SYSTEM-1000

FLOW AND ENERGY MEASUREMENT SYSTEM

Installation and Operation Guide

ONICON
Flow and Energy Measurement

DOC-0005327 Rev.A

SAFETY INFORMATION

The System-1000 BTU Meter was calibrated at the factory before shipment. To ensure correct use of the system, please read this manual thoroughly.

Regarding this manual:

- This manual should be passed on to the end user.
- Before use, read this manual thoroughly to comprehend its contents.
- The contents of this manual may be changed without prior notice.
- All rights reserved. No part of this manual may be reproduced in any form without ONICON Incorporated's written permission.
- ONICON Incorporated makes no warranty of any kind with regard to this material, including, but not limited to, implied warranties of merchantability and suitability for a particular purpose.
- All reasonable effort has been made to ensure the accuracy of the contents of this manual. However, if any errors are found, please inform ONICON Incorporated.
- ONICON Incorporated assumes no responsibilities for this product except as stated in the warranty.
- If the customer or any third party is harmed by the use of this product, ONICON Incorporated assumes no responsibility for any such harm owing to any defects in the product which were not predictable, or for any indirect damages.

SAFETY PRECAUTIONS:

The following general safety precautions must be observed during all phases of installation, operation, service, and repair of this product. Failure to comply with these precautions or with specific WARNINGS given elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. ONICON Incorporated assumes no liability for the customer's failure to comply with these requirements. If this product is used in a manner not specified in this manual, the protection provided by this product may be impaired.

The following messages are used in this manual:

WARNING
Messages identified as "WARNING" contain information regarding the personal safety of individuals involved in the installation, operation or service of this product.

CAUTION
Messages identified as "CAUTION" contain information regarding potential damage to the product or other ancillary products.

IMPORTANT NOTE
Messages identified as "IMPORTANT NOTE" contain information critical to the proper operation of the product.

TABLE OF CONTENTS

SECTION 1.0 GENERAL INFORMATION

We at ONICON Incorporated would like to thank you for purchasing our quality American made System-1000 BTU Meter. As our valued customer, our commitment to you is to provide fast reliable service, while continuing to offer quality products to meet your growing flow measurement needs.

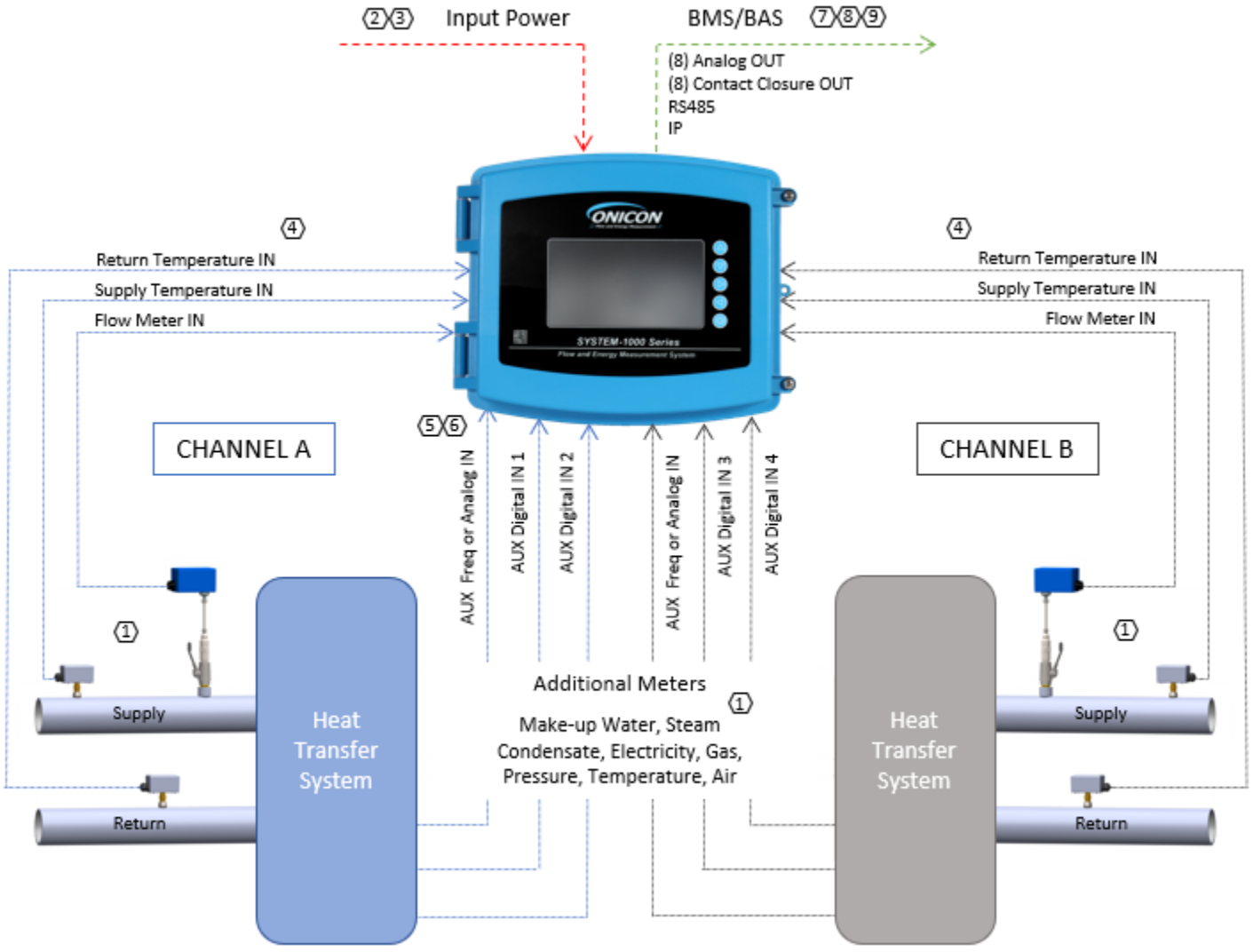
1.1 PURPOSE OF THIS MANUAL

The purpose of this guide is to provide installation and commissioning procedures and basic operating and servicing instructions for the ONICON System-1000 BTU Meter.

WARNING

Only qualified service personnel should attempt to install or service this product. Serious injury may result from the improper Installation or use of this product.

1.2 TYPICAL SYSTEM-1000 BTU METER INSTALLATION



1. ONICON Flow Meters and Temperature Sensors are provided separately
2. Provide a Power supply 24VAC/DC, 100VA Class II or 120/230 VAC 50/60 Hz, 200VA
3. Provide sufficient power supply when the combined current of all devices connected to the SYS-1000 exceeds 1 Amp
4. Flow Meter and Temperature sensors used for thermal energy calculations
5. Auxiliary Digital Inputs are available for close contact alarm signals and totalization
6. Auxiliary Digital Inputs designed for Dry or Wet Contact and Open Collectors
7. Digital Outputs are available for Energy Totals, Flow Totals, Operating Modes, and Alarms
8. Analog outputs are available for Energy Rate, Flow Rate, Supply Temp, Return Temp, Efficiency, and Aux Inputs
9. RS485 or IP for BACnet MSTP or BACnet UDP/IP

1.3 STANDARD FEATURES AND SPECIFICATIONS*

PERFORMANCE	CALCULATOR ACCURACY	Computing nonlinearity within ±0.05% Calculator meets EN1434 requirements for 2K sensors for all applications.	
	TEMPERATURE ACCURACY / AVAILABLE OPTIONS	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. Liquid temperature range: 32°F to 200°F	
		1000Ω platinum RTDs calibrated to a differential measurement uncertainty of ± 0.18°F over the stated range	
	FLOW RATE	See accuracy statement provided with the flow meter (ordered separately)	
MECHANICAL	DIMENSIONS	13.96″ W x 12″ H x 6.04″ D	
MATERIALS	ENCLOSURE	ADC12 Die Cast Aluminum	
ENVIRONMENTAL	OPERATING TEMPERATURE RANGE	-13°F to 140°F	
	ENCLOSURE RATING	NEMA 13	
POWER SUPPLY REQUIREMENTS	24 VAC/DC	22 - 28 VAC, 50/60Hz, 100VA or 22 - 28VDC, 4.6A, 100W	
	120-240 VAC	99 - 253 VAC, 50/60 Hz, 100VA	
I/O SIGNALS	ONE CHANNEL CONFIGURATION	Frequency Inputs	Two (2) Active Frequency Inputs
		Analog Inputs	Two (2) Active Analog Inputs
		Digital Inputs	Two (2) Open Collector / Isolated Dry Contact for totalization or alarm
		Temperature Sensor Inputs	Two (2) Passive Analog Inputs or Two (2) 1000 Ω RTD Inputs
		Analog Outputs	Four (4) Active Analog Outputs
		Digital Outputs	Four (4) Isolated Dry Contact Inputs for Totalization or Alarm
	DUAL CHANNEL CONFIGURATION	Frequency Inputs	Four (4) Active Frequency Inputs
		Analog Inputs	Four (4) Active Analog Inputs
		Digital Inputs	Four (4) Open Collector / Isolated Dry Contact for totalization or alarm
		Temperture Sensor Inputs	Four (4) Passive Analog Inputs or (4) 1000 Ω RTD Inputs
		Analog Outputs	Eight (8) Active Analog Outputs
		Digital Outputs	Eight (8) Isolated Dry Contact Inputs for Totalization or Alarm

***** SPECIFICATIONS subject to change without notice.
Note - See model codification for additional information regarding option selections.

1.3 STANDARD FEATURES AND SPECIFICATIONS (CONTINUED)*

NETWORK CONNECTIONS	Isolated RS485 serial interface or IP ethernet port connection		
COMMUNICATION PROTOCOLS	BACnet MS/TP or BACnet UDP/IP		
NETWORK CONFIGURATION & ADDRESSING	BACnet MS/TP	Baud Rates	9600, 19200, 38400, 57600, or 76800 (Default: 38400)
		Device Address Range	0 – 127 (Master) 128 - 254 (Slave) (Default: 128**)
		Device Instance Range	1 – 4,194,302 (Default:57017)
		Max master	1-127
	BACnet UDP/IP (IPv4)	Default Address	192.168.1.24
		Instance Number	1 – 4,194,302 (Default:57017)
		Subnet Mask	Programmable (Default:255.255.255.0)
		Gateway Address	Programmable
		UDP port:	Programmable (Default:47808)
APPROVALS	FCC	Part 15, Subpart B	
	BTL	Certified to ASHRAE Standards	
	UL	UL 61010	
	CE		

***** SPECIFICATIONS subject to change without notice.
** The default address is set to slave to prevent bus contention. The user will have to program the master address they desire for MS/TP communication with the SYSTEM-1000 to proceed.

1.4 MODEL NUMBERING SYSTEM

Meter Model Number Coding = SYS-1X00-ABC

X = System Configuration
1 = Single Channel System
2 = Dual Channel System
A = Electronics Enclosure
1 = NEMA 13 enclosure with LCD display
B = Input Power
1 = 24 VAC/DC, 22 - 28 VAC, 50/60Hz, 100VA or 22 - 28VDC, 4.6A, 100W
2 = 120 / 230 VAC, 99 - 253 VAC, 50/60 Hz, 100VA
C = Network Communications
0 = No communications
1 = RS485 or IP (BACnet MS/TP or UDP/IP)

1.5 ADDITIONAL REQUIRED HARDWARE

ONICON offers a wide variety of flow meters to satisfy most hydronic energy metering applications.

Type of Meter	Flow Meter Model	Line Sizes	Installation Type
Chilled Water, Hot Water, Water/Glycol Solutions	**F-1100 Single Turbine Flow Meter**	1¼" and larger	Insertion
	F-1200 Dual Turbine Flow Meter	2½" and larger	Insertion
	F-11XX Turbine Flow Meter	¾" and 1"	Inline
	F-3500 Insertion Mag Flow Meter	1¼" and larger	Insertion
	FT-3000 Series Electromagnetic Flow Meter	¼" and larger	Inline
	F-4300 Ultrasonic Flow Meter	½" and larger	Clamp-on
	F-4600 Ultrasonic Flow Meter	½"- 2½"	Inline
Steam	**F-2600 Vortex Flow Meter**	½" - 8"	Inline
	F-2700 Vortex Flow Meter	3" - 16"	Insertion
	F-1500 Turbine Flow Meter	3" - 36"	Insertion
Gas	**F-5400/F-5500 Thermal Mass Flow Meters**	¾" - 24"	Inline/Insertion

Please refer to ONICON's flow meter IOM, or contact ONICON for help in selecting the flow meter that will best fit your requirements.

1.6 WORKING ENVIRONMENT

The System-1000 was designed for installation and use in typical industrial environments that are free of corrosive liquids and fumes, direct liquid exposure, temperature extremes and vibrations. Do not expose the meter to direct sunlight.

The operating ambient air temperature range is -13°F to 140°F. The electrical power should be relatively clean, free of high frequency noise, large voltage transients, and protected from power surges and brown outs.

1.7 SERIAL NUMBER

The System-1000's serial number is a unique identifier for the product, and is located outside of the enclosure and within the meter data screens. Please have this number available when contacting ONICON for assistance.

SECTION 2.0 UNPACKING

2.1 CHECKING THAT YOU HAVE RECEIVED EVERYTHING

IMPORTANT NOTICE

Flow and BTU meters will be configured and programmed for use together as a system. The flow meter(s) serial number(s) will be shown on the System-1000 configuration sheet.

CAUTION

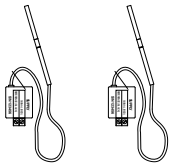
Please open the package with caution to avoid damaging its contents. If any item is damaged upon receipt, notify the shipping company immediately and alert the ONICON customer service department. Most products are shipped insured unless the customer specifically requests otherwise.

CHECK THAT YOU HAVE RECEIVED EVERYTHING

Each box comes with a label identifying the ONICON job number, Model Number, Serial Number, and Tag Information. (Use tags to identify the meter location.)

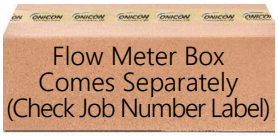
Typical order includes:

1



System-1000 with temperature sensors located inside of the enclosure

2

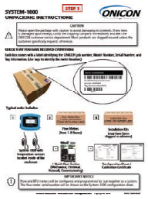


Flow Meters (from 1-8 Boxes)

3

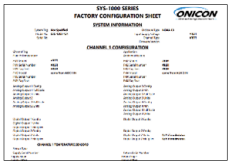
Installation Kits (may have been shipped in advance)

4



4 Quick Start Guides (Mechanical, Electrical, Network, Commissioning)

5



Configuration Sheet / Calibration Certificate

SECTION 3.0 INSTALLATION

The System-1000 BTU Meter should be installed by experienced contractors with related knowledge and experience in hydronic heating and cooling systems, and fluid metering applications in general. Contact ONICON for installation assistance.

The installer should use good trade practices and must adhere to all state and local building or other applicable codes.

3.1 SITE SELECTION

Careful attention to the site selection for the system components will help the installers with the initial installation, reduce start-up problems, and make future maintenance easier.

When selecting a site for mounting, consider the criteria under Section 1.6 WORKING ENVIRONMENT, as well as the following.

IMPORTANT NOTE
Proper site selection is critical to the performance of this BTU meter. Both the flow meter and the two temperature sensors must be properly located within the piping system in order to ensure an accurate energy measurement.

3.1.1 The System-1000 BTU Meter

Find an easily accessible location where wire connections can be made and meter readings can be taken from floor level. Mount the System-1000 enclosure on a vibration free surface. Avoid locations such as the plenum of a fan coil, heat exchanger or any housing that may contain electric motors or other strong sources of electrical interference.

3.1.2 The Flow Meter

When properly installed, the flow meter will only measure flow associated with that portion of the piping system for which the energy measurement is being made. The flow meter may be installed in either the supply or return line. Choose the location with the longest straight run of unobstructed pipe. Please refer to 1.5 ADDITIONAL REQUIRED HARDWARE and to the flow meter IOM for specific information regarding the straight run requirements.

3.1.3 The Temperature Sensors

The two or four temperature sensors must be located in such a manner as to 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 the System-1000 is configured as a dual-channel system, it can be paired with two sets of temp sensors for two independent energy measurements.

