydrocarbon Transportation

3.4 Theory of Operation

The gas flow meter relies on the MultiPulse transit-time. Two WideBeam ultrasonic sensors per measuring path, alternating as transmitter and receiver, are used to interrogate the gas flowing within the metering section. The resulting time of arrival for each direction of transmit (upstream and downstream) is then measured using a highly accurate and stable digital signal processing method.

Using this detection scheme, the flow meter is capable of resolving the relative transit-time difference (dT) to within ±100 psec. Considering typical gas flow transit-time differences ranging from $1x10^4$ to $1x10^6$ psec, the flow meter is capable of providing an exceptional turn-down ratio. The flow meter also incorporates a correlation technique which enables the system to detect very high flow velocities with the same high degree of resolution. The ultrasonic sensors are designed with sufficient beam divergence characteristics to insure that the receive sensor will always have sufficient signal to maintain operation under conditions of high beam blowing, a condition that occurs under very high flow velocities where the path of the ultrasonic beam is actually blown past the receivable area of the sensor.

With accurate signal arrival time available, the flow meter can compute the raw flow velocity from the measured upstream and downstream transit times.



① Velocity of Sound
② Flow Vector
③ Pipe ID
④ WideBeam Sensors

$\varnothing = \sin^{1}(VOS / V_{phase})$

$T_L = 2 * ID / (VOS * \cos \varnothing)$

$V_F = V_{phase} * DT / (2 * TL)$

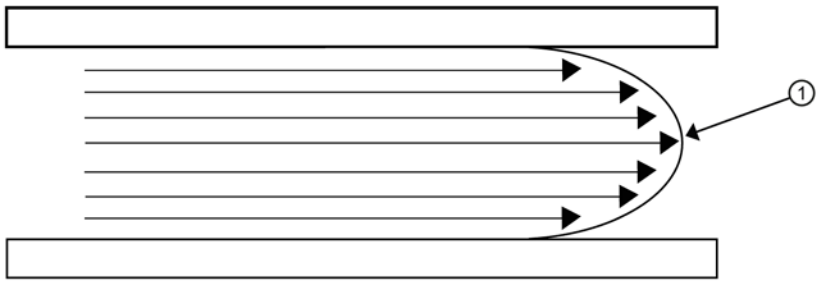
Where:

VOS = Velocity of sound in gas
V_{phase} = Phase velocity of sensor
ID = Pipe inside diameter
T_L = Transit time in gas
DT = Measured Transit-Time difference
V_F = Flow Velocity

Flow Profile Compensation

The flow equation shown above is only valid for "plug" flow, where the flow velocity is uniform across the entire cross-section of the pipe. Frictional forces between the fluid and the pipe wall cause the flow velocity to be nearly zero at the pipe wall and peaked toward the center of the pipe (as shown in the diagram below).

The acoustic beam traverses the center of the pipe and therefore must account for the influence that flow profile has on the line integration through a round pipe. The shape of this flow profile (for fully developed flow) is defined by the Reynolds number.



① Fluid velocity near the axis of the flow stream tends to be greater.

The Reynolds number is then computed as follows:

$$Rn = \frac{645 * \text{Pipe ID} * V_F}{\text{Viscosity}}$$

where:

viscosity = cS = cP/density

Pipe ID = inches

V_F = inches/sec

cS = kinematic viscosity

cP = absolute viscosity

The flow meter then uses this computation of Reynolds number to compensate the raw flow velocity for conditions of laminar or turbulent flow profile as defined by an internal Reynolds compensation table. The flow meter then converts the compensated flow velocity to volumetric flow rate.

Rate = V_F * Comp(Rn) * Pipe area

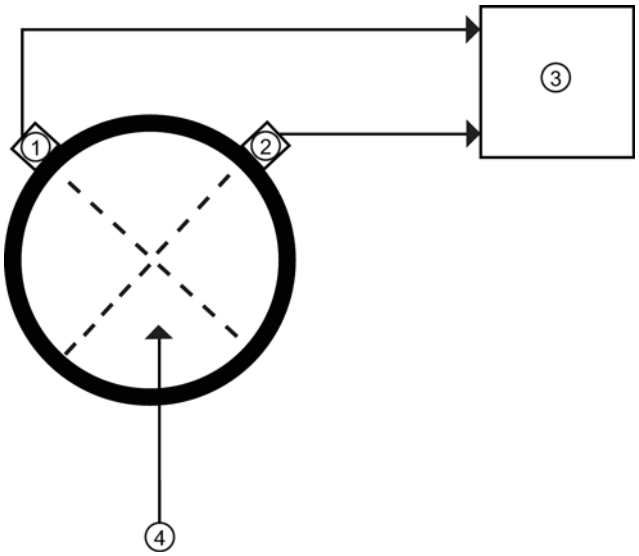
Flow Meter Types

The meter automatically conditions Installation Menu choices to suit the selected meter type. The following paragraphs introduce the available flow meter types that include:

- 2-Path
- 4-Path

2-Path

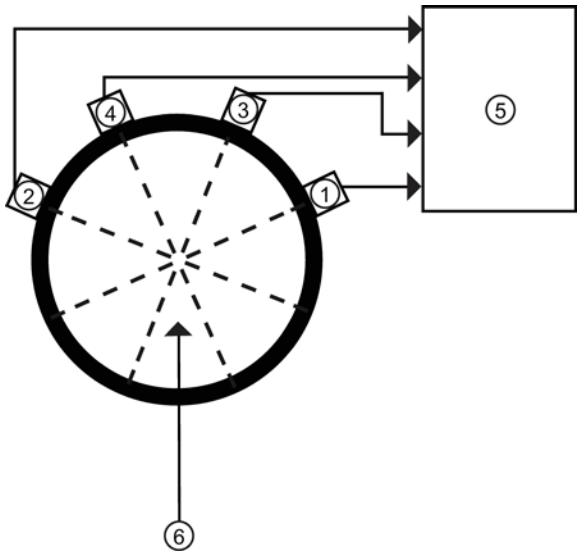
2-Path flow meters use two measurement channels to achieve a single output via a "virtual" third channel. The resultant data is the average of the two channels. Only clamp-on or in-line transit-time operation is allowed. Benefits include highest available precision and enhanced immunity to distorted flow profile conditions.



① Sensor Path 1
② Sensor Path 2
③ Average= (Path 1 + Path 2) / 2
④ Pipe (front view)

4-Path

4-Path flow meters use four measurement channels to achieve a single output via a "virtual" fifth channel. The resultant data is the average of the four channels.



①	Sensor Path 1	④	Sensor Path 4r
②	Sensor Path 2	⑤	Average= (Path 1 + Path 2 + Path 3 + Path 4) / 4
③	Sensor Path 3	⑥	Pipe (front view)

WideBeam Transmission

As shown in the figure above, an ultrasonic sensor induces an axial sonic beam within the wall of the pipe. These vibrations spread along the pipe wall and then enter the gas in the form of a WideBeam wave front traveling at an angle to the main pipe axis. The wide beam "rains" over the receiving sensor. The wide coverage of the receiver is necessary because the angle of the sonic beam is related to the gas's sonic propagation velocity by Snell's Law.

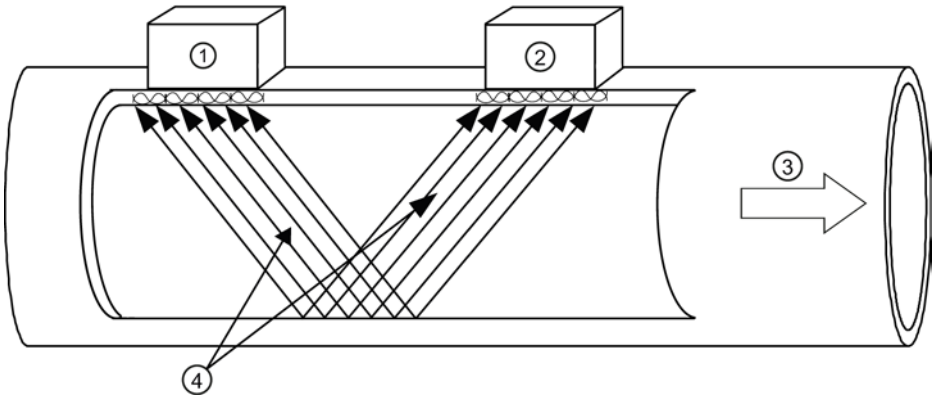
$$\text{Beam Angle} = \text{Arc Sine}\left(\frac{\text{Gas Sonic Propagation Velocity}}{\text{Transducer Phase Velocity}}\right)$$

According to this formula, it can be stated that as the gas sonic propagation velocity changes so will the angle between the sonic beam and the flow stream.

Therefore, a significant gas sonic velocity shift could deflect a "narrow" beam transmission away from the receiving sensor entirely. The upstream vs. downstream transit-time difference will also be affected by the changing (or refracting) beam angle. This makes it necessary for flow meter systems to continuously compute this angle, since it is subject to varying degrees of refraction. The flow meter derives the angle by knowing the fixed position of the sensors, the dimensions of the pipe and the measured transit-time.

Flow Calibration Factor

Normally, the flow stream is parallel to the axis of the pipe. On this basis, the calibration factor of a clamp-on ultrasonic flow meter is proportional to the cosine of the beam angle relative to the pipe axis. However, this reveals that if the angle of flow stream is not in line with the pipe axis, the flow calibration factor could be compromised. This most often occurs when the sensor mounting location is within close proximity of a bend or other pipe obstruction.



① Upstream Sensor
② Downstream Sensor
③ Flow Direction
④ Wide Beam transmissions exchanged between the Upstream and Downstream sensors

Reflect mounting automatically corrects for non-axial flow or cross flow since the 2 vectors in a reflected beam are affected in opposite directions, such that the individual cross flow errors cancel each other.

Installing/Mounting

4

4.1 Installation safety precautions

⚠ WARNING
High pressure hazard In applications with working pressures/media that can be dangerous to people, surroundings, equipment or others in case of pipe fracture, we recommend that special precautions such as special placement, shielding or installation of a pressure guard or a safety valve are taken when the sensor is mounted.

4.2 Determining a location

⚠ WARNING
Electrical Shock Hazard May cause death or serious personal injury. Disconnect power before working on this product.

Upstream / Downstream

The location parameters for the gas flow meter are 20 diameters upstream of the sensor and 10 diameters downstream of the sensor.

Sensor Location in piping system

The optimum location in the system depends on the application

- For gas applications the presence of excessive liquid in the fluid may result in erroneous measurements.

4.3 Use according to specifications

"Use according to specifications" covers:

- Use within technical limits.
- Consideration of liquid specifications and references.
- Consideration of specifications as to installation, commissioning and maintenance.

Do NOT:

- Use the sensors as a footboard for installation purposes.
- Change the flow meter in any way. For e.g. decomposition of material in connection with processing, welding and use of accessories and spare parts not approved by Siemens.

Note

If the flowmeter is not used according to the specifications, the manufacturer cannot be held responsible for any resulting damage.

4.4 Application Guidelines

Basic Requirements

- Determine pipe material and dimensions.
- Avoid installation of sensors on the top and bottom of horizontal pipes, if 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 paint.
- Avoid pressure reduction components upstream.
- Avoid mounting on or near weld seams.
- Pipe must be fully pressurized during set-up.

Note

Flow meter Application Data menu [Pipe Configuration] parameter is preset for [Fully Developed] flow.

4.5 Mounting the Transmitter

⚠ WARNING

Hazardous Voltage

May cause death or serious personal injury.

Disconnect power before working on this product.

Wall Mounting

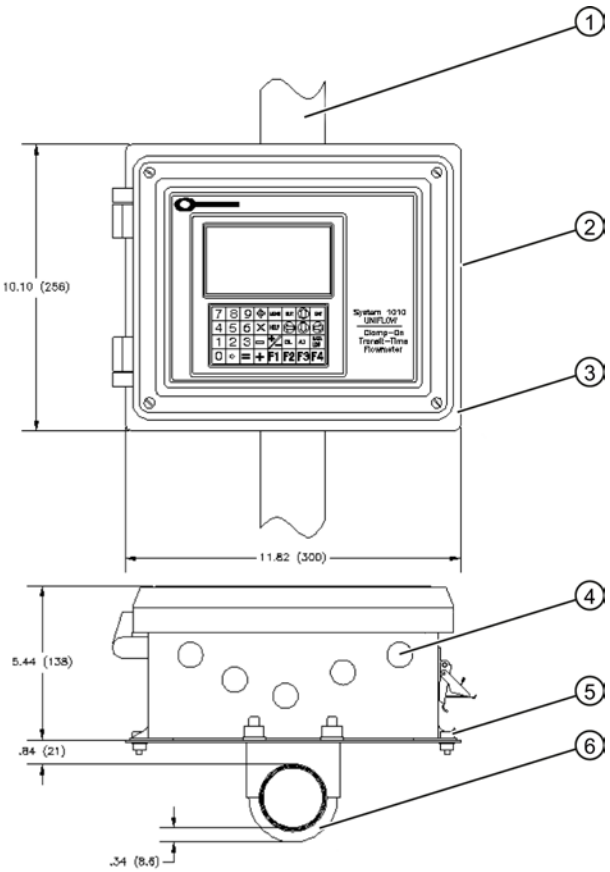
The transmitter can be mounted on any wall surface including wood, metal or concrete. Use the appropriate bolts and screws as needed for your mounting application and adhere to local codes. (See figure below for mounting bracket locations.)

Pipe Mounting

For installation on 2-inch (6 cm) mounting pipe use Pipe Mount Kit CQO:1012NMB-1 (optional - see catalog). See figure below.

Note

Pipe mounting kit CQO:1012NMB-1 is not available for IP66 NEMA 7 enclosures.



①	2-in (6cm) pipe	④	Cable Entry Ports
②	Transmitter	⑤	Mounting Flange (also use for wall mounting)
③	Mounting Plate	⑥	U-Bolt Assembly for standard 2-in (6 cm) mounting pipe

Figure 4-1 Pipe Mounting and Mounting Locations for Transmitter

Note

Use conduit fittings or cable glands on all cables.

NOTICE

Weather Seal Malfunctions

Incorrect installation of weather seals may result in failure to meet to IP65 standards and damage to the equipment.

Install weather tight seals at all unused holes using proper cable conduit and close additional holes to IP65 standards.

Connecting

5

5.1 Safety notes for connecting

Use in hazardous locations

⚠ DANGER

Explosion Hazard

Death or severe personal injury and/or equipment and property damage will result if proper Hazardous (Classified) Locations installation precautions are not taken.

Restrict use and repair to qualified personnel. Only qualified personnel may carry out work on the electrical connections.

Before opening the terminal box check that:

- No explosion hazard exists
- Local safety codes and policy requirements have been followed
- All connection leads are potential free

⚠ DANGER

Explosion Hazard

"Flameproof enclosure" type of protection

Only open devices with type of protection "Flameproof enclosure" (e.g. FUT1010 NEMA 7) in hazardous areas when the power to the device is turned off, otherwise there is a risk of explosion.

⚠ DANGER

Explosion Hazard

Hazardous areas

Observe the type examination certificates or the test certifications applicable in your country if you use transmitters as category 1/2 equipment, otherwise there is a risk of explosion.

⚠ DANGER

Explosion Hazard

Intrinsically safe circuits

If a non-conforming supply unit is used, the "fail-safe" type of protection will no longer be effective and the approval certification will be invalid, otherwise there is a risk of explosion.

With intrinsically safe circuits, use only certified meters appropriate for the transmitter.

⚠ DANGER

Explosion Hazard

Laying Cables

Cable for use in zone 1 and 2 must satisfy the requirements for having a proof voltage < AC 500 V applied between the conductor/ground, conductor/shield and shield/ground, otherwise there is a risk of explosion.

Connect the devices that are operated in hazardous areas as per the stipulations applicable in the country of operation, e.g. for Ex "d" and "nA", permanent cables must be laid.

DANGER

Explosion Hazard

Devices with the common approval "Intrinsically safe" and "Flameproof"

The following is applicable for devices with the common approval "Intrinsically safe" and "Flameproof" (Ex ia + Ex d): Before commissioning, make sure that the type of protection that is not suitable is permanently defaced on the nameplate to avoid improper use, otherwise there is a risk of explosion.

If a non-conforming infeed is used, the "fail-safe" type of protection will no longer be effective.

WARNING

Electrical Voltage Hazard

Incorrect device connections may result in death or severe personal injury and/or equipment and property damage.

Only commission the device after the device has been properly connected and, if required, closed.

5.2 Transmitter Wiring

5.2.1 Connecting Power

DANGER

Electrical Shock Hazard

Contact with exposed wiring will lead to fire, electric shock or serious injury.

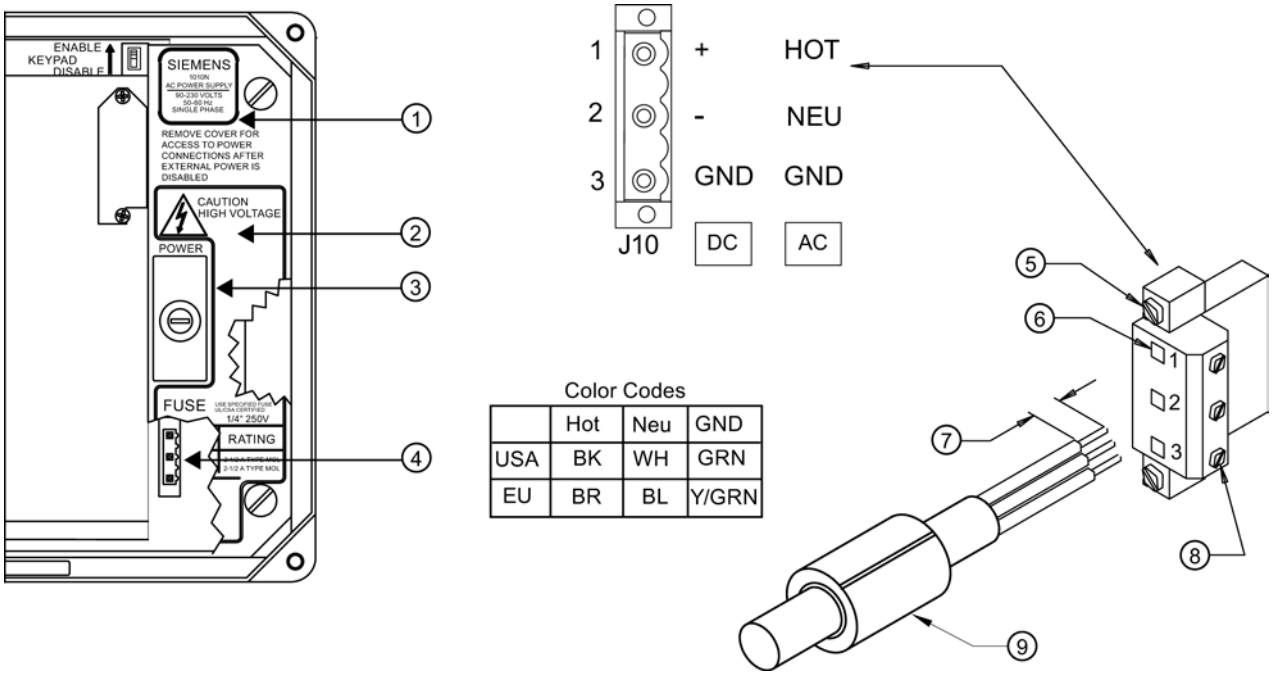
Turn off main power before installing AC connections to the transmitter.

Note

If the transmitter is not already mounted and cabling has not been run, proceed to Mounting the Transmitter (Page 35) before connecting power.

1. Open the transmitter top cover by releasing the cover latch (for IP66 NEMA 7, remove bolts).
2. Unscrew the two power supply access cover fasteners and remove access cover.

3. Locate power supply connector J10. Using a flat blade screwdriver, remove plug from connector J10. Set aside.



① Power Supply label
② Power Supply Access Cover
③ Fuse F1
④ Input Power Conn J10
⑤ Connector mounting screws
⑥ Wire Entry
⑦ Strip length 8mm (0.31 in)
⑧ Wire Clamp Screws
⑨ Ferrite power cord

Figure 5-1 Input power (J10) Wiring

4. Pull the desired length of input power wires through a cable gland and into transmitter case before wiring connector.
5. Wire input power connector for AC or DC power depending on power supply provided.

Note

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

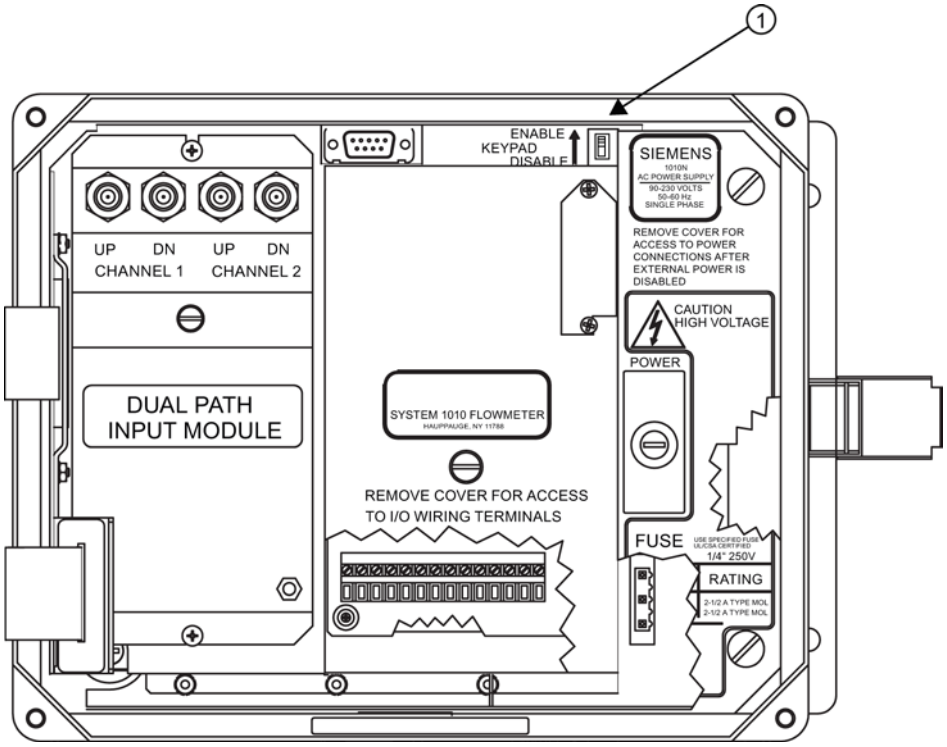
6. Insert wires into wire entry holes and secure by tightening wire clamp screws (see figure above).

Note

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

7. Plug input power plug into connector J10 and secure using two captive connector mounting screws.

8. Replace access cover. Make sure Keypad Enable switch is in the "Enable" position (see below).



① Enable Switch

9. If installing a Temperature Sensor, go to Wiring Temperature Sensor to Transmitter (Page 41) below. If not, proceed to Navigating The Menu (Page 46).

5.2.2 Wiring Temperature Sensor to Transmitter

Wiring Temperature Sensor to the Analog Input Module

⚠ DANGER

Hazard Voltage

Contact with exposed wiring will lead to fire, electric shock, or serious personal injury.

Set transmitter and instrumentation power to OFF when inserting or removing the Analog Input Module, or when making connections to TB1, TB2, TB3 and TB4.

1. Disconnect power from the unit to the transmitter.
2. Open the transmitter top cover by releasing the cover latch.

3. Loosen the captive thumbscrew securing the Access Cover and remove Access Cover.
4. Using a flat-blade screwdriver, remove four captive screws securing the I/O board. Remove board and set it aside.

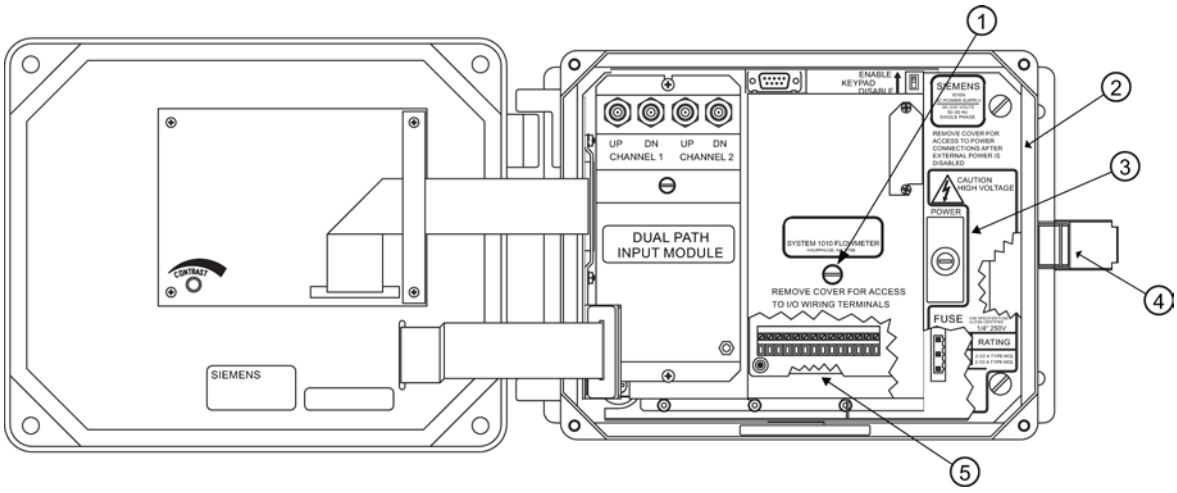


Figure 5-2 Analog Input Module Access

①	Access Cover Screw	④	Latch
②	Flow Meter	⑤	Access to Analog Input Module
③	Power Switch		

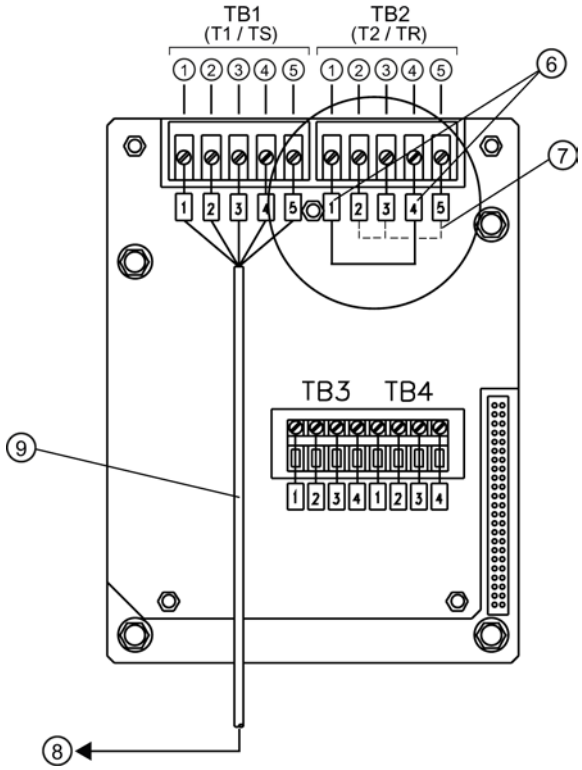


Figure 5-3 Temperature Sensor Inputs

①	Black	⑥	Short Terminals 1 and 4
②	Orange	⑦	Ground Terminals 2 and 3 to Terminal 5
③	Brown	⑧	To Sensor
④	Red	⑨	7ME39600CR (992EC) Series Cable
⑤	Blue		

Note

Alternate color codes for certain 1012EC cables:

White = Orange

Green = Brown

Wiring Temperature Sensor Board

1. Using a flat-blade screwdriver, loosen Terminal Block TB1 screw.
2. Wire the RTD 992EC temperature cable as shown in the table below:

992EC Series Cable	Terminal TB1
Wire #1 (Black)	To TB1--1
Wire #2 (Orange)	To TB1--2
Wire #3 (Brown)	To TB1--3
Wire #4 (Red)	To TB1--4
Wire #5 GND/SHLD (Blue)	*To TB1--5

Note

*For cathodically protected pipes, do not attach blue #5 wire at RTD end of cable.

3. Replace I/O Board and secure with four captive screws paying careful attention to pin alignment.
4. Replace Access Cover and finger tighten captive thumbscrew.

Note

TB3 and TB4 are also active analog inputs. See wiring table below.

Pin	TB3 Function	TB4 Function	Use	Description	Behavior	Load	Wiring
1	AUX. 1 IN	AUX. 3 IN	Iin1 Input	Analog current input referenced to meter ground.	4 to 20mA	200Ω	305 meters (1000 ft.) Max w/o factory approval
2	AUX. 1 COM	AUX. 3 COM	Iin1 Common				
3	AUX. 2 IN	AUX. 4 IN	Iin2 Input				
4	AUX. 2 COM	AUX. 4 COM	Iin2 Common				

Note

If analog input is used for temperature, this will take priority over clamp-on RTD measurement.

⚠ WARNING

Electrical Shock Hazard

Certain parts inside the device carry dangerous high voltage and may result in electric shock, or serious personal injury.

The transmitter must be grounded and the top cover closed before applying power to the device.

NOTICE

Power Supply Damage

Improper power connections will damage power supply.

Ensure that all AC or DC power supply connections are properly connected to the appropriate power source (100-250 VAC @ 50/60 Hz or 9-36 VDC).

5. Connect power cables to the appropriate power source (90-240 VAC @ 50-60 Hz or 9-36 VDC). Close transmitter top cover.
6. Proceed to Navigating the Menu.

5.3 Navigating the Menu

Menu Navigation and Initial Power-up

Before you can navigate the menu you must first power-up the flow meter. Follow the instructions below to ensure safe connection of power to the meter and then proceed to the menu navigation.

NOTICE
Power Supply Damage Improper power connections will damage power supply. Ensure that all AC or DC power supply connections are properly connected to the appropriate power source (100-250 VAC @ 50/60 Hz or 9-36 VDC).

⚠ WARNING
Electrical Shock Hazard Certain parts inside the device carry dangerous high voltage that may lead to fire, electric shock or serious injury. The transmitter must be grounded and the top cover closed before applying power to the device.

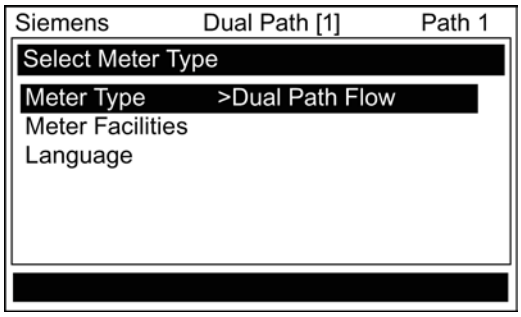
Power-up Procedure

1. Connect the power cables to the appropriate power source (90-240 VAC @ 50/60 Hz or 9-36 VDC). Close top cover.
2. Apply power.
3. Within 10 seconds of power-up the main display will become active and a typical Siemens graphic will appear briefly. The screen also identifies the software version of the unit as shown below.



① Software Version (x.xx.xx)

4. Press the <MENU> key and the Main Menu will appear. (Language selection is not on Version 3 op systems.)



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 that are display parameters in a column at the right of the screen.		
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	

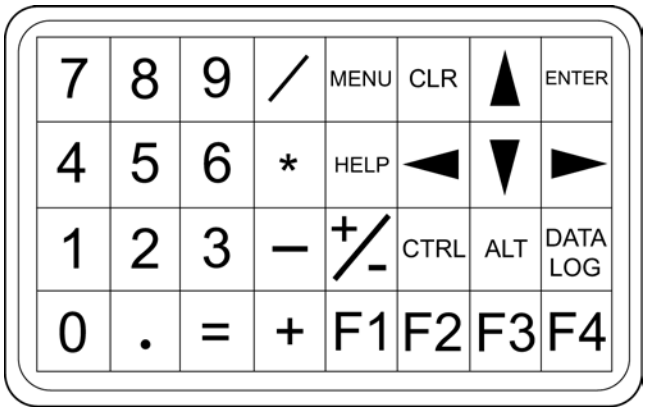


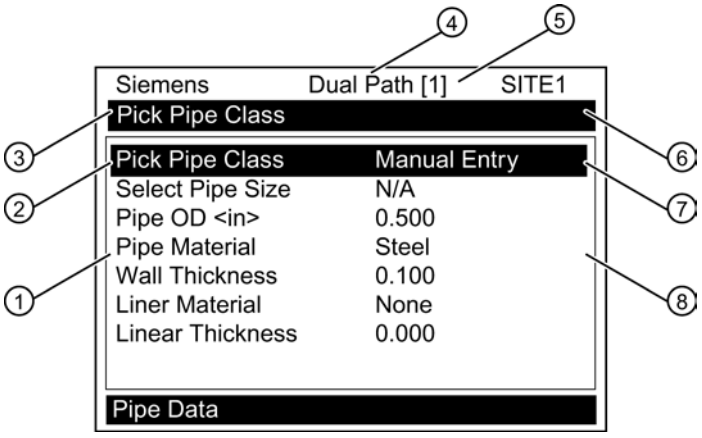
Figure 5-4 Keypad

Note

Use <Left Arrow> key to return to previous menus.

Table 5- 1 Keypad Function Chart

Keys	Description
MENU	Press to activate the Installation Menu.
ENTER	Store numeric data, select from option lists, etc.
Left / Right Arrows	Menu navigation keys move cursor.
Up / Down Arrows	Same as <Left> and <Right> arrows. Scrolls option lists and graphic display screen.
CLR	Erases data or selects list options.
Numbers 0 - 9	Use to type numeric data.
Decimal Point	Use for decimal points in numeric data.
Math Operators	4-function math operations in numeric entry cells.
"F" Keys 1, 2, and 3	Used to start/stop/reset Totalizer.
F4	Caution: used during power up for system reset.
CTRL and ALT	Used as shift keys for alternative key functions.
DATALOG	Triggers immediate Datalogger report.
Plus and Minus [+ / -]	Changes the sign of numeric data.



①	Menu Cell Data (left-hand column)	⑤	Current Selected Measurement Channel
②	Highlighted Menu Cell	⑥	Site Name Identified
③	Menu Prompt Line (Reverse Video)	⑦	Highlighted Data
④	Current Selected Meter Type	⑧	Menu Cell Data (right-hand column)

Figure 5-5 Typical Installation Menu Screen

5.4 Programming the Transmitter

Note

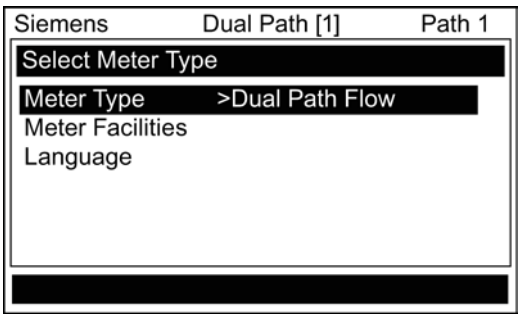
Before creating a site select a language and then English or Metric units from the Meter Facilities menu.

Note

To select English or metric units: In [Meter Type] menu, scroll to [Meter Facilities] menu. Press <Right Arrow> and select [Preferred Units]. Press <ENTER> to select. Press <Left Arrow> and <Up Arrow> to return to main menu.

Select Meter Type

1. Press the <MENU> key and select the Meter Type.
2. Press the <Right Arrow> and scroll to [Dual Path Flow]
3. Press <ENTER> to select. The [Dual Path Flow] menu will appear.



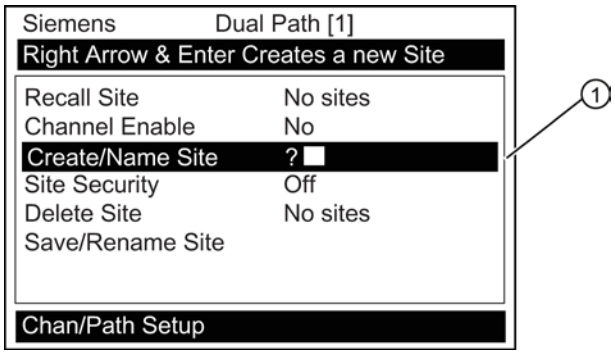
Create a Site

1. At the [Chan/Path Setup] menu press the <Right Arrow>.

Note

Before proceeding make sure that English or metric units have been selected.

2. Press <Down Arrow> to select the [Create/Name Site] menu and enter a Site name.
3. Press <Right Arrow> to create Site name.



① Insert desired name (8 characters maximum)

Note

To select letters: Press <Right Arrow> to cursor and then press <Up/Down Arrows> to select letters. Press <ENTER> when done.

4. Press <Left Arrow> and return to the [Chan/Path Setup] menu.

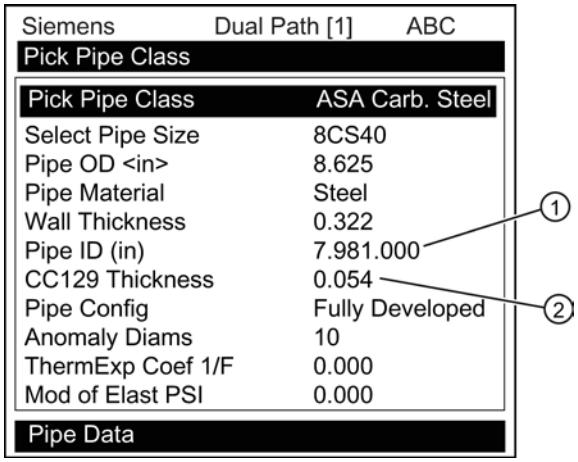
Note

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.

Selecting Pipe Class

Pipe Class is a pre-loaded set of default pipe sizes for various ASA and metric pipes. If the intended pipe is standard the user may select this function to pre-load necessary pipe data, otherwise enter data manually using [Pipe O.D.], [Pipe Material] and [Wall Thickness].

1. Press the <Right Arrow> to select [Pick Pipe Class]. Press <Right Arrow> again and scroll to desired Pipe Class.
2. Press <ENTER> to select.



① Enter ID directly if known. Pipe OD will be automatically adjusted.

② Refer to CC129 Material table to determine CC129 pipe damping material thickness.

3. Pre-programmed Pipe Size and relevant pipe parameters will appear in menu cells. Press <Right Arrow> and scroll to desired pipe size. Press <ENTER>. 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.

4. Press the <Left Arrow> and return to the [Channel Setup] menu.

Selecting CC129 Thickness

1. After selecting the appropriate sensor size (see Sensor Installation) determine the corresponding damping material final thickness using the CC129 thickness table and transfer entry to menu cell.
2. Press the <Left Arrow> and return to the main menu.

Selecting Pipe Configuration

1. Scroll down to [Pipe Config] and press the <Right Arrow>.
2. Select a configuration and number of pipe diameters that approximates the conditions upstream of your sensor mounting location. (Refer to definitions below.)

3. Press <ENTER> to save selection.
4. Press the <Left Arrow> and return to the main menu.

Table 5- 2 Pipe Configuration Option List Definitions

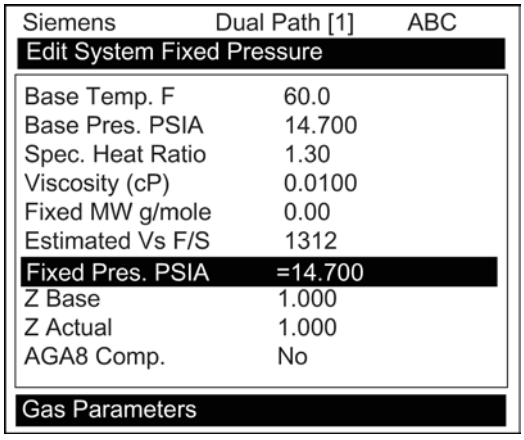
Options	Definitions
Fully Developed	Fully developed flow, as would be expected for very long straight pipe runs or installation downstream of a flow condition.
1 Elbow	Single 90 degree Elbow upstream of sensor installation.
Dble Elbow+	Double out-of-plane Elbows upstream of sensor installation.
Dble Elbow-	Double in-plane Elbows upstream of sensor installation.
Valve	Not available at this time.
Expander	Pipe expansion upstream of sensor installation.
Reducer	Pipe reduction upstream of sensor installation.
Norm Entry	Not available at this time.
Header Inlet	Header or pipe manifold upstream of sensor installation.
Intrusions	Not available at this time.

Selecting Gas Parameters

It is recommended to edit the Gas Parameters immediately after creating a site. If reliable data is available for gas specific heat ratio, gas viscosity, sound velocity or gas compressibility factor, these settings should be modified. It is particularly important that the approximate (nominal) operating pressure be entered to allow for proper flow profile compensation.

Setting Fixed Pressure

1. At the [Gas Parameters] menu, scroll down to [Fixed Pres. PSIA].
2. Press the <Right Arrow> to select and edit the default Fixed Pressure value. (See table below for additional gas parameter values.)



The table below indicates the viscosity, specific heat ratio and estimated sound velocity (Vs) for some common gases. The default "Gas Parameters" are suitable for natural gas.

Table 5- 3 Common Gases for Clamp-On Measurement (at 14 BAR & 15.5°C / 200 PSIA & 60°F)

Gas	Viscosity (cP)	Spec. heat Ratio (Cp/Cv)	Estimated Vs (m/s)
Carbon Monoxide	0.017	1.43	348
Ethane	0.010	1.32	281
Helium	0.019	1.66	1006
Hydrogen	1.410	1.41	1306
Methane	0.011	1.35	437
Natural Gas	0.011	1.33	400
Nitrogen	0.017	1.42	348
Oxygen	0.020	1.42	324

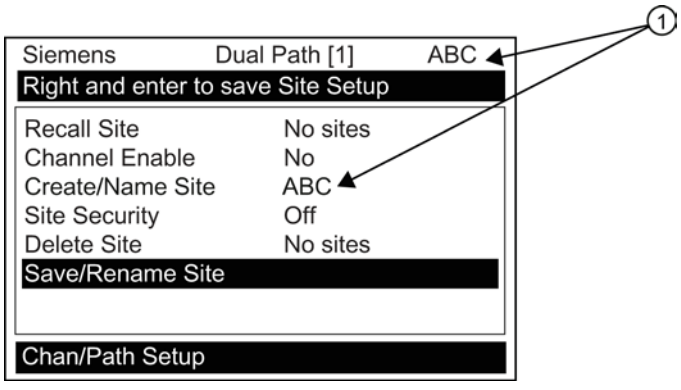
Standard Volume Compensation

If a direct standard volume output is required from the meter, then the entry of an AGA8 compensation table may be needed.

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. A "pop-up" prompt to save the site will appear to remind you to save your changes.

1. At the pop-up prompt, press the <Right Arrow> and <ENTER> key to save all programmed data.
2. An alternative method to save site data is foiund within the [Chan/Path] menu.
3. Scroll to [Chan/Path]. Press the <Right Arrow> and scroll to [Save/Rename Site].



① The saved site name now appears in the menu screen.

4. Press the <Right Arrow> and then <ENTER> to save the site, or you may change the site name before saving.

5.5 Sensor Installation

5.5.1 Preliminary Installation Procedures

Reflect and Direct Sensor Mounting

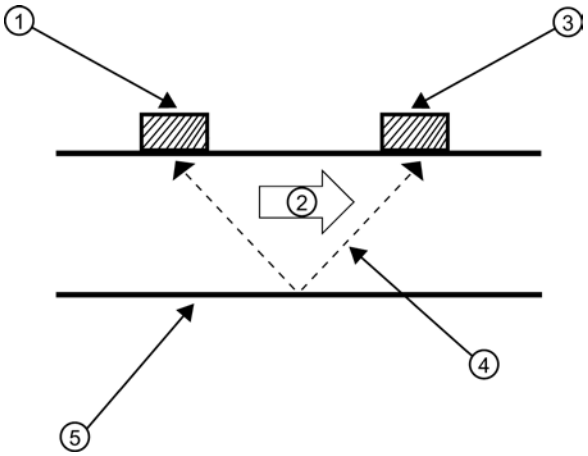
Reflect and Direct mounting modes are supported for clamp-on sensors. The flow meter recommends a mounting mode after analyzing your pipe and gas data entries.

Note

When installing sensors, do not key in the V/M (Version/Modification) label number as the Sensor Size.

Clamp-on Sensor Mounting Modes

The transmitter recommends a mounting mode after analyzing your pipe and gas data entries. However, you can install clamp-on sensors in the way that best suits your application and the sensor type you have purchased.



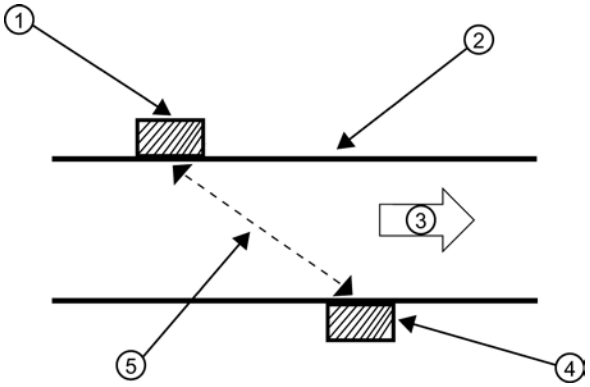
① Upstream Sensor
② Flow Direction
③ Downstream Sensor
④ Sonic Path
⑤ Pipe

Figure 5-6 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. Reflect mount supports the AutoZero function, which zeroes the flow meter automatically without user-participation. 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 gas 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.



① Upstream Sensor
② Pipe
③ Flow Direction
④ Downstream Sensor
⑤ Sonic path

Figure 5-7 Direct Mount (Pipe shown from above in 12 o'clock position)

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 and/or coupling pads
- Sensors (matched set)

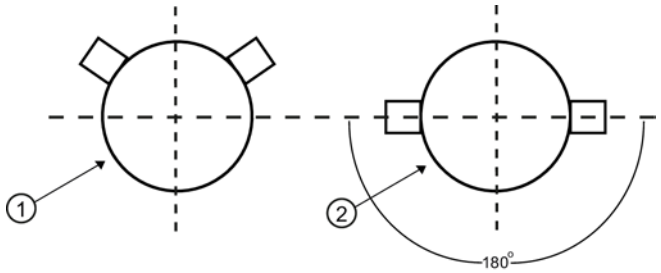
Mounting Strap Kits

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.

Mounting Strap Kits	Pipe Diameter	SAE Band Sizes (Qty.)
7ME396000SM00	50.8mm (2-inch) to 177.8mm (7-inch)	#88 (2) #128 (2)
7ME396000SM10	50.8mm (2-inch) to 330.2mm (13-inch)	#88 (2) #152 (2)
7ME396000SM20	330.2mm (13-inch) to 609.6mm (24-inch)	#188 (2) #280 (2)
7ME396000SM30	609.6mm (24-inch) to 1219.2mm (48-inch)	#152 (4) #312 (4)

Selecting a location for the sensors

1. Locate the sensors downstream from the center of the longest available straight run. A location 20 pipe diameters or greater downstream from the nearest bend or intrusion will provide adequate flow profile conditions.
2. Do not, if possible, install the sensors downstream from any equipment that could possibly disturb the flow profile of the gas; such as elbows, valves or protrusions. 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 flow meters 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 flow meter.
6. Never mount sensors under water, unless you order submersible units and you install them in accordance with factory instructions.
7. Avoid mounting sensors on the top or bottom of a horizontal pipe. The best placement on a horizontal pipe is to place one path at the ten o'clock position and the other path at the two o'clock position for Reflect Mode, or one sensor at nine o'clock and one sensor at three o'clock for Direct Mode.



① Dual Path, Reflect Mount and Reflect Mount 4-Pass
② Dual Path, Direct Mount and Direct Mount 3-Pass

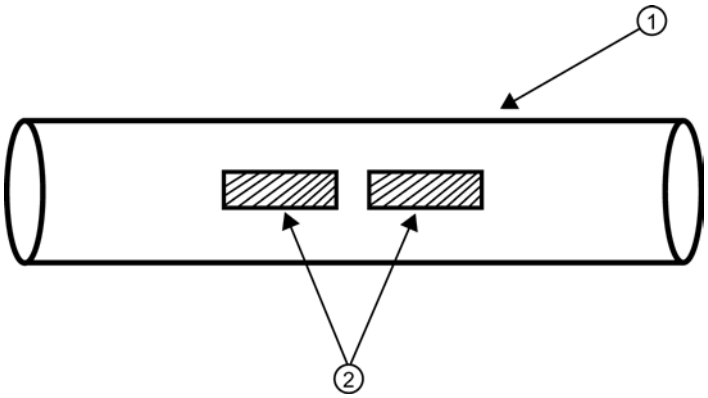
Figure 5-8 Sensor Alignment (Horizontal Plane)

Preparing the Pipe

1. Pick a mounting location with the longest straight run. You must have easy access to at least one side of your 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.
3. 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 vertical mounting for clarity purposes only. Do not install sensors on the top of a pipe.



① Pipe
② Cleaned Areas

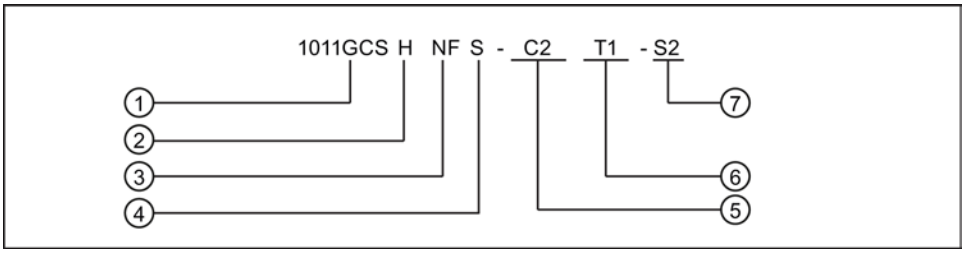
Figure 5-9 Pipe Surface Preparation

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

5.5.2 Sensor Identification and Selection

Sensor identification

The sensor part number located on the front face provides a detailed identification. For example, the Part Number: 1011GCS-H-C2T1-S2 means:



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

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).

Sensor Selection Chart

Refer to the Sensor Selection Chart to select the correct sensor size.

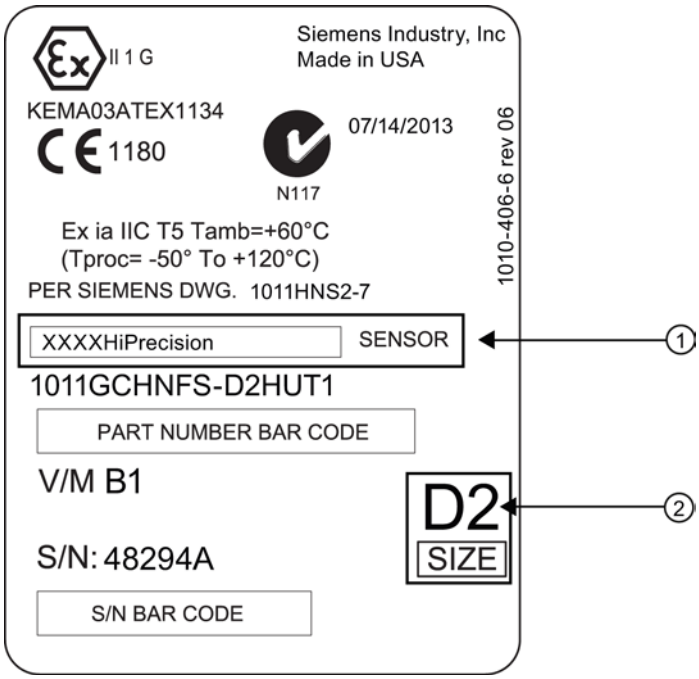
Note

Selection chart lists High Precision sensors for steel pipe with outer diameter/wall thickness ratio >10.

Table 5- 4 Sensor Selection Chart

Sensor Size Code	Pipe Wall (mm) Min.	Max.	Pipe Wall (inches) Min.	Max
B1H	2.0	3.0	0.08	0.12
B2H	3.0	4.1	0.12	0.16
B3H	2.7	3.3	0.106	0.128
C1H	4.1	5.8	0.16	0.23
C2H	5.8	8.1	0.23	0.32
D1H	8.1	11.2	0.32	0.44
D2H	11.2	15.7	0.44	0.62
D3H	7.4	9.0	0.293	0.354
D4H	15.7	31.8	0.62	1.25

Typical Sensor Labels



① Hi Precision sensor model number
② Sensor size

Figure 5-10 Hi Precision Sensor Label

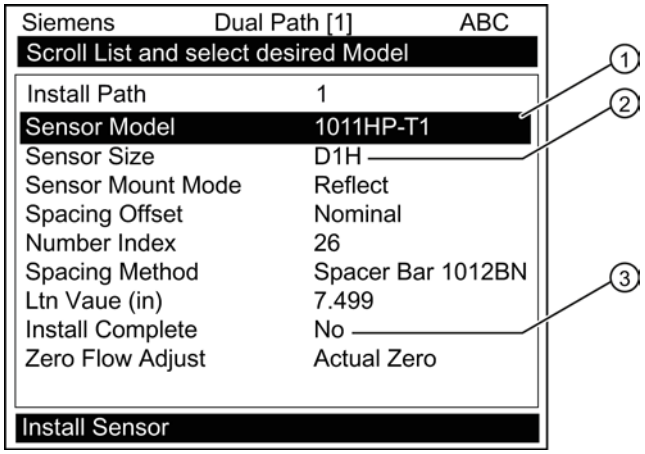
Sensor Selection

The following is a typical sensor selection procedure.

Note

The transmitter must be powered up before you can select a sensor model. Refer to Transmitter Wiring (Page 39).

1. Press <Left Arrow> to return to main menu. At [Meter Type], press the <Right Arrow> and then <ENTER>.
2. The [Channel Setup] menu will appear.
3. Press the <Down Arrow> to select [install Sensor].
4. Press the <Right Arrow> to [Sensor Model]. Press <Right Arrow> and scroll to select the sensor model number on the sensor label.
5. The drop down menu lists the following sensor selections:
   - 1011 Universal
   - 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.
6. For this example, select the sensor model that appears on the sensor label then press <ENTER>.



① Select based on type

② Select based on size

③ **After sensor is mounted select "Install."**

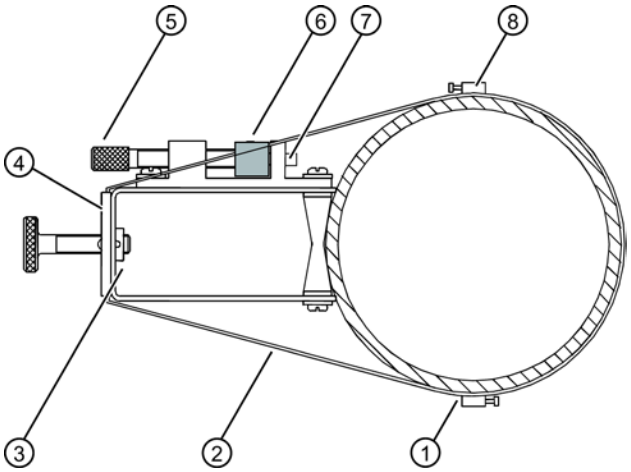
7. To select Sensor Size, press <Right Arrow>. Scroll to select the sensor size that matches the size indicated on the sensor label. Press <ENTER>.
8. At [Sensor Mount Mode], press the <Right Arrow>. Scroll to select [Reflect] or [Direct] mount and then press <ENTER>.

9. **IMPORTANT: Record Spacing Method and Number Index. This data will be used to mount the sensors.**
10. Sensors can now be mounted. Refer to sensor mounting procedures (Reflect or Direct) and select the mounting mode desired.
11. **After sensors are mounted scroll to [Install Complete] and select [Install].**

Reflect Mount - Sensor Installation using Mounting Frames and Spacer Bar

1. After receiving the spacing index from the Installation Menu, prepare the pipe surface area where the sensors will be mounted.
2. Degrease the surface and remove any grit, corrosion, rust, loose paint, etc.

Before beginning refer to the Reflect Mount Installation diagram example below.



①	Optional: On larger pipes, multiple lengths of straps can be linked together to surround pipe	⑤	Space Bar Platform & Clamping Screw
②	Mounting Strap positioned around Mounting Frame	⑥	Space Bar (Front View)
③	Sensor shown in the 9 o'clock position on pipe	⑦	Metal Post
④	Mounting Frame	⑧	Mounting Strap Adjusting Screw

Figure 5-11 Reflect Mount with Mounting Frames and Spacer Bar

Note

Minimum Ltn 18 mm (0.75 in).

Ltn Menu Cell

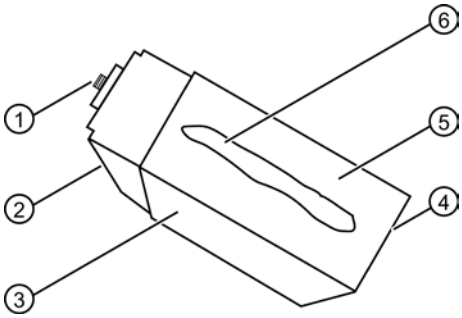
This view only menu cell shows the distance in inches or millimeters between the front faces of the sensors along the axis of the pipe. If you are mounting the sensors without a track or spacer bar, you have to space them according to this value. Note that Ltn may be a negative number for direct mount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

Preparing the Pipe

1. On a flat surface, attach the Spacer Bar to a Mounting Frame so that the Reference Hole on the Spacer Bar fits over the metal post on the platform of the frame. Tighten the clamping screw.
2. Slide the second Mounting Frame onto the other end of the Spacer Bar and align the Number Index Hole with the metal post on the platform. 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.

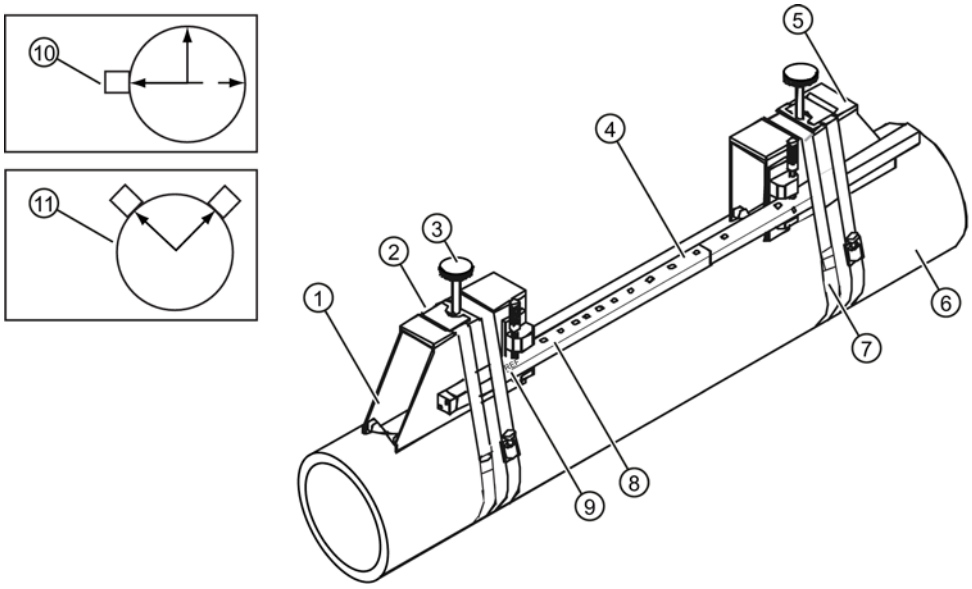
Installing the Sensor

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



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

Figure 5-12 Sensor



① Front View
② Spring Clip (Not present on some models)
③ Sensor Clamping Screw
④ Spacer Bar
⑤ 7ME39600M Mounting Frame
⑥ Pipe
⑦ Mounting Strap Note: Optional 2nd Mounting Strap shown. Larger pipes over 76cm (30 inches) may need an additional support.
⑧ Spacer Bar Platform and Clamping Screw
⑨ Spacer Bar Reference Hole
⑩ Orientation for Single Beam Sensor at 9 o'clock position
⑪ Orientation for Dual Beam Sensor at 10 & 2 o'clock positions

Figure 5-13 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. If installing a temperature sensor proceed to Mounting Temperature Sensor. If not, proceed to Sensor Wiring (Page 81).

5.5.3 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**
5.08cm x 66.04cm	2" x 26"
5.08cm x 114.3cm	2" x 45"
10.16cm x 393.7cm	4" x 155"
15.2cm x 497.8cm	6" x 196"

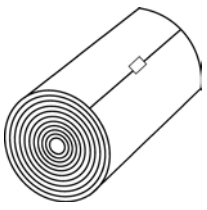
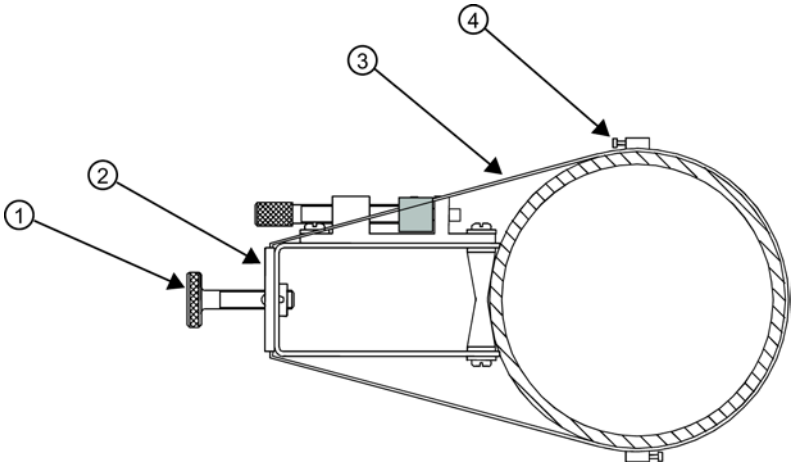


Figure 5-14 Mylar Spacing Guide

1. After receiving the spacing index from the Installation Menu, prepare the pipe surface area where the sensors will be mounted.
2. Degrease the surface and remove any grit, corrosion, rust, loose paint, etc.
3. Make a note of the Number Index displayed in the [Install] menu. 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).

4. 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.
5. 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
6. 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.

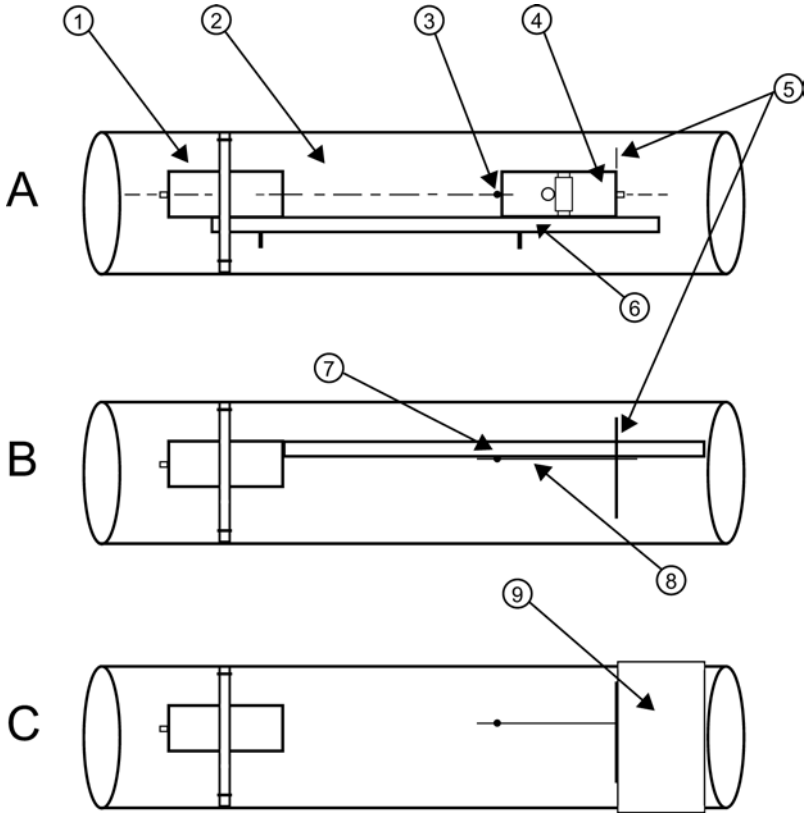


① Sensor Clamping Screw
② Spring Clip
③ Mounting Strap
④ Mounting Strap Adjusting Screw

Figure 5-15 Wrap Strap Under Pipe and Attach to Adjusting Screw

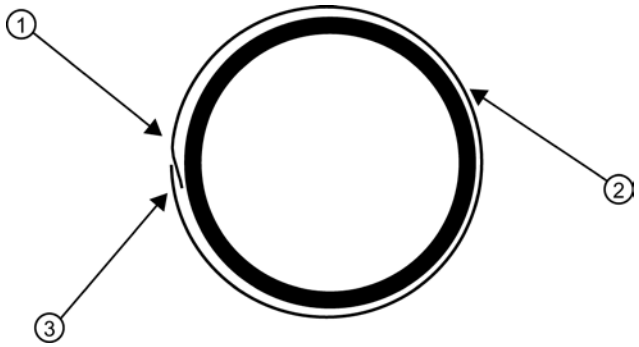
7. Slide the mounting strap over it (and under the clip if there is one) and tighten with a screwdriver. While tightening, check to ensure that the center of the tapered roller is centered on the pipe.
8. Attach the second frame to the spacer bar with an index spacer screw into the index hole specified in Step 1. The angle on the frame should be facing away from the direction that the length of the bar is going.

9. 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).



① Sensor 1
② Pipe
③ Dot
④ Sensor 2
⑤ Sensor Edge Line
⑥ Spacer Bar
⑦ Dot
⑧ Line
⑨ Mylar Spacing Guide

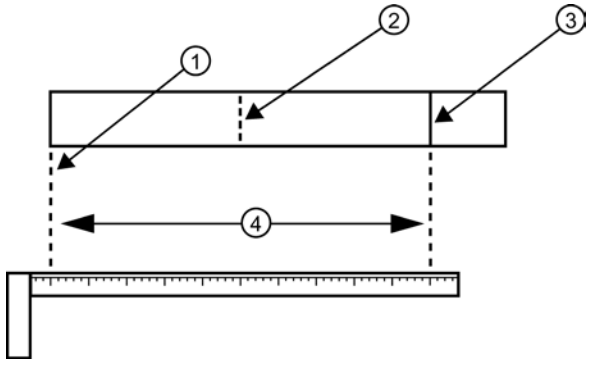
10. Disassemble the spacer bar and the unmounted frame. Use the bar as a straight edge and, with one edge against the mounted frames tapered roller center and the other crossing the dot you drew, draw a line crossing the dot (see "B" above). Set the bar aside.



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

Figure 5-16 Wrapping the Mylar Spacing Guide around the pipe (End View)

11. 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.
12. 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.
13. 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.

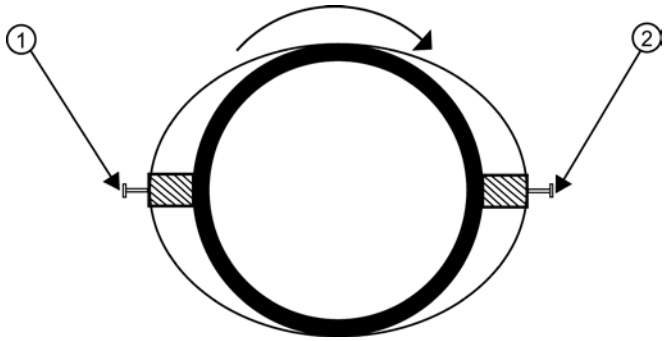


① Overlap Edge
② Mark (or fold) exactly at half-way point
③ Spacing Guide
④ Circumference

Figure 5-17 Finding the Halfway Distance

14. 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.

15. 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 5-18 Aligning the Sensors for Direct Mode operation (End View)

16. 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.
17. Replace the Mylar guide back in the same position it was in and retape it to the pipe
18. Put a mounting strap around the pipe and engage an end into adjusting screw (screw should be pointing up).
19. 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.
20. 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.
21. Tighten the sensor clamping screws to hold the sensor firmly in place. *Repeat procedure for the other sensor.*
22. 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.
23. Open the transmitter top cover. Using a flat blade screwdriver, remove the Cable Strain Relief bracket.
24. Observing the upstream and downstream orientation, attach the UP (upstream) and DN (downstream) cables to the sensors and make snug. Attach the other ends to the UP and DN terminals of the transmitter.
25. Replace the Cable Strain Relief bracket. Close top cover.
26. Proceed to Commissioning (Page 83).

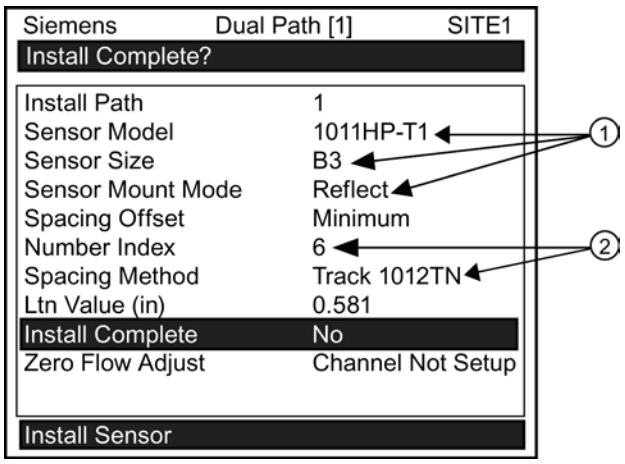
5.5.4 1012T Mounting Tracks

Using 1012T Sensor Mounting Tracks

The 1012TN and 1012TNH Mounting Tracks provide a rigid mounting platform for Series 1011 Universal or high precision size A or B sensors. The mounting tracks service pipe sizes up to a maximum of 140mm (5.00") outer diameter. The 1012T mounting tracks support both Direct and Reflect mounting modes. The transmitter recommends the appropriate sensor, mounting track and mounting mode, based on the pipe data entries.

Installing a 1012T Mounting Track in Reflect Mode

The Sensor Installation procedures show how the automatic selection of sensors, mounting mode and spacing method are established. Examine the figure below, which illustrates a typical [Install Sensor] menu screen. Note the automatic assignment of mounting track part number, plus the designation of the number index.



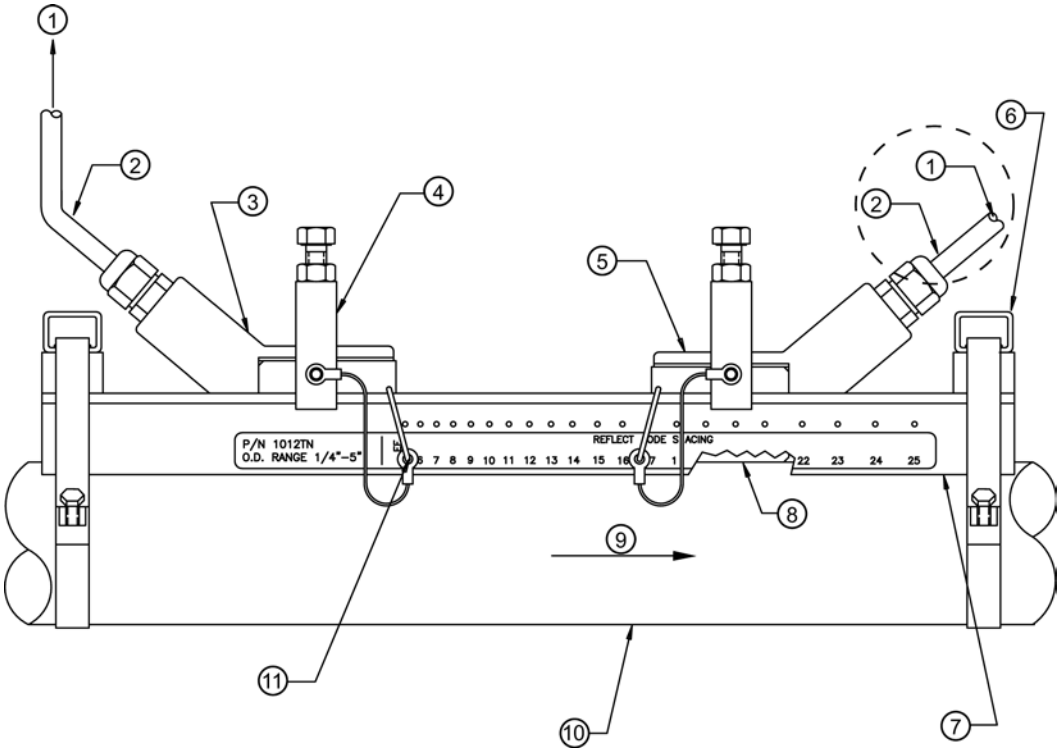
① Sensor type, size and mounting mode selection.

② Automatic selection of mounting track part number and number index.

1. Perform all required menu steps up until the point where you respond to the [Install Complete] prompt.
2. Make note of the Number Index. 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).



①	To SITRANS F 1010 Transmitter	⑥	Mounting Strap Guide
②	7ME39600CK Series Cable (992CNF)	⑦	7ME39600M Series Mounting Track (1012TN, 1012TNH)
③	7ME3950 Series Sensor Upstream	⑧	Ultrasonic Couplant
④	Sensor Clamp	⑨	Flow direction
⑤	7ME3950 Series Sensor Downstream	⑩	Pipe
		⑪	REF Hole Index Pin

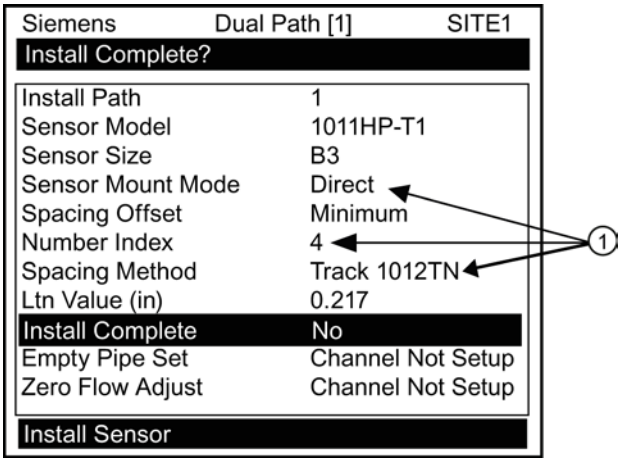
Figure 5-19 Reflect Mount with Model 1012TN Mounting Track (Side View)

3. 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.
4. 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.

5. 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.
6. 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.
7. 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.
8. Rotate the track into the position that was just cleaned. Insert the index pin into the REF hole.
9. Insert the index pin into the reference hole.
10. Select a sensor and apply a thin bead of couplant compound to the sensor's emitting surface.
11. 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.
12. Once the sensor is in place secure it with the sensor clamping screw. Do not over tighten.
13. Repeat the procedure for the Number Index sensor making sure to insert an index pin into the correct Number Index hole. Refer to the Model 1012TN Mounting Track (side view) figure above.
14. Observing the upstream and downstream orientation, attach the UP (upstream) and DN (downstream) cables to the sensors and make snug. Attach the other ends to the UP and DN terminals of the flow meter.

Installing a 1012T Mounting Track in Direct Mode

The Sensor Installation procedures show how the automatic selection of sensors, mounting mode and spacing method are established. Examine the figure below, which illustrates a typical [Install Sensor] menu screen. Note the automatic assignment of model numbers for the sensor and mounting track, plus the designation of the number index.



① Automatic selection of mounting track part number , mount mode and number index

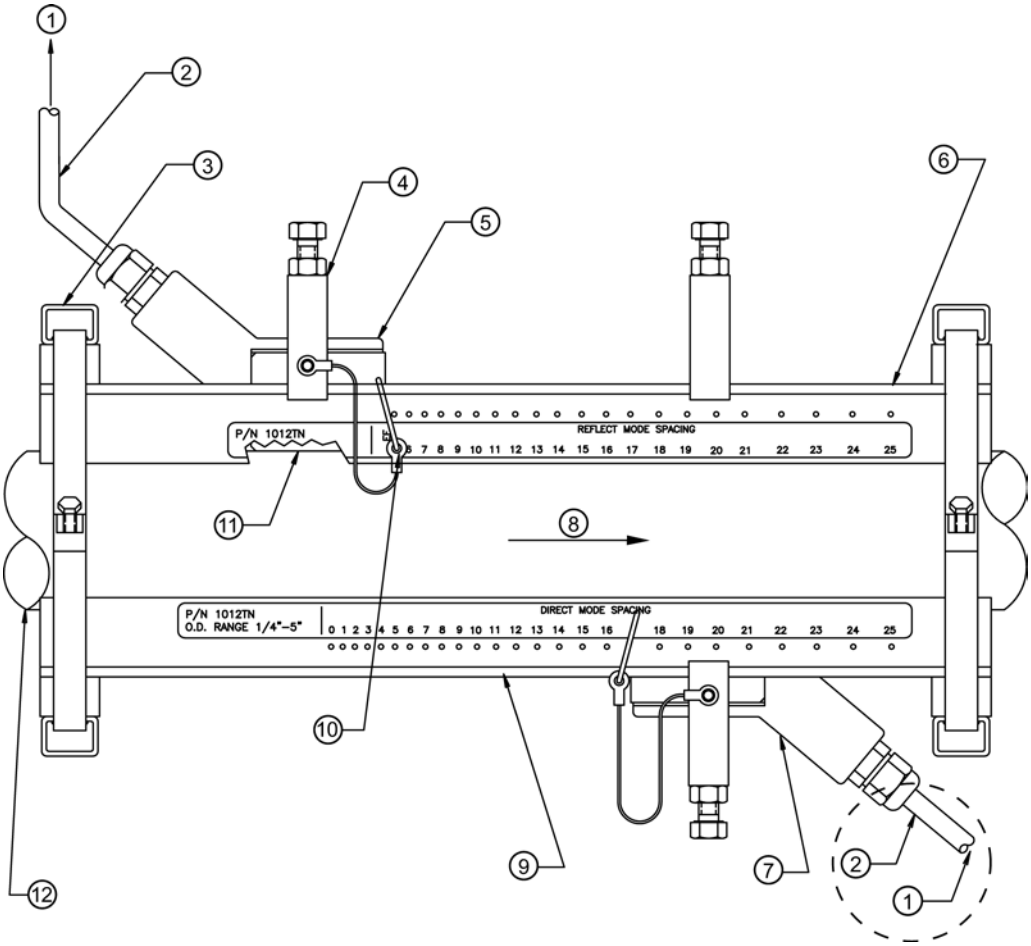
The combination of two Model 1012TN Mounting Tracks and a spacer guide is the recommended way to mount sensors in the Direct Mode. This method ensures that sensors will align exactly 180° from each other and remain spaced the proper distance apart.

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).



①	To SITRANS F Transmitter	⑦	7ME3950 Series Sensor Downstream
②	7ME39600CK Series Cable (992CNF)	⑧	Flow direction
③	Mounting Strap Guide	⑨	7ME39600M Series Mounting Track (1012TN, 1012TNH)
④	Sensor Clamp	⑩	REF Hole Index Pin
⑤	7ME3950 Series Sensor Upstream	⑪	Ultrasonic Couplant
⑥	7ME39600M Series Mounting Track (1012TN, 1012TNH)	⑫	Pipe

Figure 5-20 Direct Mount 180° opposed with Mounting Tracks

1. Perform all required menu programming steps up until the point where you respond to the [Install Complete?] prompt.
2. Make a note of the reported Number Index displayed in the [Install Sensor] menu. 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.

3. 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.
4. 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.
5. Wrap the mounting strap around the pipe and through the strap guide.

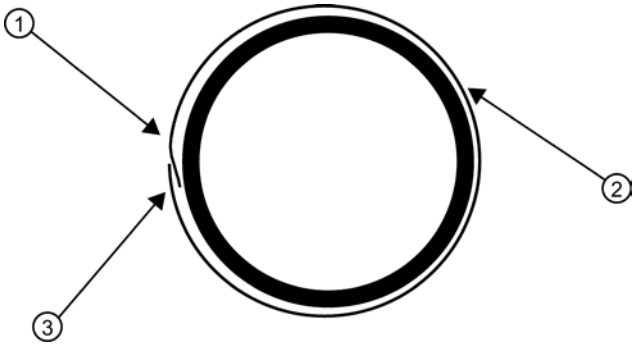
Note

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

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

Positioning Track Assemblies

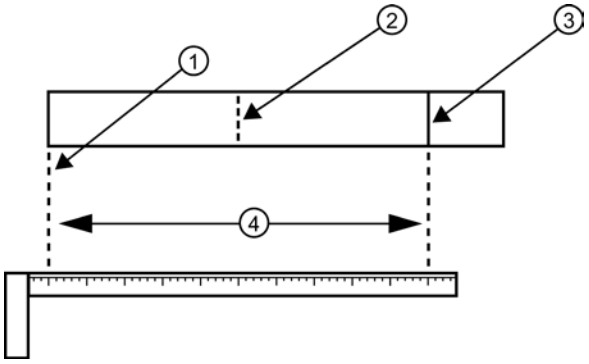
1. Wrap a length of the Mylar spacing guide around the pipe and against the end of the track assemblies. Ensure that the spacer guide edges on both sides align. Arrange so that one end overlaps the other by at least 8 cm (3 inches). Trim to fit if necessary, but in order to keep the end square, be sure 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 5-21 Wrapping the Mylar Spacing Guide around the pipe (End View)

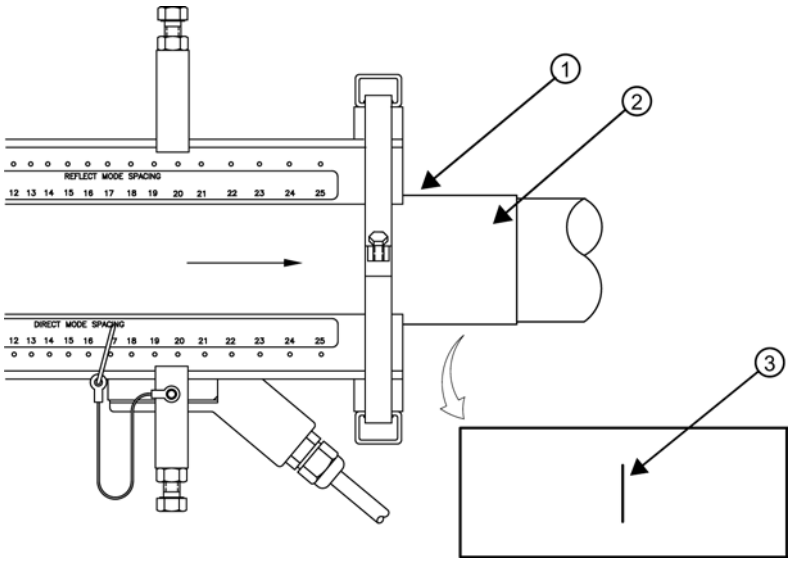
2. Remove the spacer guide. Measure or fold spacer guide to find its halfway distance. Mark a center line and then tape spacer guide to pipe.



