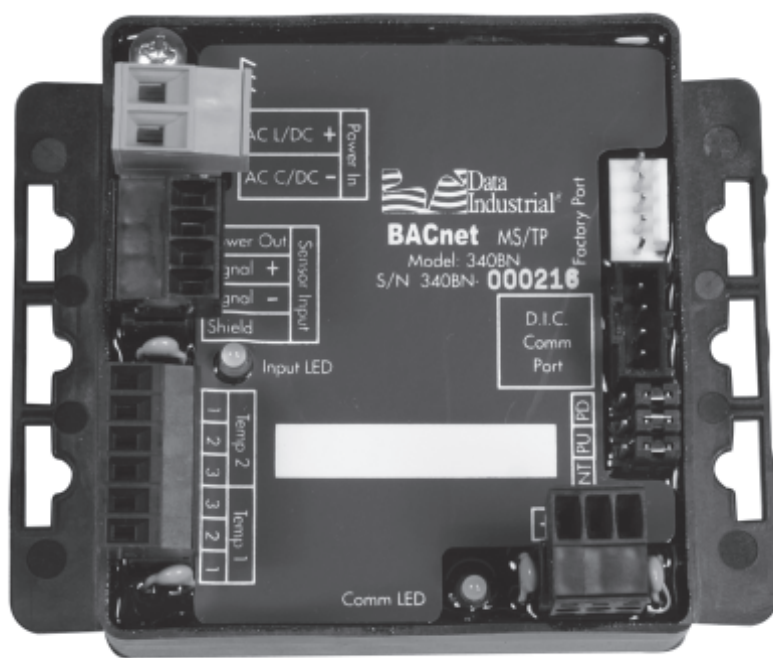


Model 340BN

BACnet® Energy Transmitter

Installation & Operation Manual



BadgerMeter, Inc.

PN# 941700-0012

3-07

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INTRODUCTION

The Badger Meter Model 340BN Btu transmitter is an economical, compact device for sub-metering applications that utilizes the BACnet® communications protocol.

The Model 340BN calculates thermal energy using the signal from a flow sensor installed in a hydronic heating or chilled water system, and signals from two 10 kΩ temperature thermistors, 100Ω RTD's, or 1000Ω RTD's installed in the system's inlet and outlet points. The flow input may be provided by any Badger Meter sensor and many other pulse or sine wave signal flow sensors.

The onboard microcontroller and digital circuitry make precise measurements and produce accurate, drift-free outputs. The Model 340BN is configured using Badger Meter Windows® based programming software. Calibration information for the flow sensor, units of measurement, and type of temperature sensor may be preselected or entered in the field. Btu transmitter information is available when connected to a PC or laptop computer. This information includes flow rate, flow total, both T1 and T2 temperature probe information, energy rate, and energy total.

The Model 340BN transmitter features two LED's to verify BACnet and flow sensor input activity.

The BACnet communications protocol allows the Model 340BN transmitter to be assigned an address, and allow all measurement parameters to be transmitted on a single 3-wire RS-485 bus.

The Model 340BN Btu transmitter operates on AC or DC power supplies ranging from 12 to 24 volts.

The compact cast epoxy body measures 3.65"(93mm) x 2.95"(75mm) and can be easily mounted in panels, enclosures or on DIN rails.

INSTALLATION

Mechanical Installation

The Model 340BN transmitter may be surface mounted onto a panel, attached to DIN rails using adapter clips or wall mounted using optional enclosures.

Location

Although the Model 340BN device is encapsulated, all wiring connections are made to exposed terminals. The unit should be protected from weather and moisture in accordance with electrical codes and standard trade practices.

In any mounting arrangement, the primary concerns are ease of wiring and attachment of the programming cable. The unit generates very little heat so no consideration need be given to cooling or ventilation.

Surface Mount Installation

The Model 340BN may be mounted to the surface of any panel using double-sided adhesive tape or by attaching fasteners through the holes in the mounting flanges of the unit.

DIN Rail Mounting

Optional clips snap onto the mounting flanges allowing the Model 340BN to be attached to DIN 15, 32, 35 mm DIN rail systems.

Wall Mounting

Optional metal and plastic enclosures are available for the Model 340BN. The enclosure is first attached to the wall using fasteners through its mounting holes.

After wiring, the transmitter may be attached to the enclosure with the terminal headers facing inwards using the slots in the mounting flanges. As an alternate mounting arrangement, the Model 340BN may be fastened to the box cover using double-sided adhesive tape.

Temperature Sensor Installation

The location of the temperature sensors with respect to the flow sensor is important to the accuracy of the energy calculation. The temperature sensor installed closest to the flow sensor will be considered as Temperature Sensor T1. Temperature sensors should not be installed closer than a distance equal to 10 pipe diameters upstream or 5 pipe diameters downstream from the flow sensor. Irregular velocity profiles caused by improperly located valves, fittings, and thermowells, etc. can lead to inaccurate flow indication and therefore affect accuracy of the energy calculation.

