F-4300 SUBMITTAL AND DATA SHEET

TO:

DATE:

REVISION:

PROJECT NAME:

CONTRACTOR:

ENGINEER:

ONICON REP:

SUBMITTAL FOR:

- ☐ RECORD
- ☐ APPROVAL

APPROVED BY:

RELEASED FOR:

- ☐ MANUFACTURING AND SHIPMENT
- ☐ HOLD FOR RELEASE
- ☐ APPROVED
- ☐ APPROVED AS NOTED
- ☐ DISAPPROVED

EXPLANATION:

PLEASE RETURN APPROVED DRAWINGS TO:

ATTENTION:

SUBMITTED BY:

DESCRIPTION

ONICON F-4300 Clamp-on Ultrasonic Flow Meters/ Thermal Energy Measurement Systems offer an ideal solution for liquid flow and energy measurement in existing systems when it is impractical to install traditional inline or insertion style flow meters. The innovative design incorporates matched precision clamp-on transducers and signal processing circuitry to accurately measure the flow of most liquids over a wide velocity range.

Each F-4300 is provided with transducers and easy-to-use mounting hardware, factory supplied transducer cabling, and a wall mount enclosure with LCD and user interface keypad. When ordered with the BTU (energy) option, the F-4300 is provided with a matched pair of temperature sensors.

Output signals include analog output(s), digital outputs, digital inputs (energy version) and an isolated RS485 output for connecting to BACnet MS/TP or MODBUS RTU networks.

APPLICATIONS

- Chilled water, hot water, condenser water & water/glycol systems for HVAC
- Steam condensate (pumped)
- Domestic/municipal water
- Process water & other clean liquids

CALIBRATION

All F-4300 flow/ energy meters and temperature sensors are wet-calibrated in a flow laboratory against standards that are directly traceable to National Institute of Standards and Technology (N.I.S.T.). A certificate of calibration accompanies every meter.

GENERAL SPECIFICATIONS*

F-4300 TRANSMITTER		
TRANSMITTER PERFORMANCE	ACCURACY	± 1.0% of reading from 1.5 to 40 ft/s (0.46 to 12.2 m/s) (26:1 range) ± 0.015 ft/s (±0.0046 m/s) for velocities below 1.5 ft/s (0.46 m/s)
	REPEATABILITY & LINEARITY	± 0.25%
DIFFERENTIAL TEMPERATURE SENSORS	Temperature sensors meet EN1434/CSA C900.1 accuracy requirements for 1K sensors for cooling applications, 32°F to 77°F Temperature sensors meet EN1434/CSA C900.1 accuracy requirements for 2K sensors for heating applications, 140°F to 212°F	
	ONICON CURRENT BASED TEMP SENSOR**	Precision solid state current based sensors. Signal (mA) is unaffected by wire length. Overall differential temperature measurement uncertainty of ± 0.15°F over the application range
	PT1000 RTD TEMP SENSOR**	1000Ω platinum RTDs calibrated to a differential measurement uncertainty of ± 0.18°F over the stated range
OPERATING CONDITIONS	AMBIENT OPERATING	-5°F to 140°F
INPUT POWER	AVAILABLE OPTIONS	• 24 V AC/DC, 50/60 Hz, 10 VA max • 110-240 VAC, 50/60 Hz, 10 VA max
I/O SIGNAL	ANALOG OUTPUT(S)	Flow Meter: One (1) isolated AO, 4-20 mA or 0-5 VDC BTU Meter Option: Three (3) isolated AOs, 4-20 mA or 0-5 VDC
	DIGITAL OUTPUTS	Flow Meter: Two (2) programmable DOs, SPST, form A, N.O. BTU Meter Option: Six (6) programmable DOs DO 1-2 : SPST, form A, N.O. DO 3-6: SPDT, form C Pulse duration: 500 ms Min. pulse interval: 2s Max. load voltage/current: 50V/ 250mA AC/DC
	DIGITAL INPUTS	BTU Meter Option: Three (3) DIs For use with open collector sinking or contact closure outputs Input voltage logic low: < 0.5 VDC Input voltage logic high range: 5 - 24 VDC Min. pulse interval: 2s
ELECTRONICS ENCLOSURE	NEMA 4X (IP67) polycarbonate enclosure with clear shatter proof cover	
	DISPLAY	Large, easy to read, backlit, 128 x 64 dot matrix display
	DATA LOGGER	Built-in 128 MB data logger with type A USB output. Capacity for 26 million data points
PROGRAMMING	Menu driven via five (5) programming keys	
ELECTRICAL CONNECTIONS	Enclosed terminal blocks, cable access through three (3) ½" conduit openings for signal and power, and one (1) ¾" conduit opening for transducer cables.	
NETWORK CONNECTIONS	AVAILABLE OPTIONS	• RS485 serial interface, BACnet MS/TP (default) or MODBUS RTU • Optional MODBUS TCP/IP (24 VDC only)

* SPECIFICATIONS subject to change without notice.
** Installation hardware are provided separately.

GENERAL SPECIFICATIONS* (CONTINUED)

NETWORK CONFIGURATION & ADDRESSING	BAUD RATES	4800, 9600, 19200, 38400, or 76800
	DEVICE ADDRESS RANGE	1 - 247
	DEVICE INSTANCE RANGE	1 – 4,194,302 (BACnet® only)
	PARITY	None, Even, Odd (MODBUS® RTU only)
APPROVALS	CE	2014/30/EU EMC Directive
F-4300 FLOW SENSOR		
PERFORMANCE	SENSING METHOD	Ultrasonic differential transit time velocity measurement via non-wetted transducers
OPERATING CONDITIONS	FLUID PROPERTIES	Clean liquids in full (pressurized) pipes
	FLUID VELOCITY RANGE	0.07 ft/s to 40 ft/s
	FLUID TEMPERATURE RANGE	-40°F to 250°F
	PIPE MATERIALS	Suitable for use in a wide range of metallic and non-metallic piping systems
	PIPE SIZE RANGE	1/2" through 48", based on transducer series selected.
TRANSDUCER DESIGN - 10 SERIES	OPERATING FREQUENCY	2.56 Mhz
	PIPE SIZE RANGE	1/2" through 4"
	TRANSDUCER HOUSING	CF8M 316 Stainless Steel
	CABLE CONNECTIONS	• Triax cable with BNC style connectors and sealing jacket • Triax cable with NEMA 6 (IP67) direct connection for wet locations
	MOUNTING KIT	304 Stainless Steel mounting brackets with conduit connection, 200 Series Stainless Steel pipe clamps, and alignment and spacer tool
TRANSDUCER DESIGN - 20 SERIES	OPERATING FREQUENCY	1.28 Mhz
	PIPE SIZE RANGE	2" through 10"
	TRANSDUCER HOUSING	CF8M 316 Stainless Steel
	CABLE CONNECTIONS	Triax cable with BNC style connectors and sealing jacket
	MOUNTING KIT	304 Stainless Steel mounting brackets with conduit connection, 200 Series Stainless Steel pipe clamps, and alignment and spacer tool
TRANSDUCER DESIGN - 30 SERIES	OPERATING FREQUENCY	640 kHz
	PIPE SIZE RANGE	12" through 48"
	TRANSDUCER HOUSING	CF8M 316 Stainless Steel
	CABLE CONNECTIONS	Triax cable with BNC style connectors and ½" MNPT conduit connection and NEMA 4 (IP66) threaded strain relief.
	MOUNTING KIT	304 Stainless Steel mounting brackets with conduit connection, 200 Series Stainless Steel pipe clamps, and alignment and spacer tool

* SPECIFICATIONS subject to change without notice.

METER ORDERING INFORMATION

	A	B	C	D		EEFF		GG
Model F-4300-					-		-	

A = Electronics Enclosure
1 = NEMA 4X Polycarbonate

B = Input Power
1 = 24 V AC/DC
2 = 110 - 240 VAC

C = Feature Set & I/O
1 = Flow only, one (1) AO, two (2) DO and RS485, BACnet or MODBUS
2 = Flow only, one (1) AO, two (2) DO and MODBUS TCP/IP [1]
3 = Flow and Energy, three (3) AO, three (3) DI, six (6) DO and RS485, BACnet or MODBUS
4 = Flow and Energy, three (3) AO, three (3) DI, six (6) DO and MODBUS TCP/IP [1]

D = Transducer Cable Length
1 = 25' transducer cable, BNC connector[2]
2 = 50' transducer cable, BNC connector[2]
3 = 100' transducer cable, BNC connector[2]
4 = 25' transducer cable, submersible connection (NEMA 6 - IP67)[3]
5 = 50' transducer cable, submersible connection (NEMA 6 - IP67)[3]
6 = 100' transducer cable, submersible connection (NEMA 6 - IP67)[3]
7 = 25' transducer cable, BNC connector, threaded strain relief (NEMA 4 - IP66)[4]
8 = 50' transducer cable, BNC connector, threaded strain relief (NEMA 4 - IP66)[4]
9 = 100' transducer cable, BNC connector, threaded strain relief (NEMA 4 - IP66)[4]

EEFF = Transducer Series & Installation Hardware
1212 = Includes pair of 10 Series transducer, 37 deg. w/ ½" to 4" nom. pipe diameter SS mounting bracket
2X21 = Includes pair of 20 Series transducer, 35 to 41 deg. w/ 2" to 6" nom. pipe diameter SS mounting bracket [5]
2X22 = Includes pair of 20 Series transducer, 35 to 41 deg. w/ 8" to 10" nom. pipe diameter SS mounting bracket [5]
3231 = Includes pair of 30 Series transducer, 37 deg. w/ 12" to 16" nom. pipe diameter SS mounting bracket
3232 = Includes pair of 30 Series transducer, 37 deg. w/ 18" to 48" nom. pipe diameter SS mounting bracket