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

Figure 5-22 Finding the Halfway Distance

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



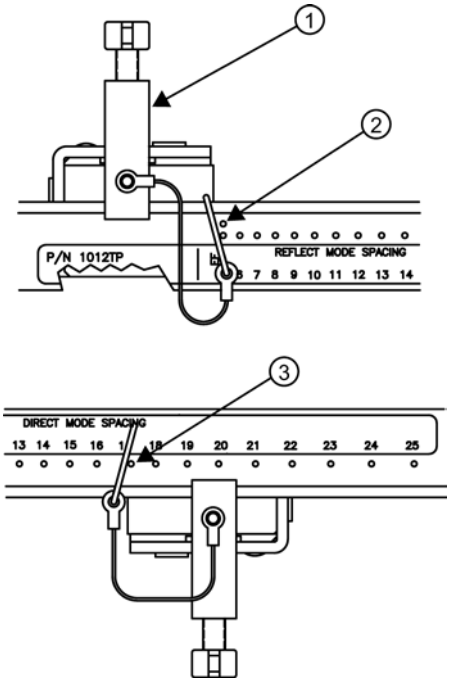
① Align tracks with Spacer Guide edge
② Mylar Spacer Guide
③ Halfway distance of Spacer Guide

Figure 5-23 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 5-24 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.

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. Observing the upstream and downstream orientation, attach the UP (upstream) and DN (downstream) cables to the sensors and make snug. Attach the other ends to the UP and DN terminals of the flow meter.
13. Proceed to Commissioning.

5.5.5 Mounting Temperature Sensors

Temperature is used to produce standard volume compensation. Temperature sensors are available in clamp-on style or in insert (Thermowell) style.

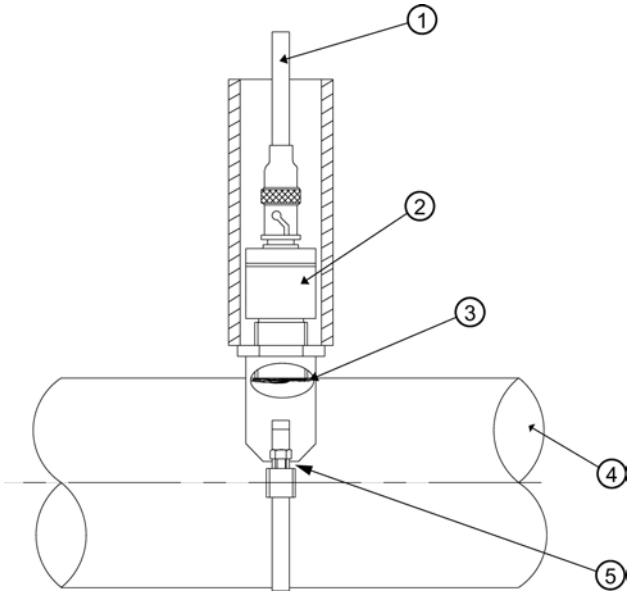
Refer to the table below. Both styles incorporate 1000 ohm platinum RTD's for high precision.

Table 5- 5 Temperature Sensors

Description	Part Number
Standard clamp-on RTD	7ME39501TA00
Submersible clamp-on RTD	7ME39501TB00
Insertion style RTD (size 1): 140mm (5.5 in)	7ME39501TJ00
Insertion style RTD (size 2): 216mm (8.5 in)	7ME39501TJ01
Insertion style RTD (size 3): 292mm (11.5 in)	7ME39501TJ02
Insertion style RTD (size 4): 368mm (14.5 in)	7ME39501TJ03

Clamp-on Temperature Sensors

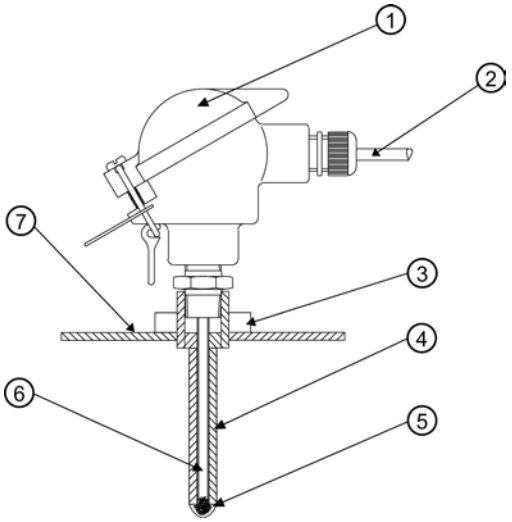
Clamp-on style sensors are mounted on the surface of the monitored pipe using mounting assemblies. Apply a generous quantity of the thermal couplant provided to the tip of the sensor and attach it securely to the cleaned pipe surface with the proper mounting assembly. Temperature measurement anomalies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



① 7ME39600CR 992EC Series Cable
② Clamp-on Temperature Sensor
③ Thermal Couplant
④ Pipe
⑤ Mounting Assembly

Figure 5-25 Clamp-on Temperature Sensor

Insert Temperature Sensors



①	Temperature Sensor Connector Head Assembly	⑤	Thermal Couplant
②	7ME39600CR 992EC Series Cable	⑥	Spring Loaded Sensing Element
③	Threaded Pipe Fitting	⑦	Pipe Wall
④	Thermowell		

Figure 5-26 Insert Temperature Sensor

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

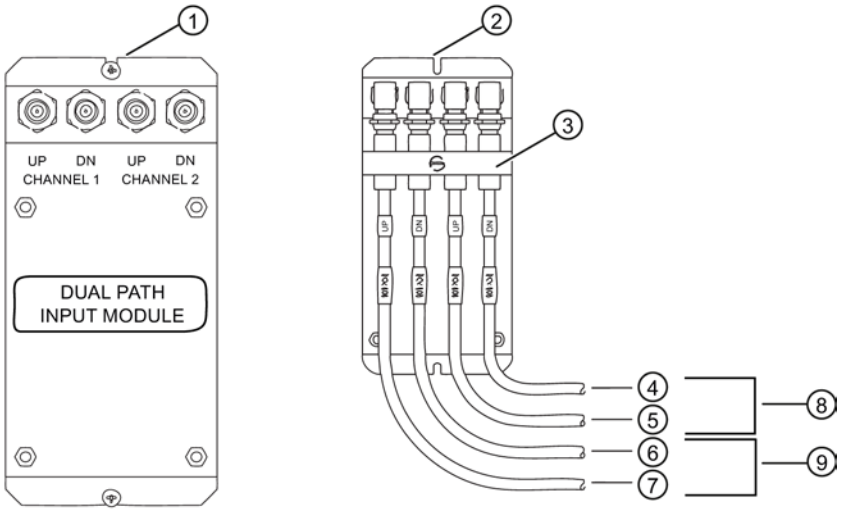
Proceed to Commissioning.

5.6 Sensor Wiring

5.6.1 Wiring the Sensors

Connecting Sensors to the Transmitter

1. Open the transmitter top cover. Using a flat blade screwdriver, remove the Cable Strain Relief bracket (see figure below).
2. Observing the upstream and downstream orientation, attach the UP (upstream) and DN (downstream) cables to the sensors and make snug. Attach the other ends to the UP and DN terminals of the flow meter (see figure below).
3. Replace the Cable Strain Relief bracket. Close top cover.
4. Proceed to Commissioning (Page 83).



①	Transmitter Input Module	⑤	To Path 2 UP
②	Sensor Cables Connected to Transmitter	⑥	To Path 1 DN
③	Cable Strain Relief Bracket	⑦	To Path 1 UP
④	To Path 2 DN	⑧	Path 2
		⑨	Path 1

Figure 5-27 Sensor Cable Connections

Commissioning

6

6.1 General requirements

Before commissioning it must be checked that:

- The device has been installed and connected in accordance with the guidelines provided in chapter 4 "Installing/mounting (Page 33)" and chapter 5 "Connecting (Page 37)"
- Device installed in hazardous location meets the requirements described in "Installation in hazardous location (Page 14)"

6.2 Commissioning

Note

Refer to [Programming the Transmitter] (Page 49) if needed.

1. Scroll down to [Install Sensor] and press <Right Arrow>.
2. Scroll down to [Install Complete]. Press the <Right Arrow> and select [Install]. Press <ENTER>. The flow meter will go through its drives.

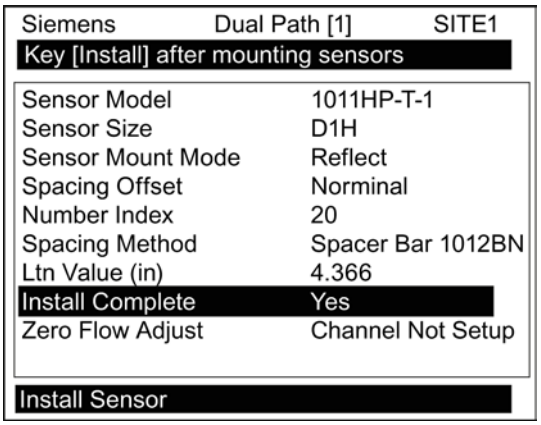


Figure 6-1 Final Setup

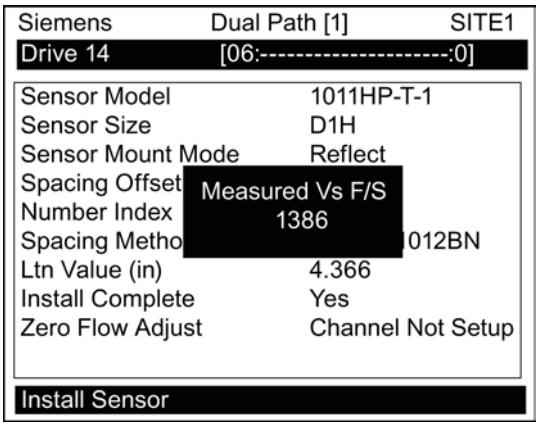
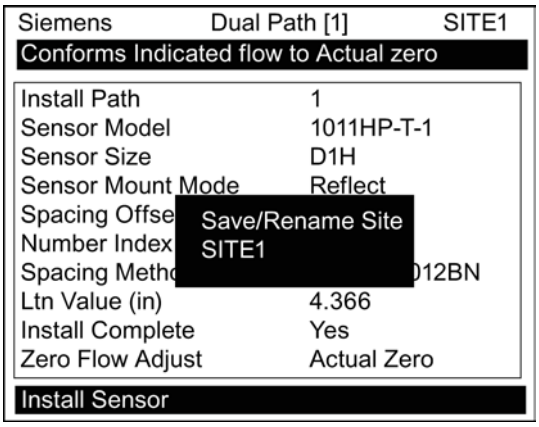


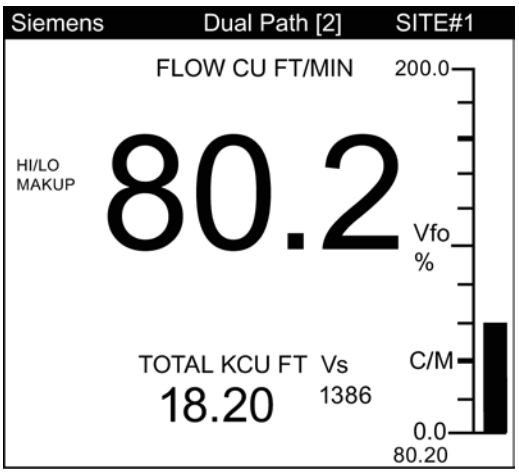
Figure 6-2 Measuring Gas Sonic Velocity

3. Observe the Measured Vs window and verify a correct sound velocity measurement (if known).
4. Press the <Down Arrow> to accept sound velocity value.

5. Press the <MENU> key.



6. Press the <Right Arrow> and then <ENTER> to save the site data.
7. **The flow meter is now ready to report flow.**



See also

Refer to the I/O Connections and Wiring (Page 163) diagrams for input/output wiring and Span Data manual section for data spanning procedures.

6.3 Installation Menus

FUG1010 Installation Menu Chart

Use <Left>, <Right>, <Up> and<Down> arrow buttons to navigate the menu between levels and sub menus.

For example: To navigate to [Sensor Size]:

1. Press <MENU> to return to Level A.
2. Press <Right Arrow> to Level B (Dual Path Flow) then press <ENTER>.
3. Scroll using <Down Arrow> to [Install Sensor].
4. Press <Right Arrow> to Level D.
5. Scroll using <Down Arrow> to [Sensor Size].
6. Press <ENTER> select size from list.

Note

Menu items in bold are required entries to establish operation.

Level A	Level B	Level C	Level D (see manual)	Level E	Level F
Meter Type	**Dual Path Flow**	**Chan/Path Setup**	Recall Site Setup	Enter From List	
			Channel Enable	Enter From List	
			Create/Name Site	**Enter From List**	
			Site Security	On/Off	
			Delete Site	Enter/Clear Site Name	
			Save/Rename Site	Enter From List	
		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**	
			Pipe ID (in)	Numeric Entry	
			CC129 Thickness	Numeric Entry	
			Pipe Config	Enter From List	
			Anomaly Diams	Numeric Entry	
			ThermExpCoef 1/F	Numeric Entry	
			Mod of Elast PSI	Numeric Entry	
		Gas Parameters	Base Temperature F	Numeric Entry	
			Base Pres. PSIA	Numeric Entry	
			Spec. Heat Ratio	Numeric Entry	
			Viscosity <cP>	Numeric Entry.	

Level A	Level B	Level C	Level D (see manual)	Level E	Level F
			Fixed MW g/mole	Numeric Entry	
			Estimated Vs F/S	Numeric Entry	
			Fixed Pres. PSIA	Numeric Entry	
			Z Base	Numeric Entry	
			Z Actual	Numeric Entry	
			AGA8 Comp.	No/Yes	
		Install Sensor	**Install Path**	**Enter From List**	
			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	**View Only**	
			Install Complete	**No / Install**	**Select Install**
			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	
			Std Vol Corr	No/Yes	
			Flow Time Units	Enter From List	
			Flow Disp. Range	Enter From List	
			Flow Disp. Scale	Enter From List	
			Total Vol. Units	Enter From List	
			Std Vol Corr	No/Yes	
			Totalizer Scale	Enter From List	
			Total Resolution	Enter From List	
			Totalizer Mode	Enter From List	
			Batch/Sample Tot	Numeric Entry	
		Span/Set/Cal	Span Data	Enter From List	
			Set Alarm Levels	Enter From List	
			Calib. Flowrate	Intrinsic	
				Kc	
				MultiPoint	
			Calib. Table 1	Index Variable 1	Enter From List
				Calib. Table 1	New Point
				Table Active 1	No/Yes-
				Clear Table 1	No/Yes

Level A	Level B	Level C	Level D (see manual)	Level E	Level F
			Calib. Table 2	Same as Table 1	
			Calib. Table 3	Same as Table 1	
			Display Setup	Select Data	Enter From List
				Data Display	Enter From List
				Time Base	Enter From List
				StripChart Clear	No/Yes
			Logger Setup	Logger Mode	Enter From List
				Logger Data	Enter From List
				Logger Interval	Enter From List
				Logger Events	Enter From List
				Display Logger	Enter From List
			I/O Data Control	Analog Out Setup	Enter From List
				Relay Setup	Relay 1,2,3,4
				Analog Inp Setup	Enter From List
			Diagnostic Data	Path Select	1,2, 1 & 2
				Path Enable	No/Yes
				Flow Data	Enter From List
				Application Info	Enter From List
				Gas Data	Enter From List
				Site Setup Data	Enter From List
				Test Facilities	Enter From List
				Print Site Setup	No/Yes
				Site Created:	View Only
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	Display Logger	Off/Line Wrap No Line Wrap		
		Output Logger	Yes/No		
		Circular Memory	Yes/No		
		Est LogTime Left	View Only		
		Clear Logger	Yes/No		
	Memory Control	Log Memory Left	Yes/No		
		Memory Map	Yes/No		
		Defragment	Yes/No		
	Analog Out Trim	Trim Io1	Operate / Trim @ 4mA		

Level A	Level B	Level C	Level D (see manual)	Level E	Level F
		Trim Io2	Operate / Trim @ 4mA		
		Trim Vo1	Operate / Trim @ 2V		
		Trim Vo2	Operate / Trim @ 2V		
		Trim Pgen1	Operate / Trim @ 1kHz		
		Trim Pgen2	Operate / Trim @ 1kHz		
	RTD Calibrate	RTD1	Factory / User Cal		
		RTD2	Factory / User Cal		
	Clock Set	Date (MM.DD.YY)	Numeric Entry		
		Time (HH.MM)	Numeric Entry		
	RS-232 Setup	Baud Rate	Enter From List		
		Parity	Enter From List		
		Data Bits	7/8		
		Line Feed	Yes/No		
		Network ID	Numeric Entry		
		RTS Key Time	Enter From List		
	Backlight	Enter From List			
	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				

Functions

7

7.1 Gas Parameters Menu

This menu becomes available after picking a flow meter type and programming pipe parameters. We recommend that you edit the Gas Parameters immediately after creating a new Site Setup. The default settings are probably suitable for most applications, however if reliable data can be provided regarding the gas specific heat ratio, gas viscosity or gas compressibility factor, these settings should be modified.

The FUG1010 Gas flow meter uses the Gas Parameters data to establish the specific gravity and the volume correction factors required for mass flow or standard volume computations.

- The base temperature and base pressure settings are customer provided and are used for standard volume correction.
- The specific heat ratio item is required for the computation of the average gas specific gravity.
- The Viscosity (cP) item is required for proper flow profile compensation.
- The fixed MW (molecular weight) allows you to force the flow meter to use a specific molecular weight for well-defined gases.
- The fixed Pressure entry allows for a fixed value to be entered when no external pressure (analog input) is available.
- The flow meter is also capable of providing an AGA8 volume compensation for fixed gas compositions. This is accomplished by creating an offline lookup table that contains the compressibility and density values for a defined range of pressure and temperature. Once completed, the table must be downloaded to the flow meter. Refer to AGA8 table generation instructions in this section.

The list below shows the defaults and description for all the [Gas Parameters] menu items. Each item in the [Gas Parameters] menu can be edited by the user. Pressing the <Right Arrow> key on any of these menu items will enable numeric entry and allowing the user to override the default values.

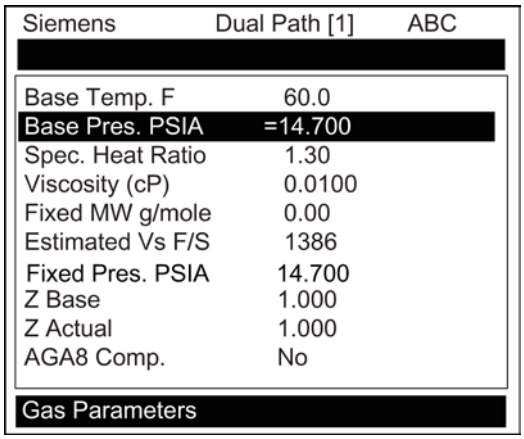


Table 7- 1 Gas Flow Meters Menu Structure and Default Values

Gas Flow meters	Base Temp	15.5°C (60°F)	Enter reference temperature in C or F.
	Base Pres. PSIA	14.7 psia (1.014 bara)	Enter reference pressure in PSIA or BARA.
	Spec. Heat Ratio	1.3	Enter gas specific heat ratio (constant pressure to constant volume.)
	Viscosity (cP)	0.010 centipoise	Enter absolute gas viscosity in centipoise.
	Fixed MW g/mole	0.0 grams/mole	Enter fixed molecular weight to override automatic computation.
	Estimated Vs ft/s	1312 ft/sec	Enter the nominal sound velocity of the gas if significantly different from this default.
	Fixed Pres. PSIA	14.7 psia (1.014 bara)	Enter fixed operating pressure if external input is not available.
	Z Base	1.000	Enter the compressibility factor for the gas at base conditions.
	Z Actual	1.000	Enter fixed compressibility factor where pressure, temperature and gas composition do not vary significantly.
	AGA8 Comp	YES/NO	If a valid AGA8 table is installed then select [YES] to activate the AGA8 compensation (Std. Vol. Comp from the Flow/Total Units menu must also be selected).

Base Temp and Base Pres. PSIA

The base temperature and base pressure represents the conditions to which the reported volumetric flow rate and volumetric total will be compensated to (standard or normal conditions) as described in the equation below. The required units for data entry are determined by the [Preferred Units] menu cell (English or Metric) selected in the [Meter Facilities] menu. If metric units are selected then the units for temperature and pressure will be degrees Celsius and BARA (absolute) respectively. For English units, temperature and pressure will be in degrees Fahrenheit and PSIA.

$$Q_{base} = Q_{act} \times \frac{P_{act}}{P_{base}} \times \frac{T_{base}}{T_{act}} \times \frac{Z_{base}}{Z_{act}}$$

where:

Q = Volumetric flow rate

P = Pressure (absolute)

T = Temperature (absolute)

Z = Compressibility

base = Base conditions (pressure and temperature)

act = Actual flowing condition (pressure and temperature)

Spec. Heat Ratio

The specific heat ratio refers to the ratio of the gas specific heat at constant pressure to specific heat at constant volume. This ratio (along with the measured gas temperature and sonic velocity) allows the flow meter to compute (dynamically) the average specific gravity of the gas. The default value of 1.3 is suitable for most gases, but should be modified if this value is known for your specific application.

Viscosity (cP)

The absolute gas viscosity (along with the measured gas density and raw flow velocity) is used by the flow meter to compute the instantaneous Reynolds number. The Reynolds number is then used to derive the correction factor the required flow profile compensation.

The expected unit for viscosity is "centipoise." The default value of 0.01 is suitable for most gases, but should be modified if this value is known for your specific application.

The Reynolds number is computed as indicated:

$$R_n = 645 \times \frac{\rho \times id \times V_f}{cP}$$

where: ρ = density at flowing conditions (g/cc)

id = spool inside dia (in)

Vf = Flow velocity (ips)

cP = absolute gas viscosity (centipoise)

Fixed MW g/mole

The flow meter uses the measured gas temperature, sonic velocity and specific heat ratio to compute the average specific gravity of the gas being measured. This feature is useful for identification of the gas as well as for proper reporting of mass flow in cases where the gas composition varies.

In cases where the gas composition does not vary significantly, a fixed value for molecular weight can be entered here. A non-zero value for Fixed MW (grams/mole) will override the automatic computation of specific gravity. Setting Fixed MW back to 0.0 will cause the automatic specific gravity computation to resume.

Estimated Vs

The [Estimated Vs] menu cell allows the numerical entry for the nominal sound velocity of natural gas. Contact your local representative for gases other than natural gas.

Note

Changing the Estimated Vs will require repeating the Transducer Install procedure.

Fixed Temp and Fixed Pres. PSIA

The flow meter can accept temperature and pressure input from an external direct sensing instrument. If you do not have external temperature or pressure available, then the flow meter will automatically use the fixed value(s) as the assumed gas temperature and/or pressure. Please note that for proper reporting of volume corrected flow, mass flow or specific gravity, the flow meter must have reliable temperature and pressure input. However, if the operating temperature and pressure is very constant, then fixed values may be used where higher accuracy is not required.

The required units for data entry are determined by the [Preferred Units] menu cell (English or Metric) selected in the [Meter Facilities] menu. If [Metric] units are selected then the units for temperature and pressure will be degrees Celsius and BARA (absolute), respectively. For English units, temperature and pressure will be in degrees Fahrenheit and PSIA.

Z Base

The [Z Base] menu cell allows entry for the compressibility factor, at base conditions, for a given gas composition. If using the internal AGA8 compensation, Z Base should be set appropriately for the gas composition.

Z Actual

The [Z Actual] menu cell allows for a fixed entry of the compressibility factor in cases where pressure, temperature and gas composition do not vary significantly. If standard volume compensation is desired then enter the average compressibility factor for the specific gas application.

AGA8

All FUG1010 gas flow meters include a facility for performing internal volume compensation using an AGA8 lookup table. This volume correction method is suitable and accurate for applications where the gas composition does not vary significantly or where the gas is infrequently sampled (not automatically sampled).

Note

In cases where automatic sampling is performed, a gas flow computer must be used in conjunction with the FUG1010 flow meter to provide the most accurate volume compensated flow output.

The internal AGA8 lookup table provides the flow meter with the actual gas density (Kg/m^3) and compressibility factor (Z Actual) for the indicated pressure and temperature (as obtained via the analog input or fixed P/T entry). These values are then used to compute either mass flow rate or standard volume corrected flow rate as indicated in the Flow/Total Units menu.

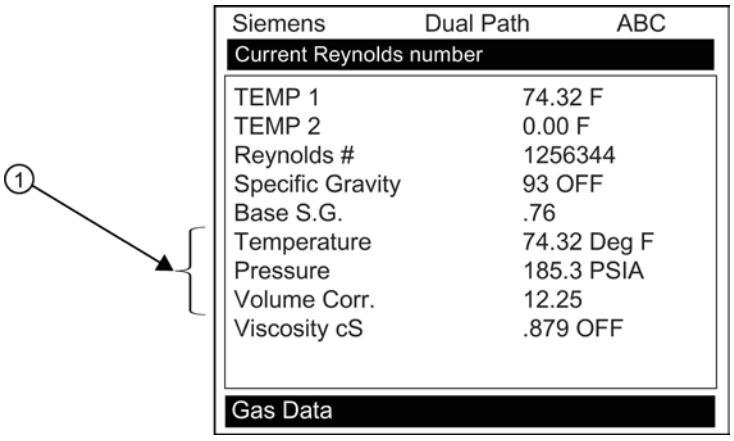
The AGA8 lookup table is essentially a 10 x 10 array or grid containing both Z-factor and Density, with a 10 point temperature and 10 point pressure index. Based on the current temperature and pressure measurement, Z-factor and Density are interpolated to provide accurate volume correction. The table should be configured to cover the full range of operating temperature and pressure; however, if the measured pressure or temperature falls

outside the table limits the flow meter lookup algorithm will extrapolate the Z-factor and Density values accordingly.

The table must first be generated externally using a software package which computes the appropriate density and compressibility factors for the specified gas composition. Siemens recommends using Si-Ware to generate this lookup table. Refer to the Si-Ware Operating Instructions manual for procedures.

7.2 Gas Data Menu

This menu is within the Diagnostic Menu. The menu shows the current Reynolds number used by the flow meter to implement flow profile compensation, as well as operating pressure and temperature and computed gas properties.



① Actively displays pressure and temperature from either analog input, computation or fixed gas parameters menu.

Table 7- 2 Gas Data Menu Items

TEMP 1	Measured temperature from Path 1 RTD.*
TEMP2	Measured temperature from Pathl 2 RTD.
Reynolds Number	The flow meter corrects the current flow rate in accordance with this Reynolds number. This number is determined from pipe ID, current flow rate and gas kinematic viscosity.
Specific Gravity	Actual specific gravity of gas computed as follows: molecular weight of gas divided by molecular weight of air.
Base S.G.	Specific Gravity measured at base temperature.
Temperature	Measured temperature (Analog input or from RTD input.)
Pressure	Measured pressure (Analog input or from Gas Parameters menu.)
Volume Corr.	Flow rate/total multiplier used to correct the measured volume to standard volume.
Viscosity	Kinematic viscosity of gas.

* If the analog input for temperature is enabled it will override the internal RTD temperature measurement and TEMP1 will reflect the analog input temperature instead. For Dual Path operation only TEMP1 is used for volume correction.

7.3 Selecting Flow Units

Selecting Flow Units

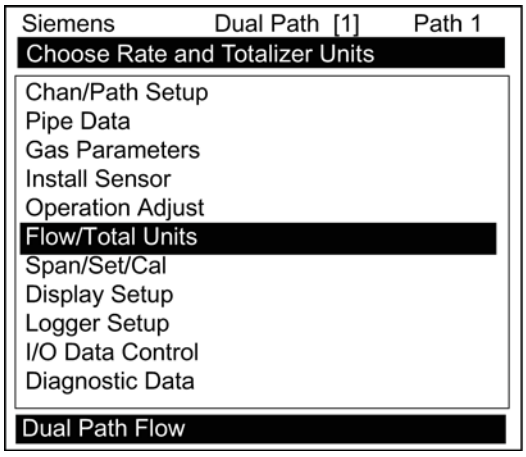
The [Flow/Total Units] menu is available after selecting a meter type and measurement channel. Use the [Flow/Total Units] menu to select volumetric flow units and an associated time base for the flow rate and total outputs. After making your selections, the display scaling menu cell shows the resultant scaling (with multiplier). The resolution can be adjusted by selecting your preferred multiplier.

Selecting Flow Volume Units

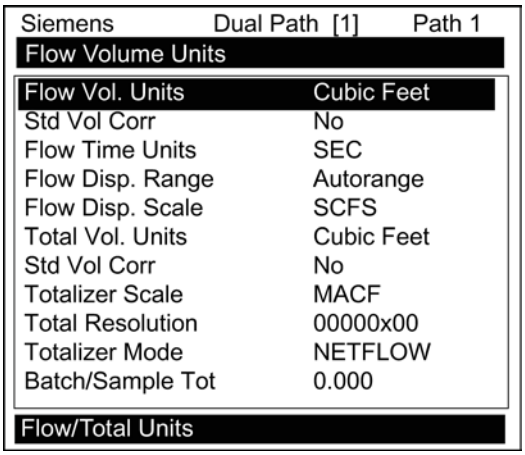
The [Flow Vol. Units] option list allows you to select the rate units the flow meter uses to report volumetric flow. The flow meter uses the computed gas specific gravity to convert volumetric flow to mass flow. The default in English Units for gas is [Cubic Feet].

To select a Volumetric or Mass unit:

1. Press the <MENU> key and [Meter Type] will be highlighted.
2. Press the <Right Arrow> to [Dual Path Flow] and then press <ENTER>.
3. The [Dual Path Flow] menu with appear with [Chan/Path Setup] menu item highlighted.
4. Scroll down to the [Flow/Total Units] menu and press the <Right Arrow> to select the [Flow Vol. Units] menu.



5. Press the <Right Arrow> to select the option list and use the <UP/Down Arrows> to select the desired units.



6. Press <ENTER> to store selection.

Totalizer Modes

The Totalizer function operates in any of the modes listed below:

Table 7- 3 Totalizer Modes

Mode	Flow Direction	Notes
POSFLOW	positive flow	Accumulates flow in positive direction only
NEGFLOW	negative flow	Accumulates flow in reverse direction only
NETFLOW	positive or negative flow	Adds to positive total; subtracts from reverse total

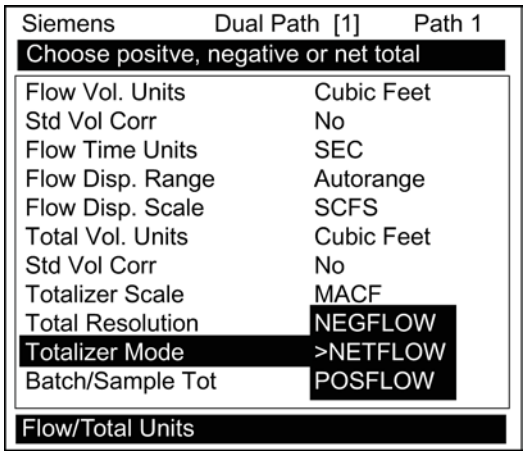
Note

NETFLOW (default) is best for applications where there may be zero flow for long periods. It minimizes false Totalizer register increments due to data scatter. Press the <Down Arrow> to accept the default setting.

Selecting Totalizer modes

1. Press the <MENU> key and [Meter Type] will be highlighted.
2. Press the <Right Arrow> to [Dual Path Flow] and then press <ENTER>.
3. The [Dual Path Flow] menu with appear with [Chan/Path Setup] menu item highlighted.
4. Scroll down to [Flow/Total Units] and press <Right Arrow>.

5. Scroll down to the [Totalizer Mode] menu and press the <Right Arrow> to select the Totalizer Mode option list.



6. Press the <Up/Down Arrows> to select the desired mode.
7. Press <ENTER> to store selection.

Totalizer Mode Controls

You can control the meter totalizer from the keypad in order to stop, start, reset, or freeze the totalizer value by utilizing the keypad sequences shown below. Alternatively the totalizer can be controlled from a PC when using Si-Ware or Hyper-Terminal to issue the specific commands identified in the Descriptions below. Refer to Appendix A for Communications setup procedures, if needed.

Table 7- 4 Totalizer Controls (the "n" in <Fn> = channel number)*

Keypad Sequence		Command	Description
F1 F2 F3 F4	1	CLRTOT (also clears overflow)	Resetting the Totalizer registers clears all total data accumulated during operation. Note: In Dual Path mode, the Totalizer operates only on the virtual system channel (Ch 3). Therefore in this case, the CLRTOT trigger would be <F3> <1>. Commands that can be invoked from Si-Ware or HyperTerminal: Terminal Command: CLRTOT 1.
F1 F2 F3 F4	2	NOTOT (Totalizer Freeze)	Invoking the NOTOT command disables the Totalizer. Totalization will not resume until you repeat the <Fn> <2> key sequence. When you activate NOTOT, an N precedes the TOTAL symbol (i.e. [NTOTAL]) on the LCD Screen. Commands that can be invoked from Si-Ware or HyperTerminal: Terminal Command: NOTOT 1 = Stop Totalizer Terminal Command: NOTOT 1 = Start Totalizer
F1 F2 F3 F4	3	LAPTOT (Totalizer snapshot)	The LAPTOT command freezes the Totalizer screen display. However, the flow meter will continue to update its internal registers. The flow meter will show the current total when you repeat the <F1>< 3> key sequence. When you activate LAPTOT, an L precedes the TOTAL symbol (i.e., [LTOTAL]) on the HyperTerminal screen.
F1 F2 F3 F4	4	CLEAR (Batch/Tot register)	Clears the Batch/Sample Totalizer register. The flow meter maintains a separate Totalizer register for Batching or Sampling applications but cannot be accessed directly. It is used for relay control only. If you assign the system relay to this function, a momentary (200 mS) relay pulse occurs whenever the BATCHTOT register accumulates the specified quantity. In the [Batch/Sample Tot] menu cell the required total flow volume is entered to activate the relay. This numeric entry must reflect the selected flow total units. The [Totalizer Scale] menu cell shows the applicable flow total units. The sign of the Batch/Sample Total determines positive or negative accumulation.
F1 F2 F3 F4	5	CLEAR (Makeup Latch)	Clears the Makeup Latch. Refer to the Span Data menu [Set Alarm Levels] and then the [Makeup Latch] On / Off option.

*Use the <F1> key as the "Lead-in command" for 4-Path Totalizer operations.

7.4 Zero Flow Adjust Menu

Zero Flow Compensation Methods

Unlike turbine flow meters ultrasonic transit-time flow meter provide active flow measurement right down to zero flow, however, the measurement of the transit-time delta is dependent on the similarity or "match" of the electronics, cables and ultrasonic sensors. Consequently some flow offset (or zero offset) may be present in any installation. To eliminate this residual zero offset Siemens has developed several different methods to insure proper zero flow compensation. The following paragraphs describe each method and when they should be used.

Auto Zero

When the 1011HP sensors are mounted in the Reflect Mode configuration the AutoZero routine is automatically invoked at the end of the Initial Makeup. Flow does not have to be stopped to perform AutoZero since only the pipe wall signal is used in determining the zero offset and not the gas component. The AutoZero routine performs a one-time analysis of the pipe wall component of the ultrasound signal to quantify any residual mismatch in the hardware. Once the AutoZero routine is complete, the system memorizes this measured zero offset and subtracts this value from the flow reading.

Actual Zero

The Actual Zero function simply averages the indicated "zero flow" readings (over a user defined time period) then stores this average value in memory. Under normal operation the indicated flow reading is zero compensated by simply subtracting this memorized value from the uncompensated flow reading. Actual Zero is the most positive method for zeroing the system; however, flow must be stopped with the line blocked (if possible) before invoking this function. If stopping flow is not possible then an alternate zeroing method should be selected.

ReversaMatic

This routine involves swapping the Up and Down sensors on the pipe (while keeping the cables attached) such that the difference in the transit-time change represents the zero offset. The fixed zero offset value is stored in memory in the same manner as described in Actual Zero. This routine would generally be used whenever flow cannot be stopped and the sensors cannot be mounted in the Reflect Mode configuration. Flow must be stable during the entire process.

ZeroMatic

When ZeroMatic is invoked the flow meter first performs the same analysis as described above in the AutoZero routine. However, after this analysis is complete the flow meter continues to interrogate the pipe wall signal and update the zero offset value under normal operation, such that the flow meter dynamically compensates for changing conditions which would normally result in zero drift. ZeroMatic will only operate with the sensors mounted in

the Reflect Mode configuration and is recommended for applications which experience large temperature extremes.

Note

Invoking ZeroMatic will clear any existing "fixed" or memorized zero offset. If any zero offset remains after flow is stopped, an Actual Zero can be performed without interrupting ZeroMatic operation. To disable ZeroMatic, invoke it again, but then press <Left Arrow> to abort the installation.

Note

The ZeroClr command only resets the memorized zero offset registers not those set when the AutoZero routine is invoked.

Using Actual Zero

Note

Flow must be stopped with the line blocked (if possible) before invoking this function.

To invoke Actual Zero:

1. Access the [Zero Flow Adjust] option list by pressing <Right Arrow>.
2. Press <ENTER>. A pop-up window prompts you to set the current flow rate (in selected rate units) to equal zero (0.000).

   Note

   If a flow offset is desired (i.e., to test analog outputs) then press <Right Arrow> to enable numeric entry.

3. Press <ENTER> to start the Actual Zero process.

When you send the command, the flow meter analyzes the current zero reading for up to sixty seconds, integrating (averaging) the data for the best zero correlation. During this time, the menu prompt at the top of the display screen shows a timer that counts from zero to sixty. You can allow zero averaging for the entire period, or complete the process at any time by pressing the <ENTER> key. This controls the amount of data the flow meter averages to obtain a zero level.

Using ReversaMatic

If site conditions do not permit stopping the flow rate at the mounting location, and you do not know the current flow rate, then you can use the ReversaMatic routine to establish the zero flow level. You should perform the ReversaMatic procedure as quickly as possible to ensure that the flow rate remains constant throughout the procedure.

To invoke ReversaMatic:

1. To access the [Zero Flow Adjust] option list press <Right Arrow>.
2. Move the cursor to [ReversaMatic]. Press <ENTER> to invoke the routine.
3. The flow meter begins to measure the positive flow rate. "Positive" flow refers to flow moving from upstream sensor location to the downstream sensor location. Note top prompt line shows: **Reversamatic Action**
4. Upon completion, the flow meter beeps and the display screen shows: **Reverse Sensors / Press <ENTER>**
5. Now remove then remount the upstream and downstream sensors in their reversed positions. Mount the Up sensor (without removing its cable) in the Down sensor/cable location. Mount Down sensor with its cable in the Up sensor/cable location. When remounting the sensors, couple them to the pipe properly. Press <ENTER> (after re-installing the sensor).
6. The flow meter measures the negative flow rate briefly, then beeps and repeats the prompt: **Reverse Sensors / Press <ENTER>**
7. Now remount the sensors for normal operation (in their original orientation). When remounting sensors, couple them to the pipe properly. Press <ENTER> (after re-installing the sensors).

This completes the ReversaMatic procedure. The system's zero accuracy will be very close to that obtainable using the Actual Zero method, providing flow remained constant during this procedure.

ZeroMatic (optional function)

Note

ZeroMatic is used in the Reflect Mode only. Invoking ZeroMatic clears any existing fixed zero offset.

Use Zero Flow Set menu cell to select the ZeroMatic option. If conditions permit the use of the Auto Zero function then the ZeroMatic option can be used as well.

To select and enable the ZeroMatic option:

1. In the [Install Sensor] menu, press <Up Arrow> to scroll to the [Zero Flow Adjust] menu cell.
2. To access the [Zero Flow Adjust] option list press <Right Arrow>.

   Note

   If ZeroMatic is not running, the [Actual Zero] menu item will be displayed next to the [Zero Flow Adjust] menu cell.

3. Select the [ZeroMatic] menu cell by pressing <Up/Down Arrow> then press <ENTER>.

The meter will now perform an Auto Zero process. When complete it will activate the ZeroMatic mode.

To disable the ZeroMatic function:

1. Select the [Install Sensor] menu cell from the [Dual Path Flow] menu.
2. Scroll down to the [Zero Flow Adjust] menu cell by pressing <Up/Down Arrow>.

Note

The highlighted [ZeroMatic] menu item is the only indication that ZeroMatic is functioning.

3. Invoke the ZeroMatic procedure as previously described above.
4. While Auto Zero is active, press <Left Arrow> to abort the process thereby disabling the function.
5. The screen will return to the [Dual Path Flow] menu and highlight the [Operation Adjust] menu cell.

7.5 Span Data

The [Span Data] menu allows you to set 0% and 100% output limits for volumetric flow (Vfo), absolute flow (Vfab), sonic velocity (Vs) and specific gravity (Vsg). Each menu cell shows appropriate rate units and time base. If you change flow rate units after spanning the system, the computer automatically updates the output data setup to reflect the change. Span limits apply to both the analog outputs and the on-screen strip chart. The flow outputs operate as follows:

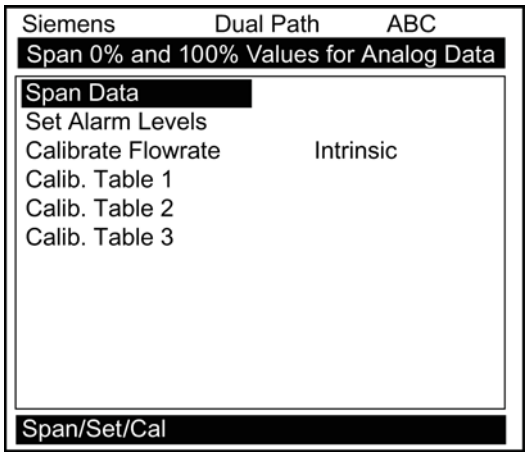
Vfo *Spanned Volumetric or Mass Flow:*	The minimum and maximum flow rate entries establish the Vfo span. The [Max Flow] menu cell sets 100% of span. The [Min Flow] menu cell sets 0% of span. Use signed numbers for bi-directional spanning. Note that negative (reverse) flow is always lower than positive flow, whatever its absolute magnitude. For example, for a flow measurement range of -30 CF/M to +10 CF/M, the 4 mA span will be -30 CF/M, and the 20mA span will be +10 CF/M.
Vfab *Spanned Absolute Volumetric Flow Rate:*	Vfab is the absolute magnitude of the volumetric flow rate (Vfo). There are no menu cells provided to span this output. Vfab shares the Vfo span entries. The Vfab minimum span is always zero. The maximum span for Vfab is the largest absolute value of either the min or the max flow rate (Vfo) entries. For example, a span between +10 CF/M and -30 CF/M, spans the Vfab output from 0 CF/M to 30 CF/M.
Vs Spanned Gas Sonic Velocity:	Vs is the sonic velocity in feet-per-second (F/S) of the flowing gas. The min and max Vs entries establish the Vs span. Max Vs (F/S) defines 100% of span. The Min Vs (F/S) defines 0% of span.
Vsg Spanned Gas Specific Gravity:	Vsg is the inferred operating specific gravity of the gas. The min and max Vsg entries establish the Vsg span. Max Vsg defines 100% of span and Min Vsg defines 0% span.

Maximum span values represent:	Minimum span values represent:
100% of span	0% of span
Current output of 20mA	Current output of 4mA
Voltage output of 10 VDC	Voltage output of 0 VDC
Pulse output of 5000 Hz	Pulse output of 0 Hz

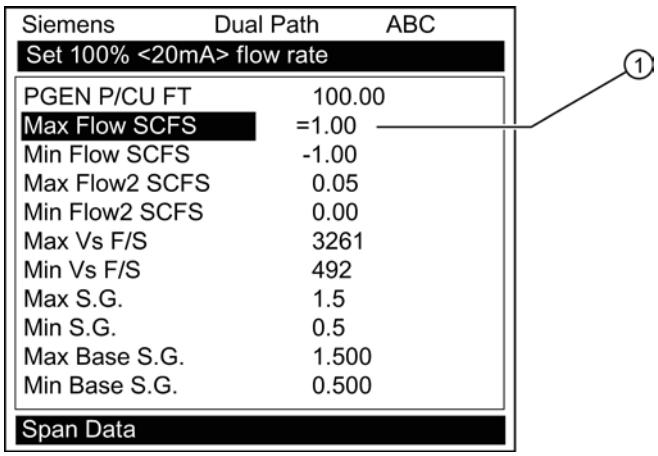
To change the default Span Data settings:

1. At [Meter Type], press <Right Arrow> to [Dual Path Flow] and press <ENTER>.
2. Scroll down to [Span/Set/Cal] and press <Right Arrow>.

3. Highlight [Span Data] and press the <Right Arrow>.



4. Highlight [Max Flow] and press <Right Arrow> to Input 100% flow rate numeric data for 20mA. Press <ENTER> to store data.
5. Scroll down to [Min Flow].Press <Right Arrow> to input 0% flow rate numeric data for 4mA. Press <ENTER> to store data.



① Input numeric flow data here

PGEN Function

The [PGEN P/Unit Volume] menu cell entry controls a digital output pulse function and is available in all units with 7ME362 and 7ME363 part numbers. It allows the assigning of PGEN digital signal pulses per unit of volume. For example, 1000 output pulses per unit of gas.

Note

The unit of volume is determined by the Volume Units initially selected from the [Total Volume Units] menu cell option list.

Table 7- 5 Input/Output Wiring (TB2) - 7ME39400AL03 Expanded I/O Module

Pin#	Signal	Definition	Description	Function Dual/Quad Path Only
12	PG4	POS [+] Total TTL	0-5000 Hz frequency output , assignable	POS [+] Total TTL
11	PG3	POS [+] Total OC		POS [+] Total OC
10	PG2	NEG [-] Total TTL)		NEG [-] Total TTL
9	PG1	NEG [-] Total OC		NEG [-] Total OC
Use reference ground for returns (TB2-2 and TB2-4)				

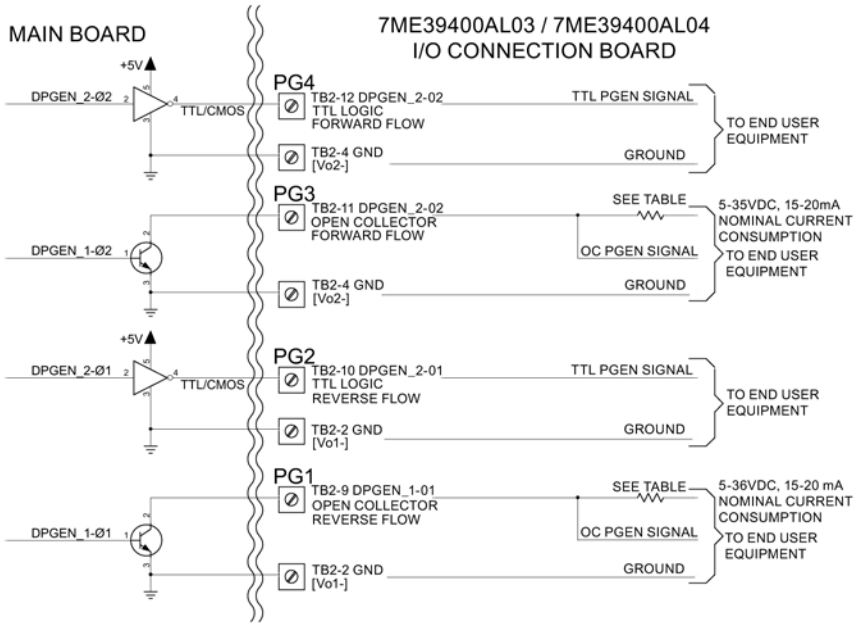


Figure 7-1 7ME39400AL03 Main Board I/O Wiring

Note

TB2-9 and TB2-11 are Open Collector Outputs that require external pull-up resistors for operation. See table for External Supply Voltage and suggested resistor value and ratings. Maximum current into the transistor is 100mA. Maximum Voltage is +36 VDC.

NOTICE

Transistor Damage

Negative voltages with respect to ground will permanently damage transistors.

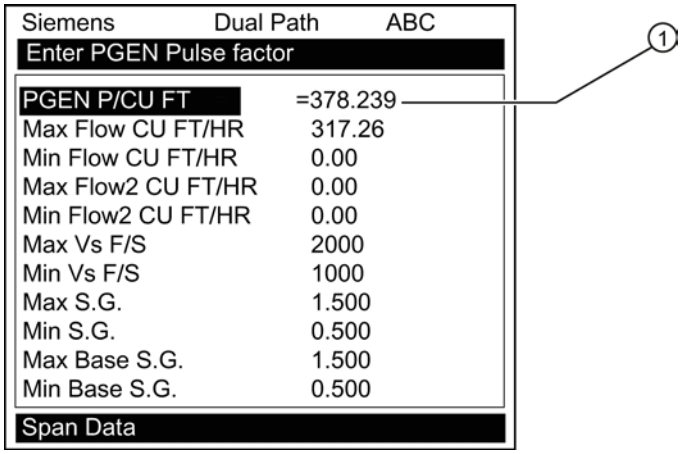
Use caution when applying power to circuit boards.

Table 7- 6 Open Collector User Resistor Recommendations

User Supply Voltage (VDC)	External Resistor (Ohms)	Expected Current Draw (mA)	Recommended Resistor Wattage (Watts)
5	270	18.5	1/2
9	510	17.6	1/2
12	680	17.6	1/2
18	1000	18	3/4
24	1500	16	1
28	1800	15.5	1 1/4
36	2400	15	1 1/4

To change the default PGEN settings:

1. From the [Span Data] menu press <Right Arrow>.
2. Highlight the [PGEN P/Unit Volume] menu cell and press <Right Arrow> to activate the numeric entry.



① Input PGEN pulse factor here

3. Use the numeric keys to enter the desired number of PGEN pulses per unit volume.

Note

Ensure that the number entered will provide sufficient resolution while remaining within the 20 Hz to 5000 Hz pulse frequency range. Note that the PGEN output will stop sending pulses at flow rates corresponding to frequencies less than 20 Hz. In this case the PGEN value must then be increased.

4. To store data press <ENTER>.

Adjusting the PGEN Output

The default setting for the Digital PGEN output provides a 5000 Hz frequency at an assumed maximum velocity of 100 ft/sec. In certain cases it may be necessary to change this default PGEN value. For example:

- If the PGEN signal cable is very long, then the added cable capacitance may prevent reliable RTU pulse detection at or near 5000 Hz. In this case it may be necessary to decrease the PGEN (Pulses / Unit Volume) setting using the equation below.

Pulses / Unit Volume = MaxFreq / MaxFlow

Where:

MaxFreq = Maximum desired frequency (Hz)

MaxFlow = Maximum flow rate (Unit Volume / second)

For very low operating flow rates, the pulse frequency may approach the 20 Hz limit of the PGEN output. In this case it may be necessary to increase the PGEN (Pulses / Unit Volume) setting.

Pulses / Unit Volume = MinFreq / MinFlow

Where:

MinFreq = Minimum desired frequency (Hz). Must be greater than 20 Hz!

MinFlow = Minimum operating flow rate (Unit Volume / second)

Note

If STD VOL is selected then the "unit volume" for PGEN will represent Standard Volume, not actual volume.

Forcing the PGEN Output Frequency

To test the operation of the flow meter with a Remote Transmitting Unit (RTU), or other pulse counting device, it may be necessary to force the PGEN output frequency, especially when the pipeline is not flowing during flow meter commissioning. This can be accomplished by setting the AnCal diagnostic value to a flow rate corresponding to the desired frequency output. (Refer to the appropriate paragraph in your manual for operation of the AnCal function.)

The example below demonstrates how to calculate the AnCal flow rate based on the desired pulse output frequency and the entered PGEN (Pulses / Unit volume) setting:

For PGEN setting = 53 Pulses /CU FT and a desired frequency = 1000 Hz

1. Temporarily change flow rate units to CU FT / SEC (Use same volume units as Totalizer.)
2. Set AnCal = 1000 / 53 = 18.868 CU FT / SEC
3. 1000 Hz frequency should now be observed on the PGEN output.

7.6 Analog Out Setup

The flow meter provides current, voltage and pulse-rate analog outputs. The [Analog Out Setup] menu allows you to assign data functions for these signals. The transmitter terminal strip contains the analog output terminals.

Table 7- 7 Analog Outputs

Io (Isolated Current)	4 to 20mA varies in proportion to an assigned data function.
Vo (DC Voltage)	0 to 10 VDC varies in proportion to an assigned data function.
Pgen (TTL Logic)	0 to 5000 Hz varies in proportion to an assigned data function.
Digital Pgen	User selective pulses per unit flow.

Table 7- 8 Analog Out Setup Data Categories

Vfo	System spanned volumetric/mass flow rate
Vfo2	Additional spanned volumetric/mass flow rate
Vfab	System spanned and signed absolute flow
Vs	Spanned gas sonic velocity
Valc	Received signal amplitude
Vtrb	Relative degree of gas turbulence
Vsg	Spanned specific gravity
Base S.G.	Spanned S.G. referenced to user temperature
Viscosity	Gas viscosity in centistoke units
Iin1, Iin2, Iin3, Iin4	Represents a re-transmit of the analog input signals (e.g. Pressure and Temp inputs can be transmitted on the 4-20mA output).

Note

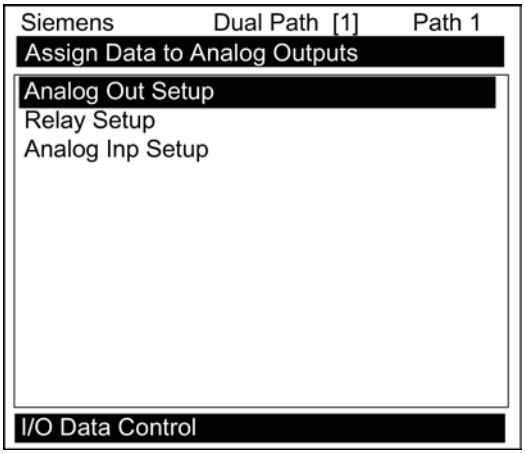
For Multi-Path flow meters: "1" = Path 1, "2" = Path 2, "3" = Path 3, "4" = Path 4 and "S" represents the system or average channel. These characters appear to the left of the option list parameter.

Io Output Functions

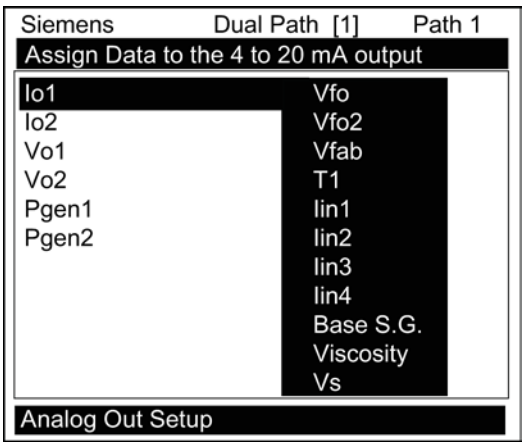
4-20mA outputs also provide a fault indication by dropping to 2mA if assigned to flow rate and under fault conditions.

Assigning a function to the current output:

1. From the [Chan/Path Setup] menu scroll to [I/O Data Control].
2. Press <Right Arrow] to highlight the [Analog Out Setup] menu.



3. Press <Right Arrow> twice to access the [Io] option list.
4. Move the cursor to the desired data function by pressing <Up/Down Arrow>.



5. To store selection press <ENTER>.

Vo Output Functions

The Vo analog output is a 0-10 VDC signal that varies linearly in relation to a selected function.

Assigning a function to the voltage output:

1. From the [Analog Out Setup] menu, press <Right Arrow> to access the [Vo1] option list.
2. Move the cursor to the desired data function by pressing <Up/Down Arrow>.
3. To store selection press <ENTER>.

Note

Refer to drawing 1010N-7-7 in Appendix A for Analog output connections.

See also

Installation/Outline Drawings (Page 187)

7.7 Analog Input Setup

The optional Analog Input Setup function assigns an active analog input to a measurement channel/path. The flow meter provides four DC current input ports for single channel and Dual Path units. The DC current input ranges from a zero level of 4mA to a full scale of 20mA. The [Analog Inp Setup] menu cell allows you to enable this port and then span it to any desired scaling.

For example, when using the analog input for pressure the numeric variables might be spanned as follows: 4mA=14.7 PSIA and 20mA=1014.7 PSIA.

Note

The flow meter expects "absolute" pressure. If the external device reports "gauge pressure" then make sure to span the pressure input so that 4mA represents 1 ATM (14.7 PSIA or 1.014 BARA) and not 0.0.

The various flow meter models allow you to associate the analog input to active system variables such as specific gravity, viscosity and others (see table below).

Note

Refer to the Installation Drawings or I/O Module markings for the locations of these inputs and wiring procedures.

Table 7- 9 I/O Data Control Menu

I/O Data Control	Analog Inp Setup	Iin1	Input	Off Aux PSIA BARA T1 Deg F T1Deg C
			4mA 20mA	Numeric entry Numeric entry
		Iin2 / Iin3 / Iin4	See In1 option list	

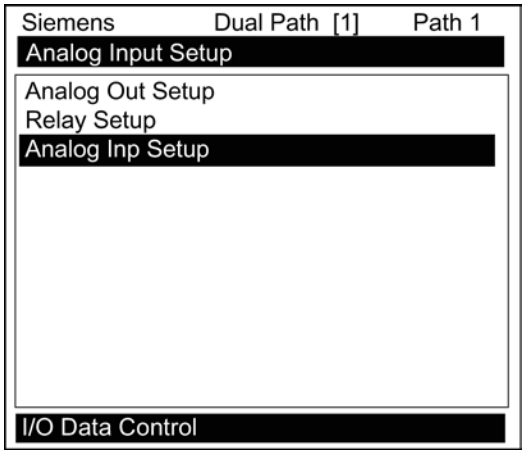
Note

The Aux input is only used as a feed through to the Datalogger.

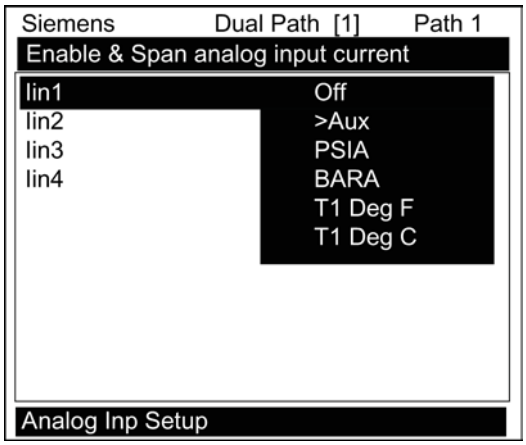
The flow meter recognizes the first analog input variable that is assigned to any given parameter and ignores any subsequent input with the same assignment. For example, if Iin1 and Iin2 are both assigned to represent pressure (PSIA), the flow meter will only use the pressure input from Iin1.

Setting the Analog Current Input

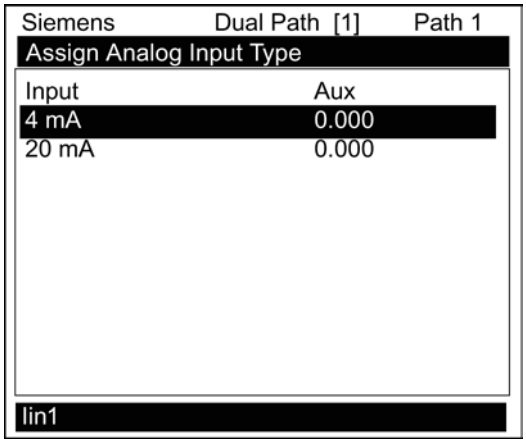
The DC current input port must be enabled first. From the [Analog Inp Setup] menu proceed as follows:



1. Access the [Iin1] option list by pressing the <Right Arrow> twice.



2. Move the cursor down to [Aux] by pressing the <Down Arrow> and then press <ENTER>. This enables the port to receive an input current. The cursor moves to [4 mA].



3. To enable numeric entry, press the <Right Arrow>. Type a numeric value corresponding to a 4mA input signal.
4. To store the data press <ENTER>. This moves the cursor to [20 mA].
5. To enable numeric entry, press the <Right Arrow>. Type the numeric value corresponding to a 20mA input signal.
6. To store the data, press <ENTER>.

7.8 Analog Output Trim

Introduction

Analog Out Trim function allows you to fine-tune the flow meter's analog voltage and current outputs using an ammeter connected to the output under test. In addition, you can use a frequency counter to fine-tune the flow meter's pulse rate output.

Note

The current, voltage, and Pgen trimming will be limited by the 12-bit resolution of the flow meter's D/A Convertor (DAC).

1. From the [Meter Facilities] menu, scroll to the [Analog Out Trim] menu.
2. Press the <Right Arrow> to access the option list.

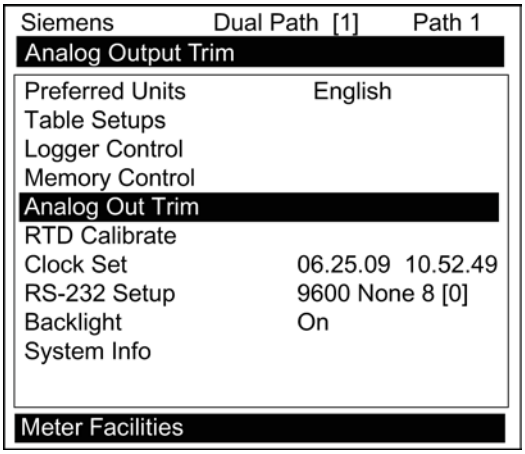


Table 7- 10 Analog Out Trim Menu Structure

Analog Out Trim	Io1/Io2	Operate Trim@	 4mA Indicated mA = x.xx
	Vo1/Vo2	Operate Trim@	 2V Indicated V = x.xx
	Pgen1 and Pgen2	Operate Trim @ 1kHz	 Indicated Hz = xxx

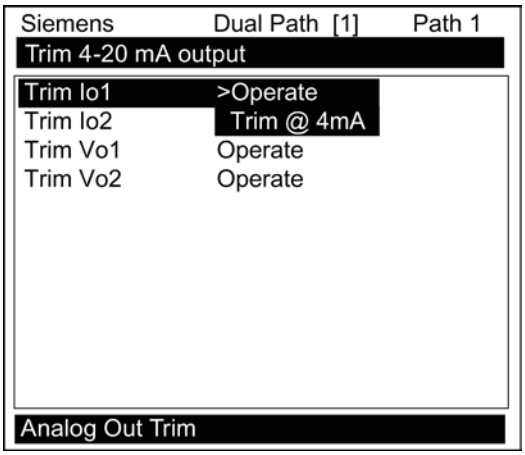
Current Output Trim (Io1 & Io2)

Note

Can be trimmed to within .005mA of nominal.

To calculate a current output:

1. Set up an ammeter, then connect it to the supply and return terminals of the current output under test.
2. Move the highlight to the port to be tested by pressing the <Up/Down Arrow>. Press the <Right Arrow> and then press the <Down Arrow> to move the cursor to [Trim @ 4mA].



3. Press <ENTER>. This triggers a 4.00 mA pop-up window. The ammeter should now be reading 4.00mA.
4. If the ammeter reading does not match, use the numeric keys to type in the current reading.
5. Press <ENTER> to register setting. This adjusts the flow meter's DAC (digital-to-analog converter) so that a 4mA output corresponds with 4mA on the ammeter.
6. Re-check the ammeter to make sure that it is now reading 4mA.

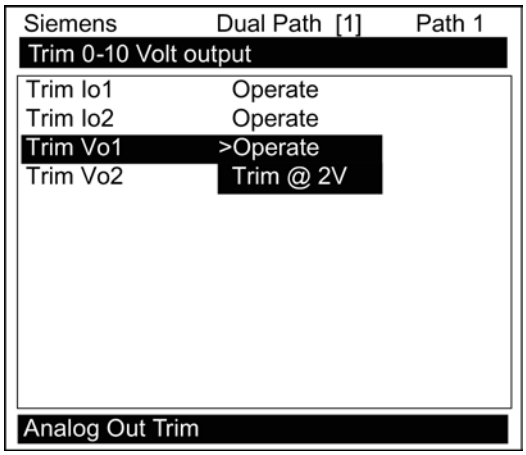
Voltage Output Trim (Vo1 & Vo2)

Note

Can be trimmed to within .0025 V of nominal.

To calculate a voltage output:

1. Set up a multimeter to read volts, then connect it to the supply and return terminals of the voltage output under test.
2. Move the highlight to the port to be tested by pressing the <Up/Down Arrow>. Then press the<Right Arrow> and then press <Down Arrow> to move the cursor to [Trim @ 2V].



3. Press <ENTER>. This triggers a 2.00 Volts pop-up window. The multimeter should now be reading 2.00 Volts.
4. If the multimeter reading does not match, use the numeric keys to type in the voltage reading.
5. Press <ENTER> to register setting. This adjusts the flow meter's DAC (digital-to-analog converter) so that a 2.00 Volts output corresponds with 2.00 Volts on the multimeter.
6. Re-check the multimeter to make sure that it is now reading 2.00 Volts.

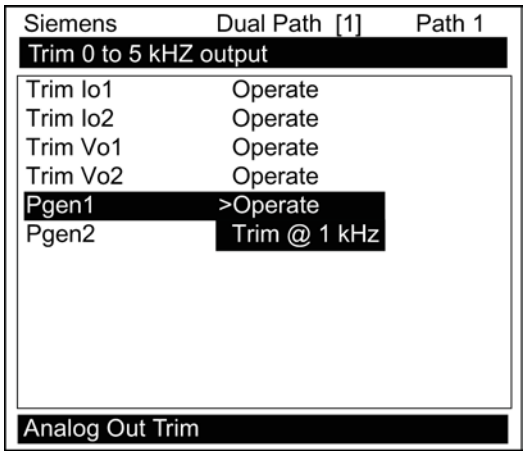
Pgen Out Trim (Pgen1 & Pgen2)

Note

Can be trimmed to within 1.25 Hz of nominal

To calibrate a pulse rate output (Pgen1 or Pgen2):

1. Connect a frequency counter to the supply and return terminals of the pulse rate output under test.
2. Move the highlight to the port to be tested, press the <Right Arrow> and then press the <Down Arrow> to move the cursor to [Trim @1 kHz].



3. Press [ENTER]. This triggers a 1 kHz pop-up window. The frequency counter should now read 1 kHz.
4. If the frequency counter reading does not match, use the numeric keys to type in the frequency counter reading.
5. Press [ENTER] to register setting. This adjusts the flow meter's DAC (digital-to analog converter) so that a 1 kHz output corresponds with 1 kHz on the frequency counter.
6. Recheck the frequency counter to make sure that it is now reading 1 kHz.

7.9 Logger Control

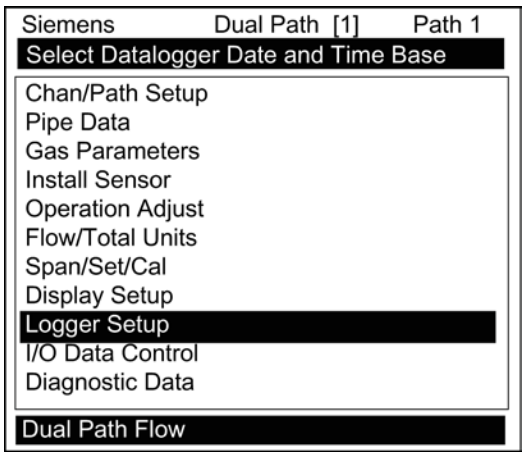
Logger Setup Menu and Logger Control

The [Logger Setup] menu found within the [Meter type] menu provides access to the flow meter’s datalogger configuration parameters. It allows the user to select data items, alarm events, a logging interval and a destination for logger reports.

The [Logger Control] menu in the [Meter Facilities] menu provides global control functions for management of the datalogger memory and logging method.

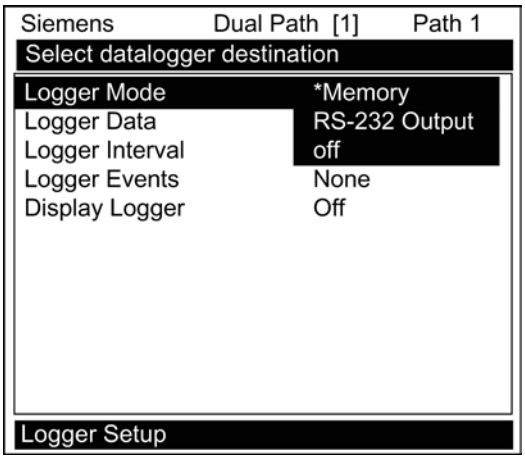
Logger Setup

From the [Meter Type} menu press the <Right Arrow> twice and scroll down to [Logger Setup]. Press <Right Arrow> to select the Logger Setup function.



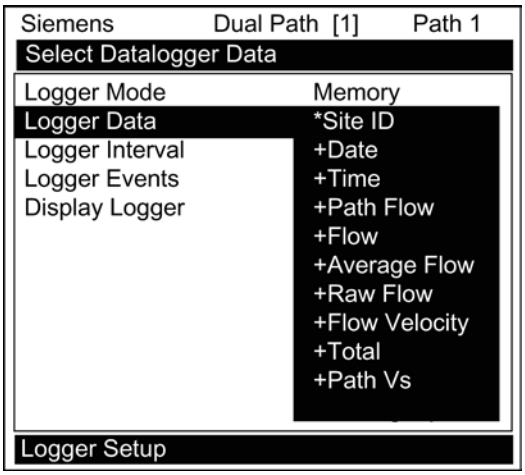
Configure the Logger to generate data reports by the following process:

1. Select the logging method by pressing the <Right Arrow> to select items from the drop-down list.



2. Choose [Memory] to record (save) data reports in the flow meter's internal memory or choose [RS-232 Output] to output each report to the meter's serial port.

3. Select the data required in each report. From the [Logger Data] menu cell press the <Right Arrow>. Press <ENTER> for each parameter that is needed in the logger report or press the <Down Arrow> to skip an unwanted parameter.



4. Continue selecting parameters until the [Site ID] parameter appears again thus completing the selection list. Press the <Left Arrow> to return to the [Logger Setup] menu. If you want to deselect a parameter previously selected, highlight the unwanted parameter and press the <CLR> key.
5. Select the [Logger Interval] by choosing the time interval desired between reports. (Default is 1 minute.)
6. [Logger Events] menu cell can be enabled by selecting one or more alarm functions from the [Events] list (in the same manner as selecting [Logger Data] parameters above). This function will generate datalogger reports should any of the selected alarm “events” occur.
7. The [Display Logger] menu cell can be selected if you wish to observe the datalogger data on the flow meter graphics display. Selecting Line Wrap, forces a line feed after approximately 40 characters to enable viewing entire reports on the screen.

Logger Control

To access the [Logger Control] menu the [Meter Facilities] menu must be selected.

1. From the Meter Facilities menu access the [Logger Control] menu by pressing the <Right Arrow>.
2. Scroll down to [Logger Control]. Press the <Right Arrow> to access the [Logger Control] menu option list.

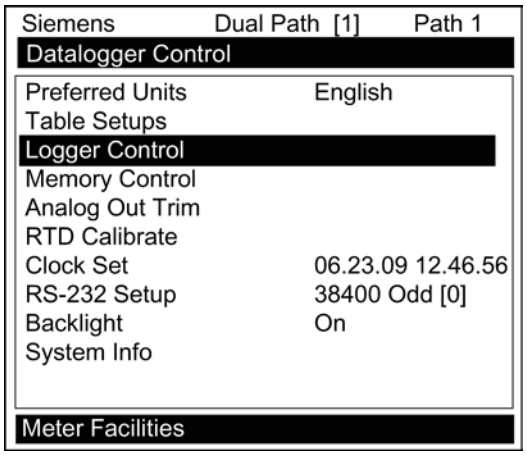


Table 7- 11 Logger Control Menu Option List

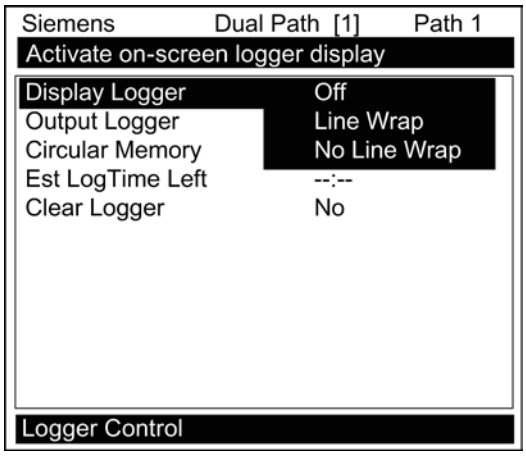
Logger Control	Display Logger	Off Line Wrap No Line Wrap
	Output Logger	No Yes
	Circular Memory (Available for Multi-Path units only)	No Yes
	Est LogTime Left	--:--
	Clear Logger	No Yes

Display Logger

This menu cell is essentially a duplicate of the menu cell in Logger Setup. It allows you to send the Logger contents to the display screen. This command is effective only after a successful install. In addition, you have to enable datalogging and select items in the [Logger Setup] menu. Note that this command transmits the data from both paths. You can set the report to scroll on the screen with or without line wrap.

To send Logger contents to the display screen:

1. Press <Right Arrow> to access the [Display Logger] option list.



2. Scroll cursor to either [Line Wrap] or [No Line Wrap] by pressing <Up/Down Arrow>.
3. To view Logger contents press <ENTER>.
4. To return to [Logger Control] press <MENU>.

Output Logger

This menu cell allows you to send the Logger contents to an external device (usually a computer or printer) via the flow meter's RS-232 Serial I/O port. This command is effective only after a successful install. In addition, you have to enable datalogging and select data items in the [Logger Setup] menu.

The flow meter interfaces with most serial printers or personal computers for Logger printouts. You must use the proper cabling between the flow meter and the external device. In addition, you must configure the RS-232 Setup correctly. You should turn off the Logger function before you transmit an extensive printout. This will avoid contaminating the printout with new Logger data. Logger reports are sequential ASCII text files.

To send Logger contents to the RS-232 Serial Port:

1. Check the flow meter-to-external device connections and your RS-232 Setup parameters (see RS-232 Setup menu).
2. To access the [Output Logger] option list press <Right Arrow>.
3. Scroll the cursor to [Yes] by pressing <Up/Down Arrow>.
4. To transmit Logger contents to external device via the serial port press <ENTER>.
5. To stop printout press <Left Arrow>.

Circular Memory

In its default mode, the Logger collects data until its memory becomes full. At that time the flow meter suspends datalogging and cannot resume until the Logger memory is cleared (see Clear Logger command). Circular Memory allows the Logger to "'write over" its oldest

records when memory reaches full capacity. If you enable [Circular Memory], you are assured of always collecting the most recent data. But also remember that you will lose the oldest Logger reports and that further invoking of [Circular Memory] deletes the current contents of the Logger.

To setup and enable Circular Memory:

1. In the [Logger Setup]: The [Logger Mode] menu must have the [Memory] menu cell selected.
2. Logger items must be selected (e.g., Site ID, Date, Time, etc.).
3. The active Site in the [Chan/Pathl Setup] menu must be disabled. To disable active channels or paths, select the [Chan/Path Enable] menu cell and then [No].
4. In the [Logger Control] menu, select [Circular Memory].
5. Press <Right Arrow> to access the [Circular Memory] option list.
6. Move the cursor to [Yes] by pressing <Up/Down Arrow>.
7. To store selection press <ENTER>.
8. Lastly, re-enable the Site that you disabled earlier.

Est LogTime Left

Est LogTime Left is a "view-only" menu cell that shows an estimate of the amount of Logger time remaining in hours and minutes. This menu cell becomes active after you enable datalogging and is based on the log interval and data selections made in the Logger Setup. Selecting [Circular Memory] and/or event-based datalogging (see Logger Setup), blanks the [Est LogTime Left] field.

Clear Logger

If you use the Logger in its default mode, eventually you will use all the memory available for Logger storage. When this occurs, you will not be able to log more data until you free up the memory. The [Clear Logger] command erases ALL stored Logger data. Therefore, you should evaluate the currently stored data, and print or save any valuable information before using this command.

Note

Saved Sites also consume Logger RAM.

Clearing Logger Memory

1. To access the [Clear Logger] option list press <Right Arrow>.
2. Move the cursor to [Yes] by pressing <Up/Down Arrow>.
3. To clear the memory press <ENTER>.

7.10 Operation Adjust Menu Settings

Introduction

The [Operation Adjust] menu becomes available after picking a meter type and measurement channel. It is recommended that you use it after the sensors are installed and operating to "fine-tune" the meter's output characteristics.

Each application presents different data display and output requirements due to unique pipe and gas conditions. Use the [Operation Adjust] menu to match flow meter operation to the site. You can set damping controls for the primary flow rate output. You can define a Deadband, (Low Flow Cutoff), below which the flow output will be forced to zero. You can also select the flow meter response to a continuous Fault condition.

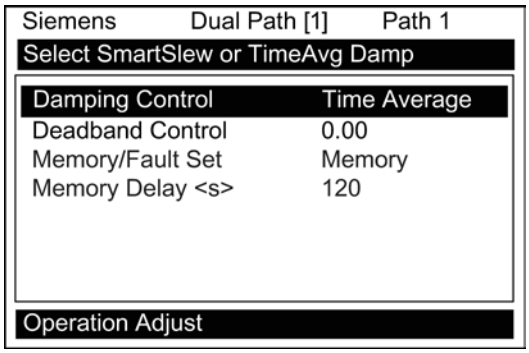
Damping Control

The flow meter provides two different data output filter types, Time Average and SmartSlew. Time Average (recommended) integrates the instantaneous flow rate over a selectable time period. Use the Time Average function when stability in flow reading is essential. A value entered (in seconds) sets the time it takes the flow meter to respond to a rate change. The default is 10 seconds. Enter any amount of time up to 60 seconds maximum.

SmartSlew performs data scatter damping during steady flow periods while maintaining the ability to respond to changing flow rates. SmartSlew values range from [1 to 9]. Pick a higher number to slow flow meter response to a rate change.

Setting the Time Average (default):

1. From the [Dual Path Flow] menu scroll to the [Operation Adjust] menu and press <Right Arrow>.
2. At the [Damping Control] menu press the <Right Arrow> and move the cursor down to [Time Average].
3. To enable Time Average entry press <Right Arrow>.



4. Use the numeric keys to type the new Time Average setting.
5. To register the new value press <ENTER>.

Setting SmartSlew :

1. From the [Dual Path Flow] menu scroll to the [Operation Adjust] menu and press <Right Arrow>.
2. At the [Damping Control] menu press the <Right Arrow> and move the cursor down to [SmartSlew].
3. To access SmartSlew option list press <Right Arrow>.
4. Scroll the numeric list to the desired choice by pressing <Up/Down Arrow>.
5. To register the new value press <ENTER>.

Deadband Control

Use the Deadband Control to instruct the flow meter to report zero flow if the flow rate falls below a specified level (usually a very low rate). It will prevent the possibility of data scatter (a natural result of digital computation) from causing false Totalizer accumulation during long non-flowing periods. Inspect the actual data scatter during zero flow conditions to find the proper Deadband setting for your application.

To edit Deadband default setting (0.000):

1. From the [Dual Path Flow] menu scroll to the [Operation Adjust] menu and press <Right Arrow>.
2. Scroll to the [Deadband Control] menu
3. Press <Right Arrow>to enable numeric entry.
4. Use the numeric keys to type in the desired rate (using selected flow rate units).
5. To register the new value press <ENTER>.

