DE 14-182

YEATON ASSOCIATES, INC.

August 31, 2015

State of New Hampshire
Public Utilities Commission
21 S. Fruit St, Suite 10
Concord, NH 03301-2429

Attn: Ms. Debra Howland, Executive Director

Re: Application for Renewable Energy Source Eligibility

Dear Ms. Howland:

On October 6, 2014, the New Hampshire Public Utilities Commission granted (DE 14-182) interim certification for the Littleton Regional Healthcare's (LRH) 3.433 megawatt (MW) equivalent, thermal biomass facility as a Class I renewable energy source, effective as of January 15, 2014.

On February 24, 2015, the Commission received an application for permanent certification of Littleton Regional Healthcare. In this application, it was noted that the facility did not have installed a metering system that satisfied the requirements of Puc 2506.04. Instead, LRH was applying for certification under section 2506.06. On April 7, 2015, the commission responded with a request for clarification.

On May 8, 2015, the Commission granted a waiver of Puc 2506.04 for the Littleton Regional Healthcare thermal biomass facility to continue to generate RECs as a Class I Thermal renewable energy source. The waiver extends to September 8, 2015, before which Littleton Regional Healthcare must complete the following:

- Installation of the meters necessary to meet the requirements of Puc 2506.04;
- Submittal of an application for final approval under Puc 2506.04.

Enclosed is an Application for Final Approval under Puc 2506.04. The Application demonstrates compliance with the conditions of the Waiver. Also enclosed are two copies of this cover letter, and two copies of Application and all Attachments.

Please let me know if you have any questions or need additional information.

Respectfully,

Wayne G. Fillion, P.E.
President

Enclosure

State of New Hampshire
Public Utilities Commission

21 S. Fruit Street, Suite 10, Concord, NH 03301-2429

DRAFT

APPLICATION FORM FOR

RENEWABLE ENERGY SOURCE ELIGIBILITY FOR

CLASS I THERMAL SOURCES WITH RENEWABLE THERMAL ENERGY CAPACITY GREATER THAN 150,000 BTU/HR

Pursuant to New Hampshire Administrative Code PUC 2500 Rules

- Please submit one (1) original and two (2) paper copies of the completed application and cover letter* to:

Debra A. Howland
Executive Director
New Hampshire Public Utilities Commission
21 South Fruit Street, Suite 10
Concord, NH 03301-2429

- Send an electronic version of the completed application and the cover letter electronically to executive.director@puc.nh.gov.

* The cover letter must include complete contact information and identify the renewable energy class for which the applicant seeks eligibility. Pursuant to PUC 2505.01, the Commission is required to render a decision on an application within 45 days of receiving a completed application.

If you have any questions please contact Barbara Bernstein at (603) 271-6011 or Barbara.Bernstein@puc.nh.gov.

Only facilities that began operation after January 1, 2013 are eligible.

Is this facility part of a Commission approved aggregation?

Yes ____ No x

Aggregator's Company Name: _____

Aggregator Contact Information: _____

Contents

Attachment Labeling Instructions

Please label all attachments by Part and Question number to which they apply (e.g. Part 3-7). For electronic submission, name each attachment file using the Owner Name and Part and Question number (e.g. Pearson Part 3-7).

Part 1. General Application Information

Please provide the following information:

Applicant

Name: Littleton Regional Healthcare

Mailing Address: 600 St. Johnsbury Road

Town/City: Littleton State: NH Zip Code: 03561

Primary Contact: Henri Wante, Director of Facilities

Telephone: 603-444-9261 Cell:

Email Address: hwante@lrhcares.org

Facility

Name: Littleton Regional Healthcare

Physical Address: 600 St. Johnsbury Road

Town/City: Littleton State: NH Zip Code: 03561

If the facility does not have a physical address, the Latitude: & Longitude

Installer

Name: Daniel Hebert, Inc.

Installer License Number: State of New Hampshire Corporate ID: 12463

Mailing Address: 18 Pleasant Street

Town/City: Colebrook State: NH Zip Code: 03576

Primary Contact: Daniel Hebert

Telephone: 603.237.4454 Cell:

Email Address: DHebert@dhiqc.com

If the equipment was installed by the facility owner, check here: ☐

Facility Operator

If the facility operator is different from the owner, please provide the following:

Name:

Facility Operator Telephone Number:

Independent Monitor

Name: Wayne G. Fillion

Mailing Address: 66 Jackson Street

Town/City: Littleton State: NH Zip Code: 03561

Primary Contact: David Kyle

Telephone: 603.444.6578 Cell:

Email Address: dkyle@yeatonassociates.com

NEPOOL/GIS Asset ID and Facility Code

In order to qualify your facility's thermal energy production for RECs, you must register with the NEPOOL – GIS. Contact information for the GIS administrator follows:

James Webb
Registry Administrator, APX Environmental Markets
224 Airport Parkway, Suite 600, San Jose, CA 95110
Office: 408.517.2174
jwebb@apx.com

Mr. Webb will assist you in obtaining a GIS facility code and an ISO-New England asset ID number.

GIS Facility Code # 15514 Asset ID # NON41354

1. Has the facility been certified under another non-federal jurisdiction's renewable portfolio standards?

Yes [ ] No [x]

If you selected yes, *please provide proof of certification in the form of an attached document as Attachment 1-1.*

2. Attach any supplementary documentation that will help in classification of the facility as Attachment 1-9

Part 2. Technology Specific Data

All Technologies

Fuel type (solar, geothermal, or biomass): biomass

Rated Thermal Capacity (Btu/hr): 12,000,000 Btu/hr

Date of initial operation using renewable fuels: January 15, 2014

Biomass

If a thermal biomass facility, provide proof of New Hampshire Department of Environmental Services approval that the facility meets the emissions requirements set forth in Puc 2500, as Attachment 2-1.

Solar Thermal

If a solar thermal facility, please provide the Solar Rating and Certification Corporation rating based on Mildly Cloudy C (kBtu/day): _____

Geothermal

If a geothermal facility, please provide the following:

The coefficient of performance (COP): _____

The energy efficiency ratio of the system: _____

Part 3. Metering and Measurement of Thermal Energy and REC Calculations

This section deals with the thermal metering system including methods for calculation and reporting useful thermal energy. **A copy of PUC 2506.04 of the RPS rules is included as Appendix A.**

Using the table below, identify the thermal metering system or custom components (e.g., heat meters, flow meters, pressure and temperature sensors) used to measure the useful thermal energy and enter the accuracy of measurement for the entire system:

System or Component	Product name	Product Manufacturer	Model No.
Total System Accuracy (Percent)			

Please see this table at the start of Attachment 3.1

Attach component specification sheets (Accuracy, Operating Ranges) as Attachment 3-1. X

Attach a simple schematic identifying the location of each sensor that is part of the metering system as Attachment 3-2. X

Check the applicable standard for meter accuracy prescribed in Puc 2506.04 among the six choices below (compliance with Puc 2506.04 shall be certified by a professional engineer licensed by the state of New Hampshire and in good standing):

If the facility is a large thermal source using a liquid or air based system, check the method that applies:

A. Installation and use of heat meters capable of meeting the accuracy provisions of European Standard EN 1434 published by CEN, the European Committee for Standardization. The heat meter shall have the highest Class flow meter that will cover the design flow range at the point of measurement and a temperature sensor pair of Class 5K or lower. [ ]

B. Installation and use of meters that do not comply with European Standard EN 1434, provided that the manufacturers' guaranteed accuracy of the meters is ±5.0% or better, [ ]

C. Use of an alternative metering method approved pursuant to Puc 2506.06. [ ]

If the facility is a large thermal source using a steam-based system, check the method that applies:

D. Installation and use of meters with accuracy of ±3.0% or better. [x]

E. Installation and use of meters with system accuracy that do not meet D but are ±5% or better. [ ]

F. Use of an alternative metering method approved pursuant to Puc 2506.06. [ ]

Please summarize the manufacturer's recommended methods and frequency for metering system calibration and provide reference for source document (e.g. owners/operators manual):

Please see attached "Littleton Regional Healthcare Attachment 3.3 - Calibration Remarks"

REC Calculation Discount factor for meter accuracy (Enter 0 if no discount is required): 0 %

If the meters used to measure useful thermal energy comply with the accuracy of the European Standard EN 1434 for liquid systems or use of meters with accuracy of ±3.0% or better for steam systems enter zero, for all other systems enter the sum total of the manufacturer's guaranteed accuracy of the meters used or the accuracy of the alternative method approved pursuant to Puc 2506.06.

REC Calculation Discount factor for operating energy and thermal energy losses: 2.0 %

Check the method used for determining the operating energy and thermal loss factor among the choices below:

Default Factor [2.0]

- For sources using solar thermal technology, the discount factor shall be 3.0% of the useful thermal energy produced;
- For sources using geothermal technology, the discount factor shall be 3.6% of the useful thermal energy produced;
- For sources using thermal biomass renewable energy technology, the discount factor shall be

2.0% of the useful thermal energy produced.

Actual Metering ☐

- Include a simple schematic identifying the operating energy and thermal energy losses and placement of the meters.

Interim Alternative Metering Method

Until such time as the Puc 2500 rule is finalized applicants may utilize an alternative method as described in the draft rule 2505.02(e)(2):

> *In lieu of the information required by Puc 2505.02 (d) (11) through (13), a thermal source may submit a detailed explanation of the methodology used to measure and calculate thermal energy and an attestation by a professional engineer that is licensed in New Hampshire and in good standing that the methodology for measuring useful thermal energy and calculating certificates is sound.*

Please see attachment, "Littleton Regional Healthcare Attachment 3.4 - Interim Alternative Metering Method"

Part 4. Affidavits

Owners Affidavit

The following affidavit must be completed by the owner attesting to the accuracy of the contents of the application pursuant to PUC 2505.02 (b) (14).

AFFIDAVIT

I, HENRI WANTE have reviewed the contents of this application and attest that it is accurate and is signed under the pains and penalties of perjury.

Applicant's Signature _____ Date 8/31/15

Applicant's Printed Name HENRI WANTE

Subscribed and sworn before me this 31ST Day of August (month) in the year 2015

County of Grafton State of _____

PEGGY J. SALTMARSH MY COMMISSION EXPIRES OCT. 29, 2019 NOTARY PUBLIC NEW HAMPSHIRE

Peggy J. Saltmarsh

Notary Public/Justice of the Peace Seal

My Commission Expires 10/29/2019

NH Professional Engineer Affidavit

AFFIDAVIT

I, WAYNE G. FILLION attest that this facility meets the requirements of the thermal REC eligibility requirements of Puc 2500, including the thermal metering and measurement methodologies and standards and REC calculation methodologies.

Professional Engineer's Signature _____ Date 9.3-15

Professional Engineer's Printed Name WAYNE G FILLION

NH Professional Engineer License Number #7427

PE Stamp

THE STATE OF NEW HAMPSHIRE WAYNE G. FILLION NO. 7427 LICENSED PROFESSIONAL ENGINEER

Attachment 2-1

New Hampshire Department of environmental Services Approval of Particulate Emissions Stack Test.

The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Thomas S. Burack, Commissioner

April 28, 2014

Debra A. Howland
Executive Director and Secretary
New Hampshire Public Utilities Commission
21 South Fruit Street, Suite 10
Concord, NH 03301-2429

Re: Recommended Certification as a Class I Thermal Renewable Energy Source
Littleton Regional Healthcare (LRH)
Littleton, NH

Dear Ms. Howland:

The New Hampshire Department of Environmental Services (DES) was contacted by Charles Niebling of Innovative Natural Resource Solutions on behalf of Littleton Regional Healthcare (LRH) requesting certification of the wood-fired boilers located at LRH as a Class I thermal renewable energy source. DES recommends that the Public Utilities Commission (PUC) grant approval to LRH as a Class I thermal renewable energy source eligible to generate renewable energy certificates. A summary of the facility description, DES's review of particulate and NOx emission rates and monitoring requirements, and a recommendation for approval are presented below.

Facility Description

Facility Name: Littleton Regional Healthcare (LRH)
Facility Location: 600 Saint Johnsbury Road
Littleton, NH 03561
Gross Nameplate Capacity: 6.3 and 8.4 MMBtu/hr
Temporary (construction) Permit: TP-0127
Issue Date: May 13, 2013
Primary Fuel: Whole-tree wood chips and other low-grade clean wood fuels

Particulate Matter (PM) Emissions

By definition, "*Thermal biomass renewable energy technologies*", requires units rated between 3 and 30 MMBtu/hr gross heat input to meet a particulate matter (PM) emission rate limit of 0.10 pounds/million British thermal units (lb/MMBtu). Permit TP-0127 issued by DES contains pollution control equipment (electrostatic precipitator) operation and maintenance requirements (see Table 4, Item #7).

Emission Rate Confirmation

A PM emission test has been performed for LRH, and the test results have been reported in writing to DES. The emission test was performed for PM in accordance with the pre-test protocol reviewed by DES. The results of the emission test indicate the actual PM emission rate in lb/MMBtu meets the required 0.10 lb/MMBtu.

Nitrogen Oxides (NOx) Emissions

By definition, "*Thermal biomass renewable energy technologies"*, requires units rated less than 100 MMBtu/hr gross heat input to meet best management practices (BMP) as established by DES for control of nitrogen oxides (NOx) emissions. DES herein establishes BMP as conducting boiler tune-ups annually and conducting combustion efficiency testing initially and annually demonstrating results equal to or greater than 99%.

BMP Confirmation

LRH measured actual carbon monoxide (CO) and carbon dioxide (CO_2) concentrations in the exhaust gas using a hand-held portable analyzer (or alternative method approved by DES) to determine combustion efficiency using the following equation:

$CE(\%) = 100 \times CO_2 / (CO_2 + CO)$

Where:

CE = combustion efficiency

CO_2 = % by volume of carbon dioxide in the flue gas, and

CO = % by volume of carbon monoxide in the flue gas.

The results of the initial test indicate that the combustion efficiency meets the required 99%. DES anticipates that LRH will be able to meet ongoing BMP annually.