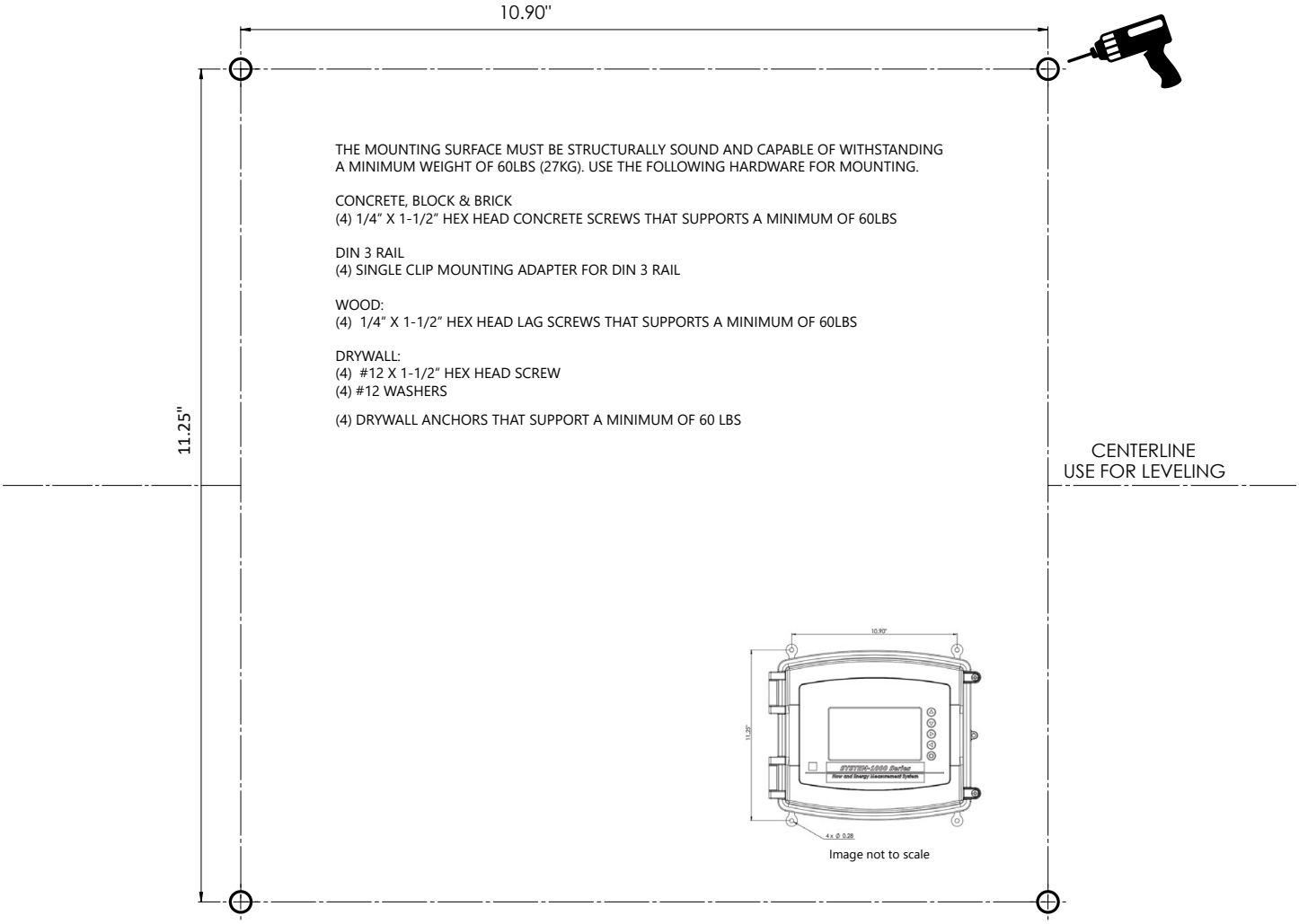
If possible, find an easily accessible location where wire connections can be made from floor level. This will facilitate any future service. Place the temperature sensors away from strong sources of electrical noise that might affect the performance of the sensors.

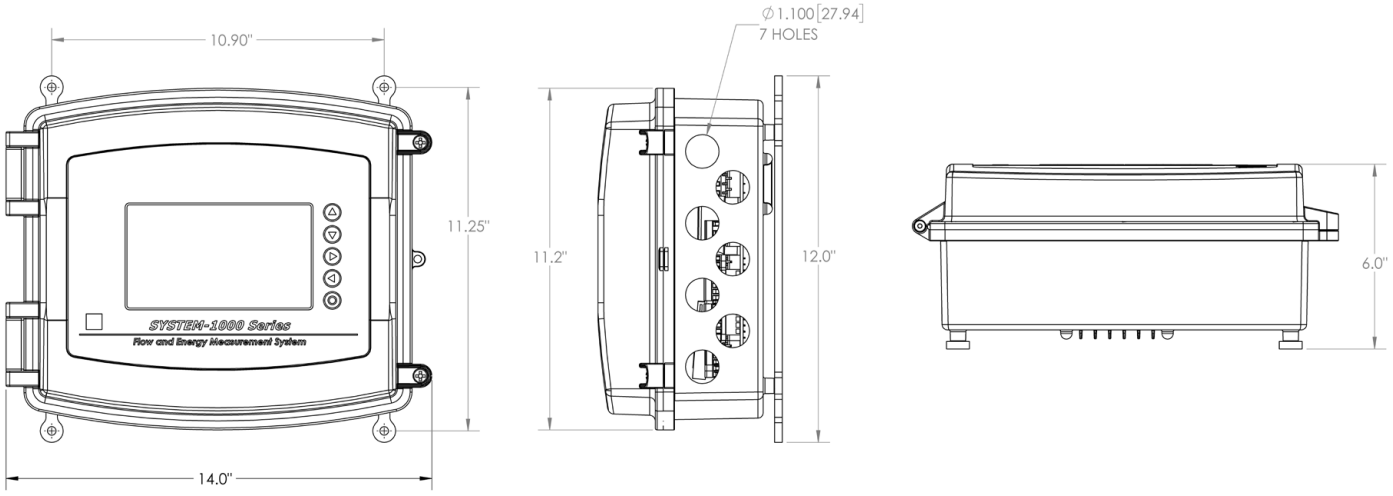
One temperature sensor thermowell will need to be placed in the same pipe with the flow meter. It should be located on the downstream side of the flow meter. The downstream distance between the thermowell and flow meter should be at least five pipe diameters, leaving enough clearance to remove either sensor from the pipe without interference from the other sensor.

Two types of thermowells might be provided with the unit and depending on the condition of the system. For empty pipes, the kit must be installed prior to filling the system, or into pipe sections that are isolated from pressure and flow. For pressurized pipes, a hot tap drilling machine is used to create a ⅞" opening in the pipe wall. Once installed, each kit allows for the insertion and removal of the thermowell without a system shutdown.

These kits are supplied for use with a specific pipe diameter and with the thermowell length matched to the temperature sensor length. Matching the thermowell to the pipe diameter ensures that the thermowell will be fully immersed in the flow stream. Matching the sensor length to the thermowell ensures that the temperature sensor will contact the bottom of the well and provide accurate, responsive temperature measurement.

3.2 MECHANICAL INSTALLATION





CAUTION
DO NOT drill holes in the enclosure. Use only the openings that are provided.

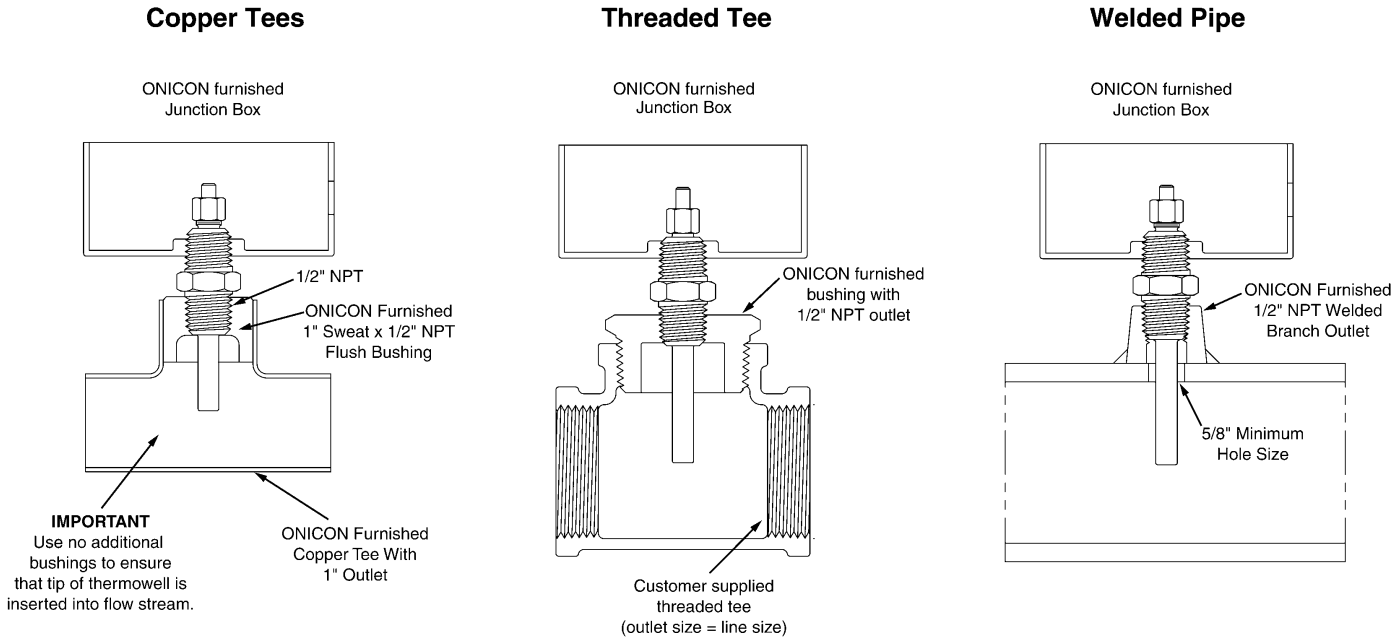
3.2.1 Thermowell Installation

Sections 3.2.1.1 - 3.2.1.3 are thermowell kits for ONICON solid state temperature sensors and high temperature RTDs with matching transmitters. See sections 3.2.1.4 - 3.2.1.5 for thermowells for 4-wire RTDs

IMPORTANT NOTE
It is important that no dirt or other foreign material be allowed into the thermowells as this could affect the thermal response of the system.

3.2.1.1 Dry Tap Thermowells

Dry tap thermowells are for new construction or scheduled shutdown. The most common installation methods are shown below. Refer to Appendix A-1 for thermal insulator installations and Appendix A-2 for high temperature (>300°F) thermowell installations. Consult ONICON for special applications.



NOTES
1. Thermowell length varies with pipe size.
2. If additional fittings are required, ensure that tip of thermowell is inserted into flow stream.

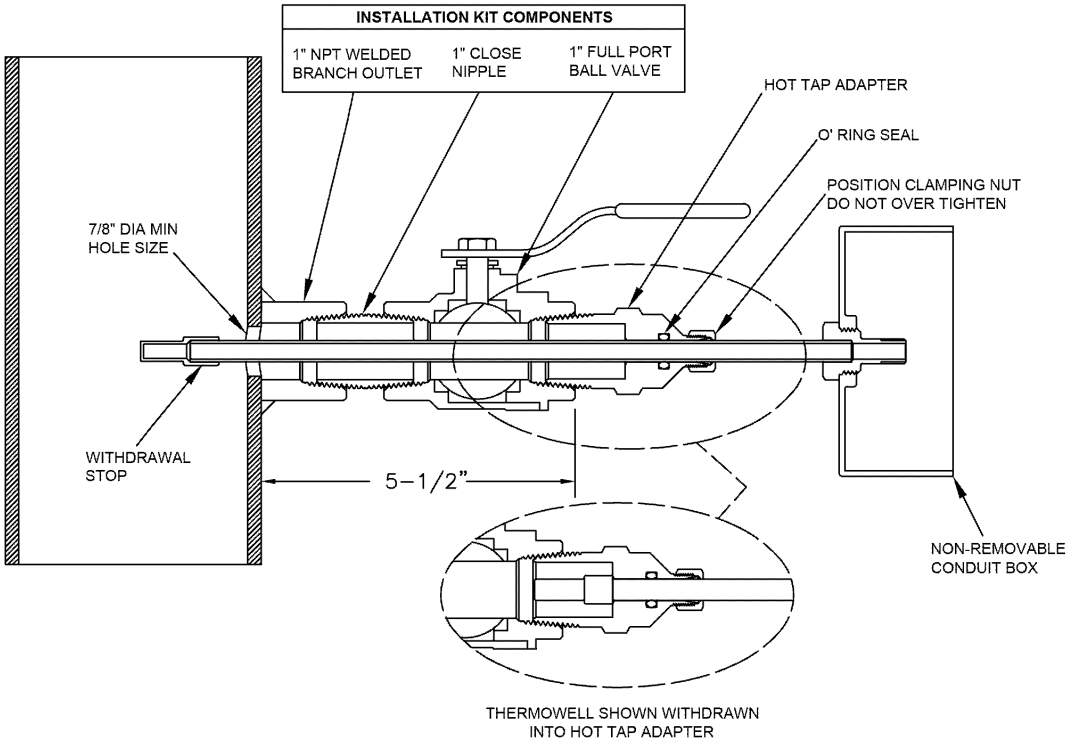
3.2.1.2 Hot Tap Thermowells

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 on the next page. A hot tap drilling machine equipped with a 7/8" drill is required to perform this type of installation.

Install the valve assembly as shown in the drawing and then drill the 7/8" hole using the hot tap drilling machine. 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.

3.2.1.2 Hot Tap Thermowells (CONTINUED)

WARNING
SYSTEM MAY BE UNDER HIGH PRESSURE. Be sure to hold the conduit box firmly by hand before slowly loosening the position clamping nut when installing, adjusting or removing the thermowell. Failure to do this will allow the pressure to suddenly and rapidly force the thermowell from the pipe, potentially causing serious injury. The thermowell could also be damaged or break apart causing a break in the water seal with the resultant loss of large amounts of water.



Hot Tap Installation Detail For Thermowell In Welded Pipe

Insertion of the Hot Tap Thermowell

1. Calculate the insertion force (lbs) required by multiplying the system pressure (psig) by 0.11. The person inserting the thermowell should ensure adequate footing for the force required prior to opening the valve.
2. Thread the hot tap adapter into the valve. Firmly grasp the wiring enclosure, loosen the position clamping nut, open the valve, and carefully push the thermowell into the flow stream. Use the attached gage to set the insertion depth.
3. Carefully tighten the position clamping nut that is located at the top of the 1" NPT hot tap adapter fitting. Do not release the wiring enclosure until the position clamping nut has been tightened.

CAUTION
Excessive vibration can damage the thermowell. Insert the thermowell to the proper depth using gauge supplied as shown. Reduce the insertion depth as necessary if strong vibrations are felt during insertion, making certain that the tip of the thermowell remains fully in the flow stream.

CAUTION
DO NOT OVER TIGHTEN THE POSITION CLAMPING NUT. If fluid leaks, do not attempt to correct by tightening this nut further. An internal o-ring seals the fluid. Contact ONICON for assistance in the event of a leak.

Removal Of The Hot Tap Thermowell

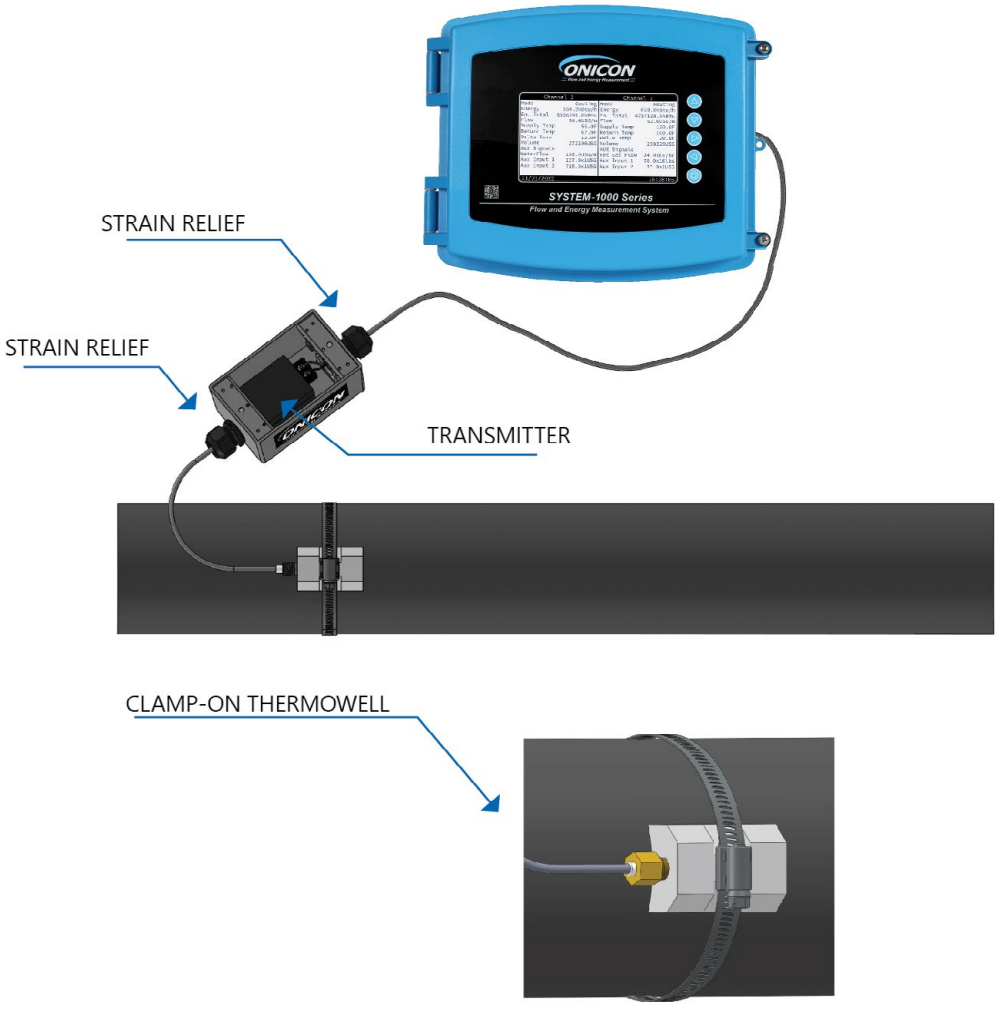
WARNING
Maintain a firm hold on the wiring enclosure until the thermowell is completely withdrawn and the valve is closed.

1. System pressure will try to push the thermowell out of the flow stream when the clamping nut is released. Be sure to establish safe footing prior to loosening the clamping nut. The force pushing out against the thermowell is the same as the insertion force calculated above.
2. Grasp the wiring enclosure firmly, holding the thermowell in the pipe and then loosen the position clamping nut. Slowly withdraw the thermowell from the pipe. After the thermowell is completely withdrawn, carefully close the isolation valve.

IMPORTANT NOTE
Rotating the thermowell as you slowly withdraw it through the valve will ensure that the lower tip is fully withdrawn and completely free of the valve. If resistance is felt when closing the valve, open valve fully and rotate the well as you pull it further out of the pipe.