Memory/Fault Set

Certain situations will interrupt data production. Use Memory/Fault Set to select the flow meter response to such an interruption. The Fault setting (default) will zero the flow rate output and declare an alarm on a flow display screen, Datalogger report and an assigned relay output.

For some applications, occasional temporary Fault conditions may be a normal part of the process and would not require an alarm response. The flow meter offers a Memory operating mode to support such an application. Memory Mode suspends the flow meter Fault response by preventing the flow outputs from dropping to zero for the interval specified in the Memory Delay menu cell. During the Memory duration, the flow meter will maintain the last valid flow reading measured before the onset of the fault condition. The default Memory Delay is 60 seconds. You may select any duration from 3 to 604,800 seconds (one week).

Selecting Memory Mode

1. From the [Dual Path Flow] menu scroll to the [Operation Adjust] menu and press <Right Arrow>.
2. Scroll to the [Memory/Fault Set] and press <Right Arrow> to access option list.
3. Move the cursor down to [Memory] by pressing <Up/Down Arrow>.
4. To make selection press <ENTER>.
5. This moves the highlight to [Memory Delay <s>].

Memory Delay (s)

Selecting [Memory Delay <s>] activates the suppressed [Memory Delay] menu cell. It allows you to specify the number of seconds that the flow meter maintains its last valid flow reading. When the memory delay expires, it triggers the fault alarm response described previously.

Setting Memory Delay

1. To enable numeric entry press <Right Arrow>.
2. Use the number keys to type the delay in seconds.
3. To register the new value press <ENTER>.

7.11 Setting Relays

Relay Functions

Use the [Relay Setup] menu to assign a function to channel relays. The flow meter supports two types of relay outputs, Alarm Relay and Pulse Relay. Alarm Relay outputs operate in "fail-safe" mode. The relay(s) are energized under normal conditions - an alarm condition causes the relay(s) to de-energize until the alarm clears. The Pulse Relay output supports Totalizer and batch relay functions, with an output pulse width of approximately 200 ms; maximum activation rate is 2.5 pulses per sec. If Totalizer pulses exceed this rate, excess pulses are stored in an overflow register. This allows the relay to "catch up" when flow decreases enough.

Note

Using the <F1> key (Totalizer clear command) also clears all channel Totalizers plus the overflow register described in the last paragraph.

Relay 1, 2, 3, and 4 Function Assignments

The flow meter, depending upon the model, provides four alarm relays. Please refer to the Appendix A for wiring details. Relays respond to any of the alarm conditions or data functions included on the Relay Option List.

Table 7- 12 Relay Option List

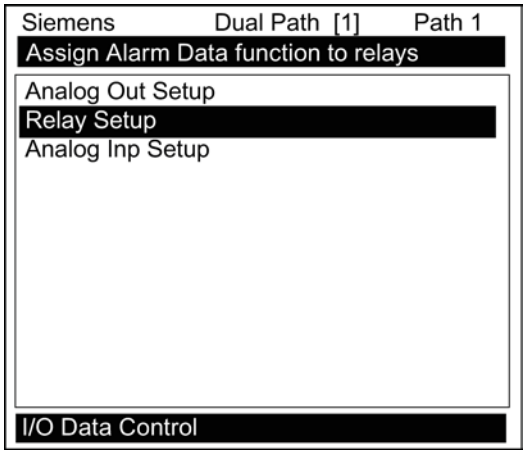
Not Used	Not Active
Power Off	Power Off alarm occurs when power fails.
S S.G.	Specific Gravity value relay trip-point.
S Base S.G.	S.G. value relay trip-point at reference temperature.
S High Visc	Kinematic viscosity (centistokes) exceeds High set point.
S Low Visc	Kinematic viscosity (centistokes) falls below Low set point.
S High Temp.	High temperature value relay trip-point.
S Low Temp.	Low temperature value relay trip-point.
S High Pressure	High pressure value relay trip-point. Note: Software version 5.04.07 and later only.
S Low Pressure	Low pressure value relay trip-point. Note: Software version 5.04.07 and later only.
S High Flow	Flow rate exceeds high flow set point.
S Low Flow	Flow rate falls below low flow set point.
S Flow Alarm	Flow rate exceeds or falls below flow set points.
S Fault Alarm	Loses receive signal (all paths in fault).
S Spacing	Sensor spacing needs adjusting.
S Turbulence	Turbulence percentage exceeds alarm set point.
S Interface	Interface set point exceeded.
S Reverse Flow	Flow is in negative direction.
S BatchTot	Batch/Sample total advances.
S Pos Total	Positive total volume advances 1 digit.
S Neg Total	Negative total volume advances 1 digit.
S Fltwarn	Fault warning occurs when 1 or more paths are in fault.
S Soft Fault	Fault condition - Memory mode active.
4 Fault Alarm	Loses receive signal (all paths in fault).
4 Spacing	Sensor spacing needs adjusting.
4 Turbulence	Turbulence percentage exceeds alarm set point.
3 Fault Alarm	Loses receive signal (all paths in fault).
3 Spacing	Sensor spacing needs adjusting.
3 Turbulence	Turbulence percentage exceeds alarm set point.
2 Fault Alarm	Loses receive signal (all paths in fault).
2 Spacing	Sensor spacing needs adjusting.
2 Turbulence	Turbulence percentage exceeds alarm set point.
1 Fault Alarm	Loses receive signal (all paths in fault).
1 Spacing	Sensor spacing needs adjusting.
1 Turbulence	Turbulence percentage exceeds alarm set point.

Note

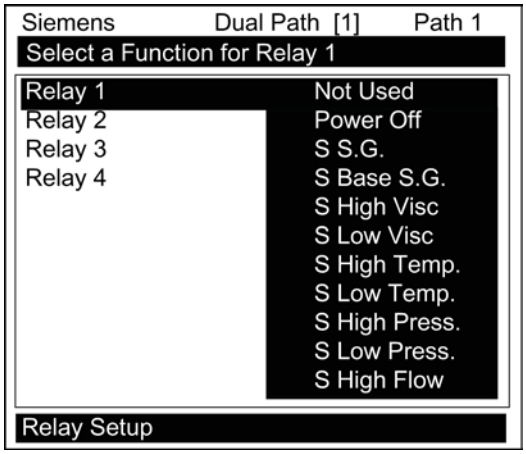
For Multi-Path flow meters: "1" = Path 1, "2" = Path 2, "3" = Path 3, "4" = Path 4 and "S" represents the system or average channel. These characters appear to the left of the option list parameter.

Assigning functions to Relay 1:

1. From the [Dual Path Flow] menu scroll down and highlight [I/O Data Control].
2. Press <Right Arrow> and scroll down to [Relay Setup].



3. To access the [Relay Setup] option list press <Right Arrow>.
4. Move the cursor to the desired Relay assignment by pressing <Up/Down Arrow>.



5. To store selection press <ENTER>. Repeat procedure for all other relays.

7.12 Memory Control

Introduction

Memory Control is a reference menu that shows the amount of bytes of data memory left. The data memory capacity depends on the number and complexity of the site setups stored in memory and the size of the current Datalogger file.

The [Memory Control] menu is located in the [Meter Facilities] menu.

Table 7- 13 Memory Control Menu

Log Memory Left→	XXXXXXX
Memory Map→	No Yes
Defragment→	No Yes

Log Memory Left

This view only menu cell shows the minimum remaining number of characters available for Datalogger and site storage. When the Datalogger is enabled for circular mode, the meter allocates all memory left except for two conventional empty sites required for Datalogger use.

To view the amount of data memory bytes available press <Right Arrow>.

Memory Map

Selecting [YES] for this item enables a snapshot display of current memory usage. In this display, the asterisk indicates a used memory block, a space indicates a free block, while a dash character indicates unused filler.

Defragment

Selecting [YES] for this item consolidates memory data blocks into contiguous storage; collapsing the filler regions. You may be able to use an additional block for site or Datalogger storage as a result. Use this command if you seem to be out of memory even though the [Log Memory Left] item indicates free capacity.

7.13 Resistive Temperature Device (RTD) Calibration

Use this menu to calibrate Temperature Sensors to an external standard. It is important to note that Siemens RTD temperature sensors are factory-calibrated for high accuracy. We recommend that before deciding to perform the calibration, check the current RTD reading in the [Diagnostics Data / Gas Data] menu. You may find that you do not need to calibrate the sensor. In any case, make sure that the temperature reading stabilizes before proceeding further. The [RTD Calibrate] menu allows you to perform an external calibration, which can be accomplished either by data entry of the current RTD temperature or by a 0°C (32°F) Ice-Bath procedure. You can switch between the intrinsic and external calibration modes at any time.

1. From the [Meter Facilities] menu scroll to the [RTD Calibrate] menu.
2. To access the [RTD Calibrate] menu press <Right Arrow>.

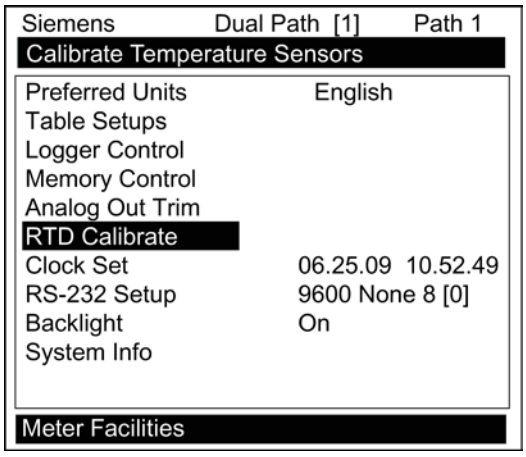


Table 7- 14 RTD Calibrate Menu Structure

RTD Calibrate	RTD 1→	Factory User Cal
	RTD 2→	Factory User Cal

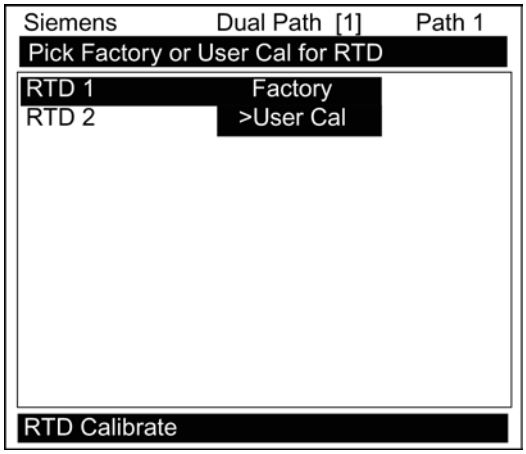
RTD Calibration by Entry Data

The [RTD Calibrate] menu allows you to adjust the intrinsic RTD reading to match an external reference thermometer by directly entering its reading. Only perform this procedure while the RTD under test is installed and currently measuring temperature.

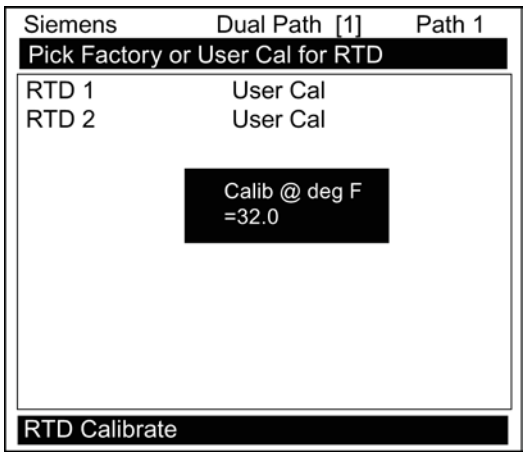
To enter the current RTD temperature:

1. From the [RTD Calibrate] menu press <Right Arrow> to access the RTD option list.
2. Press <Right Arrow> to highlight the RTD you want to calibrate (RTD 1 or RTD 2).

3. Move the highlight to [Factory] or [User Cal] then press <ENTER>.



4. This triggers the pop-up window:



5. To enable numeric entry <Right Arrow>, then type in the reading of the reference thermometer (e.g., 72.0).
6. To recalibrate the RTD sensor <ENTER>. To verify the calibrated reading, go to the Dual Path Flow menu [Diagnostic Data/Gas Data] menu to check the current RTD output. Make sure that it coincides with the gas reading of the reference thermometer. Repeat for the other RTD, if necessary.

Note

Factory Calibration provides an additional prompt after a new temperature is entered: [Are you Sure? No Yes]. It is recommended that you use [User Cal] to avoid alteration of preset factory calibration.

Ice Bath RTD Calibration

Use deionized water and ice mixture at 0°C (32°F) equilibrium for an ice bath. Ensure temperature with a reference thermometer. Siemens can not assume responsibility for the incorrect design, construction or operation of an Ice Bath.

NOTICE
Sensor Damage If RTD sensor makes direct contact with ice during an ice bath calibration procedure the sensor may be damaged and the calibration results will be incorrect. Do not allow an RTD sensor to make direct contact with ice during an ice bath calibration procedure.

To perform a 0°C (32°F) calibration:

1. Immerse RTD sensor in deionized water and ice mixture. Stir the mixture constantly.
2. In the [RTD Calibrate] menu move the highlight by the pressing <Up/Down Arrow> to the RTD you want to calibrate (RTD 1 or RTD 2).
3. To access the RTD option list press <Right Arrow>. Move the highlight to [User Cal] then press <ENTER>. This triggers the pop-up window.
4. After the RTD sensor reaches equilibrium at 0°C (32°F), press <ENTER> to recalibrate the RTD sensor.
5. To verify the calibrated reading, go to Dual Path Flow [Diagnostic Data/Gas Data] menu to check the current RTD output. Make sure that it coincides with the gas reading of the reference thermometer. Repeat for the other RTD, if necessary.

Alarm, error, and system messages

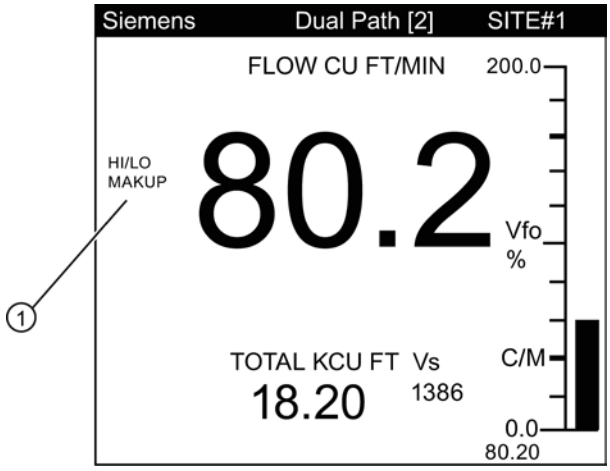
8

The following alarm codes appear on the main display of the flow meter.

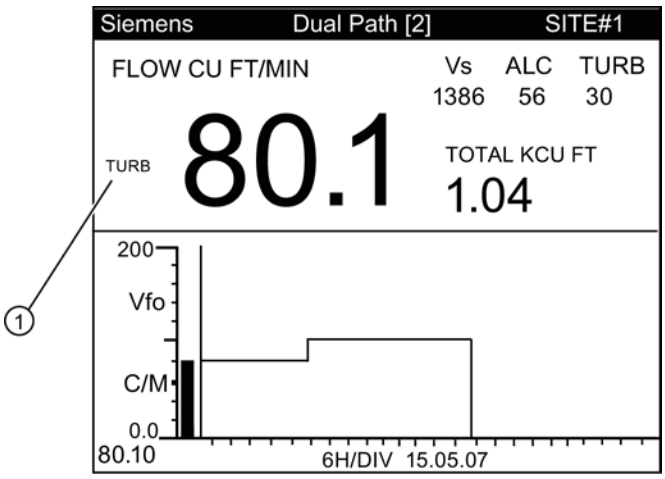
Table 8- 1 Alarm Codes

Letter Codes	Alarm Code	Description
SPACE	Spacing	Sensor spacing may need adjustment
HI/LO	Rate	Flow above High setting or below Low setting
FAULT	Fault	Three continuous seconds without new data update
TURB	Turbulence	Current turbulence percentage exceeds the alarm set point
MEMRY	Memory	Last valid reading for a selected interval during Fault condition
MAKUP	Makeup	In-Process Makeup occurred

The displays shown below indicate where the Alarm Codes appear on the screen. Press <UP> or <DOWN> Arrows to change screen views.



① Alarm Codes



① Alarm Codes

Service and maintenance

9

9.1 Maintenance

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

An inspection can include check of:

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

9.2 Technical support

If you have any technical questions about the device described in these Operating Instructions and do not find the right answers, you can contact Customer Support:

- Via the Internet using the **Support Request:**
  Support request (http://www.siemens.com/automation/support-request)
- Via Phone:
  - Europe: +49 (0)911 895 7222
  - America: +1 423 262 5710 / 1800 333-7421
  - Asia-Pacific: +86 10 6475 7575

Further information about our technical support is available on the Internet at
Technical support (http://support.automation.siemens.com/WW/view/en/16604318)

Service & Support on the Internet

In addition to our documentation, we offer a comprehensive knowledge base online on the Internet at:

Service and support (http://www.siemens.com/automation/service&support)

There you will find:

- The latest product information, FAQs, downloads, tips and tricks.
- Our newsletter, providing you with the latest information about your products.
- Our bulletin board, where users and specialists share their knowledge worldwide.
- You can find your local contact partner for Industry Automation and Drives Technologies in our partner database.
- Information about field service, repairs, spare parts and lots more under "Services."

Additional Support

Please contact your local Siemens representative and offices if you have additional questions about the device.

Find your local contact partner at: http://www.automation.siemens.com/partner

See also

Local contact person (http://www.automation.siemens.com/partner)

9.3 Return procedures

Enclose the delivery note, the cover note for return delivery together with the declaration of decontamination form on the outside of the package in a well-fastened clear document pouch.

Required forms

- **Delivery Note**
- **Cover Note for Return Delivery** with the following information

  Return delivery form (http://support.automation.siemens.com/WW/view/en/16604370)

  – product (ordering number)

  – number of devices or spare parts returned

  – reason for the return

- **Declaration of Decontamination**

  Decontamination declaration (http://pia.khe.siemens.com/efiles/feldg/files/Service/declaration_of_decontamination_en.pdf)

  With this declaration you certify *that the returned products/spare parts have been carefully cleaned and are free from any residues.*

  If the device has been operated together with toxic, caustic, flammable or water-damaging products, clean the device before return by rinsing or neutralizing. Ensure that all cavities are free from dangerous substances. Then, double-check the device to ensure the cleaning is completed.

  We shall not service a device or spare part unless the declaration of decontamination confirms proper decontamination of the device or spare part. Shipments without a declaration of decontamination shall be cleaned professionally at your expense before further proceeding.

You can find the forms on the Internet and on the CD delivered with the device.

9.4 Battery disposal



In accordance with EU directive 2006/66/EC, batteries are not to be disposed of using municipal waste disposal services.

Waste industrial batteries are accepted back by Siemens or by the local Siemens representative. Please talk to your local Siemens contact (http://www.siemens.com/automation/service&support) or follow the return procedures (Page 136) of Siemens.

Troubleshooting 10

10.1 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 Ultrasonic Flow Representative for expert help at: http://www.automation.siemens.com/partner (http://www.automation.siemens.com/partner).

Table 10- 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 the F4 key.	Use the F4 function to restore operation if a severe event (e.g., a violent power surge) disrupts 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 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.

Error or Message	Probable Cause	Solution
- - -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 Index	The measured gas sonic velocity (Vs) is more than +/- 25% of the average Vs range.	• Assure proper pipe dimensions and/or gas 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.
Invalid Setup (use Direct Mode)	During the Initial Makeup the system detects invalid sensor spacing, erroneous gas and 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 gas. • In Reflect Mode the flow meter detects that the pipe wall signal may infringe upon the gas 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.

Error or Message	Probable Cause	Solution
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 a pipe with insufficient pressure. • Coupling compound insufficient; not applied or evaporated. • A disconnected or broken sensor cable. • The pipe needs to be conditioned at the mounting location. • Insure that line is sufficiently pressurized. • The sensor cables are defective or not connected to the correct channel. 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 gas 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 insufficient line pressure or high CO_2 gas content.

Note

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

10.2 F4 Reset Procedure

You may encounter an operating problem that blocks access to the Diagnostics Menu, or the flow meter may operate erratically after exposure to a power transient or some other traumatic event. These cases may require use of the F4-reset sequence to restore operation.

The F4-Reset sequence operates on two levels:

- Clear Active Memory

The first F4-Reset deletes all the data currently in Active Memory, but leaves Datalogger data and all stored Site Setups intact. This is the most desirable method since all you have to do to restore operation is reload a saved Site Setup.

- Clear All Saved Memory

If the first sequence fails then you have to resort to the second level of the F4 sequence, which allows you to clear ALL Saved Memory. **Be aware that this erases all saved Site Setups (including flow calibrated sites), Datalogger Data and user-defined pipe and sensor tables.** This will require you to completely re-install the system and repeat all desired default settings, custom pipe tables, etc. The table below shows the sequence of the [F4] routine:

[Power On/Off + F4]⇒	[Clr Active Memory?]⇒ ⇑ ⇓ [Clr Saved Data?]⇒	⇒No ⇒Yes ⇒No ⇒Yes

Clearing only Active Memory

1. Turn off power (if it is currently on). Press <F4> and keep it pressed while you turn on power. The prompt: [Clr Active Memory? No] appears at the top of the screen.
2. Press <Right Arrow> to access F4 Reset option list. Press <Down Arrow> to switch the option list to [Clr Active Memory? Yes]. Press <ENTER> to clear all Active Site Data (but not saved Site Setups).
3. To restore operation, press <MENU> to access the installation menu. Create a new site setup or recall a stored site setup.
4. Re-select any Meter Facilities menu items (e.g. RS-232 setup parameters).

Clearing All Saved Data

1. Turn off power (if it is currently on).
2. Press <F4> and keep it pressed while you turn on power. The prompt: [Clr Active Memory? No] appears at the top of the screen. Press the <Down Arrow>. Note that the prompt switches to [Clr Saved Data? No].

3. To access the F4 Reset option list press the <Right Arrow>. Press the <Down Arrow> to switch the option list to [Clr Saved Data? Yes].

NOTICE
Loss of RAM Data Before proceeding further it is essential to understand that this function eliminates ALL data stored in RAM. This means that all saved site setups including the site data of a flow-calibrated site will be erased! In addition, the entire Datalogger file plus any custom factory or user-created pipe or sensor tables will be eliminated. The impact of this is such that we strongly recommend that you consult Technical Services before continuing with this procedure. Be aware that you will have to create a new Site Setup, re-enter all site specific parameters including user-created pipe or sensor tables, plus all desired Meter Facilities menu entries.

4. To clear all Saved Memory press <ENTER>.
5. Create a Site Setup before attempting to access other menu items.
6. To restore operation, press <MENU> to access the installation menu. Create a new site setup and complete the installation procedure.
7. Re-select desired Meter Facilities menu items (e.g. RS-232 setup parameters).

10.3 Test Facilities Graph Screen

When operating in the transit time mode the Test Facilities Graph Screen is an exceptional diagnostic tool for troubleshooting problem applications or simply determining Receive signal quality. The primary function of this screen is to display the digitized receive signal waveform with the similar appearance and function of a digital oscilloscope. This screen also allows the user to override some of the flow meter default settings by permitting adjustment to the measured transit time, the digital averaging and the zero crossover used in the measurement of the up/down transit time difference. The figure shown below is a representation of the diagnostic graph.

Note

The Test Facilities Graph Screen requires significant CPU overhead. The flow meter should not be left in this mode during normal operation where the Datalogger is the primary output or during calibration work.

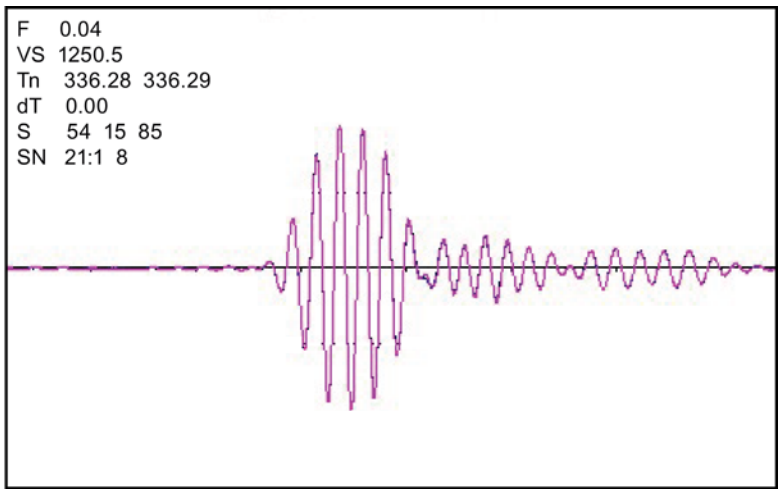


Figure 10-1 Test Facilities Signal Graph Screen

Entering the Diagnostic Graph Screen

Before you can view the Diagnostic Graph Screen the flow channel must first be properly installed and operating in a non-fault condition. If a previously installed path is in a "Fault" condition, you can still access the Graph Screen to aid in troubleshooting the cause of the failure to measure flow by using the "unmask" hot keys.

Note

To "unmask" a signal display when the meter is in a Fault condition: Press <Ctrl> and <UP Arrow> keys simultaneously.

To view the Graph Screen first enter the [Test Facilities] menu, which is a submenu of the main [Diagnostic Data] menu.

1. Pressing the <Up/Down Arrows>, scroll to the [Graph] menu item.
2. Press the <Right Arrow> to enter the [Graph] menu and scroll to highlight the [Yes] item in the option list.
3. Now press the <ENTER> key to access the Graph Screen.
4. To exit the Graph Screen and return to the main menu, press the <MENU> key once.

Diagnostic Text Display

The text at the upper left-hand corner of the screen represents diagnostic items which can be individually turned on or off to reduce unnecessary clutter on the screen. This text display can be modified by pressing the <ENTER> key and scrolling up or down through the various parameters that appear in the Graph Display menu. Pressing the <ENTER> key will select the highlighted parameter (a "+" sign appears next to selected items) and pressing <CLR> will deselect the item. Pressing the <Left Arrow> will return you to the graph screen with the selected parameters appearing at the top left corner of the screen. (The sample graph above is shown with all diagnostics items selected).

Table 10- 2 Description of Graph Screen Text Display Parameters

Screen Text Parameters	Menu List Item	Description
F	Flow	Measured flow rate in selected flow units.
VS	Vs m/s	Sound Velocity in meters per second.
[ ]	Display Metrics	Represents the digital sample position of the receive window.
	Correlated plot	Displays the receive waveform in its proper superposition or registration. The true delta time will be displayed by NOT selecting "Correlated Plot".
	Centroid Mark	Indicates with a large vertical marker the peak energy of the receive waveform.
D	Damping	Displays the minimum and maximum digital damping exponent along with the active damping exponent.
Tn	Tn (usec)	Receive signal transit time in microseconds.
dT	DeltaT (nsecs)	Transit time delta (difference) in nanoseconds.
S	Signal Strength	Displays %ALC, %Turbulence and ADC Buffer.
SN	Signal-to-Noise Ratio	Indicates the signal to noise ratio of the receive signal. Increased damping will increase the S/N ratio as the asynchronous noise reduces.
	Envelope	Percentage change of the signal from Initial Makeup conditions.

Time Base Control

The digitized receive signal can be moved either to the left or right on the screen by pressing the <Left> or <Right> keypad arrows. The direction of the arrow actually represents the direction in which the Receive "window" will move, thereby causing the receive signal to shift in the opposite direction on the screen (e.g., Pressing the <Left Arrow> moves the signal to the right).

The digitized receive signal can be expanded or contracted in the time domain by pressing the <+> or <-> keys on the keypad. This allows you to see the entire contents of the receive window, or zoom in to see greater detail. Pressing the <CLR> key once will automatically center the receive signal on the screen. When expanding the Receive signal small vertical "tick" marks will eventually appear. These marks represent the time at which the receive signal is digitally sampled.

Correlated Plot

During conditions of flow, the actual transit time delta (difference) can be observed in the displayed receive signal waveform when the [Correlated Plot] menu parameter is not selected. To observe this time difference simply depress the <+> key (to see greater signal detail) until the individual up and down receive signals are clearly discernible. To verify that the flow meter signal processing algorithms are properly correlating the up and down stream receive signals, select the [Correlated Plot] option from the display menu list.

Return to the graph screen and observe the relative position of the up and down waveforms. In a properly correlated receive signal the two images should be nearly superimposed on top of each other, even during high flow conditions. In the unlikely situation where the two images appear to be offset by one or more receive cycles then the flow readings should be considered questionable.

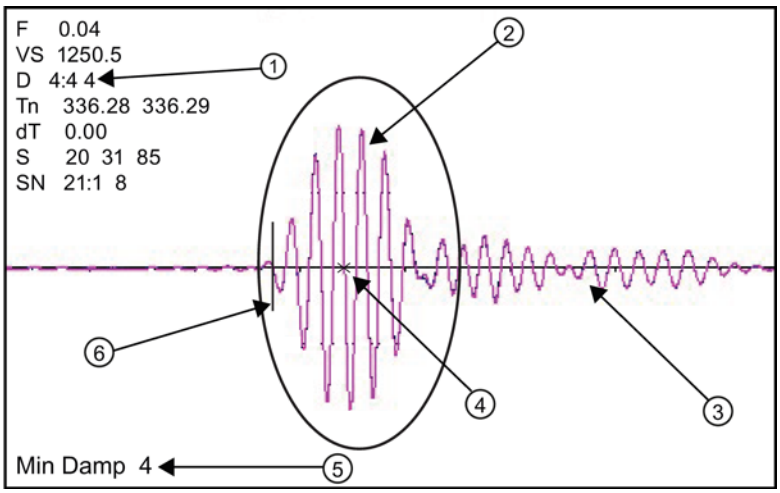
Command Modes

Although the flow meter signal processing algorithms are capable of accommodating a very wide range of signal conditions, it may be desirable to override these default settings under extremely difficult operating conditions. The following functions are available for this purpose.

Digital Damping Control: (Hot Key 1 and 2)

The Graph Screen includes the capability to access a set of command codes, which enable a user to override a number of default meter settings. The most important parameter is the digital damping control, which can be accessed by pressing number <1> or <2> on the keypad while in the Signal Graph Screen mode.

The meter permits user modification of the digital averaging used by the signal processing routines. In general, the default damping values selected by the flow meter will provide optimal performance over a wide range of transit time applications. However, in extreme cases of unstable flow, pulsating flow, low signal levels or high electronic noise it may be necessary to override these default settings to permit uninterrupted and reliable flow measurement.



① Damping Factors
② Digitized Receive Signal
③ High Baseline Noise
④ Crossover Marker
⑤ Min Damping Factor (Hot Key 1)
⑥ Tn Marker

Figure 10-2 Setting Digital Damping Factor

[MinDamp #] Command

Pressing the <1> key will cause [MinDamp #] to appear on the command line at the lower left-hand corner of the screen. The number listed to the right of the command code represents the exponent in the meter exponential averaging routine, where the larger the number the greater the digital averaging. Pressing the <+> key will increase the damping value. Likewise, pressing the <-> key will decrease the damping value.

To exit this mode, press the <0> key on the keypad.

[MaxDamp #] Command

Pressing the <2> key will bring up the [MaxDamp #] command. The function of this parameter is similar to the [MinDamp #] command described above; however, the two parameters interact in the following manner. The MinDamp value must not exceed the MaxDamp value; therefore increasing the MinDamp value above the previous MaxDamp value will set both parameters to the same value. In most cases, it is preferred that both damping parameters be set to the same value, however, in cases where rapid response to changes in sound velocity for flow rate is required, the two values may be set differently. In this situation the meter will use the MaxDamp value when conditions are stable, but then switch to a faster damping value (limited by MinDamp) when a significant change in sound velocity or flow rate is perceived.

To exit this mode, press the <0> key on the keypad.

To INCREASE the Digital Damping:

Setting the Digital Damping Factor to a value HIGHER than the default value of 4 may be necessary in cases where the signal-to-noise ratio (SN) is found to be unacceptably low (<15:1), but only if the noise is determined to be asynchronous (i.e., not associated with the transmit or flow meter timing circuitry) as shown in the signal example above, where the baseline noise has a higher frequency than the true liquid signal.

The following application conditions may require a higher Digital Damping Factor:

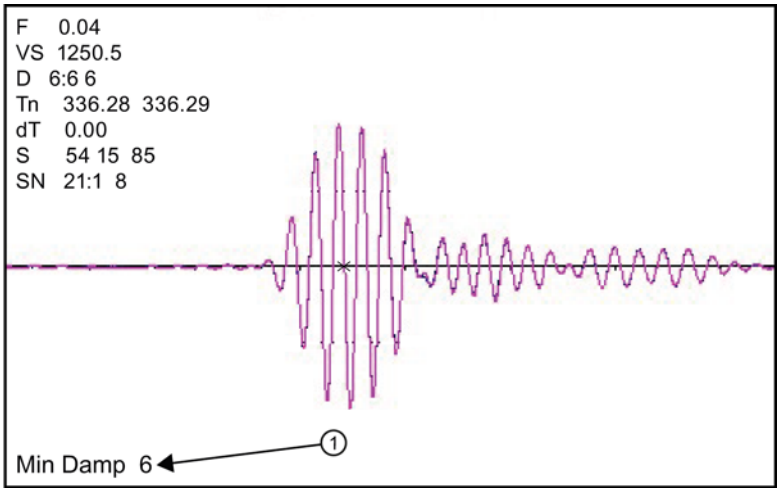
- Close proximity to pressure control valves which may generate in-band acoustic noise
- High electronic noise from variable frequency drives or other external equipment.

1. Press the <1> key while viewing the Test Facilities Graph Screen as shown above. The damping control [MinDamp #] will appear on the command line at the lower left-hand corner of the screen.

Note

The number listed to the right of the command code on the screen represents the exponent in the exponential averaging routine (digital damping), where the larger the number represents the greater the digital averaging. Setting this exponent higher than 7 is generally not recommended.

2. Pressing the <+> key will increase the MinDamp Factor by one unit for each key press. To exit this mode, press the <0> key on the keypad.



① Increased Damping Factor

Figure 10-3 Increasing the MinDamp Factor

The above example shows that increasing the Digital Damping reduces asynchronous noise.

To DECREASE the Digital Damping:

Setting the Digital Damping factor to a value LOWER than the default value of 4 may be justified in cases where pulsating flow is present (such as from a reciprocating pump) or for the purpose of diagnosing transient signal behavior. A pulsating flow condition that generates more than +/- 45 degrees of phase jitter will generally cause signal correlation problems when any digital averaging is used. In this case it may be necessary to completely eliminate the digital averaging by reducing the Digital Damping Factor to 0.

1. Press the <2> key while viewing the Test Facilities Graph Screen. The damping control [MaxDamp #] will appear on the command line at the lower left-hand corner of the screen.
2. Pressing the <-> key will decrease the MaxDamp Factor by one unit for each key press. To exit this mode, press the <0> key on the keypad.

Transit Time Adjustment: (Hot Key 3)

Observe the short vertical marker at the beginning of the receive signal in the Graph Screen above. This line represents the position in time (Tn) where the flow meter perceives the arrival of the ultrasonic signal. There are actually two Tn markers, one for the upstream arrival time and one for the downstream arrival time. For proper liquid sound velocity measurement these Tn markers should be positioned near the beginning edge of the receive waveform envelope (as shown), however, in cases of poor signal conditions it is possible for this measurement to be off by several receive waveform cycles.

1. To adjust the Tn mark position press the <3> key on the keypad to bring up the [TnSet #] command.
2. Pressing the <+> or <-> keys will cause the Tn marker to move later or earlier, respectively. As you adjust the Tn marker, both Tn and Vs (sound velocity) will change accordingly.
3. To exit this mode, press the <0> key on the keypad.

Zero Crossover Adjustment: (Hot Key 4)

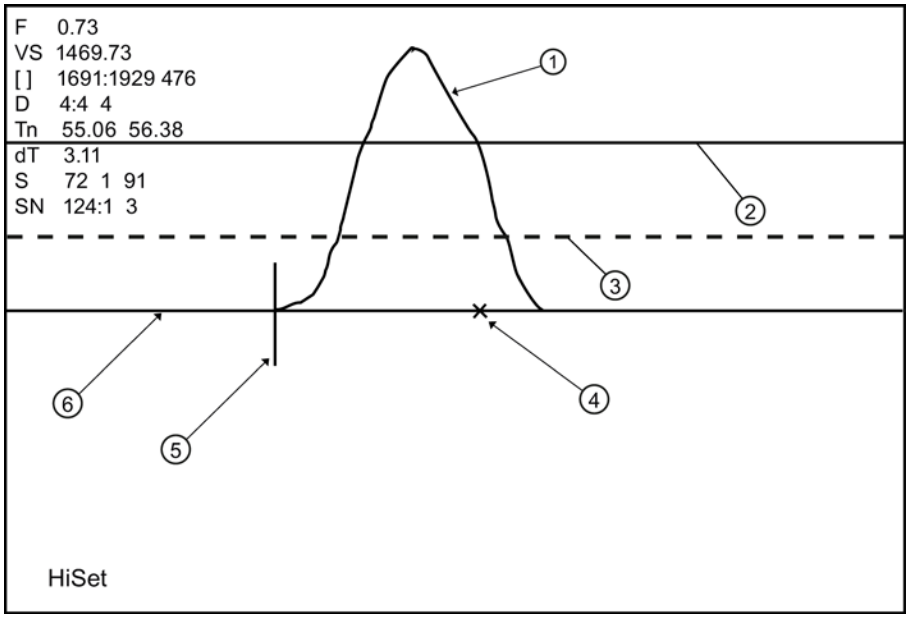
Observe the small "X" mark located on the zero crossing line near the middle of the receive signal in the Graph Screen above. This "X" indicates the central crossover which the flow meter is using to measure the transit-time delta. This crossover will generally be close to the peak of the Receive signal with at least one well formed (non-aberrated) receive cycle on each side of the crossover.

1. If it appears that the placement of this crossover is unsatisfactory then it can be adjusted by pressing the <4> key on the keypad, which will invoke the [ZCO Set #] command. The crossover point can then be moved in either direction on the waveform using the plus <+> or minus <-> keys. The change from the default value (in receive cycles) will appear in the number to the right of the command.
2. To exit this mode, press the <0> key.

Envelope Threshold Adjustment (Hot Keys 5 & 6)

Pressing the <=> key causes the graph to toggle between the default signal waveform screen and the signal envelope screen (see example below). This envelope screen can aid in the diagnosis of Tn errors caused by unusual receive waveform distortion. Signal

distortion is sometimes caused by poor sensor selection or poor pipe wall conditions, which may result in an incorrectly measured fluid sound velocity. To improve the automatic measurement of Tn, the envelope threshold limit can be adjusted to exclude portions of the envelope, which may be causing the Tn detection problem.



① Envelope Signal
② HiSet Envelope Threshold
③ LoSet Envelope Threshold
④ Crossover Marker
⑤ Tn Marker
⑥ Zero Baseline

1. If it appears that the default placement of the Tn marker is incorrect or unstable, it can be adjusted by pressing the <5> key on the keypad to invoke the [Hi Set #] command or by pressing the <6> key to invoke the [Low Set #] command (while viewing the envelope screen). A horizontal line representing the envelope threshold level will appear along with a number indicating the percentage level. The High and Low thresholds can then be moved either up or down on the envelope using the <+> or <-> keys. While viewing the Tn marker position, adjust the thresholds so that they are well above the baseline "noise" level but below the first major peak.
2. To exit this mode, press the <0> key.

Signal Masking Function: (Hot Key 7)

Under conditions of extremely low signal amplitude, a noise spike associated with the flow meter receive signal window may be present on the extreme left side of the graph display. If this spike is large enough it may interfere with the signal detection routines.

1. To eliminate this noise from the signal processing routines, press the <7> key to invoke the [Mask Set #] command, then press the <+> key until the noise is no longer present in the receive waveform.
2. Press <0> to exit this command.

Hold Set Function: (Hot Key 8)

The [Hold Set #] command is used to set the Hold Set number higher if intermittent mis-registration occurs. Press the <8> key on the keypad to invoke this function.

Hot Key Summary

Key	Command Line	Description
<+>		Expands (magnifies) waveform to view more detail.
<->		Contracts waveform to view more of the waveform.
<Left Arrow>		Shifts receive window to the left (waveform to the right).
<Right Arrow>		Shifts receive window to the right (waveform to the left).
<CLR>		Brings waveform to the center of the screen.
<ENTER>		Calls up Text Display menu items. <Left Arrow> to return to graph.
<MENU>		Exits the Graph Screen and returns to the main menu.
<1>	MinDamp	Minimum damping exponent control (+ or - to increase or decrease).
<2>	MaxDamp	Maximum damping exponent control (+ or - to increase or decrease).
<3>	TnSet	Transit time adjustment (use + or - to move Tn marker).
<4>	ZCOSet	Zero Crossover adjustment (use + or - to move crossover marker).
<5>	HiSet	Signal evelope threshold level (use + or - to move threshold). Note: Signal envelope screen must be activation. Press = sign to activate.
<6>	LoSet	Signal evelope threshold level (use + or - to move threshold). Note: Signal envelope screen must be activation. Press = sign to activate.
<7>	MaskSet	Leading edge masking functions (use + or - to alter number of samples masked).
<8>	Hold Set	Set this number higher if intermittent mis-registration occurs.
<0>		Exits the command line.
<=>		Toggle graph between receive waveform and envelope waveform.

Downloading Signal Graph Data

DP n Command

To download the Signal Graph data use either the Si-Ware or Windows HyperTerminal program.

Note
Si-Ware

The following Signal Graph Data download procedure uses the Si-Ware program.

1. Open Si-Ware and select [Terminal Mode].
2. To start Signal Data Graph download: Type: DP<Space><Path #>. For example: DP 1.
3. Import downloaded Signal Graph data to MS Excel.
4. Select [Space] delimited Data in the Text Import Wizard to distribute data in columns.
5. Use the Excel Chart Wizard to graph columns 2 and 3 and produce the Signal Graph.

10.4 Site Setup Data

This menu provides data pertaining to sensor characteristics and operation. Some menu items are for technical support interpretation only.

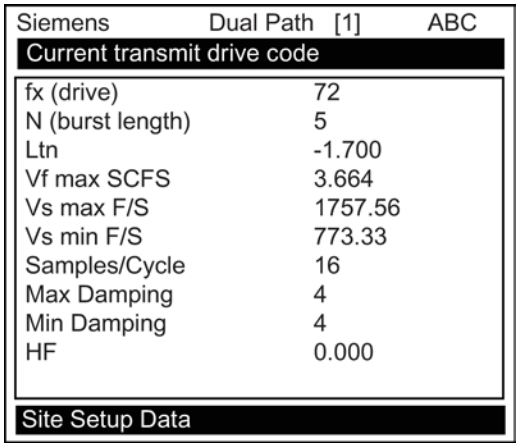


Table 10- 3 Site Setup Menu Items

fx Drive	Current Transmit drive code selected during Initial Makeup. The drive code controls the sonic transmit signal.
N (burst length)	Transmit burst duration selected during Initial Makeup. To change N count press <Right Arrow>. At equal sign enter numeric value (1 to 9 only).
Ltn (mm/in)	Spacing distance between the sensors. It will be in inches or millimeters, depending on default units.
Vf max	The flow rate (in selected units) corresponding to one whole cycle offset between upstream and downstream receive signals.
Vs max M/S	Maximum Vs for current sensor spacing.
Vs min M/S	Minimum Vs for current sensor spacing.
Samples/Cycle	Digital sampling rate.
Max Damping	Maximum signal damping. Use to average digital data when an unstable condition occurs.
Min Damping	Minimum signal damping. Use to average digital data when an unstable condition occurs.
HF	Flow registration correction parameter.

[HF] Menu Item

The flow meter includes a Diagnostics Menu item that permits the entry of a flow registration correction parameter labelled [HF]. This "HF" parameter is the input for a proprietary algorithm that automatically compensates for signal beam blowing, thereby extending the upper flow limit of the flow meter. The HF parameter should only be adjusted in cases where the user suspects that extreme flow velocity or a large delta-time may be causing signal correlation problems.

Using the [HF] Menu Cell

Two methods for adjusting this parameter are provided via the [HF] menu cell, located within the [Diagnostics] / [Site Setup] submenu. The "Manual" method provides direct entry of this parameter and is primarily intended for the advanced user, whereas the "Automatic" method allows the flow meter to automatically measure the required correction and install the parameter.

Guidelines for use

- This menu is only accessible for the sensor channels, not the virtual (average flow) channel of the flow meter (i.e., Diagnostics Path 1 or Path 2, but not Path 1 & 2).
- The flow meter will inhibit the "Automatic" installation of the [HF] parameter if the flow rate is insufficient (too low) to accurately measure the required correction. If the maximum flow rate for the application is relatively low then this correction is not be required.

- If the flow rate is very high and the flow meter is reporting erroneous or unstable flow, then the flow meter may already be having trouble resolving the upstream and downstream signals. In this event, it may be necessary to first lower the flow rate to a moderate level before performing the "Automatic" HF adjustment. Once this is done the flow meter should be able to properly measure the highest flow rates without problems.
- The limits of the "HF" parameter are +/- 0.7 and any attempt to manually install a larger value will cause the flow meter to abort the installation of the parameter.

Note

Pressing the <Left Arrow> at any stage prior to accepting the measured value will abort the installation and return to the previous setting.

Accessing the [HF] Function

1. At the [Meter Type] Menu, press the <Right Arrow> twice to access [Chan/Path Setup].
2. Press the <Down Arrow> and scroll to the [Diagnostic Data] menu cell. Press the <Right Arrow> to select it.
3. In the [Diagnostic Data] Menu, highlight [Path Select] and select the desired sensor path. Press <ENTER> to select path.
4. Press the <Down Arrow> and scroll to the [Site Setup Data] menu cell. Press the <Right Arrow> to select it and then scroll down to the [HF] parameter.

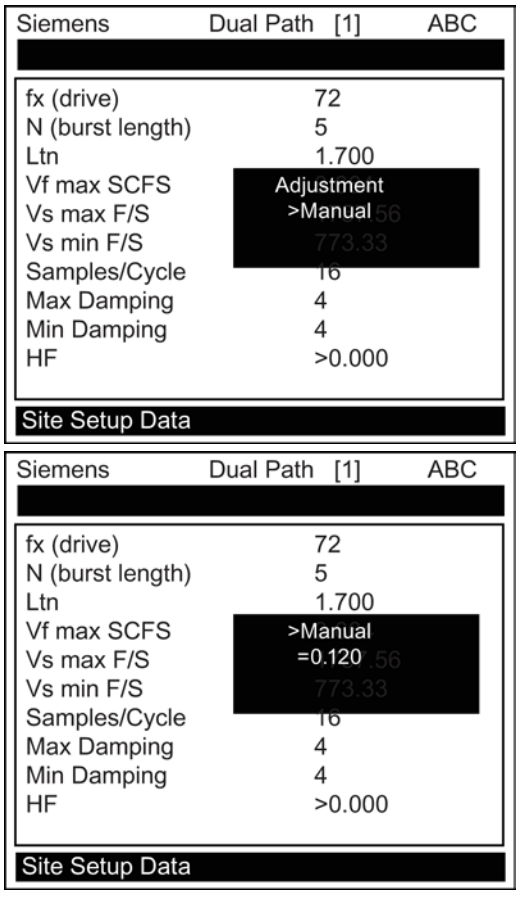
Manual Adjustment Procedure

1. In the [Site Setup Data] Menu, press the <Down Arrow> and scroll to the [HF] menu cell. Press the <Right Arrow> and a pop-up [Manual] prompt will appear as shown below.

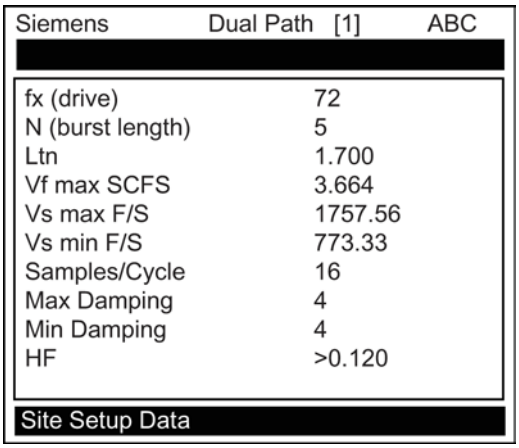
Note

Press the <Up/Down Arrow> to select [Automatic], if desired.

2. Use the numerical keys to input the desired correction value. Press <ENTER> to input value.



3. The new correction value will appear next to the [HF] menu cell as shown below.

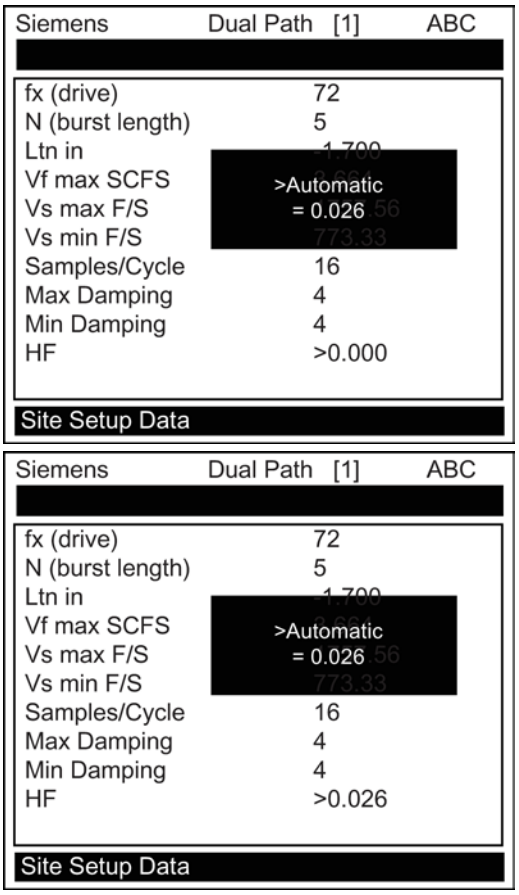


Automatic Adjustment Procedure

1. In the [Site Setup Data] Menu, press the <Down Arrow> and scroll to the [HF] menu cell. Press the <Right Arrow> and a pop-up [Manual] prompt will appear.
2. Press the <Up or Down Arrow> to select [Automatic] then press <ENTER>.
3. The current measured correction value is displayed (see below).
4. Press <ENTER> again to install this correction value which will now appear next to the [HF] menu cell.

Note

The value shown in the [Automatic] pop-up prompt can not be changed and is for user information only.



5. If you decide not to use the [Automatic] selection, press any key other than <ENTER> to abort the operation.

10.5 Force Transmit

NOTICE
Incorrect Diagnostic Procedures The Force Transmit and Force Frequency diagnostic procedures are preconfigured at the factory and should only be implemented by approved Siemens personnel.

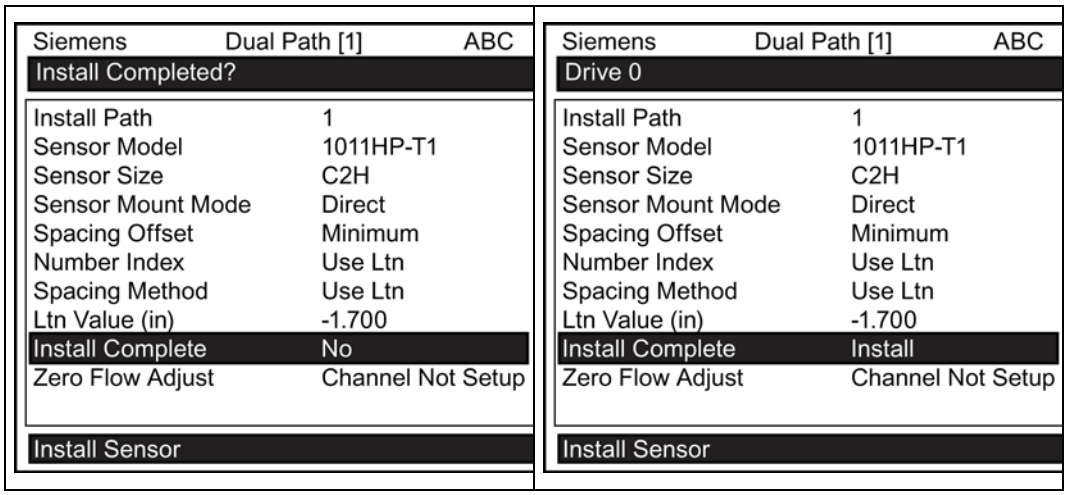
This diagnostic software routine allows the user to "force" a transmitting condition that can be used to search for an amplitude level (ALC) when Detection Fault or Low Signal alarms are present. The routine forces the flow meter to generate constant transmit bursts while reporting current receive signal strength for the user. To initiate the Force Transmit function, refer to the example shown below.

Setting a Force Transmit condition

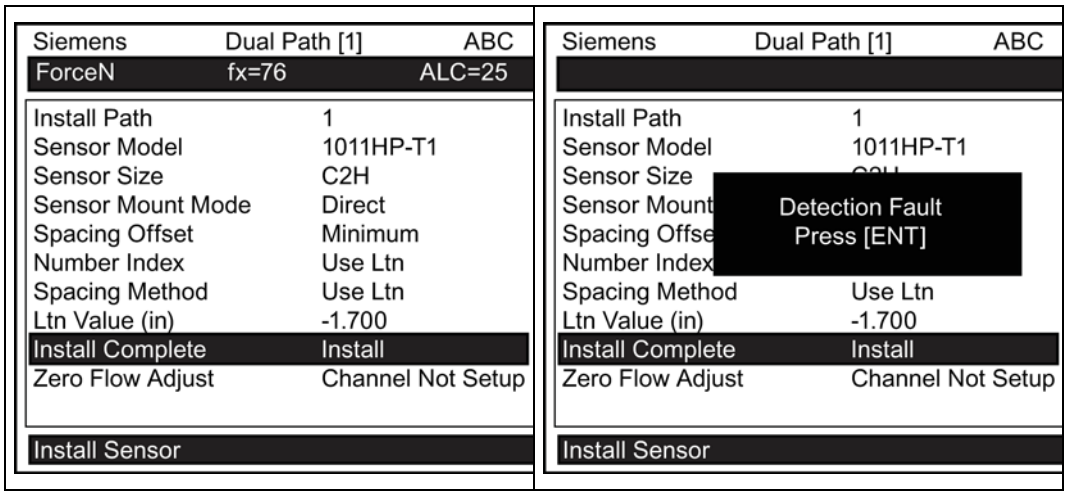
1. After [Install] command is invoked and while the flow meter is going through the drive selections press the <ENTER> key again.

Note

The <ENTER> key must be pressed before the flow meter scans through all the drives, or the <Install Complete>command must be initiated again.



2. A typical menu screen will appear as shown below and indicate the current ALC (e.g., 25). This ALC number indicates the current receive signal strength and can be used for further diagnostic purposes.



3. To exit Force Transmit, press the <Left Arrow> and a Detection Fault prompt will appear (see above).
4. Press the <Left Arrow> again and the meter will return to the [Install Sensor] menu and highlight the [Zero Flow Adjust] menu cell.

Setting a Forced Frequency

1. To force a frequency, repeat steps 1 and 2 above, but press <Right Arrow>. The following typical display line will appear: **Drive =0**
2. Using numeric keys enter the frequency and press <ENTER>.
3. To complete the [Install] process after mounting the sensors press <ENTER>.
4. If the Force Transmit diagnostic procedure is not used, the normal [Install Complete] function occurs.

Technical data

11

Transmitter

- Operating Temperature Range: -18°C to 60°C (0°F to 140°F)
- Storage Temperature Range: -20°C to 93°C (-4°F to 200°F)

Degree of Protection

- Wall mount enclosure: IP65 (NEMA 4X)
- Wall mount explosionproof: IP66 (NEMA 7)

Input

- Flow Range: ± 30 m/s (± 100 ft/s), bidirectional
- Flow sensitivity: 0.0003 m/s (0.001 ft/s), flow rate independent

Accuracy

- Typical accuracy: 1%...2% of actual volume reading (higher accuracy is pipe condition and flow profile dependent)
- Calibratable accuracy: ± 0.2% to 0.5% of flow
- Repeatability: ± 0.05%...0.1% of flow of actual volume reading for 1.5...30 m/s (5...100 ft/s) velocities (pipe condition dependent)
- Zero Drift: 0.0003 m/s (0.001 ft/s), with ZeroMatic path active
- Data refresh rate; 5 Hz

Power Supply

- IP65 (NEMA 4X) and IP66 (NEMA 7) Wall Mount - 90 to 240 VAC @50 or 60 Hz 30 VA / 9 to 36 VDC, 12 Watts

Sensor

- Type: Nonintrusive, externally mounted
- Temperature Range: -40°C to +121°C (-40°F to +250°F)
- T1: -40°C to 65.5°C (-40°F to 150°F); T2: -1.11°C to 104.4°C (30°F to 220°F)

Dimensions

- 23.6 cm (9.31 in) x 28.7 cm (11.31 in)
- Net weight: 4.1 kg (9.0 lbs.) maximum

Gas Temperature

- -40°C to +60°C (-40°F to +140°F) (for higher temperatures consult factory)

Gas Types

- Natural Gas
- Process Gas
- Compressed Air

Unit Repair and Excluded Liability

All changes and repairs must be done by qualified personnel, applicable safety regulations must be followed. Please note the following:

- The user is responsible for all changes and repairs made to the device.
- All new components must be provided by Siemens Industry, Inc.
- Restrict repair to faulty components only.
- Do not re-use faulty components.

Appendix A

A.1 Certificates

Certificates are posted on the Internet and on the manual collection shipped with the device.

See also

Certificates (http://www.siemens.com/processinstrumentation/certificates)

A.2 Ordering

In order to ensure that the ordering data you are using is not outdated, the latest ordering data is always available on the Internet: Catalog process instrumentation (http://www.siemens.com/processinstrumentation/catalogs)

See also

Process instrumentation catalog (http://www.siemens.com/processinstrumentation/catalogs)

A.3 I/O Connections and Wiring

Terminal Block Wiring - 7ME39400AL01 I/O Module

(Refer to manual drawing 1010N-2-7 sheet 2 of 2)

These connection diagrams apply to the part numbers listed below.

Table A- 1 Connection Diagrams and Part Numbers

1010N-2-7 (Sheet 2 of 2) Drawing	
FUG1010	7ME361* - * A or (Z=J1A) * = standard options

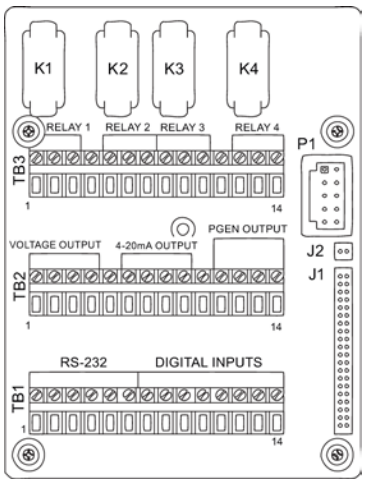
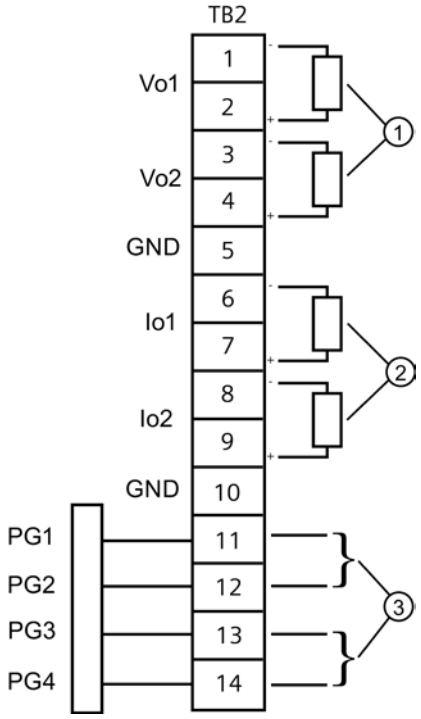


Figure A-1 7ME39400AL01 I/O Module

Table A- 2 Input/Output Wiring (TB2) - 7ME39400AL01

Pin#	Signal	Description	Definition	Function
1	Vo1+	Meter process variables are assigned to individual outputs under menu control. 4-20mA outputs also provide a fault indication by dropping to 2mA if assigned to flow rate and under fault conditions.	0-10 Volt Analog Output	System outputs assignable and scalable to flow related parameters. CGND is for cable shield terminations.
2	Vo1-		Ref. Ground	
3	Vo2+		0-10 Volt Analog Output	
4	Vo2-		Ref. Ground	
5	CGND		Chassis GND	
6	Io1+		4-20mA Output 1	
7	Io1-		Isolated Return	
8	Io2+		4-20mA Output 2	
9	Io2-		Isolated Return	
10	CGND		Chassis GND	
11	PG1	0 -5000 Hz Frequency output; assignable.	Frequency Output 1	NEG [-] Total OC
12	PG2		GND	NEG [-] Total TTL
13	PG3		Frequency Output 2	POS [+] Total OC
14	PG4		GND	POS [+] Total TTL



① 0-10Vdc, Load 10k ohm (min)

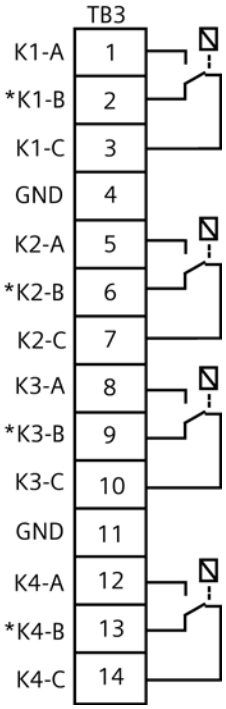
② 4-20mA, Load 1k ohm (max)

③ TB2-11 - NEG [-] Total OC (GND TB2-2)
TB2-12 - NEG [-] Total TTL (GND TB2-2)
TB2-13 - POS [+] Total OC (GND TB2-2)
TB2-14 - POS [+] Total TTL (GND TB2-2)

Table A- 3 Input/Output Wiring (TB3) - 7ME39400AL01 I/O Module

Pin#	Signal	Definition	Description	Function Dual Path Only	Function Quad Path Only
1	K1 A	Relay 1 Normally Open	Relay 1	Alarm or control functions set by CH 3.	Alarm or control functions set by CH5.
2	K1 B	Relay 1 Normally Closed (7ME39400AL00 only)			
3	K1 C	Relay 1 Common			
4	GND	Digital Return (GND)	DGND		
5	K2 A	Relay 2 Normally Open	Relay 2	Alarm or control functions set by CH 3.	Alarm or control functions set by CH5.
6	K2 B	Relay 2 Normally Closed (7ME39400AL00 only)			
7	K2 C	Relay 2 Common			
8	K3 A	Relay 3 Normally Open	Relay 3	Alarm or control functions set by CH 3.	Alarm or control functions set by CH5.
9	K3 B	Relay 3 Normally Closed (7ME39400AL00 only)			
10	K3 C	Relay 3 Common			

Pin#	Signal	Definition	Description	Function Dual Path Only	Function Quad Path Only
11	GND	Digital Return (GND)	DGND		
12	K4 A	Relay 4 Normally Open	Relay 4	Alarm or control functions set by CH 3.	Alarm or control functions set by CH5.
13	K4 B	Relay 4 Normally Closed (7ME39400AL00 only)			
14	K4 C	Relay 4 Common			



Note

Relays are shown in Power OFF position, which is the same as the alarm assertion position.

*7ME39400AL00 Mercury Relay only available with Normally Open.

Terminal Block Wiring - 7ME39400AL04 Expanded I/O Module

(Refer to manual drawing 1010N-7-7 sheet 2 of 2)

These connection diagrams apply to the part numbers listed below.

Table A- 4 Connection Diagrams and Part Numbers

1010N-7-7 (Sheet 2 of 2) Drawing	
FUG1010	7ME361* - * B or (Z=J1D) where: * = standard options

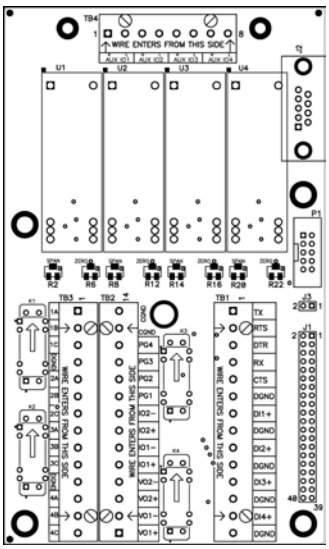
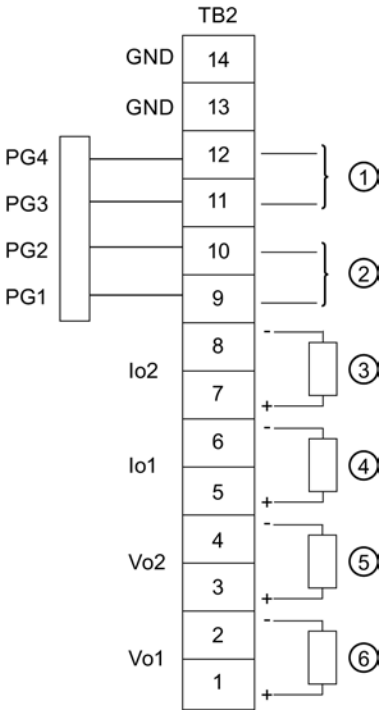


Figure A-2 7ME39400AL04 Expanded I/O Module

Table A- 5 Input/Output Wiring (TB2) - 7ME39400AL04 Expanded I/O Module

Pin#	Signal	Definition	Description	Function Dual/Quad Path Only
14		Chassis Ground	Chassis Ground	Cable Shield Terminations
13		Chassis Ground	Chassis Ground	Cable Shield Terminations
12	PG4	POS [+] Total TTL	0-5000 Hz frequency output , assignable	POS [+] Total TTL
11	PG3	POS [+] Total OC		POS [+] Total OC
10	PG2	NEG [-] Total TTL		NEG [-] Total TTL
9	PG1	NEG [-] Total OC		NEG [-] Total OC
8	Io2 (-)	Isolated Return	Flow meter process variables assigned to individual outputs under menu control. 4-20mA outputs also provide a fault indication by dropping to 2mA if assigned to flow rate and under fault conditions.	System outputs assignable & scalable to flow related parameters. OC = Open Collector
7	Io2 (+)	4-20mA Output 2		
6	Io1 (-)	Isolated Return		
5	Io1 (+)	4-20mA Output 1		
4	Vo2-	Ref. Ground		
3	Vo2+	0-10 Volt Output		
2	Vo1-	Ref. Ground		
1	Vo1+	0-10 Volt Output		



① TB2-11 - POS [+] Total OC
TB2-12 - POS [+] Total TTL

② TB2-9 - NEG [-] Total OC
TB2-10 - NEG [-] Total TTL

③ 4-20mA Load 1k ohm (max)

④ 4-20mA Load 1k ohm (max)

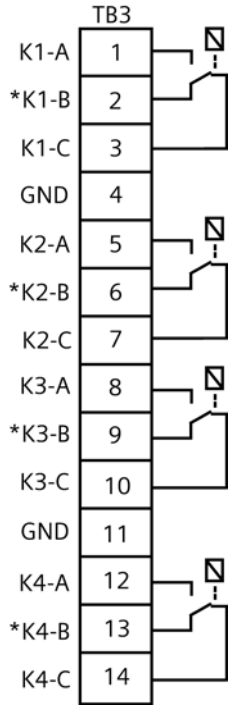
⑤ 0-10V Load 10k ohm (min)

⑥ 0-10V Load 10k ohm (min)

Table A- 6 Input/Output Wiring (TB3) - 7ME39400AL04 Expanded I/O Module

Pin#	Signal	Definition	Description	Function Dual Path Only	Function Quad Path Only
1	K1 A	Relay 1 Normally Open	Relay 1	Alarm or control functions set by CH 3.	Alarm or control functions set by CH5.
2	K1 B	Relay 1 Normally Closed (7ME39400AL04 only)			
3	K1 C	Relay 1 Common			
4	GND	Digital Return (GND)	DGND		
5	K2 A	Relay 2 Normally Open	Relay 2	Alarm or control functions set by CH 3.	Alarm or control functions set by CH5.
6	K2 B	Relay 2 Normally Closed (7ME39400AL04 only)			
7	K2 C	Relay 2 Common			
8	K3 A	Relay 3 Normally Open	Relay 3	Alarm or control functions set by CH 3.	Alarm or control functions set by CH5.
9	K3 B	Relay 3 Normally Closed (7ME39400AL04 only)			
10	K3 C	Relay 3 Common			

Pin#	Signal	Definition	Description	Function Dual Path Only	Function Quad Path Only
11	GND	Digital Return (GND)	DGND		
12	K4 A	Relay 4 Normally Open	Relay 4	Alarm or control functions set by CH 3.	Alarm or control functions set by CH5.
13	K4 B	Relay 4 Normally Closed (7ME39400AL04 only)			
14	K4 C	Relay 4 Common			



Note

Relays are shown in Power OFF position, which is the same as the alarm assertion position.

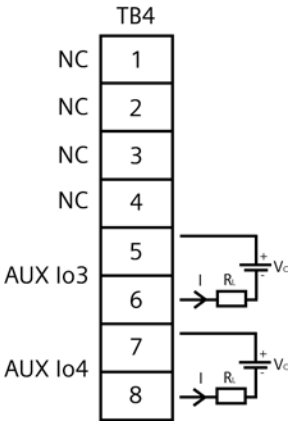
*7ME39400AL03 Mercury Relay only available with Normally Open.

Table A- 7 Input/Output Wiring (TB4) - 7ME39400AL04 Expanded I/O Module

Pin#	Signal	Definition	Description
1		No Connection	
2		No Connection	
3		No Connection	
4		No Connection	
5	AUX Io3+	Isolated Loop Power Io3	Connect +30V max. Loop Supply here
6	AUX Io3-	Io3 4-20mA Output	Vo1+ Data Presented as 4-20mA
7	AUX Io4+	Isolated Loop Power Io4	Connect +30V max. Loop Supply here
8	AUX Io4-	Io4 4-20mA Output	Vo2+ Data Presented as 4-20mA

Note

Auxiliary 4-20mA loops are assigned and spanned under menu control of Vo and PGEN outputs.



Vc: 24 VDC typical (+15 VDC to +30 VDC max) Loop Power

R: 1000 ohms (max), Loop wire resistance plus user's input load resistance

I: 4-20 mA

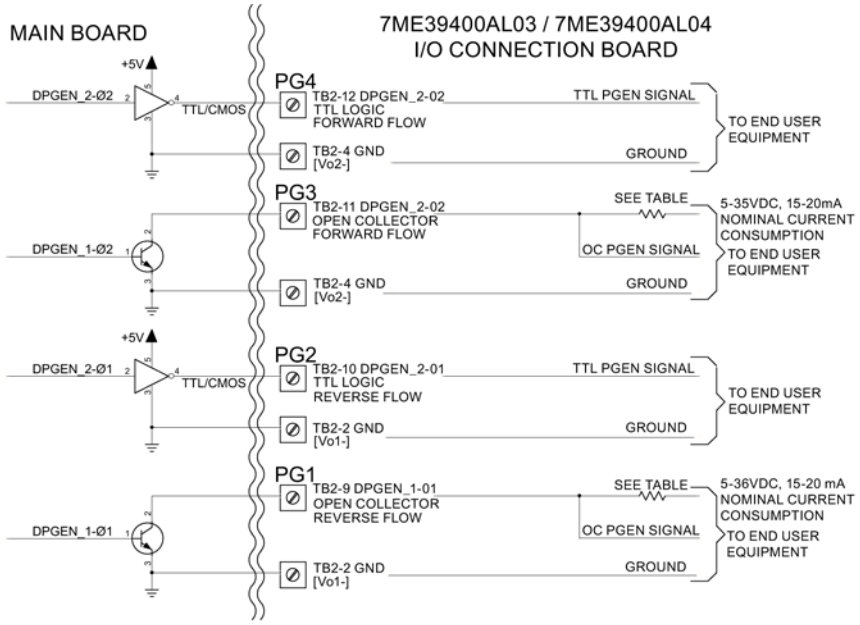


Table A- 8 Open Collector User Resistor Recommendations

User Supply Voltage (Vdc)	External Resistor (Ohms)	Expected Current Draw (mA)	Recommended Resistor Wattage (Watts)
5	270	18.5	1/2
9	510	17.6	1/2
12	680	17.6	1/2
18	1000	18	3/4
24	1500	16	1
28	1800	15.5	1 1/4
36	2400	15	1 1/4

Note

TB2-9 and TB2-11 are Open Collector Outputs that require external pull-up resistors for operation. See table for External Supply Voltage and suggested resistor value and ratings. Maximum current into the transistor is 100mA. Maximum Voltage is +36VDC.

NOTICE

Transistor Damage

Negative voltages with respect to ground will permanently damage transistors.

Use caution when applying power to circuit boards.

Note

Expanded I/O 7ME39400AL04 TB3 Input/Output wiring is the same as I/O Module 7ME39400AL01 TB3 shown above.

A.4 RS-232 Connection

The hardware and software programming for the SITRANS F 1010 models allow a PC to be connected via a RS-232 serial port. The serial interface cable includes 9-pin and 25-pin connectors to accommodate both types of IBM-compatible serial ports. A PC communication program such as Si-Ware (download program at: www.siemens.com/siware) or HyperTerminal (Windows 95/98/NT/2000/XP) serves as the data entry interface. These programs reproduce the menu screens that would appear on the system's graphic screen. Once the serial interface is established you can choose to program any FUG1010 system using a PC and a communications program. However, note that the serial interface cable is an option.

Note

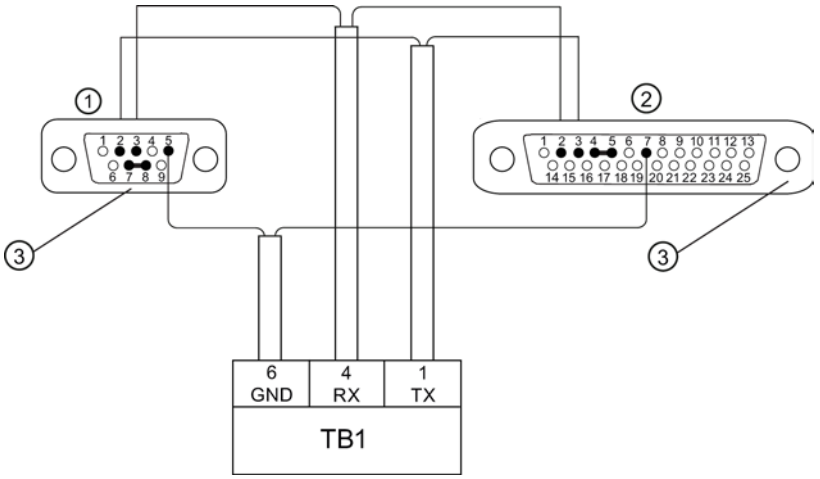
You can use a DOS-based communications program also. Make sure that your PC is loading the ANSI.SYS driver via your Config.sys file. Set the program's RS-232 parameters to match those of the flow meter (see HyperTerminal example screen on the following pages).

Note

Many newer Laptop PCs are not equipped with serial ports and only have USB ports. These PCs will require a USB RS-232 adaptor that can be purchased commercially.

The RS-232 Interface Cable

The physical connection between the flow meter and your PC is accomplished using a serial interface cable, part number: 1015CPC-N. The schematic below shows the configuration of the cable. The wire ends for the flow meter termination are tinned for easy insertion into TB1 on the flow meter. Each wire is labeled to identify the correct terminal pin on TB1. In addition, both connectors have their CTS pin shorted to the RTS pin (pins 4 - 5 on 25-pin connector and pins 7 - 8 on 9-pin connector) and this eliminates the need for hardware "handshaking."



① 9-Pin Connector
② 25-Pin Connector
③ Solder side shown

Figure A-3 1015CPC-N Serial Interface Cable

Due to the different SITRANS F 1010 flow meter configurations, there are 3 types of RS-232 communication cables employed. You can determine which cable is required for your model flow meter from the table below. Be sure you have the appropriate cable available for use.

For those who would prefer to make the cables themselves, the required parts should be available at most computer or electronics stores. You will find drawings of the terminations for these cables with the reference table below. It provides the signal names, PC termination and SITRANS F 1010 flow meter termination for each type of flow meter.

Flow meter Type	Cable Type	Siemens Part Number	Notes
All NEMA 4X	DB-9F - 3 Wire	CQO:1015CPC-N	
NEMA 4X with Expanded I/O Module	DB-9F - DB-9F	CQO:1015CPC-P	For FUG1010 N with A1 option (1010N-7 module)
FUG1010 NEMA 7 Compact	DB-9F - 3 Wire	CQO:1015CPC-N	

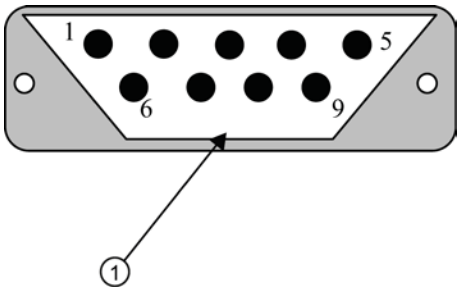
Also, in most computer stores or online, you will be able to find or you may already have a serial "LapLink" cable or "Null Modem" cable.

If you prefer to construct your own cable, the following conventions apply in the table:

- PC: Refers to an IBM compatible, DB-9 serial Com port.
- FUG1010 NEMA 4: Termination is made to the 1010N-2 I/O Data Module. Flow meter end of cable is un-terminated wire.

- FUG1010: With Expanded I/O "A1" Option: Flow meters that carry "A1" option have 1010N-7 module installed that houses a DB-9 connector for RS-232 communication.
- FUG1010X Compact: Termination is made to the 1010X-8 I/O module Terminal TB2. Flow meter end of cable is un-terminated wire.

Signal Name	PC DB-9 Terminal	1010N Terminal	1010X Terminal	1010X Compact Terminal
Ground	Pin 5	TB1-pin 6	TB1-pin 6	TB2-pin 16
Tx	Pin 2	TB1-pin 1	TB1-pin 1	TB2-pin 11
Rx	Pin 3	TB1-pin4	TB1-pin4	TB2-pin 14



① PC DB-9 Connector
1010P/990P Connector
(Wiring Side View)

Communicating with SITRANS F 1010 Systems via the RS-232 Interface

The following sections assume that you are familiar with the basics of using Windows 95/98/NT/2000/XP based communications program. All PC computers provide at least one serial port using either a 9-pin or 25-pin D-type connector. The port designation can be either COM 1 or COM 2. Usually, when a computer includes two serial ports, COM 1 will be the 9-pin connector and COM 2 will be the 25-pin connector. However, port designations can vary from manufacturer to manufacturer, so you will have to positively identify the COM port you wish to use for the flow meter interface. Connect the cable between the flow meter and your PC using the 25-pin, 9-pin or USB to RS-232 adapter connector, depending upon the port's architecture.

How to use the Windows HyperTerminal Program

Note

Si-Ware

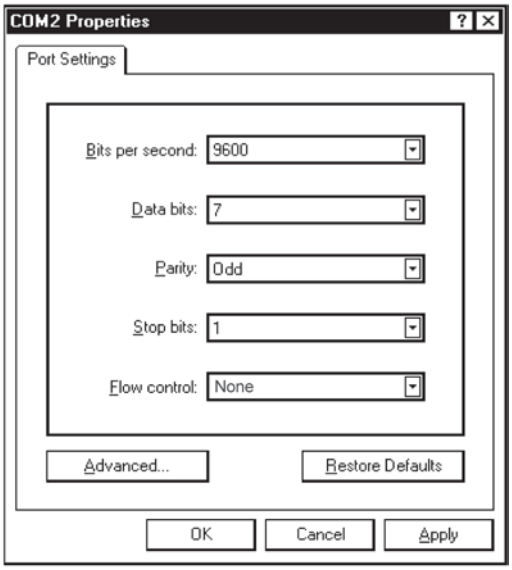
If you want to use the Si-Ware program instead of HyperTerminal, download the program at [www.siemens.com/siware] and follow the setup instructions.

Windows XP and earlier versions provide a communication program called HyperTerminal, which is ideal for interfacing your computer with the flow meter. The following typical example explains how to set up HyperTerminal.

Note

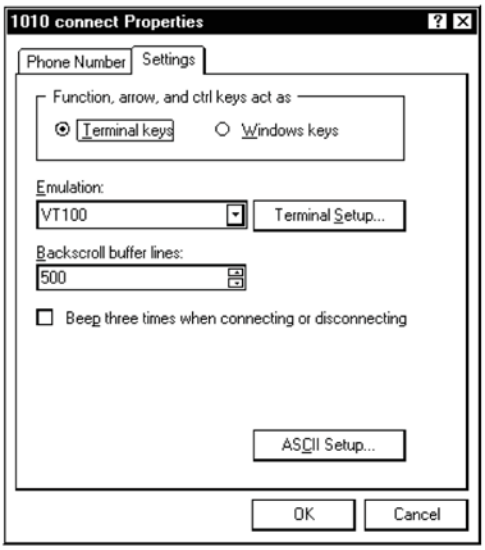
Depending upon the Windows applications being used this setup procedure may vary.