Conclusion and Recommendation for Approval

DES believes that LRH currently meets, and annually will meet, the requirements to be certified as a Class I - New Biomass thermal renewable energy source. DES recommends that the PUC certify LRH as a Class I thermal renewable energy source eligible to generate thermal renewable energy certificates beginning the second calendar quarter 2014 (April 1, 2014), because LRH has demonstrated that the following conditions have been met:

1) LRH emits PM at an average rate less than or equal to 0.10 lb/MMBtu; and
2) LRH currently maintains CE equal to or greater than 99%.

If you have any questions, please contact me at joseph.fontaine@des.nh.gov or (603) 271-6794.

Sincerely

Joseph T. Fontaine
Trading Programs Manager
Air Resources Division

Attachment 3-1

Thermal Metering System Component Specifications

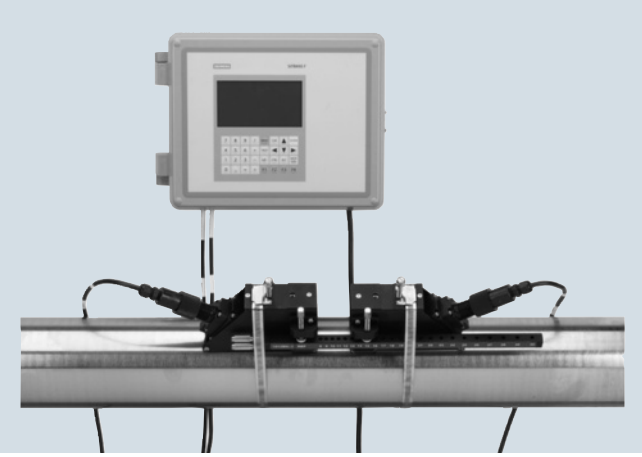
1. Table of Components
2. Mass Flowmeter
3. Feedwater Pressure Sensor
4. Feedwater Temperature Sensor
5. Supply Steam Pressure Sensor
6. Supply Steam Temperature Sensor

66 Jackson Street | Littleton, NH 03561 | Ph: 603.444.6578 | Fax: 603.444.2364
www.yeatonassociates.com

System Component	Product Name	Manufacturer	Model Number/ meter size	Manufacturer's Guarenteed Component Accuracy
Mass Flow Meter	Sitrans FUS 1010 (Standard)	Siemens	Size B3 sensor for 1-in pipe	0.5% at 1% of rated flow0.25% of rate.
Feedwater Pressure Sensor	MLH Series Guage Pressure Sensors	Honeywell	50035430-150	3.0% of Full scale, including thermal errors.
Feedwater Temperature Sensor	Series 2000 Electronic Temperature Sensors	Honeywell	C7031D3003/U	0.36°F at 77°F
Supply Steam Pressure Sensor	A2X Pressrue Transmitter	Ashcroft	A2XBM0242C2300G-XCY	0.55 OF Span; Thermal effects < 2.0% of Span.
Supply Steam Temperature Sensor	Series 2000 Electronic Temperature Sensors	Honeywell	C7031D3003/U	0.36°F at 77°F
Notes: All of these meters/sensors have been purchased and installed after the Interim Application, except for the Supply Steam Pressure Sensor, which is original.				

SITRANS FUS1010 (Standard)

Overview



SITRANS FUS1010 is the most versatile clamp-on ultrasonic flow display transmitter available today. It can operate in either Wide-Beam Transit time or Reflexor (Doppler) mode, making it suitable for virtually any liquid, even those with high aeration or suspended solids.

SITRANS FUS1010 is available in single, dual and optional four path configurations, with your choice of IP65 (NEMA 4X) wall mount, IP65 (NEMA7) compact explosionproof enclosures.

Benefits

- Versatility; there is no need to change meters when operating conditions change
- Easy installation; no need to cut pipe or stop flow
- Minimal maintenance; external sensors do not require periodic cleaning
- No moving parts to foul or wear
- No pressure drop or energy loss
- Wide turn-down ratio
- Choice of single channel or dual channel/dual path, with doppler capability. Four channel/four path optional.
  - Optional four channels allow measurement of four independent pipes at the same time, reducing overall ownership costs
  - Dual mode allows for transit time and reflexor operation at the same time on the same pipe
  - Dual path allows for two sets of sensors to be set up on one pipe and averaged for higher accuracy
- ZeroMatic Path automatically sets zero without stopping flow and reduces zero drift, even at low flow

Application

SITRANS FUS1010 is suitable for a wide variety of liquid applications, including the following:

- Water industry
  - Raw water
  - Potable water
  - Chemicals
- Wastewater industry
  - Raw sewage
  - Effluent
  - Sludges
  - Mixed liquor
  - Chemicals
- HVAC industry
  - Chillers
  - Condensers
  - Hot and cold water systems
- Power industry
  - Nuclear
  - Fossil
  - Hydroelectric
- Processing industry
  - Process control
  - Batching
  - Rate indication
  - Volumetric and mass measurement

Design

SITRANS FUS1010 is available in three configurations:

- IP65 (NEMA 4X) wall mount enclosure constructed of fiberglass reinforced polyester with stainless steel hardware and polyester keypad
  - Single channel
  - Dual channel/dual path
  - Four channel (optional)
- IP65 (NEMA 7) compact explosionproof enclosure constructed of cast aluminum with glass window, stainless steel hardware
  - Single channel
  - Dual channel/dual path
- IP66 (NEMA 7) wall mount explosionproof enclosure constructed of cast aluminum, stainless steel hardware, with glass window
  - Single channel
  - Dual channel/dual path
  - Four channel (optional)

Function

- IP65 (NEMA 4X) and IP66 (NEMA 7) flow display transmitters have integral 33 button keypads and large (128 x 240 pixel) graphic displays visible up to 12 m (40 ft) away
- IP65 (NEMA 7) compact flow display transmitter has a 2 x 16 Alphanumeric LCD display
- Current, voltage, status alarm, frequency outputs and communications including HART, BACnet MSTP/BACnet IP, Modbus RTU & TCP/IP, Ethernet IP, Johnson N2 and VT100 RS 232 (see specification section for details)
- Optional current, voltage and temperature inputs (see specification section for details)
- ZeroMatic Path automatically sets zero
- Bidirectional flow operation
- 1 MByte data logger with both site and data logger storage
- English, Spanish, German,Italian and French language selectable on IP65 (NEMA 7) enclosures[1)]

[1)] Available on NEMA 7 compact as MLFB option, all others are software selectable.

Technical specifications

SITRANS FUS1010IP65 (NEMA 4X) wall mount

Enclosure IP65 (NEMA 4X)	
Input	
Flow range	± 12 m/s (± 40 ft/s), bidirectional
Flow sensitivity	0.0003 m/s (0.001 ft/s), flow rate independent
Pipe size	6.4 mm ... 9.14 m (0.25“ ... 360“)
Optional inputs Single channel	• Current: 20 mA DC • Temperature: 4 wire 1 kΩ RTD
Output	
Standard outputs	• Current: 20 mA DC (1 kΩ at 30 V DC) • Voltage: 10 V DC (5 kΩ min.) • Status Alarm: 4 x SPDT relays • Form C relays • Pulse rate: 5 kHz
Optional outputs	• Expanded I/Os (additional 4 ... 20 mA outputs) with form C relays • UniMass (requires RTD) • Communications: HART, BACnet MSTP/BACnet IP, Modbus RTU & TCP/IP, Ethernet IP, Johnson N2 and VT100 RS-232
Accuracy	
Accuracy	± 0.5 % ... 1.0 % of flow, for velocities greater than 0.3 m/s (1 ft/s) ± 0.0015 ... 0.003 m/s (± 0.005 ... 0.01 ft/s), for velocities less than 0.3 m/s (1 ft/s)
Batch repeatability	± 0.15 % of flow, for velocities greater than 0.3 m/s (1 ft/s) ± 0.0005 m/s (± 0.0015 ft/s), for velocities less than 0.3 m/s (1 ft/s)
Data refresh rate	5 Hz

Rated operation conditions	
Degree of protection	IP65 (NEMA 4X)
Liquid temperature	
• Standard	-40 ... +120 °C (-40 ... +250 °F)
• Optional	-40 ... +230 °C (-40 ... +450 °F)
Ambient temperature	-18 … +60 °C (0 … 140 °F)
Design	
Dimensions	see SITRANS F US Clamp-on "System info and selection guide"
Weight	see diagrams
Power supply	90 ... 240 V AC, 50 ... 60 Hz, 30 VA or 9 ... 36 V DC, 12 W
Indication and operation	
Data logger memory	1 MByte
Display	128 x 240 pixel LCD with back-light
Keypad	33 keypad buttons with tactile feedback
Language options	English, Spanish, German, Italian, French selectable by software
Certificates and approvals	
FM and CSA ratings	• Transmitter N-I Class I, Div 2 S Class II, Div 2 • Sensor I.S. Class I, II, Div 1
CE	EMC Directive 2004/108/EC ATEX Directive 94/9/EC
C-TICK	
ATEX ratings	• Transmitter: Ex II (1) G [Ex ia] IIC Ex II 3 (1) G Ex nC [ia] IIC T5 • Sensors: Ex II 1 G Ex ia IIC T5
IECEx	Pending

SITRANS FUS1010 (Standard)

SITRANS FUS1010, IP65 (NEMA 7) compact explosionproof

Enclosure IP65 (NEMA 7)	
Input	
Flow range	± 12 m/s (± 40 ft/s), bidirectional
Flow sensitivity	0.0003 m/s (0.001 ft/s), flow rate independent
Pipe size	6.4 mm ... 9.14 m (0.25“ ... 360“)
Optional inputs per channel	• Current: 20 mA DC • Temperature: 4 wire 1 kΩ RTD
Output	
Outputs	• Current (externally powered): 1 x 4 … 20 mA DC (1 kΩ at 30 V DC) • Status Alarm: 1 x Isolated open collector • Pulse rate: 5 kHz • VT100 RS 232
Accuracy	
	± 0.5 % ... 1.0 % of flow, for velocities greater than 0.3 m/s (1 ft/s) ± 0.0015 ... 0.003 m/s (± 0.005 ... 0.01 ft/s), for velocities less than 0.3 m/s (1 ft/s)
Batch repeatability	± 0.15 % of flow, for velocities greater than 0.3 m/s (1 ft/s) ± 0.0005 m/s (± 0.0015 ft/s), for velocities less than 0.3 m/s (1 ft/s)
Data refresh rate	5 Hz
Rated operation conditions	
Degree of protection	IP65 (NEMA 7)
Liquid temperature	
• Standard	-40 ... +120 °C (-40 ... +250 °F)
• Optional	-40 ... +230 °C (-40 ... +450 °F)
Ambient temperature	-18 … +60 °C (0 … 140 °F)
Design	
Dimensions	see SITRANS F US Clamp-on "System info and selection guide"
Weight	see diagrams

Power supply	90 ... 240 V AC, 50 ... 60 Hz, 15 VA or 9 ... 36 V DC, 10 W 9 ... 36 V DC, 10 W - ground 9 ... 36 V DC, 10 W + ground
Indication and operation	
Data logger memory	1 MByte
Display	2 x 16 alphanumeric LCD display
Keypad	5 Magnetic hall effect switches
Language options	English, Spanish, German, Italian, French
Certificates and approvals	
FM and CSA ratings	• Transmitter XP Class I, Div 1 D-I Class II, Div 1 N-I Class I, Div 2 S Class II, Div 2 • Sensor I.S. Class I, II, Div 1
ATEX ratings	• Flow transmitter: Ex II 2 (1) G Ex d [ia] IIB + H2 T5 • Sensors: Ex II 1 G Ex ia IIC T5
IECEx	Pending
CE	EMC Directive 2004/108/EC ATEX Directive 94/9/EC

SITRANS FUS1010 IP66 (NEMA 7) wall mount explosionproof

Enclosure IP66 (NEMA 7)	
Input	
Flow range	± 12 m/s (± 40 ft/s), bidirectional
Flow sensitivity	0.0003 m/s (0.001 ft/s), flow rate independent
Pipe size	6.4 mm ... 9.14 m (0.25“ ... 360“)
Optional Inputs per channel	• Current: 20 mA DC • Temperature: 2 x 4 wire 1 kΩ RTD
Output	
Outputs single channel	• Current: 20 mA DC (1 kΩ at 30 V DC) • Voltage: 10 V DC (5 kΩ min.) • Status Alarm: 4 x SPDT Relays • Pulse rate: 5 kHz • Communications: HART, BACnet MSTP/BACnet IP, Modbus RTU & TCP/IP, Ethernet IP, Johnson N2 and VT100 RS 232
Accuracy	
Accuracy	± 0.5 % ... 1.0 % of flow, for velocities greater than 0.3 m/s (1 ft/s) ± 0.0015 ... 0.003 m/s (± 0.005 ... 0.01 ft/s), for velocities less than 0.3 m/s (1 ft/s)
Batch repeatability	± 0.15 % of flow, for velocities greater than 0.3 m/s (1 ft/s) ± 0.0005 m/s (± 0.0015 ft/s), for velocities less than 0.3 m/s (1 ft/s)
Data refresh rate	5 Hz
Rated operation conditions	
Degree of protection	IP66 (NEMA 7)
Liquid temperature	
• Standard	-40 ... +120 °C (-40 ... +250 °F)
• Optional	-40 ... +230 °C (-40 ... +450 °F)
Ambient temperature	-18 … +60 °C (0 … 140 °F)
Design	
Dimensions	see SITRANS F US Clamp-on "System info and selection guide"
Weight	see diagrams

Power supply	90 ... 240 V AC, 50 ... 60 Hz, 30 VA or 9 ... 36 V DC, 12 W
Indication and operation	
Data logger memory	1 MByte
Display	128 x 240 pixel LCD with back-light
Keypad	33 keypad buttons with tactile feedback
Language options	English, Spanish, German, Italian, French
Certificates and approvals	
FM and CSA ratings	• Transmitter XP Class I, Div 1 D-I Class II, Div 1 N-I Class I, Div 2 S Class II, Div 2 • Sensor I.S. Class I, II, Div 1
CE	EMC Directive 2004/108/EC ATEX Directive 94/9/EC
C-TICK	
ATEX ratings	• Flow transmitter Ex II (1) G [Ex ia] IIC Ex II 3 (1) G Ex nC [ia] IIC T5 Ex II 2 (1) G Ex d [ia IIC] IIB + H2 T5 • Sensors: Ex II 1 G Ex ia IIC T5
IECEx	Pending