3.2.1.3 Clamp-On Thermowell

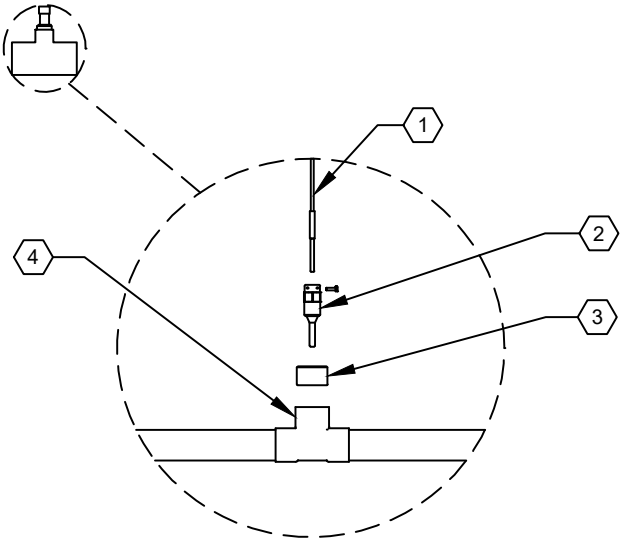
Clamp-on thermowells are for metallic pipes ONLY and are typically used along with clamp-on ultrasonic flow meters. It is also very important to properly insulate over them. The insulation thickness (or R value) required is proportional to the difference between ambient temp and process temp.



Thermowells for 4-wire RTDs

3.2.1.4 5mm Diameter Thermowell

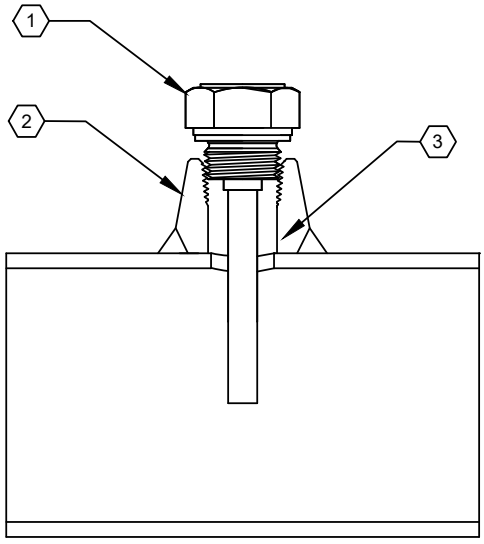
5 mm RTDs are provided with thermowells with ½" male NPT process connections. They are designed for use in ½" to 2½" line size tees provided by the customer. The RTDs are push-in type and are held in place with a set screw. Depending on the pipe material, the kit may include a copper sweat bushing or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

3.2.1.5 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.



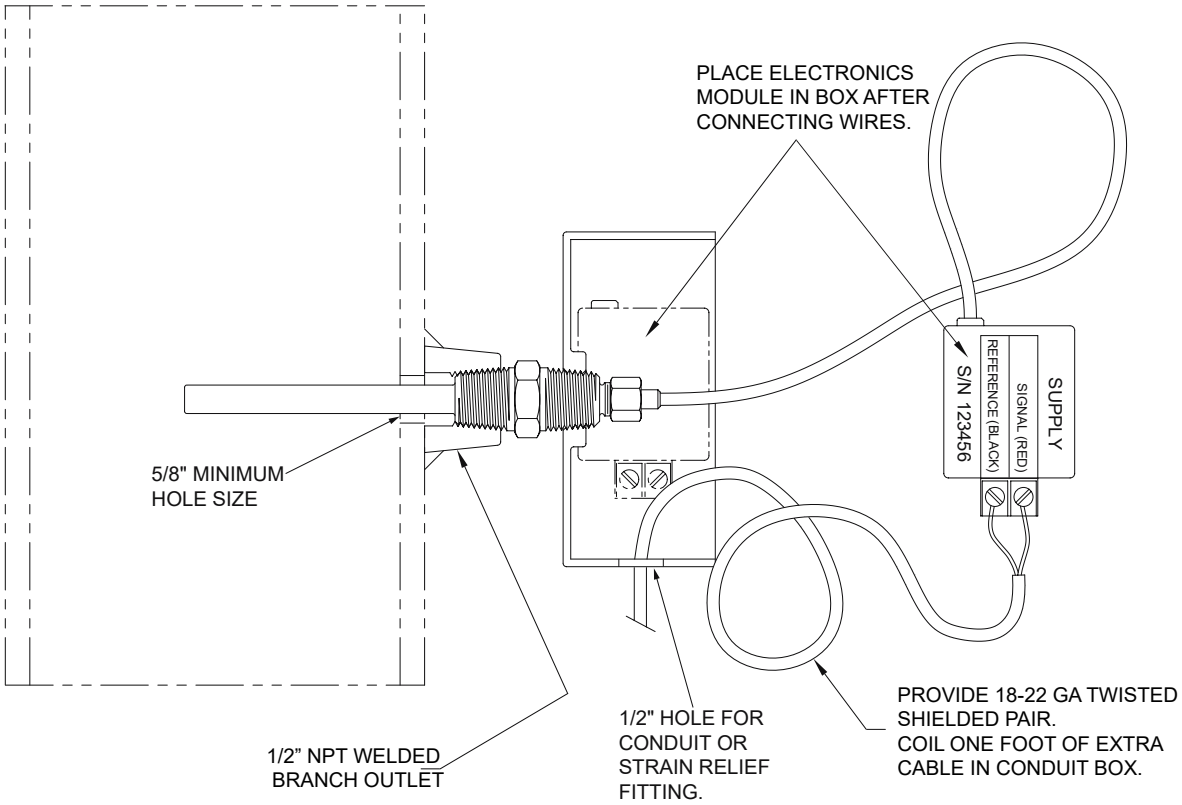
1. 6 mm diameter thermowell - provided by ONICON.
2. ½" NPT weld on branch outlet - provided by ONICON.
3. ¾" minimum hole size.

3.2.2 Temperature Sensor Installation (ONICON Solid State Sensors)

The temperature sensors are factory matched and tagged by serial number to a specific BTU meter. They are also labeled as SUPPLY and RETURN temperature sensors. Please consult ONICON before attempting to use any other temperature sensor.

- Apply a thin coat of thermal compound to the temperature sensor, and gently insert the temperature sensor all the way into the thermowell until it contacts the bottom of the cavity.
- Gently tighten the retainer nut. DO NOT OVER TIGHTEN.
- The thermowell completely seals the plumbing system without the retainer nut. The only purpose for the nut is to keep the sensor from losing contact with the bottom of the thermowell cavity.

IMPORTANT NOTE
Cable length is specified at time of order. Cable provided for temperature sensors is #22 gauge twisted shielded pair. Additional cable may be added in the field if necessary, but must be of twisted shielded pair construction. (#22 gauge minimum and #18 gauge maximum)



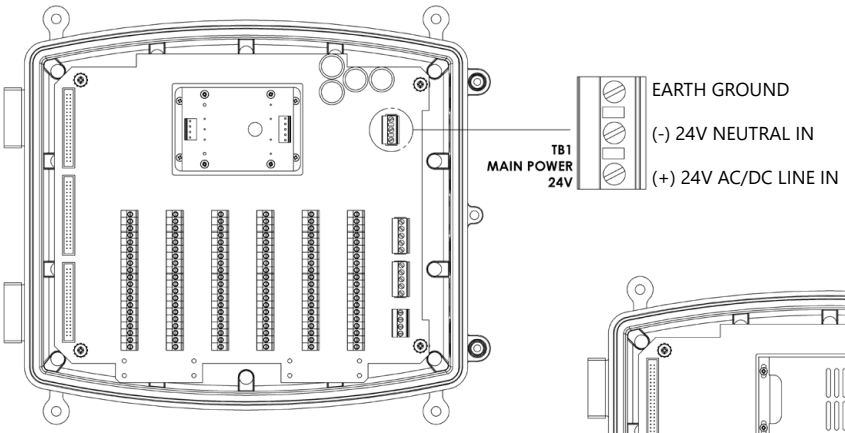
3.2.3 Flow Meter Installation

Determine which pipe (supply or return) has the longer unobstructed straight run. Install the flow meter in the longest straight pipe run available. One temperature sensor can be installed five diameters downstream of the flow meter leaving enough clearance to remove either sensor from the pipe without interference from the other sensor.

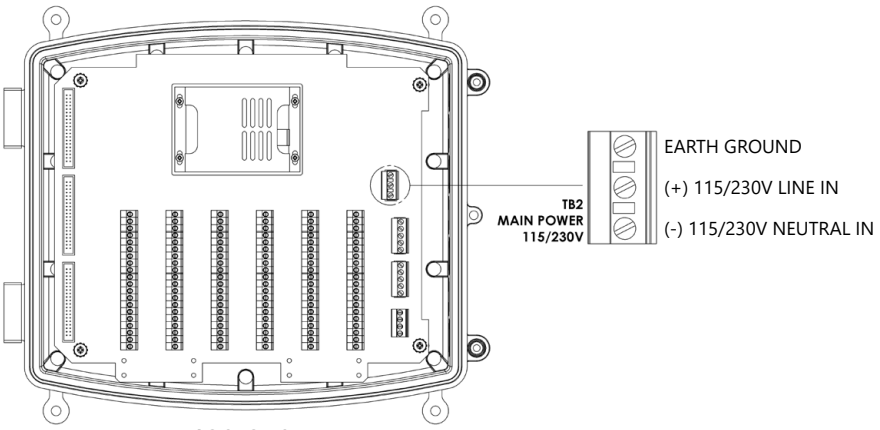
Refer to the flow meter IOM and/or other documentation that is provided with your ONICON flow meter.

3.3 ELECTRICAL INSTALLATION

3.3.1 Input Power Requirements



24V



120-240V

1. Input voltages should be within he following ranges:
   - 22-28 VAC, 50/60Hz, 100VA or 22-28VDC, 4.6A, 100W
   - 99-253 VAC, 50/60 Hz, 100VA

IMPORTANT NOTE:
This option is not field selectable. Contact ONICON prior to installation if needed to change the input voltage rating.

WARNING
Conduit openings in the System-1000 enclosure must be closed with UL listed fittings applicable to NEMA 13 enclosures.

WARNING
Disconnect main power before proceeding.

Connect the power source to the main unit through the conduit opening located on the side of the main unit. DO NOT drill holes in the enclosure. Fasten the power wires to the appropriate screw terminals as shown.

Connect the protective earth wire to the right top terminal connection of the motherboard..

CAUTION
This product must be connected to earth ground for proper operation. Failure to do so may result in erratic operation.

As power is initially applied to the System-1000, immediately confirm that the display is illuminated and displaying the Main Menu screen. If this does not occur, disconnect power immediately and re-verify all wiring connections. If the problem persists, contact ONICON.

ONICON SYSTEM-1000 Flow and Energy System

ONICON Flow and Energy Measurement

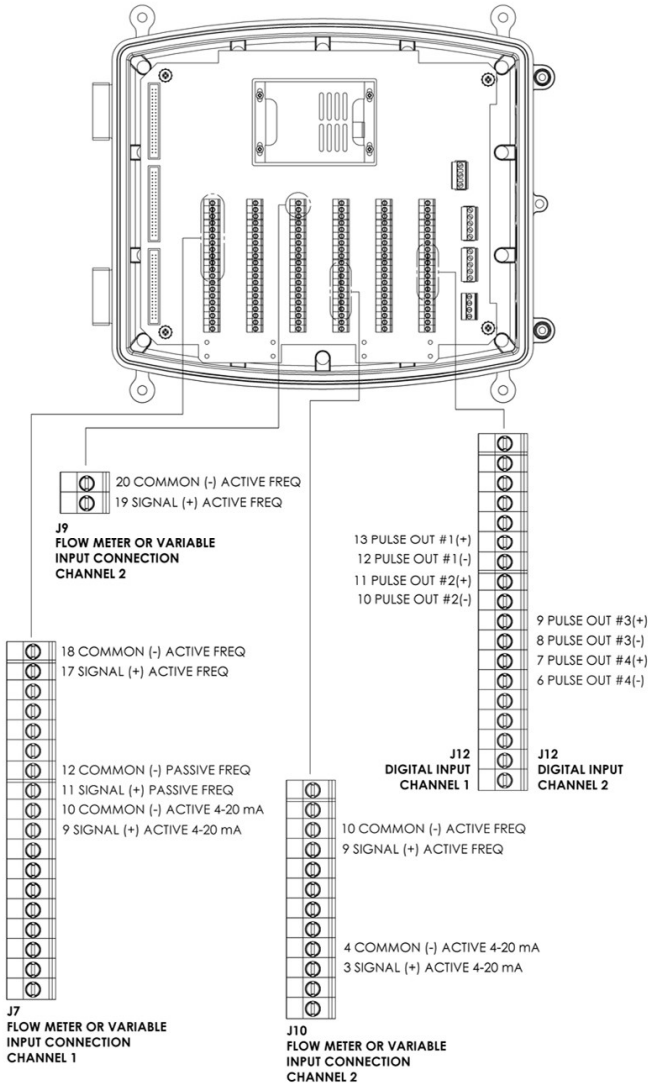
WIRING DIAGRAM

METER TAG	MODEL NUMBER	SERIAL NUMBER
CDW-FM	F-3500-11-C3-1111	001101002
FT-3	F-4600-010-000-09	001088474
HX-3/4 CWR	F-4300-1111-2222	001018068
BTU-2	F-1200-00-C3-1221	001009389
	F-1134-00-00-3229	001131240

Meter Serial Number & Cable Color			Meter Serial Number & Cable Color			Meter Serial Number & Cable Color			Meter Serial Number & Cable Color			Meter Serial Number & Cable Color			Meter Serial Number & Cable Color		
20	SHIELD	SHIELD	20	SHIELD	SHIELD	20	FREQ4 COM		20	SHIELD	SHIELD	20	4A		20	0-10V OUT 8	
19	SHIELD	SHIELD	19	SHIELD	SHIELD	19	FREQ4 IN		19	SHIELD	SHIELD	19	4A		19	4-20 OUT 8	
18	TURB2 COM		18	PULSE OUT 3 (-)		18	FREQ3 COM		18	3A		18	4B		18	ANALOG COM8	
17	TURB2 FREQ		17	PULSE OUT 3 (+)		17	FREQ3 IN		17	3A		17	4B		17	420 - HART	
16	TURB2 24V		16	PULSE OUT 2 (-)		16	AFLOW3 COM	001018068	16	3B		16	PULSE OUT 4 (-)		16	HART COM	
15	TURB1 COM		15	PULSE [illegible]		15	AFLOW3 IN	001018068	15	3B		15	PULSE OUT 4 (+)		15	4-20 IN G	
14	TURB1 FREQ		14	PULS [illegible] 1 (-)		14	[illegible]	REFER TO NOTE 1*	14	SUPPLY TEMP 2 (-)	50005-03	14	PULSE OUT 5 (-)		14	4-20 COM	
13	TURB1 24V		13	PULSE OUT [illegible]		13	[illegible]	[illegible] NO	13	[illegible] PPLY [illegible] P 2 (+)	50005-03	13	PULSE OUT 5 (+)		13	PULSE IN 1 (+)	Alarm
12	FREQ2 COM		12	2A		12	ALO [illegible] OM		12	[illegible] TUR [illegible] MP 2 (-)	50 [illegible] -04	12	PULSE OUT 6 (-)		12	PULSE IN 1 (-)	Alarm
11	FREQ2 IN		11	2A		11	[illegible] 20 OU [illegible]		11	RETUR [illegible] MP 2 (+)	5	11	PULSE OUT 6 (+)		11	PULSE IN 2 (+)	001088474 Scaled Pulse
10	AFLOW2 COM	Non-Onicon	10	2B		10	0-10V OUT4		10	TURE		10	0-10V OUT 5		10	PULSE IN 2 (-)	001088474 Scaled Pulse
9	AFLOW2 IN	Non-Onicon	9	2B		9	ANALOG COM3		9	TURB4 FREQ		9	4-20 OUT 5		9	PULSE IN 3 (+)	001009389 Scaled Pulse
8	24VDC(-)	REFER TO NOTE 1*	8	1A		8	4-20 OUT3		8	TRUB4 24V		8	ANALOG COM5		8	PULSE IN 3 (-)	001009389 Scaled Pulse
7	24VDC(+)	REFER TO NOTE 1*	7	1A		7	0-10V OUT3		7	TURB3 COM		7	0-10V OUT 6		7	PULSE IN 4 (+)	001131240 Scaled Pulse
6	FREQ1 COM	001101002	6	1B		6	ANALOG COM2		6	TURB3 FREQ		6	4-20 OUT 6		6	PULSE IN 4 (-)	001131240 Scaled Pulse
5	FREQ1 IN	001101002	5	1B		5	4-20 OUT2		5	TRUB3 24V		5	ANALOG COM6		5	PULSE OUT 7 (+)	
4	AFLOW1 COM		4	SUPPLY TEMP 1 (-)	50004-10	4	0-10V OUT2		4	AFLOW4 COM	Non-Onicon	4	0-10V OUT 7		4	PULSE OUT 7 (-)	
3	AFLOW1 IN		3	SUPPLY TEMP 1 (+)	50004-10	3	ANALOG COM1		3	AFLOW4 IN	Non-Onicon	3	4-20 OUT 7		3	PULSE OUT 8 (+)	
2	24VDC (-)	REFER TO NOTE 1*	2	RETURN TEMP 1 (-)	50004-11	2	4-20 OUT1		2	24VDC (-)	REFER TO NOTE 1*	2	ANALOG COM7		2	PULSE OUT 8 (-)	
1	24VDC (+)	REFER TO NOTE 1*	1	RETURN TEMP 1 (+)	50004-11	1	0-10V OUT1		1	24VDC (+)	REFER TO NOTE 1*	1	SHIELD	SHIELD	1	SHIELD	SHIELD
J7			J8			J9			J10			J11			J12		

SYS-1000 comes with a custom-made wiring diagram to facilitate its installation. The schematics include the meter tag, model number, serial number, and terminal connection location on the board. Please contact the factory if a copy of the wiring diagram is needed.