GG = Temperature Sensor Selection
00 = Flow only
O1 = Matched pair of current (mA) based sensors, CHW/CW range [6]
O2 = Matched pair of current (mA) based sensors, HHW range [6]
R2 = Matched pair of 4 wire PT1000 RTDs, 1/2" to 2 1/2" line size, 32°F to 250°F [6]
R3 = Matched pair of 4 wire PT1000 RTDs, 3" and larger line size, 32°F to 250°F [6]
S6 = Matched pair of PT100 current (mA) based sensors, -4°F to 104°F [6]

CLICK HERE

ONICON Order Form

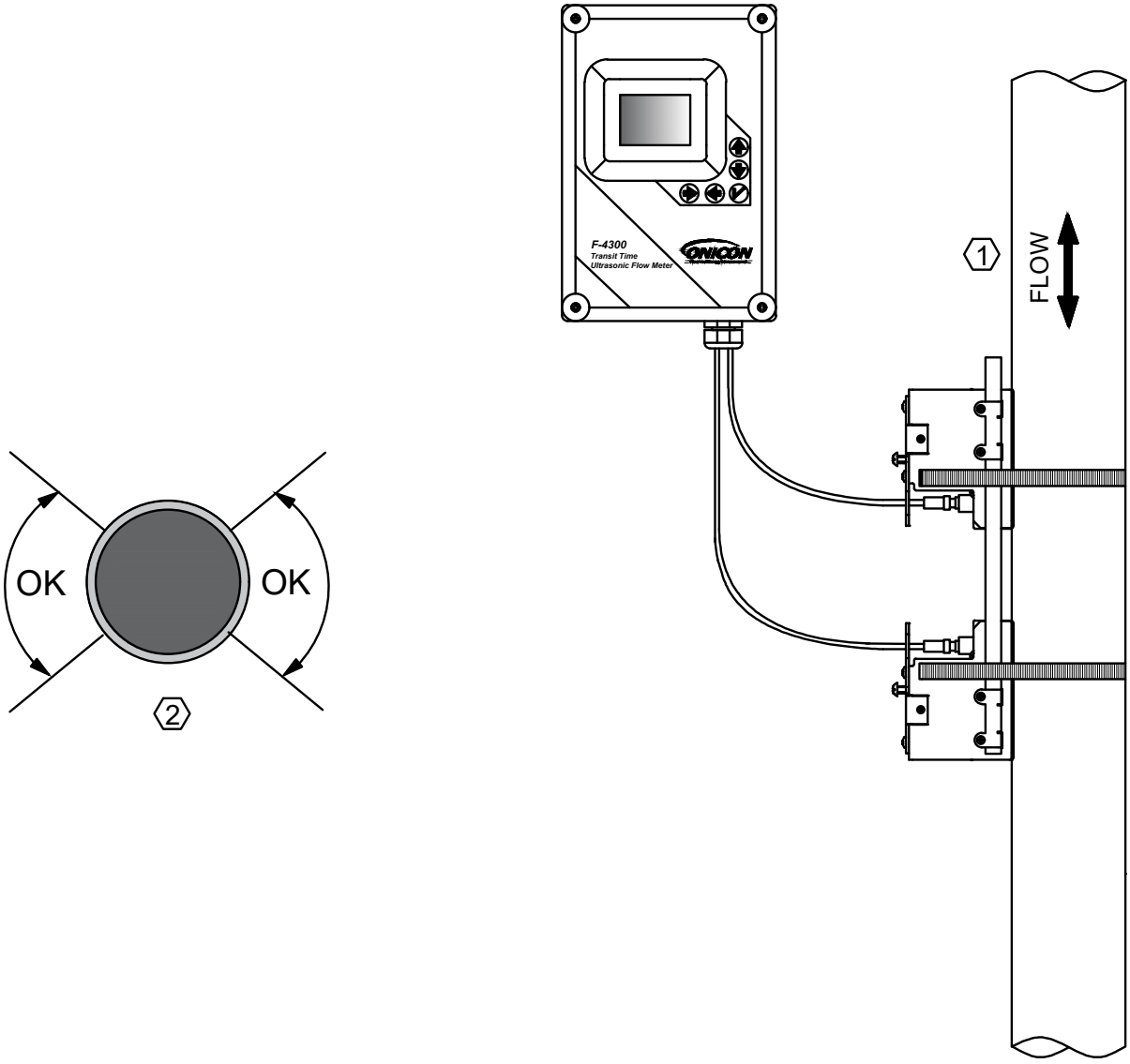
Application and Ordering Guide

[1] MODBUS TCP/IP requires 24 VDC input power
[2] Only available for transducer series EEFF = 1212, EEFF = 2X21 and EEFF = 2X22
[3] Only available for transducer series EEFF = 1212
[4] Only available for transducer series EEFF = 3231 and EEFF = 3232
[5] Actual transducer selected, 21 through 24, is factory selected at time of order
[6] Only available for feature set C = 3 and C = 4

INSTALLATION CONSIDERATION

A. Flow Meter Orientation

The transducers orientation is one of the most important considerations for accurate flow measurement. Vertical and horizontal pipe positions shown below apply to 10 Series, 20 Series and 30 Series transducers.

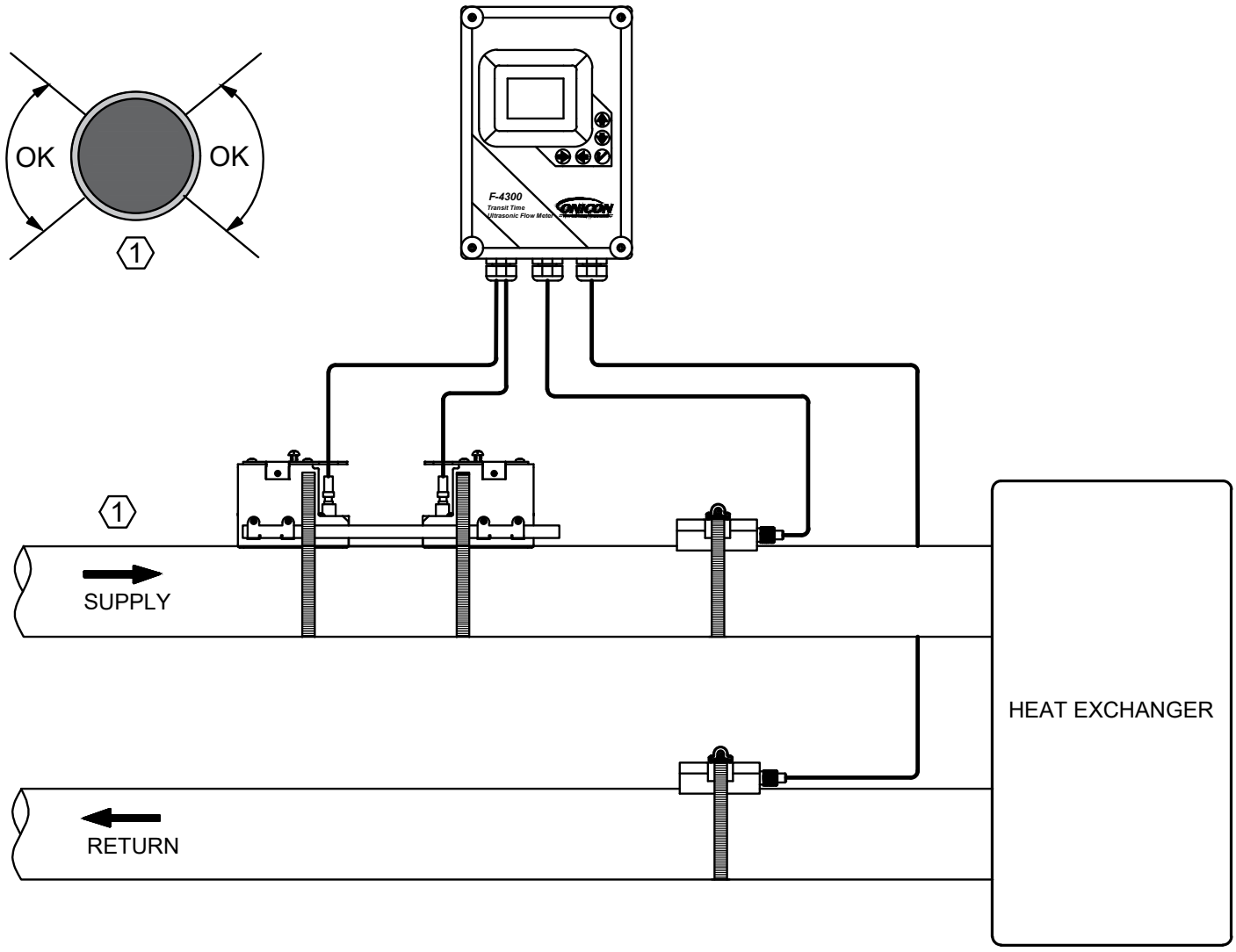


1. Vertical Pipe: Mounting on a vertical pipe is recommended when flow is in the upward direction. When mounting on a vertical pipe flowing in a downward direction, make sure there is sufficient back pressure in the system to maintain a full pipe.
2. Horizontal Pipe: Avoid mounting transducers on the top of a horizontal pipe. The best placement on a horizontal pipe is either the 2:00 to 4:00 or 8:00 to 10:00 positions for two (2) cross (Reflect) or four (4) cross (Double Reflect) mode, or one sensor at 9:00 and one sensor at 3:00 for one (1) cross mode (Direct).