3

SITRANS FUS1010 (Standard)

Standard MLFB for quick delivery on SITRANS FUS1010 (Dedicated standard)

Selection and Ordering data		Article No.	Order code
SITRANS FUS1010 (Standard)		↗ 7ME353 - ■■■■■ - 0■■	■■■ + K02 + K02 + R02
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.			
IP65 (NEMA 4X) wall mount		0	
Number of channels/ultrasonic paths			
Single channel		1	
Dual channel/Dual path		2	
Flowmeter functions and I/O configurations includes graphic display and Reflexor capability			
Standard outputs • 2 x 0 ... 10 V • 2 x 4 ... 20 mA • 2 x pulse output • 4 x relay C type		A	
Meter power options			
90 ... 240 V AC		A	
9 ... 36 V DC (except NEMA 7 compact)		B	
Communication options			
VT100 RS 232 (standard)		0	
RTD temperature sensor			
(include mounting hardware for pipes between 1.5" and 24" outer diameter)			
No RTDs		0	
1x standard clamp-on		1	
2x standard clamp-on		2	
1x submersible		3	
2x submersible		4	
Sensor for channel 1 (includes pipe mounting kit and spacer bar for indicated max. OD listed) See "Sensor selection charts" for specifications.			
no sensor		A	
A2 universal	Trackmount and straps provided up to 75 mm (3")	B	
B3 universal	Trackmount and straps provided up to 125 mm (5")	C	
C3 universal[3]	Mounting frame and straps provided up to 300 mm (13")	D	
D3 universal[3]	Mounting frame and straps provided up to 600 mm (24")	E	
E2 universal[3]	Mounting frame and straps provided up to 1200 mm (48")[1]	F	
C1H (high precision)[3]	Mounting frame and straps provided up to 600 mm (24")[2]	M	
C2H (high precision)[3]	Mounting frame and straps provided up to 600 mm (24")[2]	N	
D1H (high precision)[3]	Mounting frame and straps provided up to 1200 mm (48")[2]	P	
D4H (high precision)[3]	Mounting frame and straps provided up to 1200 mm (48")[2]	R	
Doppler	to 12" with strap kit (not for IP65 (NEMA7)), for up to 121 °C (250 °F)	S	
D1H [3]	High temperature range 104 °C/220 °F HP[2]	Z	P1P

Selection and Ordering data		Article No.	Order code
SITRANS FUS1010 (Standard)		7ME353 ■ - ■■■■■ - 0 ■■■	■■■ + K02 + K02 + R02
Sensor for channel 2 (includes pipe mounting kit for indicated max. OD listed) See "Sensor selection charts" for specifications.			
No sensor		A	
A2 universal	Trackmount and straps provided up to 75 mm (3")	B	
B3 universal	Trackmount and straps provided up to 125 mm (5")	C	
C3 universal[3]	Mounting frame and straps provided up to 300 mm (13")	D	
D3 universal[3]	Mounting frame and straps provided up to 600 mm (24")	E	
E2 universal[3]	Mounting frame and straps provided up to 1200 mm (48")[1]	F	
C1H (high precision)[3]	Mounting frame and straps provided up to 600 mm (24")[2]	M	
C2H (high precision)[3]	Mounting frame and straps provided up to 600 mm (24")[2]	N	
D1H (high precision)[3]	Mounting frame and straps provided up to 1200 mm (48")[2]	P	
D4H (high precision[3])	Mounting frame and straps provided up to 1200 mm (48")[2]	R	
Doppler	to 12" with strap kit (not for IP65 (NEMA7)), for up to 121 °C (250 °F)	S	
D1H [3]	High temperature range 104 °C/220 °F HP[2]	Z	Q1P
Approvals			
FM/CSA, CE (default)		1	
ATEX, CE, C-TICK		2	

1) Supplied spacer bar supports pipes up to 1050 mm (42 inch). For pipes larger than 1050 mm (42 inch) purchase also, spare part 7ME3960-0MS40 (1012BN-4)

2) Supplied spacer bar supports pipes up to 750 mm (30 inch). For pipes larger than 750 mm (30 inch) purchase also, spare part 7ME3960-0MS40 (1012BN-4)

3) Made with stainless steel construction.

Standard MLFB product offering represents 4 to 6 weeks delivery time.

For sensor and RTD cables for quick delivery see tables at end of section.

SITRANS FUS1010 (Standard)

Selection and Ordering data	Article No.	Ord. code
SITRANS FUS1010 (Standard)		
• IP65 (NEMA 4X) wall mount ↗	**7ME3530-**	
• IP65 (NEMA 7) compact explosionproof ↗	**7ME3531-**	
• IP66 (NEMA 7) wall mount explosionproof ↗	**7ME3533-**	
	0 -	
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.		
Number of channels/ultrasonic paths		
Single channel	**1**	
Dual channel/Dual path	**2**	
Special: Four channel/Four path (NEMA 4X wall mount and NEMA 7 wall mount explosionproof only)	**9**	**H 1 A**
Flowmeter functions and I/O configurations includes graphic or digital display and Reflexor capability for all except IP65 (NEMA 7) compact units		
IP65 (NEMA 4X) wall mount and IP66 (NEMA 7 wall mount explosionsproof) units		
• Standard outputs - 2 x 0 ... 10 V - 2 x 4 ... 20 mA - 2 x pulse output - 4 x relay C type For H1A multi channel option above: - 4 x 0 ... 10 V - 4 x 4 ... 20 mA - 4 x relay C type	**A**	
• Standard outputs with optional input adder - UniMass capability with 2 x RTD input (1 x RTD only for H1A multi channel option) - 4 x 4 ... 20 mA analog input	**C**	
• Extended outputs plus optional inputs (Dual channel only) Outputs: - 2 x 0 ... 10 V - 2 x 4 ... 20 mA active - 4 x 4 ... 20 mA passive - 2 x 0 ... 5K pulse - 4 x relay C type Inputs: - 4 x 4 ... 20 mA - 1 x RTD inputs per chanel	**Z**	**J 1 B**
IP65 (NEMA 7) compact explosionproof units		
• Standard outputs - 1 x 4 ... 20 mA (Loop) and 1 x status (open collector) **per channel** - 1 x pulse output for single channel units only	**D**	
• Standard outputs with optional input adder - UniMass capability with 1 RTD input (1x RTD only, for H1A multi channel option) - 1 x analog input **per channel**	**F**	
Meter power options		
90 ... 240 V AC	**A**	
9 ... 36 V DC (except compact NEMA 7)	**B**	
9 ... 36 V DC negative GND (compact only)	**J**	
9 ... 36 V DC positive GND (compact only)	**K**	

Selection and Ordering data	Article No.	Ord. code
SITRANS FUS1010 (Standard)		
• IP65 (NEMA 4X) wall mount	**7ME3530-**	
• IP65 (NEMA 7) compact explosionproof	**7ME3531-**	
• IP66 (NEMA 7) wall mount explosionproof	**7ME3533-**	
	0 -	
Communication options		
VT100 RS 232	**0**	
Modbus RTU & TCP/IP, HART, BACnet MSTP/BACnet IP, Ethernet IP, Johnson N2	**6**	
RTD temperature sensor (includes mounting hardware for pipes between 1.5“ and 24“ outer diameter)		
No RTDs	**0**	
1 x Standard clamp-on RTD	**1**	
2 x Standard clamp-on RTD	**2**	
1 x Submersible clamp-on RTD	**3**	
2 x Submersible clamp-on RTD	**4**	
1 x Insertion style RTD with thermowell and lagging	**9**	**N 1 A**
2 x Insertion style RTD with thermowell and lagging	**9**	**N 1 B**
Sensor for channel 1 Including pipe mounting tracks for sizes A & B sensors indented for pipe with a OD less than 125 mm (5") and mounting frame/spacer bars for sizes C, D & E sensors. Straps provided are for the indicated maximum OD listed below. Strap kits are available to accommodate larger pipes (refer to spare part list). Refer to "Sensor Selection Charts" for the sensor suitability of pipe size and wall thickness".		
no sensor	**A**	
A2 universal — Trackmount and straps provided up to 75 mm (3”)	**B**	
B3 universal — Trackmount and straps provided up to 125 mm (5”)	**C**	
C3 universal[3] — Mounting frame and straps provided up to 300 mm (13”)	**D**	
D3 universal[3] — Mounting frame and straps provided up to 600 mm (24”)	**E**	
E2 universal[3] — Mounting frame and straps provided up to 1200 mm (48”)[1]	**F**	

Selection and Ordering data		Article No.	Ord. code
SITRANS FUS1010 (Standard)			
• IP65 (NEMA 4X) wall mount		**7ME3530-**	
• IP65 (NEMA 7) compact explosionproof		**7ME3531-**	
• IP66 (NEMA 7) wall mount explosionproof		**7ME3533-**	
		0 -	
Sensor for channel 1 (continued)			
For the following A1H to D4H sensors, temperature range is -40 °C ... 65 °C			
A2H (high precision)	Trackmount and straps provided up to 75 mm (3")		**H**
A3H (high precision)	Trackmount and straps provided up to 75 mm (3")		**J**
B1H (high precision)	Trackmount and straps provided up to 125 mm (5")		**K**
B2H (high precision)	Trackmount and straps provided up to 125 mm (5")		**L**
C1H (high precision)[3]	Mounting frame and straps provided up to 600 mm (24")		**M**
C2H (high precision)[3]	Mounting frame and straps provided up to 600 mm (24")		**N**
D1H (high precision)[3]	Mounting frame and straps provided up to 1200 mm (48")[2]		**P**
D2H (high precision)[3]	Mounting frame and straps provided up to 1200 mm (48")[2]		**Q**
D4H (high precision)[3]	Mounting frame and straps provided up to 1200 mm (48")[2]		**R**
Doppler	to 12" with strap kit (not for IP65 (NEMA 7)), for up to 121 °C (250 °F)		**S**
High temperature sensor size 2 for up to 230 °C (446 °F) (30 to 200 mm diam. (1.18 to 7.67 inch diam.))			**Z** **P 1 A**
High temperature sensor size 3 for up to 230 °C (446 °F) (150 to 610 mm diam. (5.90 to 24 inch diam.))			**Z** **P 1 B**
High temperature sensor size 4 for up to 230 °C (446 °F) (400 to 1200 mm diam. (15.75 to 47.25 inch diam.))			**Z** **P 1 C**
For the following B1H to D4H sensors, temperature range is -1 °C up to 104 °C (30 °F up to 220 °F), nominal 65 °C (150 °F):			
B1H (high temperature range HP)			**Z** **P 1 K**
B2H (high temperature range HP)			**Z** **P 1 L**
C1H (high temperature range HP)[3]			**Z** **P 1 M**
C2H (high temperature range HP)[3]			**Z** **P 1 N**
D1H (high temperature range HP)[2][3]			**Z** **P 1 P**
D2H (high temperature range HP)[2][3]			**Z** **P 1 Q**
D4H (high temperature range HP)[2][3]			**Z** **P 1 R**

Selection and Ordering data		Article No.	Ord. code
SITRANS FUS1010 (Standard)			
• IP65 (NEMA 4X) wall mount		**7ME3530-**	
• IP65 (NEMA 7) compact explosionproof		**7ME3531-**	
• IP66 (NEMA 7) wall mount explosionproof		**7ME3533-**	
		0 -	
Sensor for channel 2 (includes pipe mounting kit for indicated max. OD listed) See "Sensor selection charts" for specifications.			
no sensor			**A**
A2 universal	Trackmount and straps provided up to 75 mm (3")		**B**
B3 universal	Trackmount and straps provided up to 125 mm (5")		**C**
C3 universal[3]	Mounting frame and straps provided up to 300 mm (13")		**D**
D3 universal[3]	Mounting frame and straps provided up to 600 mm (24")		**E**
E2 universal[3]	Mounting frame and straps provided up to 1200 mm (48")[1]		**F**
For the following A1H to D4H sensors, temperature range is -40 °C to 65 °C (-41 °F to 150 °F), nominal 21 °C (70 °F):			
A2H (high precision)	Trackmount and straps provided up to 75 mm (3")		**H**
A3H (high precision)	Trackmount and straps provided up to 75 mm (3")		**J**
B1H (high precision)	Trackmount and straps provided up to 125 mm (5")		**K**
B2H (high precision)	Trackmount and straps provided up to 125 mm (5")		**L**
C1H (high precision)[3]	Mounting frame and straps provided up to 600 mm (24")		**M**
C2H (high precision)[3]	Mounting frame and straps provided up to 600 mm (24")		**N**
D1H (high precision)[3]	Mounting frame and straps provided up to 1200 mm (48")e[2]		**P**
D2H (high precision)[3]	Mounting frame and straps provided up to 1200 mm (48")[2]		**Q**
D4H (high precision)[3]	Mounting frame and straps provided up to 1200 mm (48")[2]		**R**
Doppler	to 12" with strap kit (not for IP65 (NEMA 7)), for up to 121 °C (250 °F)		**S**

SITRANS FUS1010 (Standard)

Selection and Ordering data	Article No.	Ord. code
SITRANS FUS1010 (Standard)		
• IP65 (NEMA 4X) wall mount	**7ME3530-**	
• IP65 (NEMA 7) compact explosionproof	**7ME3531-**	
• IP66 (NEMA 7) wall mount explosionproof	**7ME3533-**	
	0 -	
Sensor for channel 2 (continued)		
High temperature sensor size 2 for up to 230 °C (446 °F) (30 to 200 mm diam. (1.18 to 7.67 inch diam.))		**Z Q 1 A**
High temperature sensor size 3 for up to 230 °C (446 °F) (150 to 610 mm diam. (5.90 to 24 inch diam.))		**Z Q 1 B**
High temperature sensor size 4 for up to 230 °C (446 °F) (400 to 1200 mm diam. (15.75 to 47.25 inch diam.))		**Z Q 1 C**
For the following B1H to D4H sensors, temperature range is -1 °C up to 104 °C (30 °F up to 220 °F), nominal 65 °C (150 °F):		
B1H (high temperature range HP)		**Z Q 1 K**
B2H (high temperature range HP)		**Z Q 1 L**
C1H (high temperature range HP)[3]		**Z Q 1 M**
C2H (high temperature range HP)[3]		**Z Q 1 N**
D1H (high temperature range HP)[2][3]		**Z Q 1 P**
D2H (high temperature range HP)[2][3]		**Z Q 1 Q**
D4H (high temperature range HP)[2][3]		**Z Q 1 R**
Approvals		
FM/CSA, CE		**1**
ATEX, CE, C-TICK		**2**

[1] Supplied spacer bar supports pipes up to 1050 mm (42 inch). For pipes larger than 1050 mm (42 inch) purchase also, spare part 7ME3960-0MS40 (1012BN-4).

