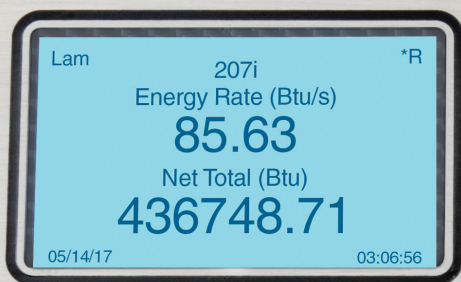


InnovaSonic



The Transit-Time Ultrasonic Flow Meters
for Precise Liquid Flow Metering / BTU Measurement



InnovaSonic[®]207i
Ultrasonic Flow Meter

What does it mean to **challenge** the status quo?

With skyrocketing energy costs, there has never been a better time to invest in the precise flow measurement required to maximize your heating and cooling system efficiency, meet regulations, and bring down costs.

Designed, built and calibrated by Sierra for non-intrusive liquid flow metering, and optimized for thermal energy / BTU measurement, the InnoVaSonic® 207i transit-time ultrasonic flow meter is the ideal turnkey solution for building and district metering, and submetering.

The Flow Engine Behind it All

At the heart of every 207i is advanced digital signal processing to enhance ultrasonic transit-time flow metering technology and fluid dynamic measurements.

Sierra's Raptor™ OS is the true "Brain" of the instrument and includes a revolutionary, living, learning algorithm set made possible by today's powerful microprocessors. Raptor 2 manages changes in liquid flow, temperature, and pressure.

The result is a proprietary, fundamentally different liquid flow rate calculation using all pertinent variables for the most precise, stable and accurate flow energy measurement possible.

The OS interfaces with many of Sierra's software apps to read, adjust and even upgrade the meter firmware in the field.

Thermal Energy / BTU Metering

The 207i calculates thermal energy / BTU flow energy and provides you with the highest accuracy measurements possible to manage energy costs.

A critical element of any thermal energy / BTU flow energy measurement is determining the amount of heat transferred between the cold and hot flow legs of a heating or cooling process.

Often with only a small difference in temperature between the two flow legs, a precise measurement makes a huge difference. Sierra calibrates the entire flow energy package—flow meter and temperature transmitters—as a system to improve

accuracy. Raptor takes into account this temperature difference as well as all fluid properties required to accurately measure flow, and makes ultra-precise temperature measurements between the cold and hot flow legs.

High Accuracy Through Density Compensation

Raptor also enables improvements in liquid flow metering accuracy. Since an ultrasonic flow meter detects the speed of sound in the liquid being measured, a small change in liquid density can have a big impact on accuracy and repeatability.

By adding a temperature input from a transmitter provided by Sierra or by using an external input from an existing transmitter, the 207i can calculate real-time liquid density, assuring accuracies of +/- 0.5% of reading from 0.16 to 40 ft/s (0.05 to 12 m/s).

207i Highlights

- Accuracy +/- 0.5% of reading from 0.16 to 40 ft/s (0.05 to 12 m/s)
- One meter for a wide range of pipe sizes from 2 to 236 inches (50 to 6000 mm)
- Clamp-on or insertion transducers measure bi-directional flow
- Optional clamp-on or insertion PT 100 temperature inputs for thermal energy/BTU measurement
- Optional current input modules for pressure, temperature, & density
- Clamp-on transducers operating temperature range: 14°F to 176°F (-10°C to 80°C)
- Clamp-on high-temperature transducers operating temperature range: 14°F to 302°F (-10°C to 150°C)
- 1.5 in (38.1 mm) insertion diameter transducers; operating temperature range: -40°F to 176°F (-40°C to 80°C)
- Keypad with 16 tactile keys with 14 dual-function keys with audible feedback
- Flow totalizer
- Memkey: automatically detects sensor type; calculates optimal mounting
- Internal memory datalogger

Notable Apps

- ValidCal Diagnostics
- Datalogging
- Meter tuning
- Quick Start
- Signal setup
- EnergyPro

Making it Easier

With the InnovaSonic 207i's clamp-on sensors, there's no pipe cutting or expensive plumbing.

The 207i features a large backlit display and dual-function keypad with audible feedback. With its visual sensor spacing tool on the display (see photo in center), slightly move the sensors together or apart to position the indicator line between the "goal posts" and assure optimal signal strength.

Easily connect the 207i to your building management system with Modbus or BACnet communications. With its robust stainless steel enclosure, permanently fasten the transducers to make it a hardened installation, and you're ready to measure for years to come.

It Has Apps

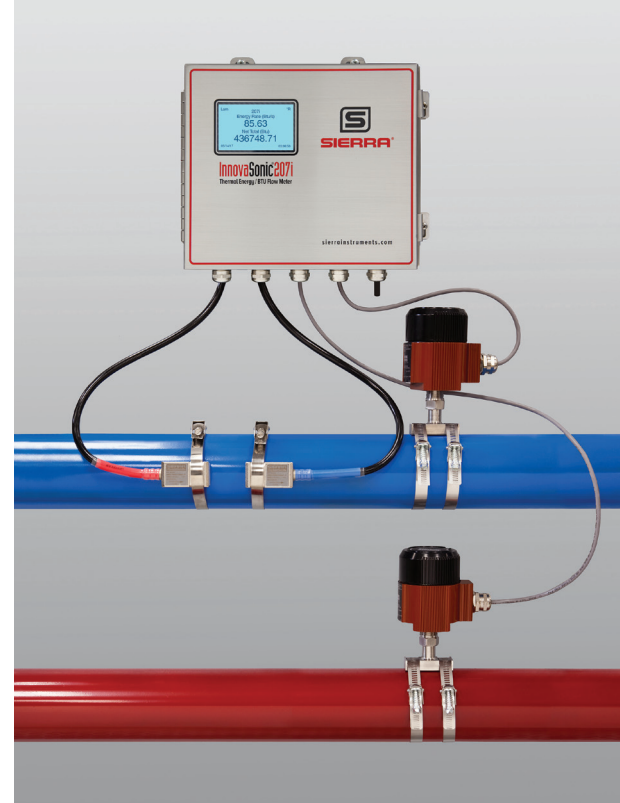
The InnovaSonic 207i is the first transit-time ultrasonic flow meter to come with a comprehensive software package of apps for ease of use, field upgrades, and calibration validation.