3.3.2.1 Input Signal Connections From Flow Meters



FLOW METER INPUT

FLOW METER CONNECTION CHANNEL 1			FLOW METER CONNECTION CHANNEL 2		
INPUT TYPE	FREQUENCY	4-20mA	INPUT TYPE	FREQUENCY	4-20mA
SIGNAL (+) COMMON (-)	J7-5 J7-6	J7-3 J7-4	SIGNAL (+) COMMON (-)	J9-17 J9-18	J9-15 J9-16

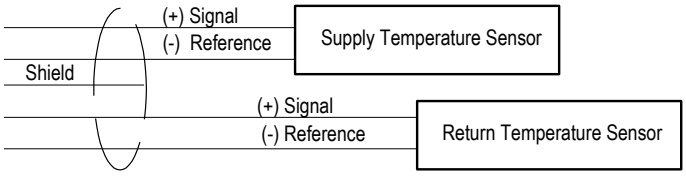
AUX INPUTS

CHANNEL 1			CHANNEL 2		
INPUT TYPE	FREQUENCY	4-20 mA	INPUT TYPE	FREQUENCY	4-20 mA
SIGNAL (+) COMMON (-)	J7-11 J7-12	J7-9 J7-10	SIGNAL (+) COMMON (-)	J9-19 J9-20	J10-3 J10-4

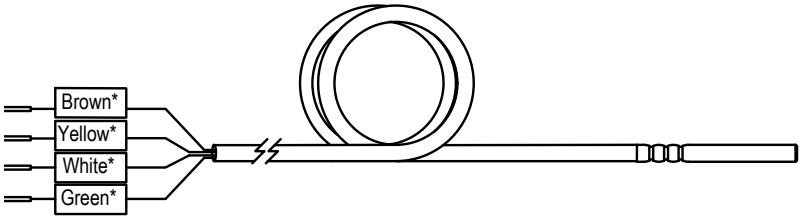
DIGITAL INPUT CHANNEL 1			DIGITAL INPUT CHANNEL 2		
INPUT TYPE	DIGITAL INPUT 1	DIGITAL INPUT 2	INPUT TYPE	DIGITAL INPUT 3	DIGITAL INPUT 4
PULSE OUT (+) PULSE OUT (-)	J12-13 J12-12	J12-11 J12-10	PULSE OUT (+) PULSE OUT (-)	J12-9 J12-8	J12-7 J12-6

3.3.2.2 Temperature Input Wiring Details

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

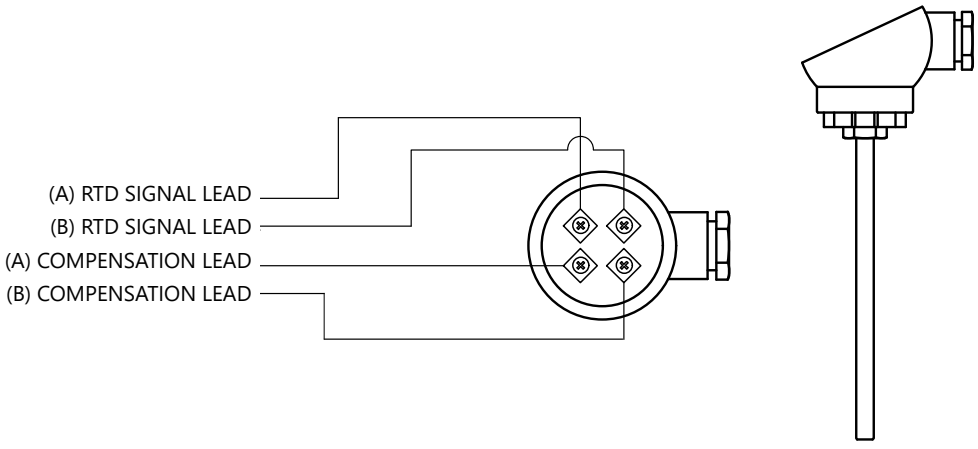


1000 OHMS 4-WIRE PLATINUM RTD TEMPERATURE INPUTS w/ ATTACHED PIGTAILS CABLE



** Cable color coding to DIN 47100*

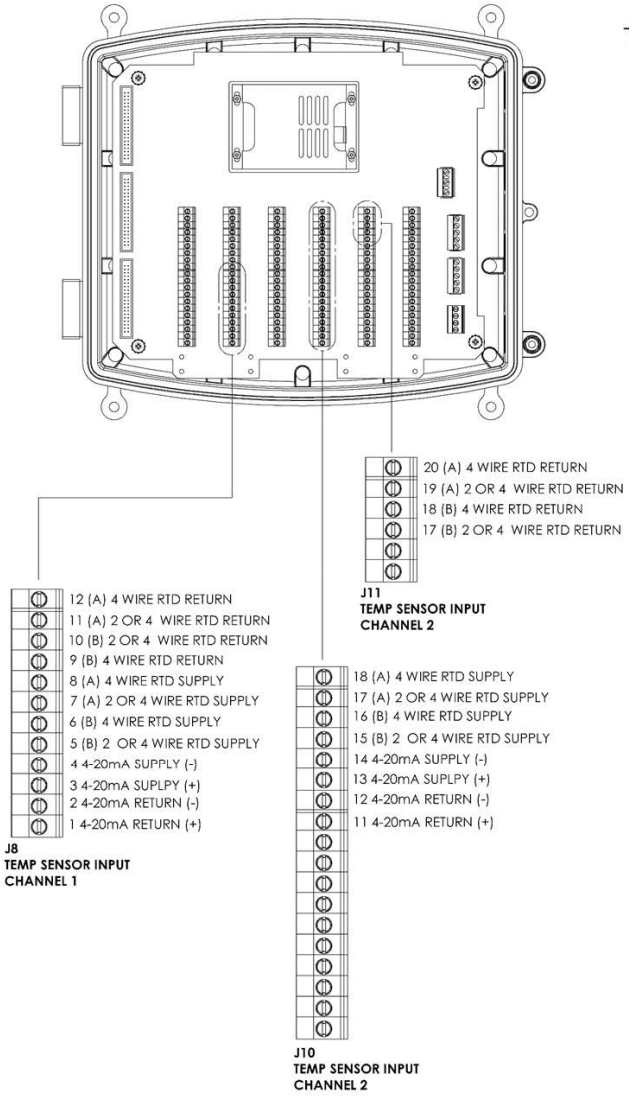
1000 OHMS 4-WIRE PLATINUM TEMPERATURE INPUTS w/ INTEGRAL CONDUIT READY JUNCTION BOX



Refer to Temperature Sensor Connection on next page for additional details on the terminal location.

3.3.2.3 Input Signal Connections for Temperature Sensors

Do not exceed 4.5 in-lb (0.5 Nm) of torque when tightening.



TEMP SENSOR INPUT

SUPPLY INPUT CHANNEL 1			SUPPLY INPUT CHANNEL 2		
4-20mA	2 WIRE RTD	4 WIRE RTD	4-20mA	2 WIRE RTD	4 WIRE RTD
J8-3 (+) J8-4 (-)	J8-7 (A) J8-5 (B)	J8-8 (A) BR J8-7 (A) YE J8-6 (B) WH J8-5 (B) GR	J10-13 (+) J10-14 (-)	J10-17 (A) J10-15 (B)	J10-18 (A) BR J10-17 (A) YE J10-16 (B) WH J10-15 (B) GR
RETURN INPUT CHANNEL 1			RETURN INPUT CHANNEL 2		
4-20mA	2 WIRE RTD	4 WIRE RTD	4-20mA	2 WIRE RTD	4 WIRE RTD
J8-1 (+) J8-2 (-)	J8-11 (A) J8-9 (B)	J8-12 (A) BR J8-11 (A) YE J8-10 (B) WH J8-9 (B) GR	J10-11 (+) J10-12 (-)	J11-19 (A) J11-17 (B)	J11-20 (A) BR J11-19 (A) YE J11-18 (B) WH J11-17 (B) GR

CAUTION

Shield connections are required for proper operation. Failure to use shielded cable may result in erratic operation.

3.3.2.4 Peripheral Devices: Flow Meters

ONICON flow meters are provided with a number of different output configurations. These affect the number of wires contained in the cable attached to the flow meter. Refer to the diagram below meter.

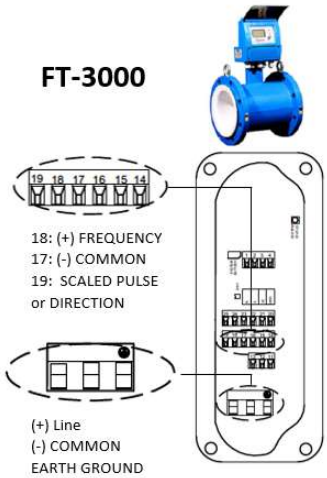
FLOW METER WIRING DIAGRAM

F-1000

F-3500

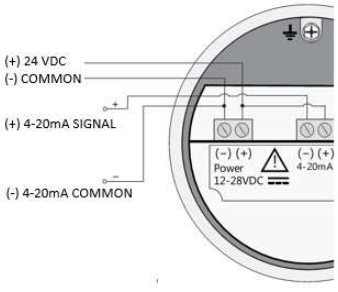
F-4600

FT-3000

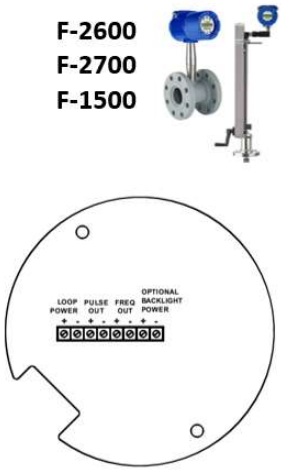


F-4600

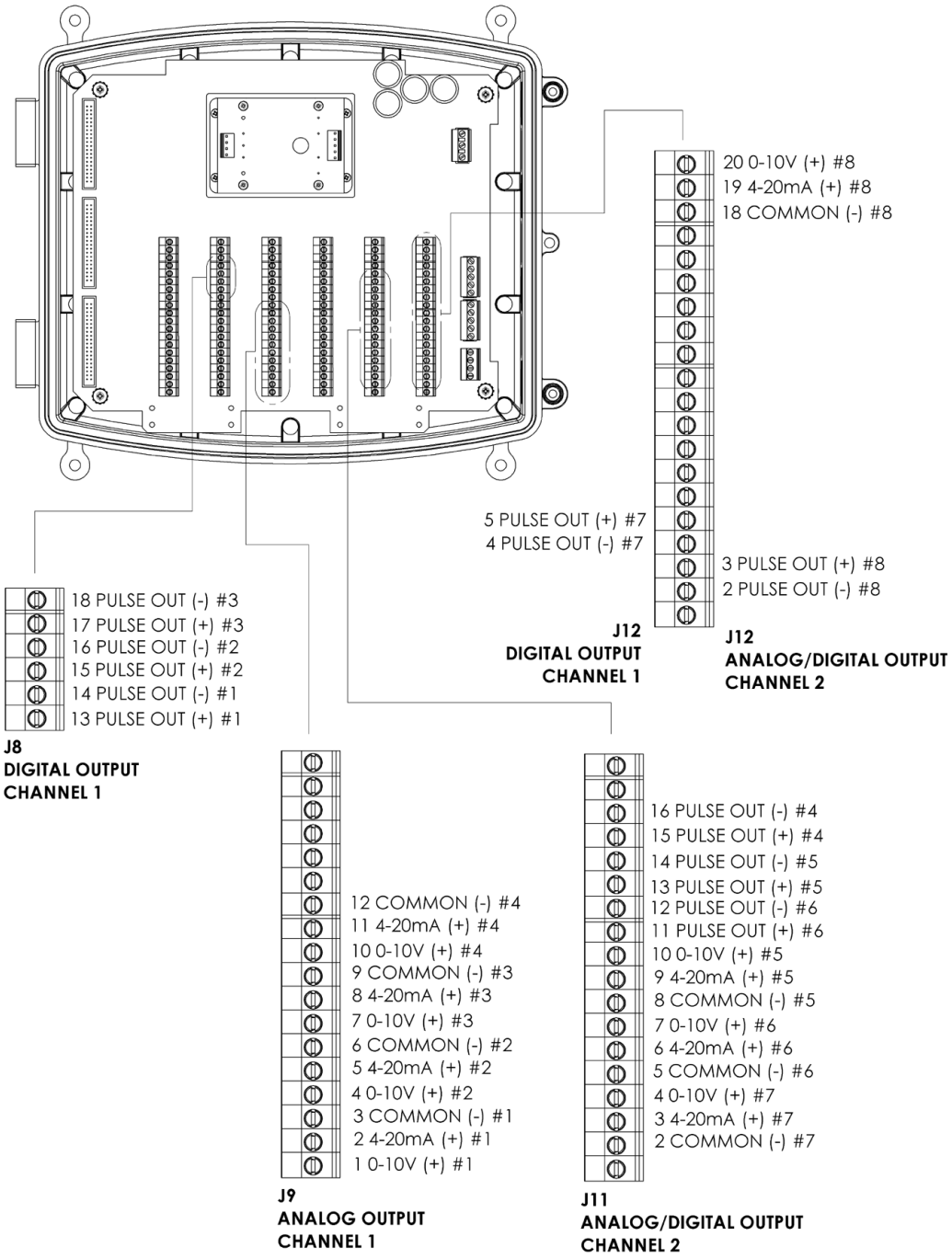
F-5400



F-2600
F-2700
F-1500



3.3.2.5 Output Signal Connections



ANALOG OUTPUT CHANNEL 1				
INPUT TYPE	ANALOG OUTPUT 1	ANALOG OUTPUT 2	ANALOG OUTPUT 3	ANALOG OUTPUT 4
0-10V (+) 4-20mA (+) COMMON (-)	J9-1 J9-2 J9-3	J9-4 J9-5 J9-6	J9-7 J9-8 J9-9	J9-10 J9-11 J9-12

ANALOG OUTPUT CHANNEL 2				
INPUT TYPE	ANALOG OUTPUT 5	ANALOG OUTPUT 6	ANALOG OUTPUT 7	ANALOG OUTPUT 8
0-10V (+) 4-20mA (+) COMMON (-)	J11-10 J11-9 J11-8	J11-7 J11-6 J11-5	J11-4 J11-3 J11-2	J12-20 J12-19 J12-18

DIGITAL OUTPUT CHANNEL 1				
INPUT TYPE	DIGITAL OUTPUT 1	DIGITAL OUTPUT 2	DIGITAL OUTPUT 3	DIGITAL OUTPUT 7 COMM
PULSE OUT (+) PULSE OUT (-)	J8-13 J8-14	J8-15 J8-16	J8-17 J8-18	J12-5 J12-4

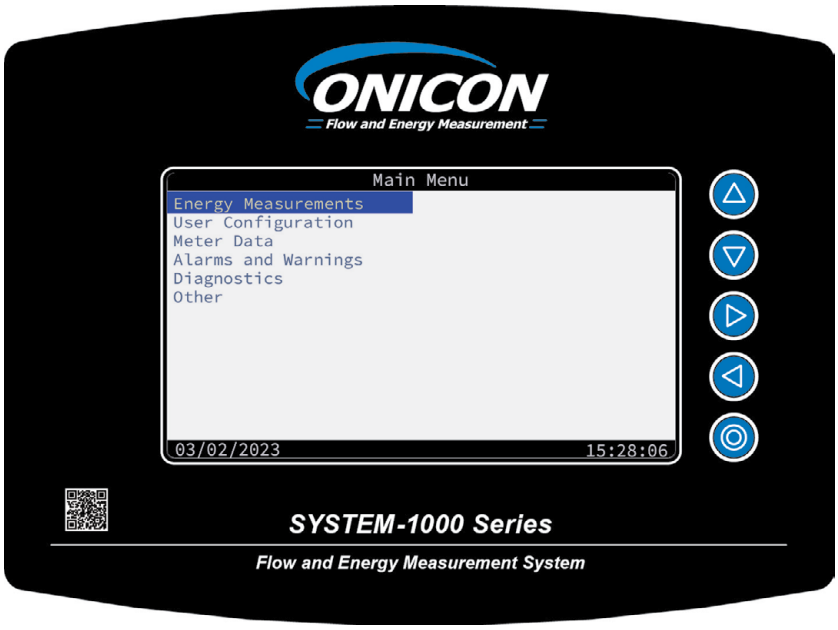
DIGITAL OUTPUT CHANNEL 2				
INPUT TYPE	DIGITAL OUTPUT 4	DIGITAL OUTPUT 5	DIGITAL OUTPUT 6	DIGITAL OUTPUT 8 COMM
PULSE OUT (+) PULSE OUT (-)	J11-15 J11-16	J11-13 J11-14	J11-11 J11-12	J12-3 J12-2

SECTION 4.0 START-UP AND COMMISSIONING

4.1 DISPLAY AND USER INTERFACE

When power is applied to the System-1000, the Main Menu screen will appear on the display.

Five (5) button user interface is provided to operate and program the meter.



The main menu screen will indicate the meter is operating. Press the Energy Measurement screen to access the real-time data.