IMPORTANT NOTE
DO NOT mount transducers on the bottom of a horizontal pipe.

INSTALLATION CONSIDERATION (CONTINUED)

B. BTU (Energy) Meter Orientation



1. Horizontal Pipe: Avoid mounting transducers on the top of a horizontal pipe. The best placement on a horizontal pipe is either the 2:00 to 4:00 or 8:00 to 10:00 positions for two (2) cross (Reflect) or four (4) cross (Double Reflect) mode, or one sensor at 9:00 and one sensor at 3:00 for one (1) cross mode (Direct).

   Vertical Pipe: Mounting on a vertical pipe is recommended when flow is in the upward direction. When mounting on a vertical pipe flowing in a downward direction, make sure there is sufficient back pressure in the system to maintain a full pipe.

IMPORTANT NOTE
DO NOT mount transducers on the bottom of a horizontal pipe.

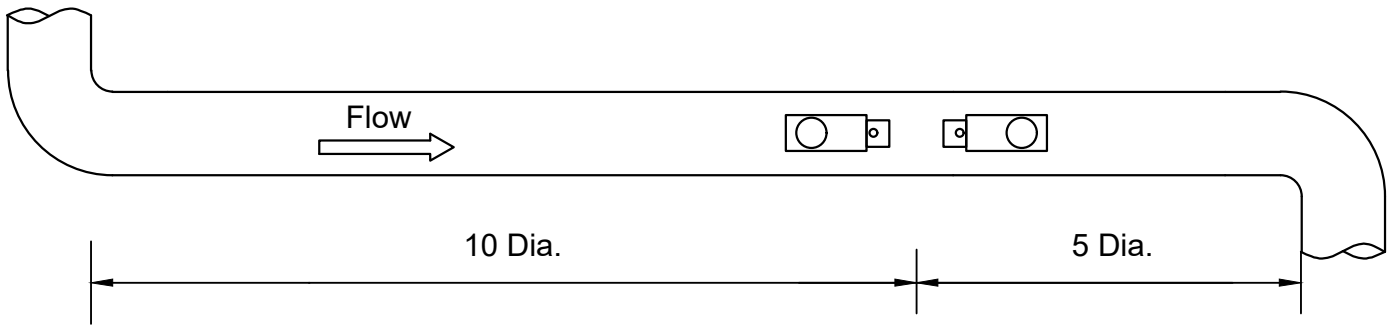
INSTALLATION CONSIDERATION (CONTINUED)

C. Straight Run Requirement

For best results, the transducers should be installed on a straight run of pipe free of bends, tees, valves, transitions, insertion probes and obstructions of any kind. For most installations, ten straight unobstructed pipe diameters upstream and five diameters downstream of the transducers is the minimum recommended distance for proper operation. Additional considerations are outlined below.

IMPORTANT NOTE

In some cases, longer straight runs may be necessary where the transducers are placed downstream from devices which cause unusual flow profile disruptions or swirl (for example, modulating valves, two elbows in close proximity and out of plane, etc.).

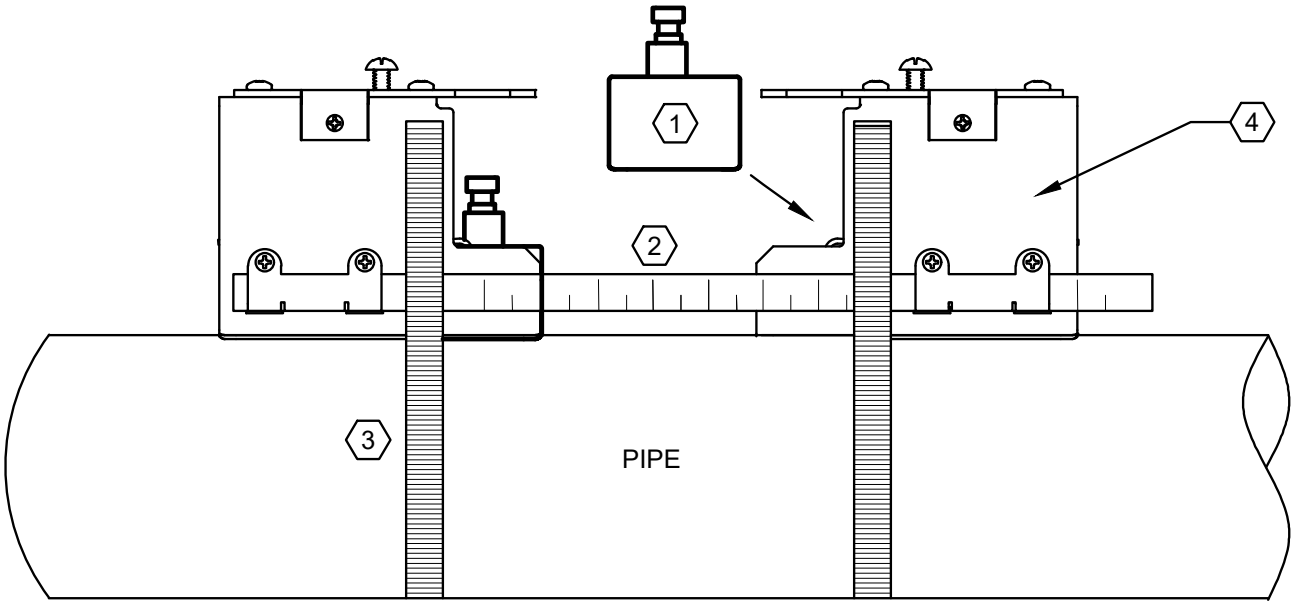


- Avoid installing the transducers downstream from a throttling valve, a mixing tank, the discharge of a positive displacement pump, or any other equipment that could possibly aerate the liquid. The best location will be as free as possible from flow disturbances, vibration, sources of heat, noise, or radiated energy.
- Avoid mounting the transducers on a section of pipe with any external scale. Remove all scale, rust, loose paint, etc., from the location prior to mounting the transducers.
- Do not mount the transducers on a surface aberration (pipe seam, etc.).
- Do not mount transducers from different ultrasonic flow meters on the same pipe.
- Do not run the transducer triaxial 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.
- Never mount transducers under water.
- Avoid mounting transducers on the top of a horizontal pipe. The best placement on a horizontal pipe is either the 8:00 to 10:00 or 2:00 to 4:00 position for 2 cross (Reflect) or 4 cross (Double Reflect) mode, or one sensor at 9:00 and one sensor at 3:00 for 1 cross mode (Direct).
- Do not mount transducers on the bottom of a horizontal pipe.
- Mounting on a vertical pipe is the recommended installation method if flow is in the upward direction. When mounting on a vertical pipe flowing in a downward direction, make sure there is sufficient back pressure in the system to maintain a full pipe.

TRANSDUCER INSTALLATION SCHEMATICS

A. Overview

Each F-4300 Ultrasonic Flow Meter is provided with a pair of matched ultrasonic transducers. The transducers are mounted (clamped) on to the outside wall of the pipe. Triaxial cables convey the transducer signals to the wall mount enclosure containing the signal processing circuitry and the user interface display.



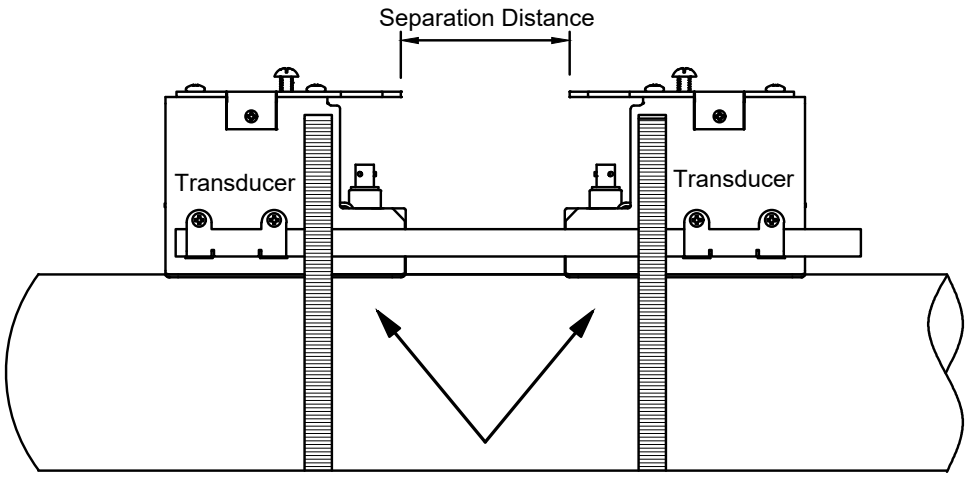
1. Transducer
2. Alignment and spacer tool
3. Adjustable stainless steel pipe clamp
4. Transducer mounting bracket

Ultrasonic transducers can be configured to operate in either 1 (Direct), 2 (Reflect) or 4 (Double Reflect) cross operating modes. The choice of operating mode is dictated by the configuration settings programmed into the meter. For new installations, configuration data is programmed into the meter prior to shipment. Programming data determines the transducer operating mode and the spacing between the transducers.