1. From the Windows desktop, left-click on the [START] button.
2. Holding down the left mouse button, move the highlight up to [Programs], then across to [Accessories]. Slide the highlight down to [HyperTerminal], then release the left mouse button.
3. Within the HyperTerminal window, move the mouse pointer down to [Hyperterm.exe] and then double-click the left mouse button.
4. This selects the [Connection Description] dialog box. Enter a name for your connection (e.g., 1010N). You can optionally select an icon for this connection by clicking on one of the icons displayed in the scrolling frame at the bottom of the window. Click [OK].
5. This selects the [Phone Number] dialog box. Move the cursor to the arrow at the right of the [Connect Using] field. Left click on the arrow to expand the field and then move the highlight down to [Direct to Com 1 (or 2)] depending on the port connected to the interface cable. Click [OK] to select the [Com 1 (or 2) Properties] Dialog box. Set up your RS-232 parameters as shown in the example below. Left-click on the [OK] button.

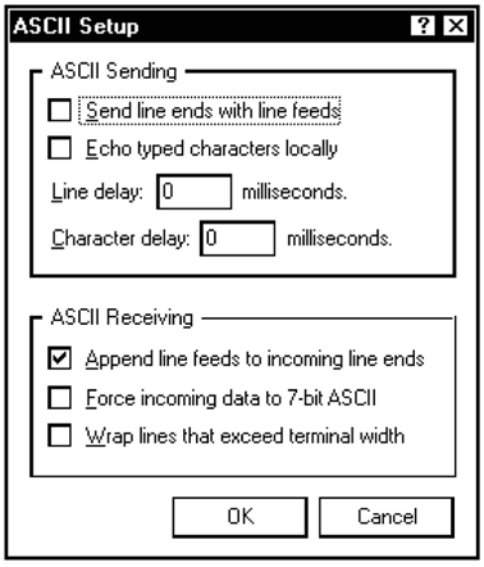


6. You will now see a blank terminal screen. Next left-click [File] on the top menu bar. Drag the highlight down to [Properties] and then left-click.

7. Left-click the [Settings] tab. Expand the [Emulation] box by left-clicking the <Down Arrow> on the right-hand side. Drag the highlight down to [VT-100] and then left-click to select it (as shown below).



8. Next, left-click on the [ASCII Setup] button (see screen above). In the [ASCII Sending] dialog box, make sure that both [send line ends with line feeds] and [Echo Typed characters locally] are UNCHECKED. In the [ASCII Receiving] dialog box, left-click to place a check mark before the [Append line feeds to incoming line ends] dialog. When your screen looks like the example below, left-click the [OK] button.



9. You are now ready to communicate with the 1010 flow meter. But first, save your settings by moving the mouse cursor to [File], sliding the cursor to [Save], then clicking [OK] on the Save dialog box.

10. The next time you want to use HyperTerminal:

- Click on Start.
- Drag to Programs.

- Drag to Accessories. Drag to HyperTerminal, and click.
- Double-click the icon you selected for the connection.

Note

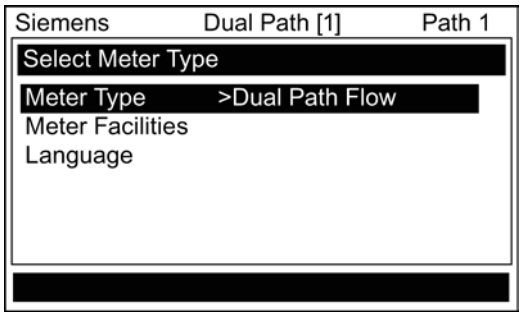
For easier access, create a shortcut to the connect icon from your desktop. Right-click on the icon to open its dialog box. Left-click on [Copy] or [Create a Short Cut] and then move the mouse cursor to a blank area on your desktop. Right-click to open dialog box and then left-click on [Paste] to place a shortcut to the connect icon on your desktop.

Accessing the Installation Menu

Once the parameters are set, HyperTerminal automatically initiates Command mode. You will see a blank screen.

1. Press <Enter> a few times until you see [? For Help] on the screen.
2. Type: ? (question mark) and then press <Enter> to see a list of the available commands.

Use the MENU command (type Menu and then press <Enter>) to access the top level of the Installation Menu. You will see a screen similar to the example below.

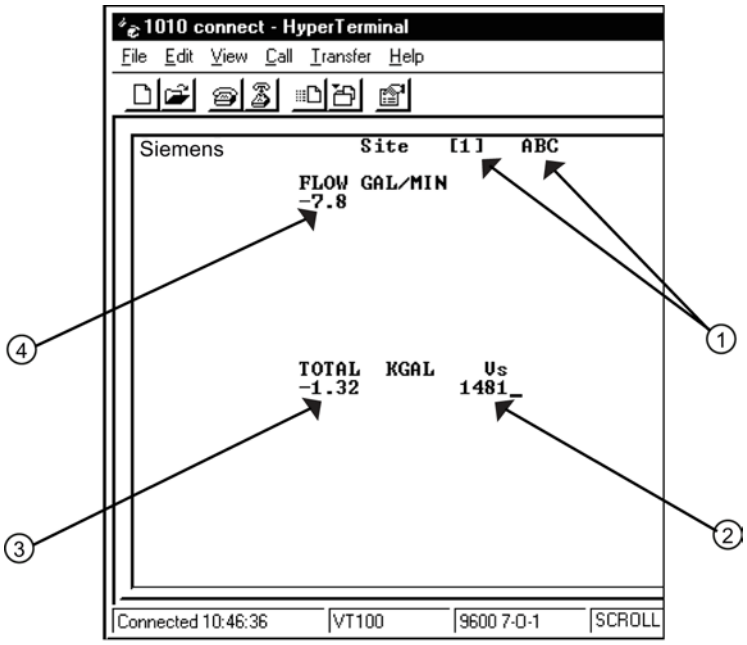


Note

To facilitate connecting through modems, the [Menu] command times out after three minutes of inactivity. To maintain a longer connection type: Menu 1000 and press <Enter>. The optional number is the amount in minutes that the connection will be maintained. Typing [Menu 1000] essentially keeps the interface active until you cancel it.

Data Display Mode

After you complete the installation, you can toggle between Installation Menu mode to Data Display mode. This is the same as using the <MENU> key on the keypad (see manual). The PC keyboard equivalent to the <MENU> key is <CTRL> + <L>. Note that the RS-232 interface does not support graphics. Therefore, when you use HyperTerminal to view the data display screens, you will see the same data in alphanumeric form only (as shown below). You can still use the <Up Arrow> and <Down Arrow> to switch between available display screens.



① Current active site setup name. The [1] indicates that the measurement channel is active.

② The current measured liquid sonic velocity.

③ The flow Total display.

④ The current flow reading and flow units.

Navigating through the Installation Menu

After accessing the Installation Menu, you can begin to setup your flow meter according to the instructions in this manual. The chart below shows the PC keyboard equivalents to the keypad keys while you are in the menu.

SITRANS F 1010 Keypad	PC Keyboard	Description
<Up Arrow>	<Up Arrow>	Move up 1 menu cell (or Flow Display screen)
<Down Arrow>	<Down Arrow>	Move down 1 menu cell (or Flow Display screen)
<Right Arrow>	<Right Arrow>	Move right 1 menu cell (or Flow Display screen)
<Left Arrow>	<Left Arrow>	Move left 1 menu cell (or Flow Display screen)
<MENU>	^L (Ctrl L)	Toggle between Menu and Flow Display
<DATALOG>	^D (Ctrl D)	Generate Datalogger report
<CLR>	<Backspace> or <DEL>	Deselect list selection
<ALT+Up Arrow>	^U (Ctrl U)	Logger Display Page Advance
<+/-> (chg sign)	| (bar, shift + backslash)	Change numeric sign. Can also type (-) key
<ENTER>	<Carriage Return>	Enter Key
Digits	Digits	Numerals zero through 9
/	/	Divide by
X	* (upper case 8)	Multiply by
+	+	Plus
-	-	Minus
=	=	Equals
.	.	Decimal Point

Terminal Mode Menu Commands

In addition to Menu, the following commands (followed by the <Enter> key) can be used to control the flow meter while in Terminal Mode.

Note

The "n" refers to the flow meter Channel number. For a 2-Channel Arithmetic site (Ch1 + Ch2 or Ch1 – Ch2) the virtual Channel is number 3.

Logger

Invokes the download of all data stored in the Datalogger. Note that the Datalogger data is not erased from the flow meter memory when it is downloaded. It is recommended to capture this information into a file with a "csv" extension, which can be easily imported into MS Excel.

SITE

Invokes a full site download for a single channel or multi-path 1010 flow meter.

SITE "n"

Invokes a site download for channel "n", where "n" = the Channel # (1, 2, 3, 4, etc.).

DP "n"

Commands the flow meter to download the digitized receive signal data for Channel or Path "n".

CLRTOT

Clears the Totalizer for a single channel or multi-path 1010 flow meter.

CLRTOT "n"

Clears the Totalizer for Channel "n" of a multi-channel flow meter.

Lf on

Turns on the Line Feed at the end of any text string sent by the flow meter.

Lf off

Turns off the Line Feed at the end of any text string sent by the flow meter.

?

Provides a list of available Terminal Mode flow meter commands.

Transferring information from a 1010 flow meter to the PC

With HyperTerminal active:

1. Point to [Transfers], and click.
2. Select [Capture Text].
3. Select desired drive path or directory, enter a file name, and click the Start button.
4. Use the following conventions for data file names:
   - For site data or Wave shape data: filename.txt
   - For Datalogger data: filename.csv
5. On the PC type the proper command for the data desired (Logger, Site, or DP) and then press [Enter] key.
6. The data should begin streaming on the HyperTerminal screen.

7. Wait for EOT (End Of Transmission) to be displayed.
8. Close the file by pointing to Transfer, drag to Capture Text and click Stop button.

Closing the Terminal or HyperTerminal Program

You may now close the Terminal program. The file(s) you have downloaded are now saved in the location you selected. You may now import the file you have saved into the appropriate program (i.e. MS Word for site data, or MS Excel for Datalogger or wave shape data for graphing or analysis).

The Datalogger contains data that has its fields separated by commas. By using the file extension ".csv" (comma separated values) suggested earlier, the data will import directly into MS Excel without any further modification. For the wave shape data, the fields are separated by spaces, therefore, it is best to save those files as .txt and then use the MS Excel Import Wizard to select "Space Delimiters" for importation of the data.

Site data is downloaded in plain text and can be imported directly into MS Word.

To Clear Active Memory using the RS-232 Interface

1. Turn off power (if it is currently on). Turn power on. As soon as you apply power, immediately type the @ character three times. The prompt: **[Clr Active Memory? No]** appears at the top of the screen.
2. Press the <Right Arrow> and then the <Down Arrow> to switch the option list to: **[Clr Active Memory? Yes]** Press <ENTER> to clear all Active Site Data (but not saved site setups).
3. To restore operation, press <MENU> to access the Installation Menu. Create a new site setup or recall a stored site setup. Re-select any Meter Facilities items (e.g., RS-232 setup parameters).

To Clear All Saved Data using the RS-232 Interface

NOTICE
Loss of RAM Data Before proceeding further it is essential to understand that this function eliminates ALL data stored in RAM. This means that all saved site setups including the site data of a flow-calibrated site will be erased! In addition, the entire Datalogger file plus any custom factory or user-created pipe or sensor tables will be eliminated. The impact of this is such that we strongly recommend that you consult Technical Services before continuing with this procedure. Be aware that you will have to create a new Site Setup, re-enter all site specific parameters including pipe or sensor tables, plus all desired Meter Facilities menu entries.

1. Turn off power (if it is currently on).
2. Turn the power on. As soon as you apply power, type the @ character three times.
   – The prompt: **[Clr Active Memory?]** appears at the top of the screen. Press the <Down Arrow>.

   Note

   Note that the prompt switches to **[Clr Saved Data? No].**
3. Press the <Right Arrow> and then the <Down Arrow> to switch the option list to: **[Clr Saved Data? Yes]**.
4. Press <ENTER> to clear all Saved Site Data, Datalogger Data, user created Pipe Data and Sensor Data.
5. To restore operation, press <MENU> to access the Installation Menu. Create a new site setup or recall a stored site setup. Reselect any Meter Facilities items (e.g., RS-232 setup parameters).

A.5 Flowrate Calibration and Calibration Tables

Flowrate Calibration Methods

SITRANS F 1010 equipment provides three ways to condition the calibration performance of its flowrate output: Intrinsic (factory set), Kc, and Calibration Tables 1 through 3. Access to these calibration options is found in the [Calibrate Flowrate] menu cell and the three [Calib. Table] menu cells of the [Span/Set/Cal] menu.

Intrinsic

When selected, the flow meter uses no slope adjustment at all. Output data is still zeroed and corrected for Reynolds number, but no slope adjustment is imposed on the flow meter's flow register.

Some applications may require an output adjustment to match an official external reference. The [Calibrate Flowrate] menu allows you to select a calibration mode. The right-hand column shows the active calibration mode. You can select Intrinsic (factory) and Kc (Slope Correction) Calibration. Selecting either of the external calibration modes will not eliminate the Intrinsic (factory) calibration. You can use this menu cell to switch between Intrinsic and Kc at any time.

Kc Calibration

For most applications, the measured flow range produces a linear meter response. Therefore, the Kc (slope correction) calibration is the preferred method since it only requires a single correction factor for all the flow rates encountered.

Note

Changing the calibration can cause profound changes in flow meter operating characteristics. Use only the most respected flow standard to obtain a correction factor. The percentage entered must provide an accurate and consistent shift across the entire flow range anticipated for the application.

Kc Factor

To obtain the Kc factor, compare flow total data taken simultaneously from the flow meter and a reference meter whose accuracy meets the required standard. Allow both meters to accumulate flow total data long enough to average out any differences due to flow fluctuation between the two meter locations. Compare outputs of the two totalizers to determine percentage increase (+) or decrease (-) that is necessary to produce the best average correlation between the flow meter and the reference standard.

Selecting the Kc Factor

When the [Kc] menu cell is selected, the flow meter imposes this percentage slope adjustment of its rate output. Output data is zeroed and corrected for the Reynolds number (flow profile compensated), however, a percent change in the rate output is imposed based on the data entered in this cell. The number entered by the user is evaluated into a slope correction factor by dividing it by 100 and algebraically adding it to 1. The resulting factor is used as a multiplier on the rate register of the instrument. Thus an entry of -3% will multiply the rate register by 0.97, for example.

To calculate Kc:

$$Kc = \left[\frac{\text{Actual Rate}}{\text{Indicated Rate}} - 1 \right] \times 100$$

To enter the Kc Factor

1. To enable numeric entry press <Right Arrow>.
2. Use the numeric keys to type the required Kc (as calculated above). Note that the Kc value can be negative or positive. Enter the - or + sign first, then type in the calibrated value.
3. To store the data press <ENTER>. Note that Kc now appears in the right-hand column of the [Calibrate Flow Rate] menu cell with its new value. Also note that this Kc value can be viewed on the site printout.

Calibration Tables 1 through 3

SITRANS F 1010 instruments offer a unique methodology by which a particular flow response of an instrument may be linearized or optimized by tabulating the results of a series of calibration exercises or collected batch data points. Basically, the flow meter allows the user to select any of a wide variety of system variables (flow rate, pressure, viscosity, etc.) as a pointer into a table of calibration factors (up to 32). As the system variable is updated, the value of the table's output factors (or positive and negative flow) is re-evaluated and used as a modifier for the current rate register. Note that the flow register is still zeroed and Reynolds number compensated normally and these slope corrections are in addition to these fundamentals.

Note

Kc is still active when this method is being used.

To install a Calibration table:

1. The user selects a system variable that appears to correlate strongly with calibration shifts observed.
2. A table of values is formed comprised of the values that this index could assume over the range of system operation. Remember, the tables created do not extrapolate beyond their end points, they "clip."
3. A calibration factor, a number usually close to 1.00, is entered as a positive and a negative flow rate correction factor (termed PosFlow Corr and NegFlow Corr) for each of the desired index points.

The table may contain up to 32 pairs of these slope correction factors. Note that the Kc factor, unlike these slope correction factors, is entered as a signed percent change in rate, while these factors are simply rate multipliers. As points are entered, the point editor will provide list access to the already entered points plus access to the [New Point] menu cell, used to add a new point. The table may be created in its entirety and then activated by selecting [Yes] in the [Table Active] menu cell. The entire table may be cleared by selecting [Yes] in the [Clear Table] menu cell.

Note

Careless use of the calibration tables can have a detrimental impact on the measurement performance of the flow meter.

Note

Take precautions before enabling these calibration tables. Although it is unlikely that all three tables would ever be employed in a real installation, three tables are offered for maximum user flexibility. Since the tables can be disabled without being destroyed, 2 or 3 optimization strategies may be tested by this means in order to determine which approach is most effective.

A.6 Setting Thermal Coefficient and Modulus of Elasticity

Introduction

This operating system includes routines that will compensate the measured raw flow rate for dynamic changes in the pipe dimensions, caused by variations in line temperature and pressure supplied to the flow meter. To account for variations in pipe material, two data entry items (Thermal Expansion Coefficient and Modulus of Elasticity) are provided in the Pipe Data menu screen (see sample menu screen below).

The equation used to automatically compute the change in pipe inside diameter is:

$$d_1 = d_0(1 + \alpha(T_1 - T_0)) * \left(1 + d_0\frac{(P_1 - P_0)}{E_w}\right)$$

Where:

d_0 = inside diameter of pipe at STP

d_1 = inside diameter of pipe after temperature and pressure change

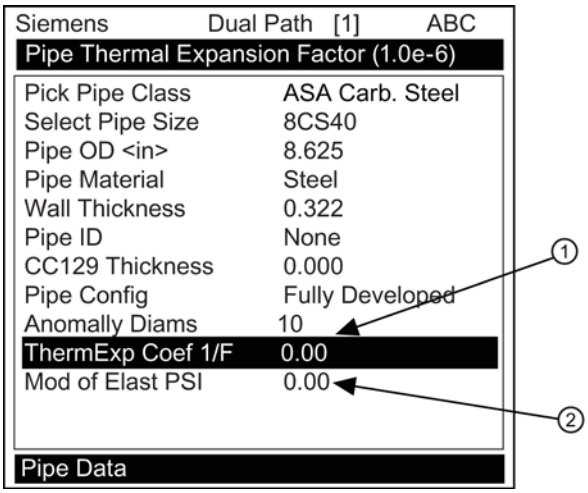
w = pipe wall thickness

T_0 and P_0 = Standard temperature and pressure

T_1 and P_1 = Operating temperature and pressure

α = Coefficient of Thermal Expansion of Pipe material

E = Modulus of Elasticity of pipe material



① Use this menu cell to edit the Thermal Expansion Coefficient of the pipe wall.

② Use this menu cell to change the Modulus Of Elasticity of the pipe wall.

The default value for each of these new parameters is 0.0. A value of zero effectively disables the pressure and temperature pipe volume compensation routine. When entering a value for the thermal expansion coefficient and modulus of elasticity, keep in mind that the numeric entry already includes an exponent multiplier. For the Thermal Expansion Coefficient the multiplier is 10^{-6} and for the Modulus of Elasticity the multiplier is 10^{6}.

Typical values for each parameter are shown below:

Pipe Material	Thermal Expansion	Modulus of Elasticity
Mild Carbon Steel	6.20 x 10^{-6} F^{-1} (11.16 x 10^{-6} C^{-1})	30 x 10^{6} psi 2.07 x 10^{6} bar
304 Stainless	9.60 x 10^{-6} F^{-1} (17.28 x 10^{-6} C^{-1})	28 x 10^{6} psi 1.93 x 10^{6} bar
316 Stainless	8.83 x 10^{-6} F^{-1} (15.89 x 10^{-6} C^{-1})	28 x 10^{6} psi 1.93 x 10^{6} bar

Note

Do not enter exponents of above values.

[ThermExp Coef 1/F]

Use this menu cell to set the Thermal Expansion Coefficient.

Entering the Thermal Expansion Coefficient value:

1. In the [Pipe Data] menu, scroll down to highlight [ThermExp Coef 1/F].
2. To enable numeric entry press <Right Arrow>.
3. Use the number keys to type the Thermal Coefficient value.
4. To register the data press <ENTER>.

Mod of Elast PSI

Use this menu cell to set the Modular Elasticity in PSI.

Entering the Modulus of Elasticity value:

1. In the [Pipe Data] menu, scroll down to highlight [Mod of Elast PSI].
2. To enable numeric entry press <Right Arrow>.
3. Use the number keys to type the Modular Elasticity PSI value.
4. To register the data press <ENTER>.

Appendix B

B.1 Installation/Outline Drawings

The following are the installation and outline drawings for the SITRANS FUG1010 NEMA 4X flow meter.

1010NS2-7 Rev D - Installation Drawing, 1010 Series Flow Computer, Agency Approved

1010N-7-7 Rev 08 - Installation Wiring, Expanded I/O Module

1010N-2-7 Rev 05 - Installation Wiring, I/O Module

1010N-5S2-7 Rev D - Installation Drawing, Analog Input Module

1010N-5DS2-7 Rev 06 - Installation Drawing, Analog Input Module

1010N-8MS2-7 Rev 03 - Installation Wiring, I/O Module

1010-304 Rev 14 - Connection Diagram for Hazardous Area Use, Agency Approved, 1010NS2/1010MNS2 Series Flow Computer

1010WX-S2-7 Rev A - Installation Drawing, 1010 Series Single/Dual Channel Flow Computer, Agency Approved

1010MNS2-7 Rev C - Installation Drawing, 1010 Series Multi-Channel Flow Computer, Agency Approved

1010MWX-S2-7 Rev A - Installation Drawing, 1010 Series Multi-Channel Flow Computer, Agency Approved

1010-443 Rev 05 - Connection Diagram for Hazardous Area Use, Agency Approved, 1010WX-S2 Series Flow Computer

1010NS9-7 Rev A - Installation Drawing, 1010 Series Flow Computer, Agency Approved

1010MNS9-7 Rev A - Installation Drawing, 1010 Series Multi-Channel Flow Computer, Agency Approved

1010-389 Rev 05 - Connection Diagram, Agency Approved for Hazardous Area Use, 1010NS9/1010MNS9 Series Flow Computer

1010-391 Rev C - Connection Diagram, Agency Approved for Zone 2 Connections, 1010NS9 Flow Computer System

1011NS2-7 Rev D - Installation Guide, Connection Diagram Selection, Agency Approved, 1011N Series Transducers

1011NS9-7 Rev C1 - Installation Guide, Connection Diagram Selection, Agency Approved, 1011N Series Transducers

1011NFPS-7 Rev 003 - Installation Drawing, 1011NPFS Series dedicated Plastic Body Transducer

1011HNS2-7 Rev D - Installation Guide, Connection Diagram Selection, Agency Approved, 1011HN Series Transducers

1011HNS9-7 Rev C1 - Installation Guide, Connection Diagram Selection, Agency Approved, 1011HN Series Transducers

1011HNFS-7 Rev 004 - Installation, 1011HNFS Series Dedicated Plastic Body Transducer

1012F-DB-7 Rev B - Installation Drawing, Dual Path Transducer Set w/Mounting Frames

1012MS-8 Rev F - Installation/Outline, Adjustable Mounting Strap

1012TN-7 Rev A - Installation Drawing, 1010 Series Transducers and Mounting Tracks

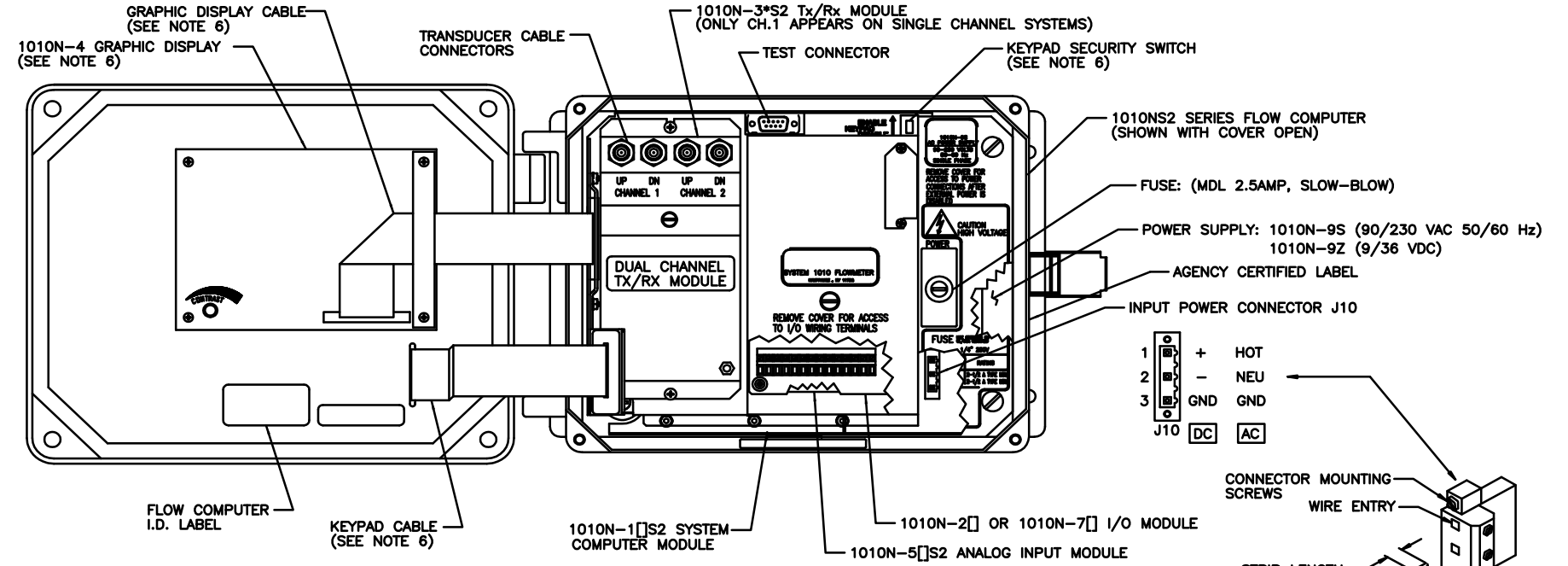
1012TNH-7 Rev A - Installation Drawing, 1010 Series Transducer and Mounting Tracks

991TDS2-7 Rev 03 - Installation Drawing, 991TD Temperature Sensor, Submersible, Agency Approved

A5E31323498 Rev AA - Outline Drawing, Precision Mount Enclosures

1012WSM-8 Rev 04 - Installation/Outline Drawing,Adjustable Mounting Strap

CC129-7 Rev A - Installation, CC129 Dry Film Couplant



THE INPUT POWER CONNECTOR IS A PLUGGABLE, LUG-LESS WIRE CLAMP TYPE, PROVIDING RELIABLE TERMINATION OF STRIPPED STRANDED OR SOLID CONDUCTORS AWG.12-18 SECURE WITH SCREWS AFTER MATING CONNECTOR.

NOTES:

1. SEE DRAWING 1010NS2-8 FOR OUTLINE DIMENSIONS.
2. SEE 1010 FIELD MANUAL AND APPROPRIATE TRANSDUCER INSTALLATION DRAWINGS FOR MOUNTING PROCEDURE.
3. DISABLE INSTRUMENT POWER BEFORE SERVICING POWER SUPPLY, POWER SWITCH / CIRCUIT BREAKER OR INPUT POWER CONNECTOR.
4. ALL TRANSDUCER CABLES ORIGINATING AT THE SAME FLOW COMPUTER MAY SHARE THE SAME CONDUIT. NO OTHER CABLES SHOULD BE HOUSED IN THE TRANSDUCER CABLE CONDUITS. CONNECT METALLIC CONDUITS TO EARTH GROUND.
5. OBSERVE FOLLOWING LIMITS WHEN INSTALLING TRANSDUCER CABLES IN CONDUIT:
   MAX. PULL TENSION: 80 lbs.
   MIN. BEND RADIUS: 2-1/2 INCHES
6. OPTIONAL DISPLAY AND KEYPAD APPEAR ON MODELS WITH GRAPHIC DISPLAY ONLY.
7. SEE DRAWING 1010N-2-7, 1010N-7-7 OR 1010N-8MS2-7 FOR USER I/O WIRING CONNECTIONS.
8. SEE DRAWING 1010N-5S2-7 OR 1010N-5DS2-7 FOR USER ANALOG INPUT WIRING CONNECTIONS.

CONTROLLED DRAWING
CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND TOLERANCES ON-

INCHES	(MM)
± .1	± 2

CONTRACT NO.

DR	H.J	DATE 4/22/98
CHK		DATE
ENG		DATE
PROD		DATE
APPD		DATE

CERTIFIED

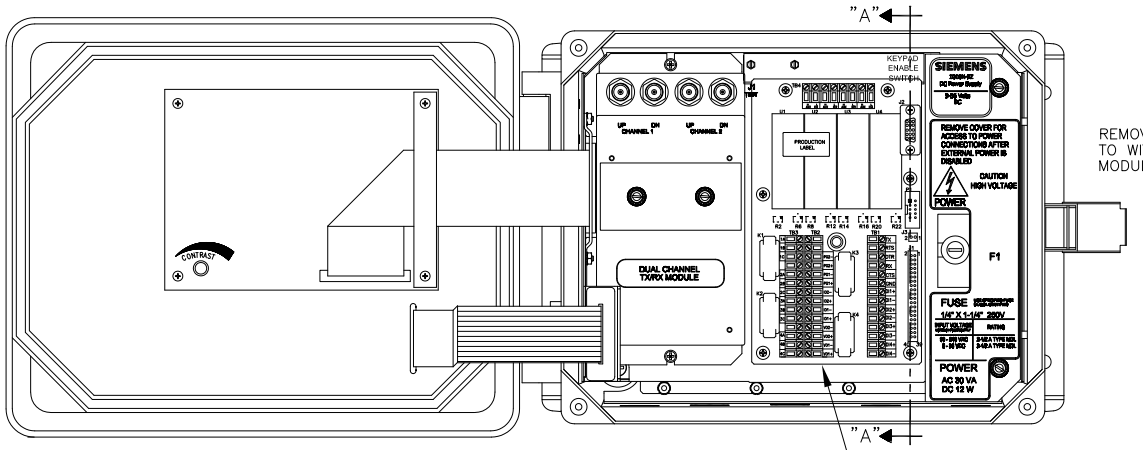
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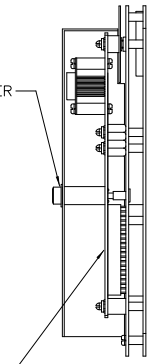
SIEMENS
Siemens Energy & Automation, Inc.
Process Instrumentation Business Unit
CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788

INSTALLATION DRAWING
1010 SERIES FLOW COMPUTER
AGENCY APPROVED

SIZE	CODE IDENT NO.		REV.
C	21614	1010NS2-7	D
SCALE: NONE	WT.	SHEET 1 OF 1	

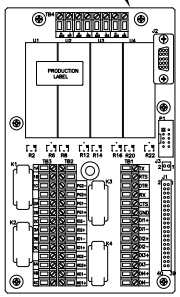
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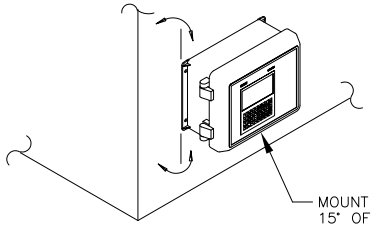




VIEW "A-A"

1010N–7[]S2 I/O MODULE
INSTALLED IN 1010DN SERIES FLOWMETER
(SHOWN WITH COVER REMOVED)
SEE APPROPRIATE FLOWMETER OUTLINE
DRAWING FOR OTHER CONFIGURATIONS





MODULE MARKING	ORDERING PN	RELAY TYPE
1010N–7K2–OR–CQO:1010N–7AK2S2–5	7ME3940–0AL03	Hg WETTED, FORM 1A
1010N–7K3–OR–CQO:1010N–7AK3S2–5	7ME3940–0AL04	DRY REED, FORM 1C

NOTES:

1. TERMINAL BLOCK TB1, TB2, TB3 AND TB4 ARE LUG–LESS WIRE CLAMPS FOR STRIPPED STRANDED WIRE, AWG. #14–24.
2. RELAY TYPE VARIES WITH MODULE PART NUMBER. SEE TABLE, ZONE B4.
3. RELAY CLOSURES ARE USER PROGRAMMABLE THROUGH THE FUS/FUH/FUG/FUE/FUT 1010 INSTALLATION MENU. SEE THE ASSOCIATED FIELD MANUAL AND SHT.2 FOR LIST OF ASSIGNABLE FUNCTIONS.
4. SET METER AND INSTRUMENTATION POWER TO OFF WHEN INSERTING OR REMOVING THE MODULE OR WHEN MAKING CONNECTIONS TO TB1, TB2, TB3 AND TB4.
5. REFER TO THE APPROPRIATE FIELD MANUAL FOR ADDITIONAL INSTALLATION INFORMATION.
6. WHEN SUPPLIED WITH MERCURY WETTED RELAYS (MODULE PART NO. 1010N–7K2 –OR– CQO:1010N–7AK2S2–5) MOUNT FLOW COMPUTER WITHIN 15° OF VERTICAL, BOTH PLANES, FOR PROPER RELAY OPERATION. (SEE ZONE B2).
7. LOAD CAPABLITY VARIES WITH SUPPLIED VOLTAGE. MAXIMUM LOAD FIGURES INCLUDE WIRING.

TABLE LEGEND:

N.O. = NORMALLY OPEN
N.C. = NORMALLY CLOSED
DGND = DIGITAL GROUND
GND = GROUND, SAME AS DGND
OC = OPEN COLLECTOR

SIEMENS
Siemens Industry, Inc.
Industry Automation Division
Hauppauge, NY 11788

INSTALLATION WIRING EXPANDED I/O MODULE

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON-
FRACTIONS ± 1/64" DECIMAL XX±0.01 XXX±0.005 ANGLES ±0°30' HOLES ±.003

SAP MATERIAL NO.		REV
ITEM NO.		AS
DOCUMENT NO.	1010N-7-7	DS 08
DRAWN BY: H.Jenkins	DATE: 8/30/00	SCALE: NONE SHEET 1 OF 2

TERMINAL BLOCK WIRING CONNECTIONS

METER PN'S AND OPERATING SYSTEMS →	"7ME350*a SITRANS FUE1010 OP SYSTEMS: 5EN02−−>5EN04 7ME353*a SITRANS FUS1010 OP SYSTEMS: 5N04 7ME360*a2 SITRANS FUH1010 OP SYSTEMS: *a = 0, 2 or 3, Indicating enclosure type."	"7ME360*a [FUH1010] 5PVN03 5DVN03 7ME361*a [FUG1010] 5GN05"	"7ME360*a [FUH1010] 5PVN04 5DVN04 7ME361*a [FUG1010] 5GN07"

METER INSTALLATION CONFIGURATION →					FUE SINGLE CHANNEL ONLY	DUAL CHANNEL	DUAL PATH	DUAL PATH ONLY	QUAD PATH ONLY				
TB1	PIN #	SIGNAL	DEFINITION	DESCRIPTION	FUNCTION	FUNCTION	FUNCTION	FUNCTION	FUNCTION	LOAD	WIRING	CABLE LENGTH	NOTES
RS232 DIAGNOSTIC PORT	1	Tx	TRANSMIT	EIA/TIA−232E STANDARD SIGNALS	RS232 COMMUNICATIONS PORT	RS232 COMMUNICATIONS PORT	RS232 COMMUNICATIONS PORT	RS232 COMMUNICATIONS PORT	RS232 COMMUNICATIONS PORT	PER EIA/TIA−232E STANDARD	SHIELDED DATA CABLE, 24 AWG MINIMUM	DEFINED BY EIA/TIA−232 STANDARD [2500pF MAX ~50 FEET]	
	2	RTS	REQUEST TO SEND										
	3	DTR	DATA TERMINAL READY										
	4	Rx	RECEIVE										
	5	CTS	CLEAR TO SEND										
	6	GND	GROUND [GND]	DGND	RS232 GROUND	RS232 GROUND	RS232 GROUND	RS232 GROUND	RS232 GROUND				
TOTALIZER CONTROL INPUTS	7	D1+	DIGITAL INPUT 1	CH1 NOTOT	STOPS CH1 TOTAL	STOPS CH1 TOTAL	STOPS CH3*b TOTAL	STOPS CH3*b TOTAL	STOPS CH5*b TOTAL	ACTIVE LOW; TTL	SHIELDED INSTRUMENT CABLE, 24 AWG MINIMUM	1000 FEET MAXIMUM, WITHOUT FACTORY APPROVAL	CH1 NOTOT AND CLRTOT LINES ALSO CONTROL DUAL & QUAD BEAM SYSTEM TOTALIZER FUNCTIONS *b CH3−or−CH5 IS THE SYSTEM CHANNEL
	8	D1−	DIGITAL RETURN [GND]	DGND	GND	GND	GND	GND	GND				
	9	D2+	DIGITAL INPUT 2	CH2 NOTOT	NOT USED	STOPS CH2 TOTAL	NOT USED	NOT USED	NOT USED	ACTIVE LOW; TTL			
	10	D2−	DIGITAL RETURN [GND]	DGND	GND	GND	GND	GND	GND				
	11	D3+	DIGITAL INPUT 3	CH1 CLRTOT	RESET CH1 TOTAL	RESET CH1 TOTAL	RESETS CH3*b TOTAL	RESETS CH3*b TOTAL	RESETS CH5*b TOTAL	ACTIVE LOW; TTL			
	12	D3−	DIGITAL RETURN [GND]	DGND	GND	GND	GND	GND	GND				
	13	D4+	DIGITAL INPUT 4	CH2 CLRTOT	NOT USED	RESET CH2 TOTAL	NOT USED	NOT USED	NOT USED	ACTIVE LOW; TTL			
	14	D4−	DIGITAL RETURN [GND]	DGND	GND	GND	GND	GND	GND				

METER INSTALLATION CONFIGURATION →					SINGLE CHANNEL	DUAL CHANNEL	DUAL PATH	DUAL PATH ONLY	QUAD PATH ONLY				
TB2	PIN #	SIGNAL	DEFINITION	DESCRIPTION	FUNCTION	FUNCTION	FUNCTION	FUNCTION	FUNCTION	LOAD	WIRING	CABLE LENGTH	NOTES
ANALOG OUTPUTS	1	Vo1+	0−10 VOLT OUTPUT	METER PROCESS VARIABLES ARE ASSIGNED TO INDIVIDUAL OUTPUTS; UNDER MENU CONTROL.	SYSTEM OUTPUTS ASSIGNABLE & SCALABLE TO FLOW RELATED PARAMETERS.	SYSTEM OUTPUTS ASSIGNABLE & SCALABLE TO FLOW RELATED PARAMETERS.	SYSTEM OUTPUTS ASSIGNABLE & SCALABLE TO FLOW RELATED PARAMETERS.	SYSTEM OUTPUTS ASSIGNABLE & SCALABLE TO FLOW RELATED PARAMETERS.	SYSTEM OUTPUTS ASSIGNABLE & SCALABLE TO FLOW RELATED PARAMETERS.	10KΩ MINIMUM	SHIELDED INSTRUMENT CABLE 24 AWG MINIMUM	1000 FEET MAXIMUM, WITHOUT FACTORY APPROVAL	TB2 4−20mA OUTPUTS ARE METER POWERED, DO NOT CONNECT TO EXTERNAL POWER SUPPLY TTL; MIN RESISTOR=4.7K *c FOR 7ME360a2; THIS IS AN OPEN COLLECTOR SIGNAL *d USE TB2−2 OR TB2−4 AS GND CONNECTIONS
	2	Vo1−	REF. GROUND							GND			
	3	Vo2+	0−10 VOLT OUTPUT							10KΩ MINIMUM			
	4	Vo2−	REF. GROUND							GND			
	5	Io1+	4−20mA OUTPUT 1							1000 Ω MAXIMUM			
	6	Io1−	ISOLATED RETURN							RETURN FOR 4−20mA OUT 1			
	7	Io2+	4−20mA OUTPUT 2							1000 Ω MAXIMUM			
	8	Io2−	ISOLATED RETURN							RETURN FOR 4−20mA OUT 2			
PULSE OUTPUT	9	PG1	FREQUENCY OUT 1	0 TO 5000Hz FREQUENCY OUTPUT,	5V TTL SIGNAL*c	5V TTL SIGNAL*c	5V TTL SIGNAL*c	NEG [−] TOTAL OC*d	NEG [−] TOTAL OC*d	TTL−OR−OPEN COLLECTOR 28V MAX			
	10	PG2	SEE FUNCTION COLUMN→		GND	GND	GND	NEG [−] TOTAL TTL*d	NEG [−] TOTAL TTL*d	TTL SQ WAVE−OR−GND			
	11	PG3	FREQUENCY OUT 2		5V TTL SIGNAL*c	5V TTL SIGNAL*c	5V TTL SIGNAL*c	POS [+] TOTAL OC*d	POS [+] TOTAL OC*d	TTL−OR−OPEN COLLECTOR 28V MAX			
	12	PG4	SEE FUNCTION COLUMN→		GND	GND	GND	POS [+] TOTAL TTL*d	POS [+] TOTAL TTL*d	TTL SQ WAVE−OR−GND			
	13	CGND	CHASSIS GROUND	ASSIGNABLE CHASSIS GROUND	CABLE SHIELD TERMINATIONS	CABLE SHIELD TERMINATIONS	CABLE SHIELD TERMINATIONS	CABLE SHIELD TERMINATIONS	CABLE SHIELD TERMINATIONS	CHASSIS GND			
	14	CGND	CHASSIS GROUND							CHASSIS GND			

METER INSTALLATION CONFIGURATION →					SINGLE CHANNEL	DUAL CHANNEL	DUAL PATH	DUAL PATH ONLY	QUAD PATH ONLY				
TB3	PIN #	SIGNAL	DEFINITION	DESCRIPTION	FUNCTION	FUNCTION	FUNCTION	FUNCTION	FUNCTION	LOAD	WIRING	CABLE LENGTH	NOTES
OUTPUT RELAY CONTROL	1	K1 A	RELAY 1 N.O.	RELAY 1	ALARM OR CONTROL SIGNALS SET BY CH1	ALARM OR CONTROL SIGNALS SET BY CH1	ALARM OR CONTROL SIGNALS SET BY CH3*b	ALARM OR CONTROL SIGNALS SET BY CH3*b	ALARM OR CONTROL SIGNALS SET BY CH5*b	MODULE CQ0:1010N−7AK2−5 50VA CONTACT RATING 70VDC OR PEAK AC 0.5A MAX	WIRING AS REQUIRED FOR APPLICATION CIRCUIT	1000 FEET MAXIMUM, WITHOUT FACTORY APPROVAL	RELAY ASSIGNED ALARMS ARE ENERGIZED WHEN NO ALARM EXISTS. COUNT RELAYS ARE ENERGIZED FOR 200mS FOR EACH TOTALIZER INCREMENT. SEE NOTE 7. NO N.C. RELAY ON 1010N−7AK2S2−5 *b CH3 / CH5 IS THE SYSTEM CHANNEL
	2	K1 B	RELAY 1 N.C.[−7AK3 ONLY]										
	3	K1 C	RELAY 1 COMM										
	4	GND	DIGITAL RETURN [GND]	GND	GND	GND	GND	GND	GND				
	5	K2 A	RELAY 2 N.O.	RELAY 2	ALARM OR CONTROL SIGNALS SET BY CH1	ALARM OR CONTROL SIGNALS SET BY CH1	ALARM OR CONTROL SIGNALS SET BY CH3*b	ALARM OR CONTROL SIGNALS SET BY CH3*b	ALARM OR CONTROL SIGNALS SET BY CH5*b				
	6	K2 B	RELAY 2 N.C.[−7AK3 ONLY]										
	7	K2 C	RELAY 2 COMM										
	8	K3 A	RELAY 3 N.O.	RELAY 3	ALARM OR CONTROL SIGNALS SET BY CH1	ALARM OR CONTROL SIGNALS SET BY CH2	ALARM OR CONTROL SIGNALS SET BY CH3*b	ALARM OR CONTROL SIGNALS SET BY CH3*b	ALARM OR CONTROL SIGNALS SET BY CH5*b	MODULE CQ0:1010N−7AK3−5 3VA CONTACT RATING 30VDC PEAK 0.25A MAX			
	9	K3 B	RELAY 3 N.C.[−7AK3 ONLY]										
	10	K3 C	RELAY 3 COMM										
	11	GND	DIGITAL RETURN [GND]	GND	GND	GND	GND	GND	GND				
	12	K4 A	RELAY 4 N.O.	RELAY 4	ALARM OR CONTROL SIGNALS SET BY CH1	ALARM OR CONTROL SIGNALS SET BY CH2	ALARM OR CONTROL SIGNALS SET BY CH3*b	ALARM OR CONTROL SIGNALS SET BY CH3*b	ALARM OR CONTROL SIGNALS SET BY CH5*b				
	13	K4 B	RELAY 4 N.C.[−7AK3 ONLY]										
	14	K4 C	RELAY 4 COMM										

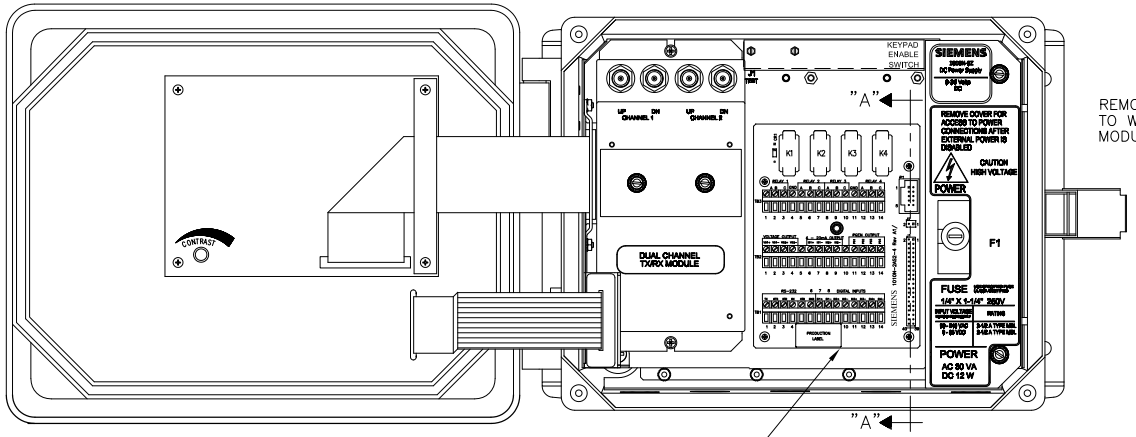
					FUE SINGLE CHANNEL ONLY	DUAL CHANNEL	DUAL PATH	DUAL PATH ONLY	QUAD PATH ONLY				
TB4	PIN #	SIGNAL	DEFINITION	DESCRIPTION	FUNCTION	FUNCTION	FUNCTION	FUNCTION	FUNCTION	LOAD	WIRING	CABLE LENGTH	NOTES
ISOLATED 4−20mA OUTPUTS	1	Aux IO1+	Isolated Loop Power IO1	IO1 External Power	+30V Maximum Supply Voltage Allowed			NOT USED	NOT USED	1000 Ω MAXIMUM, WHEN USING EXTERNAL 24Vdc POWER SUPPLY	WIRING AS REQUIRED FOR APPLICATION CIRCUIT	1000 FEET MAXIMUM, WITHOUT FACTORY APPROVAL	FULLY ISOLATED, EXTERNALLY POWERED 4−20mA CONTROL SIGNALS, ASSIGNED TO PARAMETERS BY METER TYPE & METER SETUP
	2	Aux IO1−	IO1 4−20mA Output	IO1 Signal	Same Output Assignment as TB2−9								
	3	Aux IO2+	Isolated Loop Power IO2	IO2 External Power	+30V Maximum Supply Voltage Allowed								
	4	Aux IO2−	IO2 4−20mA Output	IO2 Signal	Same Output Assignment as TB2−11								
	5	Aux IO3+	Isolated Loop Power IO3	IO3 External Power	SYSTEM OUTPUTS ASSIGNABLE & SCALABLE TO FLOW RELATED PARAMETERS.			+30V Max	+30V Max				
	6	Aux IO3−	IO3 4−20mA Output	IO3 Signal				Same as TB2−1	Same as TB2−1				
	7	Aux IO4+	Isolated Loop Power IO4	IO4 External Power				+30V Max	+30V Max				
	8	Aux IO4−	IO4 4−20mA Output	IO4 Signal				Same as TB2−3	Same as TB2−3				

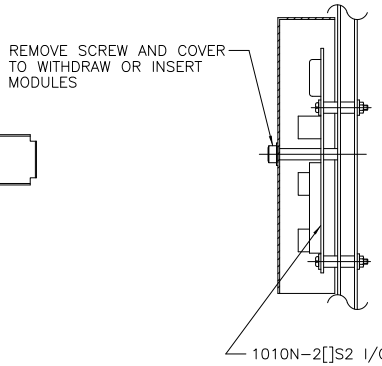
SIEMENS
Siemens Industry, Inc.
Industry Automation Division
Hauppauge, NY 11788

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON-
FRACTIONS ± 1/64" DECIMAL XX±0.01 XXX±0.005 ANGLES ±0°30' HOLES ±.003

INSTALLATION WIRING EXPANDED I/O MODULE

SAP MATERIAL NO.			REV
ITEM NO.			AS
DOCUMENT NO.	1010N-7-7		DS 08
DRAWN BY: H.Jenkins	DATE: 8/30/00	SCALE: NONE	SHEET 2 OF 2





SECTION "A-A"

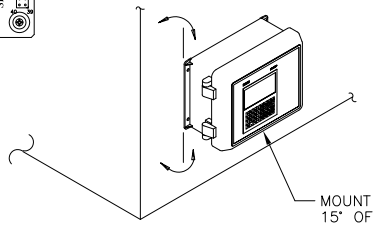
MODULE MARKING	ORDERING PN	RELAY TYPE
1010N-2K2-OR-CQO:1010N-2AK2S2-5	7ME3940-0AL00	Hg WETTED, FORM 1A
1010N-2K3-OR-CQO:1010N-2AK3S2-5	7ME3940-0AL01	DRY REED, FORM 1C

NOTES:

1. TERMINAL BLOCK TB1, TB2 AND TB3 ARE LUG-LESS WIRE CLAMPS FOR STRIPPED STRANDED WIRE, AWG. #14-24.
2. RELAY TYPE VARIES WITH MODULE PART NUMBER. SEE TABLE, ZONE C4.
3. RELAY CLOSURES ARE USER PROGRAMMABLE THROUGH THE FUS/FUH/FUG/FUE/FUT 1010 INSTALLATION MENU. SEE THE ASSOCIATED FIELD MANUAL AND SHT.2 FOR LIST OF ASSIGNABLE FUNCTIONS.
4. SET METER AND INSTRUMENTATION POWER TO OFF WHEN INSERTING OR REMOVING THE MODULE OR WHEN MAKING CONNECTIONS TO TB1, TB2 AND TB3.
5. REFER TO THE APPROPRIATE FIELD MANUAL FOR ADDITIONAL INSTALLATION INFORMATION.
6. WHEN SUPPLIED WITH MERCURY WETTED RELAYS (MODULE PART No. 1010N-2K2 OR CQO:1010N-2AK2S2-5) MOUNT FLOW COMPUTER WITHIN 15° OF VERTICAL, BOTH PLANES, FOR PROPER RELAY OPERATION. (SEE ZONE B2).
7. LOAD CAPABLITY VARIES WITH SUPPLIED VOLTAGE. MAXIMUM LOAD FIGURES INCLUDE WIRING.

TABLE LEGEND:

N.O. = NORMALLY OPEN
N.C. = NORMALLY CLOSED
DGND = DIGITAL GROUND
GND = GROUND, SAME AS DGND
OC = OPEN COLLECTOR



SIEMENS
Siemens Industry, Inc.
Industry Automation Division
Hauppauge, NY 11788

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON-
FRACTIONS DECIMAL ANGLES HOLES
± 1/64" XX±0.01 ±0°30' ±.003
XXX±0.005

INSTALLATION WIRING I/O MODULE

SAP MATERIAL NO.		REV.___
ITEM NO.		AS ___
DOCUMENT NO.	1010N-2-7	DS 05
DRAWN BY: H.Jenkins	DATE: 2/20/98	SCALE: NONE SHEET 1 OF 2

TERMINAL BLOCK WIRING CONNECTIONS

METER PN'S AND OPERATING SYSTEMS →	"7ME350*a SITRANS FUE1010 OP SYSTEMS: 5EN01−−>5EN04 7ME353*a SITRANS FUS1010 OP SYSTEMS: 5N01−−>5N04 7ME360*a2 SITRANS FUH1010 OP SYSTEMS: 5BN01−−>5BN02 *a = 0, 2 or 3, Indicating enclosure type.*	"7ME360*a [FUH1010] 5PVN01 & 5PVN02 5DVN01 & 5DVN02 7ME361*a [FUG1010] 5GN03 & 5GN04"	

METER INSTALLATION CONFIGURATION →				SINGLE CHANNEL	DUAL CHANNEL	DUAL PATH	DUAL PATH ONLY				
TB1	PIN #	SIGNAL	DEFINITION	DESCRIPTION	FUNCTION	FUNCTION	FUNCTION	FUNCTION	LOAD	WIRING	CABLE LENGTH	NOTES
RS232 DIAGNOSTIC PORT	1	Tx	TRANSMIT	EIA/TIA−232E STANDARD SIGNALS	RS232 COMMUNICATIONS PORT	RS232 COMMUNICATIONS PORT	RS232 COMMUNICATIONS PORT	RS232 COMMUNICATIONS PORT	"PER EIA/TIA−232E STANDARD "	SHIELDED DATA CABLE, 24 AWG MINIMUM	DEFINED BY EIA/TIA−232 STANDARD [2500pF MAX ~50 FEET]	
	2	RTS	REQUEST TO SEND									
	3	DTR	DATA TERMINAL READY									
	4	Rx	RECEIVE									
	5	CTS	CLEAR TO SEND									
	6	GND	GROUND [GND]	GND	RS232 GROUND	RS232 GROUND	RS232 GROUND	RS232 GROUND				
TOTALIZER CONTROL INPUTS	7	D1+	DIGITAL INPUT 1	CH1 NOTOT	STOPS CH1 TOTAL	STOPS CH1 TOTAL	STOPS CH3*b TOTAL	STOPS CH3*b TOTAL	ACTIVE LOW; TTL	SHIELDED INSTRUMENT CABLE, 24 AWG MINIMUM	1000 FEET MAXIMUM, WITHOUT FACTORY APPROVAL	CH1 NOTOT AND CLRTOT LINES ALSO CONTROL DUAL BEAM SYSTEM TOTALIZER FUNCTIONS *b CH3 IS THE SYSTEM CHANNEL
	8	D1−	DIGITAL RETURN [GND]	GND	GND	GND	GND	GND				
	9	D2+	DIGITAL INPUT 2	CH2 NOTOT	NOT USED	STOPS CH2 TOTAL	NOT USED	NOT USED	ACTIVE LOW; TTL			
	10	D2−	DIGITAL RETURN [GND]	GND	GND	GND	GND	GND				
	11	D3+	DIGITAL INPUT 3	CH1 CLRTOT	RESETS CH1 TOTAL	RESETS CH1 TOTAL	RESETS CH3*b TOTAL	RESETS CH3*b TOTAL	ACTIVE LOW; TTL			
	12	D3−	DIGITAL RETURN [GND]	GND	GND	GND	GND	GND				
	13	D4+	DIGITAL INPUT 4	CH2 CLRTOT	NOT USED	RESETS CH2 TOTAL	NOT USED	NOT USED	ACTIVE LOW; TTL			
	14	D4−	DIGITAL RETURN [GND]	GND	GND	GND	GND	GND				

METER INSTALLATION CONFIGURATION →				SINGLE CHANNEL	DUAL CHANNEL	DUAL PATH	DUAL PATH ONLY				
TB2	PIN #	SIGNAL	DEFINITION	DESCRIPTION	FUNCTION	FUNCTION	FUNCTION	FUNCTION	LOAD	WIRING	CABLE LENGTH	NOTES
ANALOG OUTPUTS	1	Vo1+	0−10 VOLT OUTPUT	METER PROCESS VARIABLES ARE ASSIGNED TO INDIVIDUAL OUTPUTS; UNDER MENU CONTROL.	SYSTEM OUTPUTS ASSIGNABLE & SCALABLE TO FLOW RELATED PARAMETERS. CGND IS FOR CABLE SHIELD TERMINATIONS.	SYSTEM OUTPUTS ASSIGNABLE & SCALABLE TO FLOW RELATED PARAMETERS. CGND IS FOR CABLE SHIELD TERMINATIONS.	SYSTEM OUTPUTS ASSIGNABLE & SCALABLE TO FLOW RELATED PARAMETERS. CGND IS FOR CABLE SHIELD TERMINATIONS.	SYSTEM OUTPUTS ASSIGNABLE & SCALABLE TO FLOW RELATED PARAMETERS. CGND IS FOR CABLE SHIELD TERMINATIONS.	10KΩ MINIMUM	SHIELDED INSTRUMENT CABLE 24 AWG MINIMUM	1000 FEET MAXIMUM, WITHOUT FACTORY APPROVAL	TB2 4−20mA OUTPUTS ARE METER POWERED, DO NOT CONNECT TO EXTERNAL POWER SUPPLY TTL; MIN RESISTOR = 4.7KV *c FOR 7ME360a2; THIS IS AN OPEN COLLECTOR SIGNAL *d USE TB2−2 OR TB2−4 AS GND CONNECTIONS"
	2	Vo1−	REF. GROUND						GND			
	3	Vo2+	0−10 VOLT OUTPUT						10KΩ MINIMUM			
	4	Vo2−	REF. GROUND						GND			
	5	CGND	CHASSIS GND						CHASSIS GND			
	6	Io1+	4−20mA OUTPUT 1						1000 Ω MAXIMUM			
	7	Io1−	ISOLATED RETURN						RETURN FOR 4−20mA OUT 1			
	8	Io2+	4−20mA OUTPUT 2						1000 Ω MAXIMUM			
	9	Io2−	ISOLATED RETURN						RETURN FOR 4−20mA OUT 2			
	10	CGND	CHASSIS GND						CHASSIS GND			
PULSE OUTPUT	11	PG1	FREQUENCY OUT 1	0 TO 5000Hz FREQUENCY OUTPUT, ASSIGNABLE	5V TTL SIGNAL*c	5V TTL SIGNAL*c	5V TTL SIGNAL*c	NEG [−] TOTAL OC*d	TTL −OR− OPEN COLLECTOR, 28V MAX			
	12	PG2	SEE FUNCTION COLUMN??		GND	GND	GND	NEG [−] TOTAL TTL*d	TTL SQ WAVE −OR− GND			
	13	PG3	FREQUENCY OUT 2		5V TTL SIGNAL*c	5V TTL SIGNAL*c	5V TTL SIGNAL*c	POS [+] TOTAL OC*d	TTL SQ WAVE −OR− OPEN COLL, 28V MAX			
	14	PG4	SEE FUNCTION COLUMN??		GND	GND	GND	POS [+] TOTAL TTL*d	TTL SQ WAVE −OR− GND			

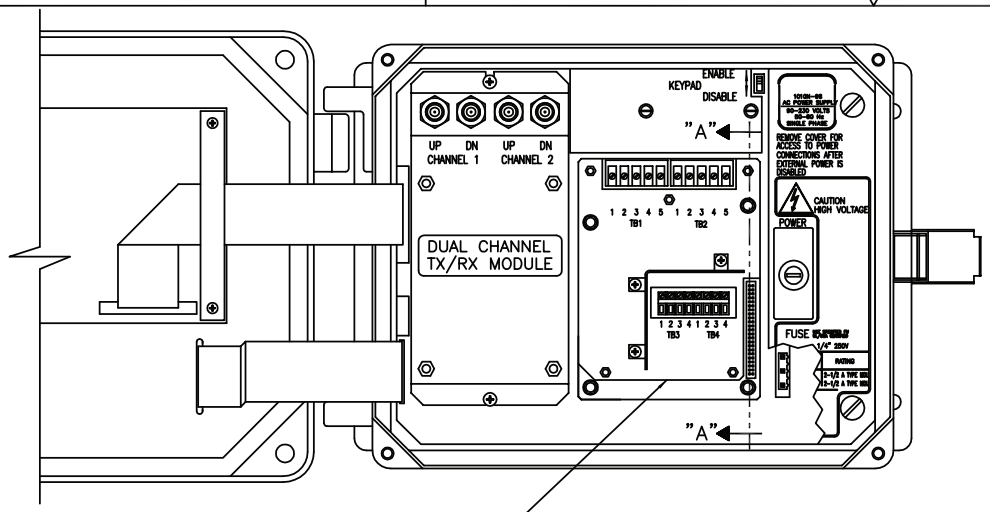
METER INSTALLATION CONFIGURATION →				SINGLE CHANNEL	DUAL CHANNEL	DUAL PATH	DUAL PATH ONLY				
TB3	PIN #	SIGNAL	DEFINITION	DESCRIPTION	FUNCTION	FUNCTION	FUNCTION	FUNCTION	LOAD	WIRING	CABLE LENGTH	NOTES
OUTPUT RELAY CONTROL	1	K1 A	RELAY 1 N.O.	RELAY 1	ALARM OR CONTROL SIGNALS SET BY CH1	ALARM OR CONTROL SIGNALS SET BY CH1	ALARM OR CONTROL SIGNALS SET BY CH3*b	ALARM OR CONTROL SIGNALS SET BY CH3*b	MODULE CQO:1010N−2AK2−5: 50VA CONTACT RATING 70VDC OR PEAK AC 0.5A MAX MODULE CQO:1010N−2AK3−5: 3VA CONTACT RATING 30VDC PEAK 0.25A MAX	WIRING AS REQUIRED FOR APPLICATION CIRCUIT	1000 FEET MAXIMUM, WITHOUT FACTORY APPROVAL	RELAY ASSIGNED ALARMS ARE ENERGIZED WHEN NO ALARM EXISTS. COUNT RELAYS ARE ENERGIZED FOR 200mS FOR EACH TOTALIZER INCREMENT. SEE NOTE 7. NO N.C. RELAY ON 1010N−2AK2S2−5 *b CH3 IS THE SYSTEM CHANNEL
	2	K1 B	RELAY 1 N.C. [−2AK3 ONLY]									
	3	K1 C	RELAY 1 COMMON									
	4	GND	DIGITAL RETURN [GND]	GND	GND	GND	GND	GND				
	5	K2 A	RELAY 2 N.O.	RELAY 2	ALARM OR CONTROL SIGNALS SET BY CH1	ALARM OR CONTROL SIGNALS SET BY CH1	ALARM OR CONTROL SIGNALS SET BY CH3*b	ALARM OR CONTROL SIGNALS SET BY CH3*b				
	6	K2 B	RELAY 2 N.C. [−2AK3 ONLY]									
	7	K2 C	RELAY 2 COMMON									
	8	K3 A	RELAY 3 N.O.	RELAY 3	ALARM OR CONTROL SIGNALS SET BY CH1	ALARM OR CONTROL SIGNALS SET BY CH2	ALARM OR CONTROL SIGNALS SET BY CH3*b	ALARM OR CONTROL SIGNALS SET BY CH3*b				
	9	K3 B	RELAY 3 N.C. [−2AK3 ONLY]									
	10	K3 C	RELAY 3 COMMON									
	11	GND	DIGITAL RETURN [GND]	GND	GND	GND	GND	GND				
	12	K4 A	RELAY 4 N.O.	RELAY 4	ALARM OR CONTROL SIGNALS SET BY CH1	ALARM OR CONTROL SIGNALS SET BY CH2	ALARM OR CONTROL SIGNALS SET BY CH3*b	ALARM OR CONTROL SIGNALS SET BY CH3*b				
	13	K4 B	RELAY 4 N.C. [−2AK3 ONLY]									
	14	K4 C	RELAY 4 COMMON									

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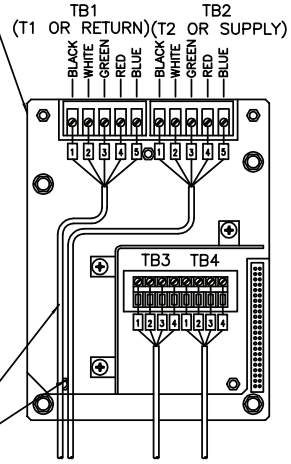
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON-
FRACTIONS DECIMAL ANGLES HOLES
± 1/64" XX±0.01 ±0°30' ±.003
XXX±0.005

INSTALLATION WIRING I/O MODULE

SAP MATERIAL NO.			REV.
ITEM NO.			AS
DOCUMENT NO.	1010N-2-7		DS 05
DRAWN BY: H.Jenkins	DATE: 2/20/98	SCALE: NONE	SHEET 2 OF 2

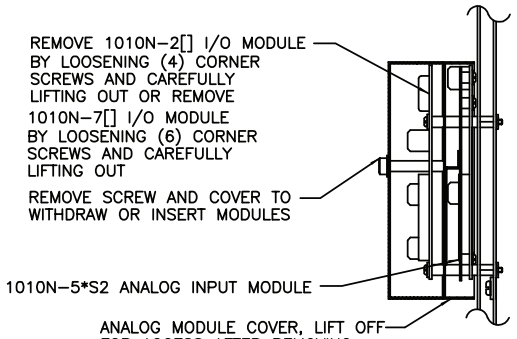


1010N–5*S2 ANALOG INPUT MODULE
(SHOWN WITH SCREW, COVER AND
I/O MODULE 1010N–2[] REMOVED)



1012EC SERIES
CABLES

ALTERNATE COLOR CODE FOR CERTAIN 1012EC CABLES:
WHITE = ORANGE
GREEN = BROWN



SECTION "A–A"

TB1 WIRING

PIN	COLOR	FUNCTION SEE NOTE 4	DESCRIPTION	WIRING	CABLE LENGTH	NOTES
1	BLACK	RTD CURRENT HIGH	RTD TEMPERATURE MEASUREMENT CHANNEL 1, T1 OR RETURN TEMP. REFERENCE CC#1012EC CABLE	AWG.14–24	1000 FT. MAX. WITHOUT FACTORY APPROVAL	SEE NOTE 3
2	WHITE	RTD VOLTAGE HIGH				
3	GREEN	RTD VOLTAGE LOW				
4	RED	RTD CURRENT LOW				
5	BLUE	GROUND				

TB2 WIRING

PIN	COLOR	FUNCTION SEE NOTE 4	DESCRIPTION	WIRING	CABLE LENGTH	NOTES
1	BLACK	RTD CURRENT HIGH	RTD TEMPERATURE MEASUREMENT CHANNEL 2, T2 OR SUPPLY TEMP.	AWG.14–24	1000 FT. MAX. WITHOUT FACTORY APPROVAL	SEE NOTE 3
2	WHITE	RTD VOLTAGE HIGH				
3	GREEN	RTD VOLTAGE LOW				
4	RED	RTD CURRENT LOW				
5	BLUE	GROUND				

TB3 WIRING

PIN	FUNCTION SEE NOTE 4	USE	DESCRIPTION	BEHAVIOR	LOAD	WIRING	CABLE LENGTH	NOTES
1	AUX.1 IN	Iin1 INPUT	ANALOG CURRENT INPUT REFERENCED TO METER GROUND	4 TO 20 mA	200 Ω	AWG.14–24	1000 FT. MAX. WITHOUT FACTORY APPROVAL	SEE NOTES 3, 5
2	AUX.1 COM	Iin1 COMMON						
3	AUX.2 IN	Iin2 INPUT						
4	AUX.2 COM	Iin2 COMMON						

TB4 WIRING

PIN	FUNCTION SEE NOTE 4	USE	DESCRIPTION	BEHAVIOR	LOAD	WIRING	CABLE LENGTH	NOTES
1	AUX.3 IN	Iin1 INPUT	ANALOG CURRENT INPUT REFERENCED TO METER GROUND	4 TO 20 mA	200 Ω	AWG.14–24	1000 FT. MAX. WITHOUT FACTORY APPROVAL	SEE NOTES 3, 5
2	AUX.3 COM	Iin1 COMMON						
3	AUX.4 IN	Iin2 INPUT						
4	AUX.4 COM	Iin2 COMMON						

CONTROLLED DRAWING
CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL

NOTES:

1. TERMINAL BLOCK TB1, TB2 , TB3 AND TB4 ARE LUG–LESS WIRE CLAMP TYPE, PROVIDING RELIABLE CONNECTION TO STRIPPED STRANDED WIRE, AWG. #14–24.
2. SET METER AND INSTRUMENTATION POWER TO OFF WHEN INSERTING OR REMOVING THE MODULE OR WHEN MAKING CONNECTIONS TO TB1, TB2 , TB3 AND TB4.
3. REFER TO THE 1010 FIELD MANUAL FOR ADDITIONAL INSTALLATION INFORMATION.
4. USE 1012ECN SERIES CABLES TO CONNECT BETWEEN TEMPERATURE SENSOR INPUT WIRING TERMINALS TB1 AND TB2 AND 991T OR 1011T SERIES TEMPERATURE SENSORS. NOTE SUPPLY AND RETURN TEMPERATURE SENSOR DESIGNATIONS WHEN USED WITH A 1010E SERIES ENERGY FLOW COMPUTER.
5. NET LOAD IS 335 OHMS WHEN SAFETY BARRIERS ARE USED.

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES (MM)
TOLERANCES ON–

INCHES	(MM)
± .1	± 2

MATERIAL:

FINISH:

CONTRACT NO.

DR	H.J	DATE 7/18/98
CHK		DATE
ENG		DATE
PROD		DATE
APPD		DATE

CERTIFIED

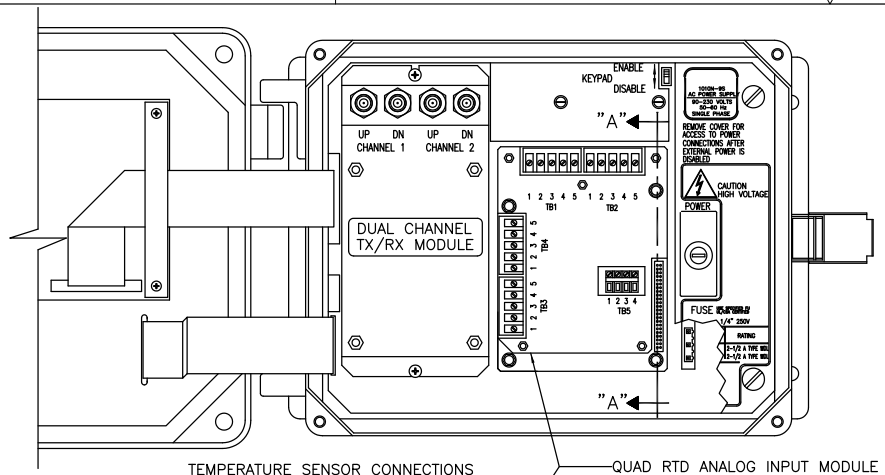
DATE

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Siemens Energy & Automation, Inc.
Process Instrumentation Business Unit
CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788

INSTALLATION DRAWING ANALOG INPUT MODULE

SIZE	CODE IDENT NO.		REV.
C	21614	1010N-5S2-7	D
SCALE: NONE	WT.	SHEET 1 OF 1	

CN#5160, #5269



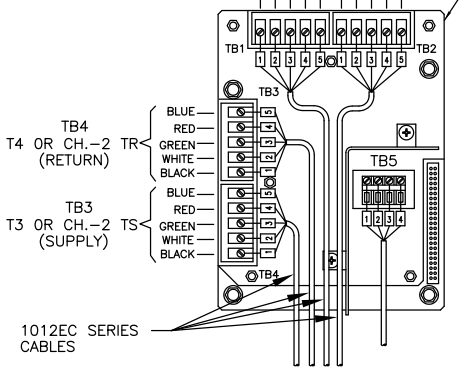
QUAD RTD ANALOG INPUT MODULE (SHOWN WITH SCREW, COVER AND I/O MODULE 1010N–2[] REMOVED)

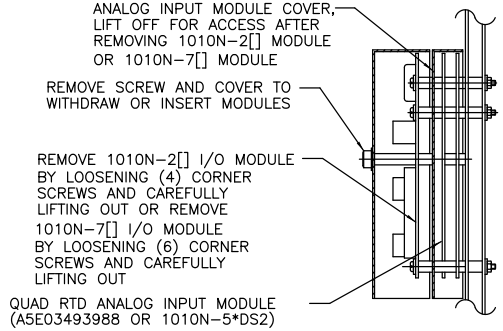
TEMPERATURE SENSOR CONNECTIONS (SEE NOTE 4)

TB1 T1 OR CH.–1 TS (SUPPLY)

TB2 T2 OR CH.–1 TR (RETURN)

ALTERNATE COLOR CODE FOR CERTAIN 1012EC CABLES:
WHITE = ORANGE
GREEN = BROWN





SECTION "A–A"

TB1 WIRING

PIN	COLOR	FUNCTION SEE NOTE 4	DESCRIPTION	WIRING	CABLE LENGTH	NOTES
1	BLACK	RTD CURRENT HIGH	RTD TEMPERATURE MEASUREMENT T1 OR CHANNEL–1 TS (SUPPLY TEMPERATURE)	AWG.14–24	1000 FT. MAX. WITHOUT FACTORY APPROVAL	SEE NOTE 3
2	WHITE	RTD VOLTAGE HIGH				
3	GREEN	RTD VOLTAGE LOW				
4	RED	RTD CURRENT LOW				
5	BLUE	GROUND				

TB2 WIRING

PIN	COLOR	FUNCTION SEE NOTE 4	DESCRIPTION	WIRING	CABLE LENGTH	NOTES
1	BLACK	RTD CURRENT HIGH	RTD TEMPERATURE MEASUREMENT T2 OR CHANNEL–1 TR (RETURN TEMPERATURE)	AWG.14–24	1000 FT. MAX. WITHOUT FACTORY APPROVAL	SEE NOTE 3
2	WHITE	RTD VOLTAGE HIGH				
3	GREEN	RTD VOLTAGE LOW				
4	RED	RTD CURRENT LOW				
5	BLUE	GROUND				

TB3 WIRING

PIN	COLOR	FUNCTION SEE NOTE 4	DESCRIPTION	WIRING	CABLE LENGTH	NOTES
1	BLACK	RTD CURRENT HIGH	RTD TEMPERATURE MEASUREMENT T3 OR CHANNEL–2 TS (SUPPLY TEMPERATURE)	AWG.14–24	1000 FT. MAX. WITHOUT FACTORY APPROVAL	SEE NOTE 3
2	WHITE	RTD VOLTAGE HIGH				
3	GREEN	RTD VOLTAGE LOW				
4	RED	RTD CURRENT LOW				
5	BLUE	GROUND				

TB4 WIRING

PIN	COLOR	FUNCTION SEE NOTE 4	DESCRIPTION	WIRING	CABLE LENGTH	NOTES
1	BLACK	RTD CURRENT HIGH	RTD TEMPERATURE MEASUREMENT T4 OR CHANNEL–2 TR (RETURN TEMPERATURE)	AWG.14–24	1000 FT. MAX. WITHOUT FACTORY APPROVAL	SEE NOTE 3
2	WHITE	RTD VOLTAGE HIGH				
3	GREEN	RTD VOLTAGE LOW				
4	RED	RTD CURRENT LOW				
5	BLUE	GROUND				

TB5 WIRING

PIN	FUNCTION SEE NOTE 4	USE	DESCRIPTION	BEHAVIOR	LOAD	WIRING	CABLE LENGTH	NOTES
1	AUX.1 IN	Iin1 INPUT	ANALOG CURRENT INPUT REFERENCED TO METER GROUND	4 TO 20 mA	200 Ω	AWG.14–24	1000 FT. MAX. WITHOUT FACTORY APPROVAL	SEE NOTES 3, 5
2	AUX.1 COM	Iin1 COMMON						
3	AUX.2 IN	Iin2 INPUT						
4	AUX.2 COM	Iin2 COMMON						

NOTES:

1. TERMINAL BLOCK TB1, TB2, TB3, TB4 AND TB5 ARE LUG–LESS WIRE CLAMP TYPE, PROVIDING RELIABLE CONNECTION TO STRIPPED STRANDED WIRE, AWG. #14–24.
2. SET METER AND INSTRUMENTATION POWER TO OFF WHEN INSERTING OR REMOVING THE MODULE OR WHEN MAKING CONNECTIONS TO TB1, TB2, TB3, TB4 AND TB5
3. REFER TO THE 1010 FIELD MANUAL FOR ADDITIONAL INSTALLATION INFORMATION.
4. USE 1012ECN SERIES CABLES TO CONNECT BETWEEN TEMPERATURE SENSOR INPUT WIRING TERMINALS TB1 THRU TB4 AND 991T OR 1011T SERIES TEMPERATURE SENSORS. NOTE SUPPLY AND RETURN TEMPERATURE SENSOR DESIGNATIONS WHEN USED WITH A 1010E SERIES ENERGY FLOW COMPUTER.
5. FOR INSTALLATION IN HAZARDOUS AREAS SEE CONTROL DRAWING REFERENCED ON TRANSMITTER NAMEPLATE.

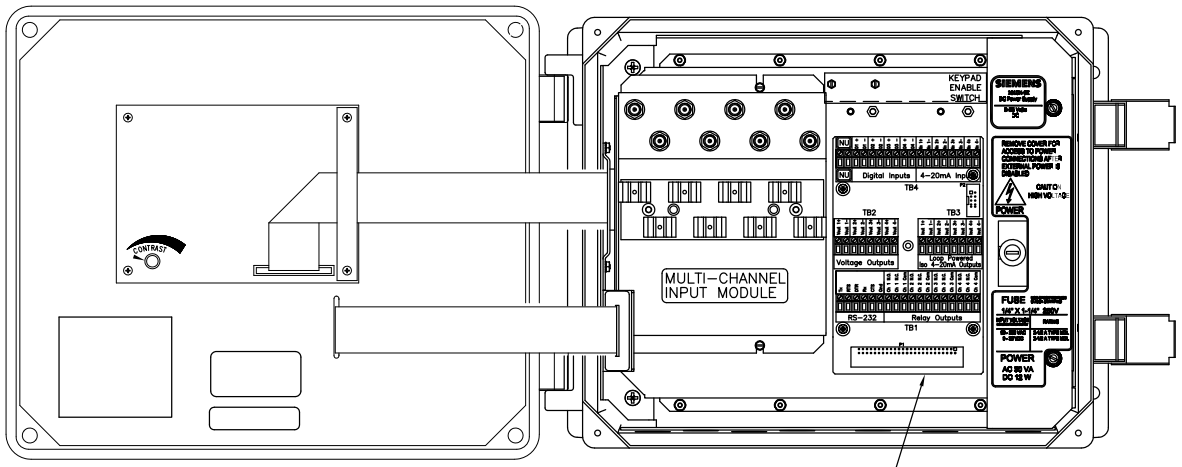
CONTROLLED DRAWING
CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL

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Hauppauge, NY 11788

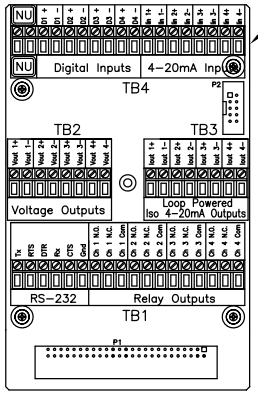
INSTALLATION DRAWING ANALOG INPUT MODULE

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON–
FRACTIONS DECIMAL ANGLES HOLES
± 1/64" XX±0.01 ±0°30' ±.003
XXX±0.005

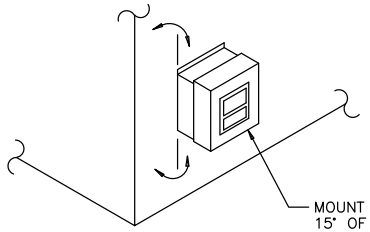
SAP MATERIAL NO.		REV
ITEM NO.		AS
DOCUMENT NO.	1010N - 5DS2 - 7	DS 06
DRAWN BY: H.Jenkins	DATE:7/18/98	SCALE: NONE SHEET 1 OF 1



1010N-8*MS2 I/O MODULE
(SHOWN WITH COVER REMOVED)
(SEE NOTE 3)



RELAY OUTPUTS OPTIONS	FDC RELAY OPTION CODE
MERCURY WETTED, FORM 1A	K1
DRY REED, FORM 1C	K



MOUNT FLOW COMPUTER WITHIN
15° OF VERTICAL IF MERCURY WETTED
RELAY OPTION IS INCLUDED
(SEE NOTE 6)

NOTES: (CONT'D ON SHT. 2)

1. TERMINAL BLOCKS TB1, TB2, TB3 AND TB4 ARE LUG-LESS WIRE CLAMP TYPE, PROVIDING RELIABLE CONNECTION TO STRIPPED STRANDED WIRE, AWG. #14-24.
2. RELAY TYPE VARIES WITH FLOW COMPUTER OPTION CODE. SEE TABLE, ZONE B4.
3. RELAY CLOSURES AND ANALOG OUTPUTS ARE USER PROGRAMMABLE THROUGH THE 1010 INSTALLATION MENU. SEE THE 1010 FIELD MANUAL AND SHT.2 FOR LIST OF ASSIGNABLE FUNCTIONS.
4. SET METER AND INSTRUMENTATION POWER TO OFF WHEN INSERTING OR REMOVING THE MODULE AND MAKING CONNECTIONS TO TB1, TB2, TB3 AND TB4.
5. REFER TO THE 1010 FIELD MANUAL FOR ADDITIONAL INSTALLATION INFORMATION.
6. WHEN SUPPLIED WITH MERCURY WETTED RELAYS, MOUNT FLOW COMPUTER WITHIN 15° OF VERTICAL, BOTH PLANES, FOR PROPER RELAY OPERATION. (SEE ZONE B2).