[2] Supplied spacer bar supports pipes up to 750 mm (30 inch). For pipes larger than 750 mm (30 inch) purchase also, spare part 7ME3960-0MS40 (1012BN-4).

[3] Made with stainless steel construction.

Selection and Ordering data	Order code
Further designs	
Please add "**-Z**" to Article No. and specify Order code(s).	
Cable assembly for sensors (add for No. of channels)	
See "Sensor cable selection chart"	**K..**
Cable assembly for RTDs (add for No. of RTDs)	
See "RTD cable selection chart"	**R..**
Cable termination kit (for one cable pair)	
• Termination for standard, plenum and armored sensor cable	**T01**
• Termination for submersible sensor cable	**T11**
• RTD cable termination kit for standard RTD	**T21**
• RTD cable termination kit for submersible RTD	**T31**
• Insert RTD cable termination kit	**T41**
• Cable gland kit	**T51**
Languages (Meter and Documentation), English (default) for compact NEMA 7 only	
• German	**B10**
• French	**B12**
• Spanish	**B13**
• Italian	**B14**
Wet flow transfer calibration (priced on request)	
6 point calibration 2/water (Price per channel)	
• 2SS40 pipe	**D01**
• 3CS40 pipe	**D02**
• 4CS40 pipe	**D03**
• 4SS40 pipe	**D04**
• 6CS40 pipe	**D05**
• 6SS40 pipe	**D06**
• 6CS120 pipe	**D07**
• 8CS40 pipe	**D08**
• 8SS40 pipe	**D09**
• 8CS120 pipe	**D10**
• 10CS Standard pipe	**D11**
• 10CS40 pipe	**D12**
• 10SS40 pipe	**D13**
• 12CS Standard pipe	**D14**
• 12CS40 pipe	**D15**
• 14CS30 pipe	**D16**
• 14CS40 pipe	**D17**
• 16CS Standard pipe	**D18**
• 16CS40 pipe	**D19**
• 18CS Standard pipe	**D20**
• 20CS20 pipe	**D21**
• 20CS30 pipe	**D22**
• 24CS Standard pipe	**D23**
• 24CS20 pipe	**D24**
• 24CS30 pipe	**D25**
• 30CS Standard pipe	**D26**
• 36CS Standard pipe	**D27**
• Other pipe, other liquid, additional points, witness	**Y28**
Tag name plate	
• Stainless steel tag with 3.2 mm (0.13 inch) character size (68 characters max.)	**Y19**
Operating Instructions for SITRANS FUS1010	Article No.
English NEMA 4X wall mount & NEMA 7 wall mount explosionproof	**A5E02951520**
German NEMA 4X & wall mount NEMA 7 wall mount explosionproof	**A5E02951532**
NEMA 7 compact explosionproof	**CQO:1010XFM-3**

This device is shipped with a Quick Start guide and a CD containing further SITRANS F literature.

All literature is also available for free at:
http://www.siemens.com/flowdocumtenion

MLFB example

Application example

A clamp-on meter is required for a 12“ carbon steel jet fuel line, with a wall thickness of 12.7 mm (0.5“). Meter electronics are to be located in a Class I Div 2 area only 18 m (60 ft) from the pipeline. 12 V DC power is available at the site.

Dual path operation is desired for improved accuracy and redundant measurement.

MLFB Article No.: **7ME3530-2AB00-0QQ1-Z**
K03 + K03

Selection and Ordering data	Article No.	Ord. code
SITRANS FUS1010 meter family	**7 M E 3 5 3 -**	**0 -**
IP65 (NEMA 4X) enclosure	**0**	
Dual Path	**2**	
Standard I/O option	**A**	
9 ... 36 V DC power option	**B**	
RS 232 Standard	**0**	
No RTD required		**0**
Sensor code for path 1		**Q**
Sensor code for path 2		**Q**
FM approval required		**1**
30 m (100 ft) sensor cable for path 1		**K 0 3**
30 m (100 ft) sensor cable for path 2		**K 0 3**

Universal sensor selection chart IP68

Based on pipe size (pipes other than steel)					
Sensor	**Order Code**	**Outer diameter range (mm)**		**Outer diameter range (inch)**	
Pipe size		**min.**	**max.**	**min.**	**max.**
A2	**B**	12.7	50.8	0.5	2
B3	**C**	19	127	0.75	5
C3[1]	**D**	51	305	2	12
D3[1]	**E**	203	610	8	24
E2[1]	**F**	254	6 096	10	240

High precision sensor selection chart IP68

Based on pipe wall thickness (steel pipes only)					
Sensor	**Order Code**	**Pipe wall (mm)**		**Pipe wall (inch)**	
Pipe wall		**min.**	**max.**	**min.**	**max.**
A1H	**G**	0.64	1.02	0.025	0.04
A2H	**H**	1.02	1.52	0.04	0.06
A3H	**J**	1.52	2.03	0.06	0.08
B1H	**K**	2.03	3.05	0.08	0.12
B2H	**L**	3.05	4.06	0.12	0.16
C1H[1]	**M**	4.06	5.84	0.16	0.23
C2H[1]	**N**	5.84	8.13	0.23	0.32
D1H[1]	**P**	8.13	11.18	0.32	0.44
D2H[1]	**Q**	11.18	15.75	0.44	0.62
D4H[1]	**R**	15.75	31.75	0.62	1.25

[1] Made with stainless steel construction.

Sensor cable (pair) selection chart

Sensor cable codes for length and type options				
Cable length m (ft)	**Standard (PVC jacket) -40…+80 °C (-40…+176 °F)**	**Submersible (polyethylene jacket) -40…+80 °C (-40…+176 °F)**	**Plenum Rated (teflon jacket) -40…+200 °C (-40…+392 °F)**	**Armored -40…+80 °C (-40…+176 °F)**
	Order code			
6 (20)	**K01**[1]	**K11**	**K21**	**K31**
15 (50)	**K02**[1]	**K12**[1]	**K22**	**K32**[1]
30 (100)	**K03**[1]	**K13**[1]	**K23**	**K33**
46 (150)	**K04**[1]	**K14**	**K24**	**K34**
61 (200)	**K05**	**K15**	**K25**	**K35**
91 (300)	**K06**[1]	**K16**	**K26**	**K36**

RTD cable (single) selection chart

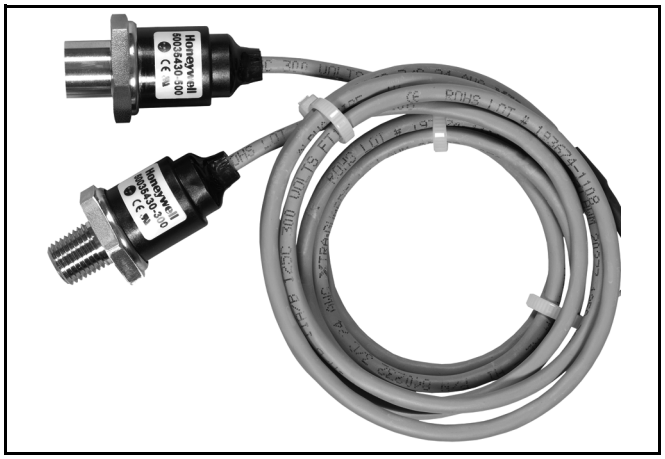
RTD cable codes for length and type		
Cable length m (ft)	**Standard (teflon wrapped) -40 ... +200 °C (-40 … +392 °F)**	**Submersible (extruded jacket) -40 ... +200 °C (-40 … +392 °F)**
	Order code	
6 (20)	**R01**[1]	**R11**
15 (50)	**R02**[1]	**R12**
30 (100)	**R03**[1]	**R13**
46 (150)	**R04**	**R14**
61 (200)	**R05**	**R15**
91 (300)	**R06**	**R16**

[1] Standard MLFB for quick delivery

Honeywell

MLH Series
Gauge Pressure Sensors

PRODUCT DATA



DESCRIPTION

The MLH Series is a two-wire 4-20mA gauge pressure sensor. This digitally compensated sensor offers an unparalleled value and performance combination, making it the ideal pressure sensing solution for demanding applications. The MLH series is available in pressure ranges up to 1000 psi.

FEATURES

- **Available in 50, 150, 300, 500 and 1000 psi.**
- **All metal wetted parts for use in a wide variety of fluid applications.**
- **Suitable for use with refrigerants.**
- **No internal elastomeric seals mean no o-ring compatibility issues.**
- **3 meter cable standard.**
- **Reverse polarity and overvoltage protection—protects against reversed excitation.**
- **Less than 2 ms response time provides accurate, high speed measurement.**
- **Select models available with 1/4-in. SAE female Schrader connection with valve depressor.**
- **Exceeds CE heavy industrial EMC for use in areas of high RFI/EMI.**

Models:

Old Part Number	New Part Number	Pressure Range	Pressure Connection
50035430-050/U	MLH050PSCDJ1235	0-50 psig	1/4"-18 NPT
50035430-150/U	MLH150PSCDJ1236	0-150 psig	1/4"-18 NPT
50035430-300/U	MLH300PSCDJ1237	0-300 psig	1/4"-18 NPT
50035430-500/U	MLH500PSCDJ1240	0-500 psig	1/4" SAE female Schrader
50035430-01K/U	MLH01KPSCDJ1241	0-1000 psig	1/4" SAE female Schrader

SPECIFICATIONS

(All specifications are measured at 25°C (77°F) and at rated excitation unless otherwise specified.)

Operating, storage and compensated temperature range:
-40° C to 125° C (-40° F to 257° F)

Proof Pressure:
3X Working Pressure Range (50-500 psi)
2X Working Pressure Range (1000 psi)

Burst Pressure:
10X Working Pressure Range

Dimensions:
See Fig. 1 and 2.

Housing Material:
Black plastic — Amodel AS-4133 HS - PPA

Material in contact with media:
Stainless steel 304L and Haynes 214 alloy

Excitation:
9.5Vdc to 30Vdc

Signal Output:
4mA to 20ma

Zero Output:
4.0mA

Full Scale Span (FSS):
16mA (4 to 20mA)

Supply rejection ratio:
90db

Termination:
Cable (3 meter)
Red Lead (Excitation)
White Lead (Output Signal)

Shock:
50 g peak [5 ms], 100 g peak [11 ms]

Vibration:
MIL- STD- 810C. Figure 514.2-5, Curve AK, Table 514.2-V, Random Vibration Test [overall g rms = 20.7 min.]

Performance

Parameter	Specification
Response Time	<2 ms
Accuracy[1]	
<100 psi	±0.50% FSS
≥100 psi	±0.25% FSS
Total error band[2]	
<300 psig (-40°C to 125°C [-40°F to 257°F])	±3% FSS
≥300 psig (>65°C to 125°C [>149°F to 257°F])	±2% FSS

[1] Includes pressure non-linearity (BFSL), pressure hysteresis, and non-repeatability. Thermal errors are not included.

[2] Includes zero error, span error, thermal effect on zero, thermal effect on span, thermal hysteresis, pressure-non-linearity, pressure hysteresis, and non-repeatability.

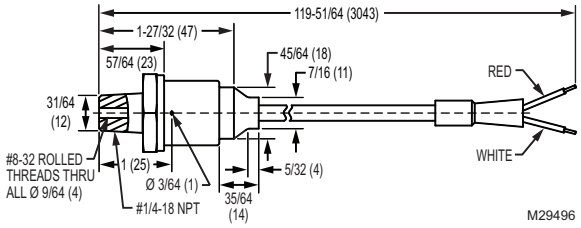


Fig. 1. MLH050PSCDJ1235/MLH150PSCDJ1236/ MLH300PSCDJ1237 dimensions in in. (mm).

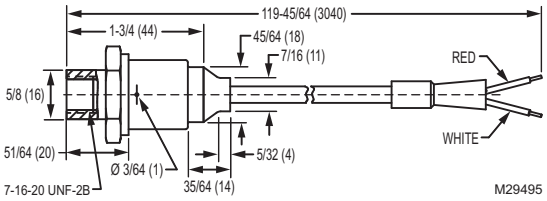


Fig. 2. MLH01KPSCDJ1241/MLH500PSCDJ1240 dimensions in in. (mm).

⚠ WARNING

Personal Injury

Do not use these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.
Failure to comply with these instructions could result in death or serious injury.

General Information

All gauge sensors are vented to the atmosphere through a case vent hole that is protected with a vapor inhibiting material.

Pressure Overloads

⚠ CAUTION

Product Damage

Do not exceed the pressure overload rating.
Failure to comply with these instructions may result in reduced life or electrical failure.

The MLH series pressure sensors will withstand high overloads; however, if the proof rating is exceeded, the life of the sensor may be reduced and electrical failure may occur. Both static and dynamic overloads must be considered, particularly in hydraulic system applications. Hydraulic pressure fluctuations can have very high and very fast peak pressures, as in a water hammer effect.

An oscilloscope is recommended for determining if high-pressure transients exist in a system. If system pressure pulses are expected, choose a sensor with a pressure rating high enough to allow continuous operation at the highest expected pressure spikes.

A pressure “snubber” may be used to reduce the peak pressure applied to the sensor. Snubbers may be obtained from the Mott Corp., Farmington, CT, USA (860) 747-6333. Catalog #4100-1/8-SS is recommended.

Media Compatibility

CAUTION

Product damage

Use non-abrasive, chemically compatible media to prevent damage to diaphragm or port materials.

Failure to comply with these instructions may result in product failure.

The MLH series pressure port and diaphragm is an assembly of Haynes 214 alloy (or equivalent) and 304 stainless steel.

INSTALLATION

CAUTION

Product Damage

Use a hex wrench for installation. Never apply torque to the connector housing or the body of the sensor.