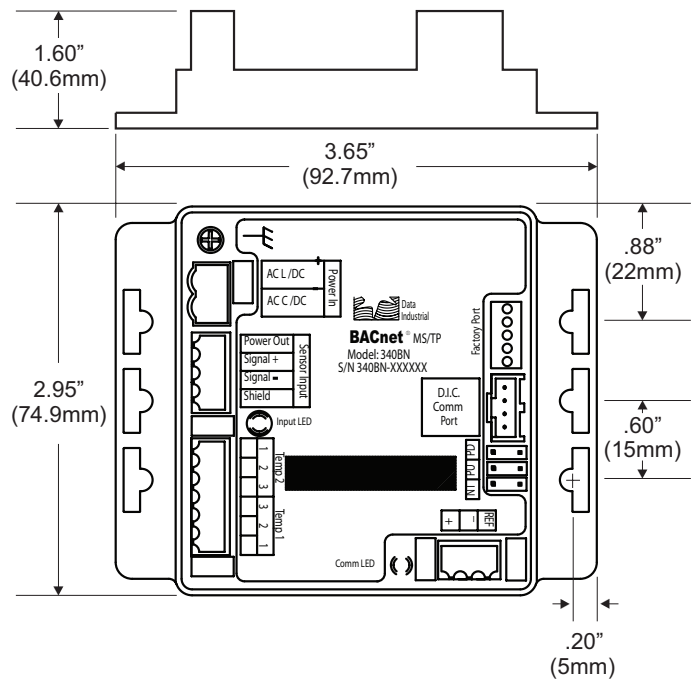


Figure 1: Model 340BN Dimensions

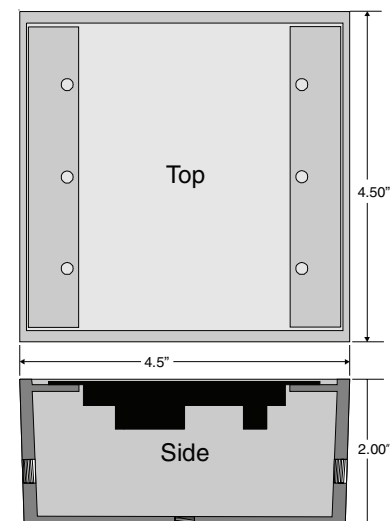


Figure 2: Model 340BN Metal Box Dimensions

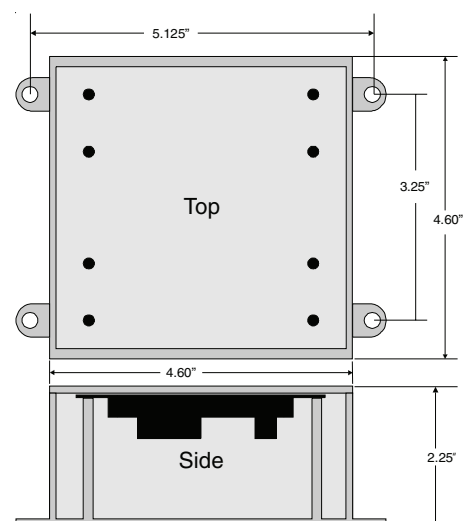


Figure 3: Model 340BN Plastic Box Dimensions

Electrical Installation

All connections to the Model 340BN are made to screw terminals on removable headers.

Power Supply Wiring

The Model 340BN requires 12-24 volts AC or DC to operate. The power connections are made to the ORANGE header. The connections are labeled beside the header. Observe the polarity shown on the label.

If a Badger Meter plug in type power supply (Model A-1026 or A-503) is used, connect the black/white striped wire to the terminal marked positive (+) and the black wire to the terminal marked negative (-).

Note:

Connect the earth ground lug of the Model 340BN to a solid earth ground with a wire which is as short as possible. This will help prevent electrical interference from affecting the Model 340BN's normal operation.

Sensor Wiring

All flow sensor types connect to the four terminal header labeled Sensor Input.

Series 200

Connect the flow sensor red wire to Model 340BN Sensor Input Signal (+) terminal, and connect the flow sensor black wire to Model 340BN Sensor Input Signal (-) terminal. The bare wire connects to the Sensor Input Shield terminal.

SDI Series (standard pulse output option)

Connect SDI terminal number 3 to the Model 340BN transmitter Sensor Input Signal (+) terminal, and SDI terminal number 2 to the Model 340BN transmitter Sensor Input Signal (-) terminal. Connect the shield terminal of the SDI sensor to the Sensor Input Shield terminal of the Model 340BN transmitter.

Other Sensors

The Sensor Input Power Out terminal on the 340BN transmitter supplies nominal 12VDC excitation voltage for 3-wire sensors. Connect the signal (+) and signal (-) terminals on the sensor to corresponding terminals on the 340BN transmitter.

Note:

The green input LED flashes on and off as sensor pulses are received.