TRANSDUCER INSTALLATION SCHEMATICS (CONTINUED)

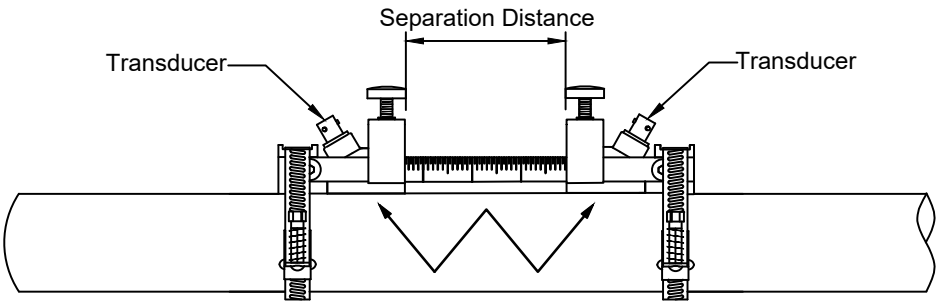
B. Two (2) or Four (4) Cross Mode (Reflect, Double Reflect)

Two (2) cross (Reflect) mode is the recommended operating mode whenever possible. It is the simplest way to mount the transducers. Operating in the reflect mode also minimizes the effects of some flow distortions.



2 Cross Separation Distance (Reflect)

Four (4) cross (Double Reflect) mode is used for some installations in small pipe sizes using the 10 Series transducers.

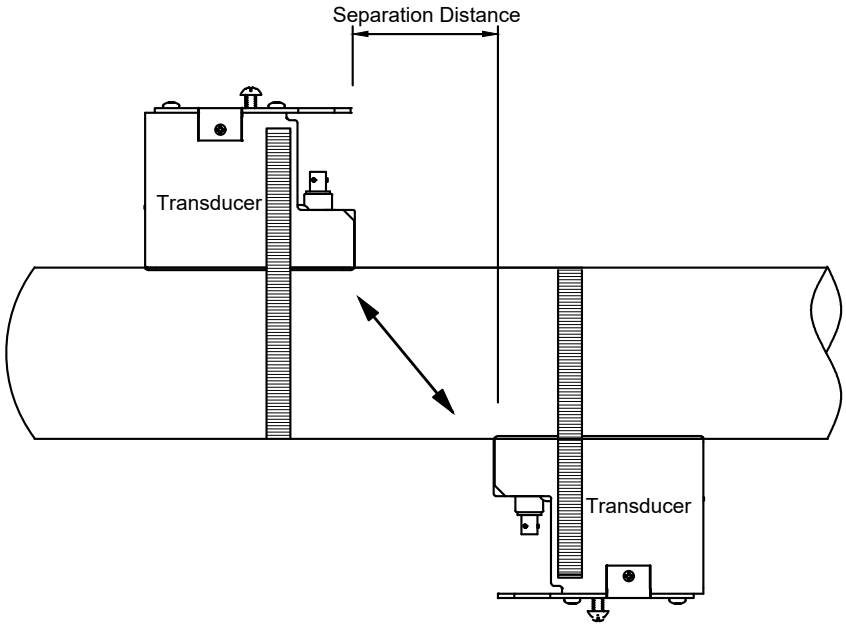


4 Cross Separation Distance (Double Reflect)

TRANSDUCER INSTALLATION SCHEMATICS (CONTINUED)

C. One (1) Cross Mode (Direct)

One (1) cross mount provides a shorter sonic path. The shorter path typically improves performance with difficult pipe conditions, such as older and/ or corroded piping. One (1) cross (Direct) mounting requires half the distance between transducers when compared to the two (2) cross (Reflect) mode and may be the only option if the availability of the mounting space is limited.



1 Cross Separation Distance (Direct)

THERMOWELLS INSTALLATION SCHEMATICS

A. Overview

ONICON offers four different types of temperature sensor pairs and the associated thermowells for use with the F-4300.

CAUTION

Temperature sensor thermowells must match the sensor diameter. Using the wrong diameter hardware will result in significant temperature measurement errors.

Sensor Type	Sensor Diameter	Nominal Pipe Size Range (inches)
ONICON fixed range temperature sensor pair	0.25"	½ to 48"
100 Ω Platinum RTD pair, w/4-20mA transmitters	0.25"	½ to 48"
1000 Ω Platinum RTD pair, 4 wire	5mm	½ to 2½"
1000 Ω Platinum RTD pair, 4 wire	6mm	3 to 48"

The two temperature sensors must be located so they accurately measure only the temperature of the supply line entering and the return line leaving the portion of the piping system for which the energy measurement is being made.

If possible, find an easily accessible location where field wiring connections can be made from floor level. This will facilitate future service. Place the temperature sensors away from strong sources of electrical noise that might affect the performance of the sensors.

One temperature sensor thermowell will need to be placed in the same pipe with the flow meter. If it is an immersion thermowell, it must be located at least five pipe diameters downstream of the flow meter leaving enough clearance to remove either sensor from the pipe without interference from the other sensor.

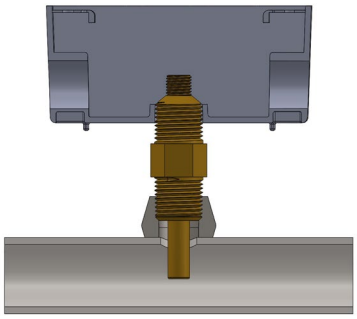
THERMOWELLS INSTALLATION SCHEMATICS (CONTINUED)

B. 0.25" Diameter Thermowell

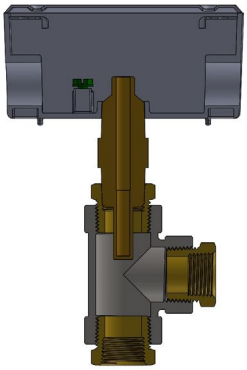
1. Dry Tap Thermowell

Dry tap thermowells are for new construction or scheduled shutdown. The most common installation methods are shown below. Consult ONICON for special applications.

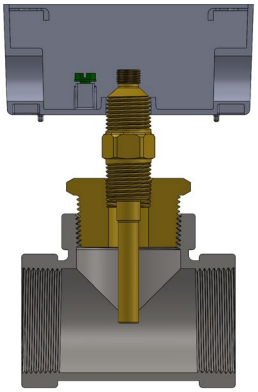
Welded Pipe



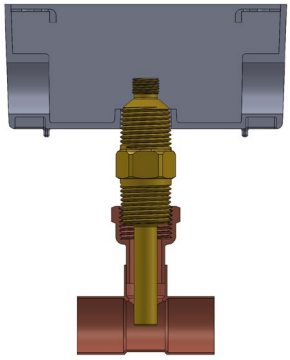
Threaded Tee (for 1/2" pipes)



Threaded Tee (for 3/4" and larger pipes)



Copper Tee



NOTES

1. Thermowell length varies with pipe size.
2. Do not use multiple bushings to reduce the outlet size on threaded tees.

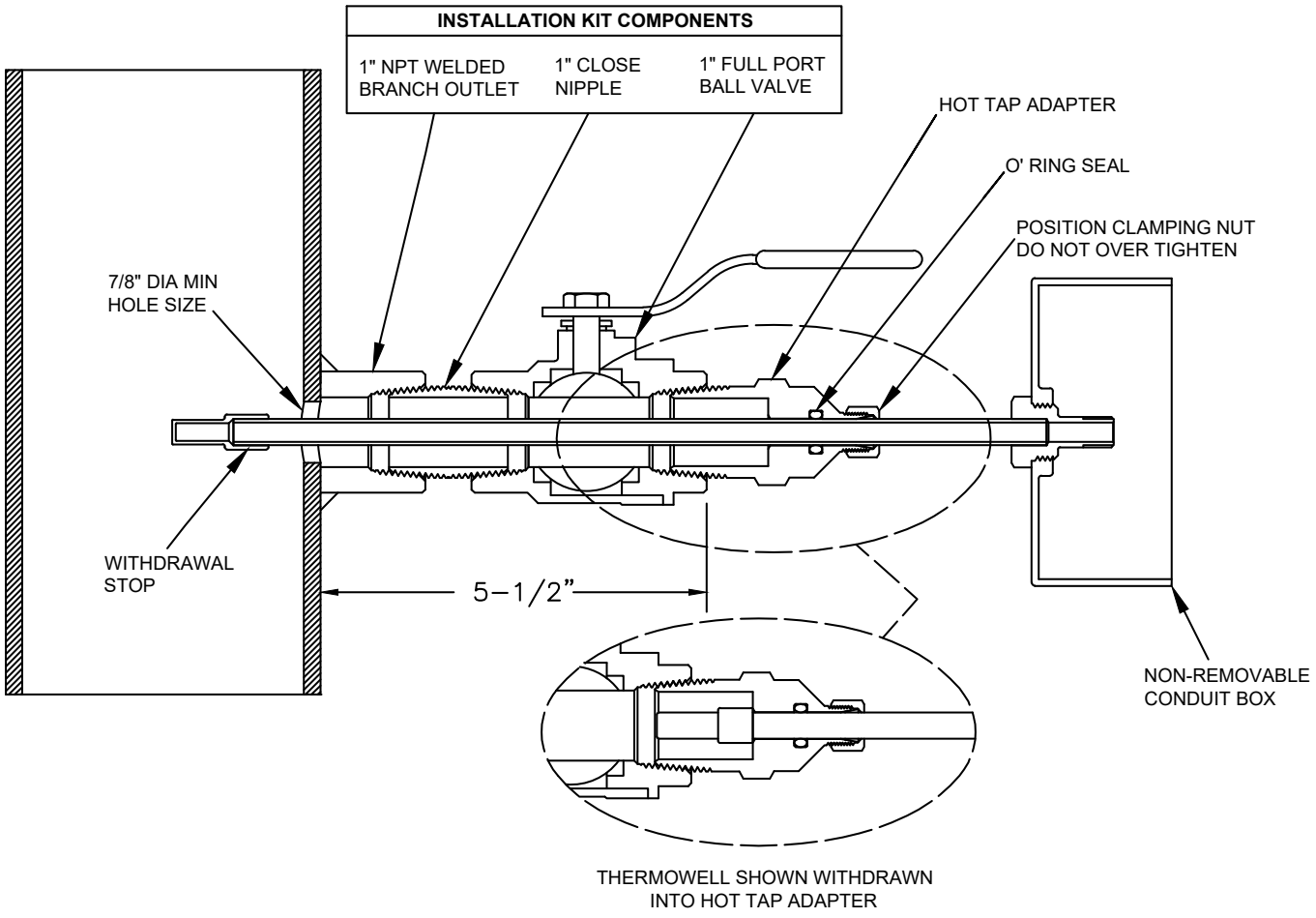
THERMOWELLS INSTALLATION SCHEMATICS (CONTINUED)

B. 0.25″ Diameter Thermowell (Continued)

2. Hot Tap Thermowell

Hot tap thermowells are designed for retrofit applications where it is not practical to isolate and drain the pipe section prior to installation. The thermowell is installed through a 1″ full port ball valve as shown in the drawing below. A hot tap drilling machine equipped with a 7/8″ drill is required to perform this type of installation.

