Model 340MB	Modbus Energy Transmitter	Installation & Operation Manual

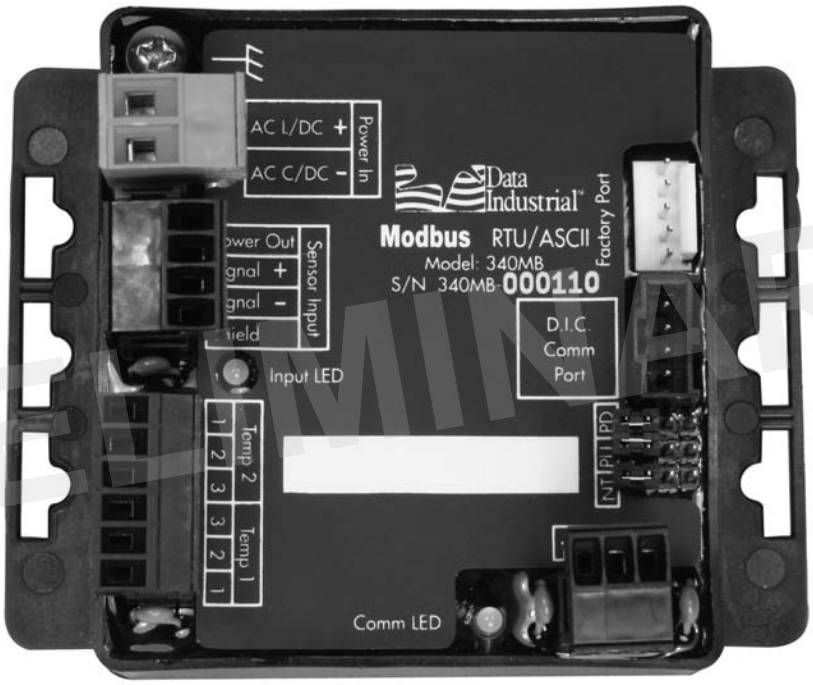


TABLE OF CONTENTS

INTRODUCTION

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

The Model 340MB 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 impeller 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 340MB 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 340MB transmitter features two LED's to verify Modbus and flow sensor input activity.

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

The Model 340MB 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 340MB 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 340MB 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 340MB 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 340MB to be attached to DIN 15, 32, 35 mm DIN rail systems.

Wall Mounting

Optional metal and plastic enclosures are available for the Model 340MB. 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 340MB 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.

