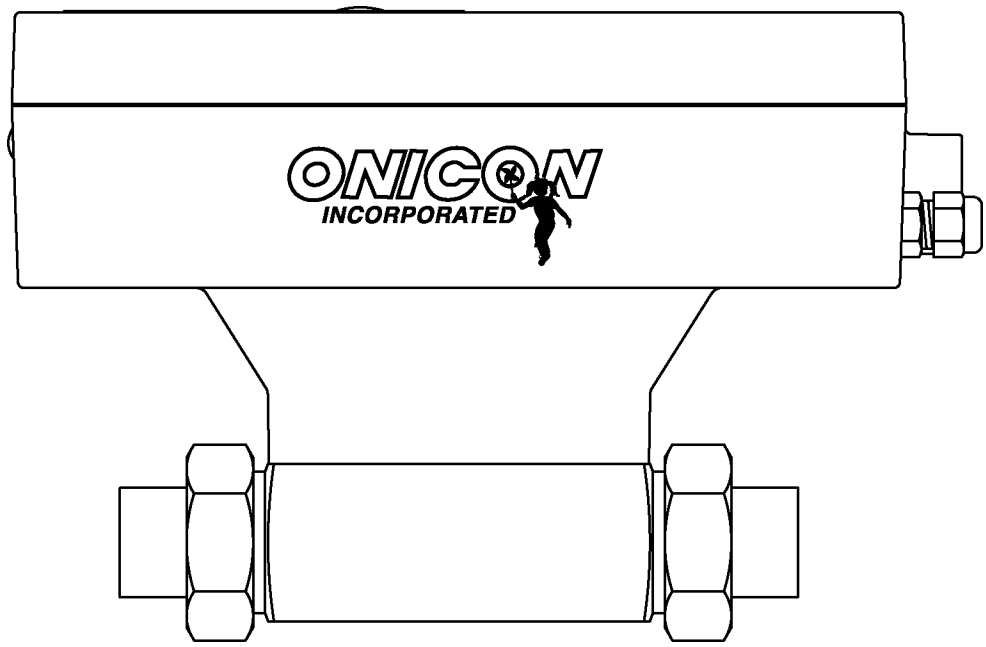
SYSTEM-30 BTU MEASUREMENT SYSTEM
Installation and Operation Guide



For Software Version 2.8B Higher

June 7, 2004

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Safety Information

This meter was calibrated at the factory before shipment.

To ensure correct use of the meter, 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's written permission.
- ONICON 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.
- ONICON 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 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 symbols 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: INTRODUCTION

WARNING

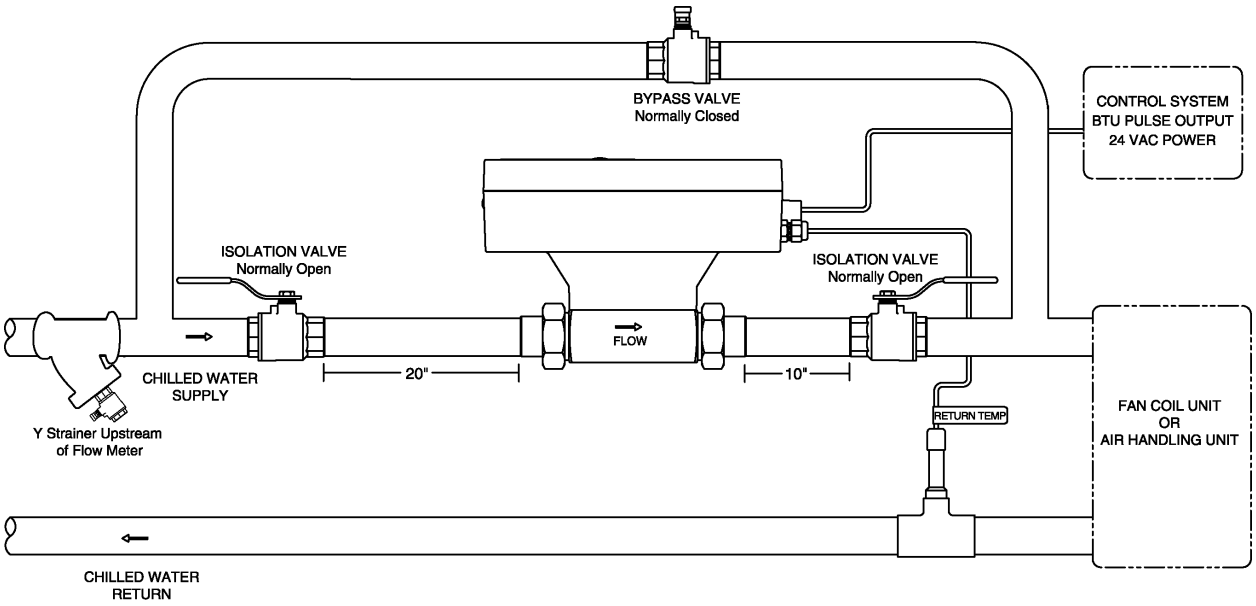
Only qualified service personnel should attempt to install or service this equipment. Serious injury may result from the improper installation or use of this equipment.

1.1 PURPOSE OF THIS GUIDE

The purpose of this guide is to provide installation and commissioning procedures and basic operating and servicing instructions for the ONICON SYSTEM-30 BTU MEASUREMENT SYSTEM.

1.2 TYPICAL SYSTEM-30 BTU MEASUREMENT SYSTEM

ONICON'S System-30 is a true heat (BTU) computer, which accepts data from several sensors, performs a series of computations with that data, and transmits the results as an indication of the amount of heat (BTU's) being transferred or as a totalized amount.



1.3 STANDARD FEATURES AND SPECIFICATIONS

- Single mode BTU calculations, in either the heating or cooling mode, are totalized and reported.

- Two-pipe dual mode BTU calculations in both the heating mode and the cooling mode are totalized and reported separately.

CALIBRATION

Flow sensor and temperature sensors are individually calibrated, followed by a complete system calibration.
Field commissioning is also available.