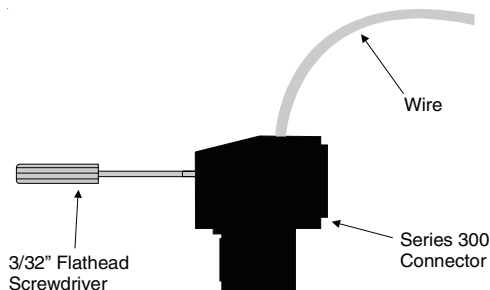


Figure 4:
Side View - Typical 300 Series Removable Connector Wiring

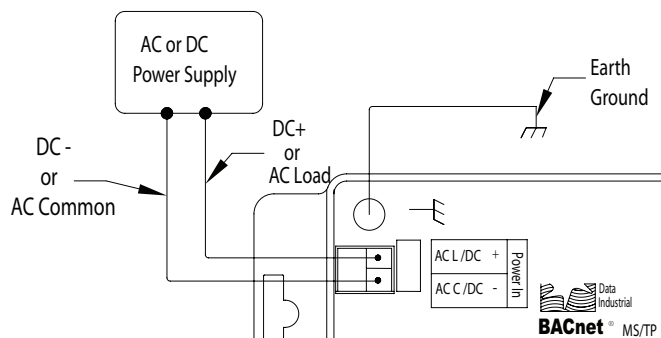


Figure 5: Sample Power Supply Wiring Diagram

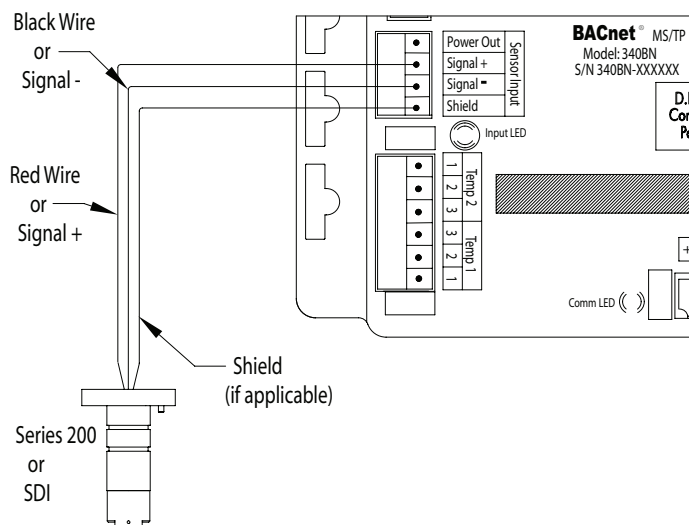


Figure 6: Sample Sensor Wiring Diagram

Temperature Element Wiring

Thermistors

Badger Meter thermistors are not polarity sensitive. The thermistor located closest to the flow sensor, termed temperature sensor T1, should be connected to terminals 2 and 3 on terminal block Temp 1. The thermistor located farthest from the flow sensor, termed temperature sensor T2, should be connected to terminals 2 and 3 on terminal block Temp 2. As shown in the thermistor wiring diagram, it is strongly recommended to install a jumper between terminals 1 and 3 for both thermistors. This is considered good practice for all unused inputs to limit electro-magnetic interference.

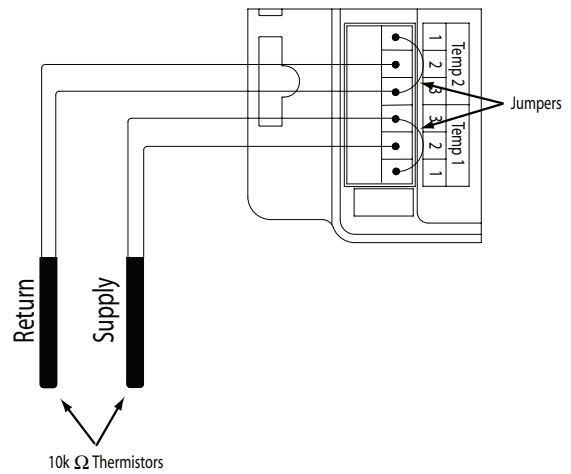


Figure 7: Thermistor Wiring Diagram

Resistance Temperature Detectors (RTD's)

Badger Meter RTD's are three-wire devices. Two of these wires are the same color, and one of these two wires is used for lead compensation. The lead compensation wire is attached to terminal 1. The other common color lead is attached to terminal 3. The single color lead is attached to terminal 2. The RTD located closest to the flow sensor, termed temperature sensor T1, should be connected to terminal block Temp 1. The RTD located farthest from the flow sensor, termed temperature sensor T2, should be connected to terminal block Temp 2.

Connecting the BACnet® Buss

As shown in the BACnet Sample Wiring Diagram, the position of jumpers on each 340BN transmitter and wiring between each 340BN transmitter and the BACnet network are different depending on where the transmitter is installed, i.e. its nodal position. For all but the final 340BN transmitter in a BACnet network, the three jumpers NT, PU, and PD should be in the open position, and only the (+) and (-) network terminals should be connected to the BACnet buss. For the final 340BN transmitter in a BACnet network, the three jumpers NT, PU, and PD should be in the closed position, and all three network terminals (+), (-), and REF should be connected to the BACnet buss.

Note: The Model 340BN transmitter default polling address must be changed before it is introduced into an existing network to avoid possible address conflicts. Please refer to programming instructions in the next section.