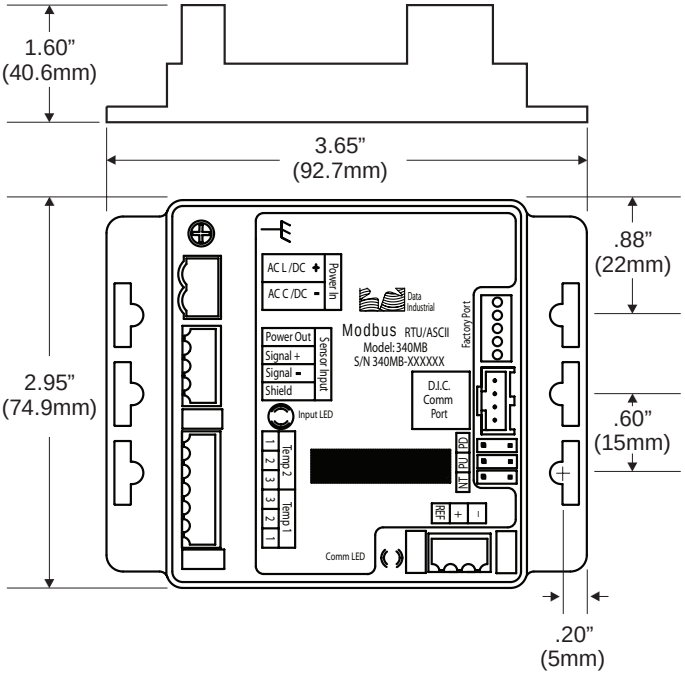


Figure 1: Model 340MB Dimensions

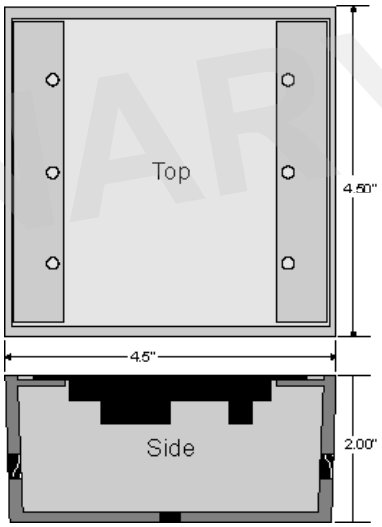


Figure 2: Model 340MB Metal Box Dimensions

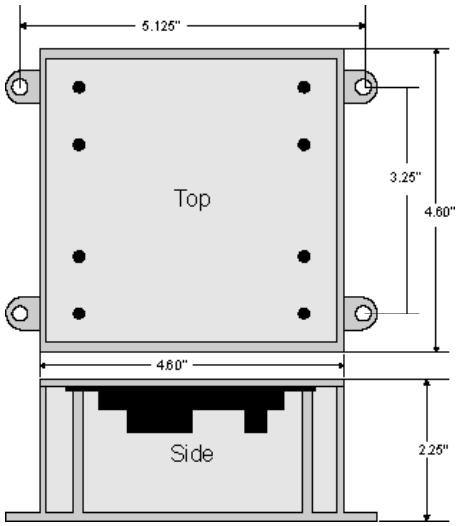


Figure 3: Model 340MB Plastic Box Dimensions

Electrical Installation
All connections to the Model 340MB are made to screw terminals on removable headers.

Power Supply Wiring
The Model 340MB 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 340MB to a solid earth ground with a wire which is as short as possible. This will help prevent electrical interference from affecting the Model 340MB'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 340MB Sensor Input Signal (+) terminal, and connect the flow sensor black wire to Model 340MB 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 340MB transmitter Sensor Input Signal (+) terminal, and SDI terminal number 2 to the Model 340MB transmitter Sensor Input Signal (-) terminal. Connect the shield terminal of the SDI sensor tot he Sensor Input Shield terminal of the Model 340MB transmitter.

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

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

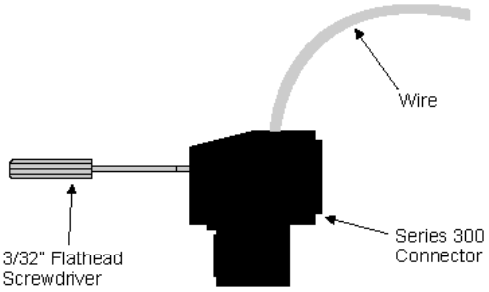


Figure 4:
Side View - Typical 300 Series Removable Connector Wiring

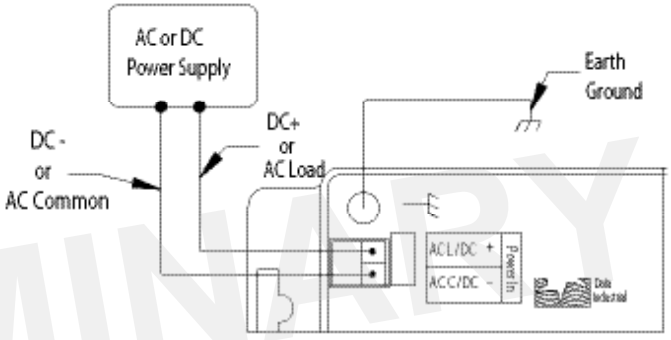


Figure 5: Sample Power Supply Wiring Diagram

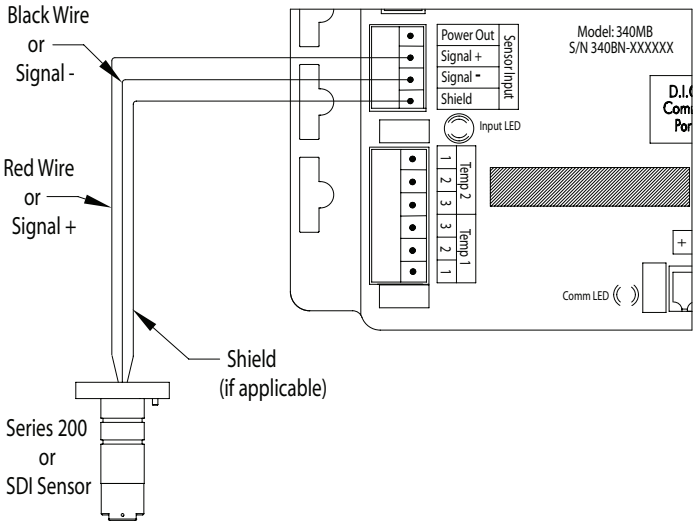


Figure 6: Sample Sensor Wiring Diagram

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 electromagnetic interference.