Once the valve assembly has been installed and the hole has been drilled, the thermowell can be inserted into the flow stream without a system shutdown.

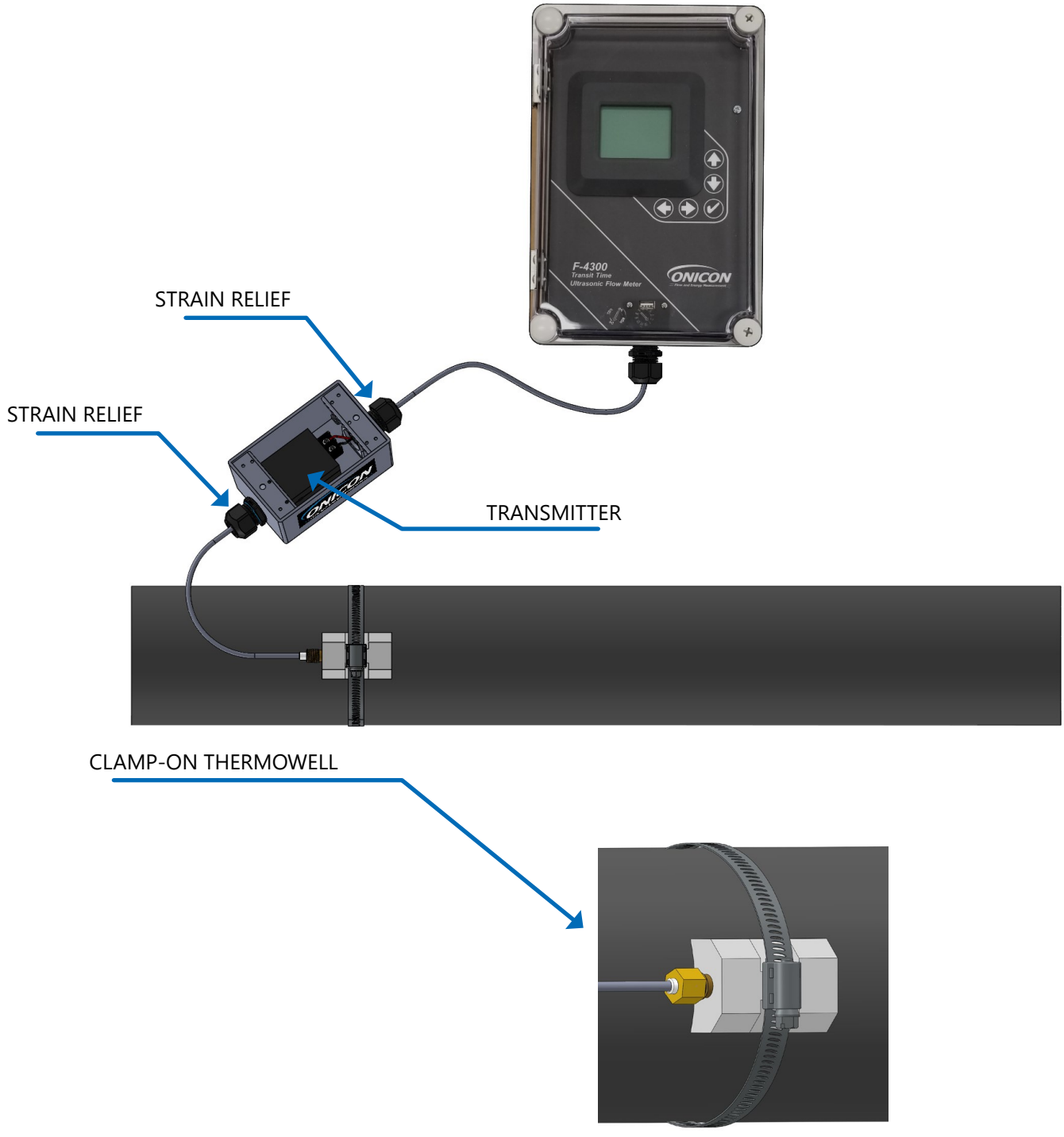


Hot Tap Installation Detail For Thermowell In Welded Pipe

THERMOWELLS INSTALLATION SCHEMATICS (CONTINUED)

C. Clamp-On Thermowell

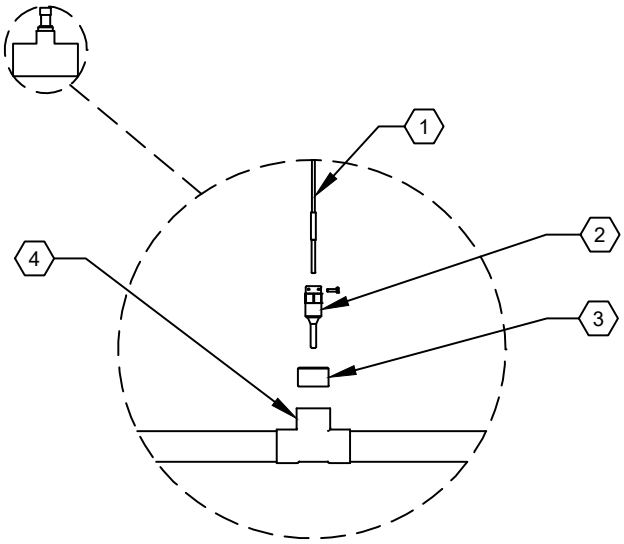
The two clamp-on temperature sensors must be located such that they only measure the temperature of the supply pipe entering and the return pipe leaving the portion of the piping system for which the energy measurement is being made. Once installed, the pipes and clamp-on thermowells must be fully insulated.



THERMOWELLS INSTALLATION SCHEMATICS (CONTINUED)

D. 5mm Diameter Thermowell

5 mm RTDs are provided with thermowells with ½" male NPT process connections. They are designed for use in ½" to 2½" line size tees provided by the customer. The RTDs are push-in type and are held in place with a set screw. Depending on the pipe material, the kit may include a copper sweat bushing or a threaded reducer bushing.

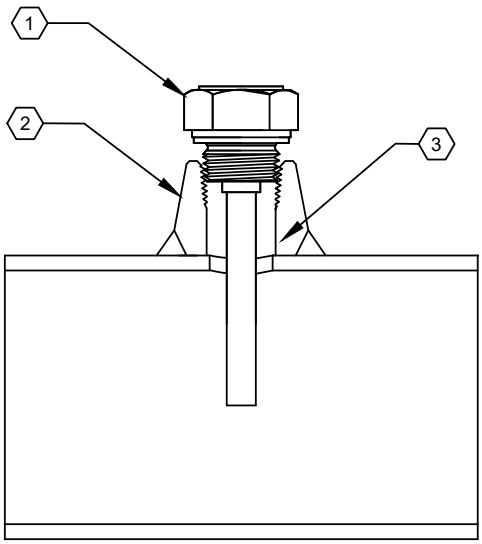


1. RTD temperature sensor – provided by ONICON.
2. 5 mm diameter thermowell – provided by ONICON.
3. 1" solder x ½" NPT bushing OR line size x ½" bushing – provided by customer or ordered from ONICON.
4. Customer supplied line size tee.

THERMOWELLS INSTALLATION SCHEMATICS (CONTINUED)

E. 6mm Diameter Thermowell

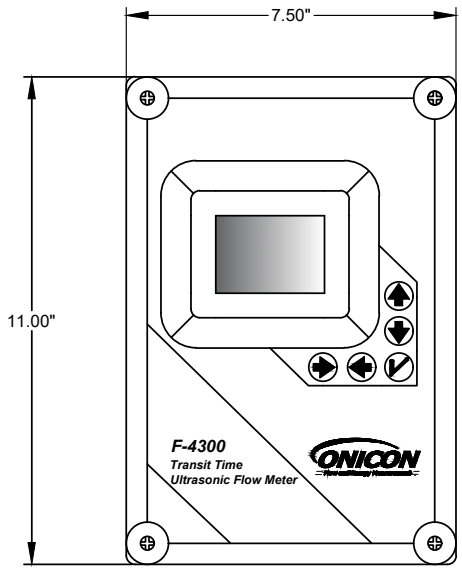
6mm RTDs are provided with matching length thermowells with ½" male NPT process connections. They are designed for use in 3" and larger diameter pipes. The RTDs are push-in type and are held in place with a set screw. The kit includes two (2) weld-on branch outlets with ½" NPT threads.