Apps like MeterFit™ help you optimize signal strength to assure best performance.

Apps like EnergyPro™ allow you to fully configure your thermal energy / BTU flow energy measurement system, including datalogging and totalization of all energy functions.

Apps like ValidCal™ Diagnostics make field calibration validation easy.

Sierra has many more apps under development to enhance your product experience.



WaterLoop World Class Calibration

Designed by Sierra and located at our metrology headquarters in Monterey, California, Sierra's Water-Loop™ is among the world's most accurate liquid/gas calibration facilities.

Rated at +/- 0.2% of reading, all calibrations follow the guidelines of ISO 17025 and are directly traceable to national standards such as NIST (US National Institute of Standards and Technology).

Fully automated, once flow application data is programmed, calibration automation software manages all aspects of flow calibration testing. This results in high-speed time-aligned data acquisition and performance analysis over the entire flow measurement range, and generates a calibration certificate documenting instrument performance upon completion.

Service, Commissioning & Training

The need to deliver fast, localized support to global customers has resulted in the establishment of dedicated Sierra Flow Centers on almost every continent. And they are backed up by technical experts in over 150 locations in more than 50 countries.

Sierra's team of engineers can commission your flow meter to assure optimal performance and train you to get the most out of your instrument.

We provide lifetime support for all Sierra products and will get on a plane to help you when necessary.

Sierra's Big-3 Technologies

The InnovaSonic 207i is one of three advanced flow meter technologies Sierra has developed to help facility managers tackle tough energy management challenges.

For what we call our Big-3, Sierra has become a recognized expert in thermal mass (QuadraTherm®), vortex shedding (InnovaMass®), and transit-time ultrasonic (InnovaSonic®). Sierra is the only company in the USA to manufacture all three flow technologies.

The Big-3 are optimized to be a complete solution for flow energy measurement—facility flows that impact costs like compressed air, natural gas, steam, and hot or chilled water.

As new apps and improvements become available, all Big-3 technologies benefit and are field firmware upgradable.

Watch the Video

sierrainstruments.com/207ivideo



PERFORMANCE SPECIFICATIONS

Fluids

All acoustically conductive liquids with <5% solids or bubbles

Quantities Measured

Volumetric flow
Totalized volumetric and mass flow
Heat energy
Totalized energy flow
Density
Speed
Heat capacity
Enthalpy
Ambient temperature
Inlet and outlet temperature via PT 100 or current inputs
Pressure (optional)
Reynold's number

Pipe Size

2 to 236 inches (50 to 6000 mm)

Accuracy

Accuracy +/- 0.5% of reading from 0.16 to 40 ft/s
(0.05 to 12 m/s)

Repeatability

+/- 0.15% of reading > 0.16 ft/s (0.05 m/s)

Resolution

0.01 ft/s (0.00025 m/s)

Response Time

150 ms measuring cycle

OPERATING SPECIFICATIONS

Flow Velocity Range

Bi-directional flows: 0.16 to 40 ft/s (0.05 to 12 m/s)

Note: 0.08 ft/s (0.025 m/s) is the default low flow cut-off

Temperature

Ambient electronics: -4°F to 140°F (-20°C to 60°C)

Clamp-on transducer: 14°F to 176°F (-10°C to 80°C)

High temperature clamp-on transducer: 14°F to 302°F
(-10°C to 150°C)

Insertion transducer: -40°F to 176°F (-40°C to 80°C)

Note: Insertion pressure limited to 300 psig (20 barg)

Relative Humidity

Up to 99% RH, (non-condensing)

Power Supply

AC powered 100-240 VAC, 50-60 Hz, 0.5 Amps
or DC powered 9-36 VDC, 0.5 Amps
(sold separately)

Analog Output

Analog: active or passive 4-20 mA current loop

Accuracy: +/- 0.1% of reading

Active loop $R_{ext} < 750 \text{ Ohm}$

Passive loop $V < 24 \text{ VDC}$, $R_{ext} < 1 \text{ kOhm}$

Note: For 1 to 5 VDC output, add 250 Ohm resistor to 4 to 20 mA loop.

Digital Output

Pulse output: 0 to 9999 Hz, OCT (min. and max. frequency adjustable)

Solid state relay, 250 VDC/VAC max, 100 mA max, 40 Ohm max on-state resistance no/nc (SPDT)

Digital Communications

RS-485, RS-232 and USB proprietary Sierra Protocol, Modbus RTU, BACnet pending

Inputs

Upstream and downstream ultrasonic transducers; 1 Mhz

Two PT 100 RTD temperature transducers (optional)

Two wire or four wire supported

Range: -4.0°F to 302°F (-20°C to 150°C)

Resolution: 0.018°F (0.01°K)

Accuracy: +/- 0.01% of reading +/- 0.05°F (0.03°K)

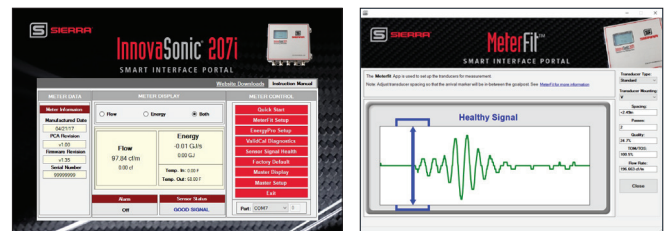
Configurable current inputs for temperature, pressure, and density

SOFTWARE

Software

Smart Interface Portal (SIP)

User-centered software allows for easy installation and field validation via USB or RS-232.