Do not subject the sensor to high temperatures from soldering, brazing, or welding of the system plumbing or operating environments above the specified maximum temperature.

Failure to comply with these instructions may result in product damage.

A pigtail siphon should be installed to protect the sensor element from damage that can occur from direct exposure to high temperature steam.

Electromagnetic Energy/Noise

CAUTION

Product damage/erratic operation

Do not use in areas where electromagnetic energy may affect sensor operation.

Failure to comply with these instructions may result in improper operation and/or product failure.

The MLH series has been rated for high immunity to electrical noise; however, care should be taken when used around high voltage sources that emit high levels of radiated electromagnetic energy like variable frequency motor drives, solenoids, radio transmitters and engine ignition systems. The use of shielded cable and grounding of pressure port is also recommended.

Automation and Control Solutions

Honeywell International Inc.

1985 Douglas Drive North

Golden Valley, MN 55422

customer.honeywell.com

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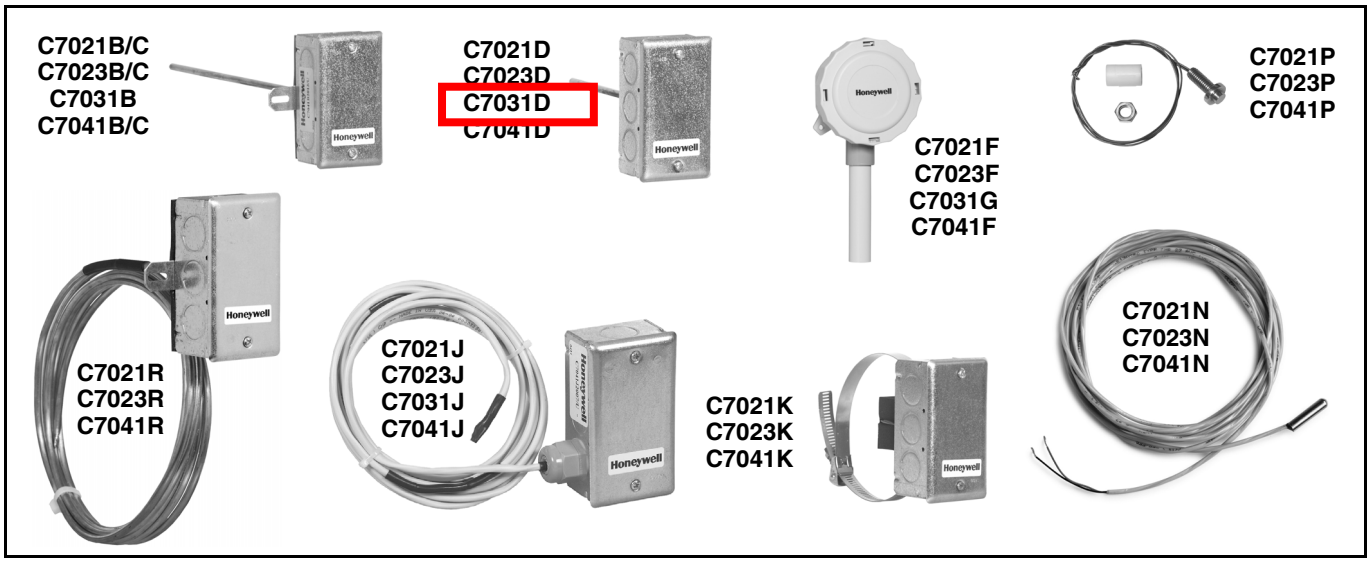
Honeywell

Series 2000
Electronic Temperature Sensors

PRODUCT DATA



APPLICATION

The Series 2000 C7021, C7023, C7031 and C7041 Electronic Temperature Sensors are designed for use with electronic controllers in domestic or commercial heating and cooling systems.

FEATURES

- **C7021D, C7023D, C7031D, C7041D for immersion mounting sense water temperature.**
- **C7021F, C7023F, C7031G, C7041F sense outdoor air temperature and are weatherproof for outdoor use (knockouts allow for 1/2 in. conduit connection).**
- **C7021J/R, C7023J/R, C7031J, C7041J/R sense average duct air temperature.**
- **C7021B/C, C7023B/C, C7031B, C7041B/C sense duct air temperature.**
- **C7021K, C7023K, C7041K with strap-on mounting senses water temperature.**
- **C7021N, C7023N, C7041N probe senses water or air temperature.**
- **C7021P, C7023P, C7041P senses air temperature.**
- **Solid state components not affected by dust or dirt.**

Contents

63-2590-06

SPECIFICATIONS

See Table 1 for additional specifications.

Compatibility:

Use Series 2000 C7031, C7041 Temperature Sensors with Excel 10, 15, 80, 100, and 500 controllers.

Series 2000 C7031B,D,G,J sensors are compatible with various Honeywell controllers. The C7031G2014 is compatible with the T7350 Commercial Thermostat.

Series 2000 C7021 temperature sensors are compatible with TB7600, TB7300 and TB7200 communicating thermostats.

Series 2000 C7023 temperature sensors are compatible with WEBs-AX I/O modules.

Dimensions:

See Fig. 1 through Fig. 11.

Sensor Accuracy:

±0.36°F at 77°F (±0.2°C at 25°C) for 20K ohm NTC sensors and 10K ohm NTC Type II and Type III sensors.

Long-term Temperature Sensor Drift (for C7041 models only): Maximum sensor drift is nominally +/-0.13°F after 5 years of operation, no appreciable drift thereafter. No calibration of the device is possible. Long term drift calibration/maintenance through controller software is typically not necessary.

Accessories:

32006523-001 20K Probe: to allow replacement of old style C7031D1062-1 with non-threaded well.

50001774-001 Stainless Steel 304 Well Assembly: 1/2 in. external and internal NPT threading. Use with C7021D/C7023D/C7031D/C7041D.

50001775-001 Well Adapter: Used with C7021D/C70231D/C7031D/C7041D to allow threading sensor into previously installed Series 1000 32005960-001 Well.

Table 1. Sensor Selection and Application Guide

Model	Control Application	Element Insertion Length	Element Operating Range	Element Max Ambient Temperature	Sensor Resistance in Ohms	Sensitivity[a]
C7021B	Duct discharge air	6 in. (152) or 12	-40° to 250°F (-40° to 121°C)	250°F (121°C)	10K Ohms NTC @ 77° F Type II	—
C7021C	Duct discharge air	18 in. (457 mm)				
C7021D	Hot or chilled water [b]	5 in. (127 mm)				
C7021F	Outdoor air	—	-40° to 158°F (-40° to 70°C)			
C7021J	Duct discharge air (averaging sensor with 4 elements)	12 ft (3.7m)	-40° to 250°F (-40° to 121°C)			
C7021K	Hot water (strap-on mounting)[f]					
C7021N	Water / Air (bullet probe)					
C7021P	Space air temperature (button probe)					
C7021R	Duct discharge air (rigid copper averaging sensor)	12 ft (3.7m) or 24 ft (7.3m)				
C7023B	Duct discharge air	6 in. (152) or 12 in. (305 mm)				
C7023C	Duct discharge air	18 in. (457 mm)				
C7023D	Hot or chilled water [b]	5 in. (127 mm)				

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number. If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Environmental and Combustion Controls Sales Office (check white pages of your phone directory).
2. Honeywell Customer Care
   1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386
3. http://customer.honeywell.com or http://customer.honeywell.ca

International Sales and Service Offices in all principal cities of the world. Manufacturing in Belgium, Canada, China, Czech Republic, Germany, Hungary, Italy, Mexico, Netherlands, United Kingdom, and United States.

Table 1. Sensor Selection and Application Guide

Model	Control Application	Element Insertion Length	Element Operating Range	Element Max Ambient Temperature	Sensor Resistance in Ohms	Sensitivity[a]
C7023F	Outdoor air		-40° to 158°F (-40° to 70°C)	250°F (121°C)	10K Ohms NTC @ 77° F Type II	—
C7023J	Duct discharge air (averaging sensor with 4 elements)	12 ft (3.7m)	-40° to 250°F (-40° to 121°C)			
C7023K	Hot water (strap-on mounting)[f]					
C7023N	Water / Air (bullet probe)					
C7023P	Space air temperature (button probe)					
C7023R	Duct discharge air (rigid copper averaging sensor)	12 ft (3.7m) or 24 ft (7.3m)	-40° to 250°F (-40° to 121°C)	250°F (121°C)	10K Ohms NTC @ 77° F Type II	—
C7031B	Duct discharge air	6 in. (152 mm)	-40° to 250°F (-40° to 121°C)	250°F (121°C)	1097 at 77° (25°C)[c]	2.1 (3.9)
C7031D	Hot or chilled water	5 in. (127 mm)	40° to 350°F (4° to 115°C)	370°F (187°C)	1097 at 77° (25°C)[c]	2.1 (3.9)
C7031G -2006	Outdoor air	—	-40° to 120°F (-40° to 49°C)	120°F (49°C)	1715 at 90°F (32°C)[c]	2.2 (3.4)
C7031G -2014[d]	Outdoor air	—	-40° to 120°F (-40° to 49°C)	120°F (49°C)	3484 at 77°F (25°C)[c]	2.1 (3.9)
C7031J	Duct discharge air (averaging sensor with 4 elements)	12 ft (3.7m)	40° to 180°F (4° to 82°C)	250°F (121°C)	1097 at 77° (25°C)[c]	2.1 (3.9)
C7041B	Duct discharge air	6 in. (152 mm) or 12 in. (305 mm)	-40° to 250°F (-40° to 121°C)	250°F (121°C)	20K Ohms NTC at 77°F (25°C)[e]	—
C7041C	Duct discharge air	18 in. (457 mm)				
C7041D	Hot or chilled water [b]	5 in. (127 mm)				
C7041F	Outdoor air	—	-40° to 158°F (-40° to 70°C)			
C7041J	Duct discharge air (averaging sensor with 4 elements)	12 ft (3.7m)	-40° to 250°F (-40° to 121°C)			
C7041K	Hot water (strap-on mounting)[f]	—				
C7041N	Water / Air (bullet probe)					
C7041P	Space air temperature (button probe)	—				
C7041R	Duct discharge air (rigid copper averaging sensor)	12 ft (3.7m) or 24 ft (7.3m)				

[a]Control sensitivity in ohms per degree F (per degree C) for element operating range.

[b] Order immersion well separately (50001774-001)

[c] Resistance increases as temperature increases.

[d] Use with T7350 Commercial Thermostat.

[e] Nonlinear resistance decreases as temperature increases.

[f] Not equipped with well; temperature sensed at surface of pipe.

Sensor Resistance

Table 2. Typical Resistance of Sensor Models.

	Typical Resistance (in ohms)			
	C7021 Sensors (10K Ohm NTC Type II)	**C7023 Sensors (10K Ohm NTC Type III)**	**C7031 Sensors (1097 Ohms PTC)**	**C7041 Sensors (20K ohm NTC)**
At 41°F (5°C)	25,392	23,467	1,020	54,200
At 50°F (10°C)	19,901	18,789	1,039	41,758
At 59°F (15°C)	15,712	15,137	1,059	32,427
At 68°F (20°C)	12,493	12,268	1,078	25,370
At 77°F (25°C)	10,000	10,000	1,097	20,000
At 86°F (30°C)	8,057	8,196	1,117	15,856
At 95°F (35°C)	6,531	6,754	1,136	12,654

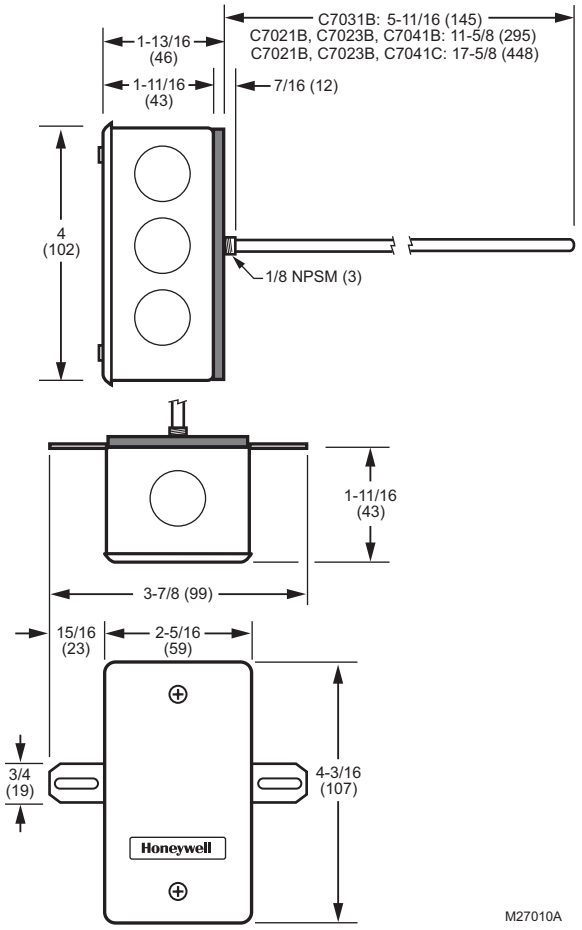


Fig. 1. C7021B/C, C7023B/C, C7041B/C dimensions in in. (mm).