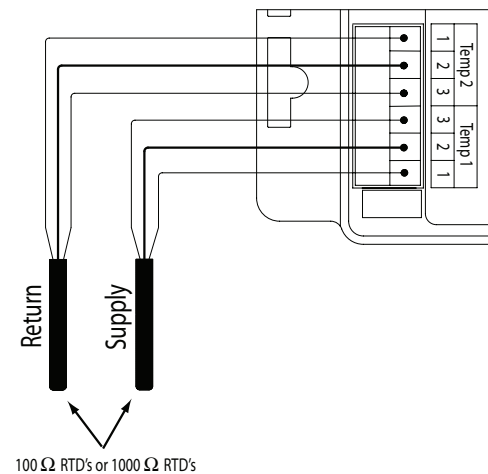


Figure 8: RTD Wiring Diagram

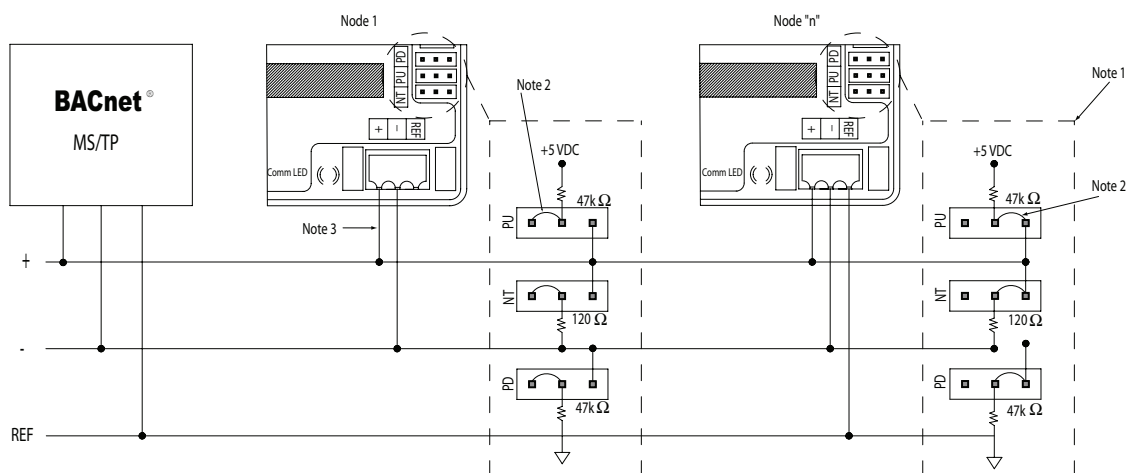


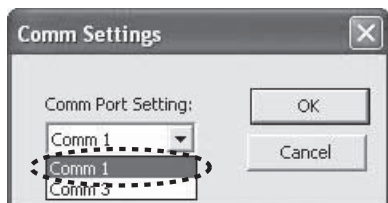
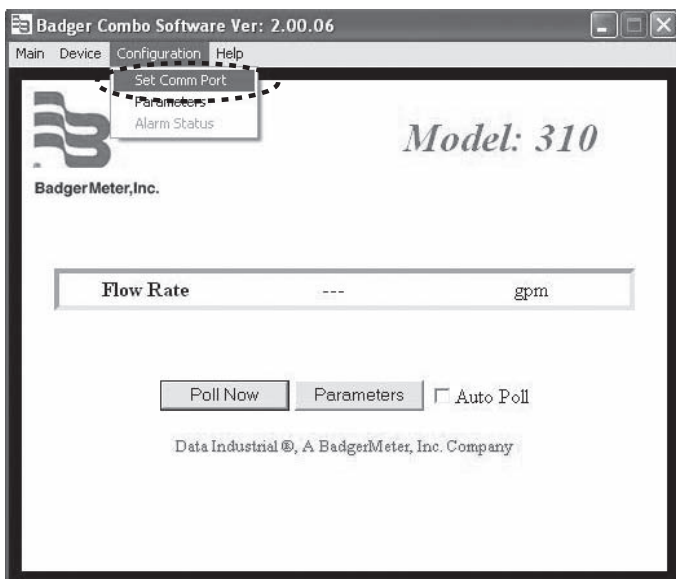
Figure 9: Sample Wiring Diagram to BACnet Network

- Note 1: Biasing, circuitry, and resistors for PU, PD, and NT terminals are integral part of 340BN transmitter.
- Note 2: For the final 340BN transmitter in a given BACnet network, NT, PU, and PD jumpers should be in "open" position. Otherwise, NT, PU, and PD should be in the "closed" position.
- Note 3: For the final 340BN transmitter in a given BACnet network, all three network terminals (+), (-), and REF should be connected to the BACnet buss. Otherwise, connect only terminals (+), (-) to the BACnet buss.

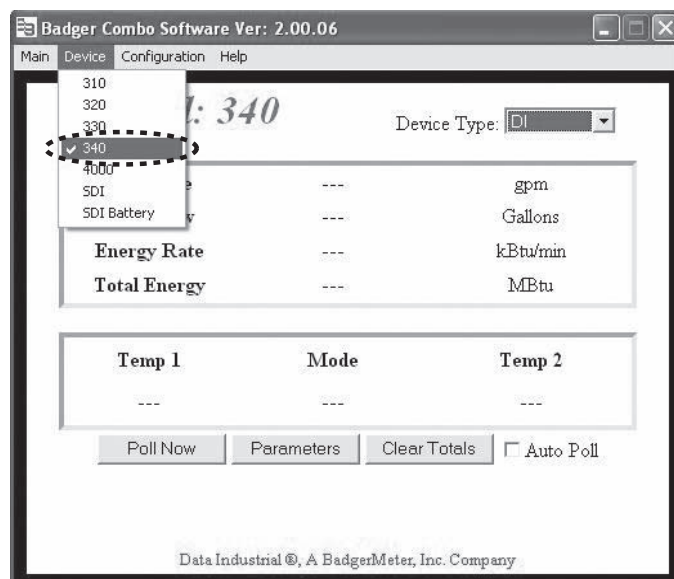
Programming the Model 340BN Transmitter

Prior to introducing the Model 340 BN onto a BACnet® network, it must be configured for the type of input signal, pipe size, desired units of measure, filter coefficient, and temperature sensor. The default network address should be assigned to an unused address to avoid conflicts with other instruments on the BACnet network. To change settings in the 340BN transmitter, Windows® based Badger Meter software must be installed and new values entered as outlined below:

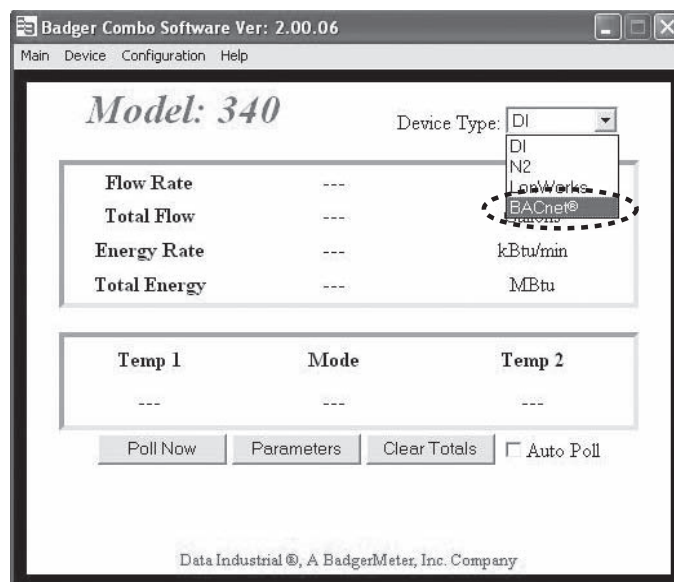
1. Install the Badger Meter Combo PC Software.
2. Connect the PC to the Model 340BN transmitter using the Badger Meter Model A301 communications cable. Plug the Model RS232 connector on the Model A301 cable to the Model 340BN socket labeled "D.I.C. Comm port", taking care to properly align the tab on the plug and socket to maintain polarity. Plug the Model DB9 connector on the opposite end of the Model A301 cable to an available PC communications port. If a cable with a Model DB9 connector is not available, a USB to DB9 adapter (e.g. IOGEAR GUC232A) can be used.
3. Connect the Model 340BN transmitter to a power supply.
4. Open the Badger Meter Combo PC Software.
5. From the main screen, select Configuration and open the Set Comm Port screen to assign the correct communications port for the Model A301 cable as shown in the dialog boxes below. Press the OK button to return to the Main screen.



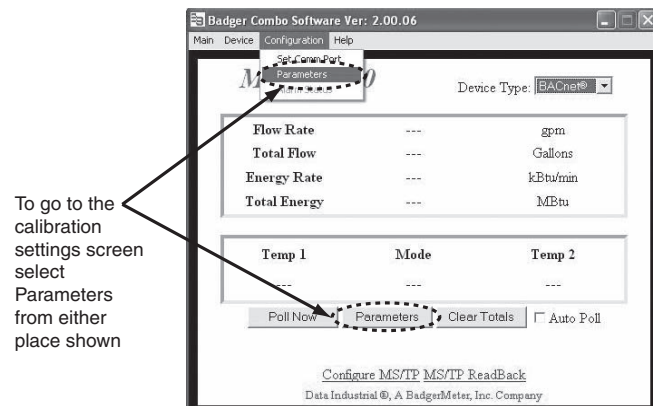
6. Select Device and 340 from the menu bar as shown below.



7. Open the Device Type pull-down menu and select BACnet protocol as shown below.



8. Select Configuration from the menu bar and open the Parameters screen as shown below.



9. Program the Model 340BN transmitter using the diagram below as a reference.

Step 1
Select the flow sensor type and enter the K and Offset values. See Note 1.

Step 2
Select the desired unit for the temperature sensor.

Step 3
Select the method of computing the temperature differential. See Note 2.

Step 4
Select the type of temperature sensor.

Step 5
Select the filter coefficients for flow and energy. See Note 3.

Step 6
Select the desired units for energy rate and energy total.

Step 7
Press Send to transmit calibration data to the transmitter.

Step 8
Press Exit to close the Parameters Screen and return to the main screen.

If required, press to view current programming of the transmitter.

If required, press to enter factory default programming. Note: This will overwrite all settings.

Note #1:

Badger Meter sensors are pulse type sensors. The K and Offset information is printed in the owners manual shipped with the product. This information is also available on our website. Calibration constants for other sensors must be supplied by the manufacturer.

Note #2

Typically the temperature measured by T1 will be greater than T2 in a heating application and less than T2 in a cooling application. The selection of one of these choices will determine if energy calculations are made for heating only (T1>T2), cooling only (T1<T2), or both (absolute).

Note #3

The filter coefficient screen allows adjustment of the flow and energy filters. Filter settings determine how the Series 340BN responds to actual changes in flow and energy. A scale of 0 -10 is used with 10 providing the greatest degree of smoothing.

10. After setting Model 340BN parameters, press Exit and return to the Main screen.
11. Select Configure MS/TP to open the MS/TP Setup screen as shown below.

Badger Combo Software Ver: 2.00.07

Main Device Configuration Help

Model: 340BN Device Type: BACnet®

Flow Rate	---	gpm
Total Flow	---	Gallons
Energy Rate	---	kBtu/min
Total Energy	---	MBtu