RELATED DRAWING
CHANGES TO THIS DRAWING REQUIRE CERTIFICATION OF CONFORMANCE WITH RELATED CONTROLLED DRAWINGS

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Hauppauge, NY 11788

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON-
FRACTIONS ± 1/64" DECIMAL XX±0.01 XXX±0.005 ANGLES ±0°30' HOLES ±.003

INSTALLATION DRAWING I/O MODULE

SAP MATERIAL NO.			REV —
ITEM NO.			AS —
DOCUMENT NO.	1010N-8MS2-7		DS 03
DRAWN BY: H.Jenkins	DATE: 1/14/2012	SCALE: NONE	SHEET 1 OF 2

TB1 - RS232 / RELAY OUTPUTS

PIN #	SIGNAL	FUNCTION	DESCRIPTION	USE	LOAD	WIRING	CABLE LENGTH	NOTES
1	Tx	RS232 TRANSMIT	STANDARD RS232 SIGNALS	STANDARD RS232 COMMUNICATION PORT		SHIELDED DATA CABLE 24 GA. MINIMUM	50 FT. MAX. AS PER EIA RS232 FOR GREATER RANGE, CONSULT FACTORY, SEE NOTE 7	
2	RTS	RS232 REQUEST TO SEND						
3	DTR	RS232 DATA TERM. READY						
4	Rx	RS232 RECEIVE						
5	CTS	RS232 CLEAR TO SEND						
6	GND	GROUND						
7	CH.1 A	RELAY 1 NORMALLY OPEN	ASSIGNMENT OF RELAY FUNCTIONS IS UNDER 1010 MENU CONTROL	ALARM OR CONTROL	DRY REED RELAY 3VA 30VDC .25A MAX. NON-INDUCTIVE	AS REQ'D	AS REQ'D	ALL RELAYS ASSIGNED AS ALARMS ARE ENERGIZED WHILE NON-ALARMED STATUS EXISTS. COUNT RELAYS ARE ENERGIZED FOR 200MS FOR EACH TOTALIZER INCREMENT. SEE NOTE 8 FLOW COMPUTERS WITH MERCURY WETTED RELAYS INCLUDE NORMALLY OPEN RELAY FUNCTION ONLY. (NOTE 10)
8	CH.1 B	RELAY 1 NORMALLY CLOSED						
9	CH.1 C	RELAY 1 COMMON						
10	CH.2 A	RELAY 2 NORMALLY OPEN						
11	CH.2 B	RELAY 2 NORMALLY CLOSED						
12	CH.2 C	RELAY 2 COMMON						
13	CH.3 A	RELAY 3 NORMALLY OPEN						
14	CH.3 B	RELAY 3 NORMALLY CLOSED						
15	CH.3 C	RELAY 3 COMMON						
16	CH.4 A	RELAY 4 NORMALLY OPEN			MERCURY WETTED RELAY 50VA 70VDC (PEAK AC) 0.5A MAX. NON-INDUCTIVE			
17	CH.4 B	RELAY 4 NORMALLY CLOSED						
18	CH.4 C	RELAY 4 COMMON						

TB2 - VOLTAGE OUTPUTS

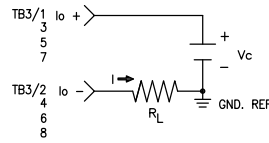
PIN #	SIGNAL	FUNCTION	DESCRIPTION	USE	LOAD	WIRING	CABLE LENGTH	NOTES
1	Vout 1+	0-10 VOLT ANALOG OUTPUT	Vo1 THROUGH Vo4 ARE VOLTAGE DRIVE SIGNALS FOR Io1 THROUGH Io4 RESPECTIVELY (SEE TB3)	SYSTEM ANALOG VOLTAGE OUTPUTS	10KΩ MIN.	24 GA. MIN.	1000 FT. MAX. WITHOUT FACTORY APPROVAL	ASSIGNABLE TO SYSTEM VARIABLES VIA MENU CONTROL OVER Io ASSIGNMENTS.
2	Vout 1-	REF. GROUND						
3	Vout 2+	0-10 VOLT ANALOG OUTPUT						
4	Vout 2-	REF. GROUND						
5	Vout 3+	0-10 VOLT ANALOG OUTPUT						0 TO 10 VDC NORMAL -.3 TO 0 VOLT UNDER FAULT CONDITIONS
6	Vout 3-	REF. GROUND						
7	Vout 4+	0-10 VOLT ANALOG OUTPUT						
8	Vout 4-	REF. GROUND						

TB3 - ISO 4-20mA OUTPUTS

PIN #	SIGNAL	FUNCTION	DESCRIPTION	USE	LOAD	WIRING	CABLE LENGTH	NOTES
1	Iout 1+	ISOLATED LOOP SUPPLY	4-20mA PROPORTIONAL TO SPANNED, SELECTED VARIABLE (LOOP POWER)	ASSIGNABLE (AND SPANNABLE) TO ALL SYSTEM VARIABLES UNDER MENU CONTROL	1000Ω MAX. WHEN USING 24VDC LOOP SUPPLY 320 omhs MAX. WHEN SAFETY BARRIERS USED PER 1010-304	SHIELDED 24 GA. INSTRUMENT CABLE	1000 FT. MAX. WITHOUT FACTORY APPROVAL	REF. SCHEMATIC "A" CONNECT USER LOOP SUPPLY TO +24 VDC (NOTE 9)
2	Iout 1-	ISOLATED LOOP RETURN						
3	Iout 2+	ISOLATED LOOP SUPPLY						
4	Iout 2-	ISOLATED LOOP RETURN						
5	Iout 3+	ISOLATED LOOP SUPPLY						
6	Iout 3-	ISOLATED LOOP RETURN						
7	Iout 4+	ISOLATED LOOP SUPPLY						
8	Iout 4-	ISOLATED LOOP RETURN						

TB4 - ANALOG/DIGITAL INPUTS

PIN #	SIGNAL	FUNCTION	DESCRIPTION	USE	LOAD	WIRING	CABLE LENGTH	NOTES
1	———	NO CONNECTION						
2	———	NO CONNECTION						
3	DI 1 +	DIGITAL INPUT	CHANNEL 1 NOTOT	SUSPENDS CHANNEL TOTALIZATION	SHORT TO RETURN OR LOGIC LOW TO ACTIVATE	24 GA. MIN.	1000 FT. MAX. WITHOUT FACTORY APPROVAL	LOGIC LEVEL STATES: HIGH: 5 TO 3 VOLTS LOW: 0 TO 1 VOLT
4	DI -	RETURN	COMMON					
5	DI 2 +	DIGITAL INPUT	CHANNEL 2 NOTOT					
6	DI 2 -	RETURN	COMMON					
7	DI 3 +	DIGITAL INPUT	CHANNEL 3 NOTOT					
8	DI 3 -	RETURN	COMMON					
9	DI 4 +	DIGITAL INPUT	CHANNEL 4 NOTOT					
10	DI 4 -	RETURN	COMMON					
11	Iin 1+	AUX.1 IN	4-20mA ANALOG CURRENT INPUT REFERENCED TO SYSTEM GROUND (NON ISOLATED)	USER ASSIGNABLE DEPENDING ON FLOW COMPUTER MODEL	200Ω RESISTIVE, APPLIED VOLTAGE MAY NOT BE NEGATIVE OR GREATER THAN +15VDC ABOVE SYSTEM GROUND 335Ω WHEN SAFETY, BARRIERS USED PER 1010-304	24 GA. MIN.	1000 FT. MAX. WITHOUT FACTORY APPROVAL	REF. SCHEMATIC "B"
12	Iin 1-	AUX.1 RETURN						
13	Iin 2+	AUX.2 IN						
14	Iin 2-	AUX.2 RETURN						
15	Iin 3+	AUX.3 IN						
16	Iin 3-	AUX.3 RETURN						
17	Iin 4+	AUX.4 IN						
18	Iin 4-	AUX.4 RETURN						



Vc: 24VDC (USER SUPPLY)

I = 4-20mA

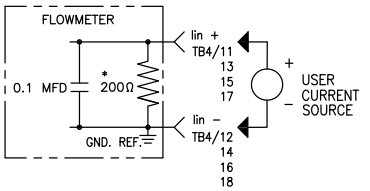
MAXIMUM R_L: $\frac{Vc - 4}{0.02}$ Ω

R_L:1000Ω max.

WHEN CONNECTED PER 1010-304 SAFETY BARRIER RESISTANCE OF 680Ω NET REDUCES R_L MAX. TO 320Ω

R_L = LOOP WIRE RESISTANCE PLUS USER'S INPUT LOAD RESISTANCE

SCHEMATIC "A"
ISOLATED 4-20mA OUTPUT



DO NOT EXCEED +15 VDC OR REVERSE POLARITY

*WHEN CONNECTED PER 1010-304, SAFETY BARRIER INCREASES SERIES RESISTANCE TO 335Ω TOTAL

SCHEMATIC "B"
4-20mA ANALOG INPUT

NOTES: (CONT'D FROM SHT. 1)

7. RS-232 RANGE CAN BE INCREASED BY:
   a) USE OF SHORT HAUL MODEMS.
   b) USE OF SPECIAL DATA CABLES AND/OR SLOWER DATA RATES.
   c) USE OF TELEPHONE LINE MODEM.

8. LOAD CAPABLITY VARIES WITH SUPPLIED VOLTAGE. MAXIMUM LOAD FIGURES INCLUDE WIRING.

9. RELAY VOLTAGE CURRENT LIMITED WHEN SAFETY BARRIERS USED PER 1010-304.

RELATED DRAWING
CHANGES TO THIS DRAWING REQUIRE CERTIFICATION OF CONFORMANCE WITH RELATED CONTROLLED DRAWINGS

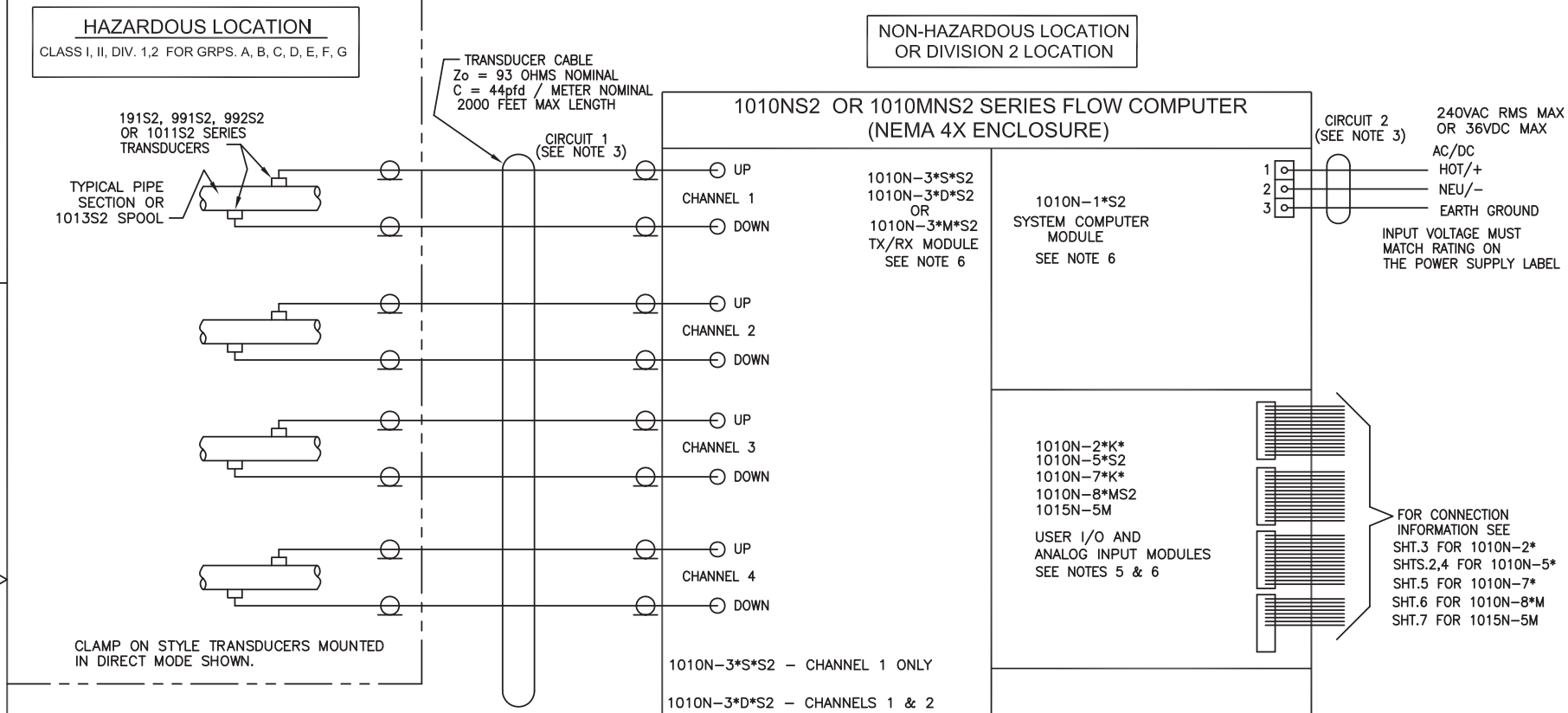
SIEMENS
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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON-
FRACTIONS ± 1/64" DECIMAL XX±0.01 XXX±0.005 ANGLES ±0°30' HOLES ±.003

DRAWN BY: H.Jenkins

INSTALLATION DRAWING I/O MODULE

SAP MATERIAL NO.	———	REV —
ITEM NO.	———	AS —
DOCUMENT NO.	1010N-8MS2-7	DS 03
DATE: 1/14/2012	SCALE: NONE	SHEET 2 OF 2



NOTES:

1. WARNING: SUBSTITUTION WITH UNSPECIFIED COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
   1.1. MODEL –S2 TRANSDUCERS ARE RATED:
   INTRINSICALLY SAFE FOR CL I, II, DIV 1, GROUPS A, B, C, D, E, F, G
   NON–INCENDIVE FOR CL I, DIV 2, GROUPS A, B, C, D
   SUITABLE FOR CL II, DIV 2, GROUPS E, F, G
   1.2. MODEL 1010NS2 AND 1010MNS2 FLOW COMPUTERS ARE RATED:
   AEx [ia] AND CLASS I, ZONE 2, AEx nC [ia] IIC T5
   ASSOCIATED EQUIPMENT, INTRINSICALLY SAFE CONNECTIONS FOR CL I, DIV 1, GPS A,B,C,D, CL II, DIV 1 GPS E,F,G
   SUITABLE FOR CL I, DIV 2, GPS A,B,C,D AND CL II, DIV 2, GPS E,F,G
2. USE 1010N MANUALS FOR OPERATION AND MAINTENANCE INSTRUCTIONS.
3. CIRCUITS 1, 2, AND 3 MUST BE IN SEPARATE CONDUIT.
4. ALL CASE CONDULET OPENINGS ARE TO USE WEATHER PROOF SEALS.
5. DATA/CONTROL SIGNAL CONNECTIONS ARE MADE ON 1015N–5M, 1010N–2*K*, 1010N–7*K* OR 1010N–8*MS2 MODULES. 1015N–5M IS ORDERED SEPARATELY, OTHER INCLUDED MODULES VARY WITH FLOW COMPUTER MODEL.
6. MODULE PART NUMBER SUFFIX (*) MAY VARY DEPENDING ON FLOW COMPUTER MODEL.

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON–
FRACTIONS– +/– 1/16
DECIMALS– XX+/–0.01 XXX+/–0.005
ANGLES– +/–0°30'

MATERIAL:

FINISH:

CONTROLLED DRAWING
CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL

DR	H.J	DATE 3/30/05
CHK		DATE
ENG		DATE
PROD		DATE
APPD		DATE

CERTIFIED

DATE

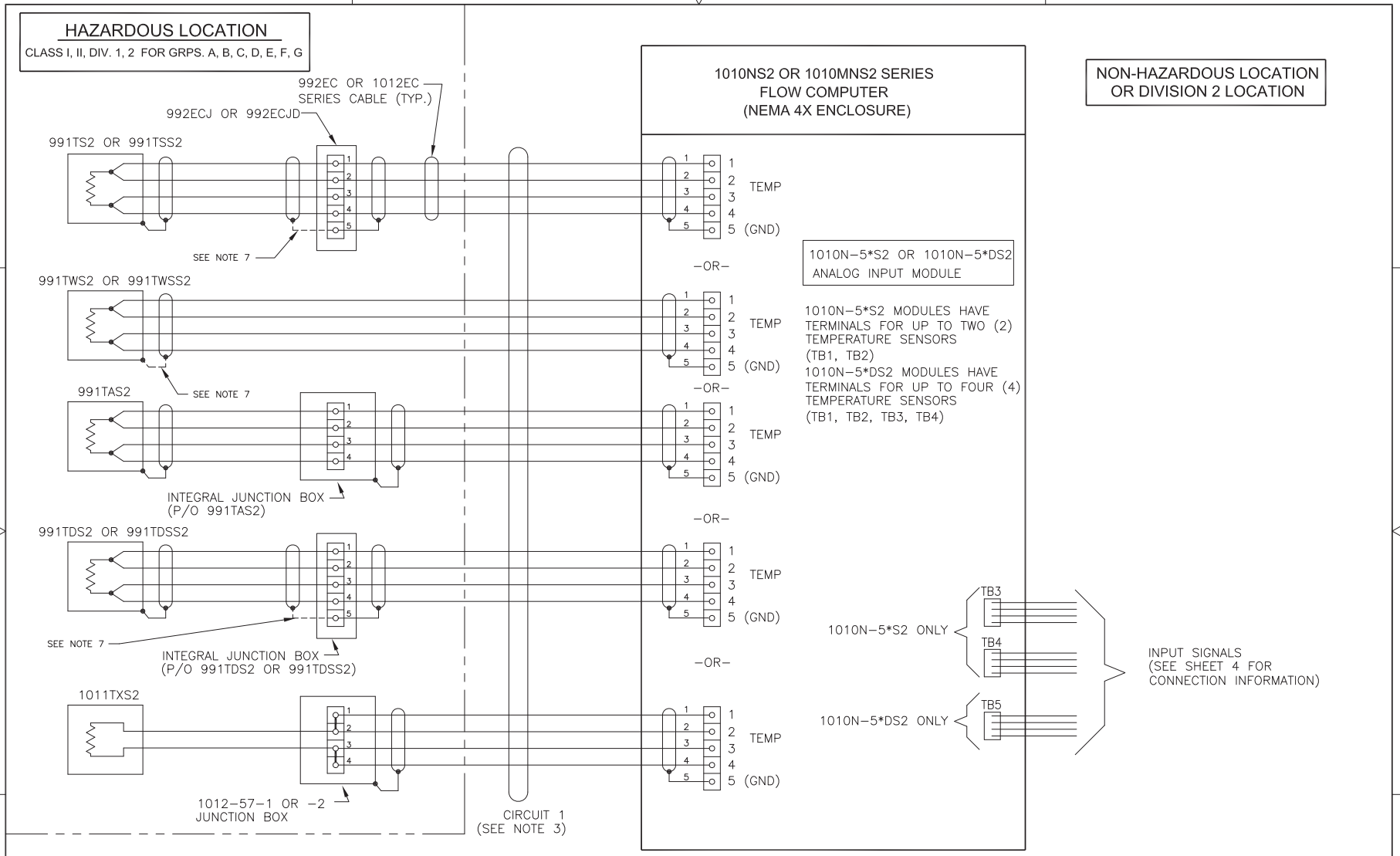
SIEMENS
Siemens Energy & Automation, Inc.
Process Instrumentation Business Unit
CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788

CONNECTION DIAGRAM
AGENCY APPROVED FOR HAZARDOUS AREA USE
1010NS2/1010MNS2 SERIES FLOW COMPUTER

SIZE	CODE IDENT NO.		REV.
C	21614	1010-304	14

SCALE: WT. SHEET 1 OF 7

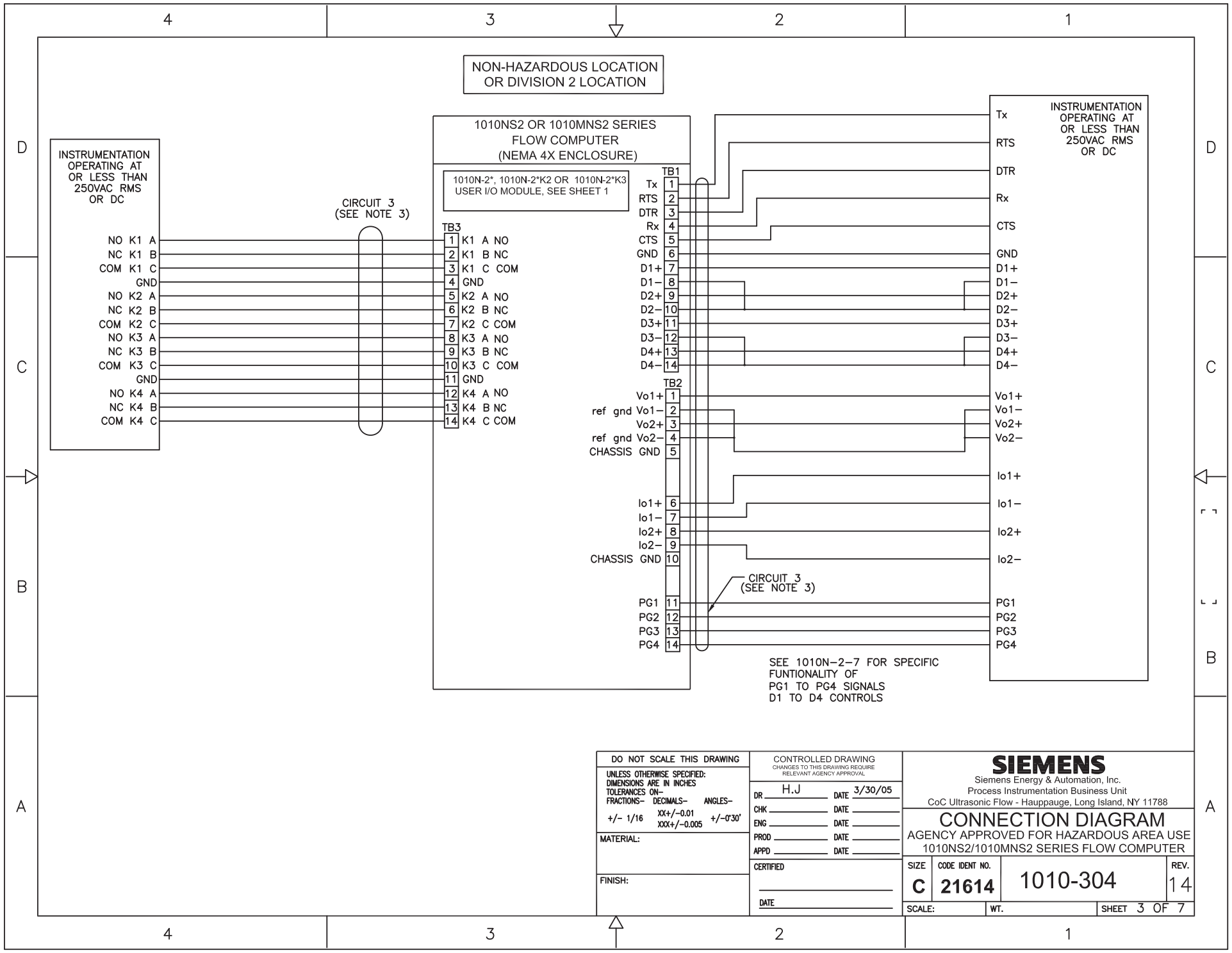
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NOTES:

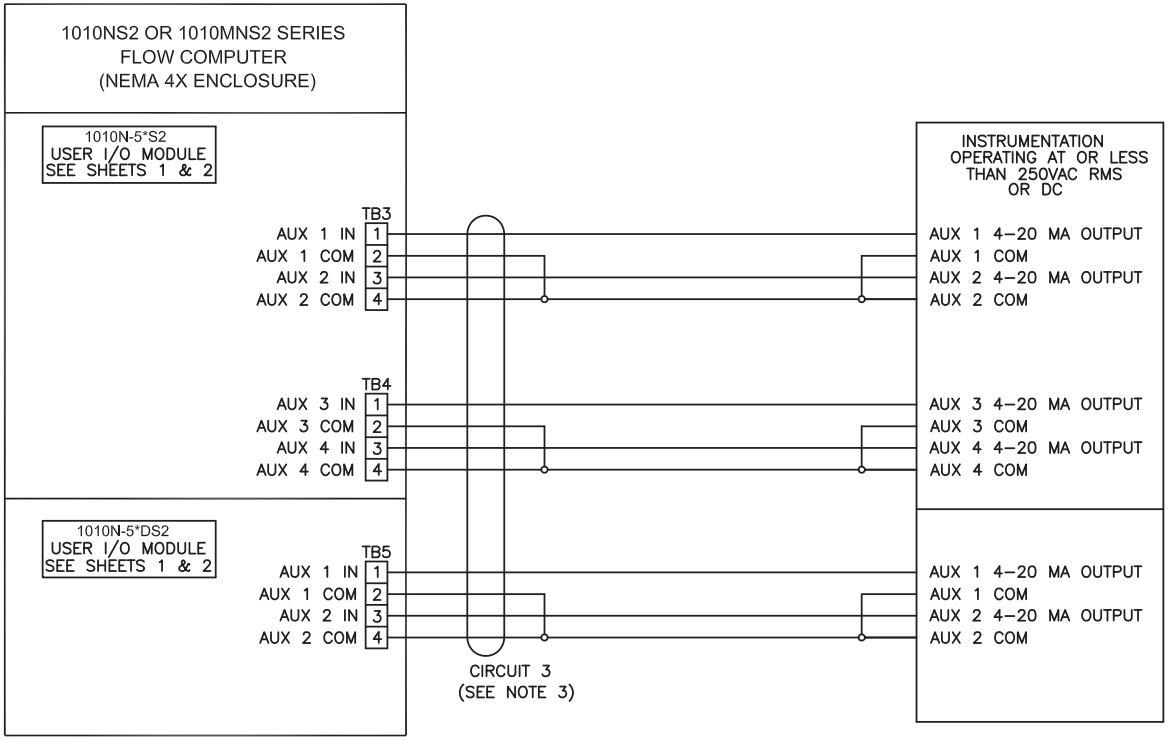
7. INDICATED SHIELD CONNECTIONS ARE OPTIONAL AND DO NOT AFFECT SAFETY.

DO NOT SCALE THIS DRAWING UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON- FRACTIONS- DECIMALS- ANGLES- +/- 1/16 XX+/-0.01 +/-0°30' XXX+/-0.005 MATERIAL: FINISH:	CONTROLLED DRAWING CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL DR H.J DATE 3/30/05 CHK DATE ENG DATE PROD DATE APPD DATE CERTIFIED DATE	SIEMENS Siemens Energy & Automation, Inc. Process Instrumentation Business Unit CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788 CONNECTION DIAGRAM AGENCY APPROVED FOR HAZARDOUS AREA USE 1010NS2/1010MNS2 SERIES FLOW COMPUTER SIZE C · CODE IDENT NO. 21614 · 1010-304 · REV. 14 SCALE: NONE · WT. · SHEET 2 OF 7

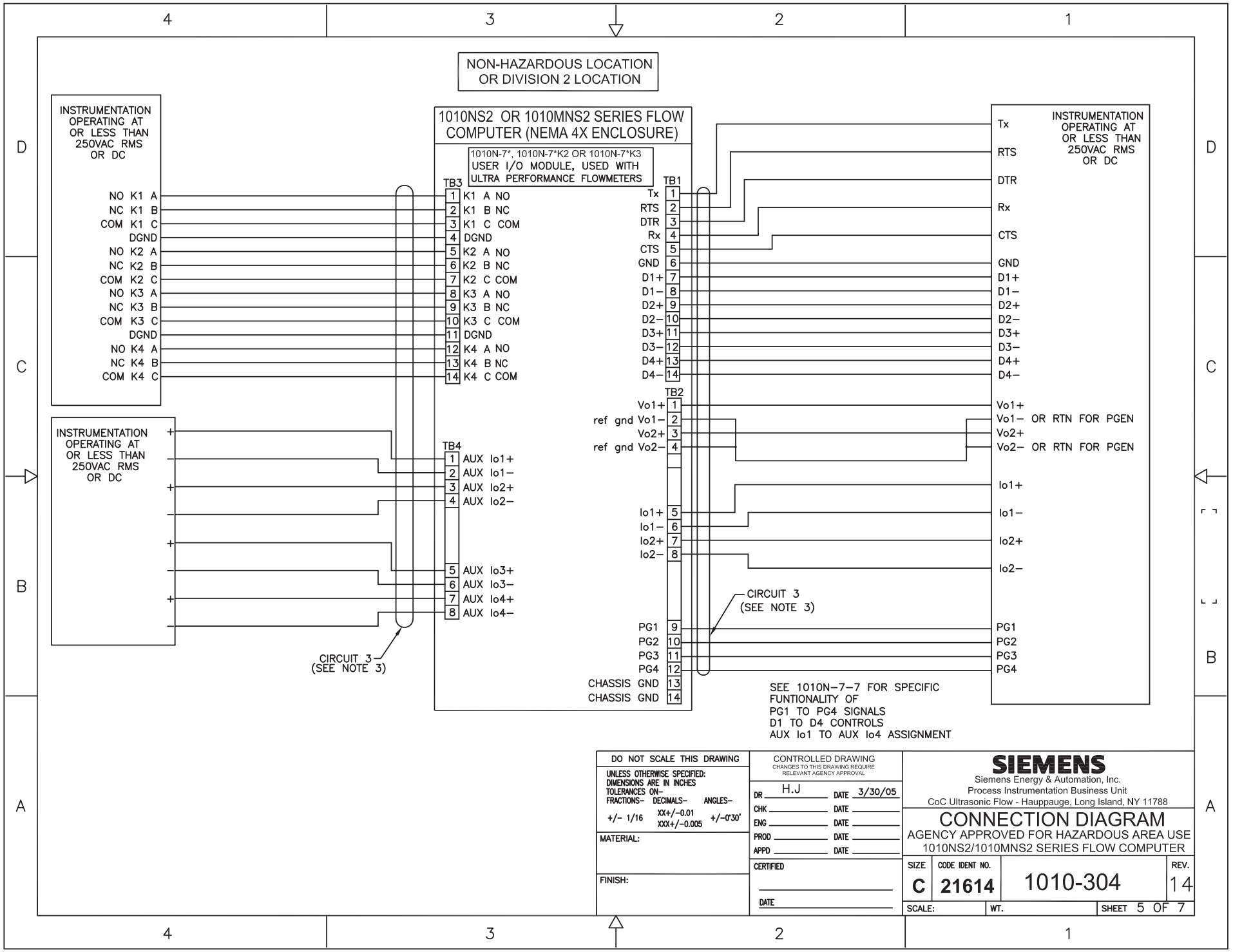


DO NOT SCALE THIS DRAWING UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON— FRACTIONS— DECIMALS— ANGLES— +/- 1/16 XX+/−0.01 +/−0°30' XXX+/−0.005 MATERIAL: FINISH:	CONTROLLED DRAWING CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL DR H.J DATE 3/30/05 CHK DATE ENG DATE PROD DATE APPD DATE CERTIFIED DATE	SIEMENS Siemens Energy & Automation, Inc. Process Instrumentation Business Unit CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788 CONNECTION DIAGRAM AGENCY APPROVED FOR HAZARDOUS AREA USE 1010NS2/1010MNS2 SERIES FLOW COMPUTER	
		SIZE C	CODE IDENT NO. 21614
		1010-304	REV. 14
		SCALE:	WT.
		SHEET 3 OF 7	

NON-HAZARDOUS LOCATION
OR DIVISION 2 LOCATION

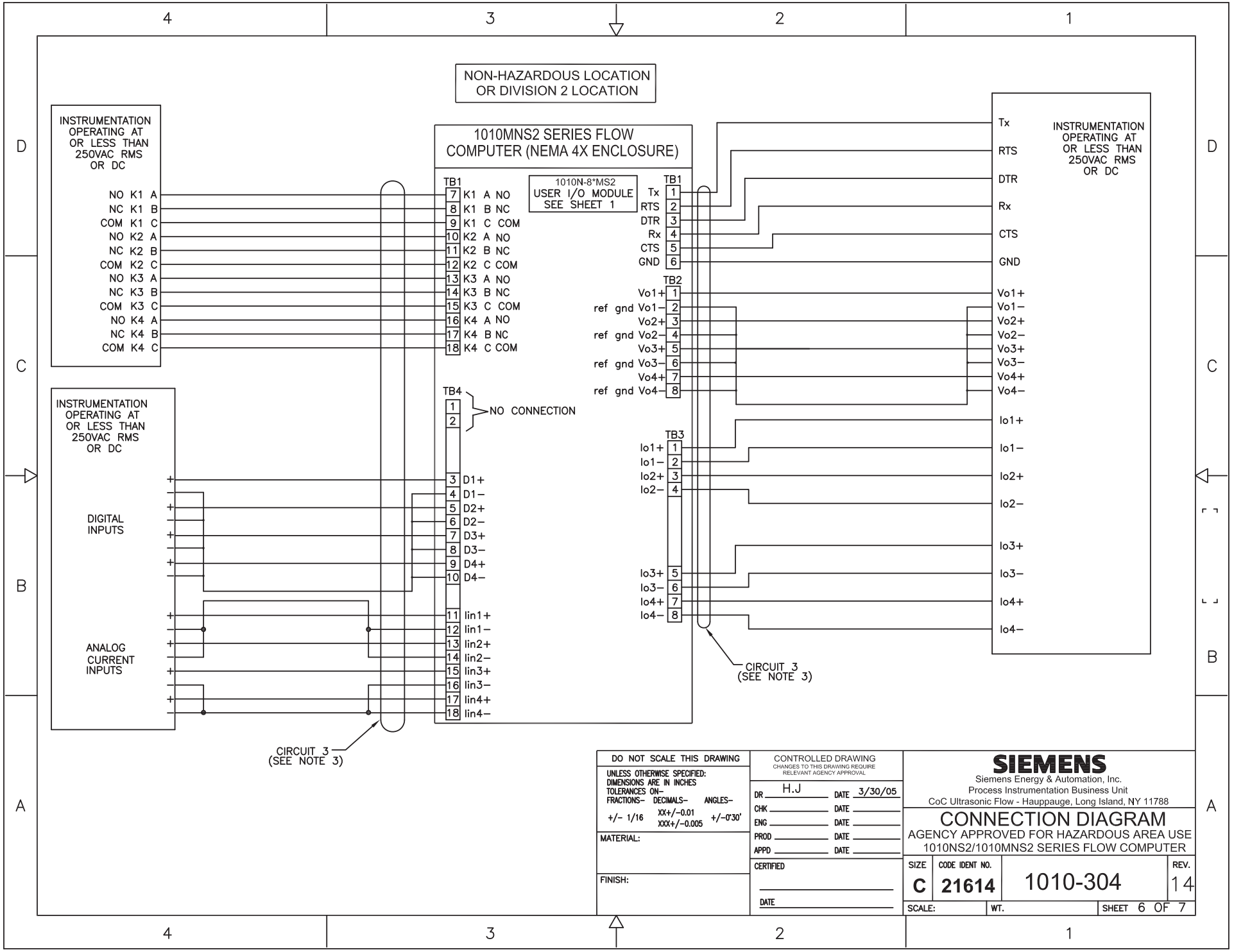


DO NOT SCALE THIS DRAWING UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON– FRACTIONS– DECIMALS– ANGLES– +/– 1/16 XX+/–0.01 +/–0°30' XXX+/–0.005 MATERIAL: FINISH:	CONTROLLED DRAWING CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL DR H.J DATE 3/30/05 CHK DATE ENG DATE PROD DATE APPD DATE CERTIFIED DATE	**SIEMENS** Siemens Energy & Automation, Inc. Process Instrumentation Business Unit CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788 CONNECTION DIAGRAM AGENCY APPROVED FOR HAZARDOUS AREA USE 1010NS2/1010MNS2 SERIES FLOW COMPUTER SIZE C · CODE IDENT NO. 21614 · 1010-304 · REV. 14 SCALE: · WT. · SHEET 4 OF 7

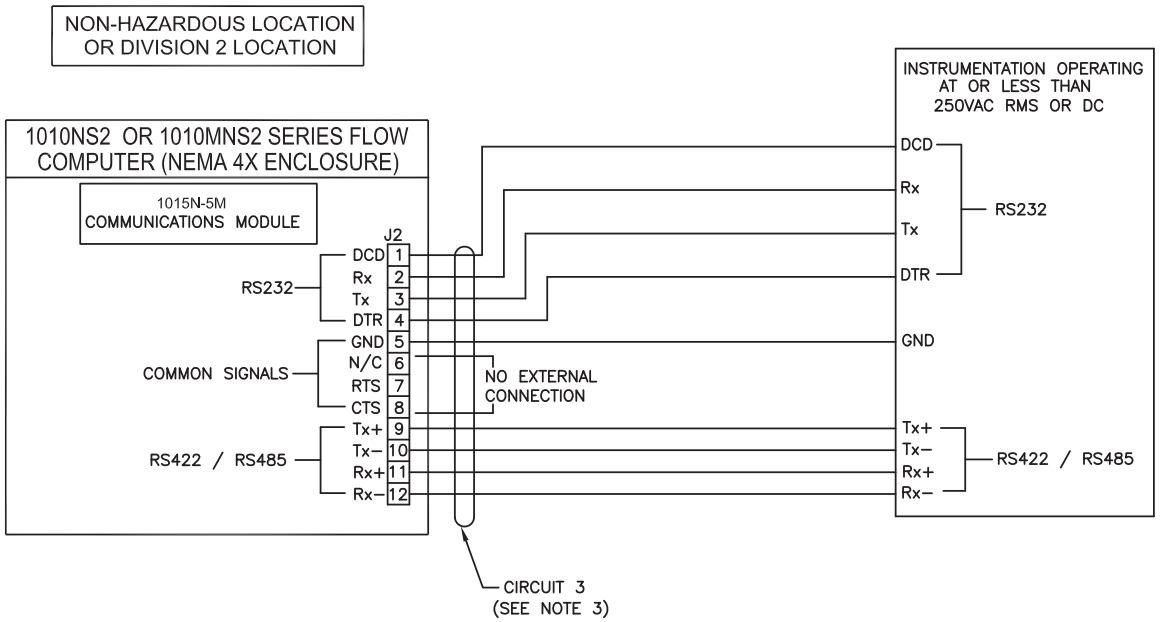


DO NOT SCALE THIS DRAWING UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON– FRACTIONS– +/– 1/16 DECIMALS– XX+/–0.01 XXX+/–0.005 ANGLES– +/–0°30' MATERIAL: FINISH:	CONTROLLED DRAWING CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL DR H.J DATE 3/30/05 CHK DATE ENG DATE PROD DATE APPD DATE CERTIFIED DATE	**SIEMENS** Siemens Energy & Automation, Inc. Process Instrumentation Business Unit CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788 CONNECTION DIAGRAM AGENCY APPROVED FOR HAZARDOUS AREA USE 1010NS2/1010MNS2 SERIES FLOW COMPUTER

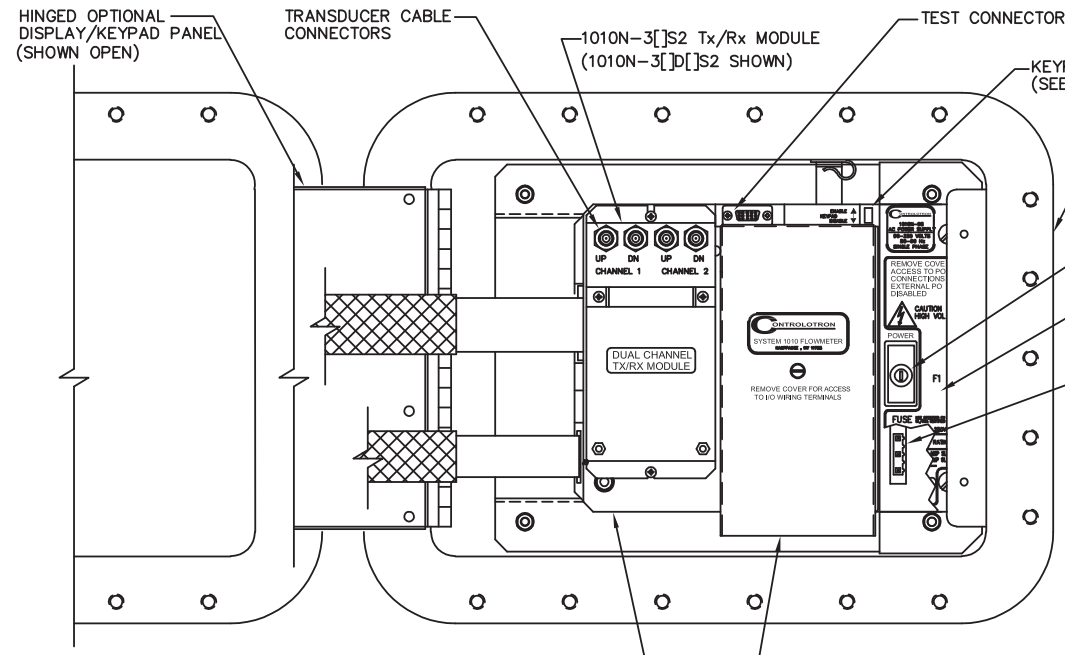
SIZE	CODE IDENT NO.		REV.
C	21614	1010-304	14
SCALE:	WT.	SHEET 5 OF 7	

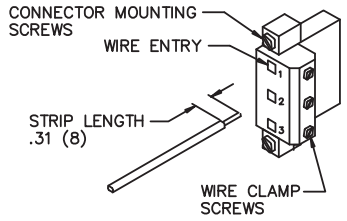


DO NOT SCALE THIS DRAWING UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON– FRACTIONS– DECIMALS– ANGLES– +/– 1/16 XX+/–0.01 +/–0°30' XXX+/–0.005 MATERIAL: FINISH:	CONTROLLED DRAWING CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL DR H.J DATE 3/30/05 CHK DATE ENG DATE PROD DATE APPD DATE CERTIFIED DATE	**SIEMENS** Siemens Energy & Automation, Inc. Process Instrumentation Business Unit CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788 CONNECTION DIAGRAM AGENCY APPROVED FOR HAZARDOUS AREA USE 1010NS2/1010MNS2 SERIES FLOW COMPUTER SIZE C · CODE IDENT NO. 21614 · 1010-304 · REV. 14 SCALE: · WT. · SHEET 6 OF 7

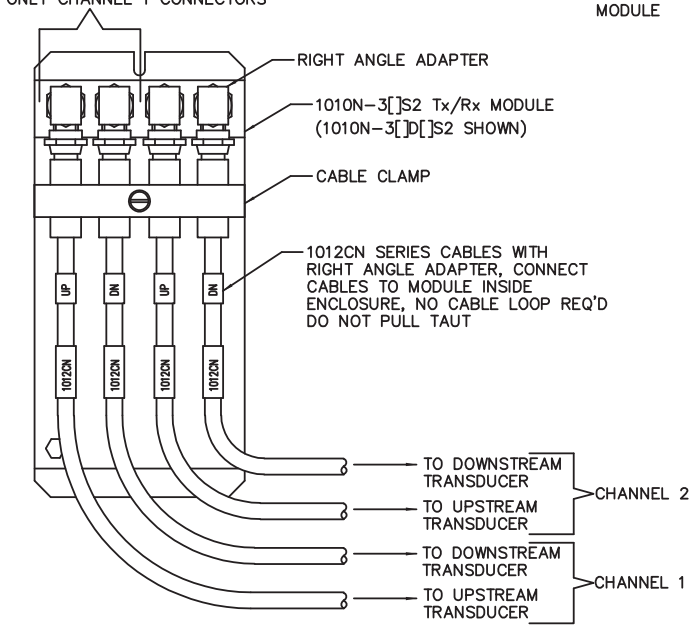


DO NOT SCALE THIS DRAWING UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON– FRACTIONS– DECIMALS– ANGLES– +/– 1/16 XX+/–0.01 +/–0°30' XXX+/–0.005 MATERIAL: FINISH:	CONTROLLED DRAWING CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL DR H.J DATE 3/30/05 CHK DATE ENG DATE PROD DATE APPD DATE CERTIFIED DATE	**SIEMENS** Siemens Energy & Automation, Inc. Process Instrumentation Business Unit CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788 CONNECTION DIAGRAM AGENCY APPROVED FOR HAZARDOUS AREA USE 1010NS2/1010MNS2 SERIES FLOW COMPUTER SIZE C · CODE IDENT NO. 21614 · 1010-304 · REV. 14 SCALE: · WT. · SHEET 7 OF 7





THE INPUT POWER CONNECTOR IS A PLUGGABLE, LUG–LESS WIRE CLAMP TYPE, PROVIDING RELIABLE TERMINATION OF STRIPPED STRANDED OR SOLID CONDUCTORS AWG.12–18 SECURE WITH SCREWS AFTER MATING CONNECTOR.



NOTES:

1. SEE DRAWING 1010WX–S2–8 OR 1010WXC5–S2–8 FOR OUTLINE DIMENSIONS.
2. SEE 1010 FIELD MANUAL AND APPROPRIATE TRANSDUCER INSTALLATION DRAWINGS FOR MOUNTING PROCEDURE.
3. DISABLE INSTRUMENT POWER BEFORE SERVICING POWER SUPPLY, POWER SWITCH / CIRCUIT BREAKER OR INPUT POWER CONNECTOR.
4. ALL TRANSDUCER CABLES ORIGINATING AT THE SAME FLOW COMPUTER MAY SHARE THE SAME CONDUIT. NO OTHER CABLES SHOULD BE HOUSED IN THE TRANSDUCER CABLE CONDUITS. CONNECT METALLIC CONDUITS TO EARTH GROUND.
5. OBSERVE FOLLOWING LIMITS WHEN INSTALLING TRANSDUCER CABLES IN CONDUIT:
   MAX. PULL TENSION: 80 lbs.
   MIN. BEND RADIUS: 2–1/2 INCHES
6. OPTIONAL DISPLAY AND KEYPAD APPEAR ON MODELS WITH GRAPHIC DISPLAY ONLY. KEYPAD SECURITY SWITCH CONTROLS ACCESS TO USER SELECTABLE PARAMETERS.

CHANGES TO THIS DOCUMENT REQUIRE SAFETY AGENCY APPROVAL

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES (MM) TOLERANCES ON–

INCHES	(MM)
± .1	± 2

CONTRACT NO.

DR	H.J	DATE 4/14/05
CHK		DATE
ENG		DATE
PROD		DATE
APPD		DATE

CERTIFIED

DATE

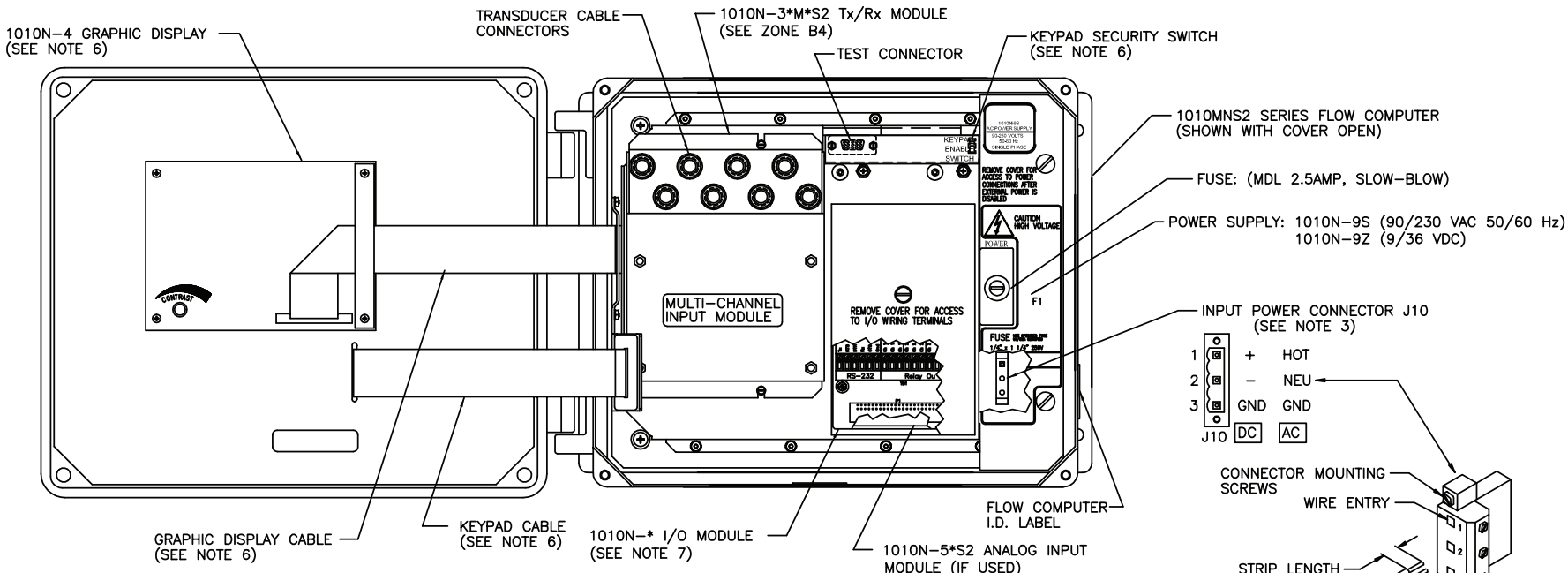
CONTROLOTRON
HAUPPAUGE , NY 11788

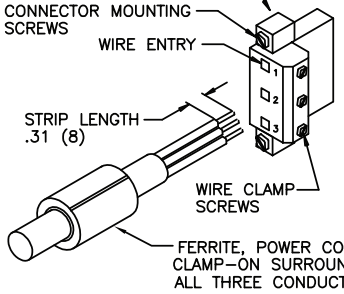
INSTALLATION DRAWING
1010 SERIES SINGLE/ DUAL CHAN. FLOW COMPUTER, AGENCY APPROVED

SIZE	CODE IDENT NO.		REV.
C	21614	1010WX-S2 - 7	A

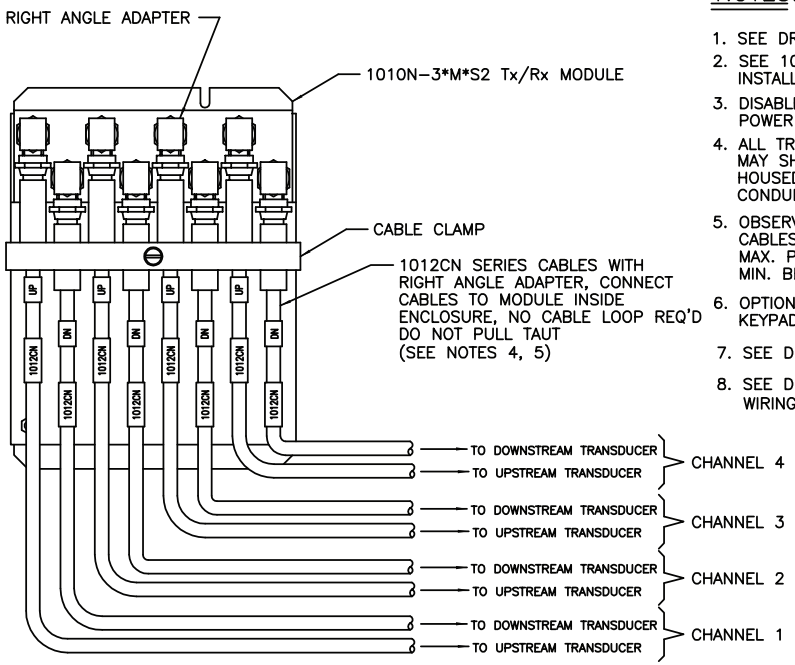
SCALE: NONE | WT. | SHEET 1 OF 1

FILE No: 1010WX–S2–7 rev.A
ER#1839





THE INPUT POWER CONNECTOR IS A PLUGGABLE, LUG–LESS WIRE CLAMP TYPE, PROVIDING RELIABLE TERMINATION OF STRIPPED STRANDED OR SOLID CONDUCTORS AWG.12–18 SECURE WITH SCREWS AFTER MATING CONNECTOR.



NOTES:

1. SEE DRAWING 1010MNS2–8 FOR OUTLINE DIMENSIONS.
2. SEE 1010 FIELD MANUAL AND APPROPRIATE TRANSDUCER INSTALLATION DRAWINGS FOR MOUNTING PROCEDURE.
3. DISABLE INSTRUMENT POWER BEFORE SERVICING POWER SUPPLY, POWER SWITCH / CIRCUIT BREAKER OR INPUT POWER CONNECTOR.
4. ALL TRANSDUCER CABLES ORIGINATING AT THE SAME FLOW COMPUTER MAY SHARE THE SAME CONDUIT. NO OTHER CABLES SHOULD BE HOUSED IN THE TRANSDUCER CABLE CONDUITS. CONNECT METALLIC CONDUITS TO EARTH GROUND.
5. OBSERVE FOLLOWING LIMITS WHEN INSTALLING TRANSDUCER CABLES IN CONDUIT:
   MAX. PULL TENSION: 80 lbs.
   MIN. BEND RADIUS: 2–1/2 INCHES
6. OPTIONAL DISPLAY AND KEYPAD APPEAR ON MODELS WITH GRAPHIC DISPLAY ONLY. KEYPAD SECURITY SWITCH CONTROLS ACCESS TO USER SELECTABLE PARAMETERS.
7. SEE DRAWING 1010N–2–7, 1010N–7–7 OR 1010N–8MS2–7 FOR USER I/O WIRING CONNECTIONS.
8. SEE DRAWING 1010N–5S2–7 OR 1010N–5DS2–7 FOR USER ANALOG INPUT WIRING CONNECTIONS.

CONTROLLED DRAWING
CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES (MM)
TOLERANCES ON–
INCHES (MM)
± .1 ± 2

CONTRACT NO.

DR H.J DATE 9/6/01
CHK DATE
ENG DATE
PROD DATE
APPD DATE

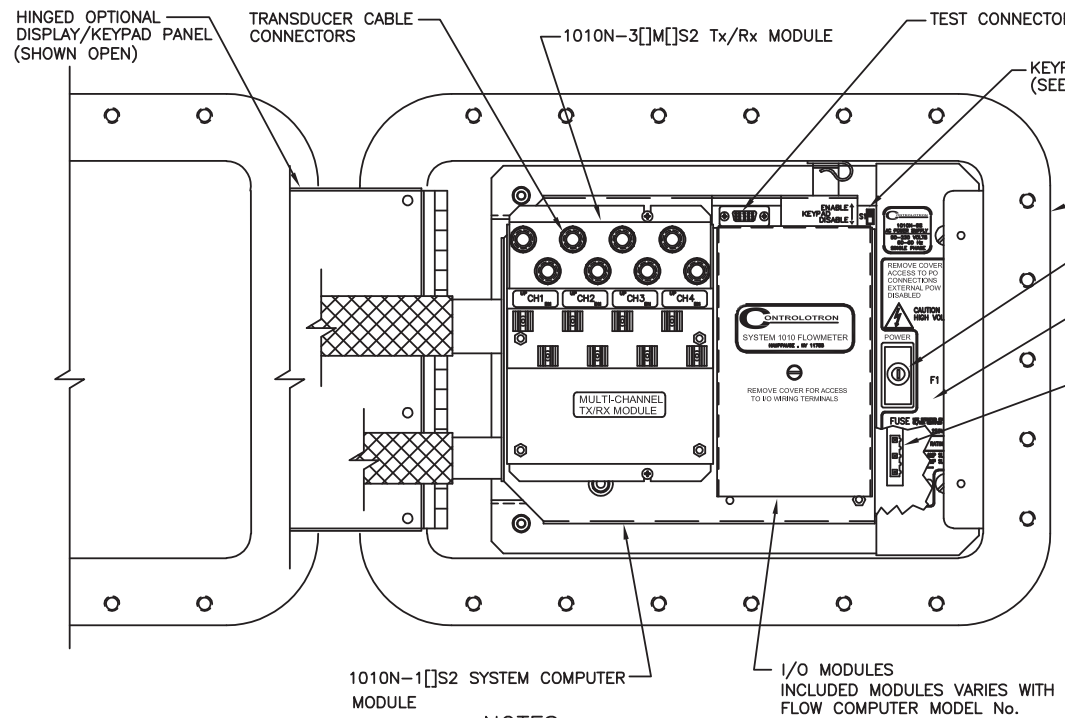
CERTIFIED
DATE

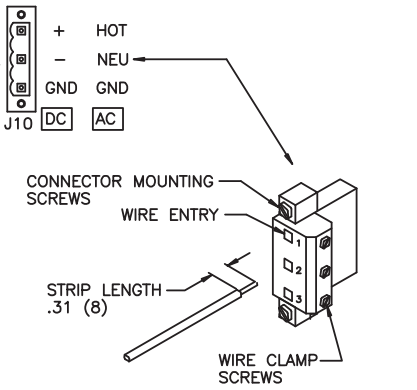
SIEMENS
Siemens Energy & Automation, Inc.
Process Instrumentation Business Unit
CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788

INSTALLATION DRAWING
1010 SERIES MULTI- CHANNEL FLOW COMPUTER, AGENCY APPROVED

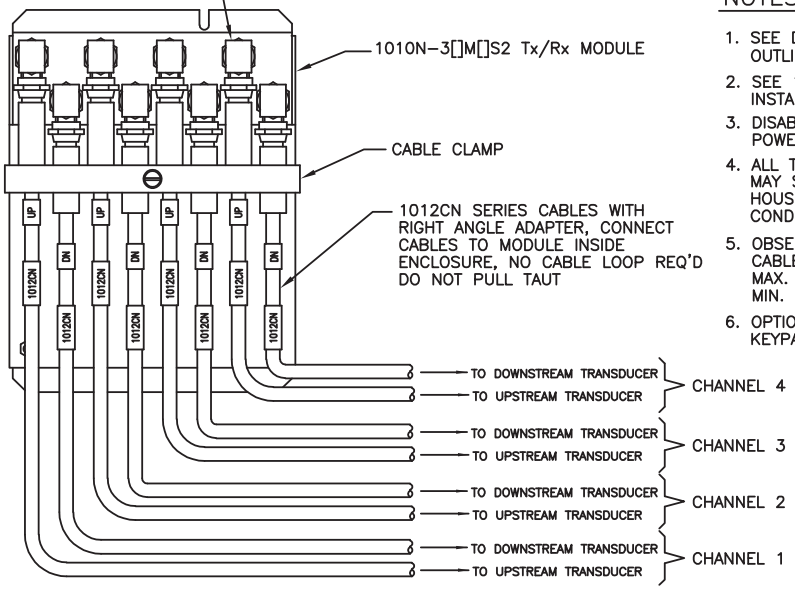
SIZE	CODE IDENT NO.		REV.
C	21614	1010MNS2 - 7	C
SCALE: NONE	WT.	SHEET 1 OF 1	

CN#5160, #5269





THE INPUT POWER CONNECTOR IS A PLUGGABLE, LUG–LESS WIRE CLAMP TYPE, PROVIDING RELIABLE TERMINATION OF STRIPPED STRANDED OR SOLID CONDUCTORS AWG.12–18 SECURE WITH SCREWS AFTER MATING CONNECTOR.



NOTES:

1. SEE DRAWING 1010WX–S2–8 OR 1010WXC5–S2–8 FOR OUTLINE DIMENSIONS.
2. SEE 1010 FIELD MANUAL AND APPROPRIATE TRANSDUCER INSTALLATION DRAWINGS FOR MOUNTING PROCEDURE.
3. DISABLE INSTRUMENT POWER BEFORE SERVICING POWER SUPPLY, POWER SWITCH / CIRCUIT BREAKER OR INPUT POWER CONNECTOR.
4. ALL TRANSDUCER CABLES ORIGINATING AT THE SAME FLOW COMPUTER MAY SHARE THE SAME CONDUIT. NO OTHER CABLES SHOULD BE HOUSED IN THE TRANSDUCER CABLE CONDUITS. CONNECT METALLIC CONDUITS TO EARTH GROUND.
5. OBSERVE FOLLOWING LIMITS WHEN INSTALLING TRANSDUCER CABLES IN CONDUIT:
   MAX. PULL TENSION: 80 lbs.
   MIN. BEND RADIUS: 2–1/2 INCHES
6. OPTIONAL DISPLAY AND KEYPAD APPEAR ON MODELS WITH GRAPHIC DISPLAY ONLY. KEYPAD SECURITY SWITCH CONTROLS ACCESS TO USER SELECTABLE PARAMETERS.

CHANGES TO THIS DOCUMENT REQUIRE SAFETY AGENCY APPROVAL

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES (MM)
TOLERANCES ON–
INCHES (MM)
± .1 ± 2

CONTRACT NO.

DR H.J DATE 4/14/05
CHK DATE
ENG DATE
PROD DATE
APPD DATE

CERTIFIED
DATE

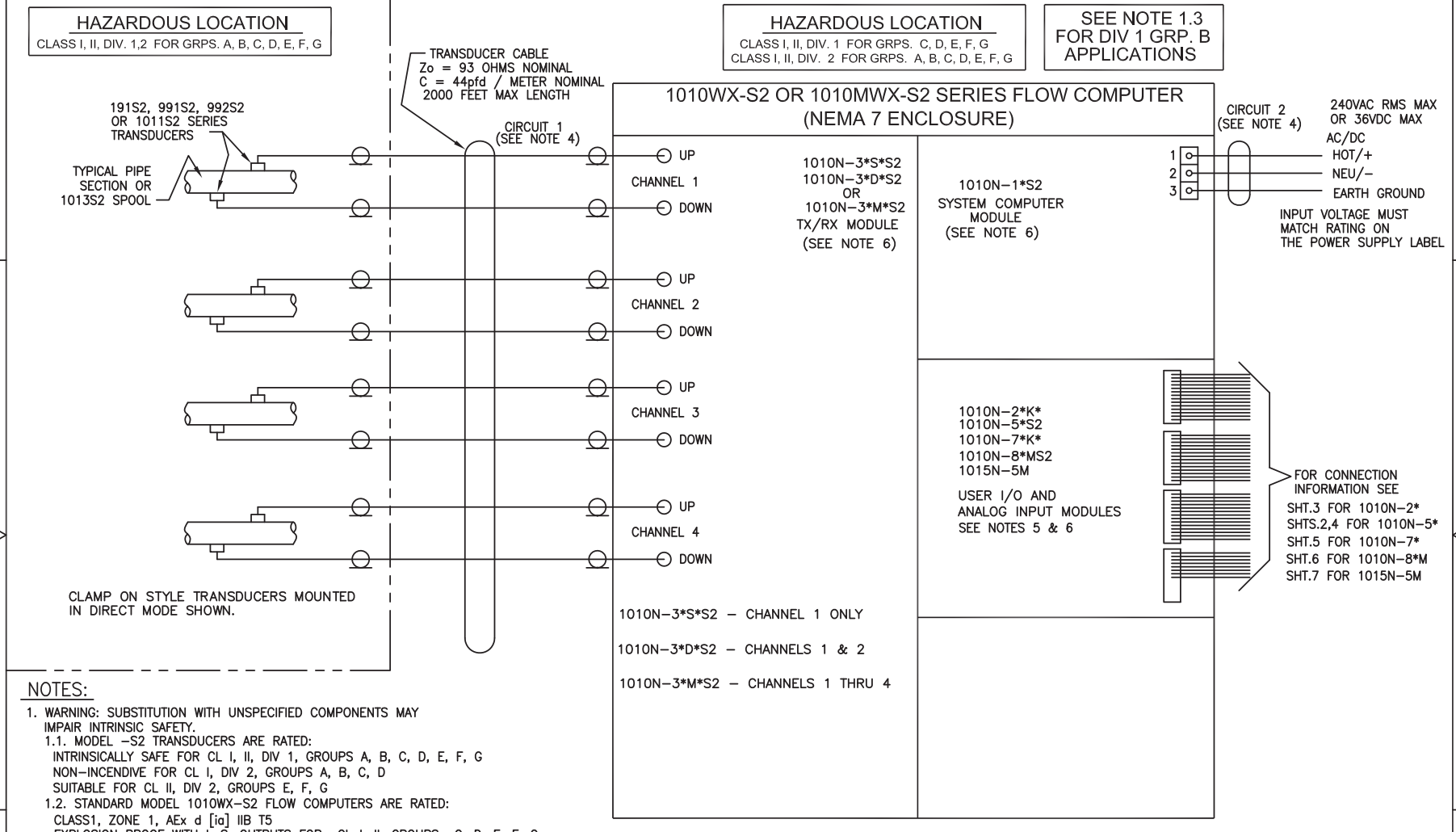
CONTROLOTRON
HAUPPAUGE , NY 11788

INSTALLATION DRAWING 1010 SERIES MULTI-CHANNEL FLOW COMPUTER, AGENCY APPROVED

SIZE	CODE IDENT NO.		REV.
C	21614	1010MWX-S2-7	A

SCALE: NONE | WT. | SHEET 1 OF 1

FILE No: 1010MWX–S2–7 rev.A
ER#1839

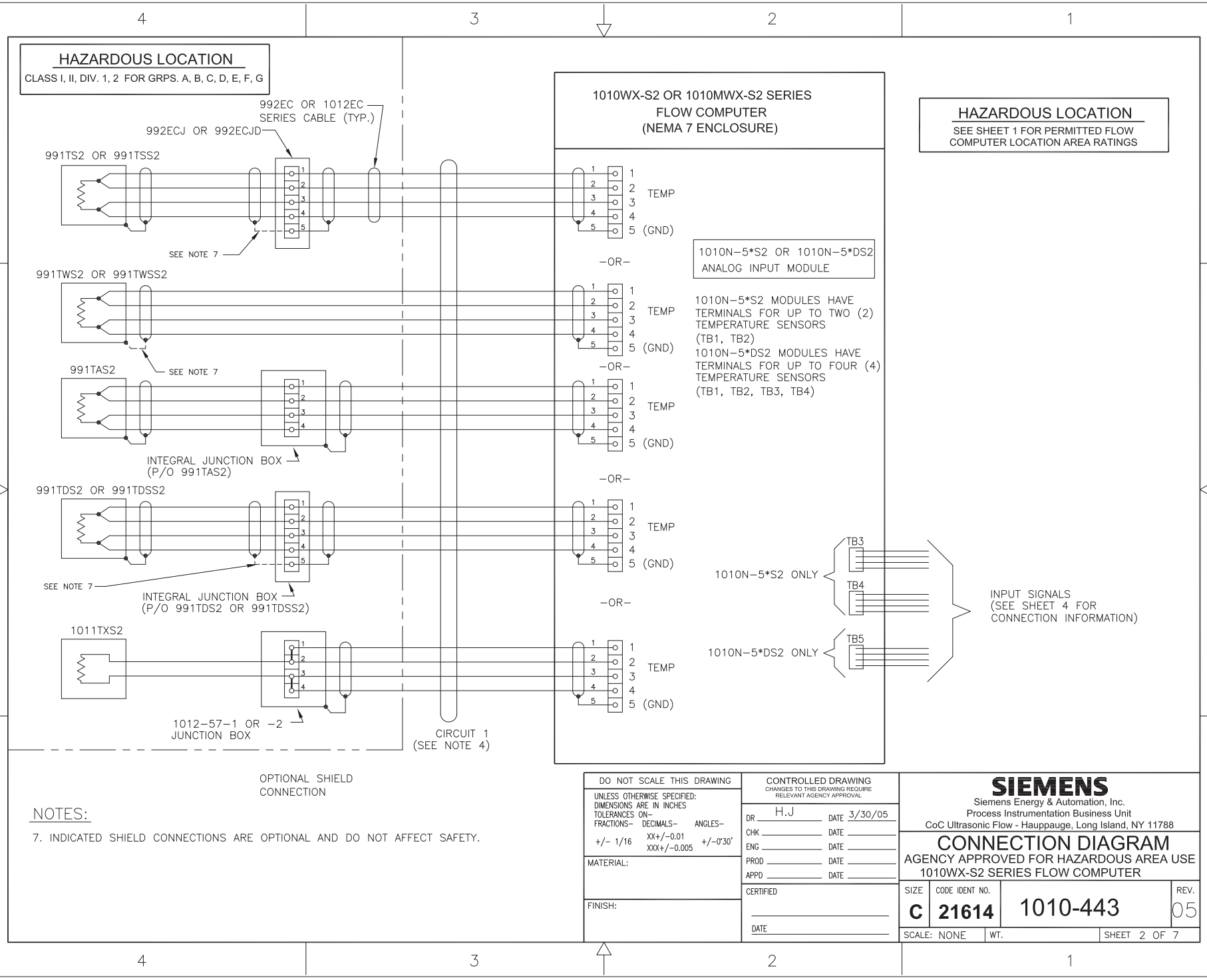


NOTES:

1. WARNING: SUBSTITUTION WITH UNSPECIFIED COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
   - 1.1. MODEL –S2 TRANSDUCERS ARE RATED:
     INTRINSICALLY SAFE FOR CL I, II, DIV 1, GROUPS A, B, C, D, E, F, G
     NON–INCENDIVE FOR CL I, DIV 2, GROUPS A, B, C, D
     SUITABLE FOR CL II, DIV 2, GROUPS E, F, G
   - 1.2. STANDARD MODEL 1010WX–S2 FLOW COMPUTERS ARE RATED:
     CLASS1, ZONE 1, AEx d [ia] IIB T5
     EXPLOSION PROOF WITH I. S. OUTPUTS FOR CL I, II, GROUPS C, D, E, F, G
     NON–INCENDIVE WITH N. I. OUTPUTS FOR CL I, DIV 2, GROUPS A, B, C, D
     SUITABLE FOR CL II, DIV 2, GROUPS E, F, G
   - 1.3. MODEL 1010WX–S2 FLOW COMPUTERS WITH "C5" ENCLOSURE CODE ARE RATED:
     CLASS1, ZONE 1, AEx d [ia] IIB+H2 T5
     EXPLOSION PROOF WITH I. S. OUTPUTS FOR CL I, II, GROUPS B, C, D, E, F, G
     NON–INCENDIVE WITH N. I. OUTPUTS FOR CL I, DIV 2, GROUPS A, B, C, D
     SUITABLE FOR CL II, DIV 2, GROUPS E, F, G
2. USE 1010WX MANUALS FOR OPERATION AND MAINTENANCE INSTRUCTIONS.
3. ANY COMBINATION OF OUTPUTS MAY BE USED.
4. CIRCUITS 1, 2, AND 3 MUST BE IN SEPARATE CONDUIT.
5. DATA/CONTROL SIGNAL CONNECTIONS ARE MADE ON 1010N–2* , 1010N–5*, 1010N–7*, 1010M–8M AND 1015N–5M MODULES. INCLUDED MODULES VARY WITH FLOW COMPUTER MODEL, 1015N–5M IS ORDERED SEPARATELY.
6. MODULE PART NUMBER SUFFIX (*) MAY VARY DEPENDING ON FLOW COMPUTER MODEL.