Includes Apps like:

Quick Install: Step-by-step meter commissioning and setup

MeterFit™: Makes transducer set up easy for a strong signal

EnergyPro™: Step-by-step thermal energy/BTU setup

ValidCal Diagnostics™: Validate firmware hardware health

Checks for:

Speed of sound (SOS)

Transit time, Delta T

Signal strength

Quality

Noise

TOM/TOS

Datalogging

Internal datalogging

Datalogging

Internal datalogging (data accessible via SIP)

PHYSICAL SPECIFICATIONS

Transmitter Enclosure

Wall-mounted, NEMA 4X (IP65) 316 stainless enclosure with five 3/4-inch (19 mm) conduit holes pre-drilled across the bottom

Transducers

Clamp-on transducers: encapsulated design IP68
Standard cable length: 30 ft (9 m)
Maximum cable length: 300 ft (90 m)
Memkey for automatic detection of sensor characteristics
Insertion transducers IP68

Transducer Mounting Methods

Pipe straps
Chain
Pipe clamps

Keypad

16 tactile keys with 14 dual-function keys, audible feedback

Display

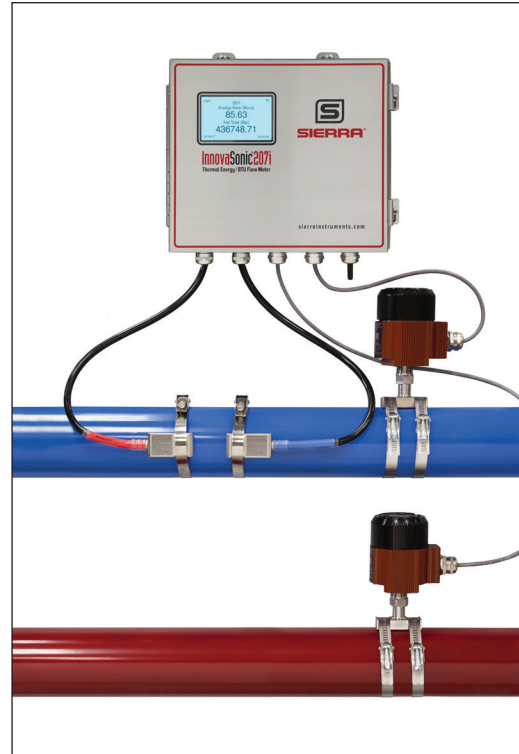
160 x 240 graphic LCD backlit display

Weights

Transmitter: approximately 4.7 lb (2.2 kg)
Transducers: approximately 2 lb (0.9 kg)

207i Transmitter Wall Mount with Transducers and Clamp-On RTDs for Thermal BTU

6



OPTIONAL RTDS: CLAMP-ON OR INSERTION

Sierra offers clamp-on or insertion RTDs to make the precise ΔT measurement, so thermal energy BTU can be calculated with a high degree of accuracy (See page 10 and 11 for dimensional drawings).

PERFORMANCE SPECIFICATIONS

Accuracy

$\pm 0.12\%$ at 0°C
Complete NIST-traceable calibration certificate

OPERATING SPECIFICATIONS

Temperature

Measurements up to 450°F (232°C)

Type

PT 100 RTD; 4-Wire; 100 Ohm, $\alpha = 0.00385$ (standard)

Stability

0.2°C (0.4°F) after 10,000 hours at max temperature
(1 year, 51 days, 16 hours continuous)

Response Time

< 5 seconds
Typical to reach a 63.2% temperature change

Humidity

Excellent moisture resistance for condensing environments

Calibration

NIST traceable test data indicating actual vs. standard temperature is supplied with each RTD

PHYSICAL SPECIFICATIONS

RTD Rating

NEMA 4X, IP66
PT 100 platinum RTD 4-wire

Electrical Connections

6-position terminal block, 4 used

Thermowell

Standard-duty threaded, stepped well
Threaded, 1/2-inch NPT
2-inch thermowell insertion length, no lagging extension
Sensor sheath material: stainless steel 316NUN (nipple union nipple)