4.2 UNITS

AVAILABLE UNITS

MEASUREMENT TYPE	SELECTABLE UNITS
ENERGY TOTAL	BTU
FLOW TOTAL	GAL
ENERGY RATE	BTU/HR
FLOW RATE	GPM
SUPPLY TEMPERATURE	DEG F
RETURN TEMPERATURE	DEG F

4.3 COMMISSIONING

Upon initial installation, it is strongly recommended that the SYSTEM-1000 and its associated flow meters are commissioned to ensure that they are properly installed and functioning correctly. This process involves verifying the mechanical installation, measuring flow and temperature signals and then comparing these measurements to the specified installation and operating parameters listed on the FACTORY CONFIGURATION SHEET provided with the meter. The data collected during this initial commissioning process will then serve as baseline data for periodic revalidation of the meter operation.

COMMISSIONING PROCEDURE

Please read the entire procedure carefully before proceeding. A wiring diagram is provided with the meter. A worksheet for checking off the following steps and recording measured values is located on the next page.

IMPORTANT NOTE
Flow meters and temp sensors are matched to the System-1000.

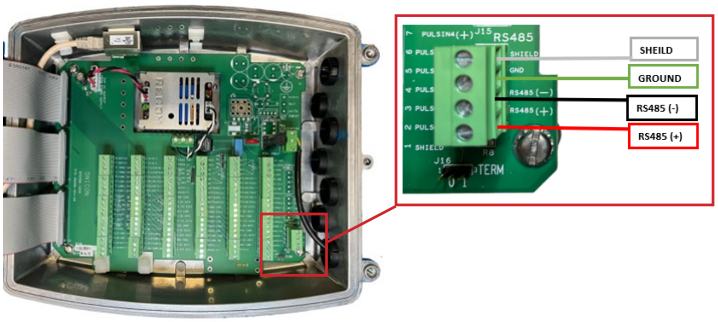
	MECHANICAL	
1	Confirm flow meter location and adequate straight pipe run to achieve desired results.	Is the flow meter located in the correct location as required by the plans? Compare actual straight pipe upstream and downstream of the flow meter location to the recommended distances identified in the flow meter installation manual.
2	Confirm pipe size & material. (for insertion meters only)	Confirm that the flow meter is tagged for the pipe diameter and material it is installed in. When in doubt, measure the circumference of the pipe. Pipe O.D. = (circumference / 3.14) – (insulation thickness x 2)
3	Confirm insertion depth and orientation (for insertion meters only).	Each insertion type flow meter comes with an attached insertion gage and instruction tag. Ensure that meter is inserted to correct depth and that the electronics enclosure is parallel with the pipe, with the arrow in the direction of flow.
4	Confirm temperature sensor thermowell installations.	Confirm that the thermowells are properly installed and the bottom of the well is in the flow stream. Make certain that only the components supplied with the installation kit were used and that additional bushings were not added.
5	Confirm temperature sensor installations.	Confirm that the temperature sensors are properly installed, and each sensor is bottomed out in the well. A small amount of thermal compound should be applied to the tip of each sensor to improve the thermal transfer.
	ELECTRICAL	
6	Confirm connection.	Using the wiring diagram, confirm that the flow meter and temperature sensor serial number matches the correct terminal connection.
7	Confirm correct supply voltage.	Verify that correct AC/DC voltage is available at the power supply input terminals per its wiring diagram. Input voltages should be within the following ranges: 24 VAC/DC 22 - 28 V DC/AC, 50/60Hz, 100VA 120-240 VAC 99 - 126 VAC or 196 - 253 VAC, 50/60Hz, 200VA
	PROGRAMMING	
8	Verify the type of fluid used in the piping system.	Confirm that the fluid specified on the BTU meter certificate of calibration matches the fluid flowing in the piping system.
In order to proceed with the following steps, the BTU meter must be operating and connected to the network. There must also be flow in pipes. Flow signal readings should be taken while holding the flow rate constant if possible. Otherwise, take the various output readings as quickly as possible.		
9	Confirm Values in the Energy Measurement Screen.	Confirm the displayed Flow Rates, Supply and Return temperature are within the expected present values of the application. Energy rate (KBTU/HR) is approximately = 500 * Delta-T * GPM/1000
10	Display/BMS Interaction.	Validate the value of the meter display match with the displayed values shown on the building control network.
End of standard commissioning. Please contact ONICON at (727)447-6140 with any questions.		

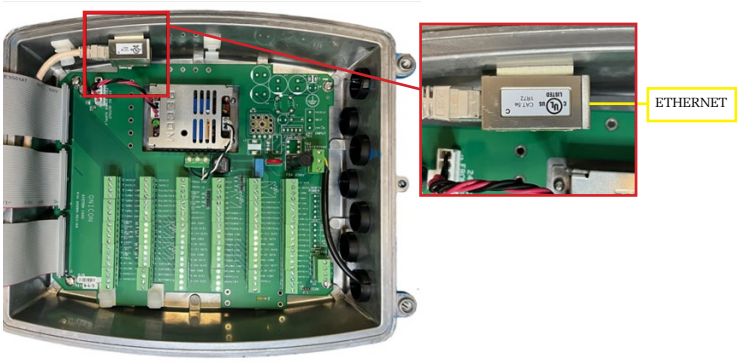
COMMISSIONING WORKSHEET

Please read all installation instructions carefully prior to proceeding with these steps. Wiring diagrams and Network Commissioning Guide are provided inside of the the SYS-1000 enclosure. Contact the factory if there is any missing documentation. Use the following worksheet for checking off the commissioning steps and recording measured values:

STEP	MEASUREMENT	S/N:	S/N:	S/N:	S/N:	S/N:	S/N:	S/N:	S/N:
1	Meter location								
2	Pipe Size								
3	Insertion depth and orientation								
4	Thermowell installation								
5	Temperature installation								
6	Terminal pin connection on the SYS-1000 (Ex: J9 Terminal 3 & 4 are Analog input 1)								
6.1	Verify flow meter and temp sensor wires match wiring diagram location								
7	Supply voltage verified (Note voltage)								
In order to proceed with the following steps, the BTU meter must be operating and connected to the network. There must also be flow in pipes. Flow signal readings should be taken while holding the flow rate constant if possible. Otherwise, take the various output readings as quickly as possible.									
8	Verify the liquid type								
9.1	Note and record the SUPPLY temperature								
9.2	Note and record the RETURN temperature								
9.3	Note and record the FLOW RATE								
9.4	Note and record the ENERGY RATE								
10.1	Measured frequency or Analog output signal from flow meter (refer to wiring diagram for terminal or wiring specific output)								
10.2	Measured frequency or Analog output signal from flow meter (refer to wiring diagram for terminal or wiring specific output) For Frequency Flow Meters: GPM = Frequency in Hz x 60 / Meter Factor (Refer to calibration tag for meter factor) For Analog Flow Meter: GPM = Full Scale * (mA DC Value - 4) / 16 (Refer to calibration tag for Full Scale output)								
10.3	Compare and record the displayed values with those shown on BTU meter certificate of calibration and the network, where appropriate.								

4.4 NETWORK CONFIGURATION





Connecting via BACnet MS/TP	Connecting via BACnet UDP/IP
1. Power on unit to verify it is functioning properly. After verifying power down the unit.	1. Power on unit to verify it is functioning properly. After verifying power down the unit.
2. Wire MS/TP cables to unit. • The RS485 network cable connections are polarity sensitive and must be connected the same way on every device (i.e. + to + and - to -). • Shield drain connections should be daisy chained in the same manner as the signal cables for RS485. The shield drain wire should be left unterminated at the end of the cable and connected to earth only at the network master controller. Shield wires must not be connected to the RS485 connector on the System-1000 • The maximum number of devices allowed on an RS485 network segment without a repeater is 32. Adding more than 32 devices to a single segment may reduce the transceiver output voltage to a level that is too low to be distinguished from back ground noise on the cable.	2. Connect ethernet cable to unit.
3. Connect power to unit.	3. Connect power to unit.
4. Navigate to the systems network configuration. From the main menu select: User Configurations -> Network -> BACnet MS/TP	4. Navigate to the systems network configuration. From the main menu select: User Configurations -> Network -> BACnet UDP/IP
5. Configure device as needed. Default values are listed below. **Baud Rates**: 38400 **Device Address**: 128* **Device Instance**: 57017 **Max Master**: 127	5. Configure device as needed. Default values are listed below. **Default Address**: 192.168.1.24 **Instance Number**: 57017 **Subnet Mask**: 255.255.255.0 **Gateway Address**: Programmable **UDP port**: 47808
6. Power cycle the device and it is now ready to connect to the controller or next device in the trunk.	6. Power cycle the device and it is now ready to connect to the controller or next device in the trunk. Note: Power cycling is always required after changing network settings.

*Set to 128 in order to prevent bus contention, user will need to set to a value from 0-127 in order to communicate

Checking Network Status

Connecting via BACnet MS/TP	Connecting via BACnet UDP/IP
1. From the main menu, select diagnostics • If the meter is connected to an active network, System-1000 display will show Active on the NETWORK message	1. From the main menu, select diagnostics • If the meter is connected to an active network, System-1000 display will show Active on the NETWORK message
2. Link Down: No traffic has been seen in 60 seconds Link Up: Traffic has been seen in the last 60 seconds	2. Link Down: The ethernet hardware does not detect that it is physically connected to another ethernet interface Up, Active: The ethernet hardware has seen traffic in the last 15 seconds Up, Inactive: No traffic has been seen by the ethernet hardware in 15 seconds

IMPORTANT NOTE FOR BACnet MS/TP CONNECTIONS

If the meter is not connected to an active network the following electrical testing can be performed with a multimeter. If the readings are outside for the normal ranges listed below, please refer to manual for common issues.

I. Check Resistance (set multimeter to Ohms)
- Shield
- Earth Ground

Normal reading: 0 Ohms

II. Check DC Voltage (set multimeter to DC)
- A-
- B+

Normal reading: 0.2 VDC

III. Check DC Voltage (set multimeter to DC)
- Earth Ground
- B+

Normal reading: 2.0 - 2.5 VDC

IV. Check DC Voltage (set multimeter to DC)
- Earth Ground
- A-

Normal reading: 2.0 - 2.5 VDC

V. Check DC Voltage (set multimeter to DC)
- B+
- Earth Ground

Normal reading: Less than 2.0 VDC

VI. Check DC Voltage (set multimeter to DC)
- A-
- Earth Ground

Normal reading: Less than 2.0 VDC

BACnet Protocol Implementation Conformance Statement

Date: 01/03/2023
Vendor Name: ONICON Inc.
Product Name: System 1000
Product Model Number: SYS-1100-111, SYS-1100-121, SYS-1200-111, SYS-1200-121
Application Software Version: 1.26.1
Firmware Revision: 1.3.0
BACnet Protocol Revision: 16

BACnet Standardized Device Profiles Supported (Annex L):

■ BACnet Application Specific Controller (B-ASC)

BACnet Interoperability Building Blocks Supported (Annex K): DS-RP-B, DS-RPM-B, DS-WP-B, DS-WPM-B, DS-COV-B, AE-N-I-B, AE-ACK-B, AE-INFO-B, AE-CRL-B, DM-DDB-B, DM-DOB-B, DM-DCC-B, DM-TS-B, DM-UTC-B, DM-RD-B

Segmentation Capability:

☐ Able to transmit segmented messages Window Size _____
☐ Able to receive segmented messages Window Size _____

Standard Object Types Supported:

Dynamic object creation and deletion is not supported for any object type.

Analog Input
Optionally Writable Required Properties:
Object Name
Conditionally Writable Properties:
Present Value (commandable when "Out of Service" is True)
Optional Properties Supported:
Description (W), COV Increment (W), Time Delay (W), Notification Class, High Limit (W), Low Limit (W), Deadband (W), Limit Enable (W), Event Enable (W), Acked Transition Bits, Notify Type, Event Time Stamps, Event Text Messages, Event Algorithm Inhibit Ref, Event Algorithm Inhibit

Analog Value
Optionally Writable Required Properties:
Object Name
Conditionally Writable Properties:
Present Value ("user defined" and "aux" pulse total AV objects are resettable by writing 0)
Optional Properties Supported:
Description (W), Priority Array, COV Increment (W), Relinquish Default

Binary Input
Optionally Writable Required Properties:
Object Name
Optional Properties Supported:
Description (W), Inactive Text, Active Text

Binary Value
Optionally Writable Required Properties:
Object Name, Present Value
Optional Properties Supported:
Description (W), Inactive Text, Active Text, Priority Array (W), Relinquish Default (W)

Device
Optionally Writable Required Properties:
Object Identifier, Object Name, APDU Timeout, Number of APDU Retries
Optional Properties Supported:
Description (W), Local Date (W), Local Time (W), UTC Offset (W), Daylight Savings Status (W), Max Master (W), Max Info Frames (W)

File
Optionally Writable Required Properties:
Object Name
Optional Properties Supported:
Description (W)

Multi-state Value
Optionally Writable Required Properties:
Object Name
Optional Properties Supported:
Description (W), State Text

Notification Class
Optionally Writable Required Properties:
Object Name, Ack Required, Recipient List
Optional Properties Supported:
Description (W)

Large Analog Value
Optionally Writable Required Properties:
Object Name
Conditionally Writable Properties:
Present Value ("user defined" and "aux" pulse total AV objects are resettable by writing 0)
Optional Properties Supported:
Description (W), Priority Array, COV Increment (W), Relinquish Default

BACnet Data Link Layer Options:

■ BACnet IP, (Annex J)
■ MS/TP master (Clause 9)
■ Master ☐ Slave
☐ Non-isolated transceiver ■ Isolated transceiver
■ Local 47K ohms bias resistors ☐ None ☐ Other: _____
Transceiver unit loading: ☐ 1 ☐ ½ ☐ ¼ ■ ⅛
Data rates: ■ 9600 ■ 19200 ■ 38400 ■ 57600 ■ 76800 ☐ 115200

Device Address Binding:

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

Character Sets Supported:

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

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

Object List:

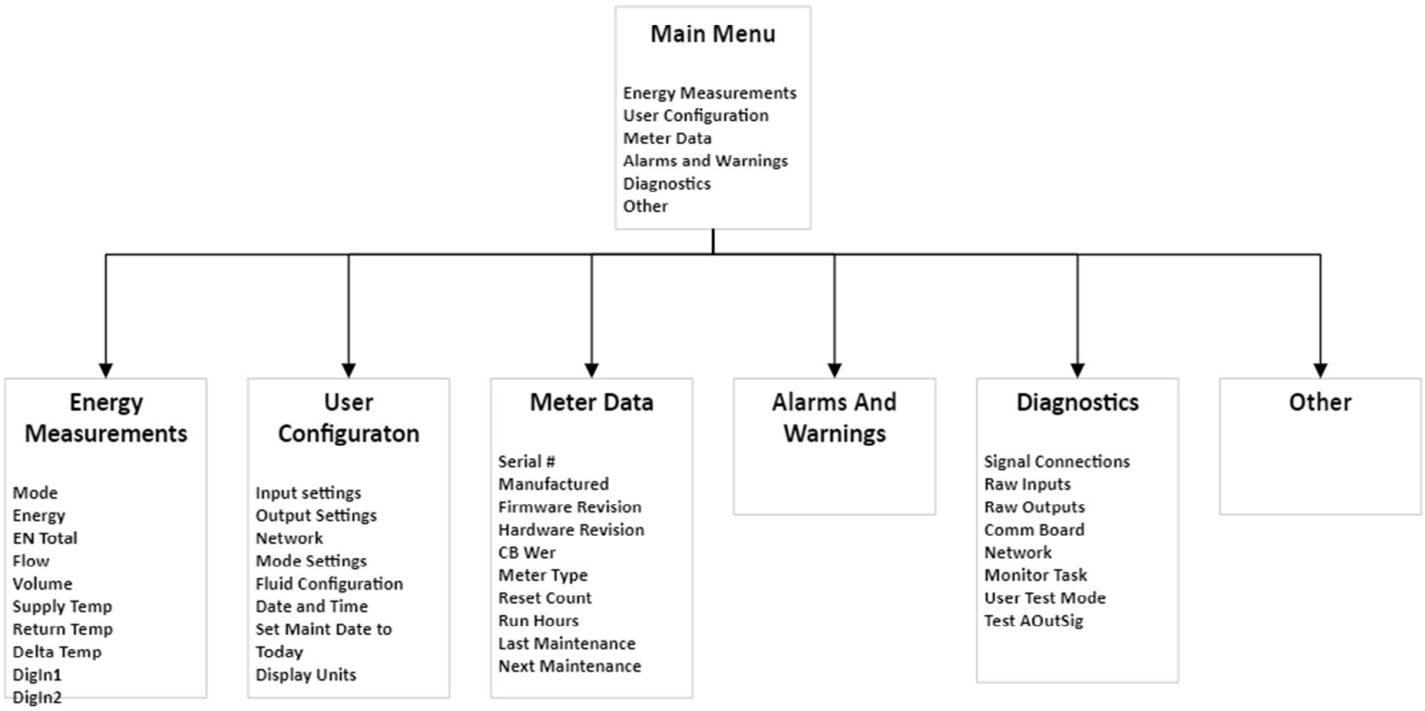
Object Identifier	Object Name	Description
AI 0	Energy Rate Ch. 1	Thermal Energy Rate of Channel 1
AI 1	Volume Rate Ch. 1	Volumetric flow rate of primary meter on Channel
AI 2	Volume Rate Primary Only Ch. 1	Volumetric flow rate primary meter only. If the unit is configured for addition or subtraction, AI 1 becomes the result of the operation
AI 3	Supply Temp Ch. 1	Present supply temperature for Channel 1
AI 4	Return Temp Ch. 1	Present return temperature for Channel 1
AI 6	Delta Temp Ch. 1	Present differential temperature for Channel 1
AI 6	AUX Input Ch. 1	Present Secondary Rate for Channel 1 (if used)
AI 7	Efficiency COP Ch. 1	Present COP. Depends on an electric meter input from AUX Input Channel 1
AI 8	Energy Rate Ch. 2	Thermal Energy Rate of Channel 2
AI 9	Volume Rate Ch. 2	Volumetric flow rate of primary meter on Channel 2
AI 10	Volume Rate Primary Only Ch. 2	Volumetric flow rate primary meter only. If the unit is configured for addition or subtraction, AI 9 becomes the result of the operation
AI 11	Supply Temp Ch. 2	Present supply temperature for Channel 2
AI 12	Return Temp Ch. 2	Present return temperature for Channel 2
AI 13	Delta Temp Ch. 2	Present differential temperature for Channel 2
AI 14	AUX Input Ch. 2	Present Secondary Rate for Channel 2 (if used)
AI 15	Efficiency COP Ch. 2	Present COP. Depends on an electric meter input from AUX Input Channel 1
AI16	Therm Energy Net Rate Ch1-Ch2	Thermal Differential between both channels (if used)