DO NOT SCALE THIS DRAWING	CONTROLLED DRAWING	SIEMENS
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON– FRACTIONS– +/– 1/16 DECIMALS– XX+/–0.01 XXX+/–0.005 ANGLES– +/–0°30'	CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL	Siemens Energy & Automation, Inc. Process Instrumentation Business Unit CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788
MATERIAL:	DR H.J DATE 9/17/04	CONNECTION DIAGRAM
FINISH:	CHK DATE	AGENCY APPROVED FOR HAZARDOUS AREA USE
	ENG DATE	1010WX-S2 SERIES FLOW COMPUTER
	PROD DATE	
	APPD DATE	
	CERTIFIED DATE	SIZE C · CODE IDENT NO. 21614 · 1010-443 · REV. 05
		SCALE: · WT. · SHEET 1 OF 7

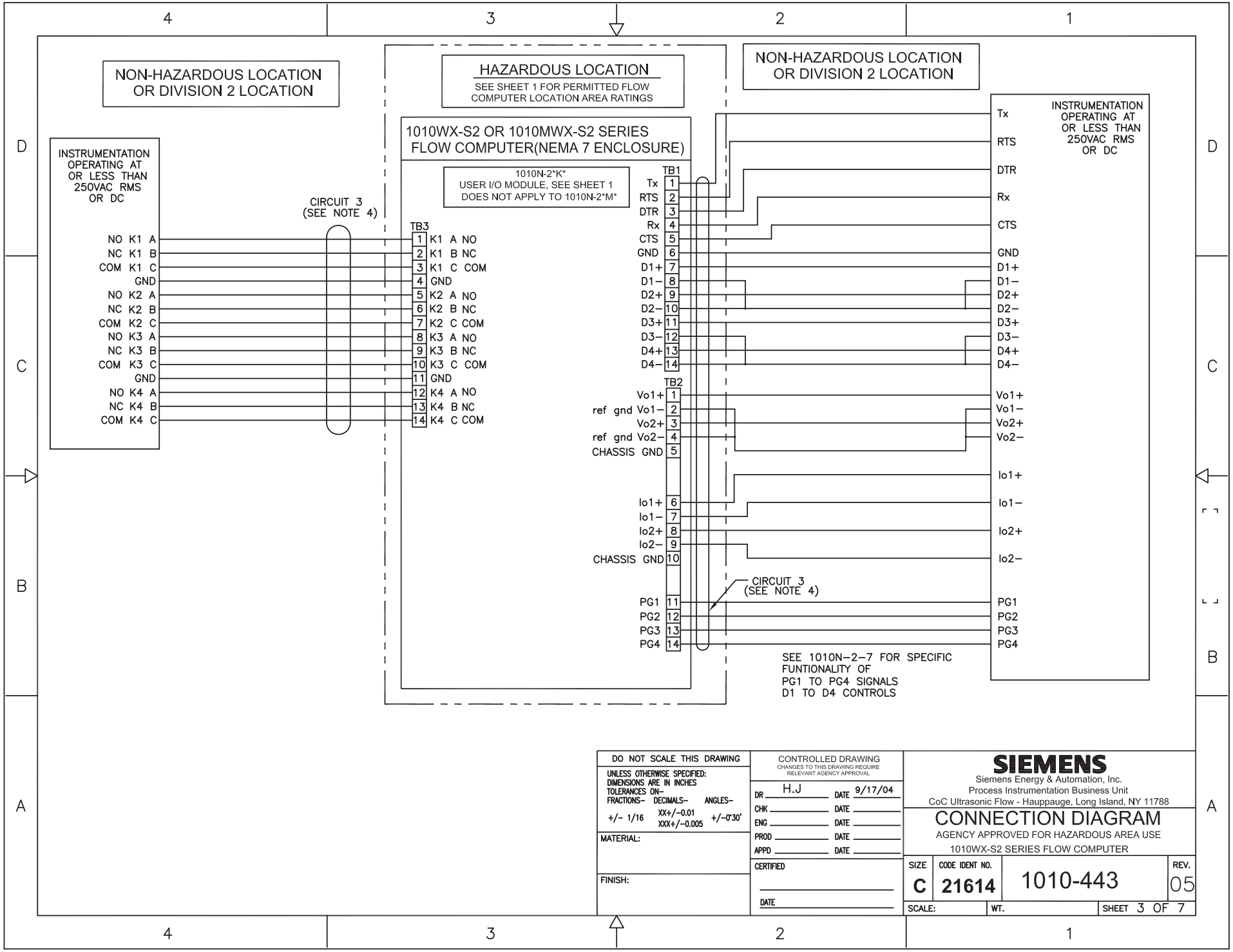
EC#79C13894



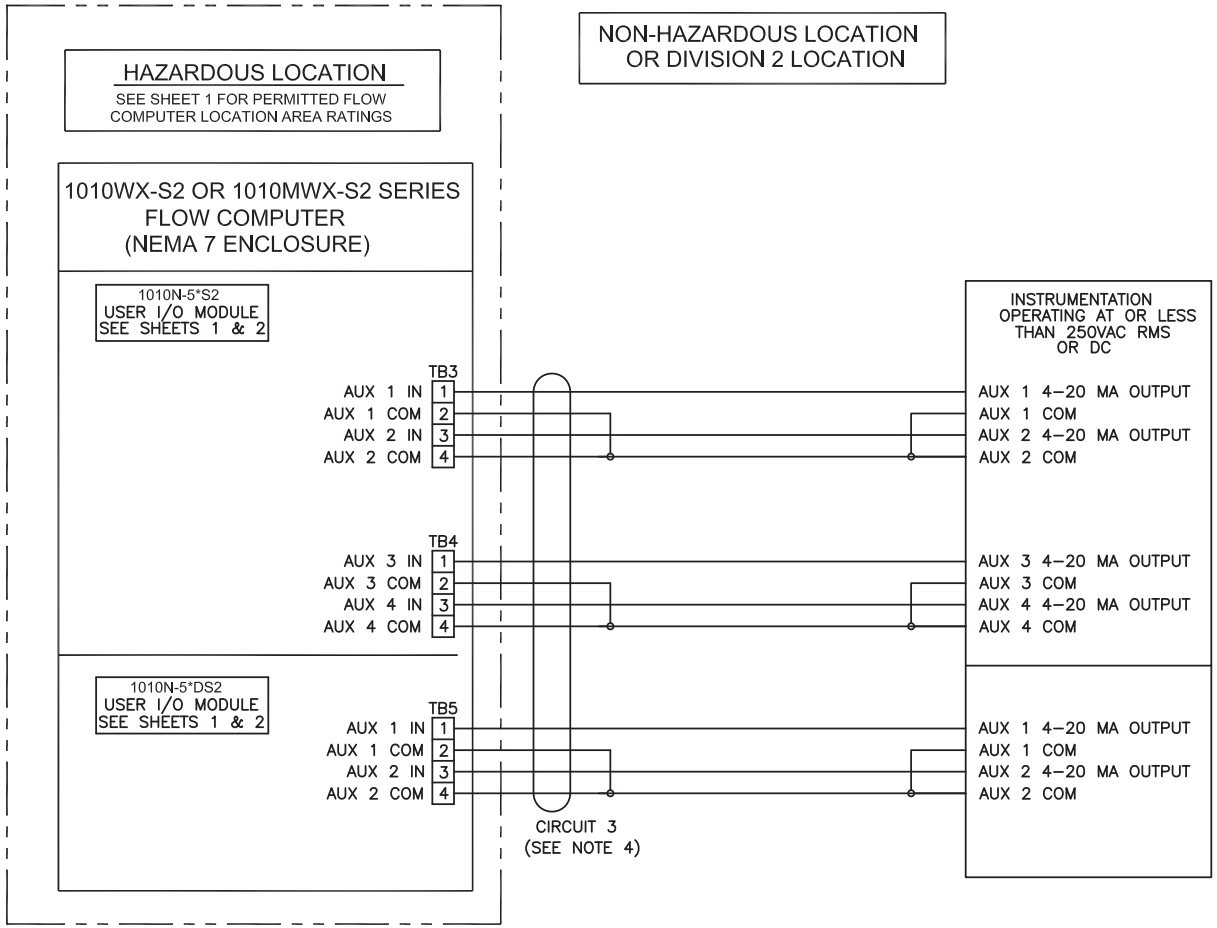
NOTES:

7. INDICATED SHIELD CONNECTIONS ARE OPTIONAL AND DO NOT AFFECT SAFETY.

DO NOT SCALE THIS DRAWING UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON– FRACTIONS– DECIMALS– ANGLES– +/- 1/16 XX+/-0.01 +/-0°30' XXX+/-0.005 MATERIAL: FINISH:	CONTROLLED DRAWING CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL DR H.J DATE 3/30/05 CHK ____ DATE ____ ENG ____ DATE ____ PROD ____ DATE ____ APPD ____ DATE ____ CERTIFIED DATE	SIEMENS Siemens Energy & Automation, Inc. Process Instrumentation Business Unit CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788 CONNECTION DIAGRAM AGENCY APPROVED FOR HAZARDOUS AREA USE 1010WX-S2 SERIES FLOW COMPUTER SIZE C · CODE IDENT NO. 21614 · 1010-443 · REV. 05 SCALE: NONE · WT. · SHEET 2 OF 7



DO NOT SCALE THIS DRAWING UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON– FRACTIONS– DECIMALS– ANGLES– +/– 1/16 XX+/–0.01 +/–0°30' XXX+/–0.005 MATERIAL: FINISH:	CONTROLLED DRAWING CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL DR H.J DATE 9/17/04 CHK DATE ENG DATE PROD DATE APPD DATE CERTIFIED DATE	**SIEMENS** Siemens Energy & Automation, Inc. Process Instrumentation Business Unit CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788 CONNECTION DIAGRAM AGENCY APPROVED FOR HAZARDOUS AREA USE 1010WX-S2 SERIES FLOW COMPUTER SIZE C · CODE IDENT NO. 21614 · 1010-443 · REV. 05 SCALE: · WT. · SHEET 3 OF 7



DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON–
FRACTIONS– +/– 1/16
DECIMALS– XX+/–0.01 XXX+/–0.005
ANGLES– +/–0°30'

MATERIAL:

FINISH:

CONTROLLED DRAWING
CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL

DR	H.J	DATE 9/17/04
CHK		DATE
ENG		DATE
PROD		DATE
APPD		DATE

CERTIFIED

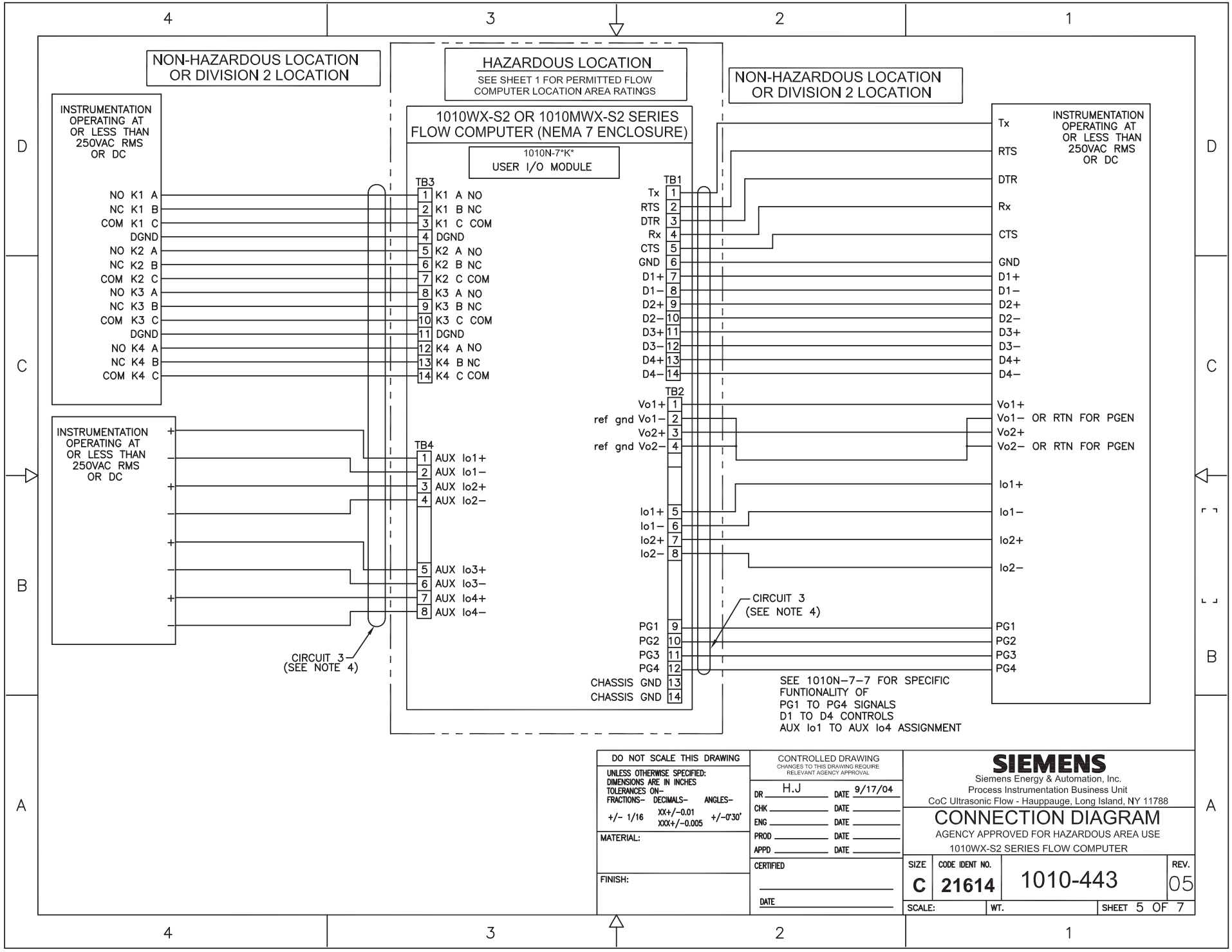
DATE

SIEMENS
Siemens Energy & Automation, Inc.
Process Instrumentation Business Unit
CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788

CONNECTION DIAGRAM
AGENCY APPROVED FOR HAZARDOUS AREA USE
1010WX-S2 SERIES FLOW COMPUTER

SIZE	CODE IDENT NO.		REV.
C	21614	1010-443	05

SCALE: | WT. | SHEET 4 OF 7



DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON–
FRACTIONS– +/– 1/16
DECIMALS– XX+/–0.01 XXX+/–0.005
ANGLES– +/–0°30'

MATERIAL:

FINISH:

CONTROLLED DRAWING
CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL

DR	H.J	DATE 9/17/04
CHK		DATE
ENG		DATE
PROD		DATE
APPD		DATE

CERTIFIED

DATE

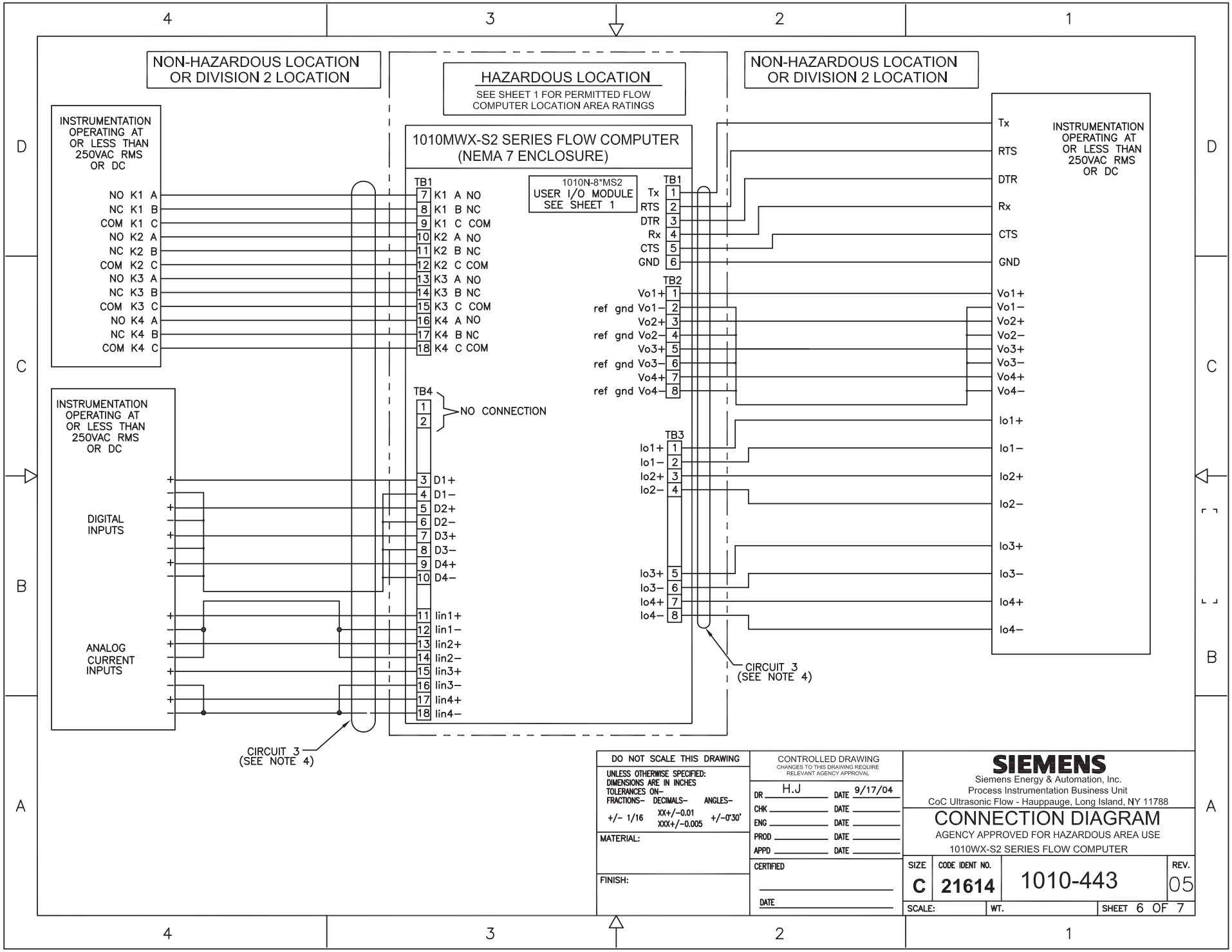
SIEMENS
Siemens Energy & Automation, Inc.
Process Instrumentation Business Unit
CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788

CONNECTION DIAGRAM

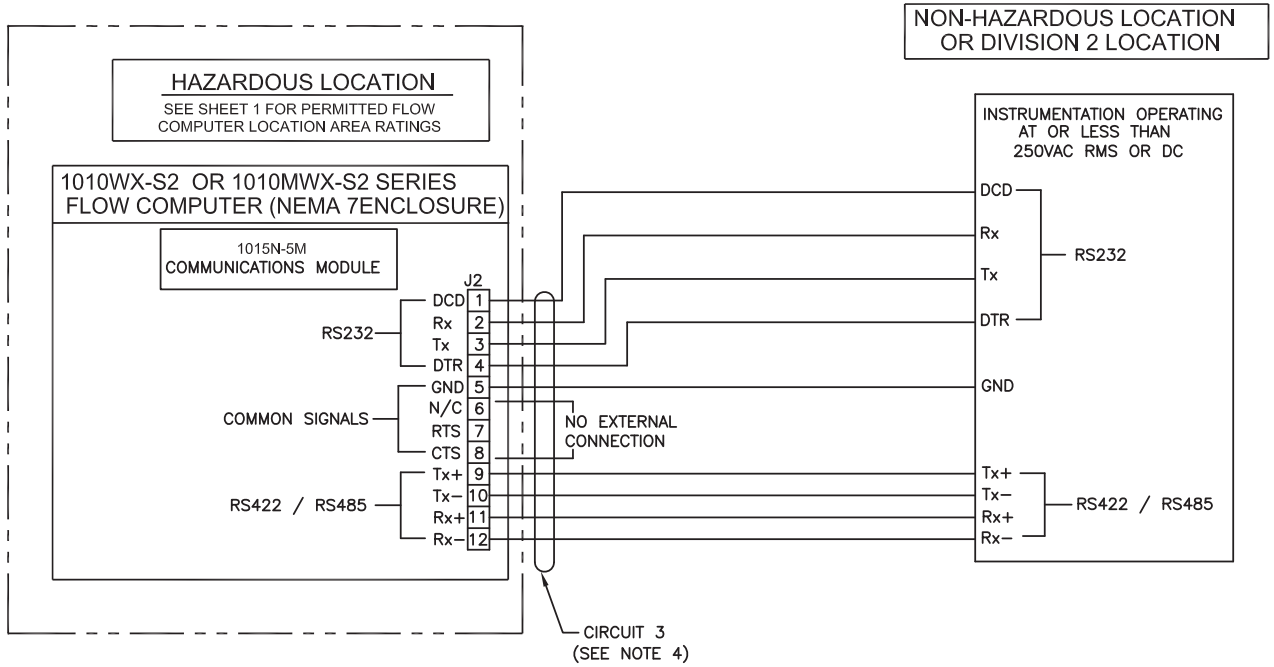
AGENCY APPROVED FOR HAZARDOUS AREA USE
1010WX-S2 SERIES FLOW COMPUTER

SIZE	CODE IDENT NO.		REV.
C	21614	1010-443	05

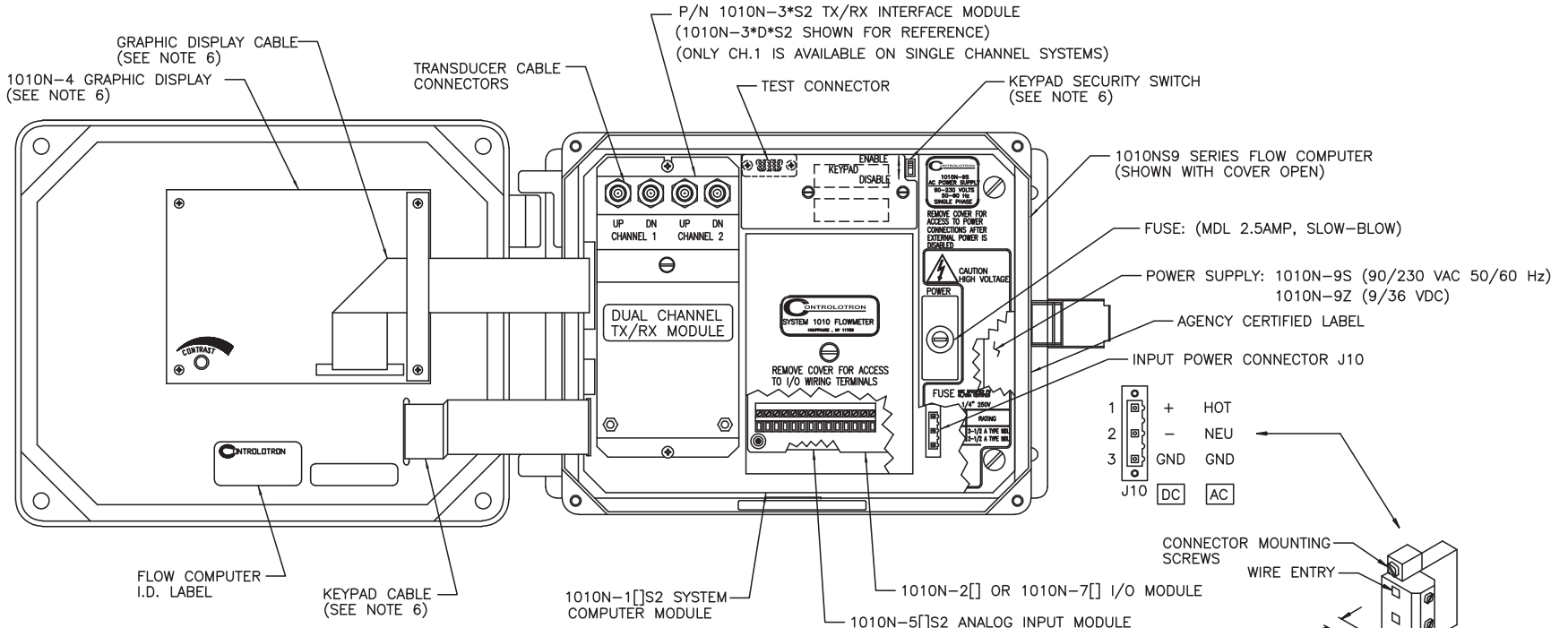
SCALE: WT. SHEET 5 OF 7

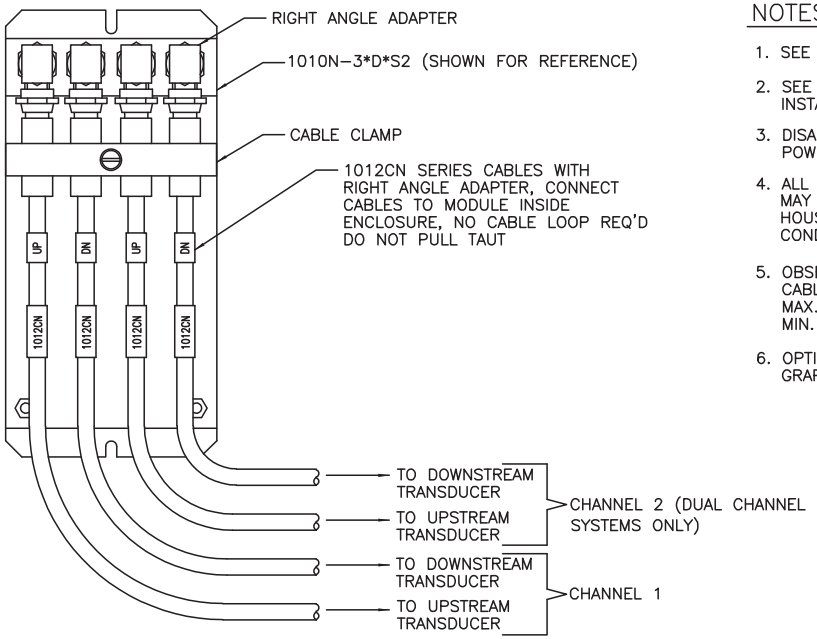


DO NOT SCALE THIS DRAWING UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON— FRACTIONS— DECIMALS— ANGLES— +/− 1/16 XX+/−0.01 +/−0°30' XXX+/−0.005 MATERIAL: FINISH:	CONTROLLED DRAWING CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL DR H.J DATE 9/17/04 CHK DATE ENG DATE PROD DATE APPD DATE CERTIFIED DATE	**SIEMENS** Siemens Energy & Automation, Inc. Process Instrumentation Business Unit CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788 CONNECTION DIAGRAM AGENCY APPROVED FOR HAZARDOUS AREA USE 1010WX-S2 SERIES FLOW COMPUTER SIZE C · CODE IDENT NO. 21614 · 1010-443 · REV. 05 SCALE: · WT. · SHEET 6 OF 7



DO NOT SCALE THIS DRAWING UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON– FRACTIONS– DECIMALS– ANGLES– +/– 1/16 XX+/–0.01 +/–0°30' XXX+/–0.005 MATERIAL: FINISH:	CONTROLLED DRAWING CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL DR H.J DATE 9/17/04 CHK DATE ENG DATE PROD DATE APPD DATE CERTIFIED DATE	SIEMENS Siemens Energy & Automation, Inc. Process Instrumentation Business Unit CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788 CONNECTION DIAGRAM AGENCY APPROVED FOR HAZARDOUS AREA USE 1010WX-S2 SERIES FLOW COMPUTER SIZE C · CODE IDENT NO. 21614 · 1010-443 · REV. 05 SCALE: · WT. · SHEET 7 OF 7





NOTES:

1. SEE DRAWING 1010NS9–8 FOR OUTLINE DIMENSIONS.
2. SEE 1010 FIELD MANUAL AND APPROPRIATE TRANSDUCER INSTALLATION DRAWINGS FOR MOUNTING PROCEDURE.
3. DISABLE INSTRUMENT POWER BEFORE SERVICING POWER SUPPLY, POWER SWITCH / CIRCUIT BREAKER OR INPUT POWER CONNECTOR.
4. ALL TRANSDUCER CABLES ORIGINATING AT THE SAME FLOW COMPUTER MAY SHARE THE SAME CONDUIT. NO OTHER CABLES SHOULD BE HOUSED IN THE TRANSDUCER CABLE CONDUITS. CONNECT METALLIC CONDUITS TO EARTH GROUND.
5. OBSERVE FOLLOWING LIMITS WHEN INSTALLING TRANSDUCER CABLES IN CONDUIT:
   MAX. PULL TENSION: 80 lbs.
   MIN. BEND RADIUS: 2–1/2 INCHES
6. OPTIONAL DISPLAY AND KEYPAD APPEAR ON MODELS WITH GRAPHIC DISPLAY ONLY.

THE INPUT POWER CONNECTOR IS A PLUGGABLE, LUG–LESS WIRE CLAMP TYPE, PROVIDING RELIABLE TERMINATION OF STRIPPED STRANDED OR SOLID CONDUCTORS AWG.12–18 SECURE WITH SCREWS AFTER MATING CONNECTOR.

CHANGES TO THIS DOCUMENT REQUIRE SAFETY AGENCY APPROVAL

DO NOT SCALE THIS DRAWING
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES (MM)
TOLERANCES ON–
INCHES (MM)
± .1 ± 2

CONTRACT NO.

DR H.J DATE 8/12/05
CHK DATE
ENG DATE
PROD DATE
APPD DATE

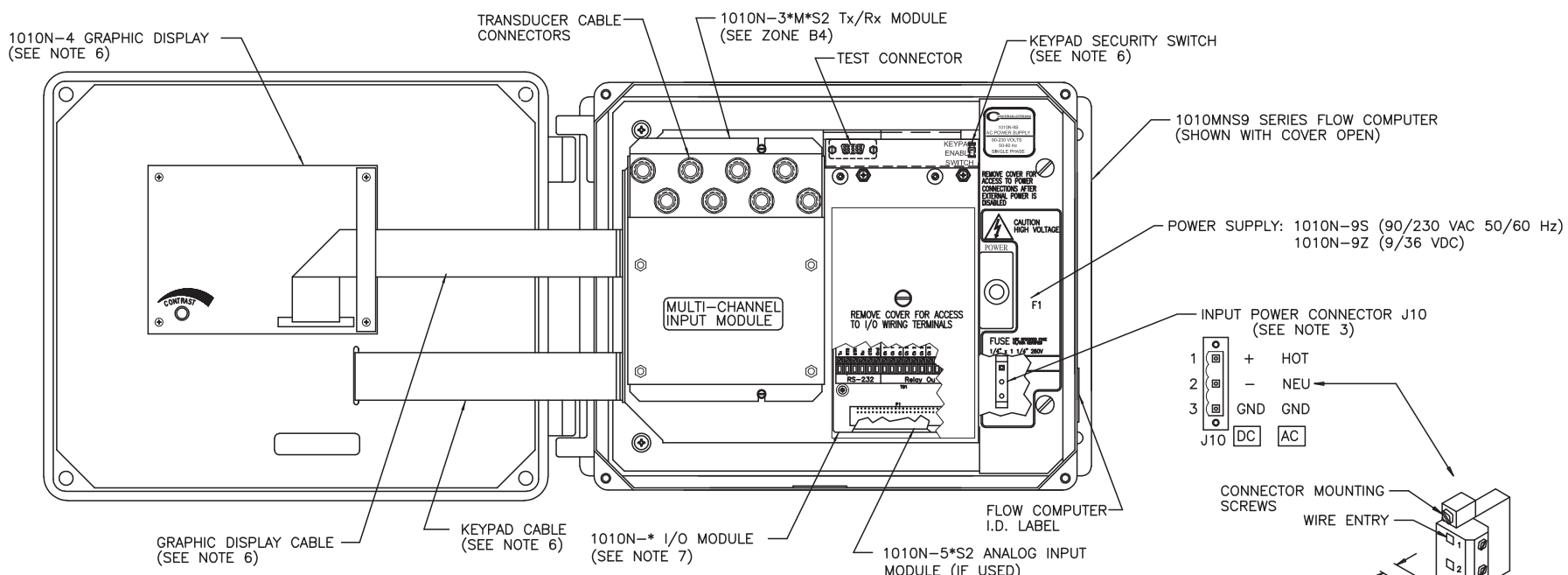
CERTIFIED
DATE

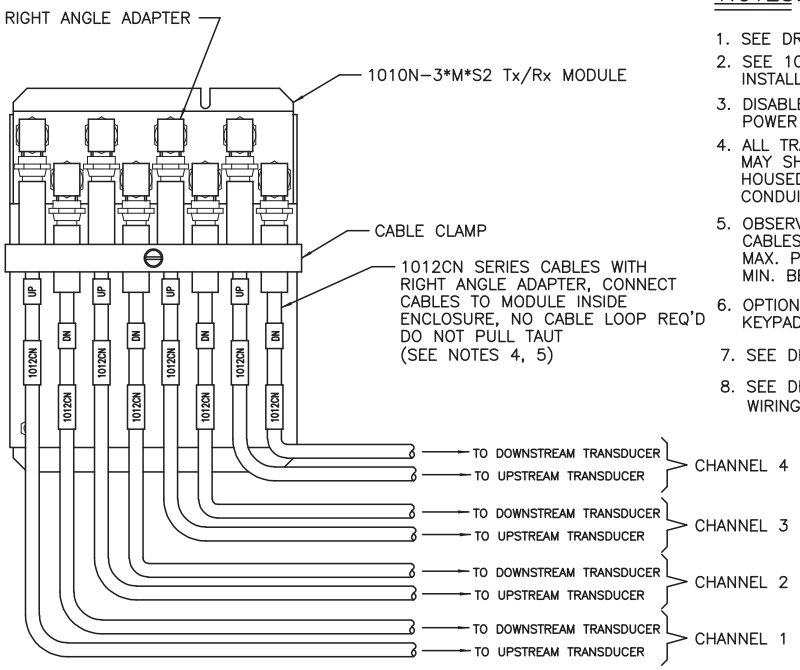
CONTROLOTRON
HAUPPAUGE , NY 11788

INSTALLATION DRAWING
1010 SERIES FLOW COMPUTER
AGENCY APPROVED

SIZE	CODE IDENT NO.		REV.
C	21614	1010NS9-7	A
SCALE: NONE	WT.	SHEET 1 OF 1	

FILE No: 1010NS9–7 rev.A
ER#1865





NOTES:

1. SEE DRAWING 1010MNS9–8 FOR OUTLINE DIMENSIONS.
2. SEE 1010 FIELD MANUAL AND APPROPRIATE TRANSDUCER INSTALLATION DRAWINGS FOR MOUNTING PROCEDURE.
3. DISABLE INSTRUMENT POWER BEFORE SERVICING POWER SUPPLY, POWER SWITCH / CIRCUIT BREAKER OR INPUT POWER CONNECTOR.
4. ALL TRANSDUCER CABLES ORIGINATING AT THE SAME FLOW COMPUTER MAY SHARE THE SAME CONDUIT. NO OTHER CABLES SHOULD BE HOUSED IN THE TRANSDUCER CABLE CONDUITS. CONNECT METALLIC CONDUITS TO EARTH GROUND.
5. OBSERVE FOLLOWING LIMITS WHEN INSTALLING TRANSDUCER CABLES IN CONDUIT:
   MAX. PULL TENSION: 80 lbs.
   MIN. BEND RADIUS: 2–1/2 INCHES
6. OPTIONAL DISPLAY AND KEYPAD APPEAR ON MODELS WITH GRAPHIC DISPLAY ONLY. KEYPAD SECURITY SWITCH CONTROLS ACCESS TO USER SELECTABLE PARAMETERS.
7. SEE DRAWING 1010N–2–7, 1010N–7–7 OR 1010N–8MS2–7 FOR USER I/O WIRING CONNECTIONS.
8. SEE DRAWING 1010N–5S2–7 OR 1010N–5DS2–7 FOR USER ANALOG INPUT WIRING CONNECTIONS.

THE INPUT POWER CONNECTOR IS A PLUGGABLE, LUG–LESS WIRE CLAMP TYPE, PROVIDING RELIABLE TERMINATION OF STRIPPED STRANDED OR SOLID CONDUCTORS AWG.12–18 SECURE WITH SCREWS AFTER MATING CONNECTOR.

CHANGES TO THIS DOCUMENT REQUIRE SAFETY AGENCY APPROVAL

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES (MM)
TOLERANCES ON–
INCHES ± .1
(MM) ± 2

CONTRACT NO.

DR H.J DATE 8/12/05
CHK DATE
ENG DATE
PROD DATE
APPD DATE

CERTIFIED
DATE

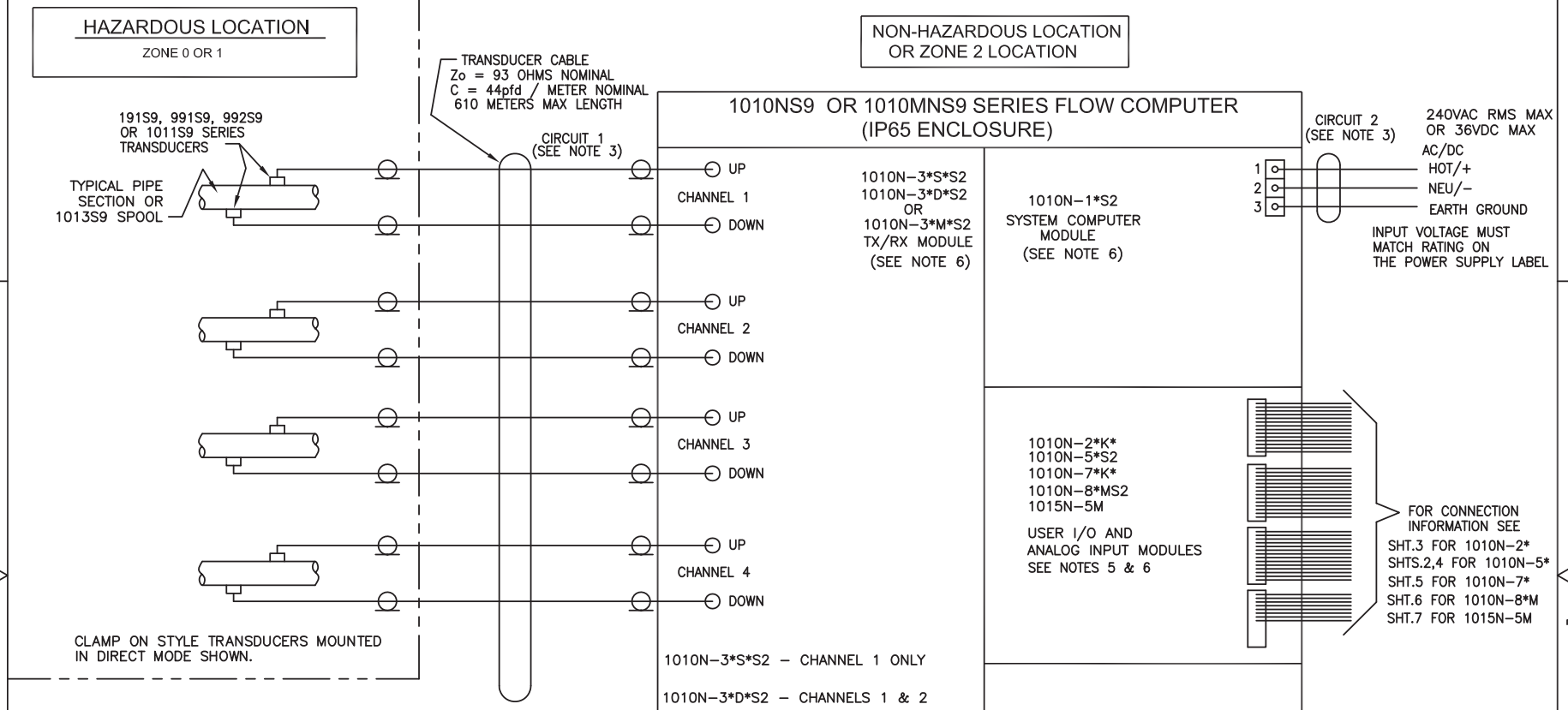
CONTROLOTRON
HAUPPAUGE , NY 11788

INSTALLATION DRAWING
1010 SERIES MULTI- CHANNEL FLOW COMPUTER, AGENCY APPROVED

SIZE	CODE IDENT NO.		REV.
C	21614	1010MNS9 - 7	A

SCALE: NONE | WT. | SHEET 1 OF 1

FILE No: 1010MNS9–7 rev.A
ER#1865



NOTES:

1. WARNING: SUBSTITUTION WITH UNSPECIFIED COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
1.1. MODEL –S9 TRANSDUCERS ARE RATED:
   II 1 G EEx ia IIC T5
1.2. MODEL 1010NS9 AND 1010MNS9 FLOW COMPUTERS ARE RATED:
   II (1) G [EEx ia] IIC or
   II 3 (1) G EEx nC [ia] IIC T5
2. USE 1010N MANUALS FOR OPERATION AND MAINTENANCE INSTRUCTIONS.
3. CIRCUITS 1, 2, AND 3 MUST BE IN SEPARATE CONDUIT.
4. ALL CASE CONDULET OPENINGS ARE TO USE WEATHER PROOF SEALS.
5. DATA/CONTROL SIGNAL CONNECTIONS ARE MADE ON 1015N–5M, 1010N–2*K*, 1010N–7*K* OR 1010N–8*MS2 MODULES. 1015N–5M IS ORDERED SEPARATELY, OTHER INCLUDED MODULES VARY WITH FLOW COMPUTER MODEL.
6. MODULE PART NUMBER SUFFIX (*) MAY VARY DEPENDING ON FLOW COMPUTER MODEL.

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON–
FRACTIONS– +/– 1/16
DECIMALS– XX+/–0.01 XXX+/–0.005
ANGLES– +/–0°30'

MATERIAL:

FINISH:

CONTROLLED DRAWING
CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL

DR	H.J	DATE 3/30/05
CHK		DATE
ENG		DATE
PROD		DATE
APPD		DATE

CERTIFIED

DATE

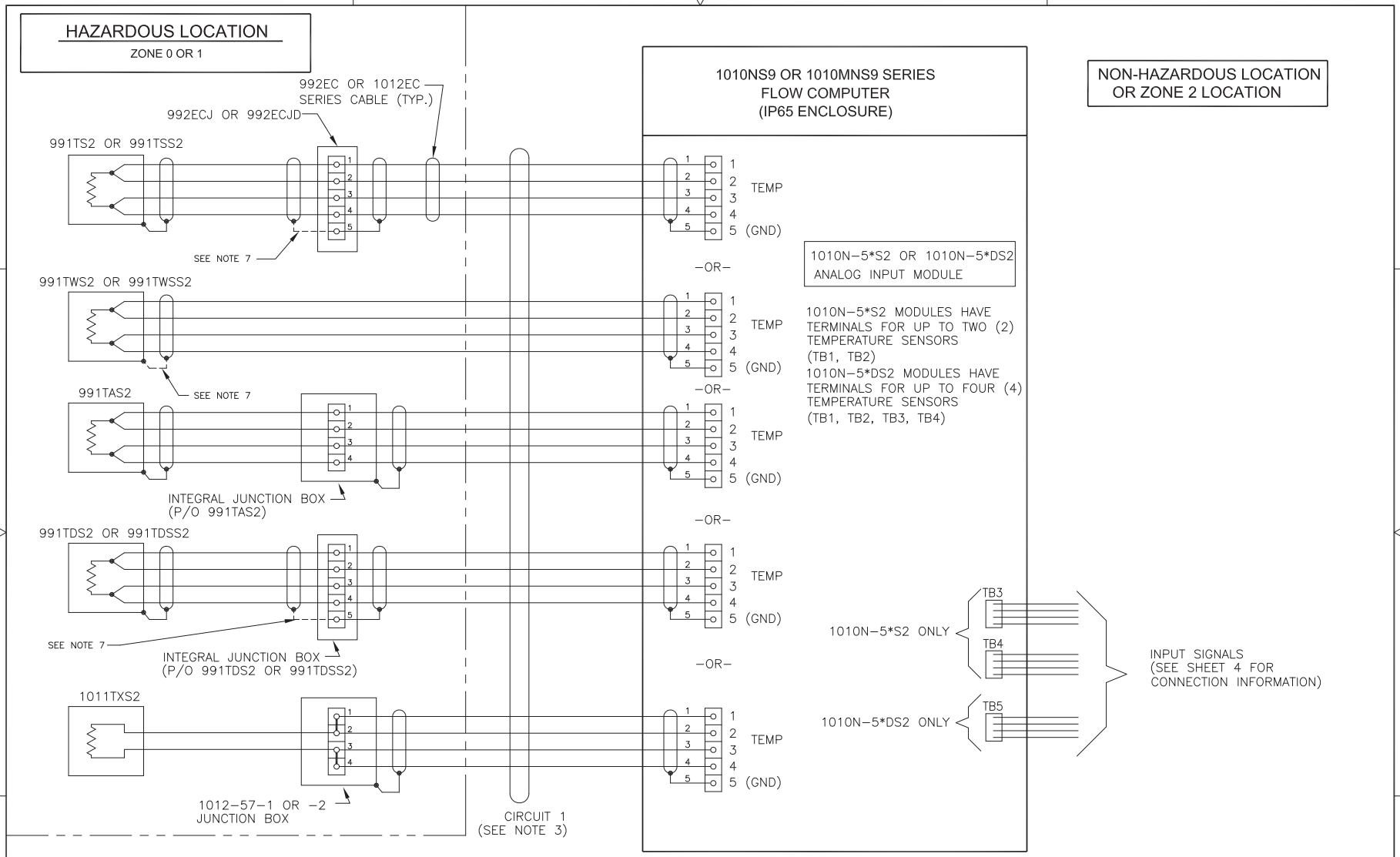
SIEMENS
Siemens Energy & Automation, Inc.
Process Instrumentation Business Unit
CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788

CONNECTION DIAGRAM
AGENCY APPROVED FOR HAZARDOUS AREA USE
1010NS9/1010MNS9 SERIES FLOW COMPUTER

SIZE	CODE IDENT NO.		REV.
C	21614	1010-389	05

SCALE: NONE | WT. | SHEET 1 OF 7

EC#79C13894



NOTES:

7. INDICATED SHIELD CONNECTIONS ARE OPTIONAL AND DO NOT AFFECT SAFETY.

DO NOT SCALE THIS DRAWING UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON- FRACTIONS- DECIMALS- ANGLES- +/- 1/16 XX+/-0.01 +/-0°30' XXX+/-0.005 MATERIAL: FINISH:	CONTROLLED DRAWING CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL DR H.J DATE 3/30/05 CHK DATE ENG DATE PROD DATE APPD DATE CERTIFIED DATE	SIEMENS Siemens Energy & Automation, Inc. Process Instrumentation Business Unit CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788 CONNECTION DIAGRAM AGENCY APPROVED FOR HAZARDOUS AREA USE 1010NS9/1010MNS9 SERIES FLOW COMPUTER SIZE C · CODE IDENT NO. 21614 · 1010-389 · REV. 05 SCALE: NONE · WT. · SHEET 2 OF 7

NON-HAZARDOUS LOCATION
OR ZONE 2 LOCATION

INSTRUMENTATION OPERATING AT OR LESS THAN 250VAC RMS OR DC

NO K1 A
NC K1 B
COM K1 C
GND
NO K2 A
NC K2 B
COM K2 C
NO K3 A
NC K3 B
COM K3 C
GND
NO K4 A
NC K4 B
COM K4 C

CIRCUIT 3
(SEE NOTE 3)

1010NS9 OR 1010MNS9 SERIES
FLOW COMPUTER
(IP65 ENCLOSURE)

1010N-2*K*
USER I/O MODULE, SEE SHEET 1
DOES NOT APPLY TO 1010N-2*M*

TB3
1 K1 A NO
2 K1 B NC
3 K1 C COM
4 GND
5 K2 A NO
6 K2 B NC
7 K2 C COM
8 K3 A NO
9 K3 B NC
10 K3 C COM
11 GND
12 K4 A NO
13 K4 B NC
14 K4 C COM

TB1
Tx 1
RTS 2
DTR 3
Rx 4
CTS 5
GND 6
D1+ 7
D1− 8
D2+ 9
D2− 10
D3+ 11
D3− 12
D4+ 13
D4− 14

TB2
Vo1+ 1
ref gnd Vo1− 2
Vo2+ 3
ref gnd Vo2− 4
CHASSIS GND 5
Io1+ 6
Io1− 7
Io2+ 8
Io2− 9
CHASSIS GND 10
PG 1 11
PG 2 12
PG 3 13
PG 4 14

CIRCUIT 3
(SEE NOTE 3)

SEE 1010N−2−7 FOR SPECIFIC
FUNTIONALITY OF
PG1 TO PG4 SIGNALS
D1 TO D4 CONTROLS

INSTRUMENTATION OPERATING AT OR LESS THAN 250VAC RMS OR DC

Tx
RTS
DTR
Rx
CTS
GND
D1+
D1−
D2+
D2−
D3+
D3−
D4+
D4−
Vo1+
Vo1−
Vo2+
Vo2−
Io1+
Io1−
Io2+
Io2−
PG 1
PG 2
PG 3
PG 4

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON−
FRACTIONS− DECIMALS− ANGLES−
+/− 1/16 XX+/−0.01 +/−0°30'
XXX+/−0.005

MATERIAL:

FINISH:

CONTROLLED DRAWING
CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL

DR H.J DATE 3/30/05
CHK DATE
ENG DATE
PROD DATE
APPD DATE

CERTIFIED

DATE

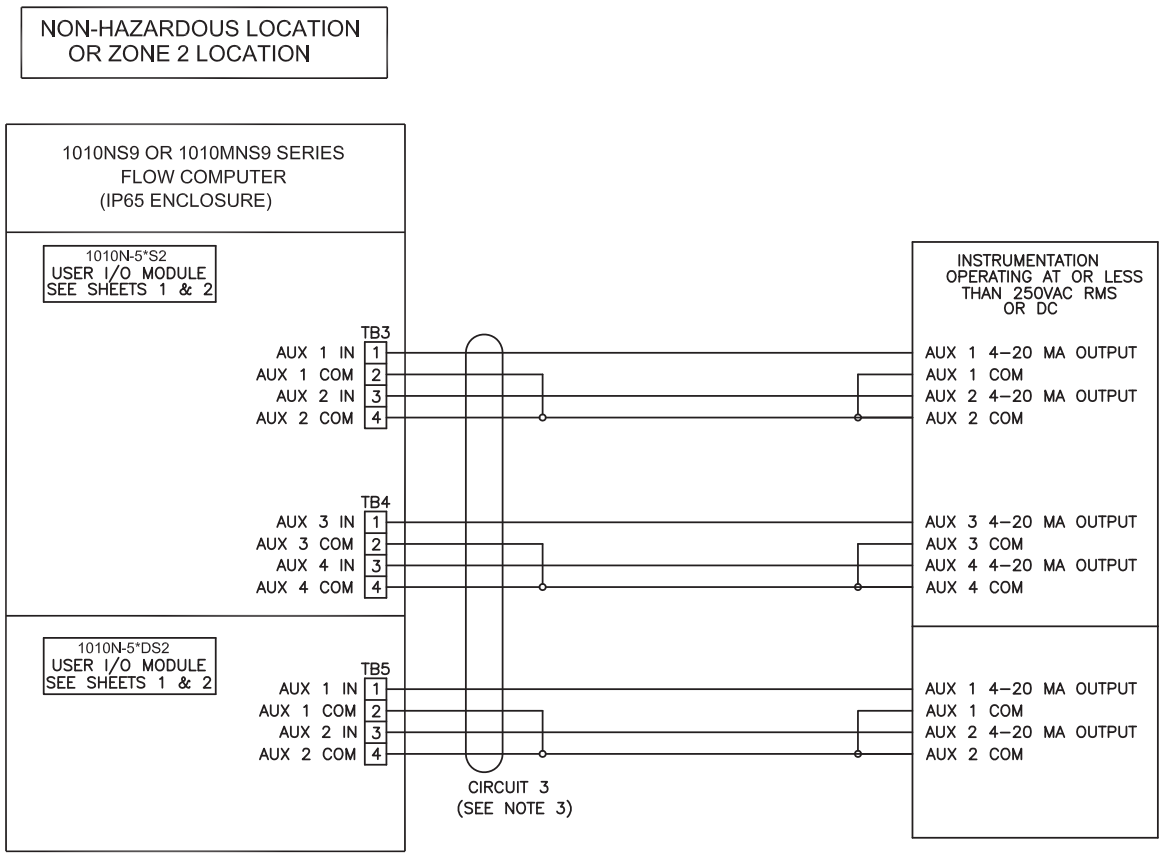
SIEMENS
Siemens Energy & Automation, Inc.
Process Instrumentation Business Unit
CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788

CONNECTION DIAGRAM

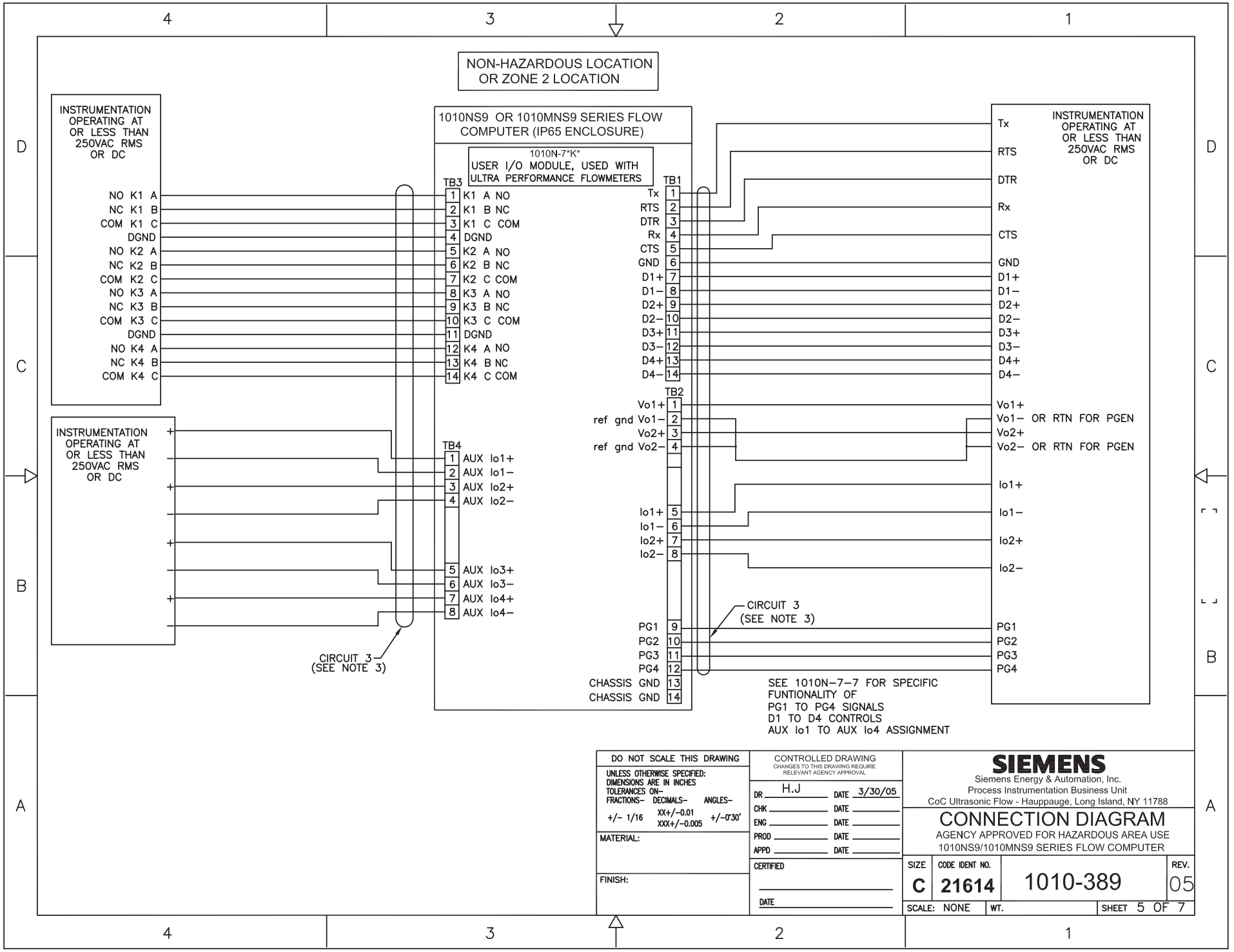
AGENCY APPROVED FOR HAZARDOUS AREA USE
1010NS9/1010MNS9 SERIES FLOW COMPUTER

SIZE	CODE IDENT NO.		REV.
C	21614	1010-389	05

SCALE: NONE WT. SHEET 3 OF 7



DO NOT SCALE THIS DRAWING UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON– FRACTIONS– DECIMALS– ANGLES– +/– 1/16 XX+/–0.01 +/–0°30' XXX+/–0.005 MATERIAL: FINISH:	CONTROLLED DRAWING CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL DR H.J DATE 3/30/05 CHK DATE ENG DATE PROD DATE APPD DATE CERTIFIED DATE	**SIEMENS** Siemens Energy & Automation, Inc. Process Instrumentation Business Unit CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788 CONNECTION DIAGRAM AGENCY APPROVED FOR HAZARDOUS AREA USE 1010NS9/1010MNS9 SERIES FLOW COMPUTER SIZE C · CODE IDENT NO. 21614 · 1010-389 · REV. 05 SCALE: NONE · WT. · SHEET 4 OF 7



DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON—
FRACTIONS— +/− 1/16
DECIMALS— XX+/−0.01 XXX+/−0.005
ANGLES— +/−0°30'

MATERIAL:

FINISH:

CONTROLLED DRAWING
CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL

DR	H.J	DATE 3/30/05
CHK		DATE
ENG		DATE
PROD		DATE
APPD		DATE

CERTIFIED

DATE

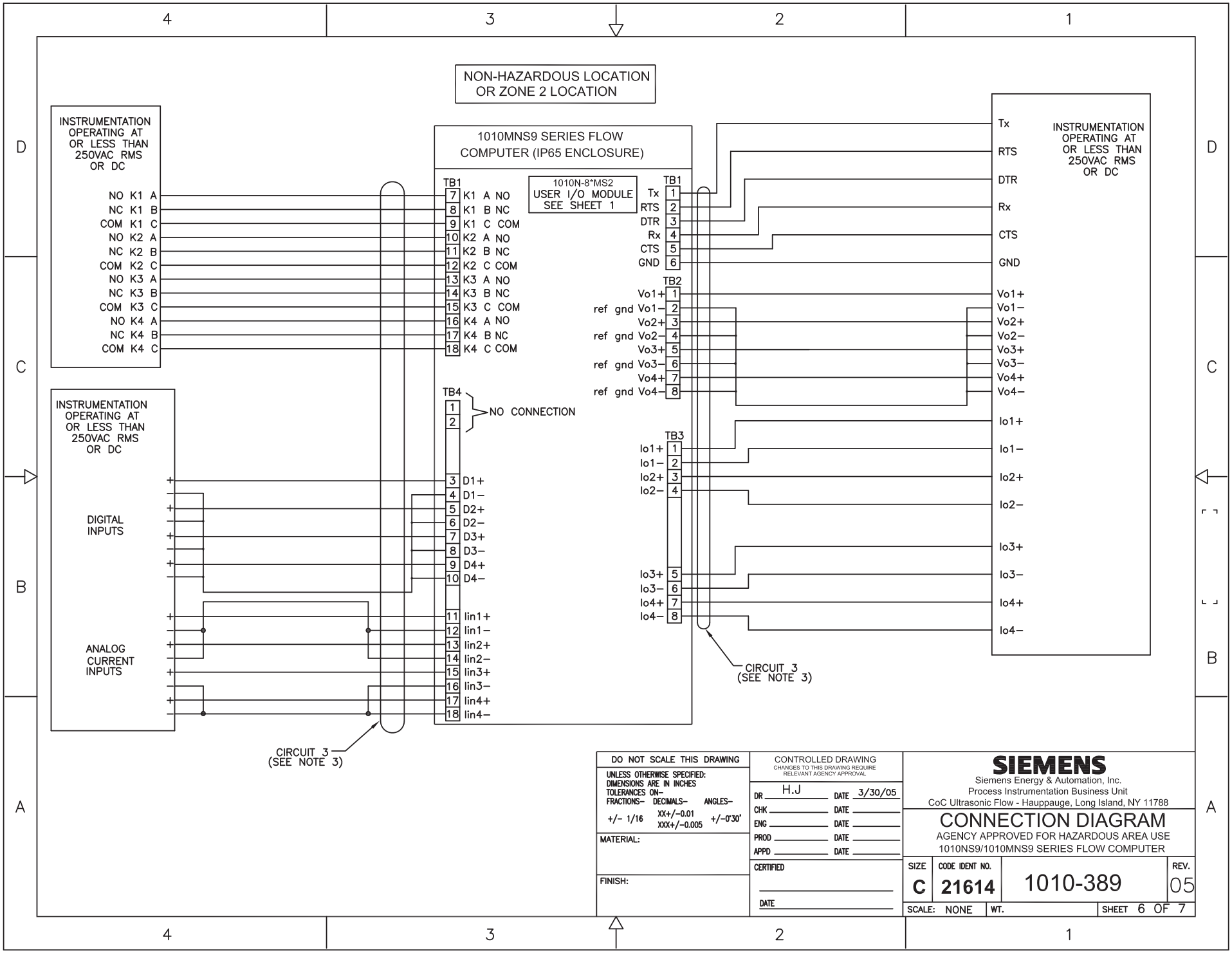
SIEMENS
Siemens Energy & Automation, Inc.
Process Instrumentation Business Unit
CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788

CONNECTION DIAGRAM

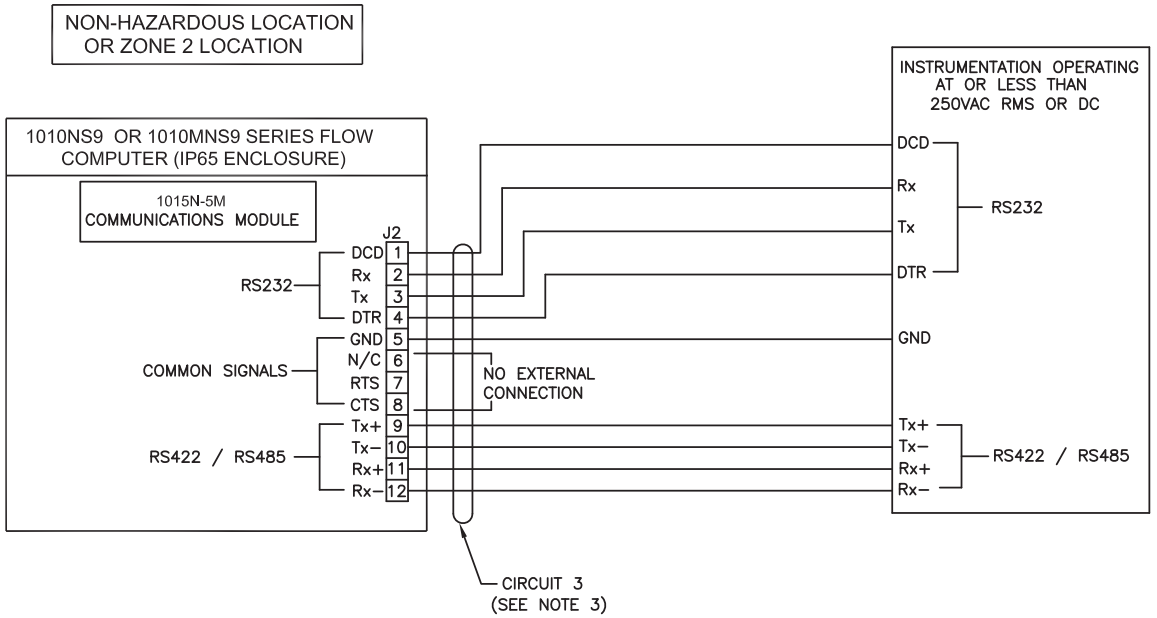
AGENCY APPROVED FOR HAZARDOUS AREA USE
1010NS9/1010MNS9 SERIES FLOW COMPUTER

SIZE	CODE IDENT NO.		REV.
C	21614	1010-389	05

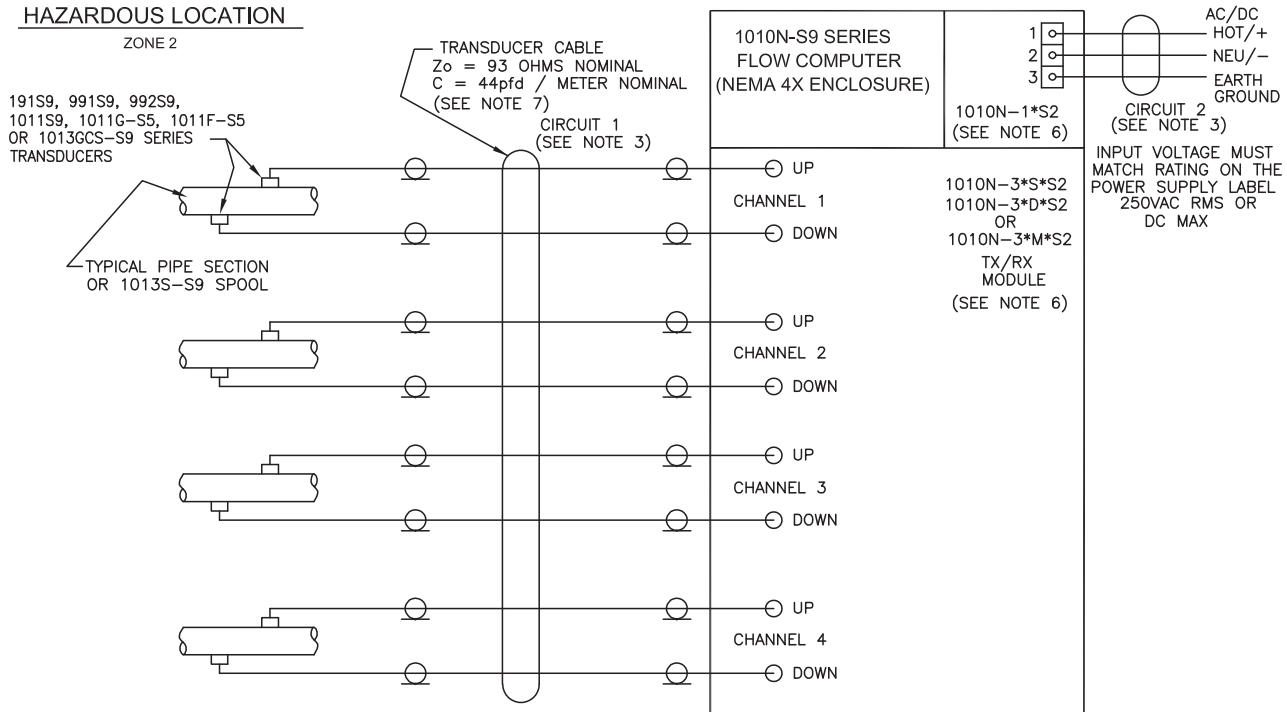
SCALE: NONE | WT. | SHEET 5 OF 7



DO NOT SCALE THIS DRAWING UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON– FRACTIONS– DECIMALS– ANGLES– +/– 1/16 XX+/–0.01 +/–0°30' XXX+/–0.005 MATERIAL: FINISH:	CONTROLLED DRAWING CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL DR H.J DATE 3/30/05 CHK DATE ENG DATE PROD DATE APPD DATE CERTIFIED DATE	**SIEMENS** Siemens Energy & Automation, Inc. Process Instrumentation Business Unit CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788 CONNECTION DIAGRAM AGENCY APPROVED FOR HAZARDOUS AREA USE 1010NS9/1010MNS9 SERIES FLOW COMPUTER	SIZE C CODE IDENT NO. 21614 1010-389 REV. 05 SCALE: NONE WT. SHEET 6 OF 7



DO NOT SCALE THIS DRAWING UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON– FRACTIONS– DECIMALS– ANGLES– +/– 1/16 XX+/–0.01 +/–0°30' XXX+/–0.005 MATERIAL: FINISH:	CONTROLLED DRAWING CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL DR H.J DATE 3/30/05 CHK DATE ENG DATE PROD DATE APPD DATE CERTIFIED DATE	**SIEMENS** Siemens Energy & Automation, Inc. Process Instrumentation Business Unit CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788 CONNECTION DIAGRAM AGENCY APPROVED FOR HAZARDOUS AREA USE 1010NS9/1010MNS9 SERIES FLOW COMPUTER SIZE C · CODE IDENT NO. 21614 · 1010-389 · REV. 05 SCALE: NONE · WT. · SHEET 7 OF 7



CHANGES TO THIS DOCUMENT REQUIRE SAFETY AGENCY APPROVAL

NOTES:

1. WARNING: SUBSTITUTION WITH UNSPECIFIED COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
2. USE 1010N MANUALS FOR OPERATION AND MAINTENANCE INSTRUCTIONS.
3. CIRCUITS 1, 2, AND 3 MUST BE IN SEPARATE CONDUIT.
4. ALL CASE CONDULET OPENINGS ARE TO USE DUST TIGHT OR EXPLOSION PROOF SEALS.
5. DATA/CONTROL SIGNAL CONNECTIONS ARE MADE ON 1015N-5M, 1010N-2*, 1010N-7* OR 1010N-8* MODULES. 1015N-5M IS ORDERED SEPARATELY, OTHER INCLUDED MODULES VARY WITH FLOW COMPUTER MODEL.
6. MODULE PART NUMBER SUFFIX (*) MAY VARY DEPENDING ON FLOW COMPUTER MODEL.
7. CABLE LENGTHS GREATER THAN 300 FEET REQUIRE CONTROLOTRON APPROVAL.

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON-
FRACTIONS- DECIMALS- ANGLES-
+/- 1/16 XX+/-0.01 +/-0°30'
XXX+/-0.005

MATERIAL:

FINISH:

CONTRACT NO.

DR	H.J	DATE 3/29/04
CHK		DATE
ENG		DATE
PROD		DATE
APPD		DATE

CERTIFIED

DATE

CONTROLOTRON
HAUPPAUGE , NY 11788

CONNECTION DIAGRAM

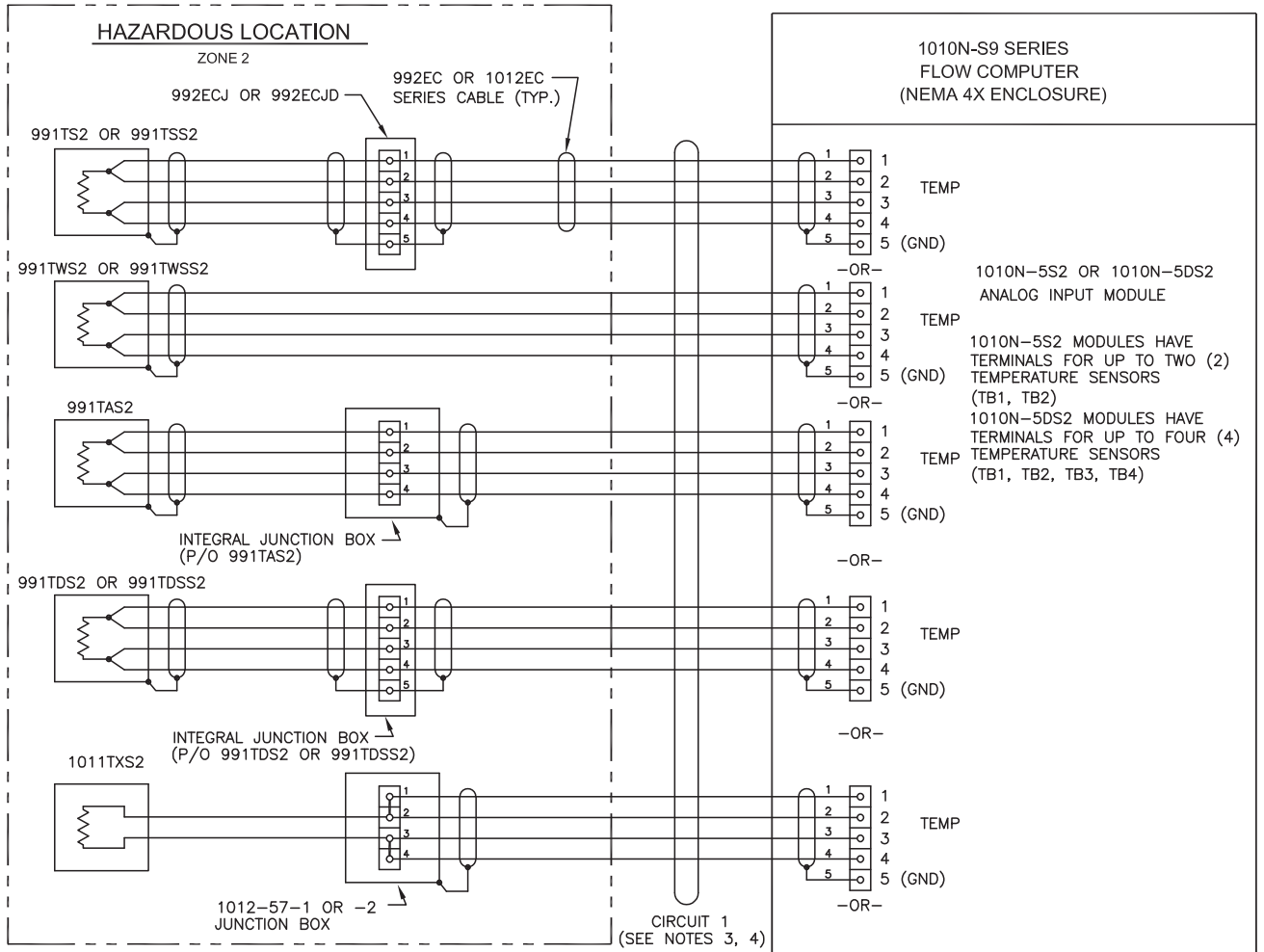
AGENCY APPROVED FOR ZONE 2 CONNECTIONS

1010NS9 FLOW COMPUTER SYSTEM

SIZE	CODE IDENT NO.		REV.
C	21614	1010-391	C

SCALE: NONE | WT. | SHEET 1 OF 4

CN#4824



CHANGES TO THIS DOCUMENT REQUIRE SAFETY AGENCY APPROVAL

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ENG		DATE
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CONTROLOTRON
HAUPPAUGE , NY 11788

CONNECTION DIAGRAM

AGENCY APPROVED FOR ZONE 2 CONNECTIONS

1010NS9 FLOW COMPUTER SYSTEM

SIZE	CODE IDENT NO.		REV.
C	21614	1010-391	C

SCALE: NONE | WT. | SHEET 2 OF 4

CN#4824

NORMAL SIGNAL CHARACTERISTICS (SEE NOTES 5 & 6)				
MODULE	LOCATION	FUNCTION	NORMAL VOLTAGE	CURRENT
1010N-2, 1010N-2K2 OR 1010N-2K3	TB1–1	Tx	to ±12 Vdc	4 mA
	TB1–2	RTS	to ±12 Vdc	4 mA
	TB1–3	DTR	to ±12 Vdc	4 mA
	TB1–4	Rx	to ±12 Vdc	4 mA
	TB1–5	CTS	to ±12 Vdc	4 mA
	TB1–6	GND	0 Vdc	20 mA
	TB1–7	D1+	0 to 5 Vdc	5 mA
	TB1–8	D1–	0 Vdc	5 mA
	TB1–9	D2+	0 to 5 Vdc	5 mA
	TB1–10	D2–	0 Vdc	5 mA
	TB1–11	D3+	0 to 5 Vdc	5 mA
	TB1–12	D3–	0 Vdc	5 mA
	TB1–13	D4+	0 to 5 Vdc	5 mA
	TB1–14	D4–	0 Vdc	5 mA
	TB2–1	Vo1+	0 – 10 Vdc	1 mA
	TB2–2	Vo1–	0 Vdc	1 mA
	TB2–3	Vo2+	0 – 10 Vdc	1 mA
	TB2–4	Vo2–	0 Vdc	1 mA
	TB2–5	NO CONNECTION	——	——
	TB2–6	Io1+	0 – 33 Vdc	4 – 20 mA
	TB2–7	Io1–	0 Vdc	4 – 20 mA
	TB2–8	Io2+	0 – 33 Vdc	4 – 20 mA
	TB2–9	Io2–	0 Vdc	4 – 20 mA
	TB2–10	NO CONNECTION	——	——
	TB2–11	PGEN 1+	0 to 5 Vdc	4 mA
	TB2–12	PGEN 1–	0 Vdc	4 mA
	TB2–13	PGEN 2+	0 to 5 Vdc	4 mA
	TB2–14	PGEN 2–	0 Vdc	4 mA
	TB3–1	K1 NO	0 – 50 Vdc	250 mA
	TB3–2	K1 NC	0 – 50 Vdc	250 mA
	TB3–3	K1 COM	0 – 50 Vdc	250 mA
	TB3–4	NO CONNECTION	——	——
	TB3–5	K2 NO	0 – 50 Vdc	250 mA
	TB3–6	K2 NC	0 – 50 Vdc	250 mA
	TB3–7	K2 COM	0 – 50 Vdc	250 mA
	TB3–8	K3 NO	0 – 50 Vdc	250 mA
	TB3–9	K3 NC	0 – 50 Vdc	250 mA
	TB3–10	K3 COM	0 – 50 Vdc	250 mA
	TB3–11	NO CONNECTION	——	——
	TB3–12	K4 NO	0 – 50 Vdc	250 mA
	TB3–13	K4 NC	0 – 50 Vdc	250 mA
	TB3–14	K4 COM	0 – 50 Vdc	250 mA

NORMAL SIGNAL CHARACTERISTICS (SEE NOTE 6)				
MODULE	LOCATION	FUNCTION	NORMAL VOLTAGE	CURRENT
1010N-5S2	TB3–1	I in 1	15 Vdc Max	4 – 20 mA
	TB3–2	I in 1 COMMON	——	4 – 20 mA
	TB3–3	I in 2	15 Vdc Max	4 – 20 mA
	TB3–4	I iN 2 COMMON	——	4 – 20 mA
	TB4–1	I in 3	15 Vdc Max	4 – 20 mA
	TB4–2	I in 3 COMMON	——	4 – 20 mA
	TB4–3	I in 4	15 Vdc Max	4 – 20 mA
	TB4–4	I iN 4 COMMON	——	4 – 20 mA
1010N-5DS2	TB5–1	I in 1	15 Vdc Max	4 – 20 mA
	TB5–2	I in 1 COMMON	——	4 – 20 mA
	TB5–3	I in 2	15 Vdc Max	4 – 20 mA
	TB5–4	I iN 2 COMMON	——	4 – 20 mA

NORMAL SIGNAL CHARACTERISTICS (SEE NOTES 5 & 6)				
MODULE	LOCATION	FUNCTION	NORMAL VOLTAGE	CURRENT
1010N-8MS2	TB1–1	Tx	to ±12 Vdc	4 mA
	TB1–2	RTS	to ±12 Vdc	4 mA
	TB1–3	DTR	to ±12 Vdc	4 mA
	TB1–4	Rx	to ±12 Vdc	4 mA
	TB1–5	CTS	to ±12 Vdc	4 mA
	TB1–6	GND	0 Vdc	20 mA
	TB1–7	K1 NO	0 – 50 Vdc	250 mA
	TB1–8	K1 NC	0 – 50 Vdc	250 mA
	TB1–9	K1 COM	0 – 50 Vdc	250 mA
	TB1–10	K2 NO	0 – 50 Vdc	250 mA
	TB1–11	K2 NC	0 – 50 Vdc	250 mA
	TB1–12	K2 COM	0 – 50 Vdc	250 mA
	TB1–13	K3 NO	0 – 50 Vdc	250 mA
	TB1–14	K3 NC	0 – 50 Vdc	250 mA
	TB1–15	K3 COM	0 – 50 Vdc	250 mA
	TB1–16	K4 NO	0 – 50 Vdc	250 mA
	TB1–17	K4 NC	0 – 50 Vdc	250 mA
	TB1–18	K4 COM	0 – 50 Vdc	250 mA
	TB2–1	Vo1+	0 – 10 Vdc	1 mA
	TB2–2	Vo1–	0 Vdc	1 mA
	TB2–3	Vo2+	0 – 10 Vdc	1 mA
	TB2–4	Vo2–	0 Vdc	1 mA
	TB2–5	Vo3+	0 – 10 Vdc	1 mA
	TB2–6	Vo3–	0 Vdc	1 mA
	TB2–7	Vo4+	0 – 10 Vdc	1 mA
	TB2–8	Vo4–	0 Vdc	1 mA
	TB3–1	Io1+	33 Vdc	4 – 20 mA
	TB3–2	Io1–	0 – 33 Vdc	4 – 20 mA
	TB3–3	Io2+	33 Vdc	4 – 20 mA
	TB3–4	Io2–	0 – 33 Vdc	4 – 20 mA
	TB3–5	Io3+	33 Vdc	4 – 20 mA
	TB3–6	Io3–	0 – 33 Vdc	4 – 20 mA
	TB3–7	Io4+	33 Vdc	4 – 20 mA
	TB3–8	Io4–	0 – 33 Vdc	4 – 20 mA
	TB4–1	NO CONNECTION	——	——
	TB4–2	NO CONNECTION	——	——
	TB4–3	D1+	0 to 5 Vdc	5 mA
	TB4–4	D1–	0 Vdc	5 mA
	TB4–5	D2+	0 to 5 Vdc	5 mA
	TB4–6	D2–	0 Vdc	5 mA
	TB4–7	D3+	0 to 5 Vdc	5 mA
	TB4–8	D3–	0 Vdc	5 mA
	TB4–9	D4+	0 to 5 Vdc	5 mA
	TB4–10	D4–	0 Vdc	5 mA
	TB4–11	Iin1+	0 – 15 Vdc	4 – 20 mA
	TB4–12	Iin1–	0 Vdc	4 – 20 mA
	TB4–13	Iin2+	0 – 15 Vdc	4 – 20 mA
	TB4–14	Iin2–	0 Vdc	4 – 20 mA
	TB4–15	Iin3+	0 – 15 Vdc	4 – 20 mA
	TB4–16	Iin3–	0 Vdc	4 – 20 mA
	TB4–17	Iin4+	0 – 15 Vdc	4 – 20 mA
	TB4–18	Iin4–	0 Vdc	4 – 20 mA

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HAUPPAUGE , NY 11788

CONNECTION DIAGRAM

AGENCY APPROVED FOR ZONE 2 CONNECTIONS

1010NS9 FLOW COMPUTER SYSTEM

SIZE	CODE IDENT NO.		REV.
C	21614	1010-391	C

SCALE: NONE | WT. | SHEET 3 OF 4

CN#4824

NORMAL SIGNAL CHARACTERISTICS (SEE NOTES 5 & 6)				
MODULE	LOCATION	FUNCTION	NORMAL VOLTAGE	CURRENT
1010N-7, 1010N-7K2 OR 1010N-7K3 USED IN STANDARD, HIGH-PERFORMANCE, OR ENHANCED-PERFORMANCE FLOWMETERS	TB1–1	Tx	to ±12 Vdc	4 mA
	TB1–2	RTS	to ±12 Vdc	4 mA
	TB1–3	DTR	to ±12 Vdc	4 mA
	TB1–4	Rx	to ±12 Vdc	4 mA
	TB1–5	CTS	to ±12 Vdc	4 mA
	TB1–6	GND	0 Vdc	20 mA
	TB1–7	D1+	0 to 5 Vdc	5 mA
	TB1–8	D1–	0 Vdc	5 mA
	TB1–9	D2+	0 to 5 Vdc	5 mA
	TB1–10	D2–	0 Vdc	5 mA
	TB1–11	D3+	0 to 5 Vdc	5 mA
	TB1–12	D3–	0 Vdc	5 mA
	TB1–13	D4+	0 to 5 Vdc	5 mA
	TB1–14	D4–	0 Vdc	5 mA
	TB2–1	Vo1+	0 – 10 Vdc	1 mA
	TB2–2	Vo1–	0 Vdc	1 mA
	TB2–3	Vo2+	0 – 10 Vdc	1 mA
	TB2–4	Vo2–	0 Vdc	1 mA
	TB2–5	Io1+	0 – 33 Vdc	4 – 20 mA
	TB2–6	Io1–	0 Vdc	4 – 20 mA
	TB2–7	Io2+	0 – 33 Vdc	4 – 20 mA
	TB2–8	Io2–	0 Vdc	4 – 20 mA
	TB2–9	PG1	0 to 5 Vdc	4 mA
	TB2–10	PG2	0 Vdc	4 mA
	TB2–11	PG3	0 to 5 Vdc	4 mA
	TB2–12	PG4	0 Vdc	4 mA
	TB3–1	K1 NO	0 – 50 Vdc	250 mA
	TB3–2	K1 NC	0 – 50 Vdc	250 mA
	TB3–3	K1 COM	0 – 50 Vdc	250 mA
	TB3–4	NO CONNECTION	——	——
	TB3–5	K2 NO	0 – 50 Vdc	250 mA
	TB3–6	K2 NC	0 – 50 Vdc	250 mA
	TB3–7	K2 COM	0 – 50 Vdc	250 mA
	TB3–8	K3 NO	0 – 50 Vdc	250 mA
	TB3–9	K3 NC	0 – 50 Vdc	250 mA
	TB3–10	K3 COM	0 – 50 Vdc	250 mA
	TB3–11	NO CONNECTION	——	——
	TB3–12	K4 NO	0 – 50 Vdc	250 mA
	TB3–13	K4 NC	0 – 50 Vdc	250 mA
	TB3–14	K4 COM	0 – 50 Vdc	250 mA
	TB4–1	AUX IO1+	30 Vdc Max.	4 – 20 mA
	TB4–2	AUX IO1–	30 Vdc Max.	4 – 20 mA
	TB4–3	AUX IO2+	30 Vdc Max.	4 – 20 mA
	TB4–4	AUX IO2–	30 Vdc Max.	4 – 20 mA
	TB4–5	AUX IO3+	30 Vdc Max.	4 – 20 mA
	TB4–6	AUX IO3–	30 Vdc Max.	4 – 20 mA
	TB4–7	AUX IO4+	30 Vdc Max.	4 – 20 mA
	TB4–8	AUX IO4–	30 Vdc Max.	4 – 20 mA

NORMAL SIGNAL CHARACTERISTICS (SEE NOTES 5 & 6)				
MODULE	LOCATION	FUNCTION	NORMAL VOLTAGE	CURRENT
1010N-7, 1010N-7K2 OR 1010N-7K3 USED IN ULTRA PERFORMANCE FLOWMETERS	TB1–1	Tx	to ±12 Vdc	4 mA
	TB1–2	RTS	to ±12 Vdc	4 mA
	TB1–3	DTR	to ±12 Vdc	4 mA
	TB1–4	Rx	to ±12 Vdc	4 mA
	TB1–5	CTS	to ±12 Vdc	4 mA
	TB1–6	GND	0 Vdc	20 mA
	TB1–7	D1+	0 to 5 Vdc	5 mA
	TB1–8	D1–	0 Vdc	5 mA
	TB1–9	NO CONNECTION		
	TB1–10	NO CONNECTION		
	TB1–11	NO CONNECTION		
	TB1–12	NO CONNECTION		
	TB1–13	NO CONNECTION		
	TB1–14	NO CONNECTION		
	TB2–1	Vo1+	0 – 10 Vdc	1 mA
	TB2–2	Vo1–	0 Vdc	1 mA
	TB2–3	Vo2+	0 – 10 Vdc	1 mA
	TB2–4	Vo2–	0 Vdc	1 mA
	TB2–5	Io1+	0 – 33 Vdc	4 – 20 mA
	TB2–6	Io1–	0 Vdc	4 – 20 mA
	TB2–7	Io2+	0 – 33 Vdc	4 – 20 mA
	TB2–8	Io2–	0 Vdc	4 – 20 mA
	TB2–9	PG1	0 to 28 Vdc	5 mA
	TB2–10	PG2	0 to 5 Vdc	4 mA
	TB2–11	PG3	0 to 28 Vdc	5 mA
	TB2–12	PG4	0 to 5 Vdc	4 mA
	TB2–13	NO CONNECTION	——	——
	TB2–14	NO CONNECTION	——	——
	TB3–1	K1 NO	0 – 50 Vdc	250 mA
	TB3–2	K1 NC	0 – 50 Vdc	250 mA
	TB3–3	K1 COM	0 – 50 Vdc	250 mA
	TB3–4	NO CONNECTION	——	——
	TB3–5	K2 NO	0 – 50 Vdc	250 mA
	TB3–6	K2 NC	0 – 50 Vdc	250 mA
	TB3–7	K2 COM	0 – 50 Vdc	250 mA
	TB3–8	K3 NO	0 – 50 Vdc	250 mA
	TB3–9	K3 NC	0 – 50 Vdc	250 mA
	TB3–10	K3 COM	0 – 50 Vdc	250 mA
	TB3–11	NO CONNECTION	——	——
	TB3–12	K4 NO	0 – 50 Vdc	250 mA
	TB3–13	K4 NC	0 – 50 Vdc	250 mA
	TB3–14	K4 COM	0 – 50 Vdc	250 mA
	TB4–1	NO CONNECTION		
	TB4–2	NO CONNECTION		
	TB4–3	NO CONNECTION		
	TB4–4	NO CONNECTION		
	TB4–5	AUX IO3+	30 Vdc Max.	4 – 20 mA
	TB4–6	AUX IO3–	30 Vdc Max.	4 – 20 mA
	TB4–7	AUX IO4+	30 Vdc Max.	4 – 20 mA
	TB4–8	AUX IO4–	30 Vdc Max.	4 – 20 mA

NORMAL SIGNAL CHARACTERISTICS (SEE NOTE 5)				
MODULE	LOCATION	FUNCTION	NORMAL VOLTAGE	CURRENT
1015N-5M	J2–1	DCD	to ±12 Vdc	22 mA
	J2–2	RX	to ±12 Vdc	22 mA
	J2–3	TX	to ±12 Vdc	22 mA
	J2–4	DTR	to ±12 Vdc	22 mA
	J2–5	GND	0 Vdc	75 mA
	J2–6	N/C		
	J2–7	RTS	to ±12 Vdc	22 mA
	J2–8	CTS	to ±12 Vdc	22 mA
	J2–9	TX+	0 to 5 Vdc	25 mA
	J2–10	TX–	0 to 5 Vdc	25 mA
	J2–11	RX+	0 to 5 Vdc	25 mA
	J2–12	RX–	0 to 5 Vdc	25 mA

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CONNECTION DIAGRAM

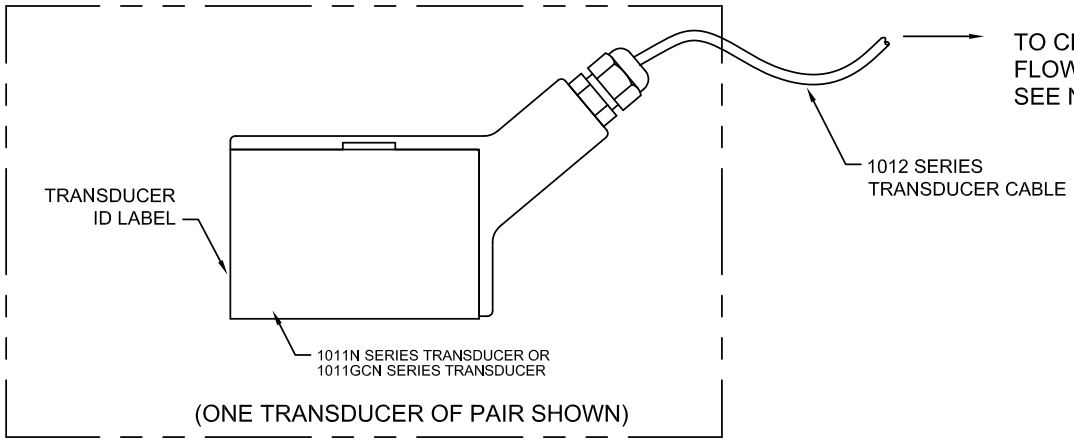
AGENCY APPROVED FOR ZONE 2 CONNECTIONS

1010NS9 FLOW COMPUTER SYSTEM

SIZE	CODE IDENT NO.		REV.
C	21614	1010-391	C

SCALE: NONE | WT. | SHEET 4 OF 4

CN#4824

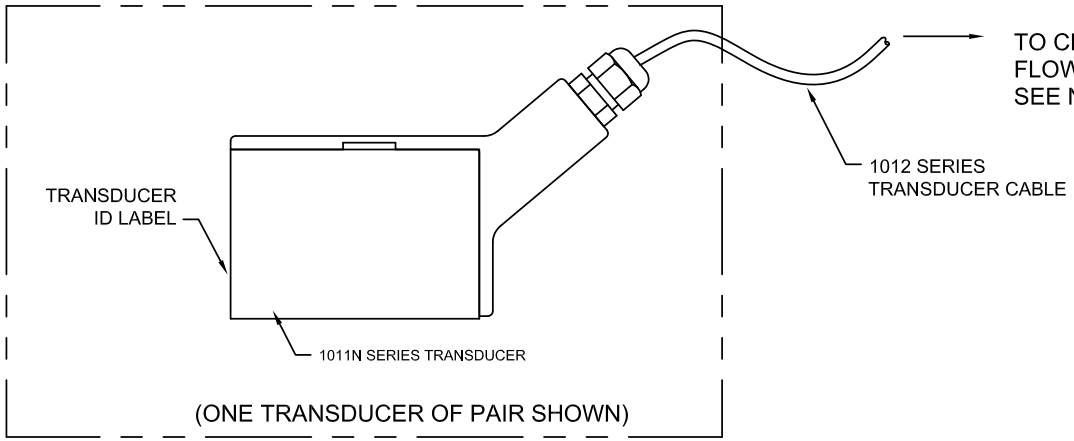


1. INSTALL ONE OF THNE FOLLOWING TRANSDUCER
   P/N 1011N(MODEL CODES)-(SIZE)-S2
   P/N 1011GCN(MODEL CODES)-(SIZE)-S2
   IN ACCORDANCE WITH THE FOLLOWING DRAWINGS:
   a. FOR USE WITH 994 SERIES AGENCY APPROVED FLOW COMPUTERS-
      INTRINSICALLY SAFE FOR CLASS I, II, DIVISION 1, GROUPS A - G, PER DRAWING 990-104 OR 990-105
      NON-INCENDIVE FOR CLASS I, DIVISION 2, GROUPS A - D, SUITABLE FOR CLASS II, DIVISION 2, GPS F, G
      PER DRAWING 990-110 OR 990-111.
   b. FOR USE WITH 1010 SERIES AGENCY APPROVED FLOW COMPUTERS-
      INTRINSICALLY SAFE FOR CLASS I, II, DIVISION 1, GROUPS A - G, PER DRAWING 1010-304, 1010-341 OR 1010-443
      NON-INCENDIVE FOR CLASS I, DIVISION 2, GROUPS A - D, SUITABLE FOR CLASS II, DIVISION 2, GPS E, F, G
      PER DRAWING 1010-304, 1010-339, 1010-342 OR 1010-443.
2. SEE DRAWING 1011NPS-7 AND APPROPRIATE FLOW COMPUTER FIELD MANUAL
   FOR ADDITIONAL INSTALLATION INSTRUCTIONS.
3. SEE DRAWING 1011NPS-8 FOR OUTLINE INSTALLATION DIMENSIONS
4. WARNING: SUBSTITUTION WITH UNSPECIFIED COMPONENTS MAY
   IMPAIR INTRINSIC SAFETY.