ACCURACY

Differential temperature accuracy ±0.15° F over calibrated range
Computing non-linearity within ±0.05%
Flow sensor accuracy:
±0.5% OF READING at calibrated velocity
±1% OF READING from 3 to 30 ft/s (10:1 range)
±2% OF READING from 0.4 to 20 ft/s (50:1 range)

TEMPERATURE SENSORS

Solid state sensors are custom calibrated using N.I.S.T. traceable temperature standards.

PROGRAMMING

Factory programmed for each specific application

MEMORY

Nonvolatile EEPROM memory retains all program parameters and totalized values in the event of power loss.

OUTPUT SIGNALS

Isolated solid state dry contacts for mode 1 and mode 2 energy total
Contact rating: 100 mA, 50V
Contact duration: 0.5, 1, 2 or 6 sec selectable

OPTIONAL OUTPUT SIGNALS

(1) Isolated analog output, factory selectable for flow rate, energy rate or delta-T
(Available as 4-20 mA, 0-10 V or 0-5 V signal)
OR
Serial connection for: Johnson Controls N2, Siemens P1 or LONWORKS® networks

OPTIONAL LOCAL DISPLAY:

Alphanumeric LCD displays total energy, total Flow, energy rate, flow rate, supply temperature and Return temperature
Alpha: 16 characters, 0.2" high
Numeric: 6 digit, 0.4" high

MAINTENANCE:

ONICON recommends periodic inspection and recalibration. No other periodic maintenance is required.

TEMPERATURE RANGE:

Liquid temperature range: 32° to 200°F
Ambient temperature range: 40° to 120°F

MECHANICAL

OVERALL DIMENSION:
9.25" L x 5" W x 6.5" H
TEMPERATURE THERMOWELL:
Brass thermowell (½" sweat or ¼" NPT)

ELECTRICAL

This equipment is intended for INSTALLATION CATEGORY (OVERVOLTAGE CATEGORY) II applications
INPUT VOLTAGE: 24 V ±10% AC 50/60 Hz or
24 V ±4 DC
INPUT CURRENT: 200 mA maximum
TERMINALS CONNECTIONS: Use 18-22 ga. Copper wire. Do not exceed 4.5 in-lb (0.5 Nm) of torque when tightening.
WIRING:
CONDUIT: Use PVC jacketed copper cable with a wire gauge suitable for the length of run and required maximum current carrying capacity. The installation must comply with all local, state and federal codes.
PLENUM AREA: (without conduit) Use plenum rated copper cable with a wire gauge suitable for the length of run and required maximum current carrying capacity. The installation must comply with all local, state and federal building codes.

Note: Specifications are subject to change without notice.

1.4 WORKING ENVIRONMENT

The SYSTEM-30 was designed for installation and use in typical commercial and residential environments that are free of corrosive liquids and fumes, direct liquid exposure, heavy condensation, and temperature extremes and vibrations.

The operating ambient air temperature range is 40° F to 120° F.

The electrical power should be relatively clean, free of high frequency noise, large voltage transients, and protected from power surges and brown outs.

1.5 WARRANTY & SERIAL NUMBER

- **Warranty**
  ONICON's 2-year "No-fault" warranty reduces start-up costs with extended coverage that includes coverage for incidental damage during installation. Certain exclusions apply. See our complete warranty statement for details.

- **Serial Number**
  The serial number of your SYSTEM-30 is located on the side of the enclosure. Serial numbers are unique identifiers that you should have available when contacting the factory for assistance regarding your system.

SECTION 2.0: UNPACKING

The SYSTEM-30 generally ships in one package unless optional hardware or equipment is ordered. If any items are damaged, notify the shipping company (all products are shipped insured) and the ONICON Customer Service Department.

2.1 CHECKING THAT YOU HAVE RECEIVED EVERYTHING

- **Standard Documentation**
  Enclosed with each SYSTEM-30 is a comprehensive documentation package that includes the following items:

  - The SYSTEM-30 BTU MEASUREMENT SYSTEM Installation and Operation Guide
  - The System-30 Calibration Data Sheet
  - Typical Installation Drawing
  - Wiring Diagram

  Please notify ONICON immediately if any items are missing.

- **The Main Unit**
  Remove the System-30 from the shipping carton and inspect it for physical damage.

- **Temperature Sensors**
  One temperature sensor is built-in to the body of the meter and the other is connected to the main unit via a permanently attached cable. Inspect the free sensor and cable for external damage.

- **Temperature Thermowell**
  A standard thermowell with installation hardware is packed with the main unit.

- **Mounting Hardware**
  The System-30 is supplied with two tail pieces to facilitate connection to the piping system. A compression fitting with retaining nut makes up one end of each tail piece. The other end will either be a sweat fitting for copper or a threaded nipple with NPT threads.

SECTION 3.0: INSTALLATION

The SYSTEM-30 BTU MEASUREMENT SYSTEM should be installed by experienced plumbers and others with related knowledge and experience in the heating, cooling, and fluid metering fields. ONICON will be happy to assist with technical recommendations and to provide guidance by telephone and/or mail. On-site field engineering, installation, and/or service is also available at an additional cost.

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

CAUTION

ONICON strongly recommends the use of a valved bypass and strainer in conjunction with the installation of the System-30 to facilitate servicing and to protect the turbine assembly during start-up.