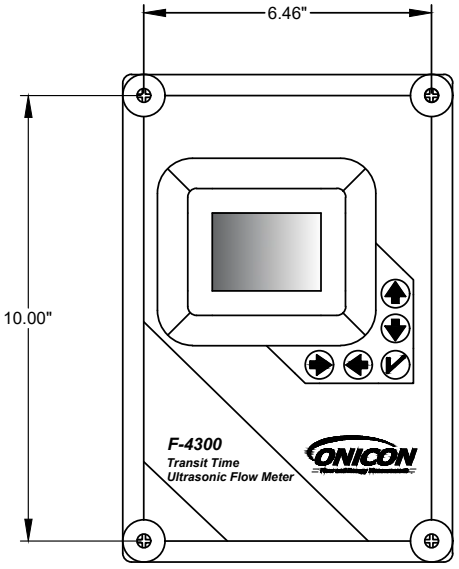
1. 6 mm diameter thermowell - provided by ONICON.
2. ½" NPT weld on branch outlet - purchased from ONICON.
3. ¾" minimum hole size.

DIMENSIONS

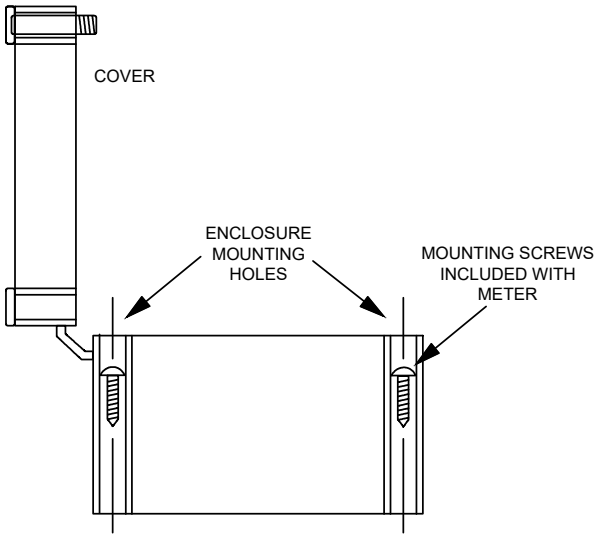
A. Enclosure Dimensions



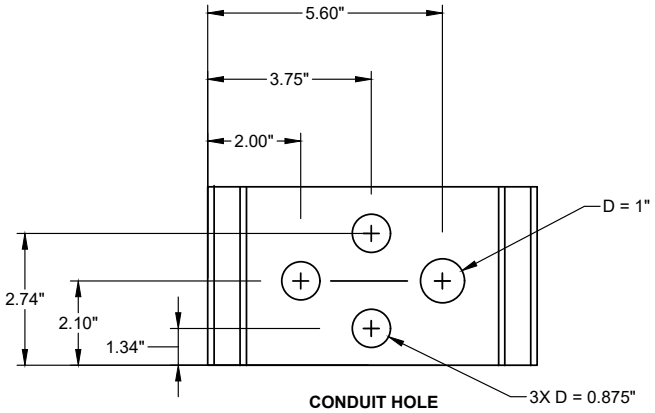
ENCLOSURE DIMENSIONS



MOUNTING HOLD DIMENSIONS



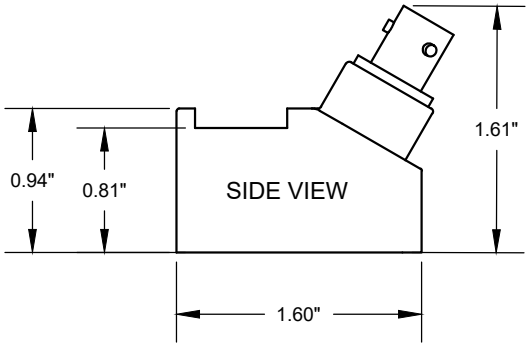
END VIEW

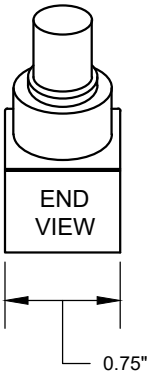


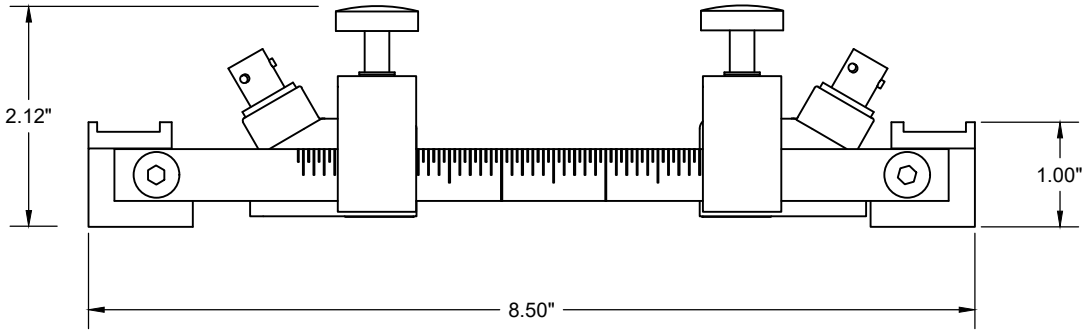
CONDUIT HOLE AND DIMENSIONS

DIMENSIONS (CONTINUED)

B. 10 Series Transducer Dimensions

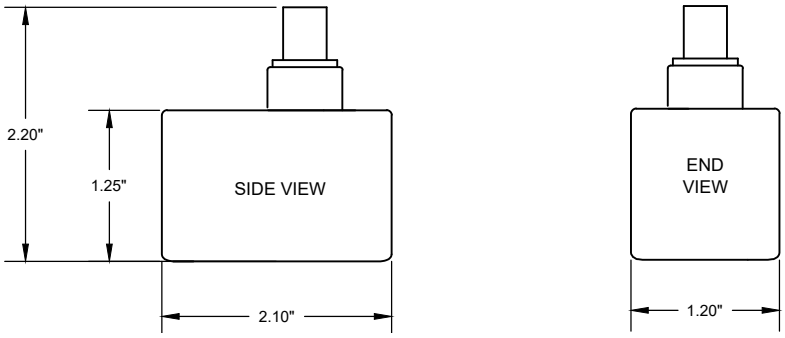


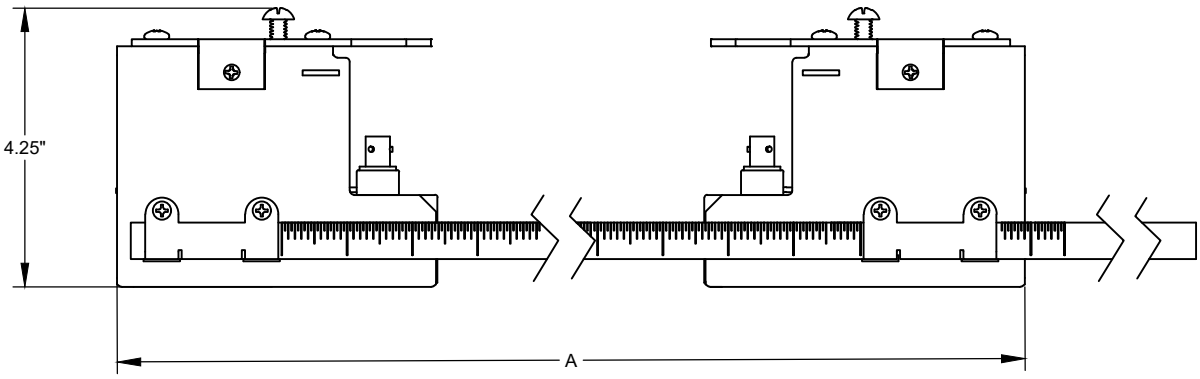




DIMENSIONS (CONTINUED)

C. 20 Series Transducer Dimensions



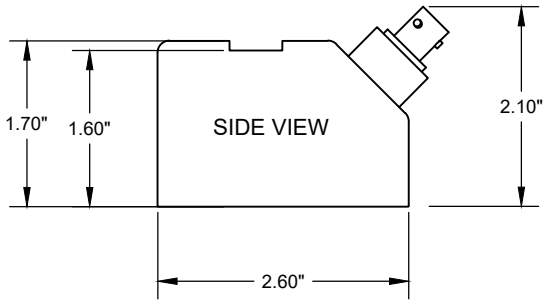


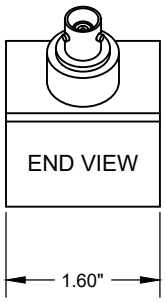
Dimension (A) varies based on pipe material and wall thickness