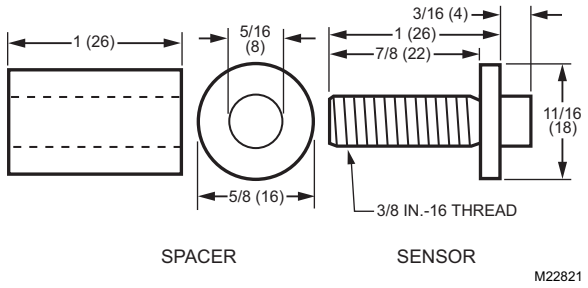


Fig. 2. Dimensions of C7021P, C7023P, C7041P in in. (mm)

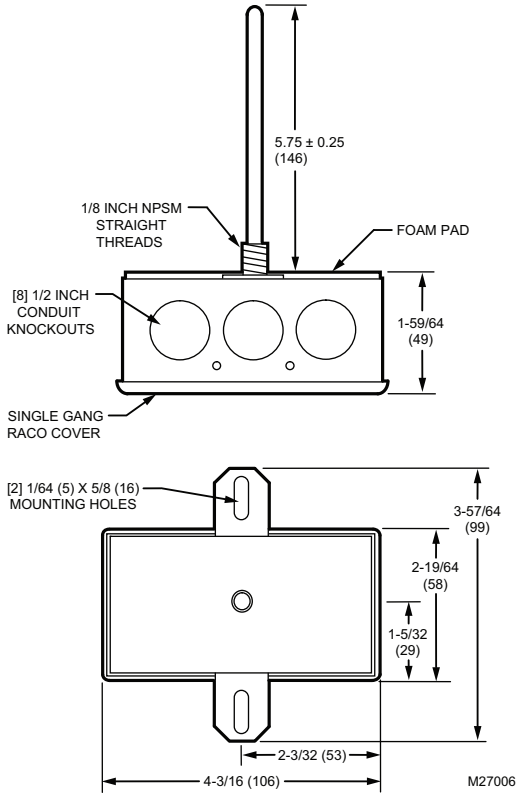


Fig. 3. C7031B dimensions in in. (mm)

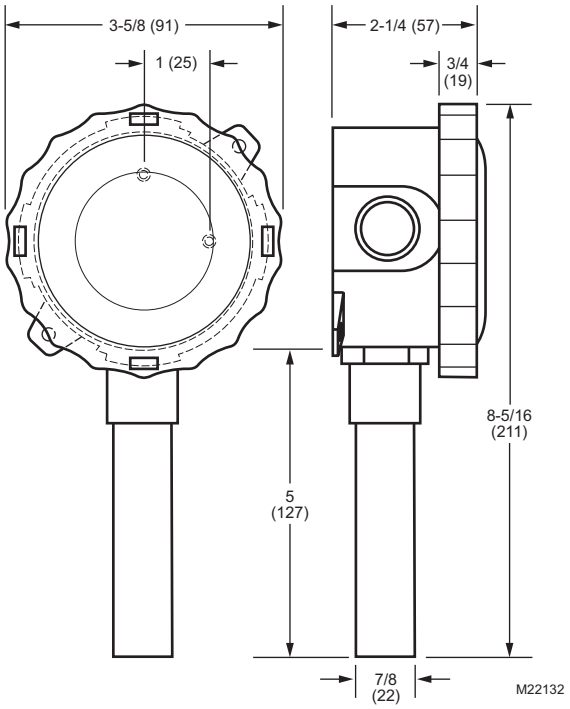


Fig. 4. C7031G, C7021F, C7023F, C7041F dimensions in in. (mm).

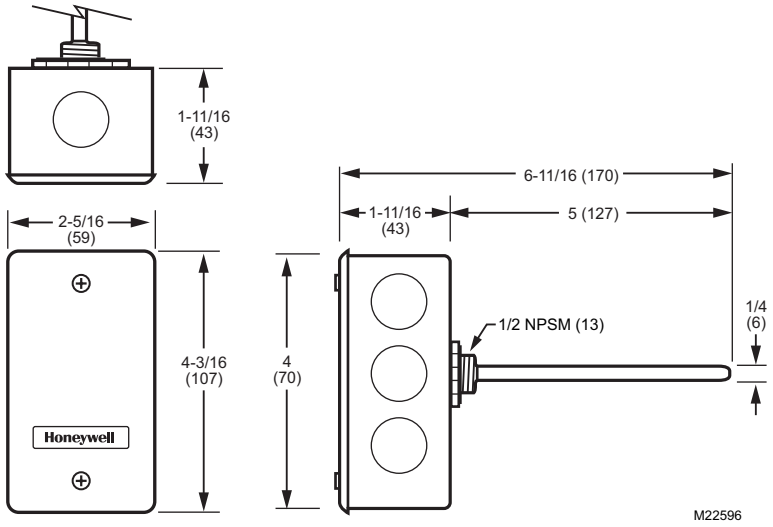


Fig. 5. C7021D, C7023D, C7031D, C7041D dimensions in in. (mm)

NOTE: The C7021D, C7023D, C7041D uses the 50001774-001 Well Assembly. See Fig. 4 for dimensions.

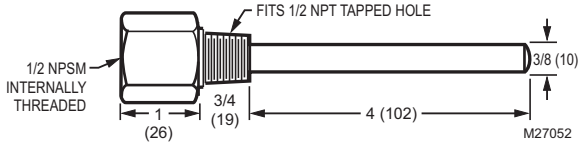


Fig. 6. 50001774-001 Immersion Well dimensions in in. (mm)

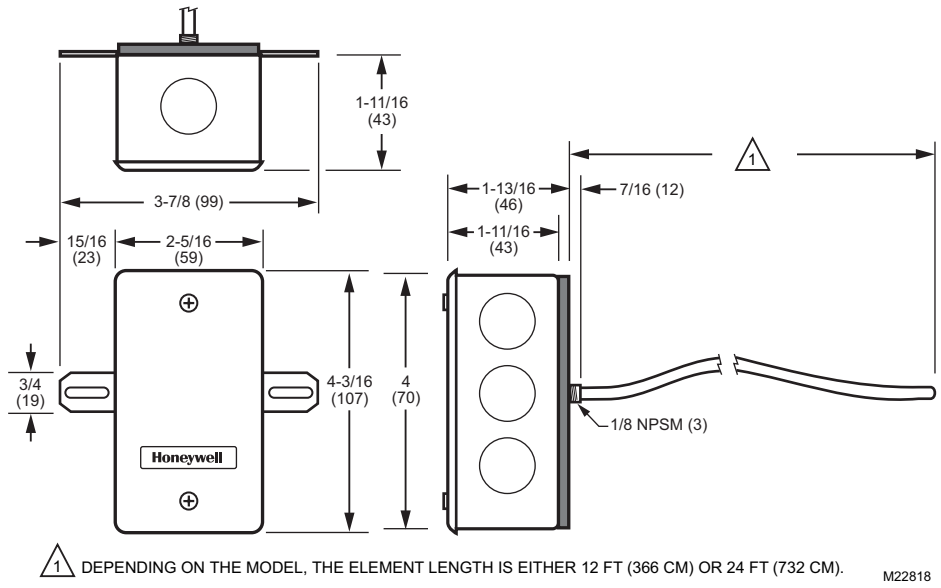


Fig. 7. C7021R, C7023R, C7041R dimensions in in. (mm).

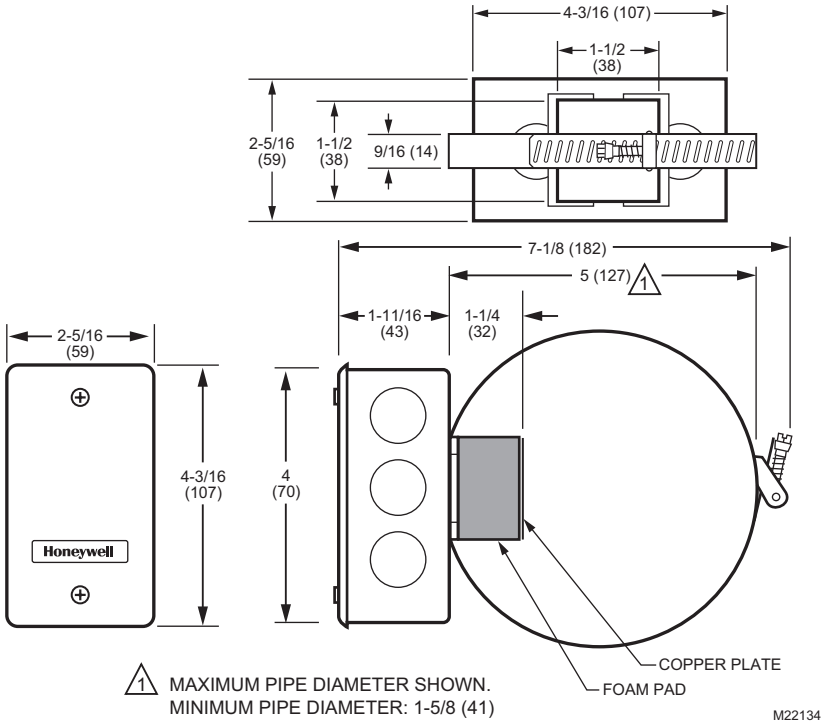


Fig. 8. C7021K, C7023K, C7041K dimensions in in. (mm).

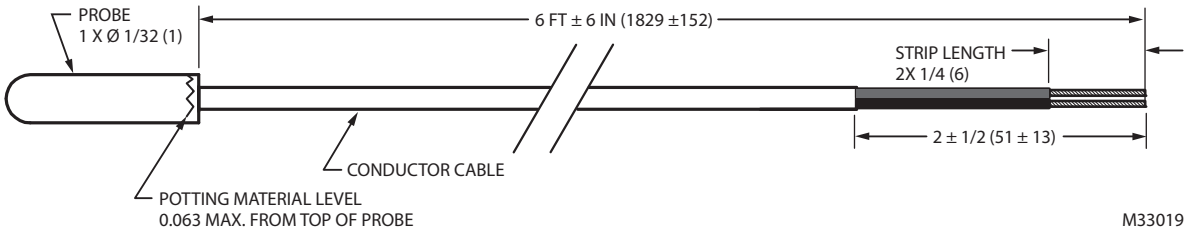


Fig. 9. C7021N, C7023N, C7041N dimensions in in. (mm).

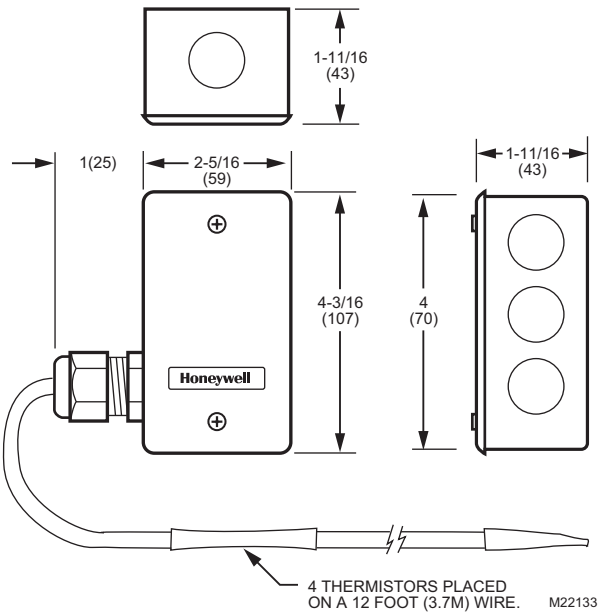


Fig. 10. C7021J, C7023J, C7031J, C7041J dimensions in in. (mm).

INSTALLATION

When Installing this Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

⚠ CAUTION

Electrical Shock or Equipment Damage Hazard. Can shock individuals or short equipment circuitry.

Disconnect power supply before installation.

Mounting

The method of mounting depends on the particular application of the temperature sensor. The following procedures include outdoor, duct, immersion well and strap-on applications. Also refer to the instructions for the electronic control.

Outdoor Mounting (C7031G, C7021F, C7023F, C7041F)

The C7031G, C7021F, C7023F and C7041F sense outdoor air temperature. Mount this control where it can sense average outdoor air temperature. Normally, the north side of a building provides a suitable location.

NOTE: These sensors are weatherproof for outdoor use. Knockouts allow for 1/2 in. conduit connection.

1. Remove and set aside the wiring box cover.
2. Mount the sensor to standard 1/2 in. conduit.

   NOTE: Mount sensor so that the element points down.
3. Make wiring connections using two wire nuts.
4. Reattach the wiring box cover.

Duct Mounting

The C7031B, C7031J, C7021B/C/J, C7023B/C/J, C7041B/C/J can be mounted in a duct to sense air temperature.

IMPORTANT

Select a spot for the sensor where it will be exposed to average duct air temperature. Avoid locations where stratification can cause sensing errors.

C7021B,C/C7023B/C, C7041B/C MOUNTING

1. Cut a hole in the duct just large enough to accept the sensing element.
2. Use the sensor case to mark the locations of the pilot holes for the mounting screws.
3. Drill the pilot holes and fasten the sensor to the duct.

C7021J, C7023J, C7031J, C7041J MOUNTING

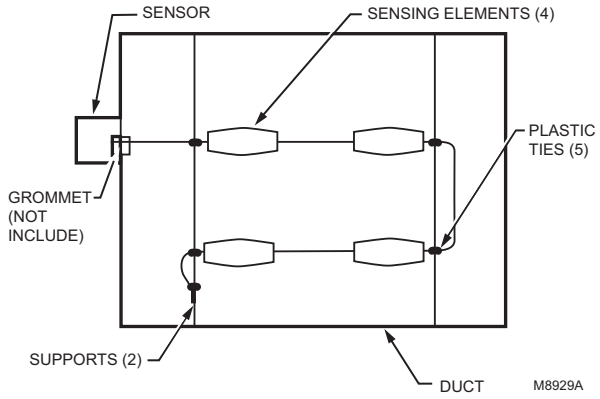


Fig. 11. Duct cross section showing method of installing C7021J, C7023J, C7031J, C7041J Averaging Electronic Sensor.

1. Install two supports inside the duct to hold the averaging element.
2. Cut a 7/8 in. (22 mm) hole in the side of the duct to insert the averaging element.
3. Fasten the terminal box to the outside of the duct and thread the element through the hole and into the duct.
4. Use plastic wire ties to fasten the element to supports. Seal the hole around the element with a rubber grommet.
5. Secure the end of the element to the duct on the support to prevent continuous flexing or abrasion.

IMPORTANT

To assure that the C7021J, C7023J, C7031J, C7041J senses average duct temperature, position the temperature elements approximately as shown in Fig. 11. Do not allow the elements to touch or be close to the duct sides.

NOTE: When the sensor is used as a deck sensor in a multizone system, be sure to space the elements equally in the duct midstream as shown in Fig. 12.

Install one C7021J, C7023J, C7031J, C7041J just upstream from the cold deck zone dampers and the other C7021J, C7023J, C7031J, C7041J upstream from the hot deck zone dampers. Position the thermistors to sense the average deck temperature.