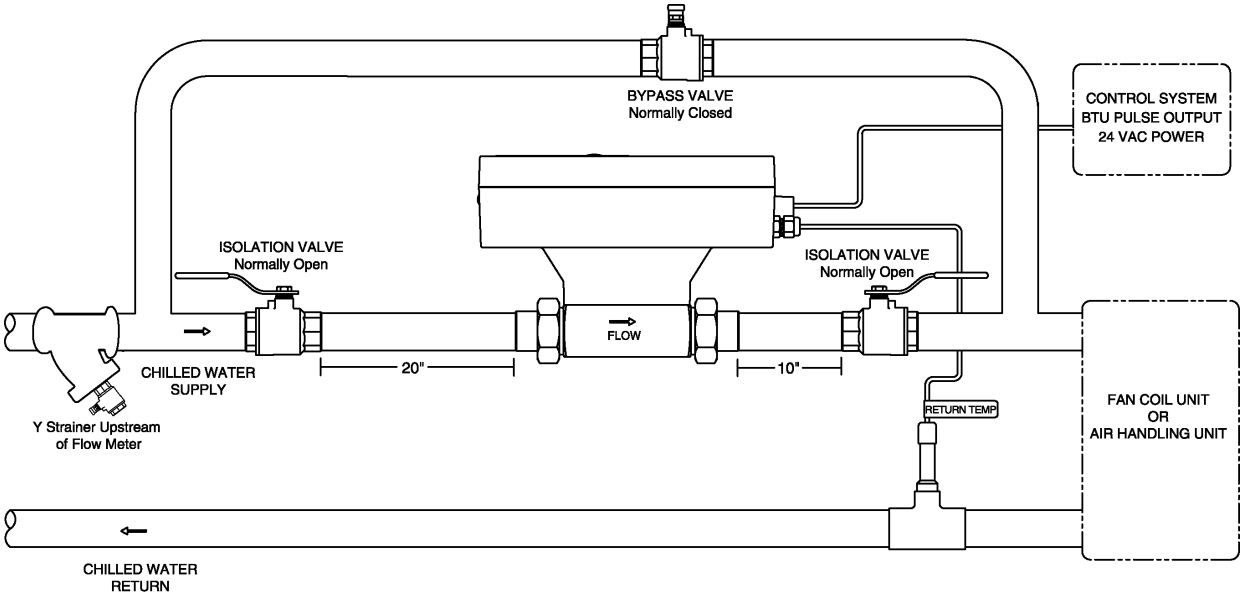
3.1 SITE SELECTION

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. For example, do not install the System-30 or its temperature sensor where it will be difficult for personnel to perform periodic maintenance and calibration. When selecting a site for mounting the system components, consider the criteria under Section 1.4, WORKING ENVIRONMENT, as well as the following:

- **The Main Unit**
  - Choose the location (supply or return) with the longest straight, unobstructed run. Ideally, the location chosen should allow for at least 20 diameters of unobstructed straight run upstream of the meter and at least 10 diameters of unobstructed straight run downstream. If both the supply and return have adequate straight run conditions, locate the meter in the supply.
  - The location must be accessible to facilitate service and recalibration.
- **The Temperature Sensor**
  - The temperature sensor should be located in an accessible location. This will facilitate any on-site service.
  - Place the temperature sensor away from sources of electrical noise that might interfere with the temperature sensor signal.

3.2 MECHANICAL INSTALLATION

3.21 MAIN UNIT INSTALLATION



TYPICAL SYSTEM-30 INSTALLATION

Find an easily accessible location where wire connections can be made and the diagnostic LED's can be viewed from floor level. The location where the main unit is mounted should be free from vibration. Clean the external surface of the pipe at the installation site so that it is free of debris, foreign matter, solids, leak inhibitors, and chemically aggressive substances. Next, locate the tail pieces that were shipped with the main unit and install these on the pipe making certain that the compression nuts are correctly oriented. Wherever appropriate, use pipe dope on threaded connections to ensure a leak free seal. **DO NOT USE TEFLON TAPE.**

Insert the main unit between the two open ends of the pipe and secure in place using the compression fittings. **MAKE CERTAIN THAT THE FLOW DIRECTION ARROW ON THE BODY OF THE MAIN UNIT IS POINTING IN THE DIRECTION OF FLOW.**

CAUTION

Before you attempt to use the BTU MEASUREMENT SYSTEM, isolate the main unit, open the bypass and flush the entire system so that it is free of flux, solder, pipe and tube cuttings and any other free moving particles.

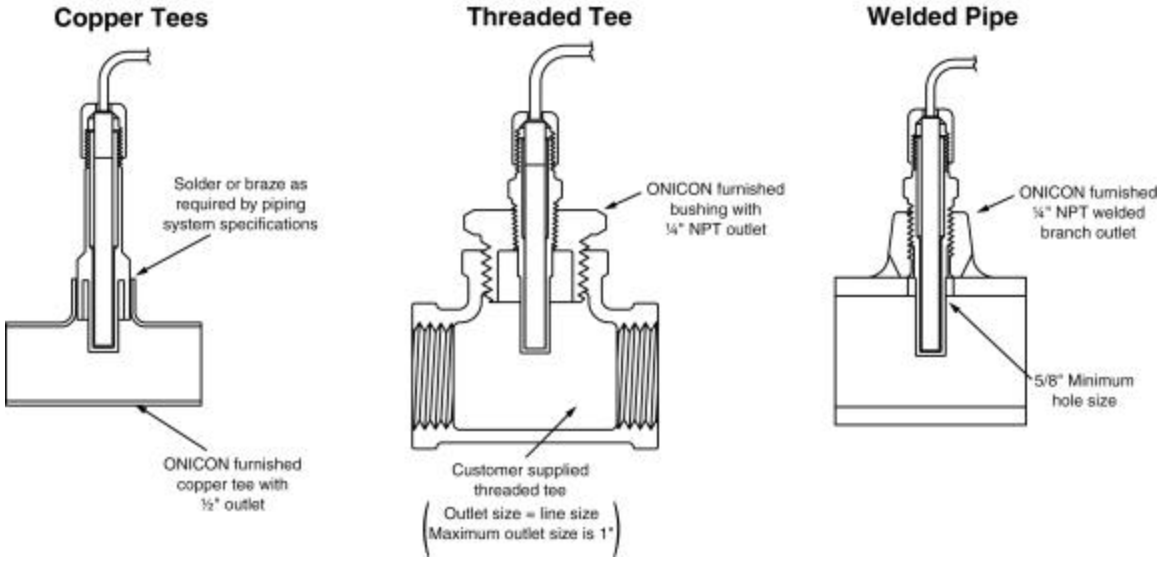
3.22 THERMOWELL INSTALLATION

IMPORTANT NOTE

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

Standard Thermowell

The most common installation methods are shown below. Consult the factory for special applications.