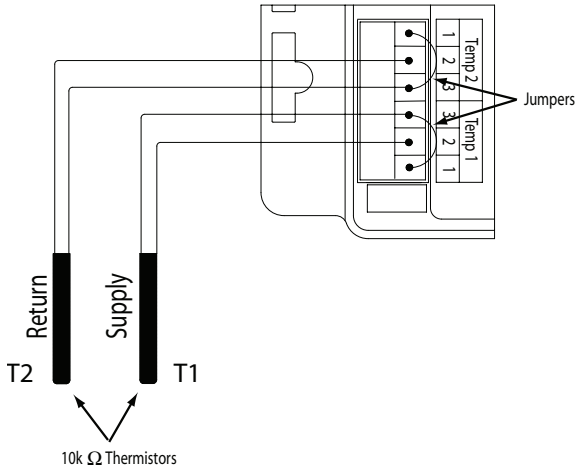


Figure 7: Thermistor Wiring Diagram

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 Modbus Buss

As shown in the Modbus Sample Wiring Diagram, the position of jumpers on each 340MB transmitter and wiring between each 340MB transmitter and the Modbus network are different depending on where the transmitter is installed, i.e. its nodal position. For all but the final 340MB transmitter in a Modbus 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 Modbus buss. For the final 340MB transmitter in a Modbus 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 Modbus buss.

Note: The Model 340MB 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.

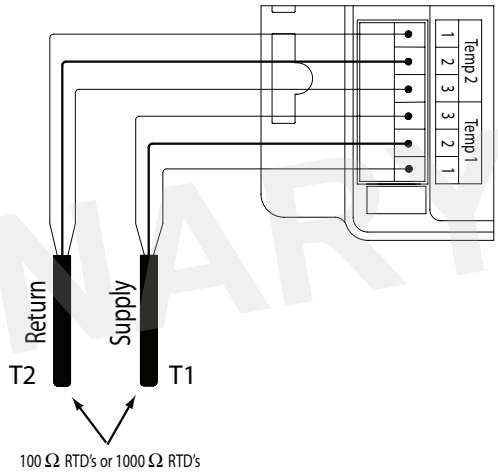


Figure 8: RTD Wiring Diagram

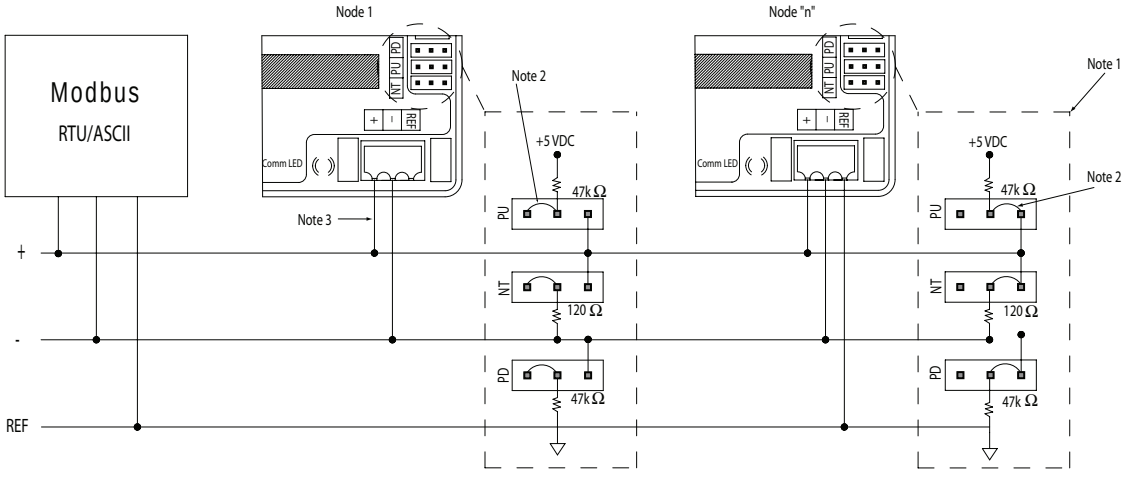


Figure 9: Sample Wiring Diagram to Modbus Network

Note 1: Biasing, circuitry, and resistors for PU, PD, and NT terminals are integral part of 340MB transmitter.