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CN#5160



1. INSTALL TRANSDUCER P/N 1011NFPS-(SIZE)-S9 (OR P/N 1011NPS-(SIZE)-S9) IN ACCORDANCE WITH THE FOLLOWING DRAWINGS:
   a. FOR USE WITH 1010 SERIES AGENCY APPROVED FLOW COMPUTERS- INTRINSICALLY SAFE EEx ia IIC T5 PER DRAWING 1010-389, 1010-422 OR 1010-464.
   b. NON-INCENDIVE FOR ZONE 2 PER DRAWING 1010-389, 1010-391, 1010-423 OR 1010-464.
2. SEE DRAWING 1011NPS-7 OR 1011NFPS-7 AND APPROPRIATE FLOW COMPUTER FIELD MANUAL FOR ADDITIONAL INSTALLATION INSTRUCTIONS.
3. SEE DRAWING 1011NPS-8 OR 1011NFPS-8 FOR OUTLINE INSTALLATION DIMENSIONS.
4. WARNING: SUBSTITUTION WITH UNSPECIFIED COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

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INSTALLATION GUIDE, CONNECTION DIAGRAM SELECTION

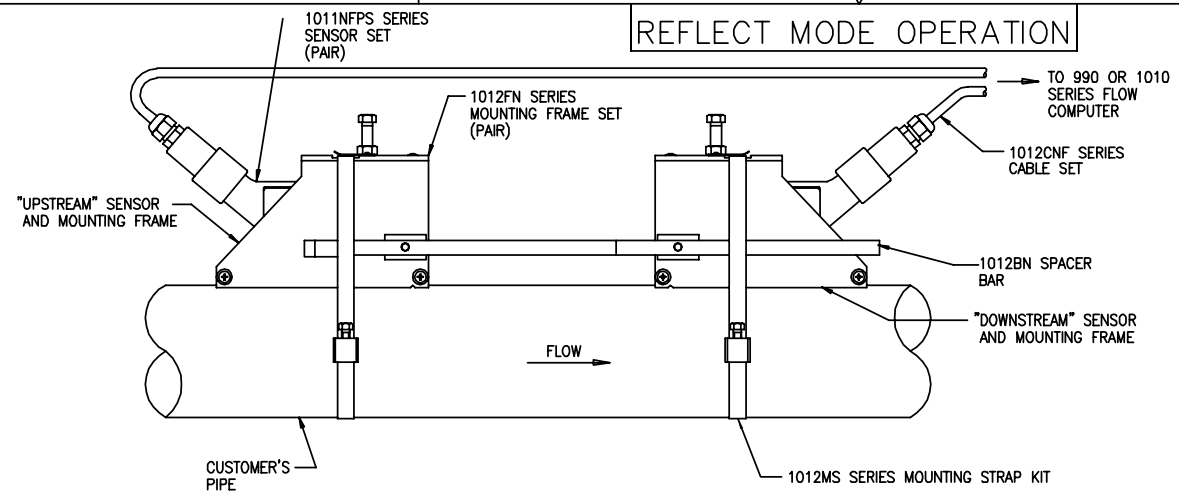
AGENCY APPROVED 1011N SERIES TRANSDUCERS

SIZE	CODE IDENT NO.		REV.
A	21614	1011NS9-7	C1

SCALE: | WT. | SHEET 1 of 1

CN#4931

REFLECT MODE OPERATION



INSTALLATION NOTES – SEE DRAWING REFERENCE ⚠

1. USING THE INSTALLATION MENU AND THE PROCEDURE OUTLINED IN THE FLOW COMPUTER FIELD MANUAL, CONFIRM THAT YOU HAVE THE APPROPRIATE SENSORS AND SPACER BAR (IF USED) FOR REFLECT MODE OPERATION ON THE CHOSEN PIPE.

2. SELECT MOUNTING LOCATION;
2.1 CHOOSE LOCATION WHICH REMAINS FULL AT ZERO FLOW.
2.2 WHERE POSSIBLE LOCATE SENSORS 10 PIPE DIAMETERS OR MORE FROM BEND TO ENSURE FULLY DEVELOPED AND STABLE FLOW PROFILE.
2.3 ON HORIZONTAL PIPE, SELECT HORIZONTAL PLANE, IF POSSIBLE TO AVOID SEDIMENT BLOCKAGE OF ULTRASONIC BEAM.

3. PREPARE PIPE FOR TRACK MOUNTING:
3.1 REMOVE GRIT, CORROSION, COATING OR HEAVY PAINT
3.2 CLEAN AND DEGREASE SURFACE
3.3 DO NOT MOUNT OVER FROST.
3.4 CONDITION PIPE SURFACE;
LOCALLY SMOOTH THE PIPE SURFACE TO ACCEPT THE SENSORS. USE THE ABRASIVE PAD PROVIDED.

4. INSTALLATION WITH MOUNTING FRAMES
4.1 CONSULT THE 1010 FIELD MANUAL AND USE THE INSTALLATION MENU TO SELECT THE APPROPRIATE INDEX HOLE OR SPACING (LTN) FOR YOUR APPLICATION.

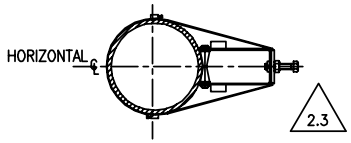
4.2 IF SPACER BAR IS USED:
4.2.1 CLAMP ONE MOUNTING FRAME AT THE UN–NUMBERED REFERENCE POSITION OF THE SPACER BAR. BE SURE THE INDEX PIN AND SPACER BAR INDEX SCREW ENGAGE THE HOLE IN THE SPACER BAR.
4.2.2 CLAMP THE SECOND MOUNTING FRAME TO THE SPACER BAR IN THE SAME MANNER AT THE INDEX HOLE INDICATED DURING STEP 4.1.
4.2.3 HOLD THE MOUNTING FRAME/SPACER BAR ASSEMBLY ON THE PIPE AT THE SELECTED LOCATION AND TEMPORARILY SECURE IT TO THE PIPE USING STRAPS FROM THE 1012MS STRAP MOUNTING KIT. GO TO 4.4.

4.3 IF MOUNTING FRAMES ARE SPACED BY MEASURING "LTN":
4.3.1 TEMPORARILY SECURE ONE OF THE MOUNTING FRAMES TO THE PIPE USING STRAPS FROM THE 1012MS STRAP MOUNTING KIT.
4.3.2 MEASURE ALONG THE PIPE AND TEMPORARILY SECURE THE SECOND MOUNTING FRAME TO THE PIPE SO THAT SPACING "LTN" DETERMINED IN STEP 4.1 IS MEASURED BETWEEN THE SPACING MARKS ON THE MOUNTING FRAMES.

4.4 IF THE PIPE SURFACE IS CLEAN AND SMOOTH, PROCEED TO SENSOR INSTALLATION ON SHT.3. IF PIPE SURFACE NEEDS CONDITIONING; MARK THE MOUNTING FRAME POSITION CAREFULLY, LOOSEN STRAPS AND MOVE THE MOUNTING FRAMES ASIDE. LOCALLY SMOOTH THE PIPE SURFACE IN THE MARKED AREAS USING THE ABRASIVE PAD SUPPLIED. SHIFT THE MOUNTING FRAMES BACK INTO THEIR APPROPRIATE LOCATIONS AND TIGHTEN THE THE MOUNTING STRAPS SECURELY.

** SEE SHEET 3 FOR INSTRUCTIONS TO COMPLETE SENSOR INSTALLATION.

PREFERRED MOUNTING PLANE

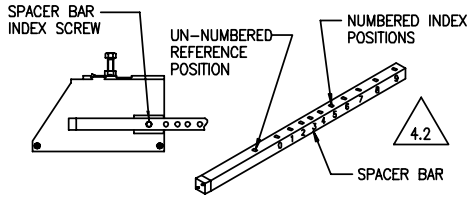


MOUNT SENSORS/MOUNTING FRAMES IN HORIZONTAL PLANE TO PREVENT BLOCKING OF ULTRASONIC BEAM BY AIR OR SEDIMENT.

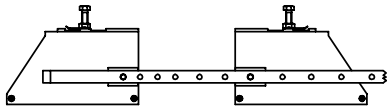
USING THE SPACER BAR TO SET SENSOR MOUNTING FRAME SPACING

USING THE INSTALLATION MENU, AS OUTLINED IN THE FLOW COMPUTER FIELD MANUAL, DETERMINE THE SPACING INDEX NUMBER FOR THE SELECTED APPLICATION.

USE THE SPACER BAR INDEX SCREW TO SECURE THE SPACER BAR TO ONE OF THE MOUNTING FRAMES AT THE UN–NUMBERED REFERENCE POSITION.

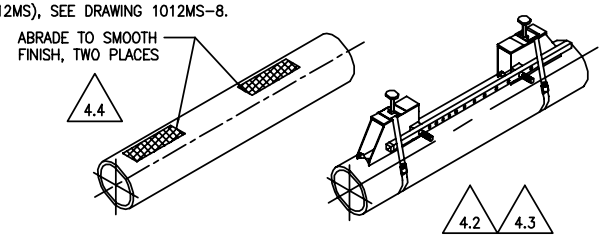


SECURE THE SECOND MOUNTING FRAME TO THE SPACER BAR AT THE NUMBERED INDEX POSITION DETERMINED FROM THE INSTALLATION MENU.



SECURING MOUNTING FRAMES TO THE PIPE SURFACE

HOLD THE MOUNTING FRAME/SPACER BAR ASSEMBLY AGAINST THE PIPE AT THE SELECTED MOUNTING LOCATION. MARK THE APPROXIMATE OUTLINE OF THE MOUNTING FRAMES ON THE PIPE SURFACE. USING THE ABRASIVE PAD SUPPLIED, SMOOTH THE PIPE SURFACE IN THE MARKED AREAS. SECURE THE MOUNTING FRAMES TO THE PIPE USING THE MOUNTING STRAP KIT (1012MS), SEE DRAWING 1012MS–8.



SEE SHEET 4 FOR SENSOR INSTALLATION WITHOUT MOUNTING FRAMES

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON-

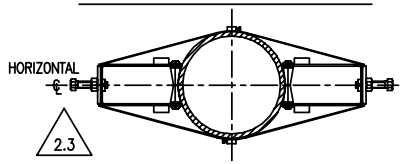
FRACTIONS	DECIMAL	ANGLES	HOLES
± 1/64"	XX±0.01 XXX±0.005	±0°30'	±.003

DRAWN BY: H.Jenkins

INSTALLATION, 1011NPFS SERIES DEDICATED PLASTIC BODY SENSOR

SAP MATERIAL NO.	A5E32959662	REV AA
ITEM NO.	A5E32959662	RS AA
DOCUMENT NO.	1011NFPS - 7	REV 003
DATE: 9/30/2013	SCALE: NONE	SHEET 1 OF 4

PREFERRED MOUNTING PLANE

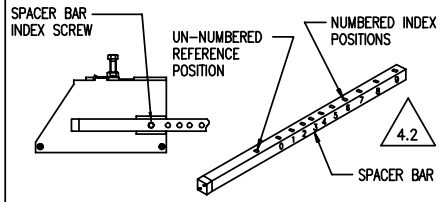


MOUNT SENSORS/MOUNTING FRAMES IN HORIZONTAL PLANE TO PREVENT BLOCKING OF ULTRASONIC BEAM BY AIR OR SEDIMENT.

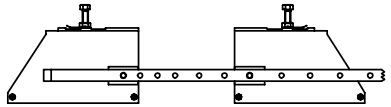
USING THE SPACER BAR TO SET SENSOR MOUNTING FRAME SPACING

USING THE INSTALLATION MENU, AS OUTLINED IN THE FLOW COMPUTER FIELD MANUAL, DETERMINE THE SPACING INDEX NUMBER FOR THE SELECTED APPLICATION.

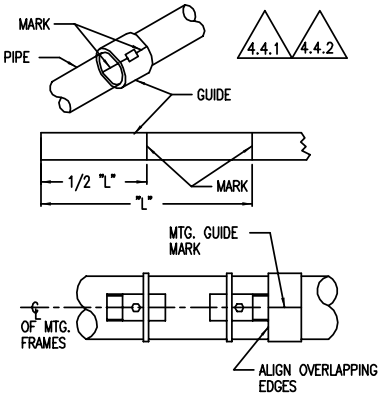
USE THE SPACER BAR INDEX SCREW TO SECURE THE SPACER BAR TO ONE OF THE MOUNTING FRAMES AT THE UN-NUMBERED REFERENCE POSITION.



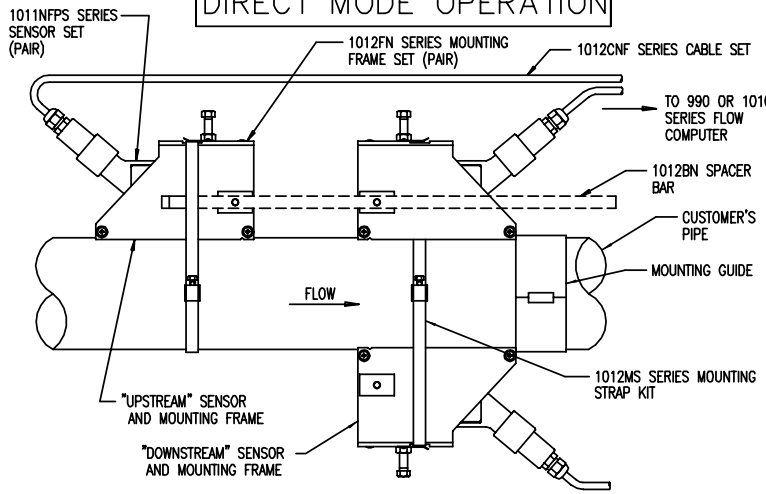
SECURE THE SECOND MOUNTING FRAME TO THE SPACER BAR AT THE NUMBERED INDEX POSITION DETERMINED FROM THE INSTALLATION MENU.



WRAP MOUNTING GUIDE AROUND PIPE AND MARK AT OVERLAPPING EDGE, UNWRAP GUIDE, MEASURE DISTANCE "L" FROM EDGE TO MARK, MARK AGAIN AT 1/2 "L". RE-INSTALL THE MOUNTING GUIDE, TAPE IN PLACE WITH BOTH MARKS VISIBLE, ALIGN ONE MARK WITH THE CENTER LINE OF THE MOUNTING FRAMES.

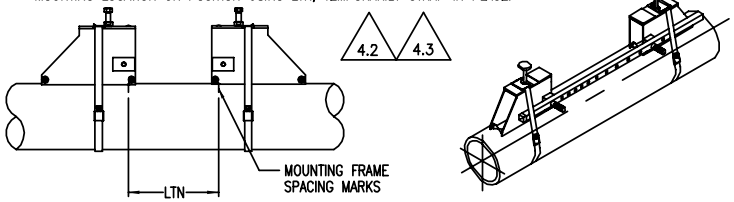


DIRECT MODE OPERATION

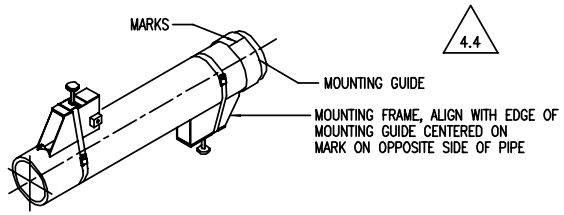


SECURING MOUNTING FRAMES TO THE PIPE SURFACE

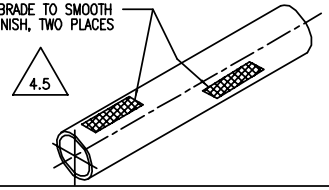
HOLD THE MOUNTING FRAME/SPACER BAR ASSEMBLY AGAINST THE PIPE AT THE SELECTED MOUNTING LOCATION OR POSITION USING LTN, TEMPORARILY STRAP IN PLACE.



USE THE MOUNTING GUIDE TO TRANSFER ONE OF THE MOUNTING FRAMES TO THE OPPOSITE SIDE OF THE PIPE.



IF NECESSARY, USE THE ABRASIVE PAD SUPPLIED TO PRODUCE A SMOOTH FINISH ON THE PIPE AT THE SENSOR MOUNTING POSITIONS.



INSTALLATION NOTES – SEE DRAWING REFERENCE ⚠

1. USING THE INSTALLATION MENU AND THE PROCEDURE OUTLINED IN THE FLOW COMPUTER FIELD MANUAL, CONFIRM THAT YOU HAVE THE APPROPRIATE SENSORS AND SPACER BAR (IF USED) FOR DIRECT MODE OPERATION ON THE CHOSEN PIPE.
2. SELECT MOUNTING LOCATION;
2.1 CHOOSE LOCATION WHICH REMAINS FULL AT ZERO FLOW.
2.2 WHERE POSSIBLE LOCATE SENSORS 10 PIPE DIAMETERS OR MORE FROM BEND TO ENSURE FULLY DEVELOPED AND STABLE FLOW PROFILE.
2.3 ON HORIZONTAL PIPE, SELECT HORIZONTAL PLANE, IF POSSIBLE TO AVOID SEDIMENT BLOCKAGE OF ULTRASONIC BEAM.
3. PREPARE PIPE FOR TRACK MOUNTING
3.1 REMOVE GRIT, CORROSION, COATING OR HEAVY PAINT
3.2 CLEAN AND DEGREASE SURFACE
3.3 DO NOT MOUNT OVER FROST.
3.4 CONDITION PIPE SURFACE;
LOCALLY SMOOTH THE PIPE SURFACE TO ACCEPT THE SENSORS. USE THE ABRASIVE PAD PROVIDED.
4. INSTALLATION WITH MOUNTING FRAMES
4.1 CONSULT THE 1010 FIELD MANUAL AND USE THE INSTALLATION MENU TO SELECT THE APPROPRIATE INDEX HOLE OR SPACING (LTN) FOR YOUR APPLICATION.
4.2 IF SPACER BAR IS USED:
4.2.1 CLAMP ONE MOUNTING FRAME AT THE UN-NUMBERED REFERENCE POSITION OF THE SPACER BAR. BE SURE THE INDEX PIN AND SPACER BAR INDEX SCREW ENGAGE THE HOLE IN THE SPACER BAR.
4.2.2 CLAMP THE SECOND MOUNTING FRAME TO THE SPACER BAR IN THE SAME MANNER AT THE INDEX HOLE INDICATED DURING STEP 4.1.
4.2.3 HOLD THE MOUNTING FRAME/SPACER BAR ASSEMBLY ON THE PIPE AT THE SELECTED LOCATION AND TEMPORARILY SECURE IT TO THE PIPE USING STRAPS FROM THE 1012MS STRAP MOUNTING KIT. GO TO 4.4.
4.3 IF MOUNTING FRAMES ARE SPACED BY MEASURING "LTN":
4.3.1 TEMPORARILY SECURE ONE OF THE MOUNTING FRAMES TO THE PIPE USING STRAPS FROM THE 1012MS STRAP MOUNTING KIT.
4.3.2 MEASURE ALONG THE PIPE AND TEMPORARILY SECURE THE SECOND MOUNTING FRAME TO THE PIPE SO THAT SPACING "LTN" DETERMINED IN STEP 4.1 IS MEASURED BETWEEN THE SPACING MARKS ON THE MOUNTING FRAMES. USE STRAIGHT EDGE OR OTHER MEANS TO ALIGN BOTH MOUNTING FRAMES WITH PIPE AXIS.
4.4 USE THE MOUNTING GUIDE INCLUDED WITH THE 1012MS STRAP MOUNTING KIT TO TRANSFER ONE OF THE MOUNTING FRAMES TO THE OPPOSITE SIDE OF THE PIPE.
4.4.1 WRAP THE MOUNTING GUIDE AROUND THE PIPE. POSITION IT SO THAT THE OVERLAPPING LENGTHS ARE EDGE-ALIGNED, MARK THE OVERLAPPED PORTION OF THE GUIDE AT THE EDGE OF THE OVERLAPPING PORTION. REMOVE THE GUIDE, MEASURE THE DISTANCE FROM THE END TO THE MARK AND MARK AGAIN HALFWAY BETWEEN.
4.4.2 RE-POSITION THE GUIDE ON THE PIPE AND TAPE IN PLACE SO THAT ONE OF THE MARKS INDICATES THE CENTERLINE OF THE INSTALLED MOUNTING FRAMES AND THE MOUNTING GUIDE EDGE IS AGAINST THE END OF ONE OF THE MOUNTING FRAMES. MAKE SURE THE OVERLAPPING LENGTHS OF THE MOUNTING GUIDE ARE EDGE-ALIGNED. THIS ASSURES A DIAMETRICAL TRANSFER OF THE MOUNTING FRAME POSITION.
4.4.3 LOOSEN THE MOUNTING STRAP ON THE MOUNTING FRAME WITH WHICH THE MOUNTING GUIDE HAS BEEN ALIGNED. ROTATE IT AROUND THE PIPE SURFACE UNTIL IT IS CENTERED ON THE OPPOSITE SIDE MOUNTING GUIDE MARK MADE IN STEP 4.4.1. TIGHTEN THE STRAP, REMOVE THE MOUNTING GUIDE.
4.5 IF THE PIPE SURFACE IS CLEAN AND SMOOTH, PROCEED TO SENSOR INSTALLATION ON SHT.3, IF PIPE SURFACE NEEDS CONDITIONING; MARK THE MOUNTING FRAME POSITION CAREFULLY, LOOSEN STRAPS AND MOVE THE MOUNTING FRAMES ASIDE. LOCALLY SMOOTH THE PIPE SURFACE IN THE MARKED AREAS USING THE ABRASIVE PAD SUPPLIED. SHIFT THE MOUNTING FRAMES BACK INTO THEIR APPROPRIATE LOCATIONS AND TIGHTEN THE MOUNTING STRAPS SECURELY.

** SEE SHEET 3 FOR INSTRUCTIONS TO COMPLETE SENSOR INSTALLATION.

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON-

FRACTIONS	DECIMAL	ANGLES	HOLES
± 1/64"	XX±0.01 XXX±0.005	±0°30'	±.003

DRAWN BY: H.Jenkins

INSTALLATION, 1011NPFS SERIES DEDICATED PLASTIC BODY SENSOR

SAP MATERIAL NO.	A5E32959662	REV AA
ITEM NO.	A5E32959662	RS AA
DOCUMENT NO.	1011NFPS - 7	REV 003
DATE: 9/30/2013	SCALE: NONE	SHEET 2 OF 4

MATING 1012CNF SERIES SENSOR CABLES WITH 1011NFPS SERIES TRANSDUCERS

a) REMOVE PROTECTIVE CAPS.

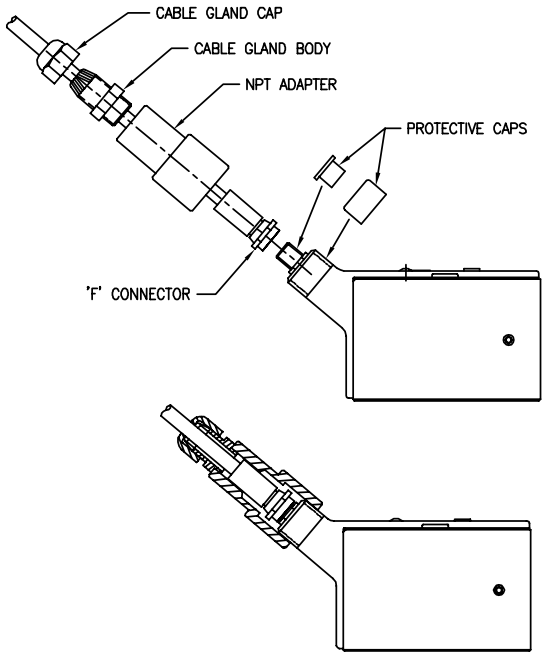
b) SEE APPROPRIATE CABLE ASSEBMLY DRAWING FOR 'F' CONNECTOR, NPT ADAPTER AND GLAND ASSEMBLY DETAIL.

c) MATE 'F' CONNECTORS, CABLES TO TRANSDUCER.

d) FOR BEST WEATHER SEAL, WRAP TEFLON PIPE TAPE (NOT SUPPLIED) AROUND MALE NPT THREADS ON SENSOR HOUSING.

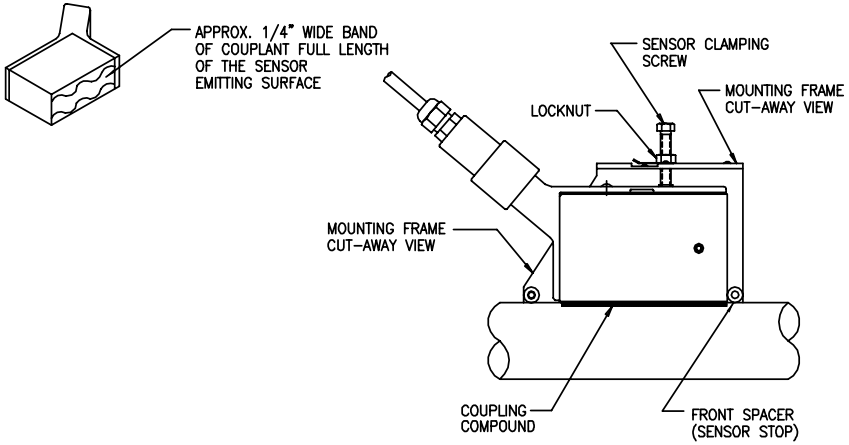
e) SCREW NPT ADAPTER TO SENSOR HOUSING (HAND TIGHT IS SUFFICIENT).

f) TIGHTEN GLAND BODY WITH NPT ADAPTER AND SECURE CABLE BY TIGHTENING GLAND TOP NUT. (HAND TIGHT IS SUFFICIENT).



INSTALLING SENSORS IN MOUNTING FRAMES

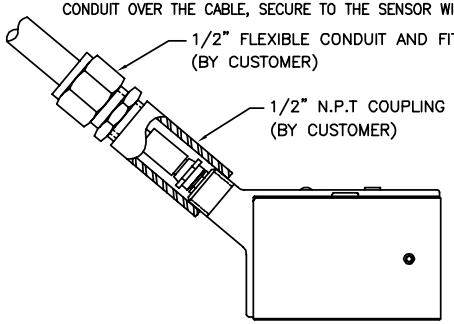
APPLY A THIN BAND OF COUPLANT TO THE EMITTING SURFACE OF THE SENSORS. SLIP THE SENSORS INTO THE MOUNTING FRAMES, SEATING THEM SQUARELY ON THE PIPE SURFACE, PUSH FORWARD INTO THE FRAMES AGAINST THE FRONT SPACER. TIGHTEN THE SENSOR CLAMPING SCREW, FIRMLY SEATING THE SENSORS ON THE PIPE SURFACE. SECURE THE CLAMPING SCREW WITH THE LOCKNUT.



**SEE DRAWING 1012TP-7 FOR INSTALLATION USING 1012TP SERIES MOUNTING TRACKS.

USE OF FLEXIBLE CONDUIT WITH SENSORS

THE SENSOR WIRING HOUSING HAS INTEGRAL 1/2" N.P.T THREADS TO ACCEPT A CONDUIT COUPLING IF FLEXIBLE CONDUIT IS USED. MAKE CONNECTION AS SHOWN, THEN PASS COUPLING AND CONDUIT OVER THE CABLE, SECURE TO THE SENSOR WIRING HOUSING.



INSTALLATION NOTES – CONT'D FROM SHT. 1 OR SHT. 2

5. MAKE CABLE CONNECTIONS AT FLOW COMPUTER IN ACCORDANCE WITH APPROPRIATE FLOW COMPUTER INSTALLATION DRAWING AND 1010 FIELD MANUAL.

6. SEE DRAWINGS 1012FN-8 AND 1011NFPS-8 FOR MOUNTING FRAME AND SENSOR OUTLINE DIMENSIONS.

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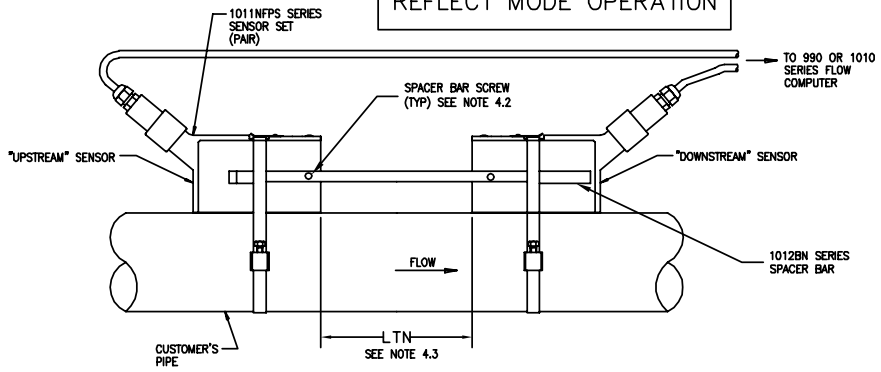
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON-
FRACTIONS DECIMAL ANGLES HOLES
± 1/64" XX±0.01 ±0°30' ±.003
XXX±0.005

DRAWN BY: H.Jenkins

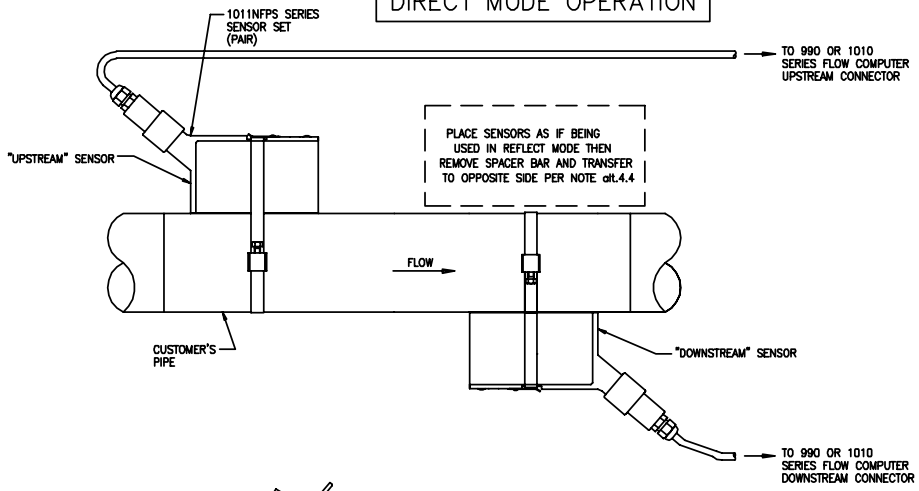
INSTALLATION, 1011NPFS SERIES DEDICATED PLASTIC BODY SENSOR

SAP MATERIAL NO.	A5E32959662	REV AA
ITEM NO.	A5E32959662	RS AA
DOCUMENT NO.	1011NFPS - 7	REV 003
DATE: 9/30/2013	SCALE: NONE	SHEET 3 OF 4

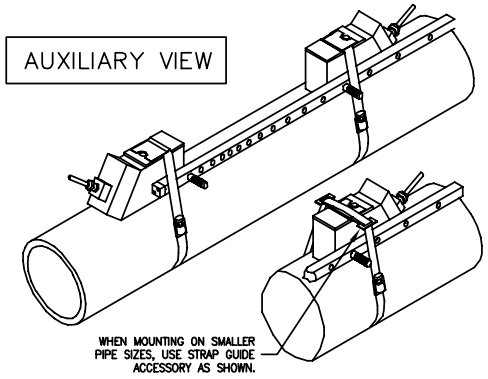
REFLECT MODE OPERATION



DIRECT MODE OPERATION



AUXILIARY VIEW



INSTALLATION OF SENSORS WITHOUT MOUNTING FRAMES

THE SAME GENERAL NOTES AND PROCEDURES APPLY WHEN INSTALLING SENSORS WITHOUT THE BENEFIT OF MOUNTING FRAMES. APPLY THE FOLLOWING ALTERNATES TO THE INSTALLATION NOTES ON SHEETS 1 & 2.

4.2 IF SPACER BAR IS USED:

alt.4.2.1 SECURE ONE SENSOR AT THE UN-NUMBERED REFERENCE POSITION OF THE SPACER BAR BY ENGAGING ONE OF THE SCREWS STOWED IN THE SPACER BAR CAP WITH THE THREADED INSERT IN THE SIDE OF THE SENSOR BLOCK.

alt4.2.2 SECURE THE SECOND SENSOR TO THE SPACER BAR IN THE SAME MANNER AT THE INDEX HOLE INDICATED DURING STEP 4.1.

alt.4.2.3 HOLD SENSOR/SPACER BAR ASSEMBLY ON THE PIPE AT THE SELECTED LOCATION AND TEMPORARILY SECURE IT TO THE PIPE USING STRAPS FROM THE 1012MS STRAP MOUNTING KIT.

4.3 IF SENSORS ARE SPACED BY MEASURING "LTN":

alt.4.3.1 TEMPORARILY SECURE ONE OF THE SENSORS TO THE PIPE USING STRAPS FROM THE 1012MS STRAP MOUNTING KIT.

alt.4.3.2 MEASURE ALONG THE PIPE AND TEMPORARILY SECURE THE SECOND SENSOR TO THE PIPE SO THAT SPACING "LTN" DETERMINED IN STEP 4.1 IS MEASURED BETWEEN THE SPACING MARKS ON THE FRONT FACES OF THE SENSORS. USE A STRAIGHT EDGE OR OTHER MEANS TO ALIGN BOTH SENSORS WITH THE PIPE AXIS.

FOR REFLECT MODE INSTALLATION GO TO STEP alt.4.5
FOR DIRECT MODE INSTALLATION CONTINUE WITH alt.4.4

alt.4.4 USE THE MOUNTING GUIDE INCLUDED WITH THE 1012MS STRAP MOUNTING KIT TO TRANSFER ONE OF THE SENSORS TO THE OPPOSITE SIDE OF THE PIPE. (SEE SHEET 2, ZONE A4)

alt.4.4.1 WRAP THE MOUNTING GUIDE AROUND THE PIPE. POSITION IT SO THAT THE OVERLAPPING LENGTHS ARE EDGE-ALIGNED, MARK THE OVERLAPPED PORTION OF THE GUIDE AT THE EDGE OF THE OVERLAPPING PORTION. REMOVE THE GUIDE, MEASURE THE DISTANCE FROM THE END TO THE MARK AND MARK AGAIN HALFWAY BETWEEN.

alt.4.4.2 RE-POSITION THE GUIDE ON THE PIPE AND TAPE IN PLACE SO THAT ONE OF THE MARKS INDICATES THE CENTERLINE OF THE INSTALLED SENSOR AND THE MOUNTING GUIDE EDGE IS AGAINST THE END OF ONE OF THE SENSORS. MAKE SURE THE OVERLAPPING LENGTHS OF THE MOUNTING GUIDE ARE EDGE-ALIGNED. THIS ASSURES A DIAMETRICAL TRANSFER OF THE SENSOR POSITION.

alt.4.4.3 LOOSEN THE MOUNTING STRAP ON THE SENSOR WITH WHICH THE MOUNTING GUIDE HAS BEEN ALIGNED. ROTATE IT AROUND THE PIPE SURFACE UNTIL IT IS CENTERED ON THE OPPOSITE SIDE MOUNTING GUIDE MARK MADE IN STEP alt.4.4.1. TIGHTEN THE STRAP, REMOVE THE MOUNTING GUIDE.

alt.4.5 WITH THE SENSORS TEMPORARILY STRAPPED IN PLACE, MARK THE PIPE SURFACE AT THE SENSOR PERIMETER. REMOVE THE SENSORS FROM THE PIPE. IF THE PIPE SURFACE IS CLEAN AND SMOOTH, PROCEED TO STEP alt.4.6. IF THE PIPE SURFACE NEEDS CONDITIONING, LOCALLY SMOOTH THE SURFACE IN THE MARKED AREAS USING THE ABRASIVE PAD SUPPLIED. DO NOT OBSCURE THE MARKED SENSOR LOCATIONS.

alt.4.6 APPLY A THIN BAND OF COUPLANT TO THE EMITTING SURFACE OF BOTH SENSORS. CAREFULLY REPLACE THE SENSORS ON THE PIPE, REPEATING THE PROCEDURE ABOVE, IF REQUIRED, TO ASSURE ACCURATE POSITIONING.

CONTINUE WITH INSTALLATION NOTE 5 AND CABLE CONNECTING INSTRUCTIONS ON SHEET 3.

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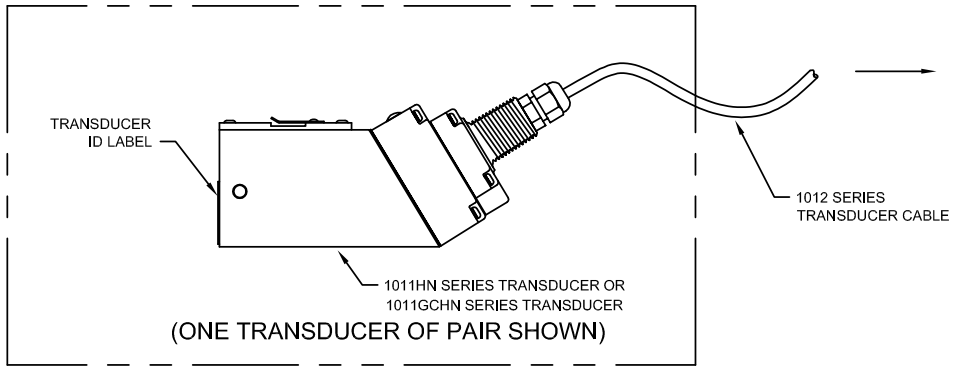
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON-

FRACTIONS	DECIMAL	ANGLES	HOLES
± 1/64"	XX±0.01 XXX±0.005	±0°30'	±.003

DRAWN BY: H.Jenkins

INSTALLATION, 1011NPFS SERIES DEDICATED PLASTIC BODY SENSOR

SAP MATERIAL NO.	A5E32959662	REV	AA
ITEM NO.	A5E32959662	RS	AA
DOCUMENT NO.	1011NFPS - 7	REV	003
DATE: 9/30/2013	SCALE: NONE	SHEET	4 OF 4



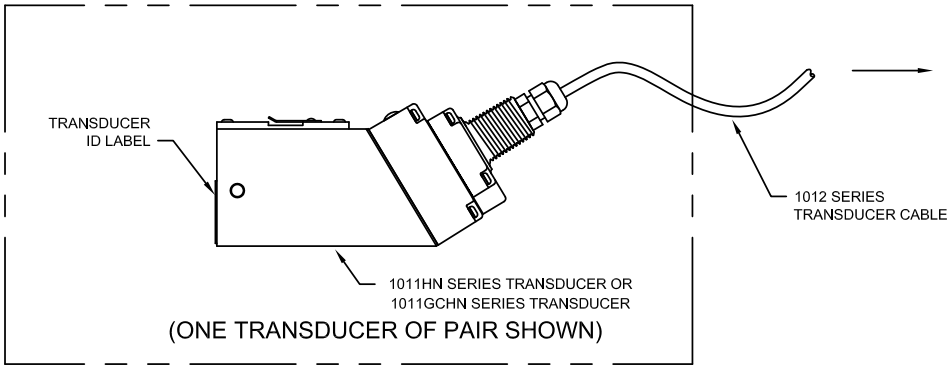
1. INSTALL ONE OF THE FOLLOWING TRANSDUCERS
   P/N 1011HN(MODEL CODES)-(SIZE)-S2
   P/N 1011GCHN(MODEL CODES)-(SIZE)-S2
   IN ACCORDANCE WITH THE FOLLOWING DRAWINGS:
   a. FOR USE WITH 994 SERIES AGENCY APPROVED FLOW COMPUTERS-
      INTRINSICALLY SAFE FOR CLASS I, II, DIVISION 1, GROUPS A - G, PER DRAWING 990-104 OR 990-105
      NON-INCENDIVE FOR CLASS I, DIVISION 2, GROUPS A - D, SUITABLE FOR CLASS II, DIVISION 2, GPS F, G
      PER DRAWING 990-110 OR 990-111.
   b. FOR USE WITH 1010 SERIES AGENCY APPROVED FLOW COMPUTERS-
      INTRINSICALLY SAFE FOR CLASS I, II, DIVISION 1, GROUPS A - G, PER DRAWING 1010-304, 1010-341 OR 1010-443
      NON-INCENDIVE FOR CLASS I, DIVISION 2, GROUPS A - D, SUITABLE FOR CLASS II, DIVISION 2, GPS E, F, G
      PER DRAWING 1010-304, 1010-339, 1010-342 OR 1010-443.
2. SEE DRAWING 1011HNS-7 OR 1011HNFS-7 AND APPROPRIATE FLOW COMPUTER FIELD MANUAL FOR ADDITIONAL INSTALLATION INSTRUCTIONS.
3. SEE DRAWING 1011HNS-8 OR 1011HNFS-8 FOR OUTLINE INSTALLATION DIMENSIONS.
4. WARNING: SUBSTITUTION WITH UNSPECIFIED COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

CHANGES TO THIS DOCUMENT
REQUIRE SAFETY AGENCY APPROVAL

DO NOT SCALE THIS DRAWING	CONTRACT NO.	SIEMENS
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES (MM) TOLERANCES ON– INCHES +/-.01 (MM) +/- 2	DR H.J DATE 11/04/04 CHK DATE ENG DATE PROD DATE APPD DATE CERTIFIED DATE	Siemens Energy & Automation, Inc. Process Instrumentation Business Unit CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788 INSTALLATION GUIDE, CONNECTION DIAGRAM SELECTION AGENCY APPROVED 1011HN SERIES TRANSDUCERS

SIZE	CODE IDENT NO.		REV.
A	21614	1011HNS2-7	D
SCALE:	WT.	SHEET 1 of 1	

CN#5160



1. INSTALL ONE OF THE FOLLOWING TRANSDUCERS
   P/N 1011HN(MODEL CODES)-(SIZE)-S9
   P/N 1011GCHN(MODEL CODES)-(SIZE)-S9
   IN ACCORDANCE WITH THE FOLLOWING DRAWINGS:

   a. FOR USE WITH 1010 SERIES AGENCY APPROVED FLOW COMPUTERS-
      INTRINSICALLY SAFE EEx ia IIC T5 PER DRAWING 1010-389, 1010-422. OR 1010-464.

   b. NON-INCENDIVE FOR ZONE 2 PER DRAWING 1010-389, 1010-391, 1010-423 OR 1010-464.

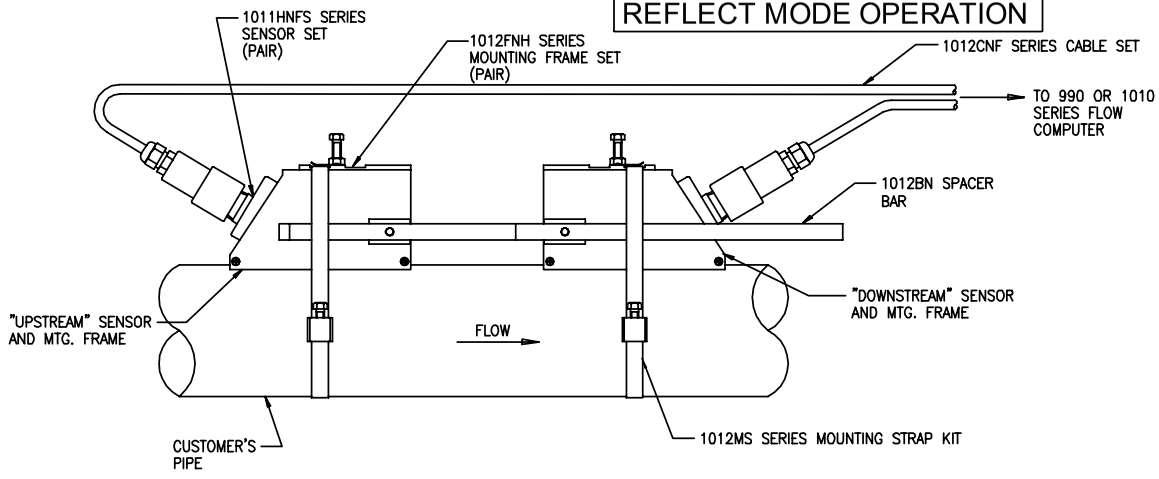
2. SEE DRAWING 1011HNS-7 OR 1011HNFS-7 AND APPROPRIATE FLOW COMPUTER FIELD MANUAL FOR ADDITIONAL INSTALLATION INSTRUCTIONS.
3. SEE DRAWING 1011HNS-8 OR 1011HNFS-8 FOR OUTLINE INSTALLATION DIMENSIONS.
4. WARNING: SUBSTITUTION WITH UNSPECIFIED COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

CHANGES TO THIS DOCUMENT
REQUIRE SAFETY AGENCY APPROVAL

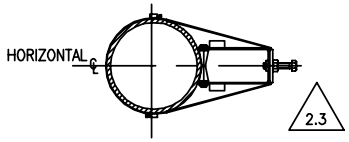
DO NOT SCALE THIS DRAWING UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES (MM) TOLERANCES ON– INCHES +/–.01 (MM) +/– 2	CONTRACT NO. DR CHEV. DATE 5/16/01 CHK DATE ENG DATE PROD DATE APPD DATE CERTIFIED DATE	CONTROLOTRON HAUPPAUGE , NY 11788 INSTALLATION GUIDE, CONNECTION DIAGRAM SELECTION AGENCY APPROVED 1011HN SERIES TRANSDUCERS SIZE A · CODE IDENT NO. 21614 · 1011HNS9-7 · REV. C1 SCALE: · WT. · SHEET 1 of 1

CN#4931

REFLECT MODE OPERATION



PREFERRED MOUNTING PLANE

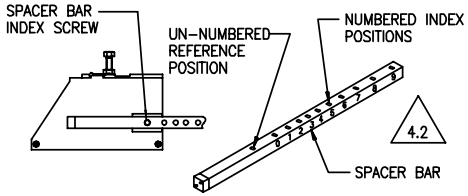


MOUNT SENSORS/MOUNTING FRAMES IN HORIZONTAL PLANE TO PREVENT BLOCKING OF ULTRASONIC BEAM BY AIR OR SEDIMENT.

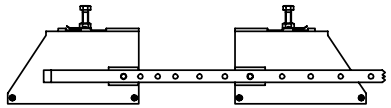
USING THE SPACER BAR TO SET SENSOR MOUNTING FRAME SPACING

USING THE INSTALLATION MENU, AS OUTLINED IN THE FLOW COMPUTER FIELD MANUAL, DETERMINE THE SPACING INDEX NUMBER FOR THE SELECTED APPLICATION.

USE THE SPACER BAR INDEX SCREW TO SECURE THE SPACER BAR TO ONE OF THE MOUNTING FRAMES AT THE UN-NUMBERED REFERENCE POSITION.

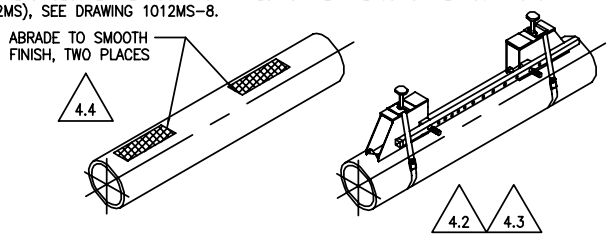


SECURE THE SECOND MOUNTING FRAME TO THE SPACER BAR AT THE NUMBERED INDEX POSITION DETERMINED FROM THE INSTALLATION MENU.



SECURING MOUNTING FRAMES TO THE PIPE SURFACE

HOLD THE MOUNTING FRAME/SPACER BAR ASSEMBLY AGAINST THE PIPE AT THE SELECTED MOUNTING LOCATION. MARK THE APPROXIMATE OUTLINE OF THE MOUNTING FRAMES ON THE PIPE SURFACE. USING THE ABRASIVE PAD SUPPLIED, SMOOTH THE PIPE SURFACE IN THE MARKED AREAS. SECURE THE MOUNTING FRAMES TO THE PIPE USING THE MOUNTING STRAP KIT (1012MS), SEE DRAWING 1012MS-8.



INSTALLATION NOTES – SEE DRAWING REFERENCE ⚠

1. USING THE INSTALLATION MENU AND THE PROCEDURE OUTLINED IN THE FLOW COMPUTER FIELD MANUAL, CONFIRM THAT YOU HAVE THE APPROPRIATE SENSORS AND SPACER BAR (IF USED) FOR REFLECT MODE OPERATION ON THE CHOSEN PIPE.

2. SELECT MOUNTING LOCATION;
2.1 CHOOSE LOCATION WHICH REMAINS FULL AT ZERO FLOW.
2.2 WHERE POSSIBLE LOCATE TRACK ASS'Y 10 PIPE DIAMETERS OR MORE FROM BEND TO ENSURE FULLY DEVELOPED AND STABLE FLOW PROFILE.
2.3 ON HORIZONTAL PIPE, SELECT HORIZONTAL PLANE, IF POSSIBLE TO AVOID SEDIMENT BLOCKAGE OF ULTRASONIC BEAM.

3. PREPARE PIPE FOR TRACK MOUNT;
3.1 REMOVE GRIT, CORROSION, COATING OR HEAVY PAINT
3.2 CLEAN AND DEGREASE SURFACE
3.3 DO NOT MOUNT OVER FROST.
3.4 CONDITION PIPE SURFACE;
LOCALLY SMOOTH THE PIPE SURFACE TO ACCEPT THE SENSORS. USE THE ABRASIVE PAD PROVIDED.

4. LOCATE MOUNTING FRAMES;
4.1 CONSULT THE 1010 FIELD MANUAL AND USE THE INSTALLATION MENU TO SELECT THE APPROPRIATE INDEX HOLE OR SPACING (LTN) FOR YOUR APPLICATION.

4.2 IF SPACER BAR IS USED:
4.2.1 CLAMP ONE MOUNTING FRAME AT THE UN-NUMBERED REFERENCE POSITION OF THE SPACER BAR. BE SURE THE SPACER BAR INDEX SCREW FITS THROUGH THE HOLE IN THE SPACER BAR AND ENGAGES THE HOLE IN THE MOUNTING FRAME BLOCK.

4.2.2 CLAMP THE SECOND MOUNTING FRAME TO THE SPACER BAR IN THE SAME MANNER AT THE INDEX HOLE INDICATED DURING STEP 4.1.

4.2.3 HOLD THE MOUNTING FRAME/SPACER BAR ASSEMBLY ON THE PIPE AT THE SELECTED LOCATION AND TEMPORARILY SECURE IT TO THE PIPE USING STRAPS FROM THE 1012MS STRAP MOUNTING KIT. GO TO 4.4.

4.3 IF MOUNTING FRAMES ARE SPACED BY MEASURING "LTN":

4.3.1 TEMPORARILY SECURE ONE OF THE MOUNTING FRAMES TO THE PIPE USING STRAPS FROM THE 1012MS STRAP MOUNTING KIT.

4.3.2 MEASURE ALONG THE PIPE AND TEMPORARILY SECURE THE SECOND MOUNTING FRAME TO THE PIPE SO THAT SPACING "LTN" DETERMINED IN STEP 4.1 IS MEASURED BETWEEN THE SPACING MARKS ON THE MOUNTING FRAMES.

4.4 IF THE PIPE SURFACE IS CLEAN AND SMOOTH, PROCEED TO SENSOR INSTALLATION ON SHT.3. IF PIPE SURFACE NEEDS CONDITIONING; MARK THE MOUNTING FRAME POSITION CAREFULLY, LOOSEN STRAPS AND MOVE THE MOUNTING FRAMES ASIDE. LOCALLY SMOOTH THE PIPE SURFACE IN THE MARKED AREAS USING THE ABRASIVE PAD SUPPLIED. SHIFT THE MOUNTING FRAMES BACK INTO THEIR APPROPRIATE LOCATIONS AND TIGHTEN THE THE MOUNTING STRAPS SECURELY.

** SEE SHEET 3 FOR INSTRUCTIONS TO COMPLETE SENSOR INSTALLATION.

CONTROLLED DRAWING
CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL

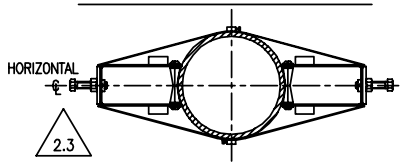
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Hauppauge, NY 11788

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON-
FRACTIONS DECIMAL ANGLES HOLES
± 1/64" XX±0.01 ±0°30' ±.003
XXX±0.005

INSTALLATION, 1011HNFS SERIES DEDICATED PLASTIC BODY SENSOR

SAP MATERIAL NO.	A5E32947129	REV AA
ITEM NO.	A5E32947129	RS AA
DOCUMENT NO.	1011HNFS-7	REV 004
DRAWN BY H.Jenkins:	DATE: 9/30/2013	SCALE NONE: SHEET 1 OF 3

PREFERRED MOUNTING PLANE

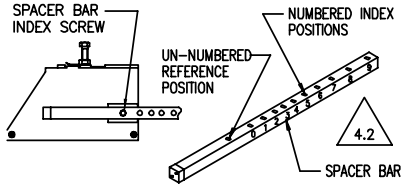


MOUNT SENSORS/MOUNTING FRAMES IN HORIZONTAL PLANE TO PREVENT BLOCKING OF ULTRASONIC BEAM BY AIR OR SEDIMENT.

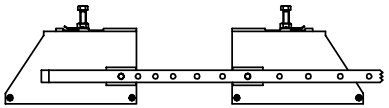
USING THE SPACER BAR TO SET SENSOR MOUNTING FRAME SPACING

USING THE INSTALLATION MENU, AS OUTLINED IN THE FLOW COMPUTER FIELD MANUAL, DETERMINE THE SPACING INDEX NUMBER FOR THE SELECTED APPLICATION.

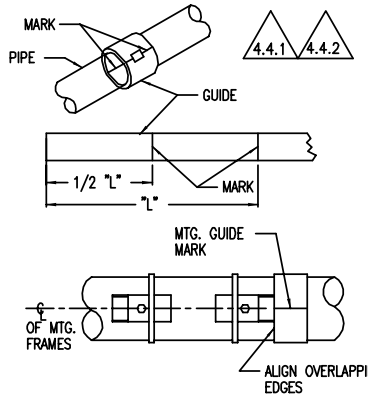
USE THE SPACER BAR INDEX SCREW TO SECURE THE SPACER BAR TO ONE OF THE MOUNTING FRAMES AT THE UN-NUMBERED REFERENCE POSITION.



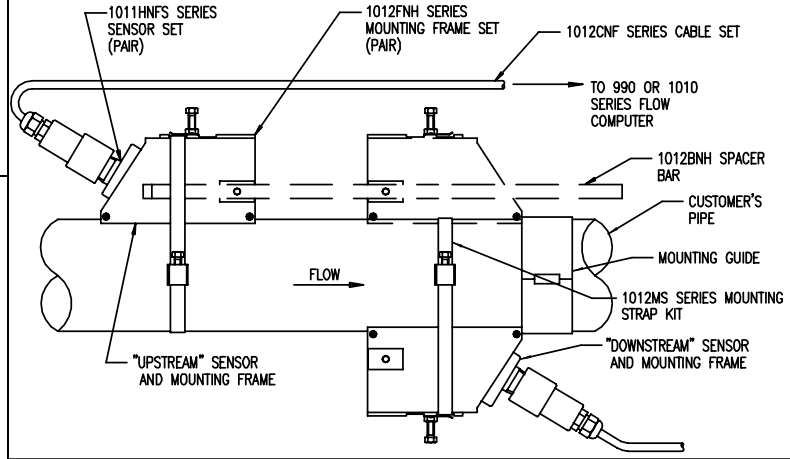
SECURE THE SECOND MOUNTING FRAME TO THE SPACER BAR AT THE NUMBERED INDEX POSITION DETERMINED FROM THE INSTALLATION MENU.



WRAP MOUNTING GUIDE AROUND PIPE AND MARK AT OVERLAPPING EDGE, UNWRAP GUIDE, MEASURE DISTANCE "L" FROM EDGE TO MARK, MARK AGAIN AT 1/2 "L". RE-INSTALL THE MOUNTING GUIDE, TAPE IN PLACE WITH BOTH MARKS VISIBLE, ALIGN ONE MARK WITH THE CENTER LINE OF THE MOUNTING FRAMES.

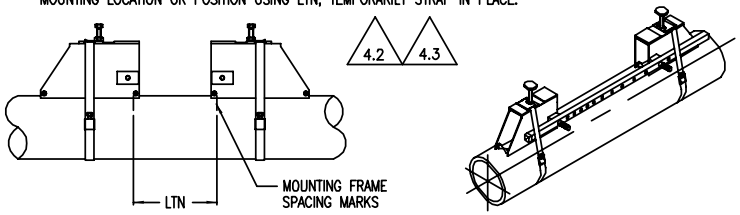


DIRECT MODE OPERATION

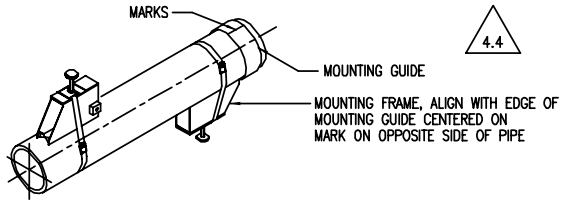


SECURING MOUNTING FRAMES TO THE PIPE SURFACE

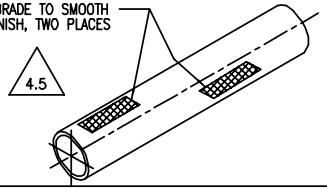
HOLD THE MOUNTING FRAME/SPACER BAR ASSEMBLY AGAINST THE PIPE AT THE SELECTED MOUNTING LOCATION OR POSITION USING LTN, TEMPORARILY STRAP IN PLACE.



USE THE MOUNTING GUIDE TO TRANSFER ONE OF THE MOUNTING FRAMES TO THE OPPOSITE SIDE OF THE PIPE.



IF NECESSARY, USE THE ABRASIVE PAD SUPPLIED TO PRODUCE A SMOOTH FINISH ON THE PIPE AT THE SENSOR MOUNTING POSITIONS.



INSTALLATION NOTES – SEE DRAWING REFERENCE ⚠

1. USING THE INSTALLATION MENU AND THE PROCEDURE OUTLINED IN THE FLOW COMPUTER FIELD MANUAL, CONFIRM THAT YOU HAVE THE APPROPRIATE SENSORS AND SPACER BAR (IF USED) FOR DIRECT MODE OPERATION ON THE CHOSEN PIPE.
2. SELECT MOUNTING LOCATION;
2.1 CHOOSE LOCATION WHICH REMAINS FULL AT ZERO FLOW.
2.2 WHERE POSSIBLE LOCATE TRACK ASS'Y 10 PIPE DIAMETERS OR MORE FROM BEND TO ENSURE FULLY DEVELOPED AND STABLE FLOW PROFILE.
2.3 ON HORIZONTAL PIPE, SELECT HORIZONTAL PLANE, IF POSSIBLE TO AVOID SEDIMENT BLOCKAGE OF ULTRASONIC BEAM.
3. PREPARE PIPE FOR TRACK MOUNT;
3.1 REMOVE GRIT, CORROSION, COATING OR HEAVY PAINT
3.2 CLEAN AND DEGREASE SURFACE
3.3 DO NOT MOUNT OVER FROST.
3.4 CONDITION PIPE SURFACE;
LOCALLY SMOOTH THE PIPE SURFACE TO ACCEPT THE SENSORS. USE THE ABRASIVE PAD PROVIDED.
4. LOCATE MOUNTING FRAMES;
4.1 CONSULT THE 1010 FIELD MANUAL AND USE THE INSTALLATION MENU TO SELECT THE APPROPRIATE INDEX HOLE OR SPACING (LTN) FOR YOUR APPLICATION.
4.2 IF SPACER BAR IS USED:
4.2.1 CLAMP ONE MOUNTING FRAME AT THE UN-NUMBERED REFERENCE POSITION OF THE SPACER BAR. BE SURE THE SPACER BAR INDEX SCREW FITS THOUGH THE HOLE IN THE SPACER BAR AND ENGAGES THE HOLE IN THE MOUNTING FRAME BLOCK.
4.2.2 CLAMP THE SECOND MOUNTING FRAME TO THE SPACER BAR IN THE SAME MANNER AT THE INDEX HOLE INDICATED DURING STEP 4.1.
4.2.3 HOLD THE MOUNTING FRAME/SPACER BAR ASSEMBLY ON THE PIPE AT THE SELECTED LOCATION AND TEMPORARILY SECURE IT TO THE PIPE USING STRAPS FROM THE 1012MS STRAP MOUNTING KIT. GO TO 4.4.
4.3 IF MOUNTING FRAMES ARE SPACED BY MEASURING "LTN":
4.3.1 TEMPORARILY SECURE ONE OF THE MOUNTING FRAMES TO THE PIPE USING STRAPS FROM THE 1012MS STRAP MOUNTING KIT.
4.3.2 MEASURE ALONG THE PIPE AND TEMPORARILY SECURE THE SECOND MOUNTING FRAME TO THE PIPE SO THAT SPACING "LTN" DETERMINED IN STEP 4.1 IS MEASURED BETWEEN THE SPACING MARKS ON THE MOUNTING FRAMES. USE STRAIGHT EDGE OR OTHER MEANS TO ALIGN BOTH MOUNTING FRAMES WITH PIPE AXIS:
4.4 USE THE MOUNTING GUIDE INCLUDED WITH THE 1012MS STRAP MOUNTING KIT TO TRANSFER ONE OF THE MOUNTING FRAMES TO THE OPPOSITE SIDE OF THE PIPE.
4.4.1 WRAP THE MOUNTING GUIDE AROUND THE PIPE. POSITION IT SO THAT THE OVERLAPPING LENGTHS ARE EDGE-ALIGNED, MARK THE OVERLAPPED PORTION OF THE GUIDE AT THE EDGE OF THE OVERLAPPING PORTION. REMOVE THE GUIDE, MEASURE THE DISTANCE FROM THE END TO THE MARK AND MARK AGAIN HALFWAY BETWEEN.
4.4.2 RE-POSITION THE GUIDE ON THE PIPE AND TAPE IN PLACE SO THAT ONE OF THE MARKS INDICATES THE CENTERLINE OF THE INSTALLED MOUNTING FRAMES AND THE MOUNTING GUIDE EDGE IS AGAINST THE END OF ONE OF THE MOUNTING FRAMES. MAKE SURE THE OVERLAPPING LENGTHS OF THE MOUNTING GUIDE ARE EDGE-ALIGNED. THIS ASSURES A DIAMETRICAL TRANSFER OF THE MOUNTING FRAME POSITION.
4.4.3 LOOSEN THE MOUNTING STRAP ON THE MOUNTING FRAME WITH WHICH THE MOUNTING GUIDE HAS BEEN ALIGNED. ROTATE IT AROUND THE PIPE SURFACE UNTIL IT IS CENTERED ON THE OPPOSITE SIDE MOUNTING GUIDE MARK MADE IN STEP 4.4.1. TIGHTEN THE STRAP, REMOVE THE MOUNTING GUIDE.
4.5 IF THE PIPE SURFACE IS CLEAN AND SMOOTH, PROCEED TO TRANSDUCER INSTALLATION ON SHT.3, IF PIPE SURFACE NEEDS CONDITIONING; MARK THE MOUNTING FRAME POSITION CAREFULLY, LOOSEN STRAPS AND MOVE THE MOUNTING FRAMES ASIDE. LOCALLY SMOOTH THE PIPE SURFACE IN THE MARKED AREAS USING THE ABRASIVE PAD SUPPLIED. SHIFT THE MOUNTING FRAMES BACK INTO THEIR APPROPRIATE LOCATIONS AND TIGHTEN THE MOUNTING STRAPS SECURELY.

** SEE SHEET 3 FOR INSTRUCTIONS TO COMPLETE SENSOR INSTALLATION.

CONTROLLED DRAWING
CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON-
FRACTIONS DECIMAL ANGLES HOLES
± 1/64" XX±0.01 ±0°30' ±.003
XXX±0.005

INSTALLATION, 1011HNFS SERIES DEDICATED PLASTIC BODY SENSOR

SAP MATERIAL NO.	A5E32947129	REV AA
ITEM NO.	A5E32947129	RS AA
DOCUMENT NO.	1011HNFS-7	REV 004
DRAWN BY H.Jenkins:	DATE: 9/30/2013	SCALE NONE: SHEET 2 OF 3

MATING 1012CNF SERIES SENSOR CABLES WITH 1011HNF SERIES SENSORS

a) REMOVE PROTECTIVE CAPS.

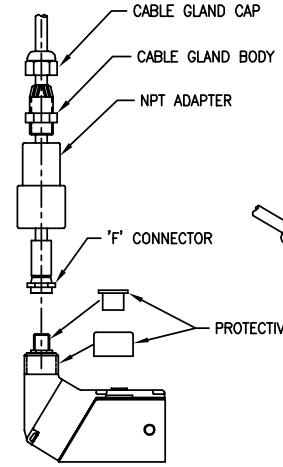
b) SEE APPROPRIATE CABLE ASSEBMLY DRAWING FOR 'F' CONNECTOR, NPT ADAPTER AND GLAND ASSEMBLY DETAIL.

c) MATE 'F' CONNECTORS, CABLES TO SENSOR.

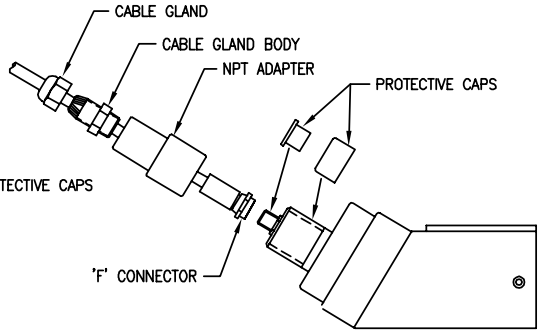
d) FOR BEST WEATHER SEAL, WRAP TEFLON PIPE TAPE (NOT SUPPLIED) AROUND MALE NPT THREADS ON SENSOR HOUSING.

e) SCREW NPT ADAPTER TO SENSOR HOUSING (HAND TIGHT IS SUFFICIENT).

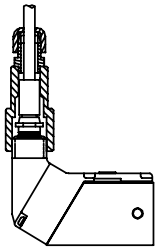
f) TIGHTEN GLAND BODY WITH NPT ADAPTER AND SECURE CABLE BY TIGHTENING GLAND TOP NUT. (HAND TIGHT IS SUFFICIENT).



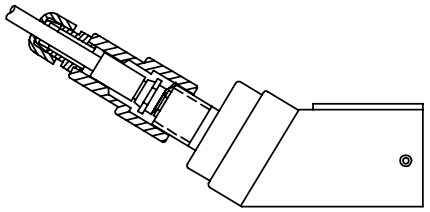
SENSOR SIZE A & B



SENSOR SIZE C & D



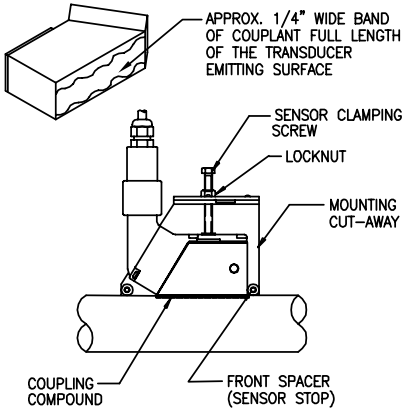
SENSOR SIZE A & B



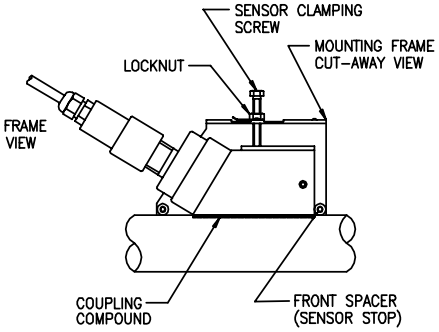
SENSOR SIZE C & D

INSTALLING SENSORS IN MOUNTING FRAMES

APPLY A THIN BAND OF COUPLANT TO THE EMITTING SURFACE OF THE SENSORS. SLIP THE SENSORS INTO THE MOUNTING FRAMES, SEATING THEM SQUARELY ON THE PIPE SURFACE, PUSH FORWARD INTO THE FRAMES AGAINST THE FRONT SPACER. LOCATE CLAMPING SCREW IN PROPER POSITION TIGHTEN THE SENSOR CLAMPING SCREW, FIRMLY SEATING THE SENSORS ON THE PIPE SURFACE. SECURE THE CLAMPING SCREW WITH LOCK NUT.



SENSOR SIZE A & B

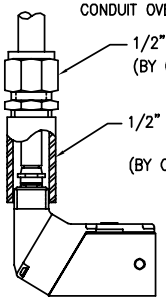


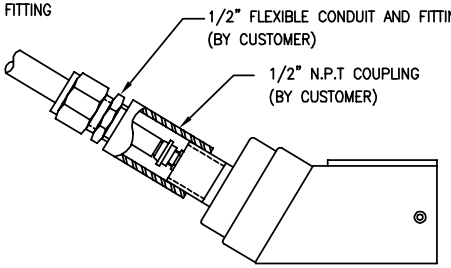
SENSOR SIZE C & D

**SEE DRAWING 1012THP–7 FOR INSTALLATION USING 1012THP SERIES MOUNTING TRACKS.

USE OF FLEXIBLE CONDUIT WITH SENSORS

THE SENSOR WIRING HOUSING HAS INTEGRAL 1/2" N.P.T THREADS TO ACCEPT A CONDUIT COUPLING IF FLEXIBLE CONDUIT IS USED. MAKE CONNECTION AS SHOWN, THEN PASS COUPLING AND CONDUIT OVER THE CABLE, SECURE TO THE SENSOR WIRING HOUSING.





INSTALLATION NOTES – CONT'D FROM SHT. 1 OR SHT. 2

5. MAKE CABLE CONNECTIONS AT FLOW COMPUTER IN ACCORDANCE WITH APPROPRIATE FLOW COMPUTER INSTALLATION DRAWING AND 1010 FIELD MANUAL.
6. SEE DRAWINGS 1012FNH–8 AND 1011HNFS–8 FOR MOUNTING FRAME AND SENSOR OUTLINE DIMENSIONS.

CONTROLLED DRAWING
CHANGES TO THIS DRAWING REQUIRE RELEVANT AGENCY APPROVAL

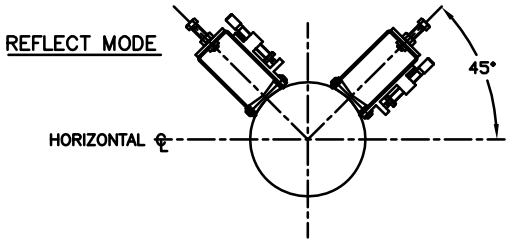
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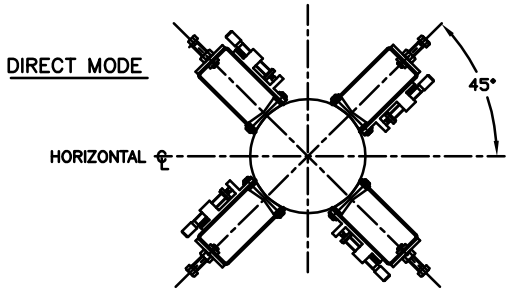
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON-

FRACTIONS	DECIMAL	ANGLES	HOLES
± 1/64"	XX±0.01 XXX±0.005	±0°30'	±.003

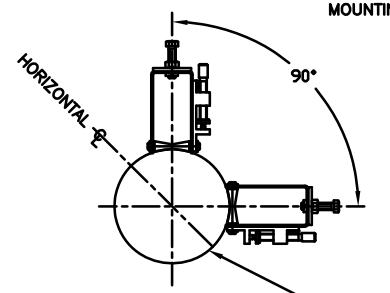
INSTALLATION, 1011HNFS SERIES DEDICATED PLASTIC BODY SENSOR

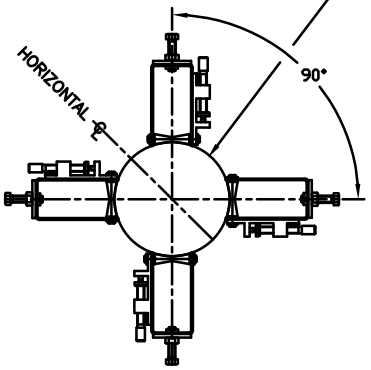
SAP MATERIAL NO.	A5E32947129	REV AA
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DRAWN BY H.Jenkins:	DATE: 9/30/2013	SCALE NONE: SHEET 3 OF 3

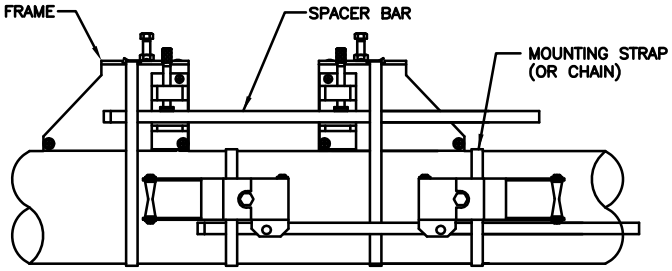




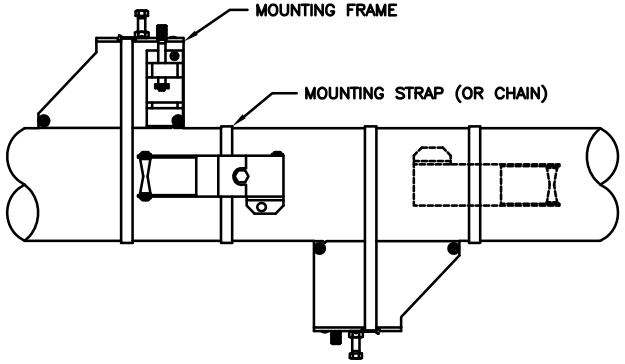
RECOMMENDED INSTALLATION
ON HORIZONTAL PIPES







POSITION FRAME ASSEMBLIES 90° APART (1/4 CIRCUMFERENCE)
BEFORE TIGHTENING ADJUSTING SCREW



NOTES:

1. USING THE INSTALLATION MENU AND THE PROCEDURE OUTLINED IN THE FIELD MANUAL. SELECT THE APPROPRIATE TRANSDUCERS AND MOUNTING FRAMES FOR THE MODE OF OPERATION CHOSEN FOR YOUR APPLICATION. REFLECT MODE IS PREFERRED.
2. SELECT MOUNTING LOCATION:
   a) TRANSDUCER SETS SHOULD BE MOUNTED SO THAT THE PLANES OF OPERATION OF THE TWO SETS INTERSECT ORTHOGONALLY; THAT IS, 90° OR 1/4 THE CIRCUMFERENCE OF THE PIPE APART.
   b) CHOOSE A LOCATION WHICH REMAINS FULL AT ZERO FLOW. ON HORIZONTAL PIPES, MOUNT AWAY AWAY FROM THE UNDERSIDE TO AVIOD SEDIMENT BLOCKAGE OF ULTRASONIC BEAM, MOUNT AWAY FROM TOPSIDE TO AVIOD BLOCKAGE DUE TO ENTRAPPED AIR.
   c) WHERE POSSIBLE, LOCATE MOUNTING FRAME ASSEMBLIES AS FAR AS POSSIBLE DOWNSTREAM FROM ANY FLOW DISTURBANCE TO ASSURE FULLY DEVELOPED AND STABLE FLOW PROFILE.
3. MOUNT FRAMES ON PIPE:
   a) REFER TO THE APPROPRIATE INSTALLATION DRAWING FOR THE PORTABLE OR DEDICATED TRANSDUCERS AND FRAMES SELECTED FOR USE, NOTE THESE DRAWINGS PROVIDE INSTRUCTIONS FOR SINGLE PATH INSTALLATIONS, DUAL PATH SYSTEMS ARE INSTALLED IN THE SAME FASHION BY OFFSETTING A SECOND SET OF MOUNTING FRAMES IN AN ORTHOGONAL PLANE AS SHOWN ABOVE.
4. CONDITION PIPE SURFACE:
   LOCALLY SMOOTH THE PIPE SURFACE AT EACH TRANSDUCER LOCATION AND INSTALL TRANSDUCERS IN ACCORDANCE WITH THE PROCEDURE DESCRIBED ON THE APPROPRIATE TRANSDUCER AND FRAME INSTALLATION DRAWING. MAKE SURE THAT TRANSDUCER PAIRS ARE INSTALLED AND CONNECTED TO THE FLOW COMPUTER CORRECTLY.
5. REFER TO THE APPROPRIATE OUTLINE DRAWINGS FOR TRANSDUCER AND MOUNTING FRAME OUTLINE DIMENSIONS.