3.23 TEMPERATURE SENSOR INSTALLATION

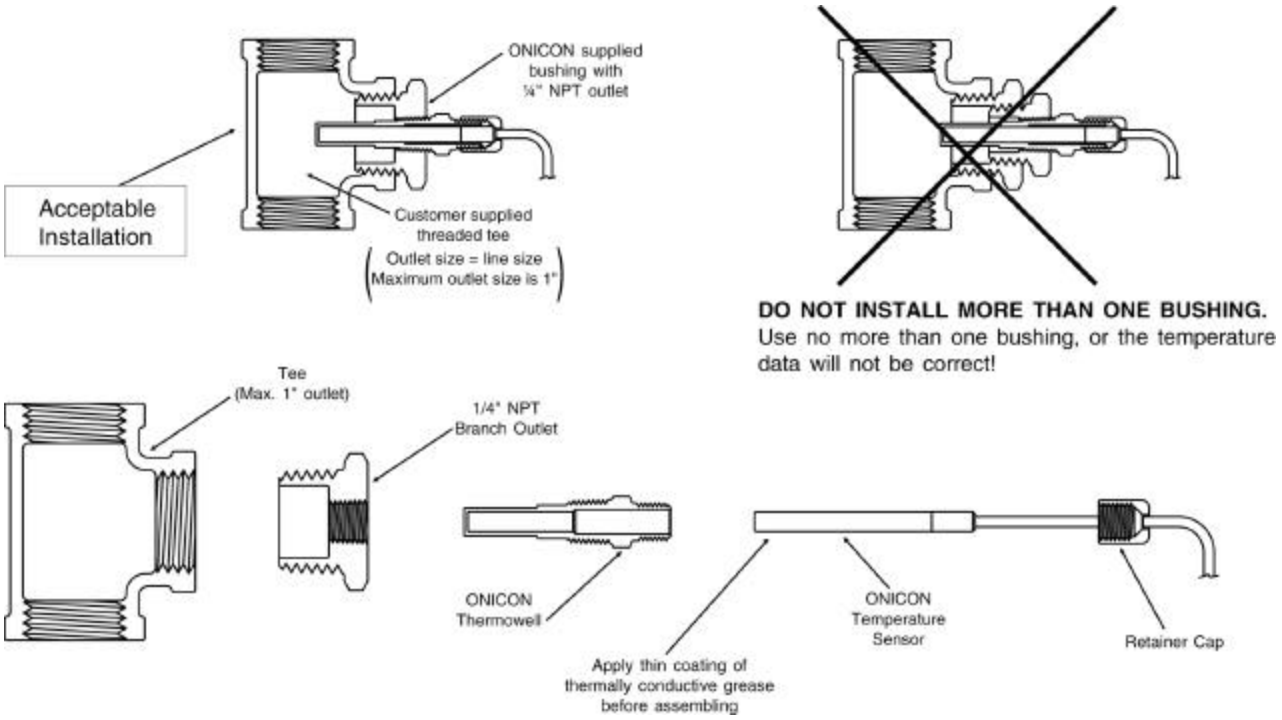
The temperature sensor is factory matched and permanently attached to the BTU MEASUREMENT SYSTEM. Sensors from different BTU meters cannot be used without being returned to the factory for recalibration.

Apply a thin coat of thermally conductive grease 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 cap. DO NOT OVER TIGHTEN. The thermowell completely seals the plumbing system without the retainer cap. The only purpose of the cap is to keep the sensor from losing contact with the bottom of the thermowell cavity.

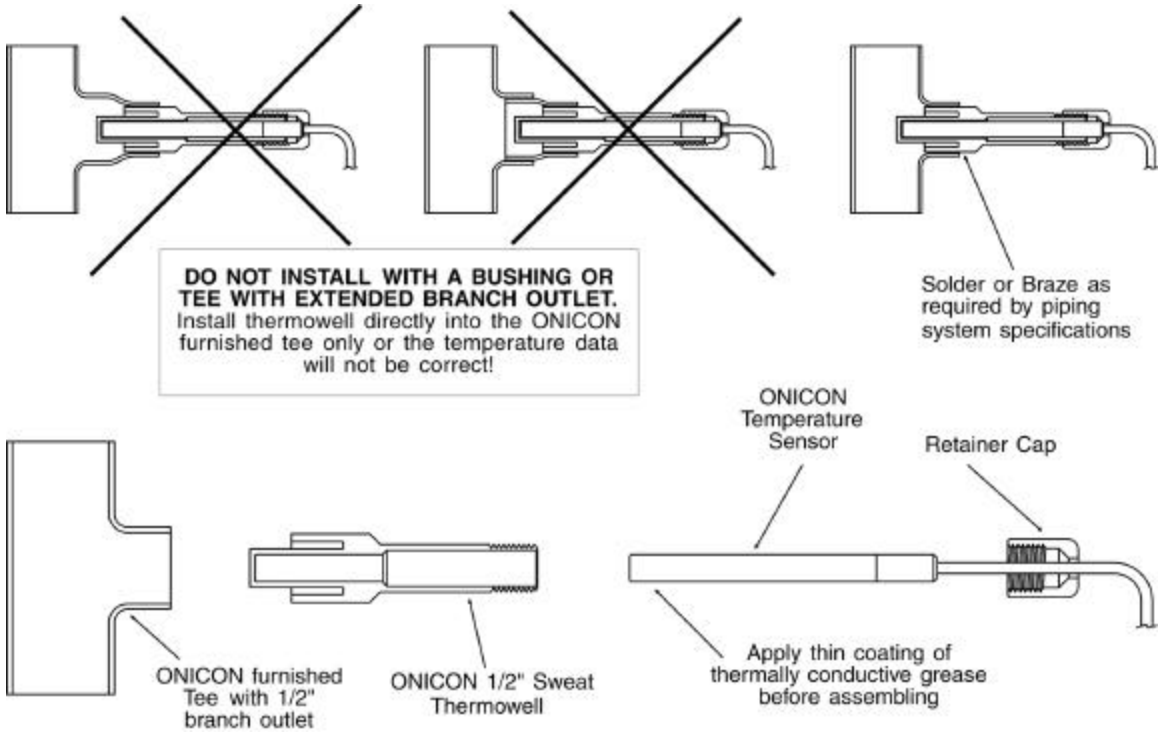
IMPORTANT NOTE

Cable length is specified at time of order. This is three wire shielded plenum rated cable. Altering the cable length may affect calibration. Do not change the cable length without consulting ONICON.