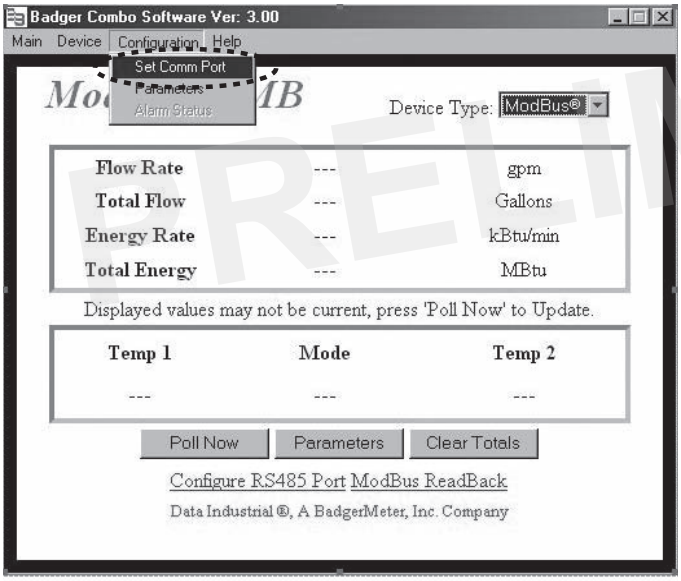
Note 2: For the final 340MB transmitter in a given Modbus network, NT, PU, and PD jumpers should be in "open" position. Otherwise, NT, PU, and PD should be in the "closed" position.

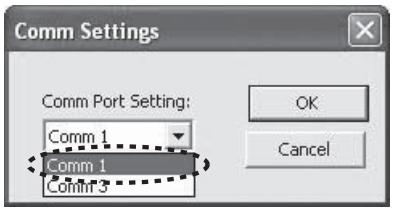
Note 3: For the final 340MB transmitter in a given Modbus network, all three network terminals (+), (-), and REF should be connected to the Modbus buss. Otherwise, connect only terminals (+), (-) to the Modbus buss.

Programming the Model 340MB Transmitter

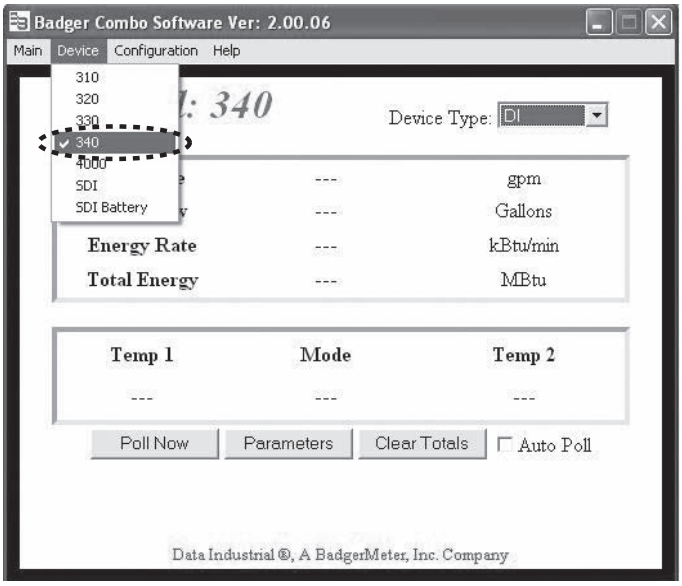
Prior to introducing the Model 340MB onto a Modbus network, it must be configured for the type of input signal, pipe size, desired units of measure, filter coefficient, and temperature sensor. The default network address should be assigned to an unused address to avoid conflicts with other instruments on the Modbus network. To change settings in the 340MB 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 340MB transmitter using the Badger Meter Model A301 communications cable. Plug the Model RS232 connector on the Model A301 cable to the Model 340MB 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 340MB 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.