DO NOT SCALE THIS DRAWING	CONTRACT NO.
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES AND TOLERANCES ON-	DR H.J DATE 9/10/98 CHK DATE ENG DATE PROD DATE APPD DATE
	CERTIFIED DATE

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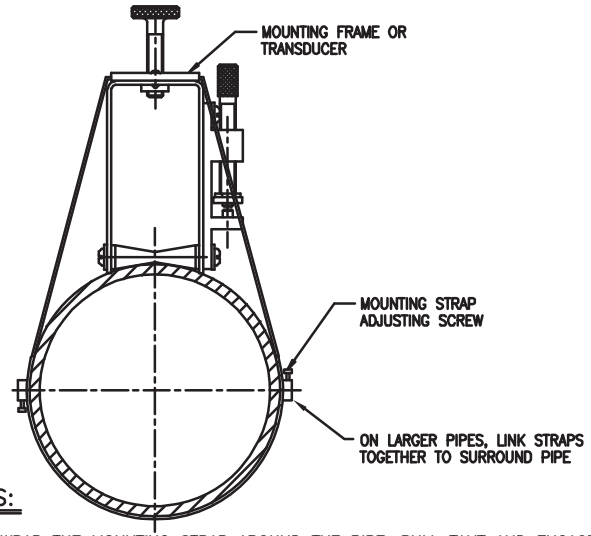
INSTALLATION DRAWING DUAL PATH TRANSDUCER SET WITH MOUNTING FRAMES

SIZE	CODE IDENT NO.		REV.
C	21614	1012F-DB-7	B
SCALE: NONE	WT.	SHEET 1 OF 1	

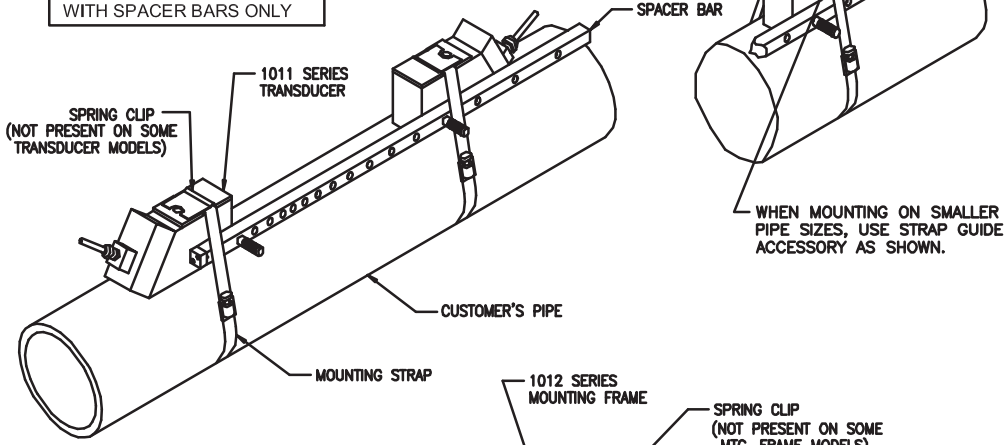
R14: 1012F-DB-7 sht.1 rev.B
CN#4344

INSTALLATION PROCEDURE

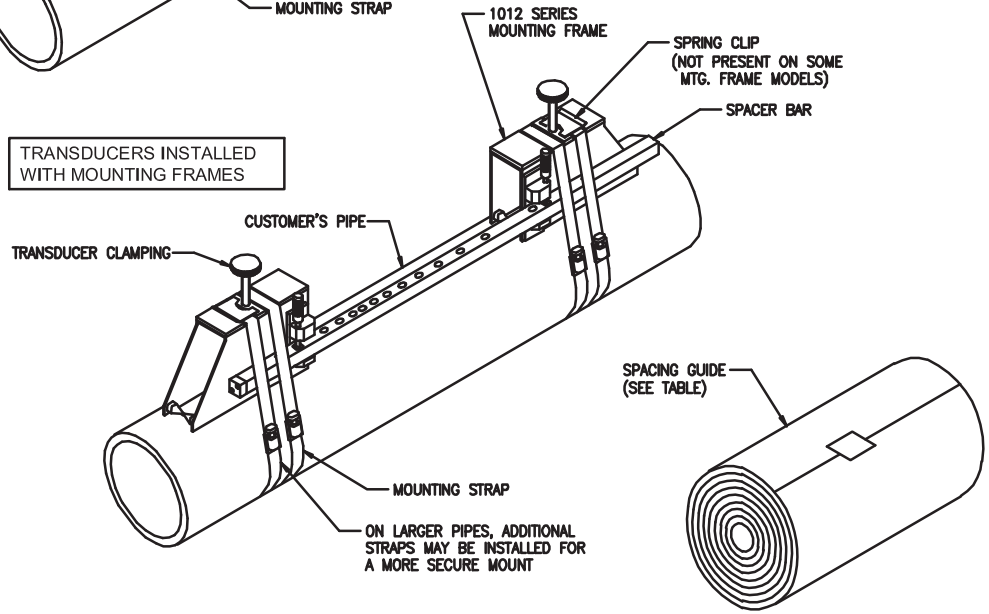
MOUNTING STRAP KITS ARE TO FASTEN TRANSDUCERS OR MOUNTING FRAMES TO THE PIPE.



TRANSDUCERS INSTALLED WITH SPACER BARS ONLY



TRANSDUCERS INSTALLED WITH MOUNTING FRAMES



NOTES:

1. WRAP THE MOUNTING STRAP AROUND THE PIPE, PULL TAUT AND ENGAGE THE END OF MOUNTING STRAP WITH THE MOUNTING STRAP ADJUSTING SCREW.
2. TIGHTEN THE ADJUSTING SCREW TO SECURE THE ASSEMBLY TO THE PIPE.
3. TO SURROUND LARGER PIPES, LINK MOUNTING STRAP SECTIONSCREW TOGETHER AS SHOWN.

STRAP MTG. KIT PART No.	PIPE DIA.	BAND SIZE (QTY)	SPACING GUIDE P/N (DESCRIPTION)	KIT NET WT.
1012MS-1A	2"-7"	#88 (2) #128 (2)	1012-145-1A (2" x 26")	
1012MS-1	2"-13"	#88 (2) #152 (2)	1012-145-1 (2" x 45")	
1012MS-2	13"-24"	#188 (2) #280 (2)	1012-145-2 (4" x 81")	
1012MS-3	24"-48"	#152 (4) #312 (4)	1012-145-3 (4" x 155")	
1012MS-4	48"-60"	36' OF 1/2" BAND AND FASTENER	1012-145-4 (6" x 196")	
1012MS-5	60"-84'	46' OF 1/2" BAND AND FASTENER	NOT SUPPLIED	
1012MS-6	84"-120"	65' OF 1/2" BAND AND FASTENER	NOT SUPPLIED	
1012MS-7	120"-216"	116' OF 1/2" BAND AND FASTENER	NOT SUPPLIED	
1012MS-8	216"-360"	190' OF 1/2" BAND AND FASTENER	NOT SUPPLIED	

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND TOLERANCES ON-

INCHES	(MM)
± .1	± 2

CONTRACT NO.

DR H.J DATE 2/14/97
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HAUPPAUGE , NY 11788

INSTALLATION / OUTLINE ADJUSTABLE MOUNTING STRAP

SIZE	CODE IDENT NO.		REV.
C	21614	1012MS - 8	F
SCALE: NONE	WT.	SHEET 1 OF 2	

R14: 1012MS-8 sht.1 rev.F
ECN#3974, ECN#4022

STEP - 1

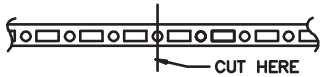
DETERMINE PROPER BAND LENGTH ONE OF TWO WAYS:

A) IF DIAMETER IS KNOWN, REFER TO BAND LENGTH TABLE OR CALCULATE MAXIMUM BAND LENGTH 3.14 x DIA. + 18", TRIM TO FIT WHEN INSTALLING.

B) IF DIAMETER IS NOT KNOWN, MEASURE CIRCUMFERENCE WITH STRING, TWINE, etc., AND ADD 18" (TO ENCIRCLE FRAMES). THIS DIMENSION IS APPROXIMATE, TRIM BAND TO FIT WHEN INSTALLING.

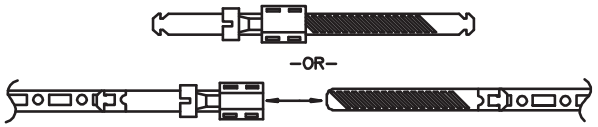
STEP - 2

MEASURE BAND TO PROPER LENGTH AND CUT THROUGH CENTER OF NEAREST ROUND HOLE WITH SHEARS, SNIPS, HACKSAW etc.

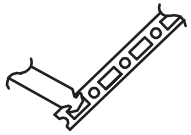


STEP - 3

EITHER MATE FASTENER HALVES AND THEN LINK TO STRAP ALREADY IN PLACE AROUND PIPE, OR LINK FASTENER HALVES INDEPENDENTLY TO STRAP ENDS (HOLD IN PLACE WITH TAPE IF NECESSARY) AND ENGAGE FASTENER AFTER WRAPPING STRAP AROUND PIPE.

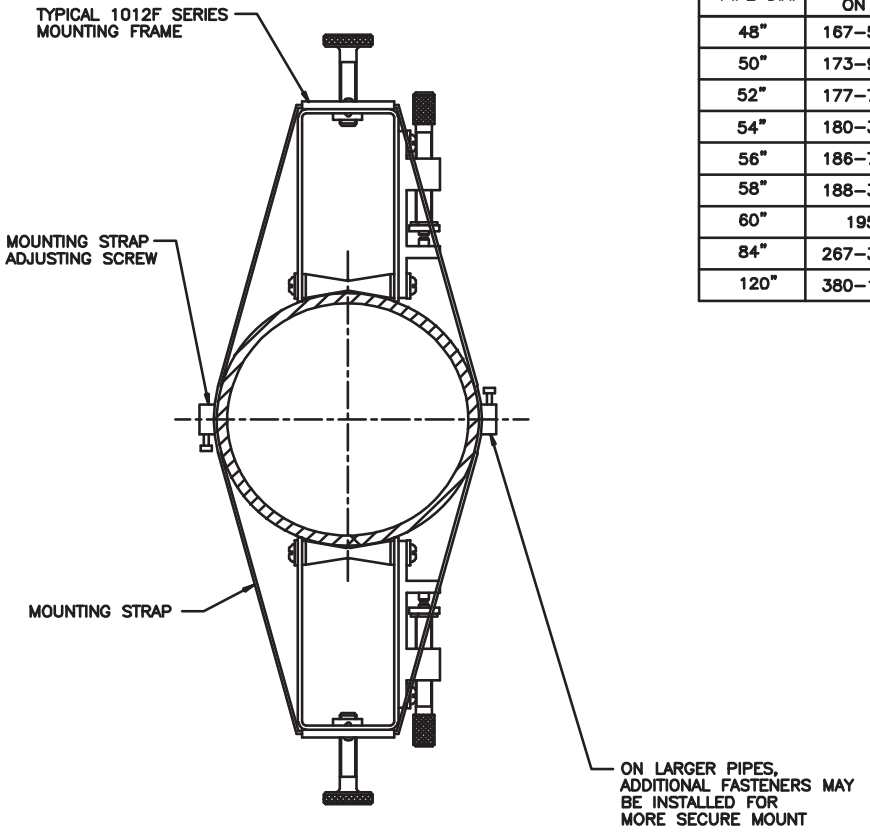


DIAGONALLY INSERT FASTENER END INTO RECTANGULAR SLOTS TO LINK WITH STRAP (INSERT AT LOCATION BEST SUITED FOR TIGHT FIT).



STEP - 4

USING STRAPS MADE TO SIZE REQUIRED, INSTALL MOUNTING TRACKS AND TRANSDUCERS IN ACCORDANCE WITH APPROPRIATE INSTALLATION DRAWING FOR SPECIFIC TRACK ASSEMBLIES.



BAND LENGTH TABLE	
PIPE DIA.	LENGTH TO CUT ON MARK
48"	167–5/16"
50"	173–9/16"
52"	177–7/8"
54"	180–3/16"
56"	186–7/16"
58"	188–3/4"
60"	195"
84"	267–3/8"
120"	380–1/2"

NOTES:

1. BAND LENGHTS ARE APPROXIMATE AND CALCULATED FOR USE OF SIZE "D" OR "E" 1011 TRANSDUCERS.

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND TOLERANCES ON-

INCHES	(MM)
± .1	± 2

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INSTALLATION / OUTLINE ADJUSTABLE MOUNTING STRAP

SIZE	CODE IDENT NO.		REV.
C	21614	1012MS - 8	F

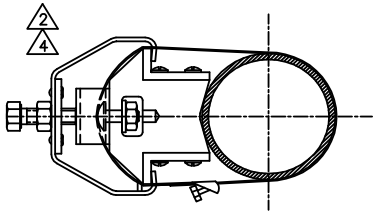
SCALE: NONE WT. SHEET 2 OF 2

R14: 1012MS–8 sht.2 rev.F
ECN#3974, ECN#4022

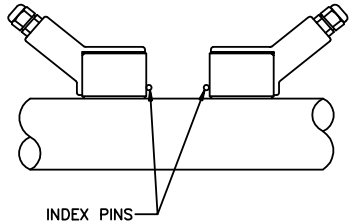
REFLECT MODE INSTALLATION

1011N UNIVERSAL TRANSDUCER AND TRACK

SELECT AND PREPARE THE TRANSDUCER MOUNTING LOCATION, SECURE TRACKS TO PIPE WITH STRAP

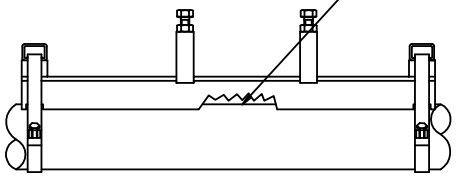


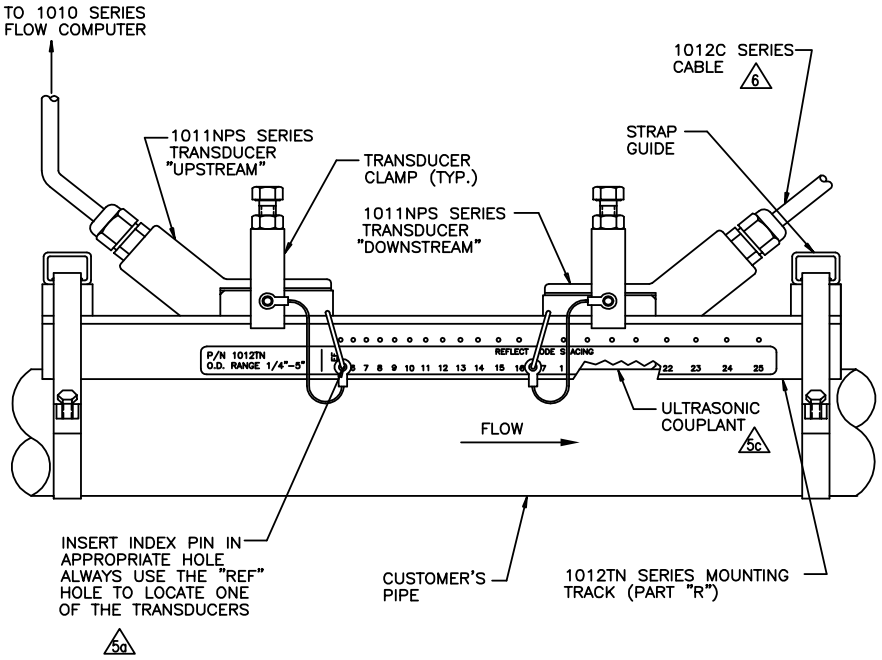
TRANSDUCER INDEX PIN ORIENTATION



ORIENTATION OF PROPERLY INSTALLED TRANSDUCERS IN REFLECT MODE OPERATION

CONDITION PIPE SURFACE AT THE TRANSDUCER MOUNTING LOCATION USING THE ABRASIVE PAD SUPPLIED. 3





INSTALLATION PROCEDURE – SEE DRAWING REFERENCES 4

1. USING THE INSTALLATION MENU PROCEDURES PRESENTED IN THE 1010 FIELD MANUAL, CONFIRM THAT YOU HAVE THE APPROPRIATE TRANSDUCERS AND TRACK FOR REFLECT MODE OPERATION ON THE CHOSEN PIPE.
2. SELECT MOUNTING LOCATION;
   a) CHOOSE LOCATION WHICH REMAINS FULL AT ZERO FLOW.
   b) WHERE POSSIBLE LOCATE TRACK ASS'Y TEN (10) PIPE DIAMETERS OR MORE FROM BEND TO ENSURE FULLY DEVELOPED AND STABLE FLOW PROFILE.
   c) ON HORIZONTAL PIPE, SELECT HORIZONTAL PLANE, IF POSSIBLE, TO AVOID SEDIMENT BLOCKAGE OF TRANSDUCER SIGNAL.
3. PREPARE PIPE FOR TRACK MOUNT;
   a) REMOVE GRIT, CORROSION, COATING OR HEAVY PAINT
   b) CLEAN AND DEGREASE SURFACE
   c) DO NOT MOUNT OVER FROST.
   d) CONDITION PIPE SURFACE; LOCALLY SMOOTH THE PIPE SURFACE TO ACCEPT THE TRANSDUCERS. USE THE ABRASIVE PAD PROVIDED.
4. MOUNT TRACK ON PIPE;
   a) PLACE TRACK RAIL ASS'Y (ASS'Y WITH STRAP) AGAINST PIPE. WHILE HOLDING TRACK, WRAP STRAP AROUND PIPE AND TIGHTEN.
   b) ROTATE ASS'Y AROUND THE PIPE FOR PROPER POSITIONING. ONCE THAT HAS BEEN ACHIEVED, SECURE THE TRACK RAIL ASS'Y TO THE PIPE WITH THE STRAP.
5. LOCATE TRANSDUCERS;
   a) CONSULTING THE 1010 FIELD MANUAL, USE THE INSTALLATION MENU TO DETERMINE THE APPROPRIATE INDEX HOLES FOR YOUR APPLICATION AND INSERT PINS.
   b) APPLY A THIN BAND OF THE ULTRASONIC COUPLANT PROVIDED TO THE BASE OF EACH TRANSDUCER.
   c) INSERT TRANSDUCERS INTO TRACK AS SHOWN, BANKING AGAINST INDEX PINS. SECURE TRANSDUCERS WITH CLAMPS.
6. MAKE TRANSDUCER CABLE CONNECTIONS IN ACCORDANCE WITH THE APPROPRIATE FLOW COMPUTER INSTALLATION DRAWING AND 1010 FIELD MANUAL.
7. SEE DRAWING 1012TN-8 AND 1011NPS-8 FOR TRACK AND TRANSDUCER OUTLINE DIMENSIONS.

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES (MM) TOLERANCES ON-

INCHES	(MM)
+/- .1	+/- 2

CONTRACT NO.

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CHK		DATE
ENG		DATE
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HAUPPAUGE , NY 11788

INSTALLATION DRAWING 1010 SERIES TRANSDUCERS AND MOUNTING TRACKS

SIZE	CODE IDENT NO.		REV.
C	21614	1012TN-7	A

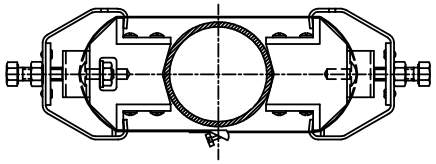
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R14: 1012TN-7A rev.A

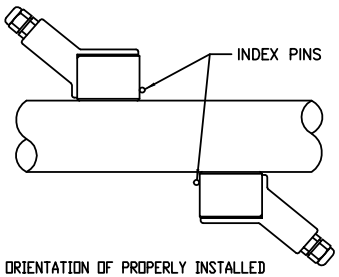
DIRECT MODE INSTALLATION

1011N UNIVERSAL TRANSDUCER AND TRACK

SELECT AND PREPARE THE TRANSDUCER MOUNTING LOCATION, SECURE TRACKS TO PIPE WITH STRAP

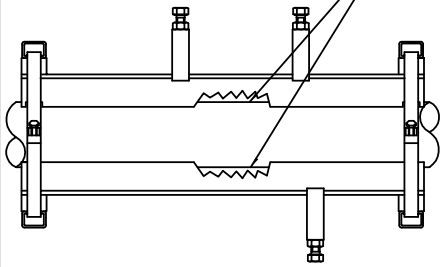


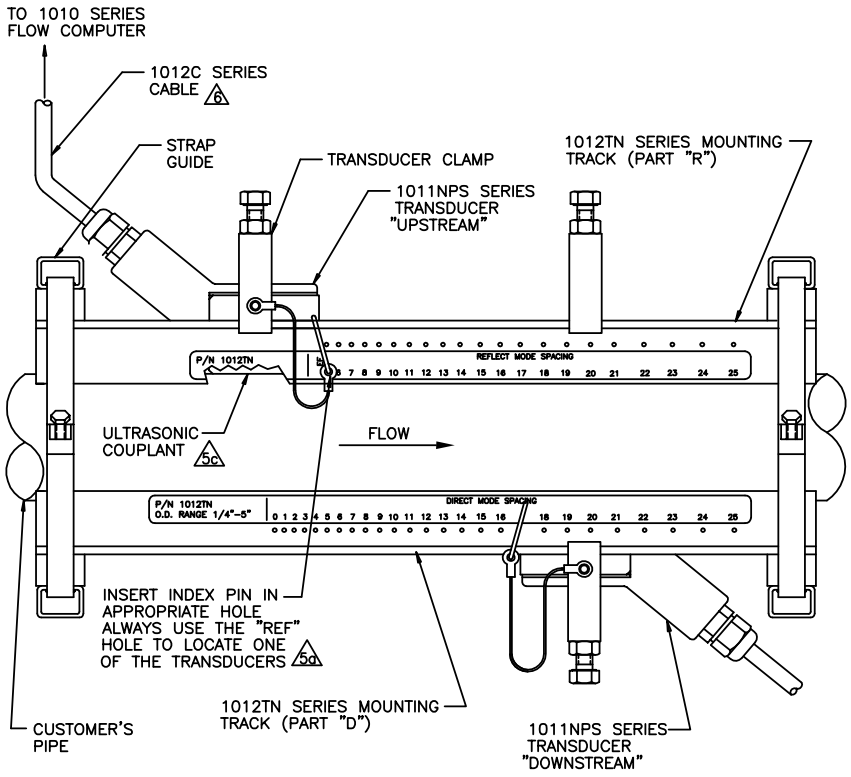
TRANSDUCER INDEX PIN ORIENTATION



ORIENTATION OF PROPERLY INSTALLED TRANSDUCERS IN DIRECT MODE OPERATION

CONDITION PIPE SURFACE AT THE TRANSDUCER MOUNTING LOCATION USING THE ABRASIVE PAD SUPPLIED. (3)





INSTALLATION PROCEDURE – SEE DRAWING REFERENCES (4)

1. USING THE INSTALLATION MENU, PROCEDURES PRESENTED IN THE 1010 FIELD MANUAL, CONFIRM THAT YOU HAVE THE APPROPRIATE TRANSDUCERS AND TRACK FOR DIRECT MODE OPERATION ON THE CHOSEN PIPE.
2. SELECT MOUNTING LOCATION;
   a) CHOOSE LOCATION WHICH REMAINS FULL AT ZERO FLOW.
   b) WHERE POSSIBLE LOCATE TRACK ASS'Y TEN(10) PIPE DIAMETERS OR MORE FROM BEND TO ENSURE FULLY DEVELOPED AND STABLE FLOW PROFILE.
   c) ON HORIZONTAL PIPE, SELECT HORIZONTAL PLANE, IF POSSIBLE, TO AVOID SEDIMENT BLOCKAGE OF TRANSDUCER SIGNAL.
3. PREPARE PIPE FOR TRACK MOUNT;
   a) REMOVE GRIT, CORROSION, COATING OR HEAVY PAINT
   b) CLEAN AND DEGREASE SURFACE
   c) DO NOT MOUNT OVER FROST.
   d) CONDITION PIPE SURFACE; LOCALLY SMOOTH THE PIPE SURFACE TO ACCEPT THE TRANSDUCERS. USE THE ABRASIVE PAD PROVIDED.
4. MOUNT TRACK ON PIPE;
   a) PLACE TRACK RAIL ASS'Y (ASS'Y WITH STRAP) AGAINST PIPE. WHILE HOLDING TRACK, PLACE THE SECOND TRACK ONTO THE PIPE AND HOLD TOGETHER IN PLACE.
   b) ROTATE ASS'Y AROUND THE PIPE FOR PROPER POSITIONING. ONCE THAT HAS BEEN ACHIEVED, SECURE THE TRACK RAIL ASS'Y TO THE PIPE WITH THE STRAP.
5. LOCATE TRANSDUCERS;
   a) CONSULTING THE 1010 FIELD MANUAL, USE THE INSTALLATION MENU TO DETERMINE THE APPROPRIATE INDEX HOLES FOR YOUR APPLICATION AND INSERT PINS.
   b) APPLY A THIN BAND OF THE ULTRASONIC COUPLANT PROVIDED TO THE BASE OF EACH TRANSDUCER.
   c) INSERT TRANSDUCERS INTO TRACK AS SHOWN, BANKING AGAINST INDEX PINS. SECURE TRANSDUCERS WITH CLAMPS.
6. MAKE TRANSDUCER CABLE CONNECTIONS IN ACCORDANCE WITH THE APPROPRIATE FLOW COMPUTER INSTALLATION DRAWING AND 1010 FIELD MANUAL.
7. SEE DRAWING 1012TN-8 AND 1011NPS-8 FOR TRACK AND TRANSDUCER OUTLINE DIMENSIONS.

DO NOT SCALE THIS DRAWING

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INCHES	(MM)
+/- .1	+/- 2

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HAUPPAUGE , NY 11788

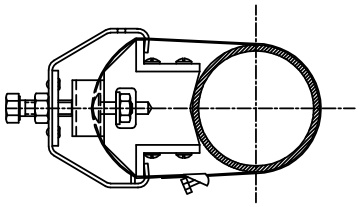
INSTALLATION DRAWING 1010 SERIES TRANSDUCERS AND MOUNTING TRACKS

SIZE	CODE IDENT NO.		REV.
C	21614	1012TN-7	A
SCALE: NONE	WT.		SHEET 2 OF 2

R14: 1012TN-7B rev.A

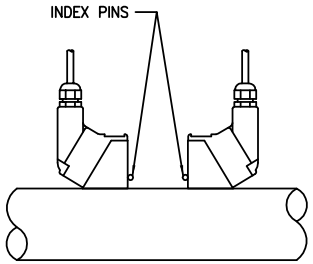
REFLECT MODE INSTALLATION

1011HN HIGH PRECISION TRANSDUCER AND TRACK



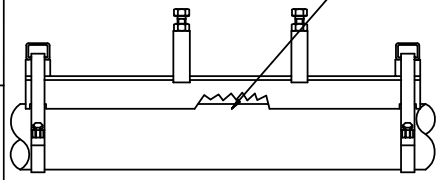
SELECT AND PREPARE THE TRANSDUCER MOUNTING LOCATION, SECURE TRACKS TO PIPE WITH STRAP

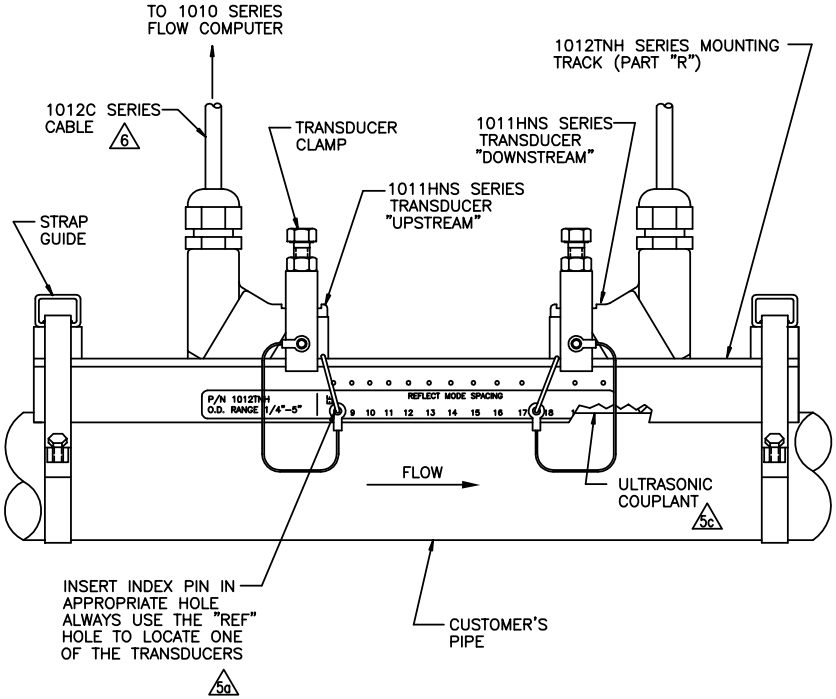
TRANSDUCER INDEX PIN ORIENTATION



ORIENTATION OF PROPERLY INSTALLED TRANSDUCERS IN REFLECT MODE OPERATION

CONDITION PIPE SURFACE AT THE TRANSDUCER MOUNTING LOCATION USING THE ABRASIVE PAD SUPPLIED.





INSTALLATION PROCEDURE – SEE DRAWING REFERENCES

1. USING THE INSTALLATION MENU PROCEDURES PRESENTED IN THE 1010 FIELD MANUAL, CONFIRM THAT YOU HAVE THE APPROPRIATE TRANSDUCERS AND TRACK FOR REFLECT MODE OPERATION ON THE CHOSEN PIPE.
2. SELECT MOUNTING LOCATION;
   a) CHOOSE LOCATION WHICH REMAINS FULL AT ZERO FLOW.
   b) WHERE POSSIBLE LOCATE TRACK ASS'Y TEN (10) PIPE DIAMETERS OR MORE FROM BEND TO ENSURE FULLY DEVELOPED AND STABLE FLOW PROFILE.
   c) ON HORIZONTAL PIPE, SELECT HORIZONTAL PLANE, IF POSSIBLE, TO AVOID SEDIMENT BLOCKAGE OF TRANSDUCER SIGNAL.
3. PREPARE PIPE FOR TRACK MOUNT;
   a) REMOVE GRIT, CORROSION, COATING OR HEAVY PAINT
   b) CLEAN AND DEGREASE SURFACE
   c) DO NOT MOUNT OVER FROST.
   d) CONDITION PIPE SURFACE; LOCALLY SMOOTH THE PIPE SURFACE TO ACCEPT THE TRANSDUCERS. USE THE ABRASIVE PAD PROVIDED.
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   a) PLACE TRACK RAIL ASS'Y (ASS'Y WITH STRAP) AGAINST PIPE. WHILE HOLDING TRACK, WRAP STRAP AROUND PIPE AND TIGHTEN.
   b) ROTATE ASS'Y AROUND THE PIPE FOR PROPER POSITIONING. ONCE THAT HAS BEEN ACHIEVED, SECURE THE TRACK RAIL ASS'Y TO THE PIPE WITH THE STRAP.
5. LOCATE TRANSDUCERS;
   a) CONSULTING THE 1010 FIELD MANUAL, USE THE INSTALLATION MENU TO DETERMINE THE APPROPRIATE INDEX HOLES FOR YOUR APPLICATION AND INSERT PINS.
   b) APPLY A THIN BAND OF THE ULTRASONIC COUPLANT PROVIDED TO THE BASE OF EACH TRANSDUCER.
   c) INSERT TRANSDUCERS INTO TRACK AS SHOWN, BANKING AGAINST INDEX PINS. SECURE TRANSDUCERS WITH CLAMPS.
6. MAKE TRANSDUCER CABLE CONNECTIONS IN ACCORDANCE WITH THE APPROPRIATE FLOW COMPUTER INSTALLATION DRAWING AND 1010 FIELD MANUAL.
7. SEE DRAWING 1012TNH–8 AND 1011HNS–8 FOR TRACK AND TRANSDUCER OUTLINE DIMENSIONS.

DO NOT SCALE THIS DRAWING

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INCHES	(MM)
+/– .1	+/– 2

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INSTALLATION DRAWING 1010 SERIES TRANSDUCERS AND MOUNTING TRACKS

SIZE	CODE IDENT NO.		REV.
C	21614	1012TNH-7	A

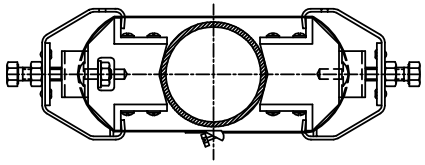
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R14: 1012TNH–7A rev.A

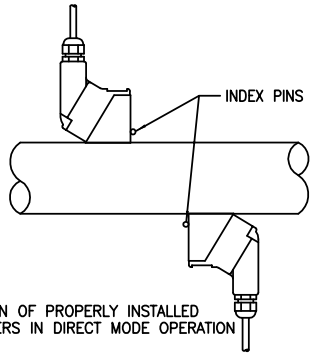
DIRECT MODE INSTALLATION

1011HN HIGH PRECISION TRANSDUCER AND TRACK

SELECT AND PREPARE THE TRANSDUCER MOUNTING LOCATION, SECURE TRACKS TO PIPE WITH STRAP

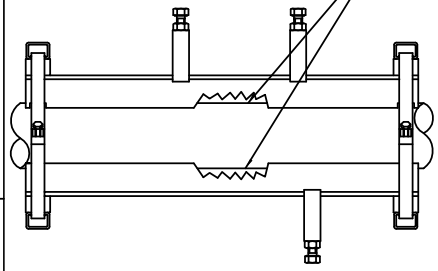


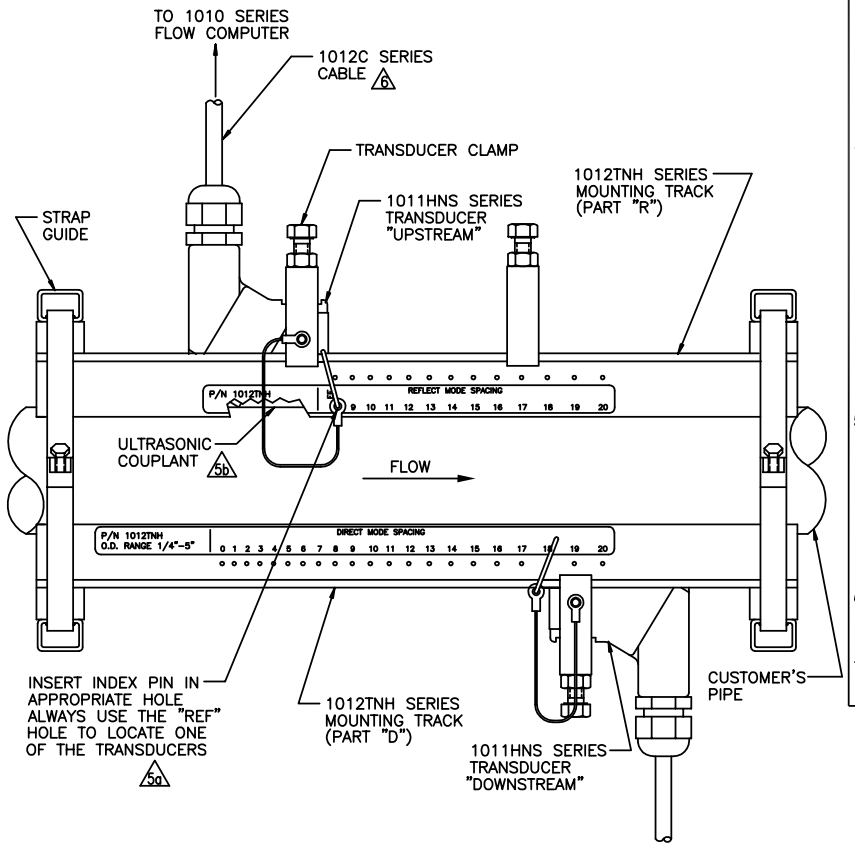
TRANSDUCER INDEX PIN ORIENTATION



ORIENTATION OF PROPERLY INSTALLED TRANSDUCERS IN DIRECT MODE OPERATION

CONDITION PIPE SURFACE AT THE TRANSDUCER MOUNTING LOCATION USING THE ABRASIVE PAD SUPPLIED.





INSTALLATION PROCEDURE – SEE DRAWING REFERENCES

1. USING THE INSTALLATION MENU, PROCEDURES PRESENTED IN THE 1010 FIELD MANUAL, CONFIRM THAT YOU HAVE THE APPROPRIATE TRANSDUCERS AND TRACK FOR DIRECT MODE OPERATION ON THE CHOSEN PIPE.
2. SELECT MOUNTING LOCATION;
   a) CHOOSE LOCATION WHICH REMAINS FULL AT ZERO FLOW.
   b) WHERE POSSIBLE LOCATE TRACK ASS'Y TEN(10) PIPE DIAMETERS OR MORE FROM BEND TO ENSURE FULLY DEVELOPED AND STABLE FLOW PROFILE.
   c) ON HORIZONTAL PIPE, SELECT HORIZONTAL PLANE, IF POSSIBLE, TO AVOID SEDIMENT BLOCKAGE OF TRANSDUCER SIGNAL.
3. PREPARE PIPE FOR TRACK MOUNT;
   a) REMOVE GRIT, CORROSION, COATING OR HEAVY PAINT
   b) CLEAN AND DEGREASE SURFACE
   c) DO NOT MOUNT OVER FROST.
   d) CONDITION PIPE SURFACE; LOCALLY SMOOTH THE PIPE SURFACE TO ACCEPT THE TRANSDUCERS. USE THE ABRASIVE PAD PROVIDED.
4. MOUNT TRACK ON PIPE;
   a) PLACE TRACK RAIL ASS'Y (ASS'Y WITH STRAP) AGAINST PIPE. WHILE HOLDING TRACK, PLACE THE SECOND TRACK ONTO THE PIPE AND HOLD TOGETHER IN PLACE.
   b) ROTATE ASS'Y AROUND THE PIPE FOR PROPER POSITIONING. ONCE THAT HAS BEEN ACHIEVED, SECURE THE TRACK RAIL ASS'Y TO THE PIPE WITH THE STRAP.
5. LOCATE TRANSDUCERS;
   a) CONSULTING THE 1010 FIELD MANUAL, USE THE INSTALLATION MENU TO DETERMINE THE APPROPRIATE INDEX HOLES FOR YOUR APPLICATION AND INSERT PINS.
   b) APPLY A THIN BAND OF THE ULTRASONIC COUPLANT PROVIDED TO THE BASE OF EACH TRANSDUCER.
   c) INSERT TRANSDUCERS INTO TRACK AS SHOWN, BANKING AGAINST INDEX PINS. SECURE TRANSDUCERS WITH CLAMPS.
6. MAKE TRANSDUCER CABLE CONNECTIONS IN ACCORDANCE WITH THE APPROPRIATE FLOW COMPUTER INSTALLATION DRAWING AND 1010 FIELD MANUAL.
7. SEE DRAWING 1012TNH–8 AND 1011HNS–8 FOR TRACK AND TRANSDUCER OUTLINE DIMENSIONS.

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES (MM) TOLERANCES ON–

INCHES	(MM)
+/– .1	+/– 2

CONTRACT NO.

DR	H.J	DATE 6/10/98
CHK		DATE
ENG		DATE
PROD		DATE
APPD		DATE

CERTIFIED

DATE

CONTROLOTRON
HAUPPAUGE , NY 11788

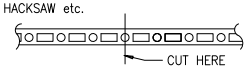
INSTALLATION DRAWING
1010 SERIES TRANSDUCERS
AND MOUNTING TRACKS

SIZE	CODE IDENT NO.		REV.
C	21614	1012TNH-7	A
SCALE: NONE	WT.	SHEET 2 OF 2	

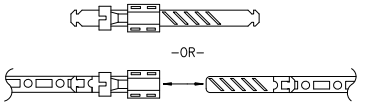
R14: 1012TNH–7B rev.A

STEP - 1 DETERMINE PROPER BAND LENGTH ONE OF TWO WAYS:
A) IF DIAMETER IS KNOWN, REFER TO BAND LENGTH TABLE OR CALCULATE BAND LENGTH = 3.14 x DIA.– 3.5".
B) IF DIAMETER IS NOT KNOWN, MEASURE CIRCUMFERENCE WITH STRING, TWINE, etc., AND SUBTRACT 3.5" (TO ALLOW LENGTH OF FASTENER) TO DETERMINE PROPER BAND LENGTH.

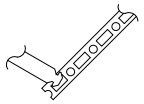
STEP - 2 MEASURE BAND TO PROPER LENGTH AND CUT THROUGH CENTER OF NEAREST ROUND HOLE WITH SHEARS, SNIPS, HACKSAW etc.



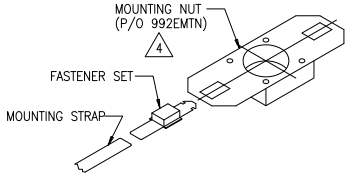
STEP - 3 EITHER MATE FASTENER HALVES AND THEN LINK TO STRAP ALREADY IN PLACE AROUND PIPE, OR LINK FASTENER HALVES INDEPENDENTLY TO STRAP ENDS (HOLD IN PLACE WITH TAPE (IF NECESSARY) AND ENGAGE FASTENER AFTER WRAPPING STRAP AROUND PIPE.

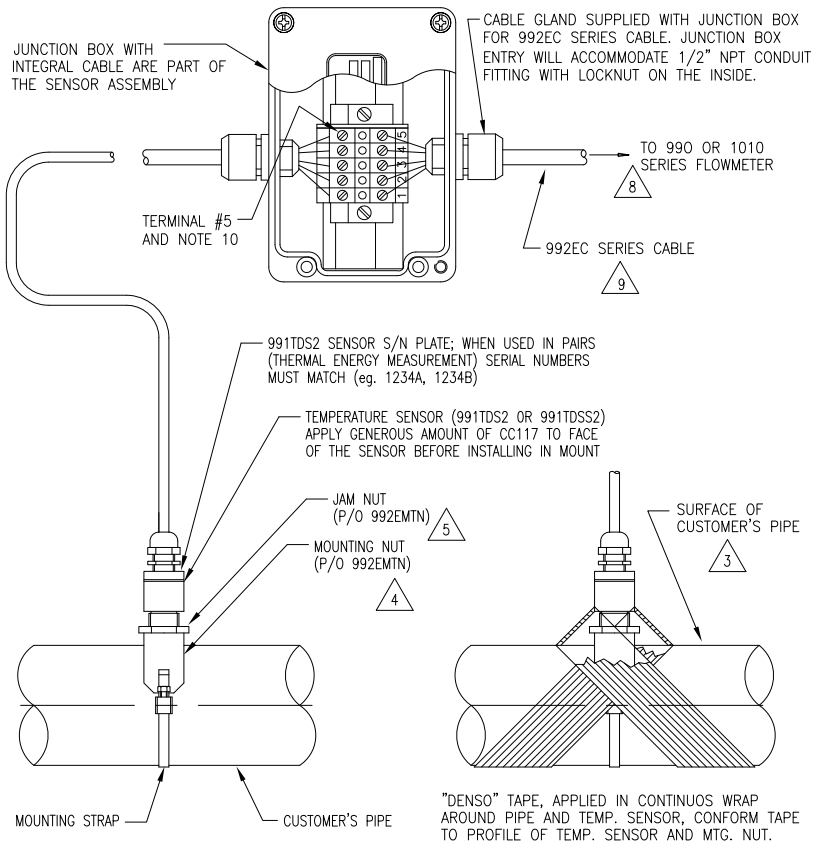


DIAGONALLY INSERT FASTENER END INTO RECTANGULAR SLOTS TO LINK WITH STRAP (INSERT AT LOCATION BEST SUITED FOR TIGHT FIT).



STEP - 4 MATE "T" ON FASTENERS WITH RECTANGULAR CUT–OUT ON MOUNTING NUT ASSEMBLY.
SIZE 2 MOUNTING ASSY'S INCLUDE FIXED LENGTH STRAPS TO MATE WITH FASTENERS ATTACHED TO MOUNTING NUT.
SIZES 3 & 4 MOUNTING ASSY'S INCLUDE A CUT–TO–FIT MOUNTING STRAP. (SEE STEP 3).





INSTALLATION PROCEDURE – SEE DRAWING REFERENCE 4

1. INSTALLATION OF THE DEDICATED NEMA 4 TEMPERATURE SENSOR FOR PIPES 1 1/4" – 48" DIAMETER CONSISTS OF THE FOLLOWING: THE SENSOR P/N 991TDS2/991TDSS2 WITH INTEGRAL CABLE AND JUNCTION BOX, A CABLE 992ECC–(LENGTH), AND MOUNTING ASS'Y 992EMTN(–2,–3 OR –4).
2. SELECT THE PIPE LOCATION WHERE TEMPERATURE IS TO BE MONITORED IN ACCORDANCE WITH RECOMMENDATIONS IN THE FIELD MANUAL.
3. CLEAN A SMALL AREA OF PIPE SURFACE (APPROXIMATELY 1" DIAMETER); REMOVE PAINT, SCALE, FOREIGN MATTER THAT CAN AFFECT GOOD THERMAL CONTACT.
4. CENTER THE MOUNTING NUT (PART OF 992EMTN) OVER THE CLEAN SPOT AND STRAP IN PLACE. ALLOW THE STRAP TO REACH APPROXIMATELY THE TEMPERATURE OF THE PIPE AND TIGHTEN SECURELY.
5. SPIN THE JAM NUT (PART OF 992EMTN) ONTO THE SENSOR BODY (991TDS2 OR 991TDSS2). APPLY A GENEROUS AMOUNT OF THERMAL COUPLANT (SUPPLIED WITH 992EMTN) TO THE FACE OF THE SENSOR AND SCREW IT INTO THE MOUNTING NUT, HAND TIGHT ENGAGEMENT IS SUFFICIENT. SECURE THE SENSOR BY TIGHTENING THE JAM NUT AGAINST THE MOUNTING NUT.
6. SELECT A MOUNTING LOCATION FOR THE JUNCTION BOX USE INTEGRAL MOUNTING HOLES OR SECURE AT END OF RIGID CONDUIT. IF CONDUIT IS USED, REMOVE THE WATERTIGHT GLAND SUPPLIED WITH THE JUCNTION BOX. INSTALL THE 992ECC CABLE, MAKING WIRING CONNECTIONS 1–5 AS SHOWN.
7. AFTER TEMPERATURE SENSOR HAS BEEN POSITIONED PROPERLY, PROTECTIVELY ENCAPSULATE IT AS FOLLOWS: PACK "DENSO" MASTIC AROUND TEMPERATURE SENSOR. SURFACE OF PIPE AND MOUNTING STRAP SHOULD BE CLEAN AND RUBBED WITH "DENSO" PASTE BEFORE WRAPPING. WRAP "DENSO" TAPE AROUND PIPE, STRAP AND TEMPERATURE SENSOR. SMOOTH THE TAPE SURFACE AFTER WRAPPING.
8. MAKE CABLE CONNECTIONS TO THE 994 OR 1010 SERIES FLOWMETER IN ACCORDANCE WITH THE APPROPRIATE FLOWMETER INSTALLATION DRAWING.
9. STANDARD TEMPERATURE SENSOR CABLE IS PART NUMBER 992ECC–(LENGTH) FOR PLENUM RATED CABLE ASSEMBLIES, USE CABLE PART NUMBER 992ECCD–(LENGTH)
10. IF NECESSARY, TO ISOLATE RTD BODY FROM FLOW METER GROUND, DISCONNECT TERMINAL #5 AND TAPE BACK TO PREVENT ELECTRICAL CONTACT, THIS GROUND ISOLATION DOES NOT AFFECT SAFETY.
11. SEE DRAWING 991TDS2–8 FOR OUTLINE DIMENSIONS.

BAND LENGTH TABLE

PIPE DIA.	LENGTH TO CUT ON MARK	PIPE DIA.	LENGTH TO CUT ON MARK	PIPE DIA.	LENGTH TO CUT ON MARK
6"	14–3/16"	16"	45–7/8"	32"	95–3/8"
7"	16–3/4"	17"	48–7/16"	34"	101–5/8"
8"	20–1/2"	18"	52–1/8"	36"	107–7/8"
9"	23–1/8"	19"	54–3/4"	38"	114–1/4"
10"	26–7/8"	20"	58–1/2"	40"	120–9/16"
11"	29–3/8"	22"	64–7/8"	42"	127"
12"	33–5/16"	24"	71–1/8"	44"	133–5/16"
13"	33–3/4"	26"	76–1/4"	46"	139–5/8"
14"	39–1/2"	28"	85–5/8"	48"	145–15/16"
15"	42–1/16"	30"	88–7/8"		

NOTES:

1. TO AID INSTALLATION, THE TEMP. SENSOR CABLE MAY BE DISCONNECTED FROM THE CABLE JUNCTION. THE CAP RING AND SEALING GLAND REMAIN ON CABLE.
2. EACH TEMP.SENSOR WRAP KIT CONSISTS OF:
   1–ROLL OF 2" WIDE "DENSO" TAPE
   1– 1# BLOCK OF "DENSO" MASTIC
   1– 1/2# CONTAINER OF "DENSO" PASTE (P/N 991–82).

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES (MM)
TOLERANCES ON–

INCHES	(MM)
± .1	± 2

MATERIAL:

FINISH:

DR	H.J	DATE	11/14/96
CHK		DATE	
ENG		DATE	
PROD		DATE	
APPD		DATE	

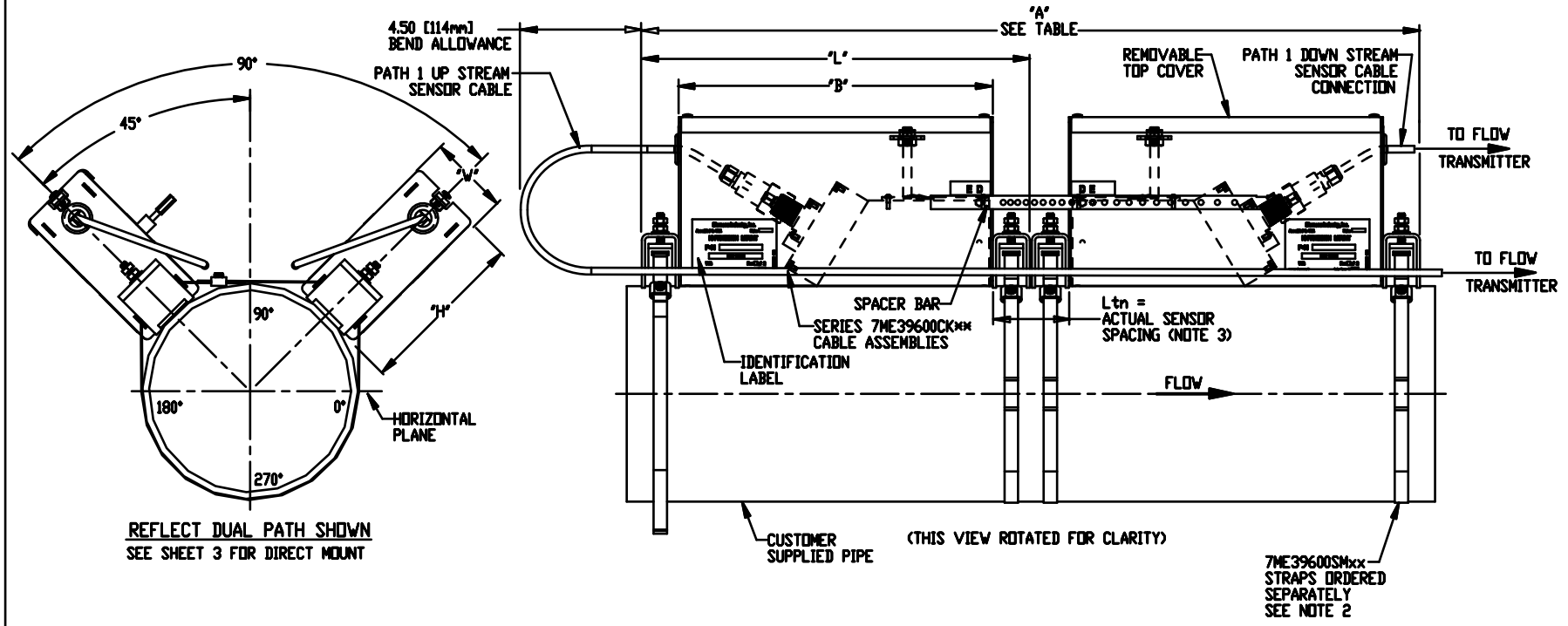
CERTIFIED

DATE

SIEMENS
Siemens Energy & Automation, Inc.
Process Instrumentation Business Unit
CoC Ultrasonic Flow - Hauppauge, Long Island, NY 11788

INSTALLATION DRAWING 991TD TEMPERATURE SENSOR SUBMERSIBLE, "FM" APPROVED

SIZE			
C	SAP MATERIAL NO.		REV
	ITEM NO.		AS
	DOCUMENT NO.	991TDS2-7	DS 03
SCALE: NONE	WT.		SHEET 1 OF 1



REFLECT DUAL PATH SHOWN
SEE SHEET 3 FOR DIRECT MOUNT

SENSOR ENCLOSURE ASSEMBLY NUMBER	DIMENSION "A"	INDEX RANGE	DIMENSION "B"	DIMENSION "L"	DIMENSION "H"	DIMENSION "W"	SENSOR	SPACER BAR
7ME39600WD50	23.58 [599mm] MIN / 43.20 [1098mm] MAX	17-43	9.01 [229]	11.75 [299]	4.91 [125]	2.35 [60]	C	SINGLE BAR
7ME39600WD60	28.88 [733mm] MIN / 62.70 [1592mm] MAX	17-52	11.66 [296]	14.40 [366]	6.28 [160]	2.97 [76]	D/E	TWO PIECE BAR

DUAL ENCLOSURE

NOTE:

1 FOR INSTALLATION PROCEDURE SEE A5E03941345.

2 7ME39600SM×× MOUNTING STRAP KITS ARE ORDERED TO MATCH PIPE SIZE.
SEE MOUNTING STRAP INSTALLATION DRAWING NO. 1012WSM-8.
TWO MOUNTING STRAP KITS REQUIRED
(INDEPENDENT OF NUMBER OF PATHS INSTALLED).

3 DIMENSION "A" IS DETERMINED BY LTN. LTN IS DEPENDENT ON
PIPE SIZE AND SOUND VELOCITY OF LIQUID.
DIMENSION RANGE AND INDEX RANGE GIVEN
SHOWS LIMITS WHEN USING INCLUDED SPACER BARS.

REV	DESCRIPTION	APPD
002	9/26/12 EC P5A0000622 CHANGE DESCRIPTION	VDB
001	8/9/12 EC79016979 REVISED PER JIN D.	VDB
0A	6/5/12 HAUPPAUGE	VDB

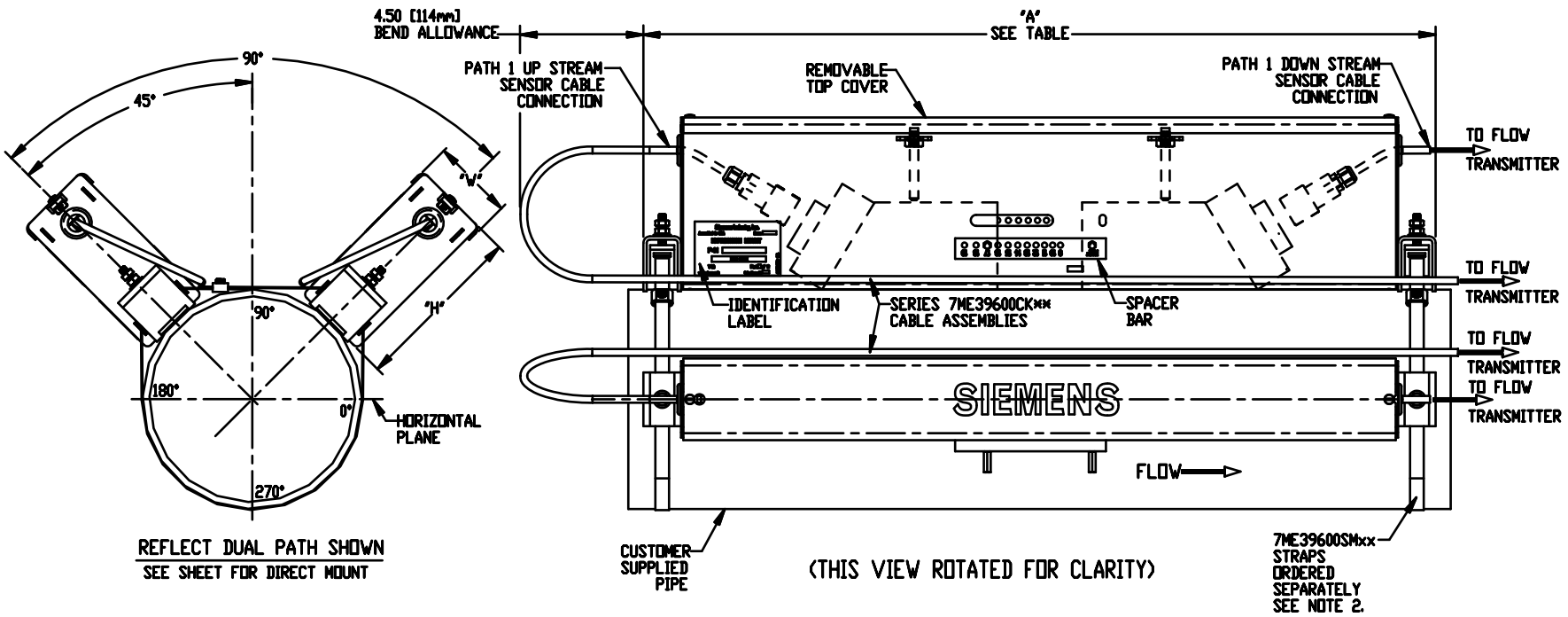
SIEMENS
Siemens Industry, Inc.
Industry Automation Division
Spring House, PA 19477 USA

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ALL DIMENSIONS ARE IN INCHES UNLESS SPECIFIED
STANDARD TOLERANCES: DECIMALS .XX ±.02 .XXX ±.005 ANGLES ±2 DEG

TITLE	OUTLINE DWG,HI-PRECISION MOUNT
SAP MATL. NUMBER	REV.
PART NUMBER	RS
DRAWN VDB DATE 8/9/12	DOCUMENT NUMBER A5E31323498A REV. 001
SCALE 1/4-X	S.N. NUMBER 16481-219

SHEET 1 OF 3



REFLECT DUAL PATH SHOWN
SEE SHEET FOR DIRECT MOUNT

(THIS VIEW ROTATED FOR CLARITY)

SENSOR ENCLOSURE ASSEMBLY NUMBER	INDEX RANGE	DIMENSION 'A'	DIMENSION 'H'	DIMENSION 'W'	SENSOR
7ME39600WS50	9-17	23.49 [597]	4.91 [125]	2.35 [60]	C
7ME39600WS60	9-17	28.90 [734]	6.28 [160]	2.97 [76]	D
7ME39600WS60	12-19	28.90 [734]	6.28 [160]	2.97 [76]	E

SINGLE ENCLOSURE

REV	DESCRIPTION	APPD
002	SEE SHEET 1	

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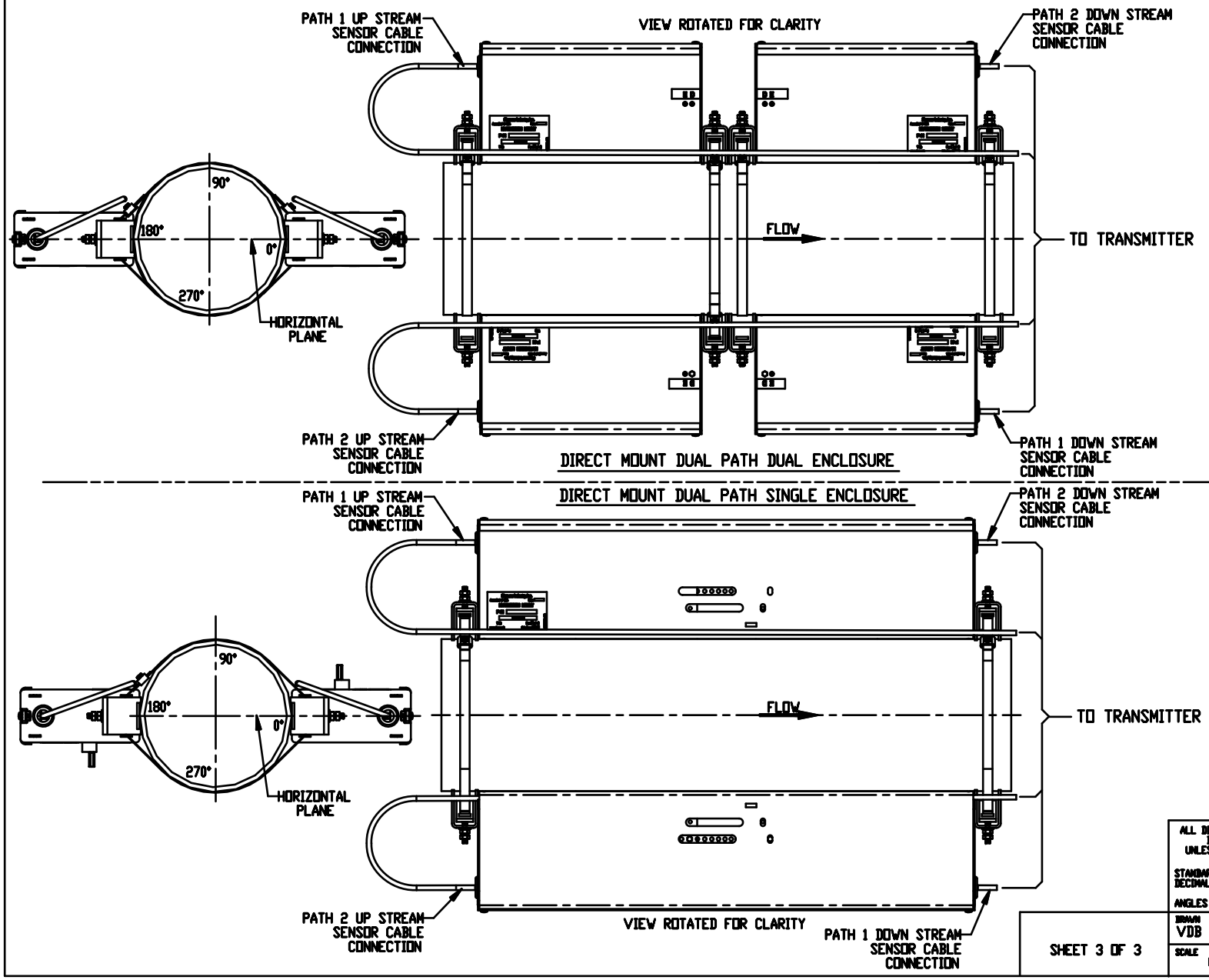
CONFIDENTIAL INFORMATION of Siemens Industry Inc.

ALL DIMENSIONS ARE IN INCHES UNLESS SPECIFIED
STANDARD TOLERANCES:
DECIMALS .XX ±.02
.XXX ±.005
ANGLES ±2 DEG

TITLE	OUTLINE DWG,HI-PRECISION MOUNT
SAP MATL. NUMBER	REV.
PART NUMBER	RS
DRAWN VDB DATE 8/9/12	DOCUMENT NUMBER A5E31323498A REV. 001
SCALE 1/4-X	S.N. NUMBER 16481-219

SHEET 2 OF 3

FORM 45 4-01



REV	DESCRIPTION	APPD
002	SEE SHEET 1	

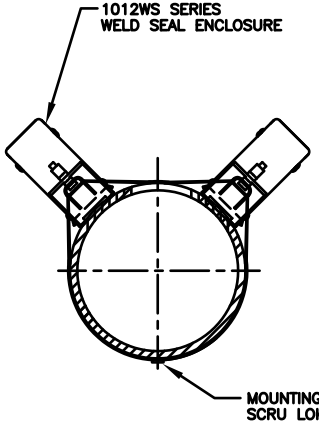
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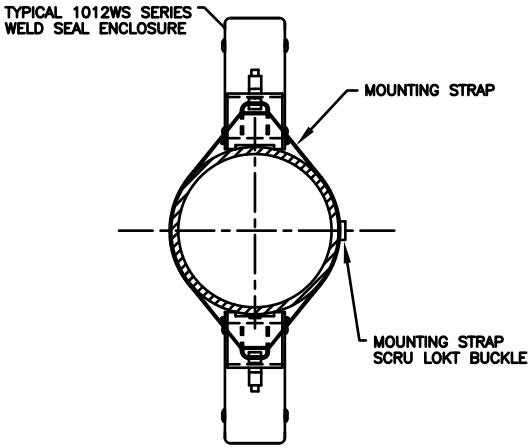
ALL DIMENSIONS ARE IN INCHES UNLESS SPECIFIED STANDARD TOLERANCES: DECIMALS .XX ±.02 .XXX ±.005 ANGLES ±2 DEG	TITLE	OUTLINE DWG,HI-PRECISION MOUNT	
	SAP MATL. NUMBER		REV.
	PART NUMBER		RS
DRAWN VDB DATE 8/9/12	DOCUMENT NUMBER	A5E31323498A	REV. 001
SCALE 0.20-1	S/N NUMBER	16481-219	

SHEET 3 OF 3

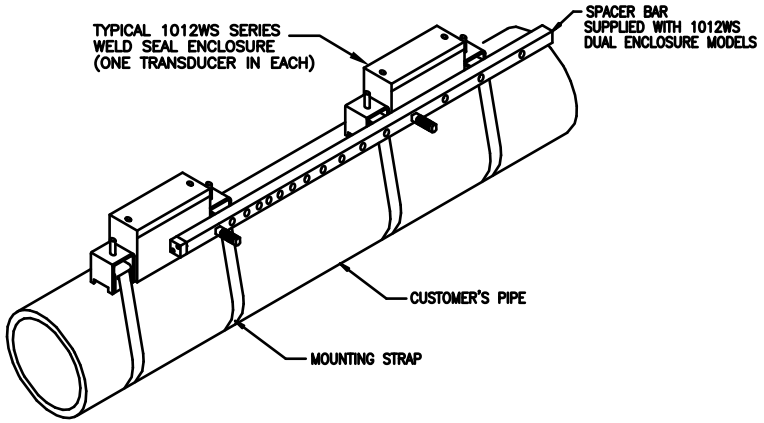
FORM 45 4-01



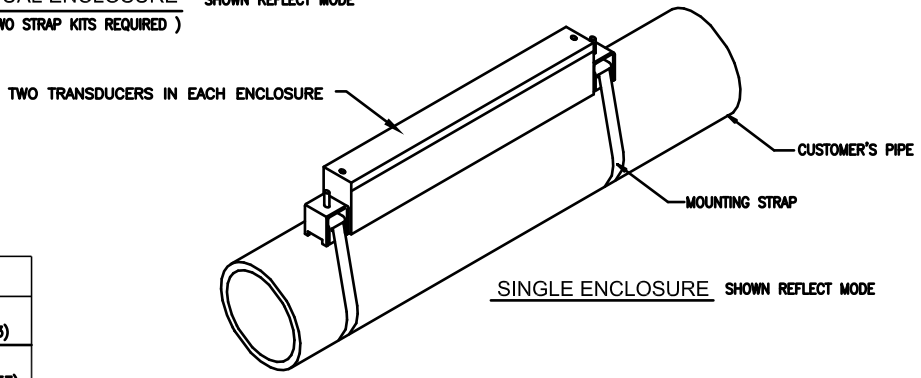
DUAL BEAM REFLECT



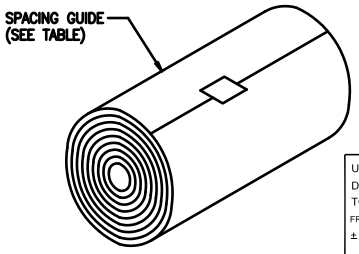
DUAL BEAM DIRECT
(DIRECT MOUNTING IS ALWAYS DUAL BEAM)



DUAL ENCLOSURE SHOWN REFLECT MODE
(TWO STRAP KITS REQUIRED)



SINGLE ENCLOSURE SHOWN REFLECT MODE



NOTES:

1. MOUNTING STRAP KITS ARE TO FASTEN WELD SEAL ENCLOSURES TO THE PIPE.
2. SEE 1012WS–7 INSTALLATION PROCEDURE
3. SEE 1012WS–8 ENCLOSURE OUTLINE DRAWING

MATERIAL ORDERING NO.	REV./AS	LEGACY PART NO.	PIPE DIA.	BAND SIZE (QTY)	SPACING GUIDE P/N (DESCRIPTION)
7ME39600SM01	02	1012WSM–1	2"–13" (50–330)	15' (4.57m) OF 1/2"(13mm) BAND AND (2) FASTENERS	1012–145–1 (2" x 45") (51 x 1143)
7ME39600SM11	02	1012WSM–2	13"–24" (330–609)	27' (8.23m) OF 1/2"(13mm) BAND AND (2) FASTENERS	1012–145–2 (4" x 81") (102 x 2057)
7ME39600SM21	02	1012WSM–3	24"–48" (609–1,219)	52' (15.9m) OF 1/2"(13mm) BAND AND (2) FASTENERS	1012–145–3 (4" x 155") (102 x 3937)
7ME39600SM31	02	1012WSM–4	48"–60" (1,219–1,524)	64' (19.5m) OF 1/2"(13mm) BAND AND (2) FASTENERS	1012–145–4 (6" x 196") (152 x 4978)
7ME39600SM41	02	1012WSM–5	60"–84" (1,524–2,134)	90' (27.4m) OF 1/2"(13mm) BAND (2 PCS., x 45'(13.7M) EACH) AND (2) FASTENERS	NOT SUPPLIED
7ME39600SM51	02	1012WSM–6	84"–120" (2,134–3,048)	130' (39.6M) OF 1/2"(13mm) BAND (2 PCS., x 65'(19.8M) EACH) AND (2) FASTENERS	NOT SUPPLIED
7ME39600SM61	02	1012WSM–7	120"–230" (3,048–5,842)	230' (70.1M) OF 1/2"(13mm) BAND (2 PCS., x 115'(35.1M) EACH) AND (2) FASTENERS	NOT SUPPLIED

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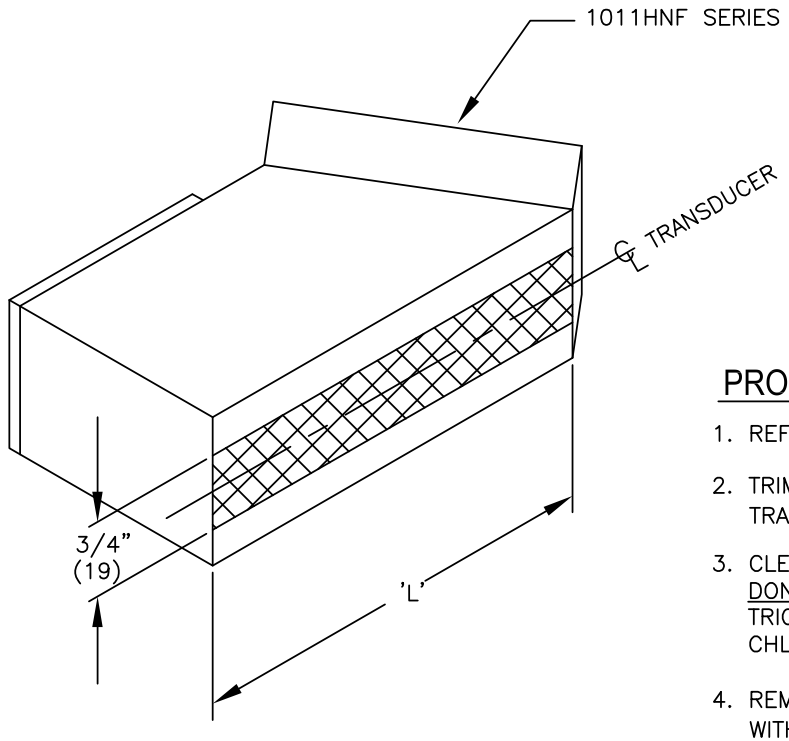
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Industry Automation Division
Hauppauge, NY 11788

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DIMENSIONS ARE IN INCHES
TOLERANCES ON-
FRACTIONS ± 1/64" DECIMAL XX±0.01 XXX±0.005 ANGLES ±0°30' HOLES ±.003

INSTALLATION / OUTLINE ADJUSTABLE MOUNTING STRAP

SAP MATERIAL NO.	SEE TABLE	REV	—
ITEM NO.	SEE TABLE	AS	—
DOCUMENT NO.	1012WSM - 8	DS	04
DRAWN BY: M.KEENAN	DATE: 1/21/02	SCALE NONE:	SHEET 1 OF 1

EC#79C57002



PROCEDURE:

1. REFER TO THE APPROPRIATE TRANSDUCER INSTALLATION DRAWING
2. TRIM THE COUPLANT STRIP LENGTH TO MATCH THE LENGTH OF THE TRANSDUCER EMITTING SURFACE 'L'.
3. CLEAN THE TRANSDUCER EMITTING SURFACE WITH ISOPROPYL ALCOHOL. DON'T CLEAN THE TRANSDUCER WITH MEK, ACETONE, TRICHLOROETHANE, TRICHLOROETHYLENE, TOLUENE, FREON (AND IT'S VAPORS), CHLOROFORM, OR XYLENE.
4. REMOVE THE PAPER BACKING FROM THE COUPLANT STRIP AND APPLY WITH THE ADHESIVE FACE TOWARD THE TRANSDUCER. APPLY CAREFULLY SO THAT NO AIR IS TRAPPED BETWEEN THE COUPLANT STRIP AND THE TRANSDUCER SURFACE.
5. MOUNT THE TRANSDUCER ON THE PIPE IN ACCORDANCE WITH THE APPROPRIATE INSTALLATION DRAWING. NO ADDITIONAL COUPLANT IS REQUIRED.

NOTES:

1. CC129-1 KIT CONSISTS OF TWO (2) STRIPS OF DRY FILM COUPLANT, 3/4" x 7" (19 x 178 MM).

DO NOT SCALE THIS DRAWING UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON– FRACTIONS– DECIMALS– ANGLES– +/- 1/64" XX+/-0.01 +/-0°30' XXX+/-0.005 MATERIAL: FINISH:	CONTRACT NO. DR H.J DATE 10/16/02 CHK DATE ENG DATE PROD DATE APPD DATE CERTIFIED DATE	CONTROLOTRON HAUPPAUGE , NY 11788 INSTALLATION, CC129 DRY FILM COUPLANT SIZE A | CODE IDENT NO. 21614 | CC129-7 | REV. A SCALE: NONE | WT. | SHEET 1 OF 1

ER#1649

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

Siemens Industry Inc.
Industry Automation Division
Coc Ultrasonic Flow
Hauppauge, New York 11788 USA
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Glossary

Active Memory

Section of RAM allocated for active site parameters (all current values). The flow meter receives site-specific operating instructions from Active Memory.

Alphanumeric Field

An 8-character data entry field that allows you to specify a Site Name or a Security code.

Arrow Keys

Use the <Up, Down, Left and Right> Arrows to navigate through the Installation Menu in their respective directions. The <Up or Down> Arrows allow you also to scroll through option list items.

Asterisk

Refers to the marker used in the Installation Menu to indicate a current option list selection. When you access an option list, you can move the asterisk with the <Up or Down> Arrows to a new selection, then press <ENTER> to select the item.

CLR (Clear) Key

Use the <CLR> key to erase a numeric value or clear a selection from a multiple select option list.

Cursor

This refers to the highlighted text and the arrow cursor that you move via the arrow direction when navigating through menus or menu cells.

Data Entry

Refers to data entered into a menu cell (either numeric or option list selection).

Datalogger Memory

Memory segment that stores data items logged during operation. You can view the Datalogger contents either on-screen or transmit it to an external device via the RS-232 serial port. The amount of Datalogger memory depends on how many sites reside in Site Storage memory.

ENTER Key

Use the <ENTER> key to store a current numeric value or option list item.

Flow Meter

Refers to the flow meter itself (the transmitter and sensors combined).

Graphic Screen

Refers to the integral LCD display screen.

Initial Makeup

An internal process performed during installation, where the flow meter acquires its receive signal and enhances other parameters for optimal operation at a site.

In-process Makeup

An internal process where the flow meter recovers its Initial Makeup parameters after a fault condition interrupts operation.

Installation Menu

The flow meter's overall menu structure. It allows you to define all aspects of operation for the flow meter.

Interface m/s

Refers to an alarm function that declares the passage of a liquid or gas interface by a comparison analysis of the relative sonic velocities of the two liquids or two gases.

LAPTOT

Refers to a system function that freezes the Totalizer display, while the Totalizer continues to update its registers.

Local Display

Refers to the transmitter integral display screen.

Menu

Sub-sections of the Installation Menu that allow you to define specific operational functions (e.g., RS-232 Setup).

Menu Cell

A location within a menu where you can define either a single numeric value or option list selection that supports the Sub-Menu's function. Certain view-only menu cells show reference data appropriate to the current application.

NEGFLOW

Totalizer mode for negative flow total only.

NETFLOW

Totalizer mode that combines positive and negative flow totals.

NOTOT

System function that disables the internal Totalizer.

Number Index

Computed sensor spacing index based on the estimated sonic velocity measurement. This Index can not be overridden by installer.

Numeric Data

Refers to a value entered into a menu cell. An example would be the pipe outer diameter.

Numeric Entry

Refers to a number you type into menu cell that stores numeric data.

Numeric Keys

Use the Numeric keys to type a numeric value where appropriate.

Op Sys ROM

The Read-Only-Memory that stores the basic operating instructions and permanent defaults of the flow meter's operating system.

Option List

Lists of options presented at menu cells that allow you to select either a single item or multiple items (depending on the function that the menu cell controls).

Parameters

Refers to value (either numeric or list selection) stored in a menu cell.

POSFLOW

Totalizer mode for positive flow total only.

Register

Refers to a memory location used by the flow meter to store data such as the flow total, etc.

RTD

Resistive Temperature Device. Temperature sensors used with energy flow of mass flow systems.

Sensor

Refers to entire spool piece, in some instances. Also flow sensors that the flow meter uses to measure the flow rate. Also called transducers and abbreviated as Xdcr.

Site Name

A user-entered name that the flow meter associates with a stored Site Setup. You retrieve a particular Site by selecting its name from a site name list.

Site Setup

A collection of parameters used by the flow meter to service a specific site (or location). The flow meter allows you to store several independent Site Setups.

Site Storage Memory

Section of RAM allocated for permanent data storage. This memory segment stores inactive site setups (including a backup of active site). The flow meter's Site Setup storage capacity depends on the dynamic memory allocation as dictated by each application. In addition, the flow meter uses Site Storage Memory to store configurable operating parameters such as pipe, liquid or gas tables.

Si-Ware

Siemens software program that interfaces with Siemens flow meters to assess flow meter installation conditions and to collect data for comparison with prior baseline data.

Spacing Index

Refers to the Number Index used by the flow meter to determine the space between the upstream and downstream sensors on clamp-on systems.

Spacing Offset

Fixed sensor offset assigned by the flow meter. This can be overridden by the installer.

TOTCNT

A Totalizer pulse count function used for Batching or Sampling.

Transducer

Also known as sensor.

Turbulence

The effect on sensor signal amplitude.

Vps

The sonic propagation velocity of a pipe.

Vs

The sonic velocity of a liquid or gas.

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