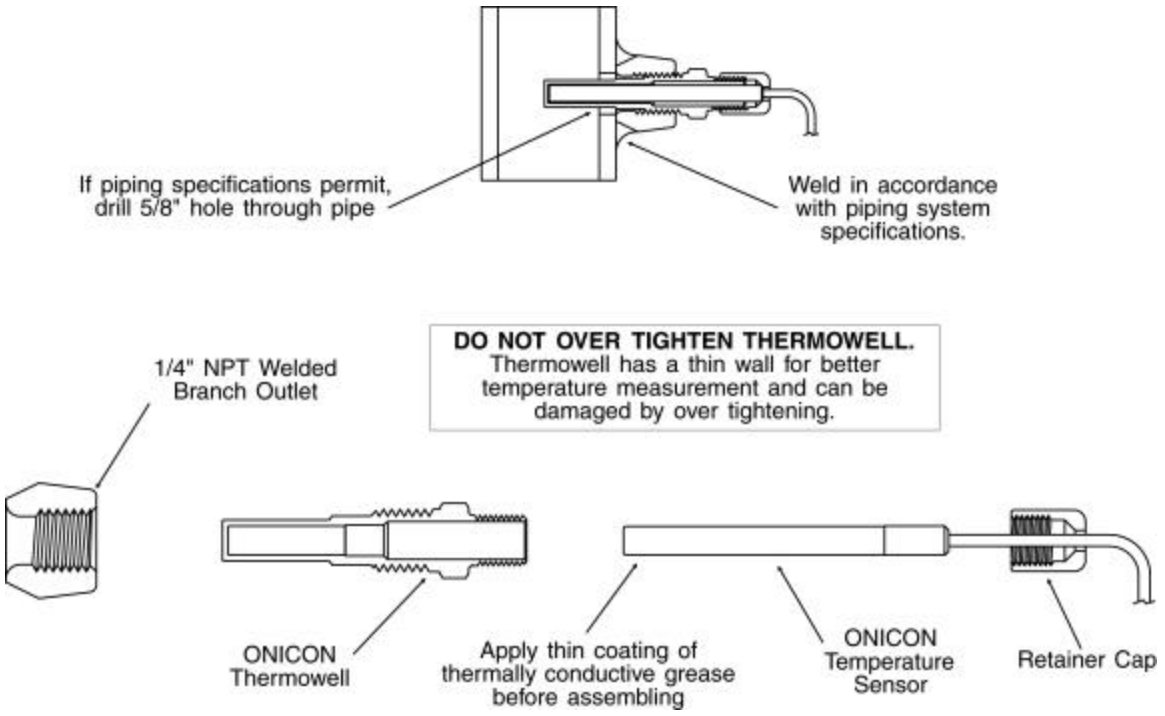
THERMOWELL INSTALLATION IN THREADED PIPE TEES



THERMOWELL INSTALLATION IN COPPER TEE



THERMOWELL INSTALLATION IN WELDED PIPE



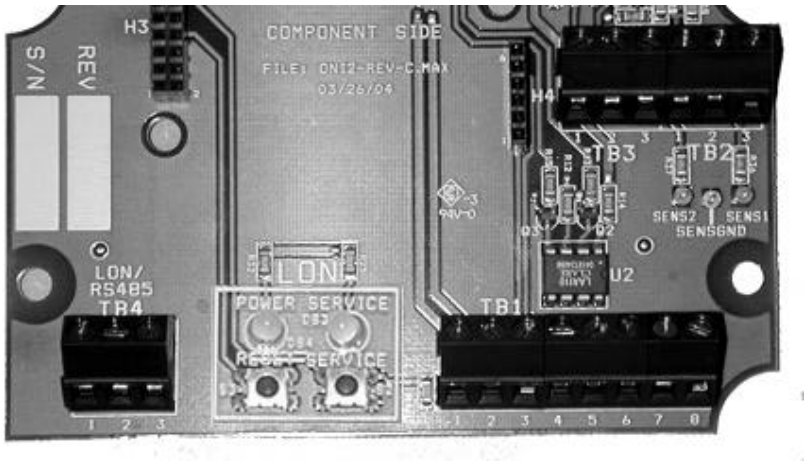
3.3 ELECTRICAL INSTALLATION

All user supplied conduit fittings, junction boxes, etc. are to be installed as required by legal codes.

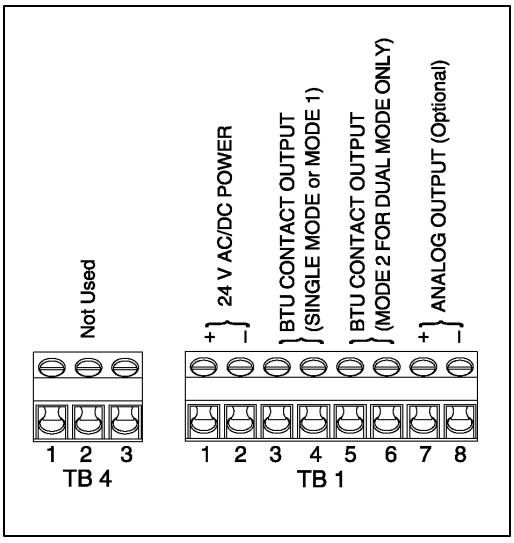
3.31 ELECTRICAL WIRING

Connect all Btu Meter signal outputs to terminal strip T1 and/or T4 (optional communication output) as shown below.

Then connect the 24 V AC/DC input power to terminal strip T1. The standard SYSTEM-30 is configured for 24 V AC 60 Hz operation or 24 V DC operation. Do not connect the 24 V AC/DC source until all other signal connections have been made and verified.