Lead Wire Materials

Teflon insulated, hermetically sealed

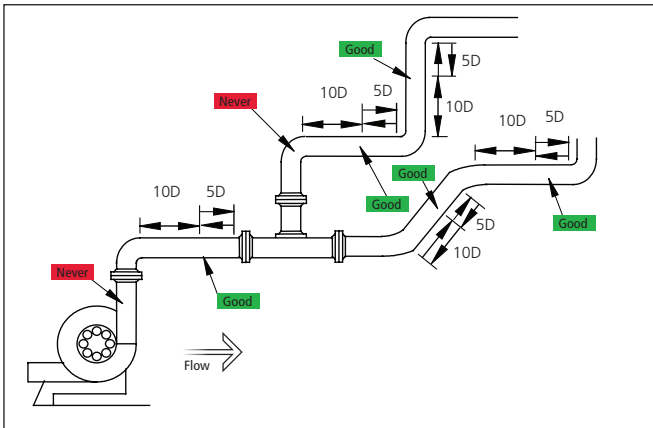
Wire Size

24 gauge wire

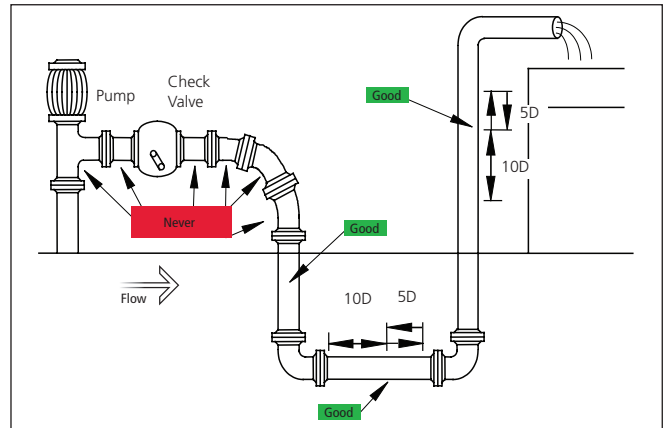
Pull Force

Wires will withstand at least 20 lb (90 newtons) of pull force before separating from sensor head