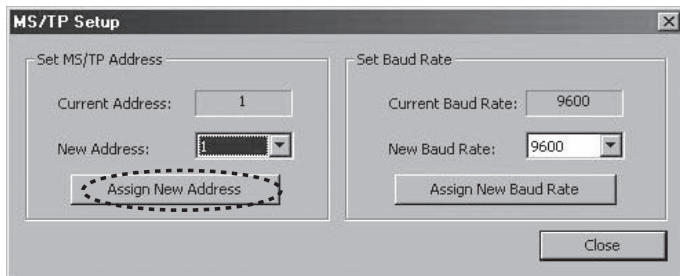
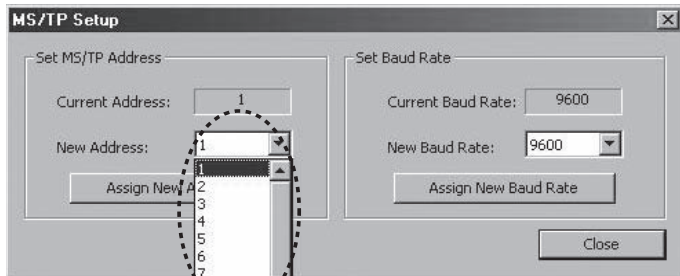
Temp 1	Mode	Temp 2
---	---	---

Poll Now Parameters Clear Totals ☐ Auto Poll

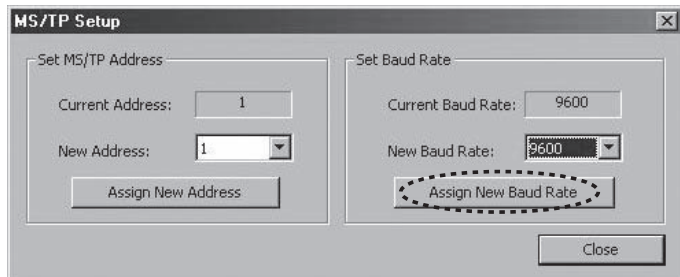
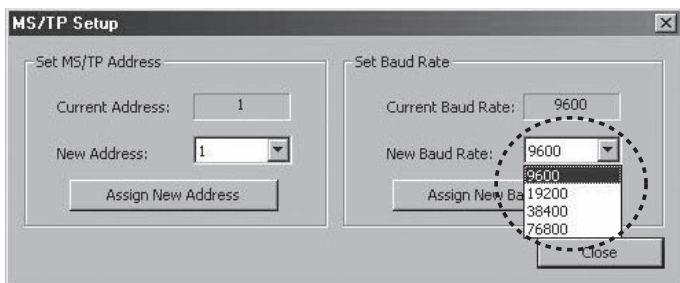
[Configure MS/TP](#) [MS/TP ReadBack](#)

Data Industrial ©, A BadgerMeter, Inc. Company

12. To set the MS/TP address for the 340BN transmitter, open the New Address pull-down menu and select the correct polling address which matches the polling address entered into the master controller for this node of the BACnet network. Press the Assign New Address button to transmit polling information to the 340BN transmitter.



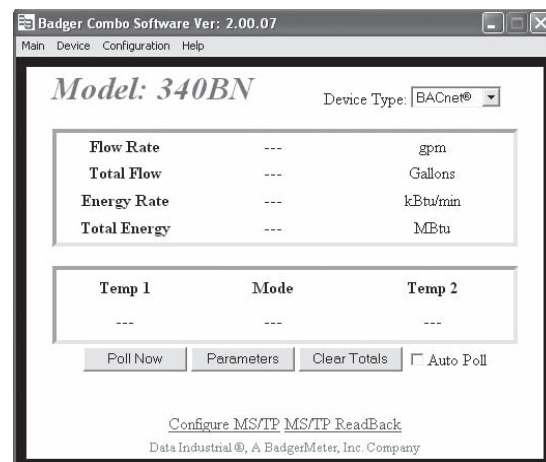
13. To set the MS/TP baud rate for communication from the BACnet® buss to the Model 340BN transmitter, open the New Baud Rate pull-down menu and select the desired value. The most common baud rate is 9600. Press the Assign New Baud Rate button to transmit the symbol rate to the Model 340BN transmitter. Press the Close button to return to the Main screen.



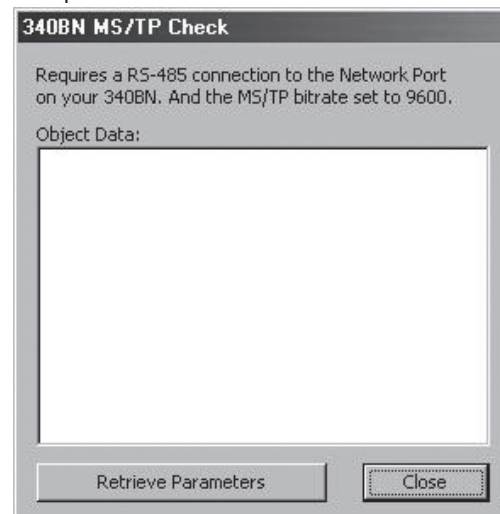
BACnet Diagnostic Utility

The MS/TP ReadBack diagnostic utility is provided as a helpful tool to verify connection between the Model 340BN transmitter and BACnet network when installing a transmitter or while troubleshooting faulty communication between an individual node and the master controller. To use this utility, the Model 340BN transmitter must be connected to a PC or laptop and the BACnet network as outlined below.

1. Connect the PC to the Model 340BN transmitter using the Badger Meter Model A301 communications cable. Plug the RS232 connector on the Model A301 cable to the 340BN socket labeled D.I.C. Comm Port, taking care to properly align the tab on the plug and socket to maintain polarity. Plug the DB9 connector on the opposite end of the Model A301 cable to an available PC communications port. If a cable with a DB9 connector is not available, a USB to DB9 adapter (e.g. IOGEAR GUC232A) can be used.
2. If not already installed, connect the Model 340BN transmitter to the BACnet network. Connect all three Model 340BN network terminals (+), (-), and REF to the BACnet buss if the transmitter is the final node in a given network. Otherwise, connect only terminals (+) and (-) to the BACnet buss. Confirm the correct position of jumpers on the Model 340BN transmitter. For the final transmitter in a given BACnet network, NT, PU, and PD jumpers should be in "open" position. Otherwise, NT, PU, and PD should be in the "closed" position. Please refer to the Sample Wiring Diagram to BACnet Network found on page 5.
3. Open the Badger Meter Combo PC Software.
4. Follow steps 5 through 7 found on page 6 to open the Model 340BN Main screen.
5. From the Main screen, select MS/TP ReadBack.