View of Signal Connection Board



Wiring Diagram

SECTION 4.0: DIAGNOSTICS & COMMISSIONING

4.1 DIAGNOSTICS


SYSTEM-30 BTU MEASUREMENT SYSTEM CALIBRATION DATA

The ONICON System 30 BTU MEASUREMENT SYSTEM uses a microprocessor to calculate energy. Factory programmed settings provide energy total outputs in accordance with the customer's application data. An optional isolated analog output for energy rate, flow rate or delta T may also be available. Refer to the BTU Meter Calibration Sheet for a complete listing of factory settings. These settings cannot be changed in the field. Contact ONICON factory service personnel if changes to the calibration are required.

The System 30 is equipped with diagnostic indicator lights that confirm the operation of the microprocessor and its input circuitry.

Please contact the ONICON factory service personnel if either of the diagnostic lights indicate a potential problem with the operation of the BTU MEASUREMENT SYSTEM .

4.11 DIAGNOSTIC LIGHTS

Energy

Located on the end of main unit opposite the cable connection is a red LED labeled BTU. This LED will flash as energy is transferred.

Liquid Flow

Located on the end of main unit opposite the cable connection is a red LED labeled FLOW. This LED will flash at a rate that is proportional to the liquid flow rate. An unlit LED indicates no flow signal.

4.2 COMMISSIONING

Please read all installation instructions carefully before proceeding. Wiring diagrams are located in the appendix. A worksheet for checking off these steps and recording measured values is located on the following page.

1.	Confirm main unit location and adequate straight pipe run to achieve desired results	Is the main unit located in the correct location as required by the plans? Compare actual straight pipe upstream and downstream of the main unit location to the recommended distances identified in this installation manual. Note: This manual is very conservative and assumes the worst-case pipe obstructions; contact ONICON's technical support department to discuss specifics of your application
In order to proceed with the following steps, the System-30 must be operating and connected to the control system. 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		
2.	Confirm correct supply voltage	Verify that the correct supply voltage is available at the System-30 signal cable connections. The System-30 BTU MEASUREMENT SYSTEM operates from 24 VAC ± 4 volts.
3.	With the HVAC system active, verify that the diagnostic LED's for FLOW and BTU are both flashing.	The LED's are located on the exterior of the main unit on the end opposite from the cables.
The following steps require a multi-meter with the ability to measure DC voltage as well as DC frequency in hertz. Remove the six screws that secure the cover to the main unit and carefully lift the cover off.		
4.	Check temperature readings for T1, T2 and the differential temperature	Set multi-meter for 2 to 4 volt range T2: Measure DC volts between terminals 2(+) and 3(-) T3: Measure DC volts between terminals 2(+) and 3(-) Delta T: Measure DC volts between terminals 2 and 2 The relationship between voltage and temperature is 10 mV/degree F. Multiply the reading in volts by 100 to obtain degrees F. Compare the calculated temperatures to expected values.
5.	Check flow signal	Set multi-meter for DC hertz, voltage range > 15 volts. The test points for flow are located next to the reset button. GPM = $\frac{\text{Frequency in Hz X 60}}{\text{Meter Factor in ppg}}$ (refer to calibration tag for meter factor) Compare the calculated flow rate to expected values.
6.	Check Energy Total Output (BTU Output Mode 1 and/or Mode 2)	Set multi-meter for DC volts, voltage range > 15 volts Mode 1: Measure DC volts between terminals 3 and 4 Mode 2: Measure DC volts between terminals 5 and 6 Confirm that the voltage changes state (low to high or high to low) each time the controls system register records a new energy total.
End of standard commissioning. Please contact ONICON's technical service department at (727)447-6140 with any questions.		

COMMISSIONING WORKSHEET
ONICON BTU METERS

Please read all installation instructions carefully prior to proceeding with these steps. Wiring diagrams are located in the appendix. Use the following worksheet for checking off the commissioning steps and recording measured values:

STEP	TEST / MEASUREMENT	S/N:	S/N:	S/N:	S/N:
1.	Meter location				
2.	Supply voltage verified				
3.	Verify diagnostic LED's are flashing				
4.	Note and record temperature readings for T1, T2 & delta T				
5.	Note and record flow rate				
6.	Confirm contact closure output operation for Mode 1 & Mode 2				

TROUBLESHOOTING GUIDE FOR
ONICON SYSTEM-30 BTU MEASUREMENT SYSTEMS

NOTE: Also refer to the COMMISSIONING GUIDE located on the preceding pages.

REPORTED PROBLEM:	**POSSIBLE SOLUTIONS:**
No Flow Signal/ Energy Signal (While hydronic system is active)	• Verify 24 VAC supply voltage to the System-30. • Verify correct wiring to the System-30 (see wiring diagram). • Check turbine for clogging due to debris. • If none of the above, double check hydronic system to ensure that flow is really present in the line. • NOTE: Flow meter function **cannot** be verified by blowing on the turbine. The sensing system requires a conductive liquid to operate.
Displayed Flow Rate too high or too low	• Verify that System-30 isolation valves are fully open and bypass valve is fully closed (if bypass is used). • Check turbine(s) for debris. • Verify supply voltages.
Displayed Temperature(s) too high or too low vs. expected values.	• Verify that thermowell is inserted into the flow stream and that the temperature sensor is completely inserted into the thermowells.
Data not available at the control system	• Verify that the wiring to the building control system is correct.

For technical assistance, contact ONICON Incorporated at (727) 447-6140.