Optimal Transducer Installation Examples

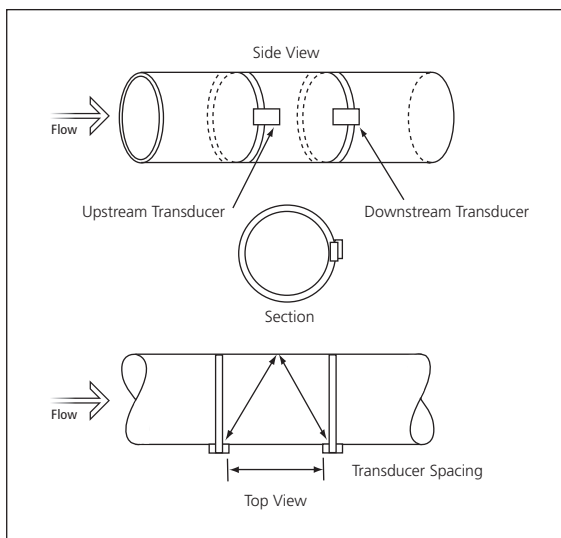


Transducer Installation For Pump Storage Tanks

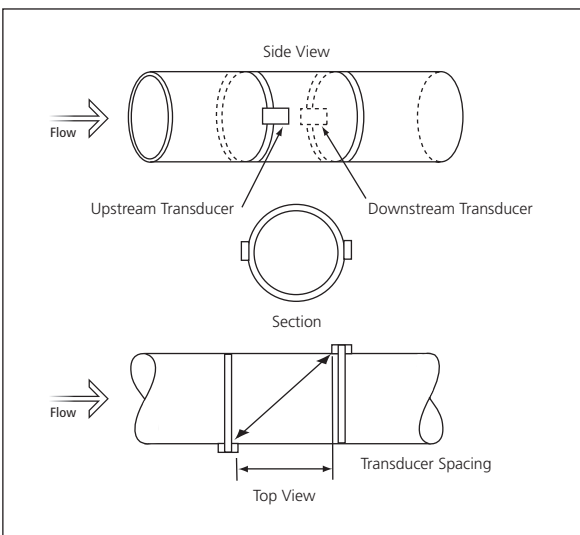


TRANSDUCER SPACING REQUIREMENTS

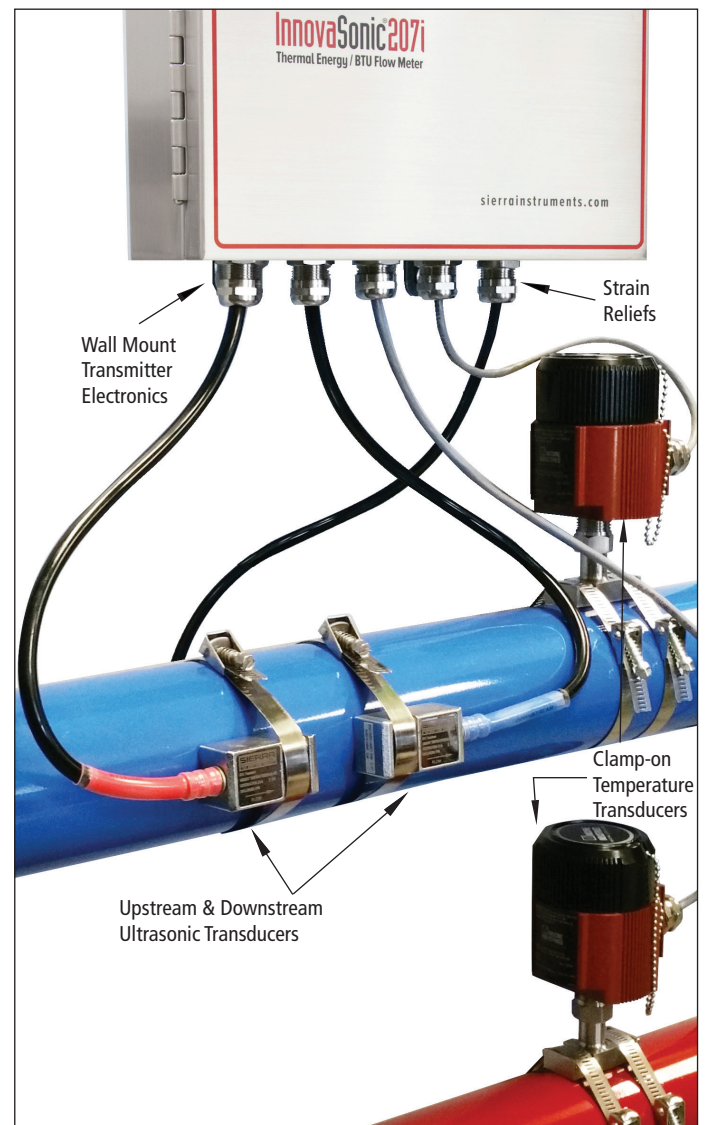
V Mount



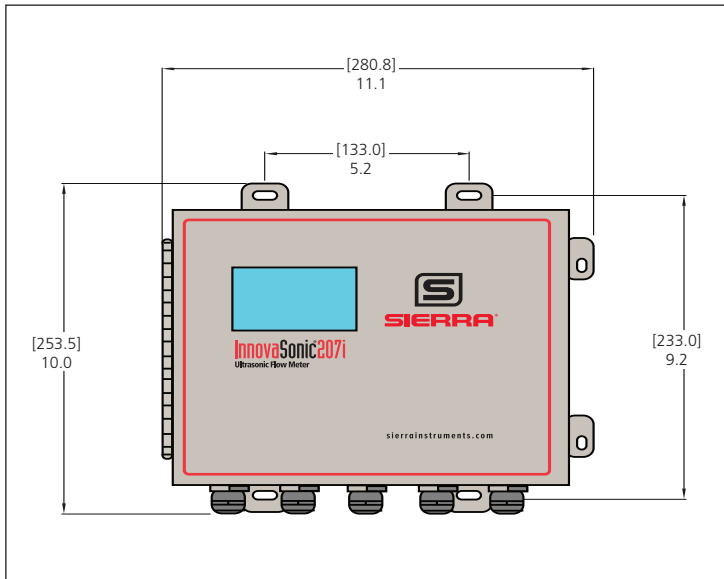
Z Mount



Transmitter Wall Mount with Pictured Transducers and Clamp-on RTDs (strain reliefs not included)



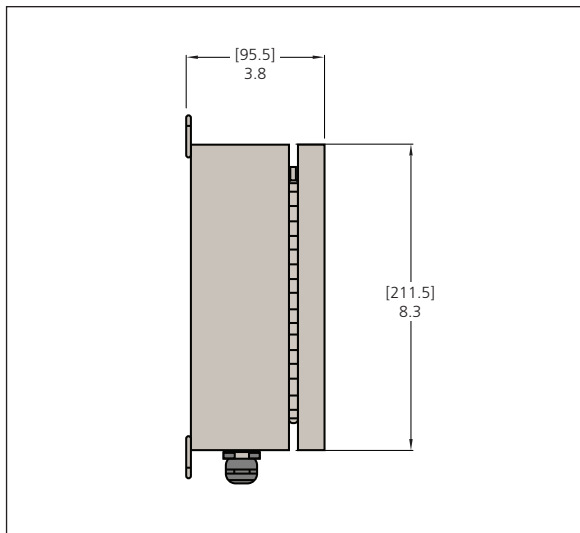
Front View 207i Transmitter Wall Mount



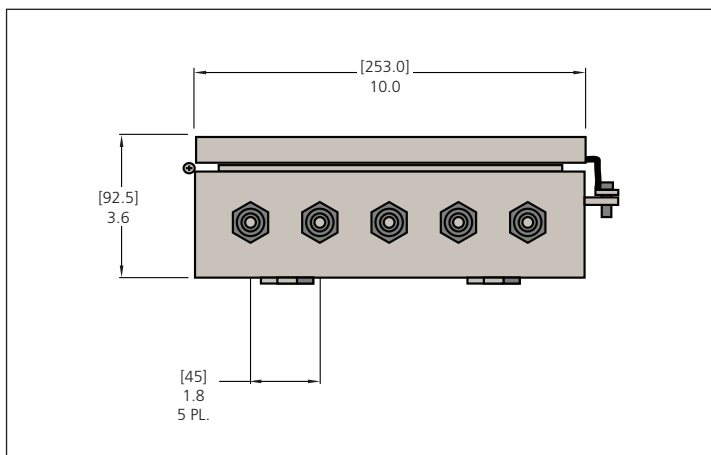
207i Transmitter Mounted With Transducers. Proudly designed, manufactured, and calibrated in the USA.



Side View 207i Transmitter Wall Mount

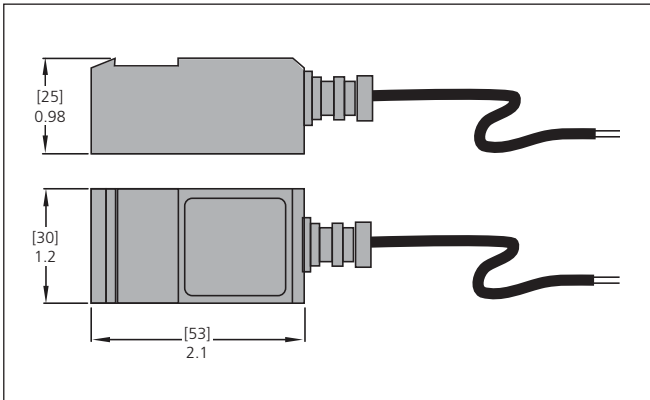


Bottom View 207i Transmitter Wall Mount

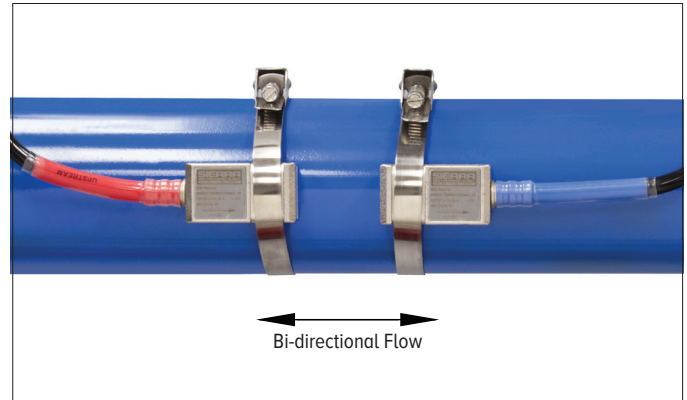


Note: All dimensions are inches (+/- .25-inch significant value). Millimeters are in parentheses. Certified drawings available on request.