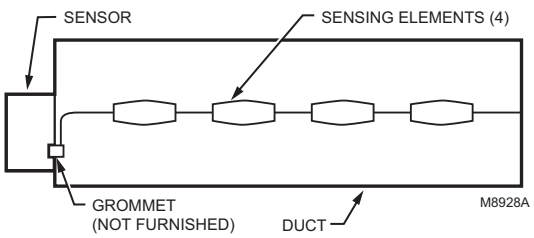


Fig. 12. Duct cross section showing method of installing C7021J, C7023J, C7031J, C7041J in a multizone system.

C7021R, C7023R, C7041R MOUNTING

1. Install two supports inside the duct to hold the averaging element.
2. Cut a 7/8 in. (22 mm) hole in the side of the duct.
3. Insert the averaging element into the duct through the hole.
4. Fasten the terminal box to the outside of the duct and thread the element through the hole and into the duct.
5. Use plastic wire ties to fasten the element to the supports. Seal the hole around the element with a rubber grommet.
6. Secure the end of the element to the duct on the support to prevent continuous flexing or abrasion.

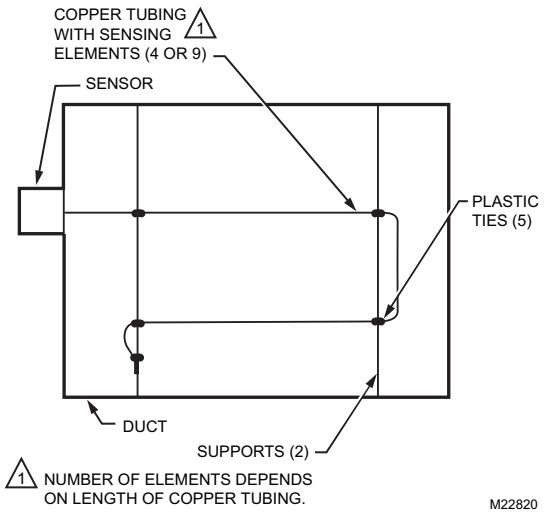


Fig. 13. Duct cross section showing method of installing C7021R, C7023R, C7041R Averaging Electronic Sensor.

IMPORTANT

To ensure that the C7021R, C7023R, C7041R senses average duct temperature, position the temperature elements approximately as shown in Fig. 13. Do not allow the elements to touch or be close to the duct sides.

NOTE: When the sensor is used as a deck sensor in a multizone system, be sure to space the elements equally in the duct midstream as shown in Fig. 14.

Install one C7021R, C7023R, C7041R just upstream from the cold deck zone dampers and the other C7021R, C7023R, C7041R upstream from the hot deck zone dampers. Position the thermistors to sense the average deck temperature.

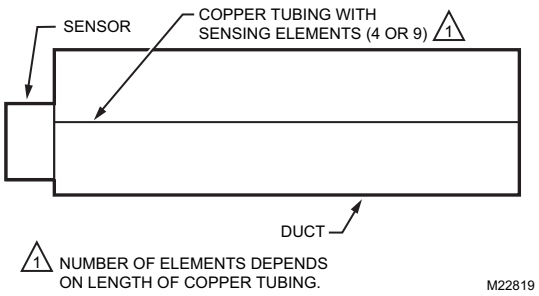


Fig. 14. Duct cross section showing method of installing C7021R, C7023R, C7041R in a multizone system.

Immersion Well Mounting (C7021D, C7023D, C7031D, C7041D)

The C7031D Sensor includes an immersion well. The C7021D, C7023D, and C7041D sensors do not include a well. For the C7021D, C7023D, and C7041D, order the well as an accessory (part no.: 50001774-001).

When used on a boiler, follow the manufacturer instructions for location. If a tapped hole is not provided for the immersion well, provide one as follows:

1. Drain boiler and drill a 23/32 in. (18 mm) hole at the selected location.
2. Cut threads in the hole with a 1/2 in. (13 mm) by 14 NPT tap.

In other installations, mount the immersion well in an elbow with a heel outlet as shown in Fig. 15.

1. Drain the system, if you have not already done it, and open the tapped hole.
2. Put pipe joint compound on the threads of the immersion well and screw it into the tapped hole or elbow, tightening it securely.
3. Refill the system and check for leaks.

Mount the C7021D, C7023D, C7031D and C7041D into the well:

NOTE: Mounting using previously installed Honeywell wells (part no.: 32005960-001) requires an adapter (part no.: 50001775-001).

1. When an adapter is required, first thread it into the well no more than one or two turns.
2. Slide the sensor into the well.
3. Rotate the sensor to thread it tightly into the adapter and the adapter tightly into the well.

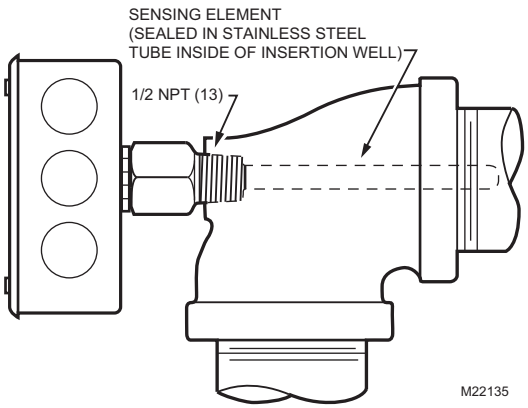


Fig. 15. Method of mounting C7021D, C7023D, C7031D, C7041D Sensor.

Strap-On Mounting (C7021K, C7023K, C7041K)

Strap-on mounting is well-suited for retrofit applications where installation costs can be reduced by not draining the system. The C7021K, C7023K, C7041K Sensor mounts on metal pipes from 1-5/8 inch to five inches in diameter using the straps supplied. Clean the surface of the pipe where the sensor makes contact before mounting (remove insulation from the pipe at the point of installation if necessary). Thermal compound is recommended with the strap-on C7021K, C7023K, C7041K Sensor. Locate the sensor on the discharge pipe within 3 feet (0.9m) of the boiler. See Fig. 16.

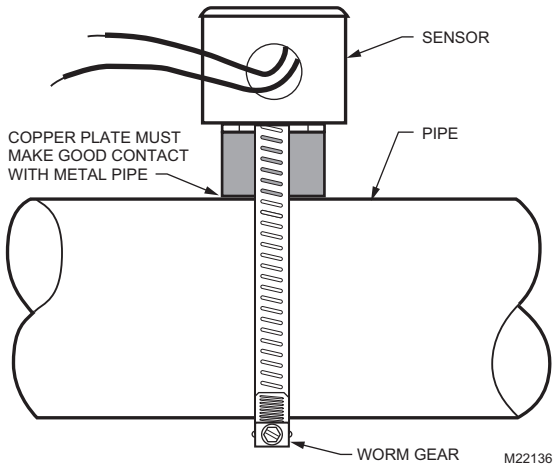


Fig. 16. Strap-on mounting of C7021K, C7023K, C7041K Sensor.

NOTE: Insulation around the contact area increases sensor accuracy.

Button Probe Mounting

The C7021P, C7023P, C7041P Button Probe Sensor design simplifies mounting into a variety of standard structural materials.

The locking nut can be used to secure the probe. See Fig. 18.

The plastic spacer helps insulate the probe from drywall, wood, or other material in which the probe is mounted. The spacer is sized to fit snugly into 1/2 in. metal conduit. See Fig. 17.

NOTES:
- The plastic spacer is threaded for easy installation.
- Use of both the locking nut and spacer requires cutting spacer to shorter length.

C7041P MOUNTING RECOMMENDATIONS

Determine the proper location based upon the following:
- Mount the probe to an inside wall approximately 54 in. (1372 mm) from the floor (or in the specified location) to allow exposure to the average zone temperature.
- Do not mount the probe to an outside wall, a wall containing waterpipes, or near air ducts.
- Avoid locations exposed to register discharge air, or radiation from lights, appliances, or the sun.

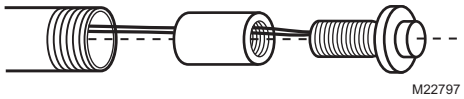


Fig. 17. Mounting sensor in conduit.

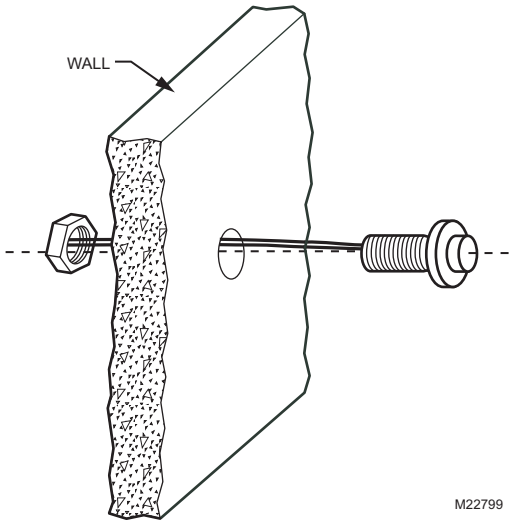


Fig. 18. Mounting sensor in wall with nut only.

Bullet Probe Sensor Mounting (C7021N, C7023N, C7041N)

The bullet probe sensor is a water-resistant sensor that provides a cost-effective solution for surface contact temperature measurement of conditioned water pipes, low pressure steam or refrigerant lines. These sensors are ideal for applications where immersion wells are not practical to install. These sensors can also be use to sense air temperature.

WIRING

⚠ CAUTION

Erratic System Operation Hazard.
Failure to follow proper wiring practices can introduce disruptive electrical interference (noise).

Keep wiring at least one foot away from large inductive loads such as motors line starters, lighting ballasts, and large power distribution panels.

Shielded cable is required in installations where these guidelines cannot be met.

Ground shield only to grounded controller case.

⚠ CAUTION

Electrical Shock or Equipment Damage Hazard.
Can shock individuals or short equipment circuitry.

Disconnect power supply before installation.

IMPORTANT

1. *All wiring must agree with applicable codes, ordinances and regulations.*
2. *Do not mount sensor in incorrect environment.*
3. *Wire according to the applicable controller instructions.*

OPERATION AND CHECKOUT

Operation

The C7041 Temperature Sensors are designed for use with XL500, XL100, XL50, XL15, XL10, and Honeywell LCBS Controllers or any controller requiring 20K ohm NTC non-linear input. As the temperature at the C7041 Sensor increases, the resistance of the sensor decreases, causing the controller to operate and offset the temperature change.

The C7021 Temperature Sensors are designed for use with the TB7600, TB7300, and TB7200 Series Communicating Thermostats or any controller requiring a 10K ohm NTC Type II input.

The C7023 Temperature Sensors are designed for use with WEBs-AX I/O Modules or any controller requiring a 10K ohm NTC Type III input.

Checkout

Refer to the applicable controller instructions when checking out the complete heating and cooling systems.

To check out the sensors, move the thermostat or remote setpoint potentiometer below the temperature of the cooling or heating medium. Watch the motor, valve or damper for the correct movement.

Automation and Control Solutions
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Honeywell

63-2590—06 M.S. Rev. 06-15
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Model A2X Explosion/Flame Proof Pressure Transmitter

LOOK FOR THESE MARKS ON OUR PRODUCTS

APPLICATIONS:

Oil field equipment, upstream oil and gas production, natural gas compression and transfer control, alternative energy projects

FEATURES:

- ***cUL and ATEX listed***
- ***Choice of 0.25, 0.50 or 1.0% accuracy***
- ***Pressure ranges from 5 psi through 10,000 psi***
- ***CE mark***
- ***316L SS wetted materials, 17-4 PH optional***
- ***304 SS case***
- ***Six output signals to choose from***
- ***Optional absolute pressure ranges available***

The Ashcroft® A2X pressure transmitter is ideal for a broad spectrum of pressure sensing requirements requiring approvals for explosion/flame proof.

The Ashcroft® A2X is designed and manufactured to provide the user with accurate, reliable, and stable output data. This is accomplished through the use of an on board microprocessor, that is programmed during a unique digital compensation process, to provide extremely linear and precise performance over the entire specified pressure and temperature range.

PERFORMANCE SPECIFICATIONS

Reference temperature 70°F (21°C)

Accuracy, Three Classes (% Span): ±.25 ±0.5 ±1.0

Includes non-linearity (Terminal Point Method), hysteresis, non-repeatability, zero offset and span setting errors

Best Fit Straight Line* (BFSL): ±.20 ±.40 ±.50

Includes non-linearity hysteresis, non-repeatability errors

*Add ±.05% for ranges above 5000 psi

Stability:
≤ ±0.25% Span/year @ reference conditions

Durability: Greater than 10 million cycles

ENVIRONMENTAL SPECIFICATIONS

Temperature Limits:

Storage:	–40 to +125°C	(–40 to 257°F)
Process:	–40 to +125°C	(–40 to 257°F)
Operating:	–40 to +125°C	(–40 to 257°F)
Compensated*:	–20 to +85°C	(–4 to 185°F)

*Consult factory for other options

Temperature Effects: –20 to +85°C (–4 to 185°F)
- 1.0% of Span for .25% Accuracy Class
- 2.0% of Span for .50% and 1.0% Accuracy Classes

Humidity Effects: No performance effects from 0 to 95% relative humidity, non-condensing, 0-100% RH with "W" enclosure.

*Consult factory

FUNCTIONAL SPECIFICATIONS

Respone Time: <2ms

Pressure Ranges: Vacuum, gauge, compound and absolute pressure from 0-5 psi through 0-10,000. Equivalent ranges in bar available. See order guide section (reverse.)

Vibration Effect:

Shock:	100g Peak, 11ms
Random:	10g RMS, 20-2000Hz
Sweep:	50-2000Hz, 5g peak

Position Effect: ± 0.02% Typical

CE Mark (standard): EN 61326:1997 + A1: 1998 Annex A
Heavy Industrial Immunity (Annex A, Table A.1)
Light Industrial/Residential Emission (Table 4)

Overpressure (F.S.)*:	**Proof**	**Burst**
0#/vac. to 300 psi	1.5 x F.S.	min. 2 x F.S.
500-10,000 psi	1.2 x F.S.	1.5 x F.S.

*For higher overpressure ratings use XK8 option. See page 2 for additional option.