APPENDIX A – DRAWINGS

SYSTEM-30 BTU MEASUREMENT SYSTEM WITH INTEGRAL FLOW METER & TEMPERATURE SENSORS

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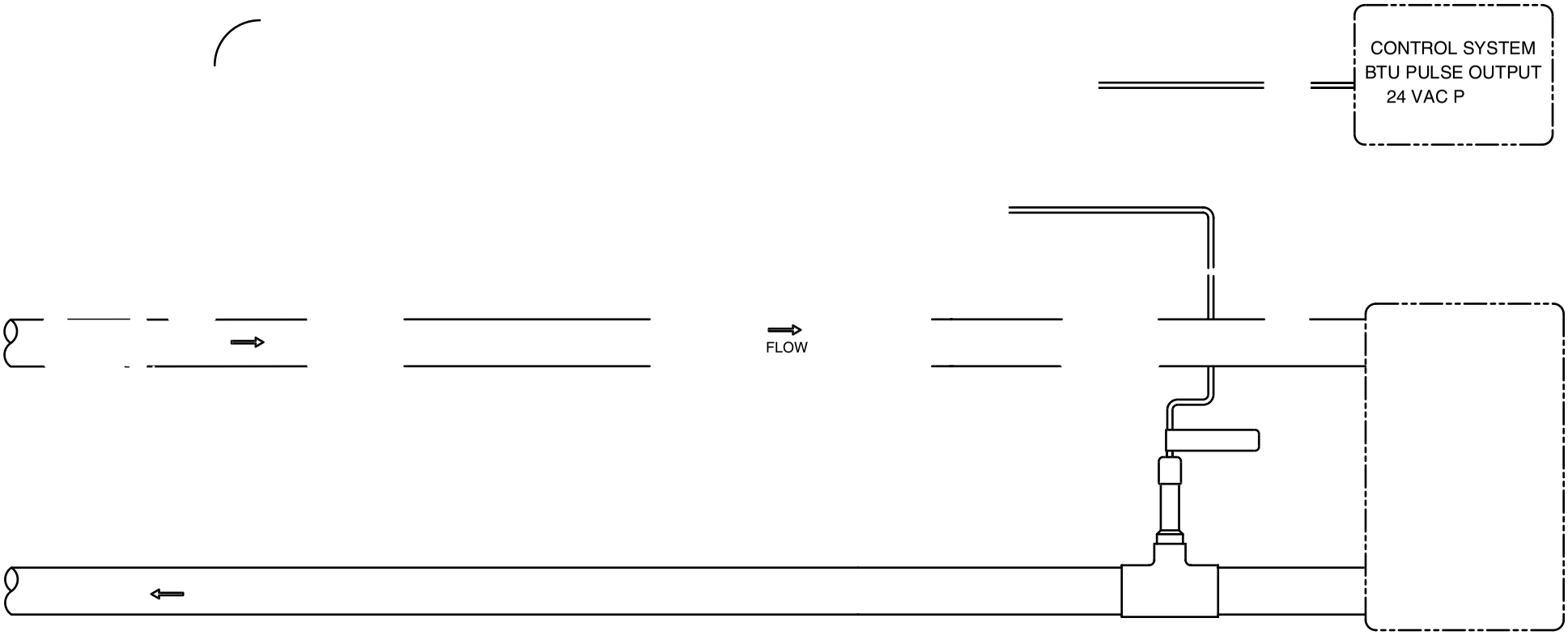

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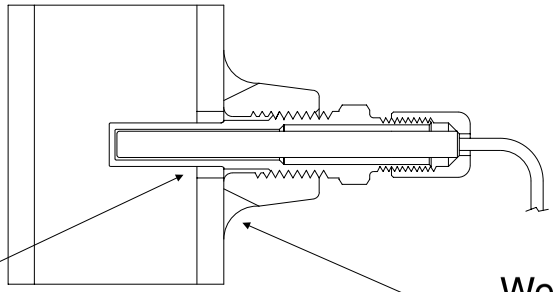
Thermowell Installation
In Welded Pipe

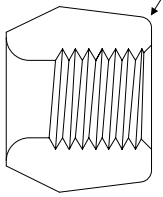


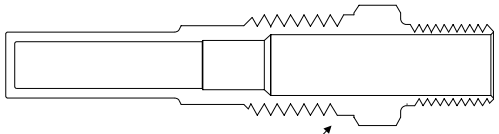
If piping specifications permit, drill 5/8" hole through pipe

Weld in accordance with piping system specifications.

DO NOT OVER TIGHTEN THERMOWELL.
Thermowell has a thin wall for better temperature measurement and can be damaged by over tightening.

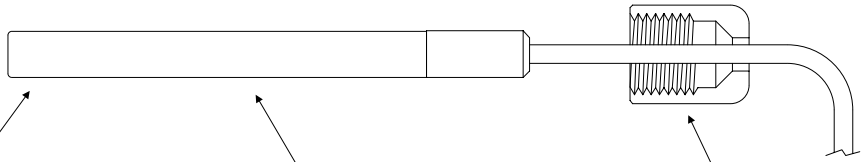
1/4" NPT Welded Branch Outlet





ONICON Thermowell

Apply thin coating of thermally conductive grease before assembling



ONICON Temperature Sensor

Retainer Cap

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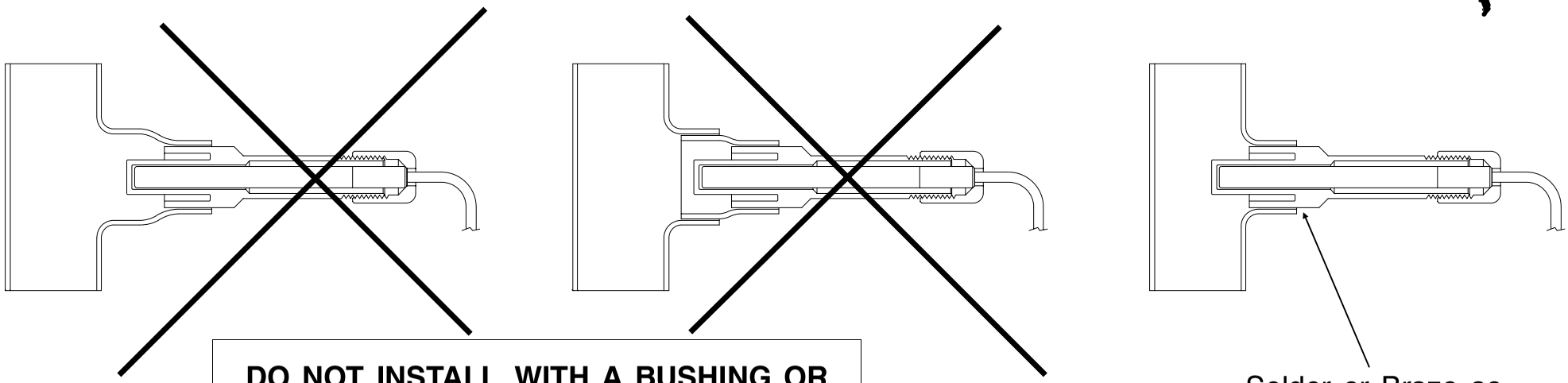
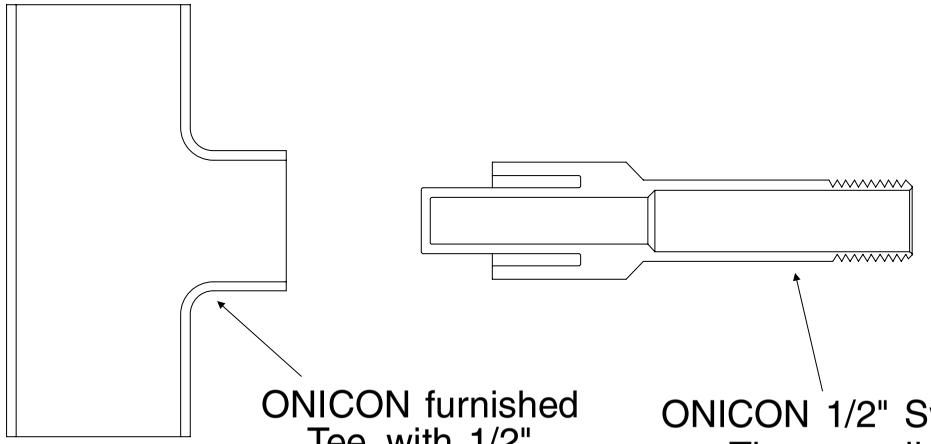
Alternate Thermowell Installation In Copper Tees