207i Clamp-on Transducers



Clamp-on Transducers

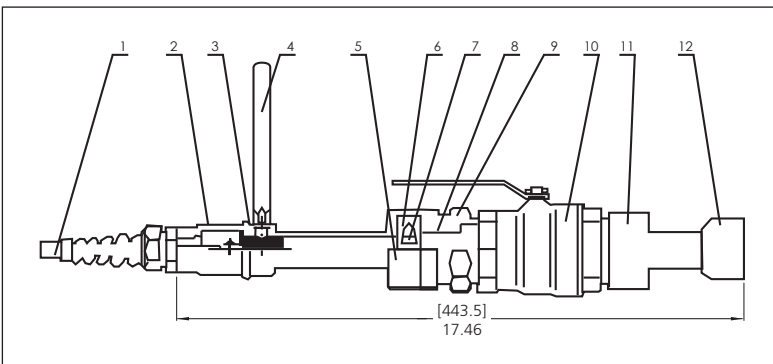


Notes: Transducer hazardous area classification: Ex d II BT4

All dimensions are inches (+/- .25-inch significant value). Millimeters are in parentheses. Certified drawings available on request.

INSERTION TRANSDUCER DIMENSIONS

Standard Insertion Transducer



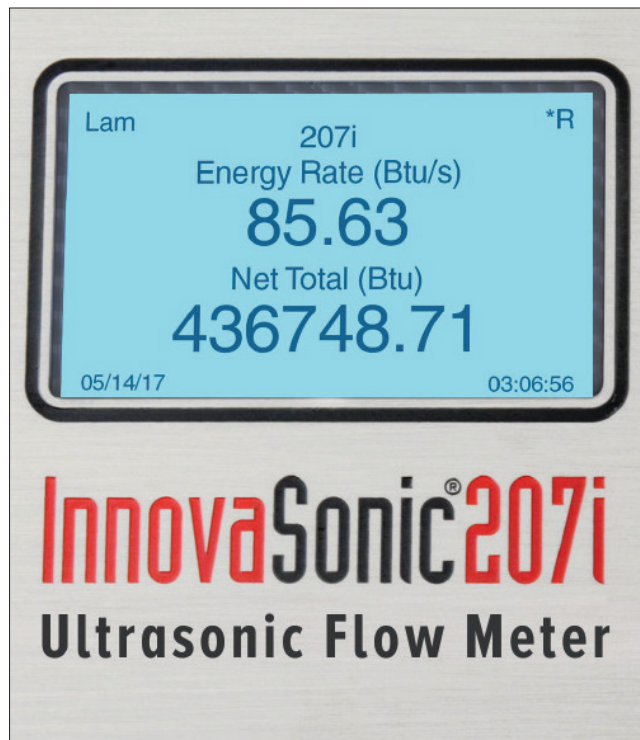
Parts List - Standard Insertion Transducers

No.	Parts	No.	Parts
1	Cable	7	Locking Nut
2	End Connector	8	Locating Sleeve
3	O-Ring	9	Joint Nut
4	Alignment Handle	10	Ball Valve
5	Locking Sleeve	11	Pedestal
6	Locking Collar	12	Sensor

Standard Insertion Transducer

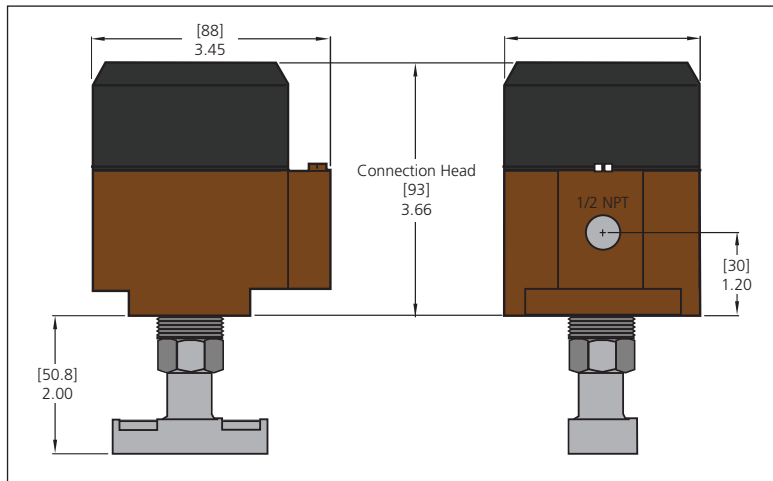


Display For Thermal Energy / BTU Readout



Note: All dimensions are inches (+/- .25-inch significant value). Millimeters are in parentheses. Certified drawings available on request.