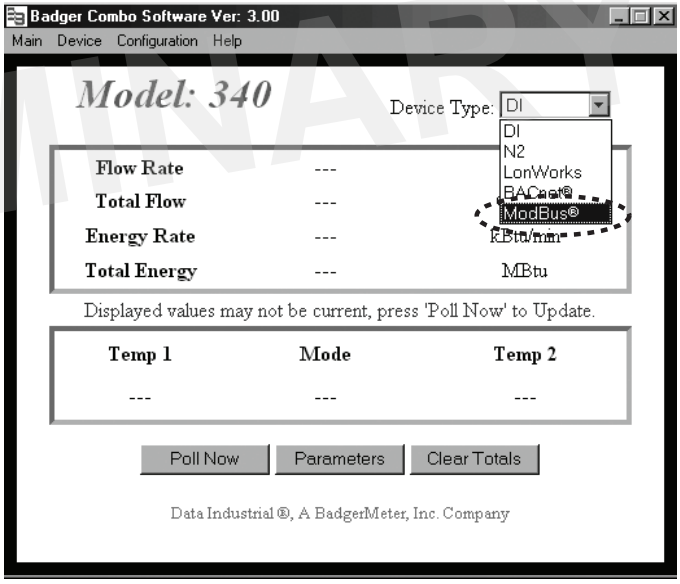




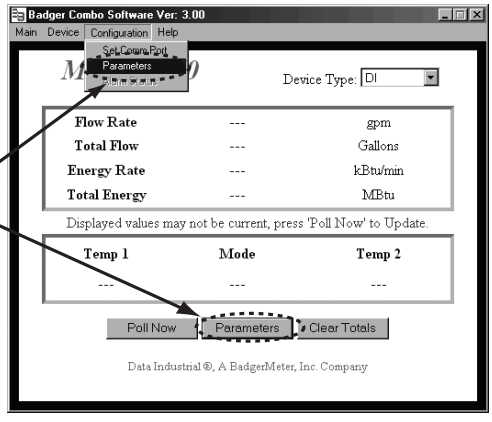
6. Select Device and 340 from the menu bar as shown below.