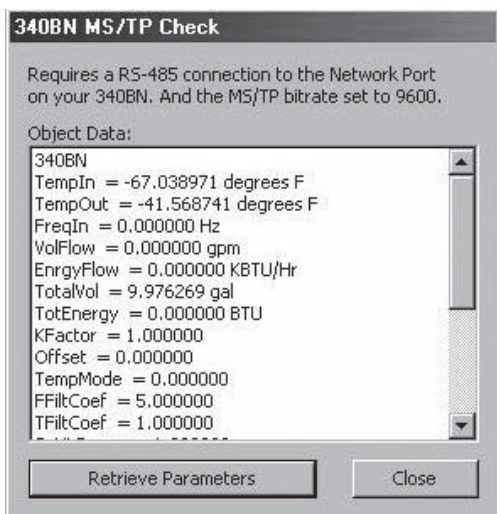


This will open the MS/TP Check screen as shown below.

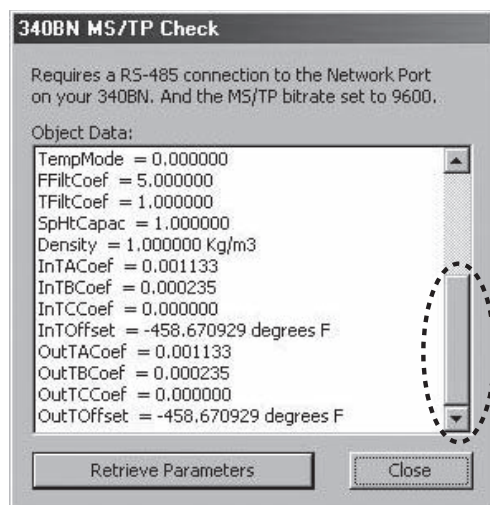


Press the Retrieve Parameters button which should display 340BN transmitter object data as shown below.

The LED located next to the 340BN network port, labeled “Comm LED”, will flash once to visually confirm communication between the 340BN transmitter and BACnet® master controller.



Use the scroll bar to view all object data.



If the 340BN transmitter fails to communicate with the BACnet master controller, check that the correct polling address was entered in step 12 found on page 8, the integrity of the network port connection and, if necessary, settings in the BACnet master controller.

Press the Close button to return to the Main Screen.

NETWORK SET-UP

The following Property Map is provided to assist in the programming of the BACnet network.

MODEL 340BN OBJECT MAP

Description	ID	Name	Out of Service	Units
Analog Input	AN1	TempIn	FALSE	°C, °F
"	AN2	TempOut	FALSE	°C, °F
"	AN3	FreqIn	FALSE	Hz
"	AN4	VolFlow	FALSE	gpm, gph, lps, lpm, lph, ft³/s, ft³/m, ft³/h, m³/s, m³/min, m³/h
"	AN5	EnrgyFlow	FALSE	kBTU/min, kBTU/h, kW, MW, HP, Tons
Analog Value	AV1	TotalVol	FALSE	gallons, liters, ft³, m³
"	AV2	TotEnergy	FALSE	BTU, kBTU, MBTU, kWh, MWh, kJ, MJ
"	AV3	Kfactor	FALSE	dimensionless
"	AV4	Offset	FALSE	dimensionless
"	AV5	TempMode	FALSE	dimensionless
"	AV6	FFilterCoef	FALSE	dimensionless
"	AV7	TFiltCoef	FALSE	dimensionless
"	AV8	SpHtCapac	FALSE	BTU/lb-F
"	AV9	Density	FALSE	lb/gallon
"	AV10	InTACoef	FALSE	dimensionless
"	AV11	InTBCoef	FALSE	dimensionless
"	AV12	InTCCoef	FALSE	dimensionless
"	AV13	InTOffset	FALSE	°C, °F
"	AV14	OutTACoef	FALSE	dimensionless
"	AV15	OutTBCoef	FALSE	dimensionless
"	AV16	OutTCCoef	FALSE	dimensionless
"	AV17	OutTOffset	FALSE	°C, °F

MODEL 340BN FACTORY DEFAULT SETTINGS

The table below is a list of factory default setting for all 340BN variables. These settings can be changed by accessing the parameters sensor (page 7) or Configure MS/TP screen (page 8) to best fit your application. As new valves are assigned, they can be written in the blank provided next to each variable for future reference.