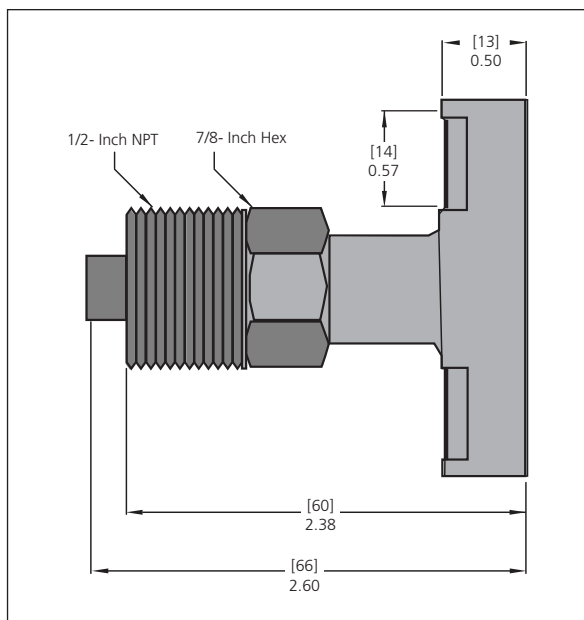
Front View Clamp-on PT 100 RTD



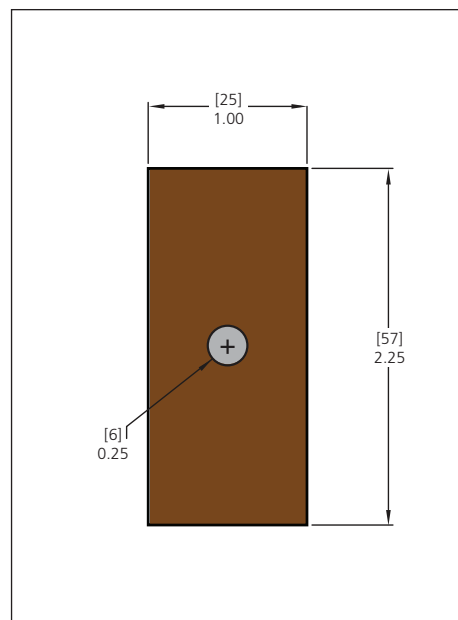
Clamp-on PT 100 RTD



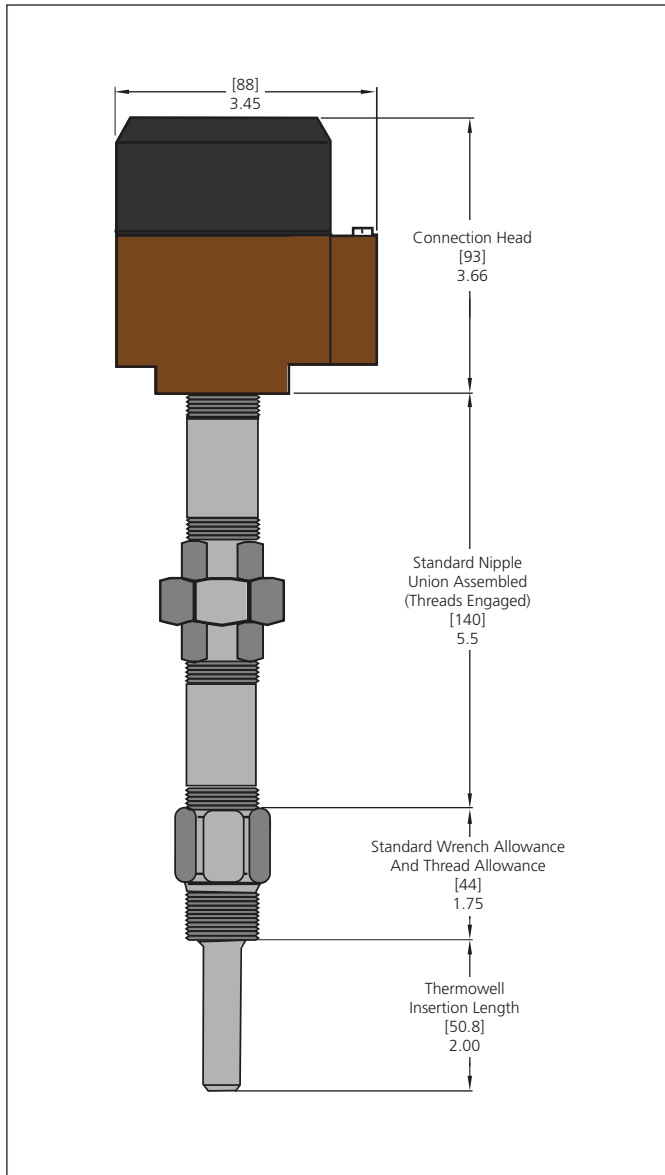
Side View Clamp-on PT 100 RTD



Bottom View Clamp-on PT 100 RTD



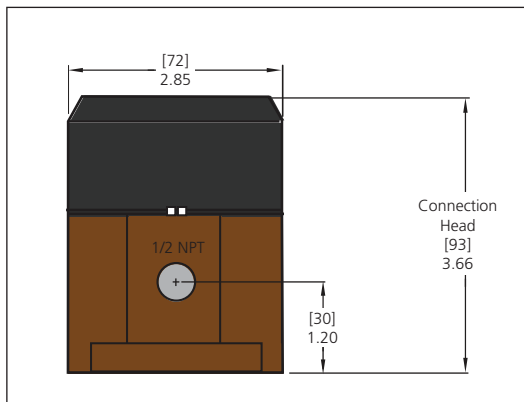
Front View Insertion PT 100 RTD



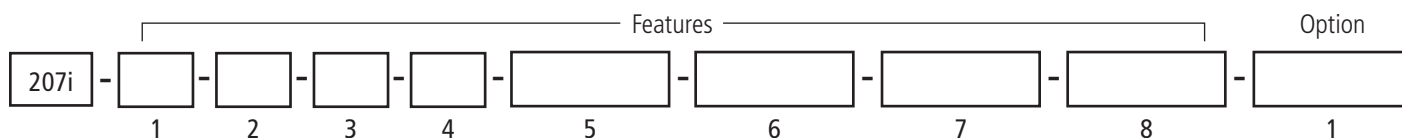
Insertion PT 100 RTD



Top View Insertion PT 100 RTD



Note: All dimensions are inches (+/- .25-inch significant value). Millimeters are in parentheses. Certified drawings available on request.