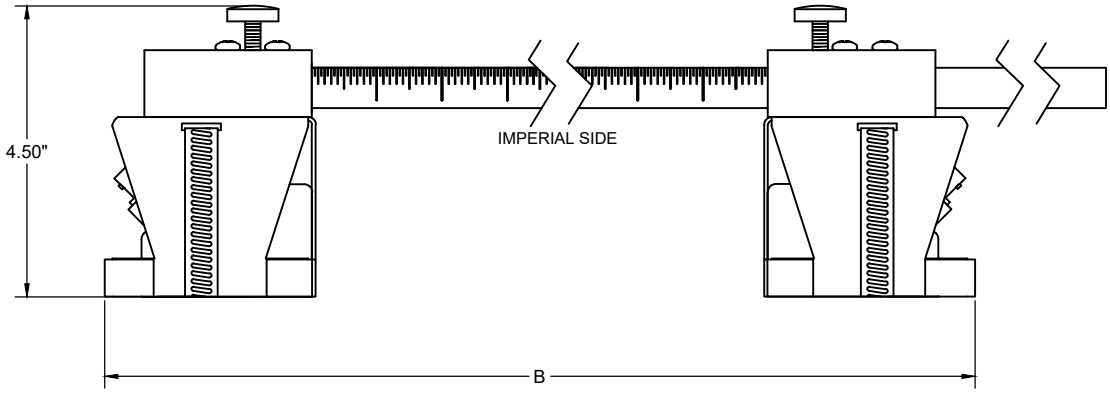
Pipe Size Range	Dim (A)
2″ to 6″	14″
8″ to 10″	19″

DIMENSIONS (CONTINUED)

D. 30 Series Transducer Dimensions



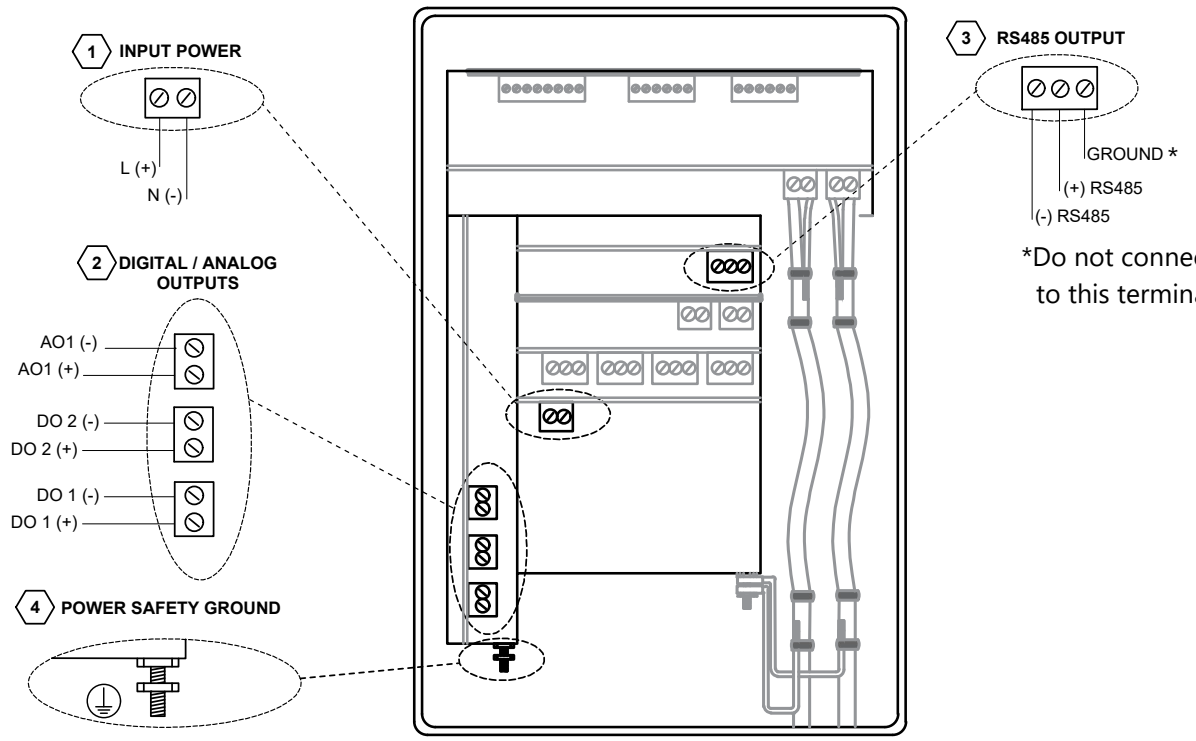




Dimension (B) varies based on pipe material and wall thickness

Pipe Size Range	Dim (B)
12″ to 16″	18″
>16″ to 24″	24″
>24″ to 48″	43″

POWER AND OUTPUT SIGNAL WIRING CONNECTIONS

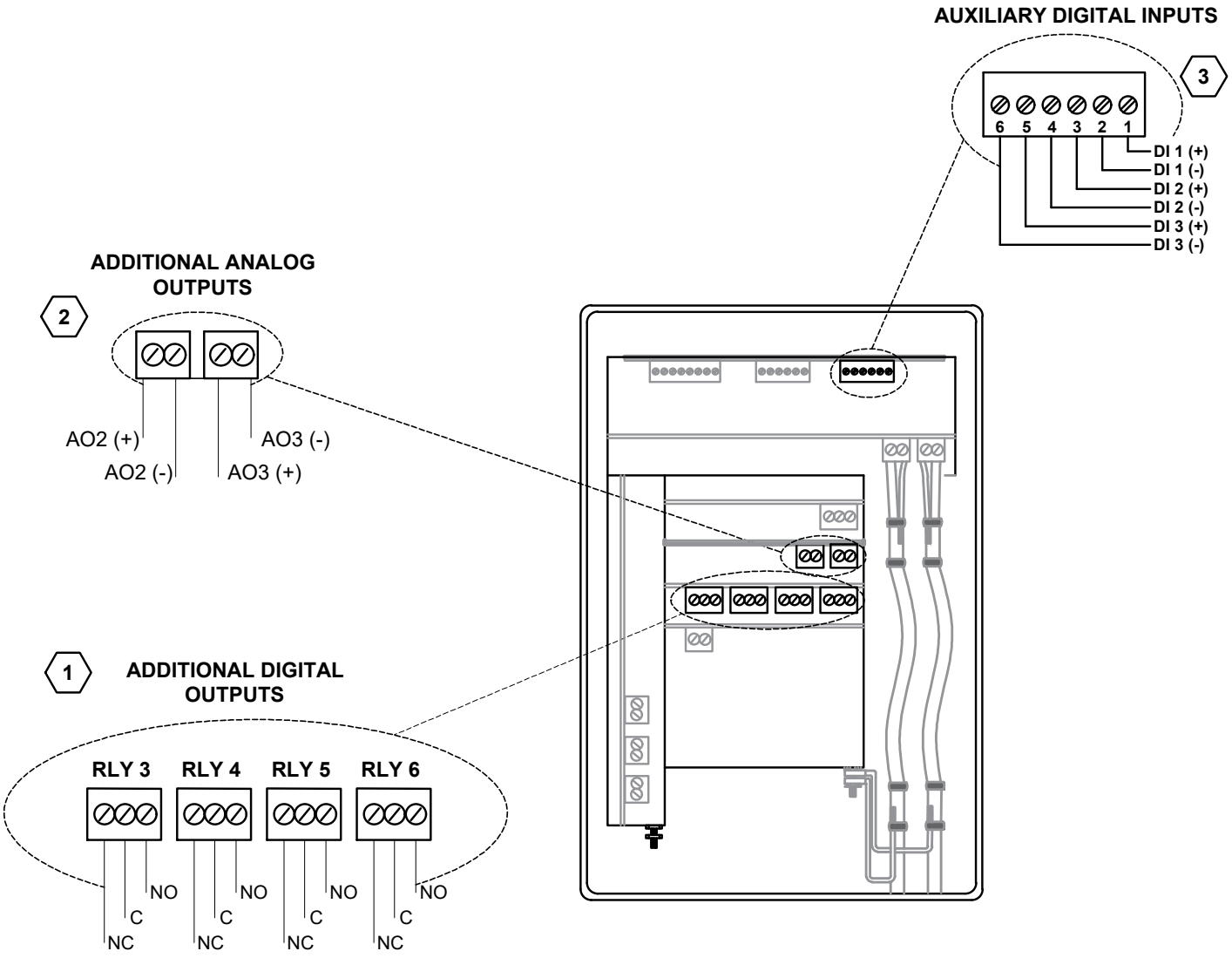


1. Input power
   - 24 VAC/ VDC, 10 VA max OR
   - 110-240 VAC, 50/ 60 Hz, 10 VA max
2. Output configuration
   - Two (2) programmable digital outputs and one (1) active analog output, 4-20 mA or 0-5 VDC (Menu selectable).
3. RS485 BACnet MS/TP or MODBUS RTU.
4. Power safety ground connection.