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

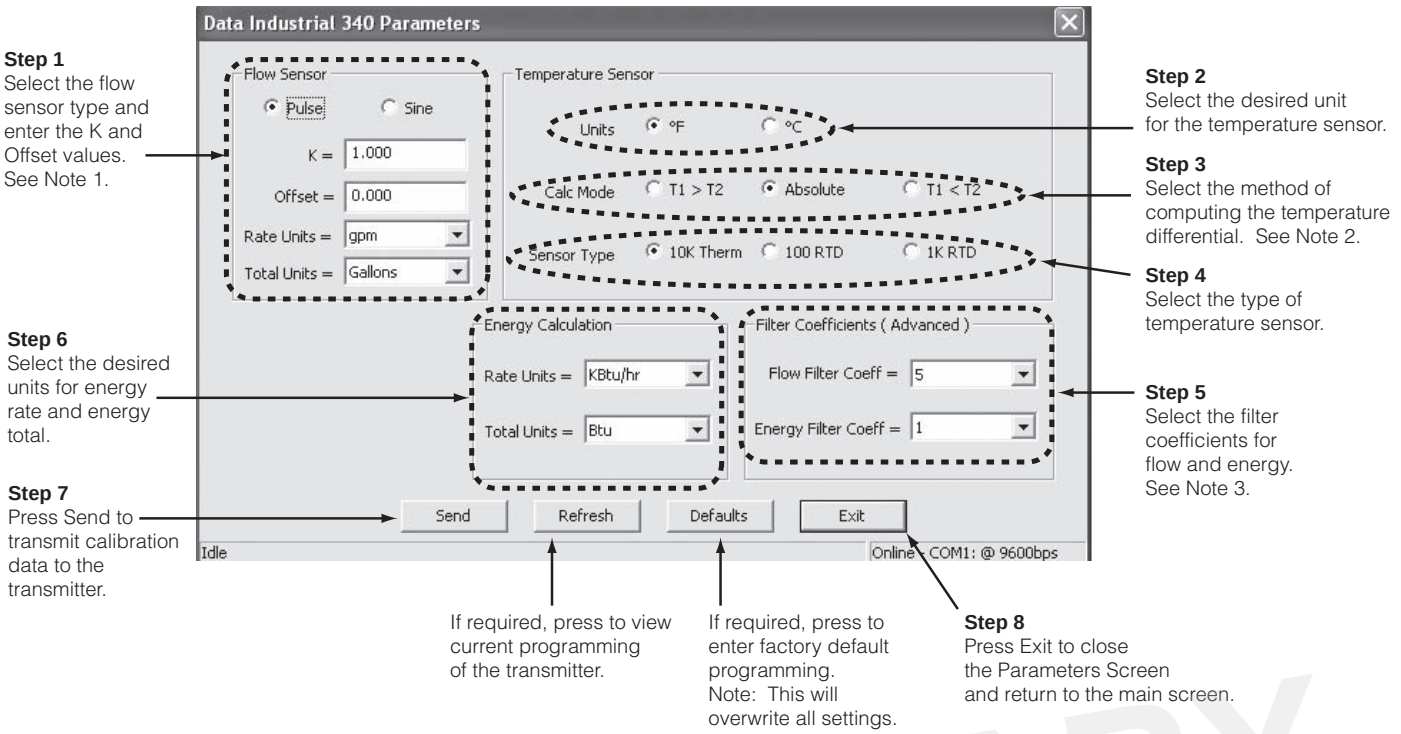


8. Select Configuration from the menu bar and open the Parameters screen as shown below.



To go to the calibration settings screen select Parameters from either place shown

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



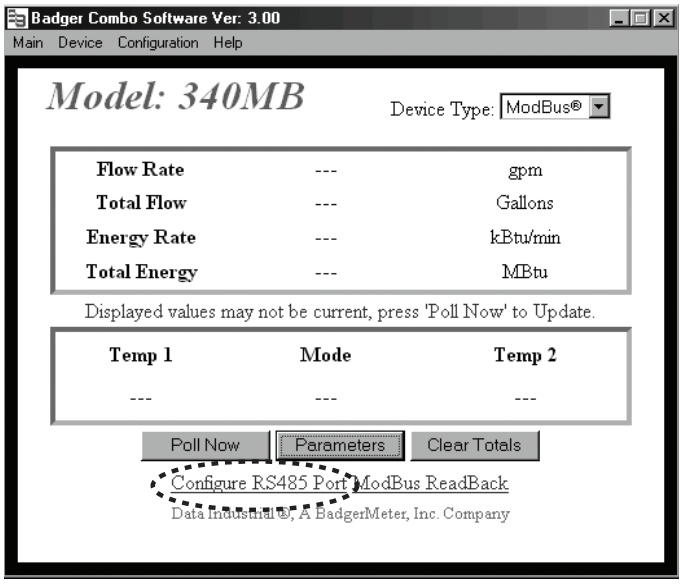
Note #1:
Badger Meter sensors are pulse type sensors. The K and Offset information is printed in the owners manual shipped with the product. This information is also available on our website. Calibration constants for other sensors must be supplied by the manufacturer.

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).

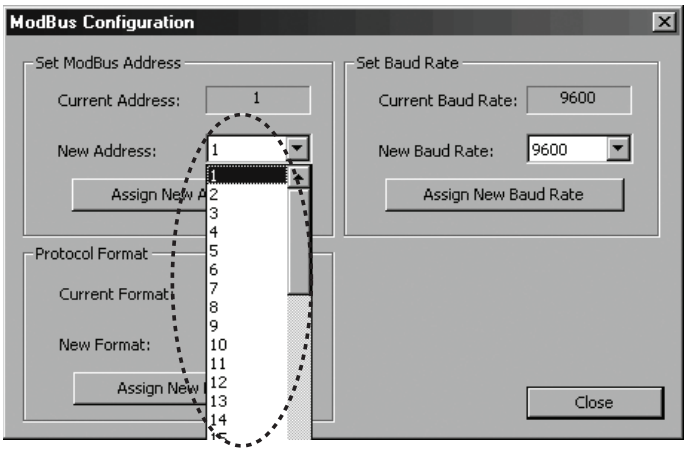
Note #3
The filter coefficient screen allows adjustment of the flow and energy filters. Filter settings determine how the Series 340MB responds to actual changes in flow and energy. A scale of 0 -10 is used with 10 providing the greatest degree of smoothing.