Object Identifier	Object Name	Description
AV 0	Energy Total Mode 1 Ch. 1	Non-resettable unidirectional Energy total Channel 1
AV 1	Energy Total Mode 2 Ch. 1	Non-resettable Reverse or dual mode energy total Channel 1 (Heating when it is dual mode settings)
AV 2	YTD Eng Total Mode 1 Ch. 1	Year-to-date unidirectional energy total Channel 1
AV 3	YTD Eng Total Mode 2 Ch. 1	Year-to-date Reverse or dual mode energy total Channel 1 (Heating when it is dual mode settings)
AV 4	PrevYr Eng Total Mode 1 Ch. 1	Previous year's unidirectional energy total Channel 1
AV 5	PrevYr Eng Total Mode 2 Ch. 1	Previous year's Reverse or dual mode energy total Channel 1 (Heating when it is dual mode settings)
AV 6	User Energy Total Mode 1 Ch. 1	Resettable unidirectional energy total Channel 1
AV 7	User Energy Total Mode 2 Ch. 1	Resettable Reverse or dual mode energy total Channel 1 (Heating when it is dual mode settings)
AV 8	Volume Total Mode 1 Ch. 1	Non-resettable unidirectional volume total Channel 1
AV 9	Volume Total Mode 2 Ch. 1	Non-resettable Reverse or dual mode volume total Channel 1 (Heating when it is dual mode settings)
AV 10	YTD Vol Total Mode 1 Ch. 1	Year-to-date unidirectional volume total Channel 1
AV 11	YTD Vol Total Mode 2 Ch. 1	Year-to-date Reverse or dual mode volume total Channel 1 (Heating when it is dual mode settings)
AV 12	PrevYr Vol Total Mode 1 Ch. 1	Previous year's unidirectional volume total Channel 1
AV 13	PrevYr Vol Total Mode 2 Ch. 1	Previous year's Reverse or dual mode volume total Channel 1 (Heating when it is dual mode settings)
AV14	User Vol Total Mode 1 Ch. 1	Resettable unidirectional volume total Channel 1
AV15	User Vol Total Mode 2 Ch. 1	Resettable Reverse or dual mode volume total Channel 1 (Heating when it is dual mode settings)
AV16	AuxIn Total Ch. 1	Non-resettable aux secondary rate meter total Channel 1
AV17	YTD Aux Total Ch. 1	Year-to-date aux secondary rate meter total Channel 1
AV 18	PrevYr Aux Total Ch. 1	Previous year's aux secondary rate meter total Channel 1
AV 19	User Aux Total Ch. 1	Resettable aux secondary rate meter total Channel 1 (Heating when it is dual mode settings)
AV 20	Energy Total Mode 1 Ch. 2	Non-resettable unidirectional Energy total Channel 2
AV 21	Energy Total Mode 2 Ch. 2	Non-resettable Reverse or dual mode energy total Channel 2 (Heating when it is dual mode settings)
AV 22	YTD Eng Total Mode 1 Ch. 2	Year-to-date unidirectional energy total Channel 2
AV 23	YTD Eng Total Mode 2 Ch. 2	Year-to-date Reverse or dual mode energy total Channel 2 (Heating when it is dual mode settings)
AV 24	PrevYr Eng Total Mode 1 Ch. 2	Previous year's unidirectional energy total Channel 2
AV 25	PrevYr Eng Total Mode 2 Ch. 2	Previous year's Reverse or dual mode energy total Channel 2 (Heating when it is dual mode settings)
AV 26	User Energy Total Mode 1 Ch. 2	Resettable unidirectional energy total Channel 2
AV 27	User Energy Total Mode 2 Ch. 2	Resettable Reverse or dual mode energy total Channel 2 (Heating when it is dual mode settings)
AV 28	Volume Total Mode 1 Ch. 2	Non-resettable unidirectional volume total Channel 2
AV 29	Volume Total Mode 2 Ch. 2	Non-resettable Reverse or dual mode volume total Channel 2 (Heating when it is dual mode settings)
AV 30	YTD Vol Total Mode 1 Ch. 2	Year-to-date unidirectional volume total Channel 2

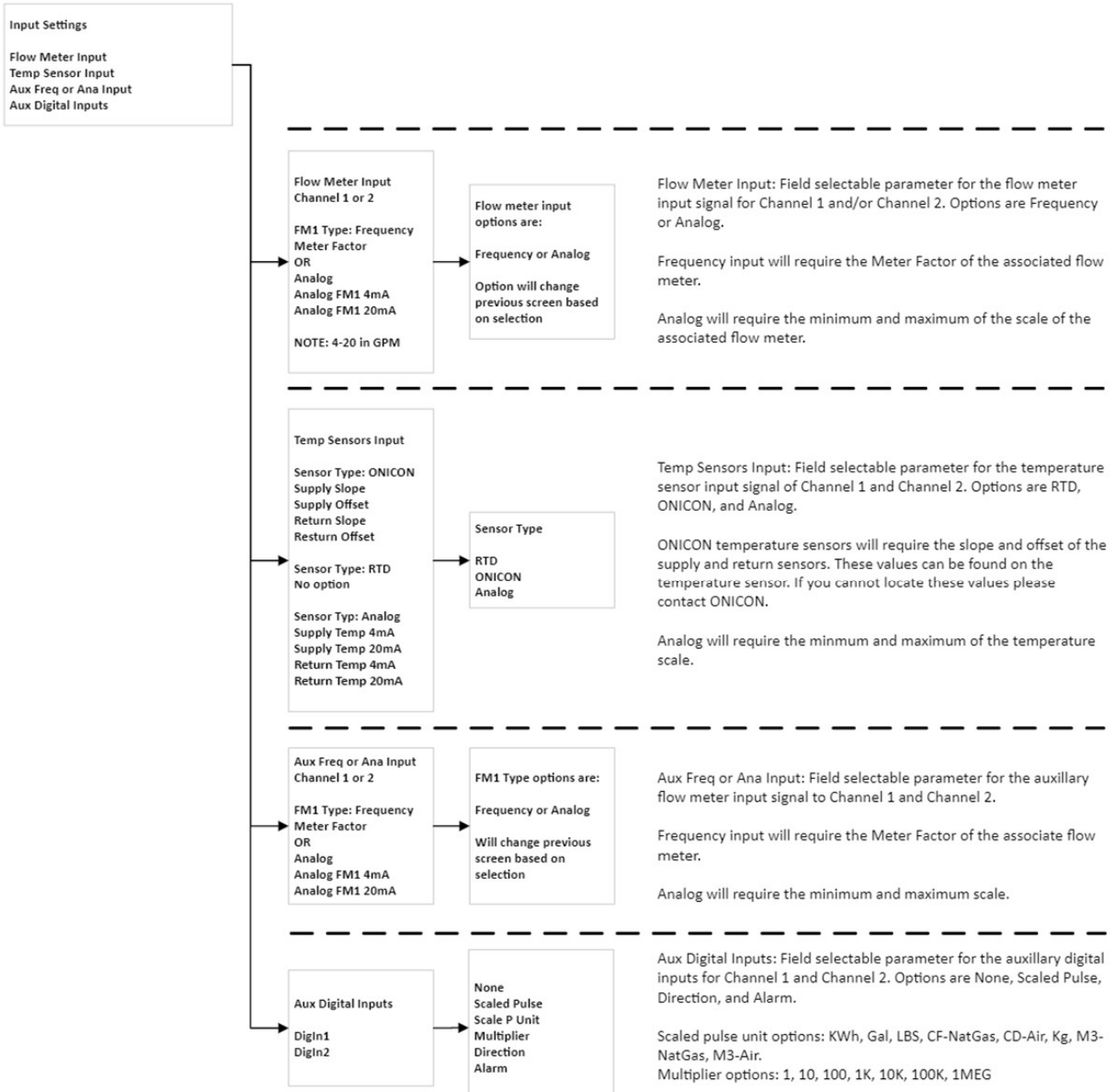
Object Identifier	Object Name	Description
AV 31	YTD Vol Total Mode 2 Ch. 2	Year-to-date Reverse or dual mode volume total Channel 2 (Heating when it is dual mode settings)
AV 32	PrevYr Vol Total Mode 1 Ch. 2	Previous year's unidirectional volume total Channel 2
AV 33	PrevYr Vol Total Mode 2 Ch. 2	Previous year's Reverse or dual mode volume total Channel 2 (Heating when it is dual mode settings)
AV 34	User Vol Total Mode 1 Ch. 2	Resettable unidirectional volume total Channel 2
AV 35	User Vol Total Mode 2 Ch. 2	Resettable Reverse or dual mode volume total Channel 2 (Heating when it is dual mode settings)
AV 36	Auxin Total Ch. 2	Non-resettable aux secondary rate meter total Channel 2
AV 37	YTD Aux Total Ch. 2	Year-to-date aux secondary rate meter total Channel 2
AV 38	PrevYr Aux Total Ch. 2	Previous year's aux secondary rate meter total Channel 2
AV 39	User Aux Total Ch. 2	Resettable aux secondary rate meter total Channel 2 (Heating when it is dual mode settings)
AV 40	Aux Pulse Input Total 1	Non-resettable aux 1 pulse totalization Channel 1
AV 41	Aux Pulse Input YTD Total 1	Year-to-date aux 1 pulse totalization Channel 1
AV 42	Aux Pulse Input PrevYr Total 1	Previous year's aux 1 pulse totalization Channel 1
AV 43	Aux Pulse Input User Total 1	Resettable aux 1 pulse totalization Channel 1
AV 44	Aux Pulse Input Total 2	Non-resettable aux 2 pulse totalization Channel 1
AV 45	Aux Pulse Input YTD Total 2	Year-to-date aux 2 pulse totalization Channel 1
AV 46	Aux Pulse Input PrevYr Total 2	Previous year's aux 2 pulse totalization Channel 1
AV 47	Aux Pulse Input User Total 2	Resettable aux 2 pulse totalization Channel 1
AV 48	Aux Pulse Input Total 3	Non-resettable aux 3 pulse totalization Channel 1
AV 49	Aux Pulse Input YTD Total 3	Year-to-date aux 3 pulse totalization Channel 1
AV 50	Aux Pulse Input PrevYr Total 3	Previous year's aux 3 pulse totalization Channel 1
AV 51	Aux Pulse Input User Total 3	Resettable aux 3 pulse totalization Channel 1
AV 52	Aux Pulse Input Total 4	Non-resettable aux 4 pulse totalization Channel 1
AV 53	Aux Pulse Input YTD Total 4	Year-to-date aux 4 pulse totalization Channel 1
AV 54	Aux Pulse Input PrevYr Total 4	Previous year's aux 4 pulse totalization Channel 1
AV 55	Aux Pulse Input User Total 4	Resettable aux 4 pulse totalization Channel 1
AV 56	Run hours	Elapsed system runtime in hours

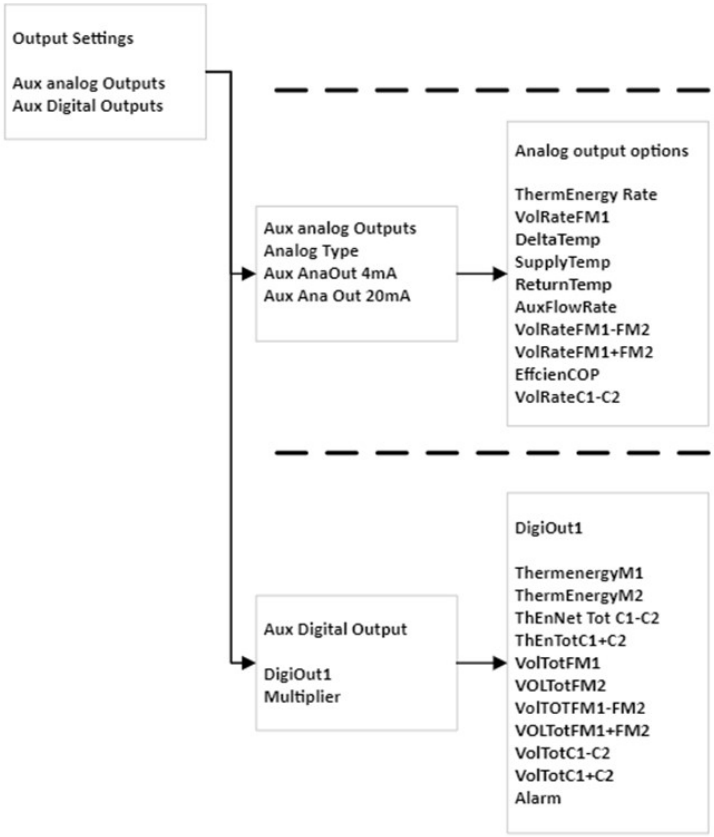
Object Identifier	Object Name	Description
BI 0	Mode Indication Ch. 1	Indicates current operating mode (Mode 1 or Mode 2) for Channel 1. Mode 1 = Forward Cooling / Mode 2 = Reverse Heating
BI 1	Alarm Ch. 1	Identifies parameters such as Flow, Temp, Energy, or Aux input for Channel 1 outside of the high and low limits.
BI 2	Mode Indication Ch. 2	Indicates current (forward or reverse) flow direction
BI 3	Alarm Ch. 2	Indicates current operating mode (Mode 1 or Mode 2) for Channel 2. Mode 1 = Forward Cooling / Mode 2 = Reverse Heating
BI 4	Aux In Alarm 1	State of the alarm if digital in 1 is configured for alarm input.
BI 5	Aux In Alarm 2	State of the alarm if digital in 2 is configured for alarm input.
BI 6	Aux In Alarm 3	State of the alarm if digital in 3 is configured for alarm input.
BI 7	Aux In Alarm 4	State of the alarm if digital in 4 is configured for alarm input.
BI 9	System Fault	System error

SECTION 5.0 MENU TREE



The real time data is found in the Energy Measurements Menu.


Input Settings
Flow Meter Input
Temp Sensor Input
Aux Freq or Ana Input
Aux Digital Inputs
Flow Meter Input
Channel 1 or 2
FM1 Type: Frequency
Meter Factor
OR
Analog
Analog FM1 4mA
Analog FM1 20mA
NOTE: 4-20 in GPM
Flow meter input options are:
Frequency or Analog
Option will change previous screen based on selection
Flow Meter Input: Field selectable parameter for the flow meter input signal for Channel 1 and/or Channel 2. Options are Frequency or Analog.
Frequency input will require the Meter Factor of the associated flow meter.
Analog will require the minimum and maximum of the scale of the associated flow meter.
Temp Sensors Input
Sensor Type: ONICON
Supply Slope
Supply Offset
Return Slope
Resturn Offset
Sensor Type: RTD
No option
Sensor Typ: Analog
Supply Temp 4mA
Supply Temp 20mA
Return Temp 4mA
Return Temp 20mA
Sensor Type
RTD
ONICON
Analog
Temp Sensors Input: Field selectable parameter for the temperature sensor input signal of Channel 1 and Channel 2. Options are RTD, ONICON, and Analog.
ONICON temperature sensors will require the slope and offset of the supply and return sensors. These values can be found on the temperature sensor. If you cannot locate these values please contact ONICON.
Analog will require the minmum and maximum of the temperature scale.
Aux Freq or Ana Input
Channel 1 or 2
FM1 Type: Frequency
Meter Factor
OR
Analog
Analog FM1 4mA
Analog FM1 20mA
FM1 Type options are:
Frequency or Analog
Will change previous screen based on selection
Aux Freq or Ana Input: Field selectable parameter for the auxillary flow meter input signal to Channel 1 and Channel 2.
Frequency input will require the Meter Factor of the associate flow meter.
Analog will require the minimum and maximum scale.
Aux Digital Inputs
DigIn1
DigIn2
None
Scaled Pulse
Scale P Unit
Multiplier
Direction
Alarm
Aux Digital Inputs: Field selectable parameter for the auxillary digital inputs for Channel 1 and Channel 2. Options are None, Scaled Pulse, Direction, and Alarm.
Scaled pulse unit options: KWh, Gal, LBS, CF-NatGas, CD-Air, Kg, M3-NatGas, M3-Air.
Multiplier options: 1, 10, 100, 1K, 10K, 100K, 1MEG
NOTE: To switch between SI and Imperial units the correct parameter must be chosen in Display Units



Aux Analog Outputs: The SYS-1000 can be factory configured with QTY (4) or QTY (8) analog outputs. Each analog output can be field configured for a variety of energy and flow readings.