Instructions: To order the 207i, please fill in each number block by selecting the codes from the corresponding features below.

Parent Number	
207i	InnovaSonic® Liquid Flow Meter with Thermal Energy/BTU Capability

Feature 1: Power	
P2	DC powered 9-36 VDC at 0.5 Amps
P3	AC powered 100-240 VAC, 50-60 hz, 0.5 Amps

Feature 2: Transducer Pair	
S	Clamp-on transducer, operating temperature: 14°F to 176°F (-10°C to 80°C) IP 68; transducer hazard area classification Ex d II BT4
H	High-temperature clamp-on transducer, operating temperature: 14°F to 302°F (-10°C to 150°C), IP 68; transducer hazard area classification Ex d II BT4
W	Insertion transducer, operating temperature: -40°F to 176°F (-40°C to 80°C), 1.5 inch (38.1 mm) DIA insertion transducer. IP 68 transducers; suitable for pipes 2 to 236 inches (50 to 6000 mm); Note: Insertion pressure limited to 300 psig (20 barg). Insertion transducers include ball valves 1.5-inch (38.1mm); carbon steel installation seat for ball valve (brass), mounting kit (includes four screws and four plastic bushings) and seal kits (consult factory for other materials).

Feature 3: Transducer Cable	
30	30 ft. (9 m) standard cable length included with S,W,H
X (in feet)	Special length up to 300 ft. (90 m).

Feature 4: NIST FLOW CAL	
NIST	NIST traceable flow calibration is standard. See Option 1 below for RTD matching.

Note: 207i has six (6) expansion slots. These slots may be used as required for features below.

Feature 5: PT100 Inputs	
PT100 ()	Accepts input from PT100 RTD; specify quantity (typically 2) in parenthesis. RTD's themselves may be purchased from Sierra (see accessories below) or are provided by the customer. Up to three PT 100 input modules may be used (for instance, inlet temperature, outlet temperature and compensation temperature).

Feature 6: 4-20 mA Inputs	
AI ()	Accepts analog current inputs from any 4-20 mA transmitter. Specify quantity in parenthesis. This is typically two temperature transmitters but pressure, density or relay inputs for batching may also be configured. Up to three input modules may be used. Note: transmitters are typically supplied by the customer.

Feature 7: Digital Communications	
Modbus	Modbus RS-485 output; outputs Modbus RTU protocol
BACNet	BACNet output pending, consult factory

Feature 8 Strain Reliefs	
STRAIN ()	The 207i enclosure has a row of five ports for wiring to enter/exit the enclosure. These holes may be typically assigned to the two ultrasonic transducers, the two RTD inputs, and power. 1/2-inch NPT strain reliefs for wiring/cable are available and recommended if 1/2-inch conduit is not being used. Specify the strain relief quantity in parentheses.

Accessories (RTDs)	
RTDC ()-X X= 30 ft. (9 m) unless otherwise specified	Clamp on PT 100 RTD, 4- wire. NEMA 4x enclosure. Maximum operating temperature: 450°F (232°C). Two are typically used for inlet/outlet temperature. Maximum of three. Requires same number of PT100 Feature 5 input modules. Cable length X equals 30 ft. (9 m) standard cable length, otherwise replace X with desired length
RTDI ()-X X= 30 ft. (9 m) unless otherwise specified	Insertion PT 100 RTD, 4- wire. NEMA 4x enclosure. Maximum operating temperature: 450°F (232°C). Two are typically used for inlet/outlet temperature. Requires same number of PT100 Feature 5 input modules. Cable length X equals 30 ft. (9 m) standard cable length, otherwise replace X with desired length

Option 1	
MATCHED RTD	RTD's are matched to each other and then to the electronics and calibrated as a matched system. Available with Feature 5 PT100 with accessories RTDC and RTDI ONLY

Accessories (Mounting)	
205-2011	Coupling compound (100 g)
205-2010	Pipe straps 43 inches (1092 mm)

Flexibility And Options.

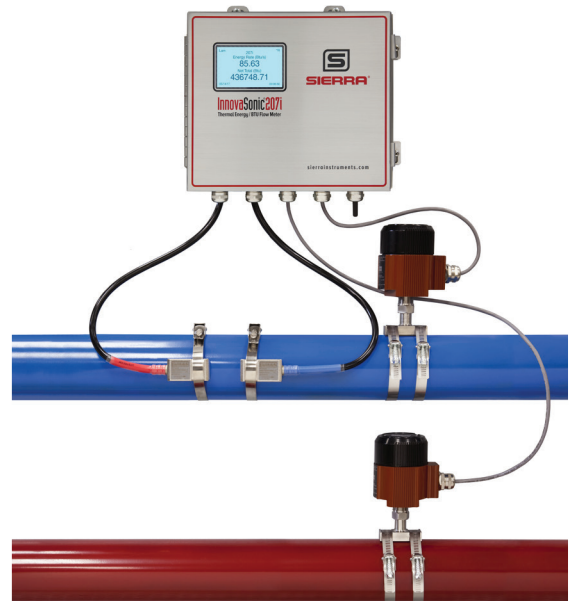
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