ELECTRICAL SPECIFICATIONS

Output Signal:		**Supply Voltage: (unregulated)** **Minimum**	**Maximum**
0-5Vdc	(3 Wire)	12Vdc	36Vdc
0-10Vdc	(3 Wire)	14Vdc	36Vdc
1-5Vdc	(3 Wire)	10Vdc	36Vdc
1-6Vdc	(3 Wire)	10Vdc	36Vdc
4-20mA	(2 Wire)	12Vdc	36Vdc*

*30Vdc max for Intrinsically Safe installations

Power Requirements:
Supply Current: <5mA for voltage outputs

Electrical Termination:
1/2 NPT male conduit with flying leads or shielded cable

Circuit Protection: Reverse polarity and mis-wire proected
Insulation Resisance (Circuit to Case): 100Mohm @ 30Vdc

PHYSICAL SPECIFICATIONS

Case: Material 304SS

Wetted Materials: 316L SS diaphragm and presure port, optional 17-4PH SS diaphragm and 316L SS pressure port (see How to Order Section).

Ingress Protection Rating: IP65; NEMA 7,9

All units less than 500 psi include a small metal sintered filter at the top of the unit. This is necessary to equalize the internal pressure with atmospheric pressure but can be a point of moisture ingress.

HAZARDOUS AREA CERTIFICATIONS

Explosion Proof – cUL (USL/CNL): Specify A2X
Class I, Div. 1 & 2, Groups A, B, C and D
Class II, Div. 1 & 2, Groups E, F and G

Flame Proof – ATEX: Specify A2X
CE Ex II 2 G
Ex d IIC T4

NOTE: For 4-20mA units following approvals also apply:
Intrinsically Safe – FM/CSA:
Class I, Div. 1
Class I, Div. 2, Non-Incendive
Refer to Ashcroft drawing #825A022 for wiring and installation requirements.

NOTE:
Refer to Ashcroft Model A2 for Heavy Industrial, non-Hazardous rated configurations and Ashcroft Model A4 for Intrinsically Safe/non-Incendive applications.

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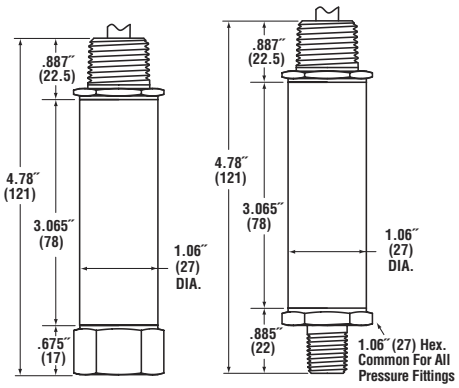
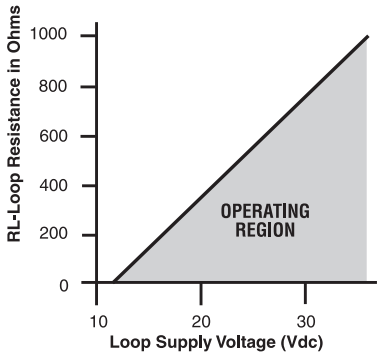
Model A2X Explosion/Flame Proof Pressure Transmitter

DIMENSIONS dimensions in ( ) are mm



EXPLOSION / FLAME PROOF ENCLOSURE

Load Limitations 4-20mA Output Only



VdcMIN = 12V + (0.022A* X (RL))

$R_L = R_S + R_W$

R_L = Loop Resistance (ohms)

R_S = Sense Resistance (ohms)

R_W = Wiring Resistance (ohms)

* (Includes a 10% safety factor)

XK8 OVERPRESSURE (F.S.)

	Proof	Burst
0 to 2000 psi	200%	800%
3000 to 5000 psi	150%	300%
7500 to 10,000 psi	120%	150%

NOTE:
Refer to Ashcroft Model A2 for Heavy Industrial, non-Hazardous rated configurations and Ashcroft Model A4 for Intrinsically Safe/non-Incendive applications.

[7]Available only with accuracy B & C.

How To Order

A2X

Type Configuration (A2X)

Accuracy / Temp. Effects
(A) 0.25%/≤1.0% (–20°C to +85°C)
(B) 0.50%/≤2.0% (–20°C to +85°C)
(C) 1.00%/≤2.0% (–20°C to +85°C)

Pressure Connection
(M01) ⅛ NPT-M
(M02) ¼ NPT-M
(F02) ¼ NPT-F
(MEK) 7/16-20 SAE-M
(F09) 9/16-18 (¼)-F (Aminco)
(M04) ½ NPT-M
(F04) ½ NPT-F
(MG4) G ½ M
(VM2) VCR inlet fitting ¼″ VCR gland with 9/16-18 male nut
(VF2) VCR inlet fitting ¼″ VCR gland with 9/16-18 female nut
(others available upon request)

Output Signal
(05) 0-5 Vdc
(10) 0-10 Vdc
(15) 1-5 Vdc
(16) 1-6 Vdc
(42) 4-20mA

Electrical Termination
½ NPT Male Conduit

Flying Leads
(C2) with 3´ leads
(C5) with 10´ leads

Shielded Cable
(C1) with 3´ cable
(C6) with 15´ cable
(C7) with 30´ cable
(P7) with customer defined length

Pressure Range
(1.5#) 1.5 psi[5],[6],[7]
(5#) 5 psi[5],[6]
(10#) 10 psi[5],[6]
(15#) 15 psi[5]
(30#) 30 psi[5]
(50#) 50 psi
(60#) 60 psi
(75#) 75 psi
(100#) 100 psi
(150#) 150 psi
(200#) 200 psi
(300#) 300 psi
(500#) 500 psi
(750#) 750 psi
(1000#) 1000 psi
(1500#) 1500 psi
(2000#) 2000 psi
(3000#) 3000 psi
(5000#) 5000 psi
(7500#) 7500 psi
(10,000#) 10,000 psi[4]
(0# & vac.) 0 psi/vac.[5],[6]
(15# & vac.) Vac./15 psi[5],[6]
(30# & vac.) Vac./30 psi[5],[6]
(45# & vac.) Vac./45 psi[6]
(60# & vac.) Vac./60 psi[6]

Measurement Type
(G) Gauge Pressure Sensor
(A) Absolute Pressure Sensor

Optional X-Variations
X
(XCL) Non-standard[4] calibration
(XK8) 17-4PH SS Sensor Material
(X6B) Cleaned For Oxygen Service

[4]17-4PH SS Sensor Required
[5]17-4PH SS Sensor Not Available
[6]Gauge pressure only
[7]Available only with accuracy B & C

NOTE: All A2X pressure transmitters include a 9 pt. NIST traceable calibration certificate

ISO 9001
REGISTERED FIRM

BULLETIN A2X-1

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Attachment 3-2

1. Description of Methodology

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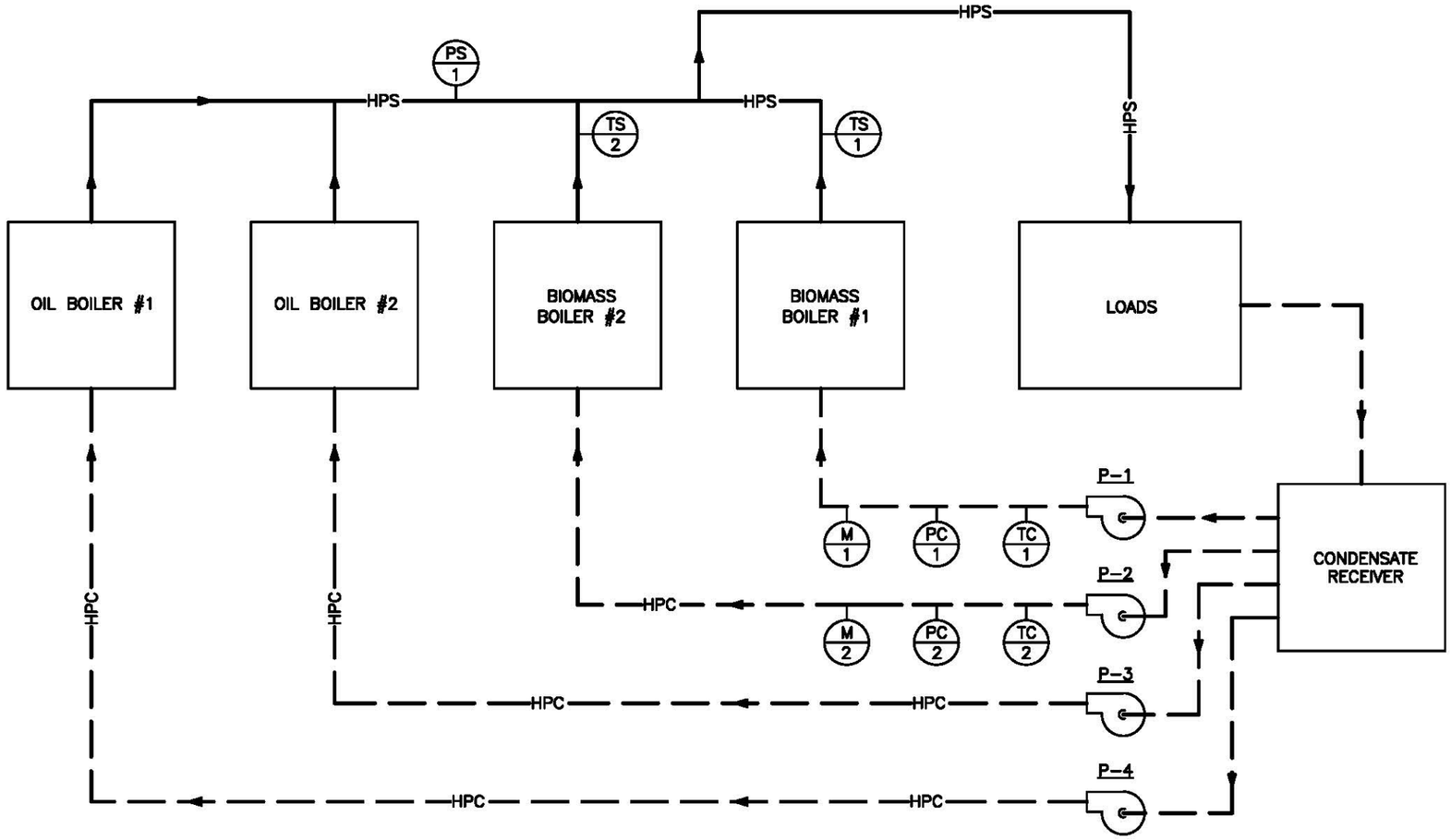
www.yeatonassociates.com



LEGEND

- M — MASS FLOW METER
- PC — CONDENSATE PRESSURE SENSOR
- TC — CONDENSATE TEMPERATURE SENSOR
- TS — STEAM TEMPERATURE SENSOR
- PS — STEAM PRESSURE SENSOR
- HPS — HIGH PRESSURE STEAM
- HPC — HIGH PRESSURE CONDENSATE
- FLOW ARROW

LITTLETON REGIONAL HEALTHCARE
600 ST. JOHNSBURY ROAD
LITTLETON, NEW HAMPSHIRE 03561

YEATON ASSOCIATES, INC.
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Littleton, NH 03561
603.444.6578
www.yeatonassociates.com
14042M

DATE: 8-31-2015
JOB NO.: 14042ME
SCALE: N.T.S.

SENSOR LOCATION
FLAT FLOW - MECH.

M-1

Description of the methodology used to calculate the useful thermal energy pursuant to Puc 2506.04

Equations 1, 2, and 3 show the proposed method for calculating useful thermal energy.

$Q = (QS - QC) * 0.98 * t$ Equation 1

$QS = hS * (Flow)$ Equation 2

$QC = hC * (Flow)$ Equation 3

Where:

- **QS (Btu/hr)** Rate of energy in steam delivered by the biomass unit to the main header, as determined by direct measurement of supply steam temperature (Sensors TS-1, TS-2), and supply steam pressure (PS).
- **QC (Btu/hr)** Rate of energy in pumped condensate entering the boiler, as determined by direct measurement of the condensate temperature (TC-1, TC-2), and condensate pressure (PC-1, PC-2).
- **Flow (lb/hr)** steam and condensate flows are measured by flow meters M-1 and M-2. Steam mass flow exiting the boilers and condensate mass flow entering the boilers are identical as the system is closed between these points. The values are measured each minute, averaged over each hour, and then the hour's average is used for calculation.
- **hS and hC (Btu/lb)** are the specific enthalpy of steam and of condensate, respectively. The values are determined by direct pressure and temperature measurements as noted above, and using IAPWS steam tables.
- **t (hr)** is time in hours. Where readings are taken more frequently, the values are converted to hourly. All parameters ae recorded hourly by the Building Energy Management System.
- The factor of 0.98 accounts for the 2% reduction in REC generation (discount factor) for parasitic load.

Fossil Fuel Boilers

Boilers 1 and 2 are fired on fuel oil. As shown in the schematic, thermal energy produced by these boilers is not metered.

Discount Factors for Calculating RECs

The metering and recording equipment meets the requirement of ±3.0% or better accuracy as called for by PUC 2506.04{f}{1}, and thus, no discount for equipment accuracy. The discount factor for parasitic load is assumed to be 2% (per Puc 2506.05(f)(3)) as shown in Equation 1.

Attachment 3-3

1. Calibration

66 Jackson Street | Littleton, NH 03561 | Ph: 603.444.6578 | Fax: 603.444.2364
www.yeatonassociates.com

Metering System Calibration

System Component	Recommendation	Source Document
Mass Flow Meter	A single "wet flow" calibration on installation is recommended. No other calibration is needed unless fluid properties change.	Owners Manual (p. 213): http://www.lesman.com/unleashd/catalog/flow/Siemens-SITRANS-FUS1010/Siemens-SITRANS-FUS1010-man-A5E02951520rAC-2013-01.pdf
Feedwater Pressure Sensor	Factory calibration. No field calibration required.	Attachment 3.1
Feedwater Temperature Sensor	No calibration of the device is possible. Long term drift calibration/maintenance through controller software is typically not necessary.	Attachment 3.1
Supply Steam Pressure Sensor	Calibration certificate from factory. No field calibration required	Attachment 3.1
Supply Steam Temperature Sensor	No calibration of the device is possible. Long term drift calibration/maintenance through controller software is typically not necessary.	Attachment 3.1