Model 340BN Factory Default Settings

Description	Default Value	Customer Value
Flow Sensor Type	Pulse	
"K" Value	1	
"Offset" Value	0	
Flow Rate	gpm	
Flow Total	gallons	
Temperature	°F	
Energy Calculation	absolute	
Temperature Sensor Type	10 kΩ thermistor	
Energy Rate	kBTU/hr	
Energy Total	BTU	
Flow Filter Coefficient	5	
Energy Filter Coefficient	1	
MS/TP Address	1	
MS/TP Baud Rate	9600	

**BACNET® PROTOCOL
IMPLEMENTATION CONFORMANCE STATEMENT**

Products

Product	Model Number	Protocol Revision	Software Version	Firmware Version
340BN	8340BN	135-2001		Rev. 1.00

Vendor Information

Badger Meter Inc. 6116 E 15 th St. Tulsa, Ok 74112 www.badgermeter.com
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Product Description

The Series 340 BTU Transmitter is a low cost, flow and temperature sensor interface used in sub-metering applications. An additional communication design feature provides connectivity for BACnet® MS/TP

BACnet Standardized Device Profile

Product	Device Profile	Tested
340BN	BACnet Smart Sensor (B-SS)	

Supported BIBBs

Product	Supported BIBBs	BIBB Name	Tested
340BN	DS-RP-B	ReadProperty-B	
	DS-WP-B	WriteProperty-B	

Standard Object Types Supported

Product	Object Type	Creatable	Deletable	Tested
340BN	Analog Input	No	No	
340BN	Analog Value	No	No	
340BN	Device	No	No	

Data Link Layer Options

Product	Data Link	Options	Tested
340BN	MS/TP Slave	Baud rates: 9600, 19200, 38400, 76800	

Segmentation Capability

Product	Segmentation Type	Supported	Window Size (MS/TP product limited to 1)	Tested
340BN	Able to transmit segmented messages	No		N/A

Device Address Binding

Product	Static Binding Supported	Tested
340BN	No	N/A

Character Sets

Product	Character Sets supported	Tested
340BN	ANSI X3.4	

SPECIFICATIONS

Power

Power supply options:
12-24 VAC rms Tolerance
12-24 VDC Tolerance
Current draw:
< 70mA @ 12 VDC

Flow Sensor Input

Pulse type sensors:
Signal amplitude:
2.5 VDC threshold
Signal limits:
Vin < 35V (DC or AC peak)
Frequency:
0-10kHz
Pull-up:
15 VDC @ 2 k Ω Source Impedance

Sine wave sensors:

Signal amplitude:
30 mV p-p threshold
Signal limits:
Vin < 35V (DC or AC peak)
Frequency:
0-10kHz

Power out terminal

Excitation voltage 3 wire sensors:
15 VDC @ 500 Ω Source Impedance

Temperature Sensor Input

2 required:
10 k Ω thermistor, 2 wire, type II,
10 k Ω @ 25°C
100 Ω platinum RTD, DIN
calibration curve, conforms to
IEC-751 Standard
1000 Ω platinum RTD, DIN
calibration curve, conforms to
IEC-751 Standard
calibration range 0-150°C

Communication Port

RS-485 with termination, pull up and
pull down jumpers

Operating Temperature

0° C to +70° C
32° F to +158° F

Storage Temperature

-40° C to +85° C
-40° F to +185° F

Weight

4.8 oz. with connector headers
installed

SENSOR CALIBRATION

Badger Meter

Use K and Offset provided in sensor
owner's manual

Other Sensors

Check with factory

UNITS OF MEASURE

Flow measurement

Rate:

gpm, gph, l/sec, l/min, l/hr, ft³/sec,
ft³/min, ft³/hr, m³/sec, m³/min, m³/hr

Total:

gallons, liters, cubic feet, cubic
meters

Energy measurement

Rate

kBtu/min, kBtu/hr, kW, MW, hp, tons

Total

Btu, kBtu, MBtu, kWh, MWh, kJ, MJ

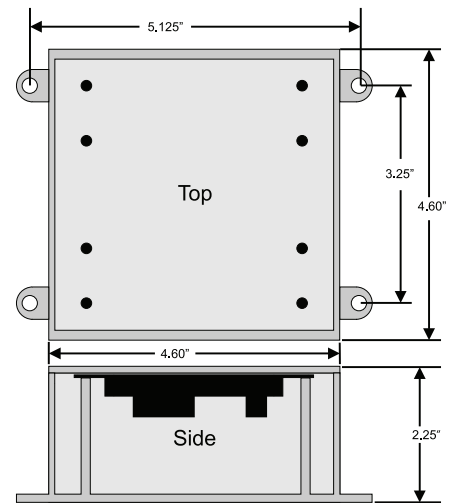
Temperature Units

Fahrenheit, Centigrade

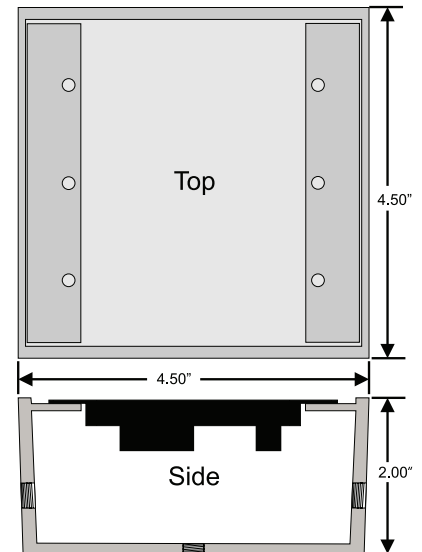
PROGRAMMING

Requires PC or laptop running
Windows® 2000, XP

Badger Meter Model A-301
programming kit containing 340BN
software and Model A-301
programming cable is required for
programming and setup



Plastic Enclosure Dimensions



Metal Enclosure Dimensions

Windows® is a registered trademark of Microsoft Corporation.

BACnet® is a registered trademark of American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).



Please see our website at www.dataindustrial.com
for specific contacts.

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