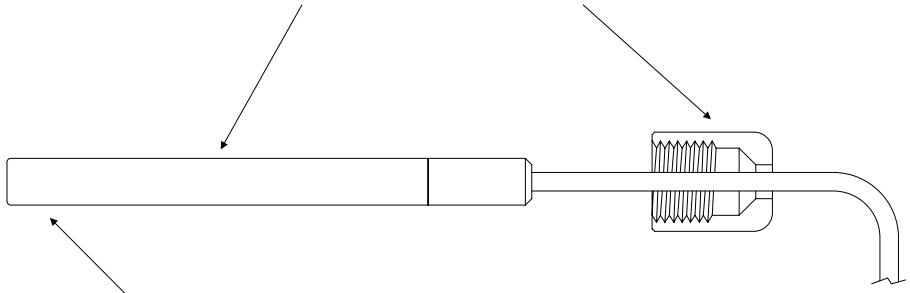
Solder or Braze as required by piping

DO NOT INSTALL WITH A BUSHING OR TEE WITH EXTENDED BRANCH OUTLET.
Install thermowell directly into the ONICON furnished tee only or the temperature data will not be correct!



ONICON furnished Tee with 1/2" branch outlet

ONICON 1/2" Sweat Thermowell



ONICON Temperature Sensor

Retainer Cap

Apply thin coating of thermally conductive grease before assembling

A-3

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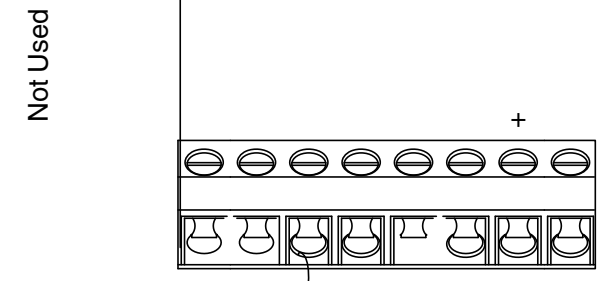
System-30 Wiring Diagram



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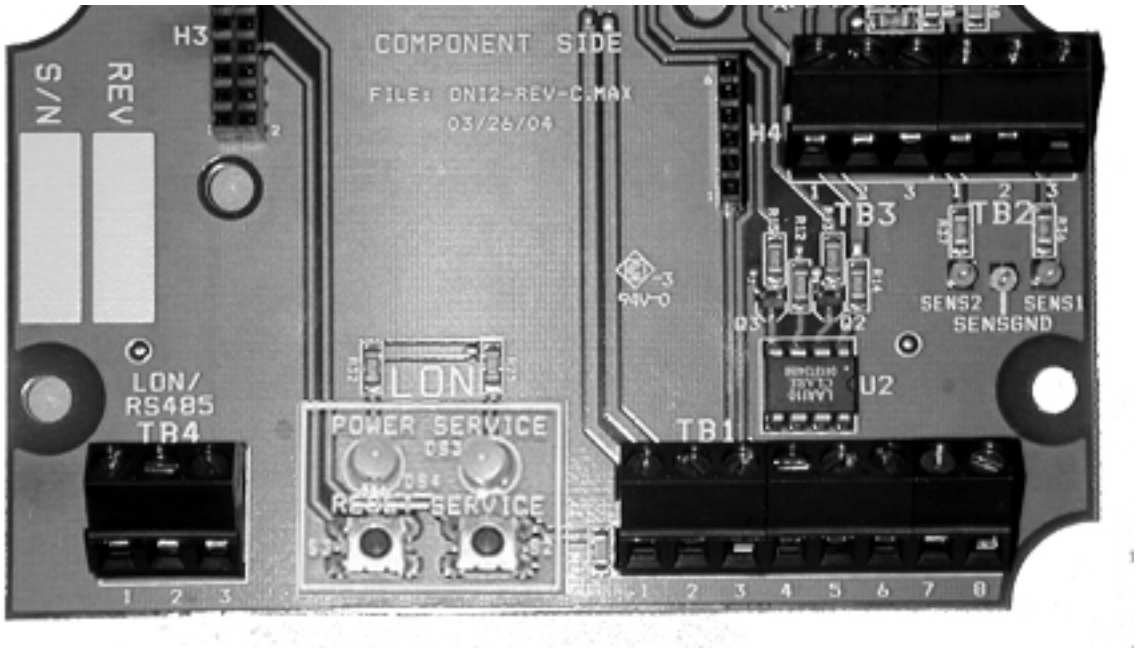
System-30 Signal Connection Board



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