Power and Output Signal Wiring Notes

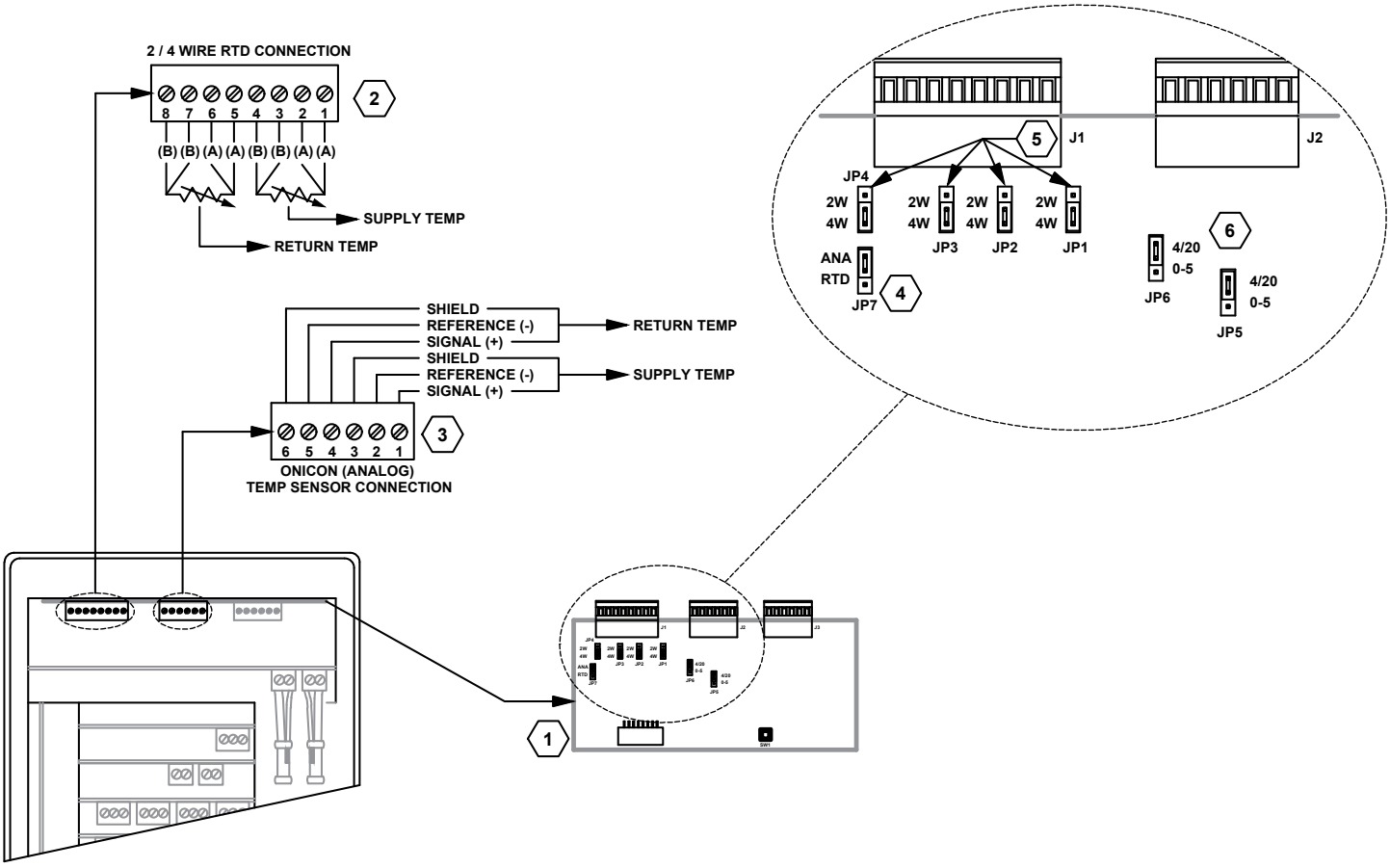
1. If the F-4300 meter will be powered by 24VDC ensure that the input power polarity is correct to avoid polarity issues on the RS485 outputs.
2. Adhere to official BACnet guidelines for selecting data wiring and grounding and implementation, ASHRAE Standard 135 - "BACnet - A Data Communication Protocol for Building Automation and Control Networks".
3. A single grounding path should connect the RS485 ground port on each F-4300 and any third-party devices, ending at a reliable grounding location, such as a grounding rod or a panel's grounding port.
4. The shield of each segment of cable should form a single path, ending either at a grounding rod, electrical panel, or at the controller's grounding point if it is properly grounded. The farthest end of the shield should remain ungrounded (open). DO NOT connect the shield to the RS485 ground port of any F-4300.
5. RS485 Ground should only be shared across the RS485 Ground path with other devices, terminated at the controller, and may not be grounded to the F-4300 chassis or power safety ground. Incorrect grounding may create communications disruptions from grounding loops.
6. Ensure the power safety ground for the F-4300 is effectively connected to a grounding panel or rod.
7. When integrating any ONICON devices into an existing network, check and correct any reversed polarity found in the data channel.
8. Review the BACnet Protocol Implementation Conformance Statement in the manual on page 56 to make sure the BMS and controller stay within property limits when interfacing with the F-4300.

BTU (ENERGY) INPUTS & OUTPUTS WIRING CONNECTIONS



1. Configurable digital outputs terminal block connections
2. Configurable analog outputs terminal block connections (4-20 mA)
3. Configurable digital inputs terminal block connections

TEMPERATURE SENSOR WIRING CONNECTIONS

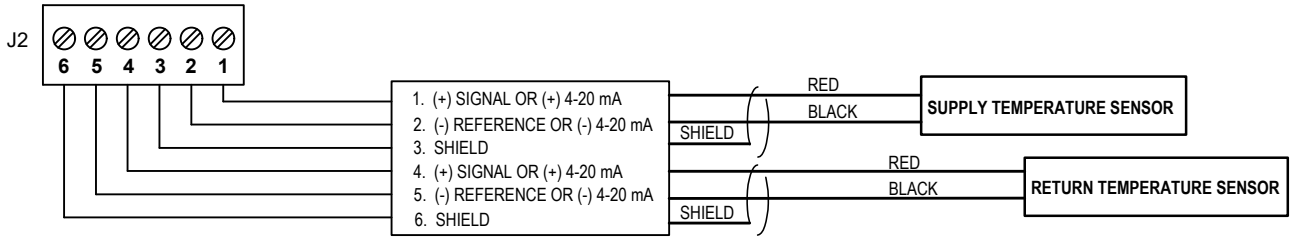


1. Energy computer circuit board.
2. 2 wire / 4 wire RTD connection terminal block.
3. ONICON temperature sensor connection terminal block.
4. Temperature sensor type selection jumper, JP7.
5. RTD type jumper selection, JP1 through JP4. Selects 2 wire vs 4 wire RTD input.
6. ONICON temperature sensor type selection jumpers, JP5 and JP6, 4-20 mA passive input or 0-5 VDC.

TEMPERATURE INPUTS WIRING DETAILS

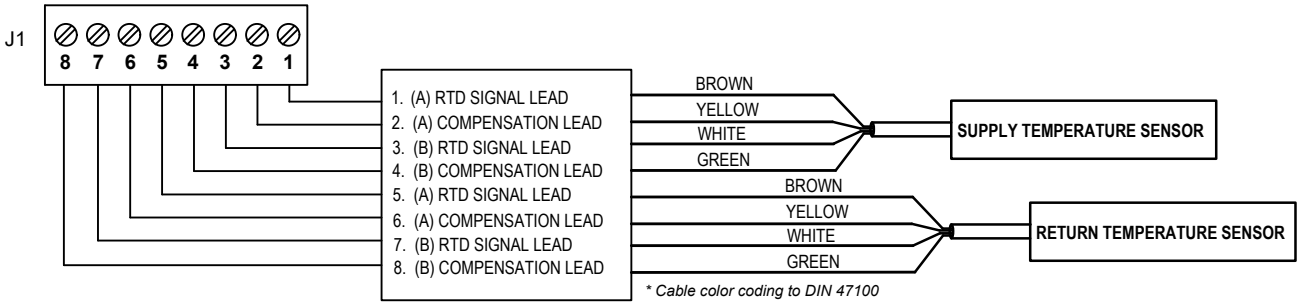
ONICON FIXED RANGE or LOOP POWERED 4-20mA SCALABLE RANGE TEMPERATURE INPUTS

ONICON (ANALOG)
TEMP SENSOR CONNECTION



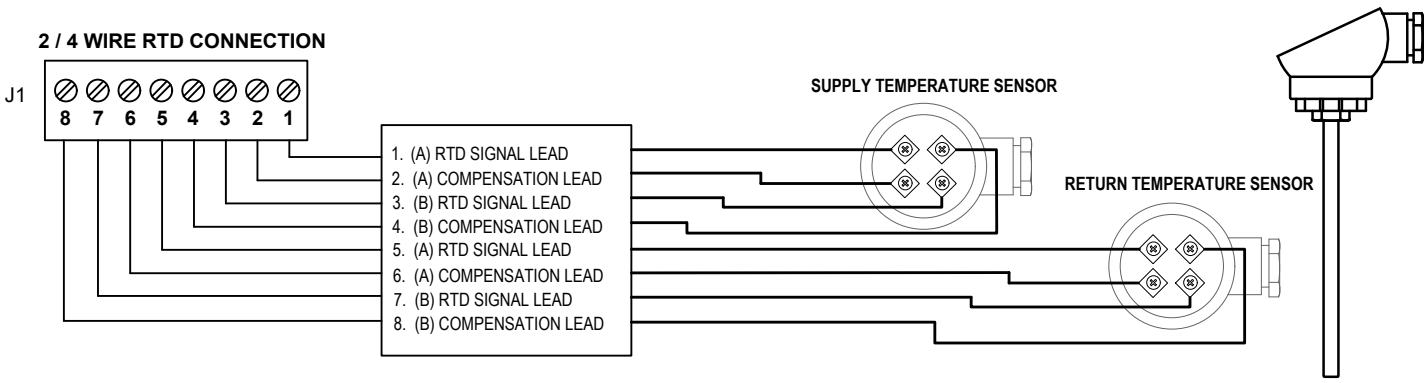
1000 OHMS 4-WIRE PLATINUM RTD TEMPERATURE INPUTS w/ ATTACHED PIGTAIL CABLE

2 / 4 WIRE RTD CONNECTION



1000 OHMS 4-WIRE PLATINUM RTD TEMPERATURE INPUTS w/ INTEGRAL CONDUIT READY JUNCTION BOX

2 / 4 WIRE RTD CONNECTION



Refer to Temperature Sensor Wiring Connections on page 24 for additional details on the terminal location.