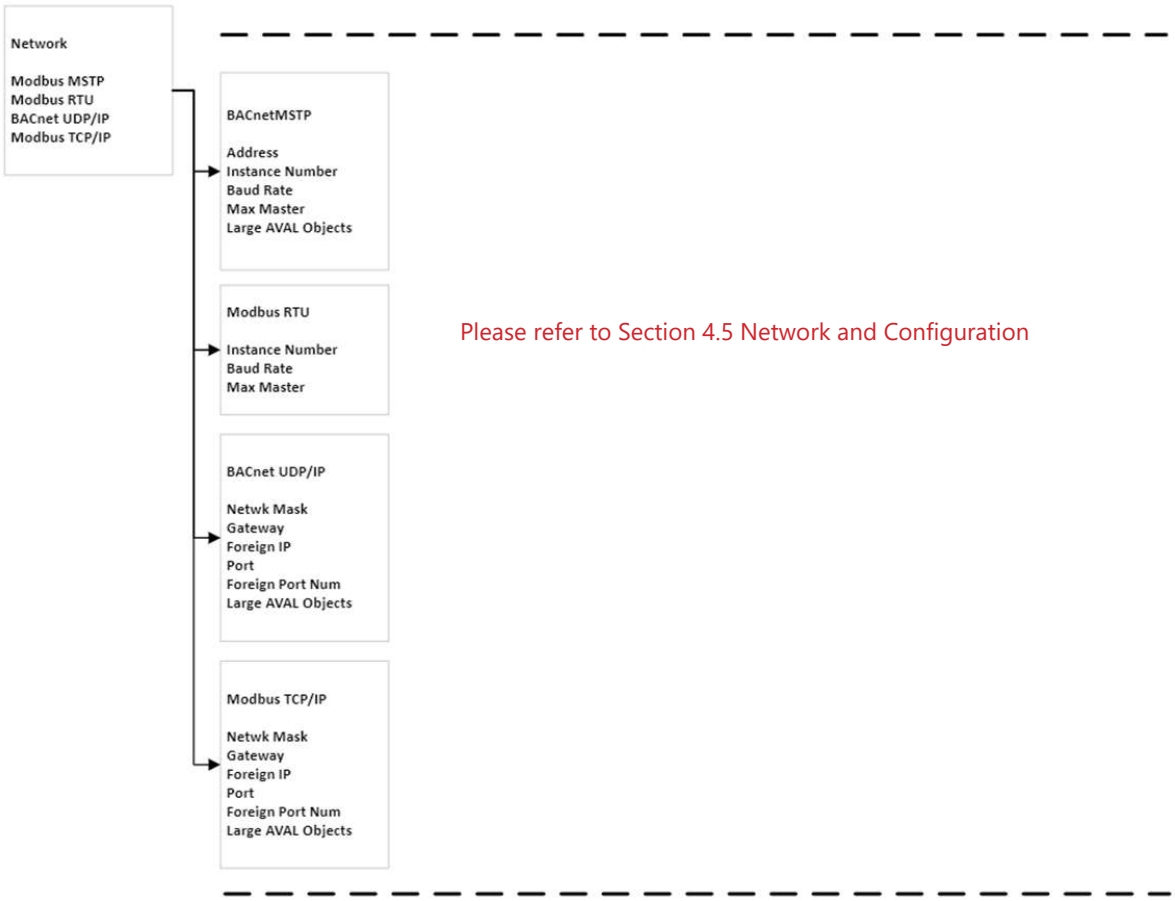
Each setting will require the minimum and maximum of scale.

Each setting will require the minimum and maximum of the scale.

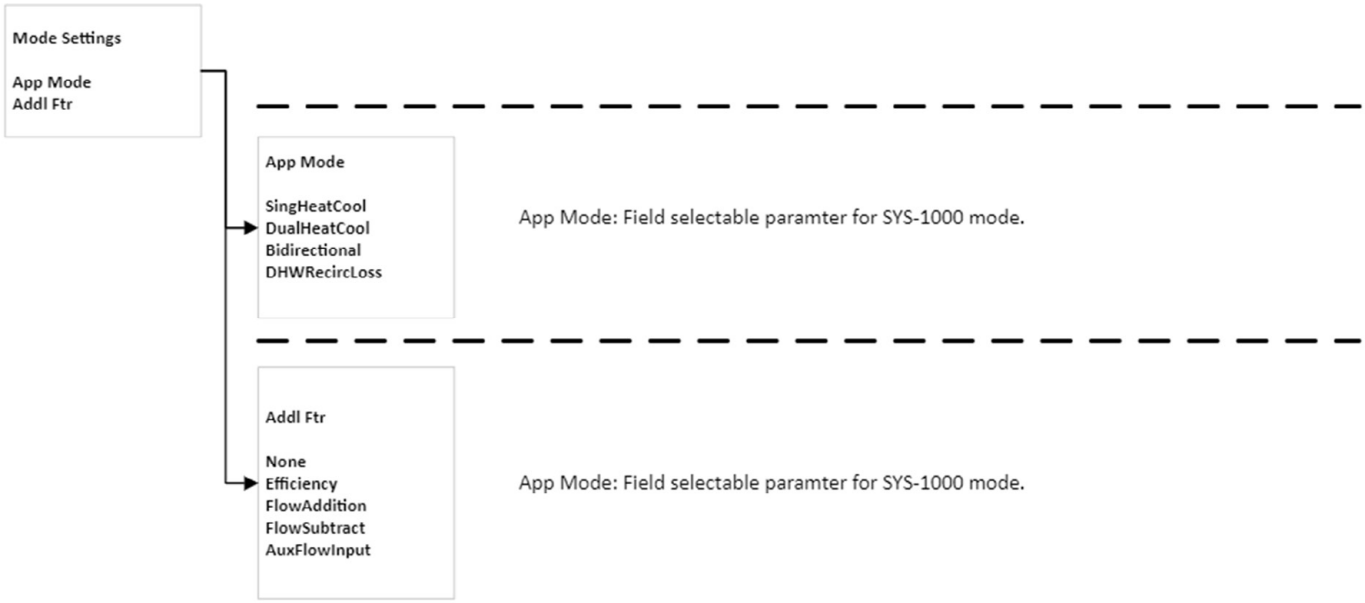
Aux Digital Outputs: The SYS-1000 can be factory configured with QTY (4) or QTY (8) digital outputs. Each digital output can be field configured for a variety of energy and flow readings.

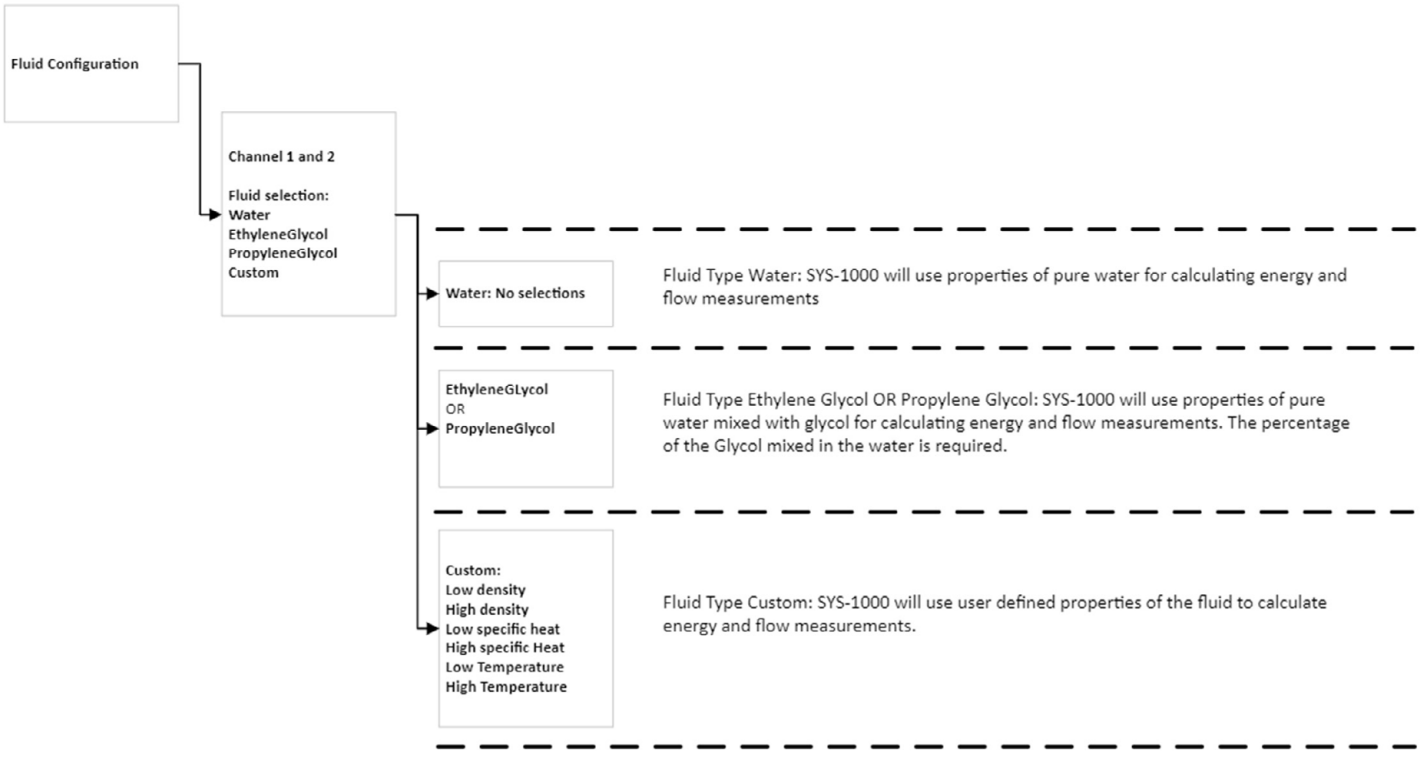
Multiplier options: 1, 10, 100, 1K, 10K, 100K, 1MEG

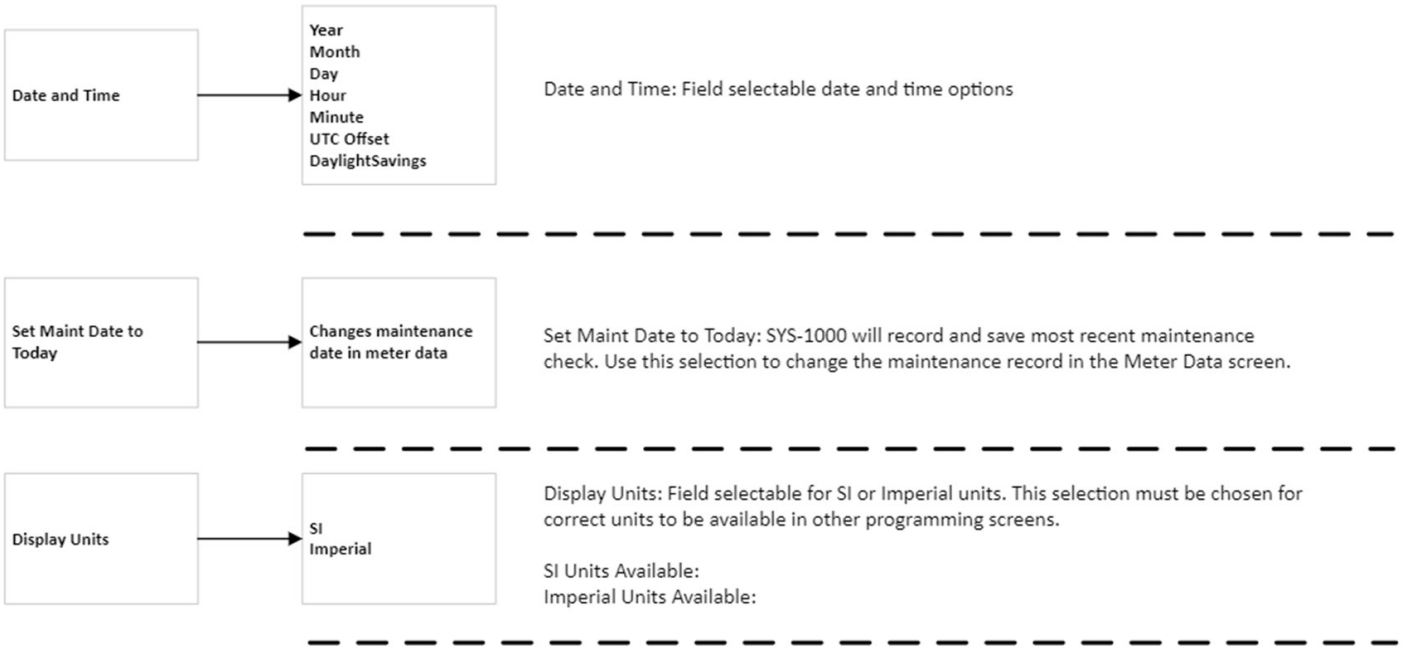
Multiplier options: 1, 10, 100, 1K, 10K, 100K, 1MEG



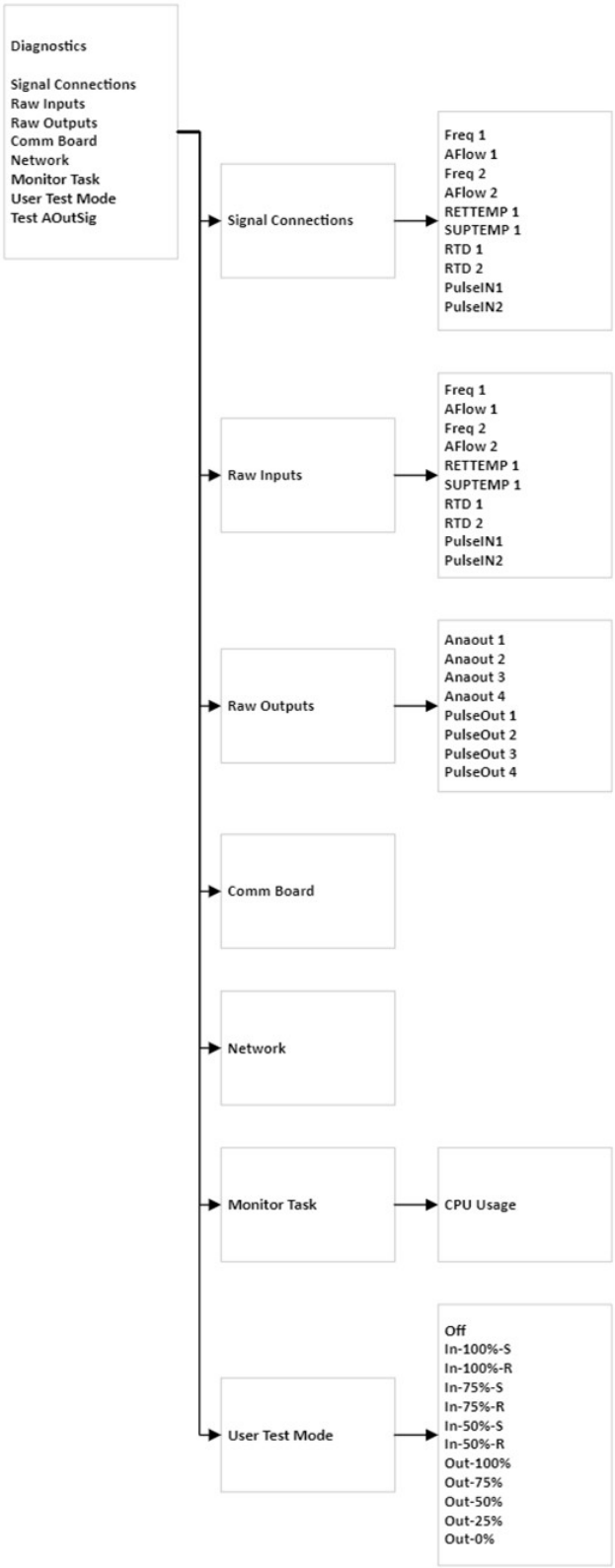
Please refer to Section 4.5 Network and Configuration


Mode Settings
App Mode
Addl Ftr
App Mode
SingHeatCool
DualHeatCool
Bidirectional
DHWRecircLoss
App Mode: Field selectable paramter for SYS-1000 mode.
Addl Ftr
None
Efficiency
FlowAddition
FlowSubtract
AuxFlowInput
App Mode: Field selectable paramter for SYS-1000 mode.


Fluid Configuration
Channel 1 and 2
Fluid selection:
Water
EthyleneGlycol
PropyleneGlycol
Custom
Water: No selections
Fluid Type Water: SYS-1000 will use properties of pure water for calculating energy and flow measurements
EthyleneGLycol
OR
PropyleneGlycol
Fluid Type Ethylene Glycol OR Propylene Glycol: SYS-1000 will use properties of pure water mixed with glycol for calculating energy and flow measurements. The percentage of the Glycol mixed in the water is required.
Custom:
Low density
High density
Low specific heat
High specific Heat
Low Temperature
High Temperature
Fluid Type Custom: SYS-1000 will use user defined properties of the fluid to calculate energy and flow measurements.


Date and Time
Year
Month
Day
Hour
Minute
UTC Offset
DaylightSavings
Date and Time: Field selectable date and time options
Set Maint Date to Today
Changes maintenance date in meter data
Set Maint Date to Today: SYS-1000 will record and save most recent maintenance check. Use this selection to change the maintenance record in the Meter Data screen.
Display Units
SI
Imperial
Display Units: Field selectable for SI or Imperial units. This selection must be chosen for correct units to be available in other programming screens.
SI Units Available:
Imperial Units Available:

SECTION 6.0 DIAGNOSTICS



Signal Connections: Provides status of the wire connection to the SYS-1000.

Open: Wire not connected properly. Check wiring diagram.

Short: Wire not connected properly or short in the flow meter signal

Good: Wire connected properly

Raw Inputs: Function as a multimeter for the incoming signals to SYS-1000. Provides the current (mA) or frequency (Hz) measured signal from the flow meter, and Resistance (ohms) if an RTD is connected.

Raw outputs: Function as a multimeter for the outgoing signals of the SYS-1000. Provides the current (mA) leaving from the analog output, and binary state for the pulse output.

Comm Board: Provides a status of the physical connection of the board.

Active: communication board is connected to the main board.

Not connected: Main board is unable to communicate with the communications board. Contact ONICON if the communications board is damaged or unresponsive.

Network: Provides information about the communication with the network.

For IP networks:

Link Down: The ethernet hardware does not detect that it is physically connected to another ethernet interface.

Up, Active: The ethernet hardware has seen traffic in the last 15 seconds.

Up, Inactive: No traffic has been seen by the ethernet hardware in 15 seconds.

For RS485 Networks:

Link Down: No traffic has been seen in 60 seconds.

Link Up: Traffic has been seen in the last 60 seconds.

Monitor Task: Reserved for ONICON Support. Please provide a picture of the display if there is a firmware issue identified.

User Test Mode: Provides a simulation to test functionality of the SYS-1000.

In-100%-S: Simulates 100% of the configured input signals and 100% of the supply temperature. Input simulation calculation can be seen in the main Measurement Screen section, it will provide a signal output, a communicate the calculations over the network.

Out 100%: simulate 100% of the configured output signals. This option will not change the measurement values, nor it will communicate the info to the network.

6.1 ALARM MESSAGES

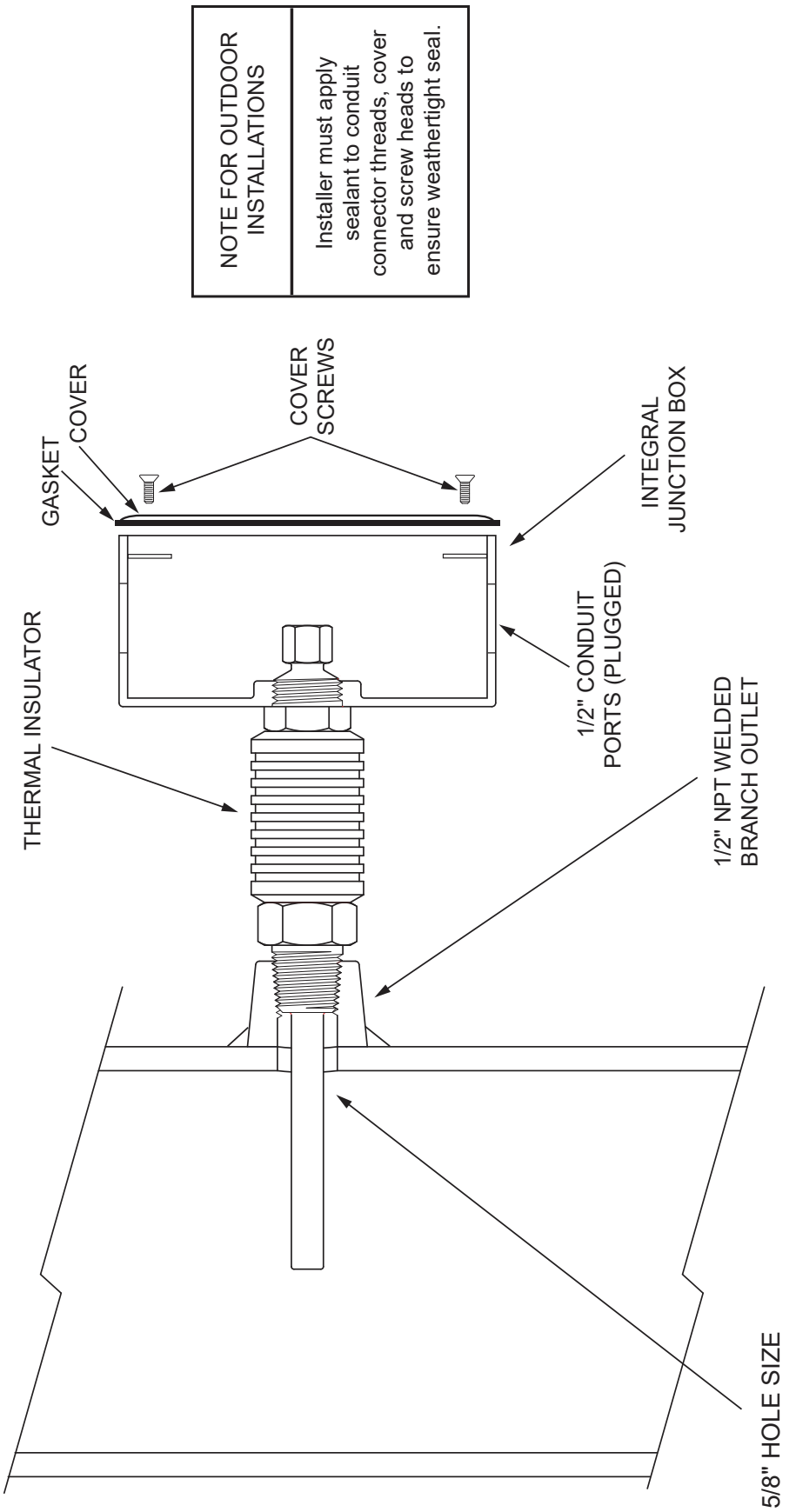
Alarm Message	Potential Issue	Possible Solution
ERROR SYSTEM FAULT	This message indicates a hardware malfunction.	Cycle Power to the meter. If the problem persists, please contact ONICON
ERROR EEPROM FAIL	This message indicates a hardware malfunction.	Cycle Power to the meter. If the problem persists, please contact ONICON
ERROR SPI I2C FAIL	This message indicates a hardware malfunction.	Cycle Power to the meter. If the problem persists, please contact ONICON
METER CONFIGURATION CORRUPT	Flowmeter configured parameters are not valid.	Verify all configured parameters match the configuration on your ONICON calibration certificates
ALARM LOW FLOW	The flow reading is below the minimum flow threshold of the meter (e.g. 0.5% of meters configured full scale).	Increase flow through the pipe. Increase configured full scale of the flow meter.
ALARM SUPPLY TEMP OPEN	The supply temperature sensor in the is reading open.	Verify temperature sensor wiring to the SYS-1000
ALARM SUPPLY TEMP SHORT	The supply temperature sensor is reading as a short circuit.	Verify temperature sensor wiring to the SYS-1000
ALARM SUPPLY TEMP LOW	The supply temperature reading is below the minimum temperature threshold of the meter (Default value is 15°F).	Reduce minimum temperature threshold via serial communication
ALARM SUPPLY TEMP HIGH	The supply temperature reading is above the minimum temperature threshold of the meter (Default value is 200°F).	Increase maximum temperature threshold via serial communication
ALARM SUPPLY TEMP BAD REFERENCE	This message indicates a hardware malfunction.	Cycle Power to the meter. If the problem persists, please contact ONICON
ALARM RETURN TEMP OPEN	The return temperature sensor in the is reading open.	Verify temperature sensor wiring to the SYS-1000
ALARM RETURN TEMP SHORT	The return temperature sensor is reading as a short circuit.	Verify temperature sensor wiring to the SYS-1000
ALARM RETURN TEMP LOW	The return temperature reading is below the minimum temperature threshold of the meter (Default value is 15°F).	Reduce minimum temperature threshold via serial communication
ALARM RETURN TEMP HIGH	The return temperature reading is above the minimum temperature threshold of the meter (Default value is 200°F).	Increase maximum temperature threshold via serial communication
ALARM RETURN TEMP BAD REFERENCE	This message indicates a hardware malfunction.	Cycle Power to the meter. If the problem persists, please contact ONICON

Alarm Message	Potential Issue	Possible Solution
ALARM DELTA T LOW	This is a warning message that the delta temperature is low.	Decrease delta temperature threshold via serial communication
ALARM DELTA T HIGH	This is a warning message that the delta temperature is high.	Increase delta temperature threshold via serial communication
ALARM ENERGY HIGH	This is a warning message that the delta temperature is high.	Increase delta temperature threshold via serial communication
WARN AOUT LOW FLOW	This is a warning that the flow reading is below the minimum flow threshold of the meter. (e.g. less than 5.0% of full scale)	Increase flow through the pipe. Decrease configured minimum full scale of the flow meter.
WARN AOUT HIGH FLOW	This is a warning that the flow reading is above the maximum flow threshold of the meter. (e.g. greater than 95.0% of full scale)	Decrease flow through the pipe. Increase configured maximum full scale of the flow meter.
WARN AOUT LOW ENERGY	This is a warning that the energy rate is below the set point low limit. (If low limit is not set the default is 100BTU/hr)	Decrease energy rate threshold via serial communication
WARN AOUT HIGH ENERGY RATE	The supply temperature reading is below the minimum temperature threshold of the meter (Default value is 15°F).	Decrease temperature threshold via serial communication
WARN SUPPLY TEMP LOW	Warning that the supply temperature is within 5% of the low rate limit.	Adjust supply low temperature limit. Check wiring of temperature sensors. Use diagnostic function to test input terminals.
WARN SUPPLY TEMP HIGH	Warning that the supply temperature is within 5% of the high rate limit.	Adjust supply high temperature limit. Check wiring of temperature sensors. Use diagnostic function to test input terminals.
WARN RETURN TEMP LOW	Warning that the return temperature is within 5% of the low rate limit.	Adjust return low temperature limit. Check wiring of temperature sensors. Use diagnostic function to test input terminals.
WARN RETURN TEMP HIGH	Warning that the return temperature is within 5% of the high rate limit.	Adjust return high temperature limit. Check wiring of temperature sensors. Use diagnostic function to test input terminals.
WARN DT< MINIMUM	Warning that the delta temperature is within 5% of the minimum limit.	Adjust supply/return temperature limits. Check wiring of temperature sensors. Use diagnostic function to test input terminals.
WARN DT > MAXIMUM	Set when energy rate temperature is higher than 0.95 * ALARM_DELTA_TEMP_HIGH (see above)	Adjust supply/return temperature limits. Check wiring of temperature sensors. Use diagnotic function to test input terminals.
WARN RTC FAIL	Warning that the internal battery has failed.	Replace internal battery. The main board must be removed to access the battery. Contact ONICON for assistance in correcting this.

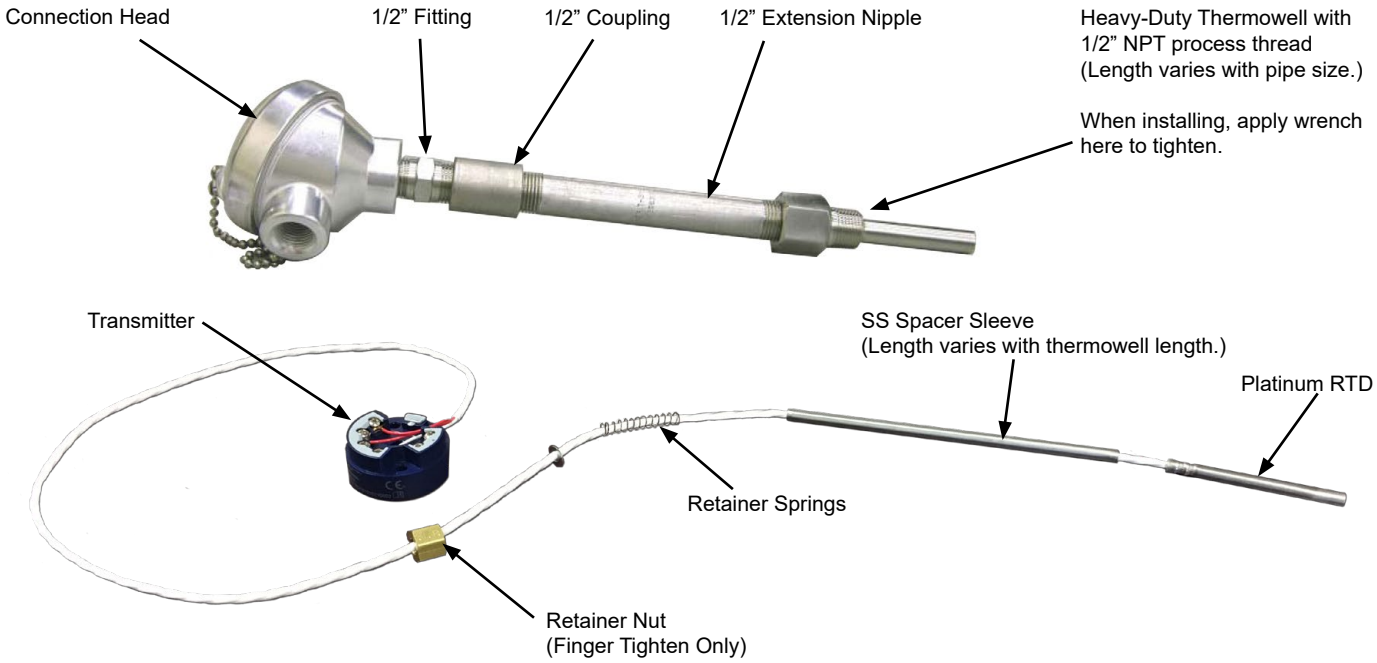
Alarm Message	Potential Issue	Possible Solution
WARN PULSE OVERRUN OUTPUT 1	Volume (Flow) Scale Overrun – This alarm is present whenever the volume flow rate causes the incremental volume total to accumulate at a rate that is too fast.	To clear this alarm message, first confirm that the flow rate data and pipe diameter data on the tag attached to the meter corresponds with the actual flow rate and actual pipe diameter. Any mismatch between the calibrated and actual flow rates or the calibrated and actual pipe diameter will cause this alarm message to appear. Contact ONICON for assistance in correcting this condition.
WARN PULSE OVERRUN OUTPUT 2	Volume (Flow) Scale Overrun – This alarm is present whenever the volume flow rate causes the incremental volume total to accumulate at a rate that is too fast.	To clear this alarm message, first confirm that the flow rate data and pipe diameter data on the tag attached to the meter corresponds with the actual flow rate and actual pipe diameter. Any mismatch between the calibrated and actual flow rates or the calibrated and actual pipe diameter will cause this alarm message to appear. Contact ONICON for assistance in correcting this condition.
WARN SD CARD FAIL	SD card for logging data is missing or faulty	Contact ONICON for assistance in correcting this condition.

APPENDIX A – DRAWINGS

OUTDOOR THERMOWELL ASSEMBLY IN WELDED PIPE



HEAVY DUTY THERMOWELL ASSEMBLY FOR SYSTEM-1000 BTU METERS FOR PROCESS TEMPERATURES OVER 300°F



IMPORTANT NOTE
The thermowell, extension nipple, coupling and fitting were made to a specific length. DO NOT attempt to change the length of this assembly.

Step 1:
Drill 7/8” hole in pipe. Install thermowell using fittings supplied by ONICON.

Complete steps 2 - 4 only after all welding, brazing & soldering are complete.

IMPORTANT NOTE
Each RTD and transmitter pair are matched at the factory and calibrated for a specific BTU meter. Do not separate the RTD from the transmitter and use care to ensure that the serial number on the transmitter matches the serial number of the BTU meter.

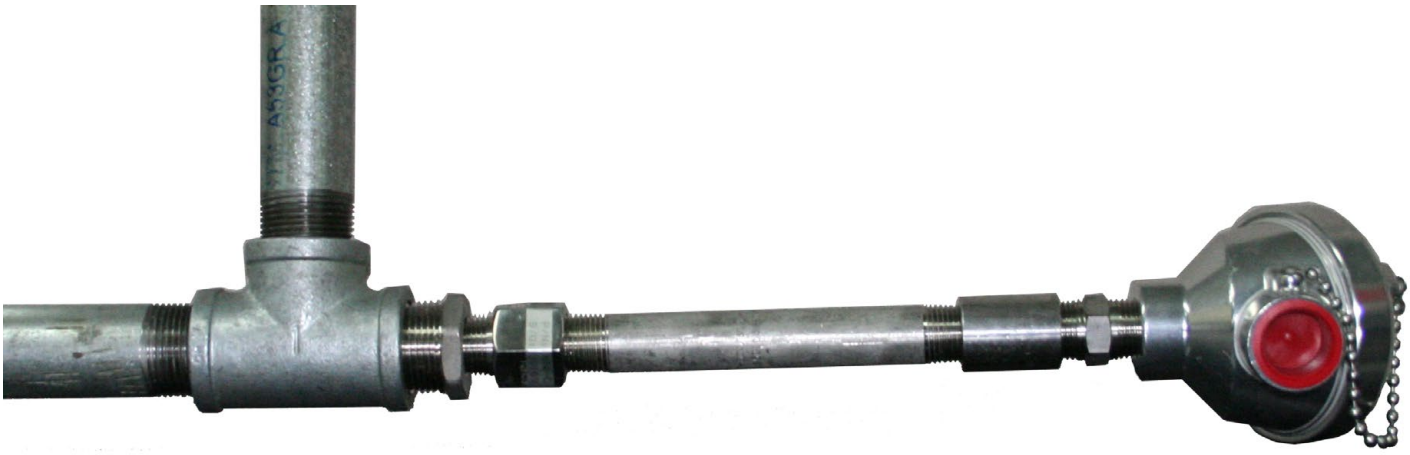
Step 2:
Remove lid and insert RTD assembly into thermowell, ensuring that it bottoms out. Thermal compound may be used; apply only a pea-sized amount to the tip of the RTD prior to insertion.

Thread retaining nut onto fitting inside the bottom of connection head. Hand tighten the retainer nut.
DO NOT OVERTIGHTEN.

Step 3:
Place the transmitter over the retainer nut, gently guiding the excess wire through the center hole of the transmitter. Use caution to avoid pinching the wires.

Step 4:
Connect field wires from the System-10 BTU meter to the transmitter as shown. Carefully coil extra wire around the transmitter and thread the lid onto the connection head.

IMPORTANT NOTE
In 1" pipe, thermowell must be installed in a customer provided tee as shown below.



The thermowell, extension nipple, coupling and fitting were made to a specific length.

DO NOT attempt to change the length of this assembly.

ONICON Incorporated • 11451 Belcher Road South • Largo, FL 33773 • USA
727.447.6140 • sales@onicon.com • onicon.com