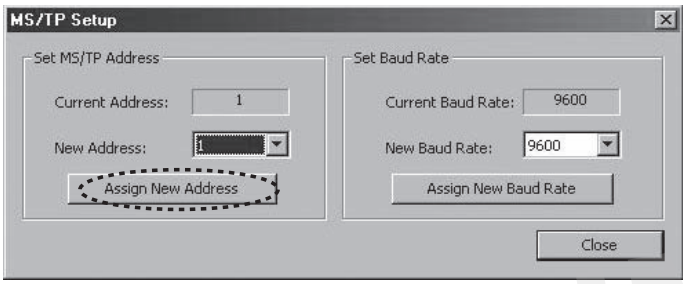
10. After setting Model 340MB parameters, press Exit and return to the Main screen.

11. Select Configure RS485 Port to open the MS/TP Setup screen as shown below.

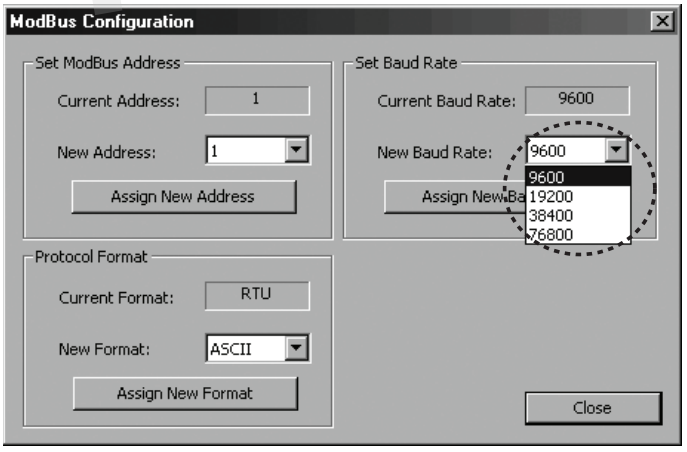


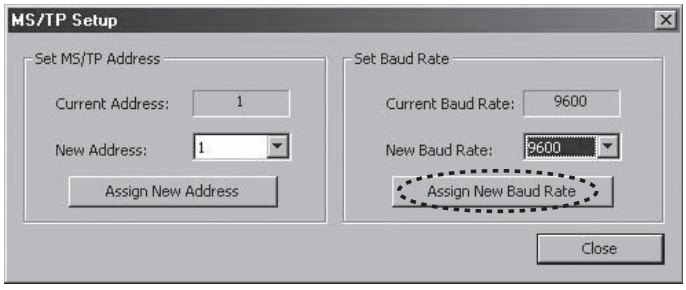
12. To set the address for the 340MB transmitter, open the New Address pull-down menu and select the correct polling address which matches the polling address entered into the master controller for this node of the Modbus network. Press the Assign New Address button to transmit polling information to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





13. To set the Dele baud rate for communication from the Modbus buss to the Model 340MB 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 340MB transmitter. Press the Close button to return to the Main screen.





Modbus Diagnostic Utility

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

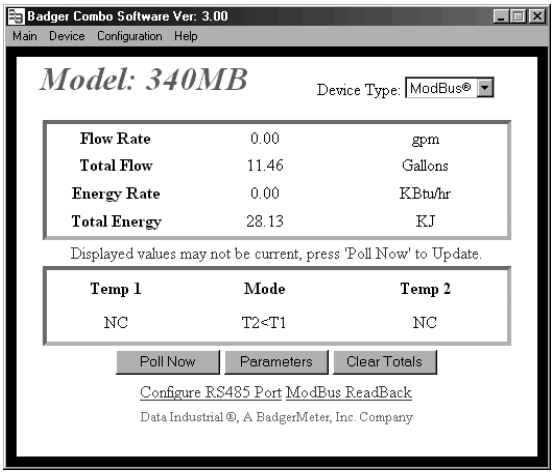
1. Connect the PC to the Model 340MB transmitter using the Badger Meter Model A301 communications cable. Plug the RS232 connector on the Model A301cable to the 340MB socket labeled D.I.C. Comm Port, taking care to properly align the tab on the plug and socket to maintain polarity. Plug the DB9 connector 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 340MB transmitter to the Modbus network. Connect all three Model 340MB network terminals (+), (-), and REF to the Modbus buss if the transmitter is the final node in a given network. Otherwise, connect only terminals (+) and (-) to the Modbus buss. Confirm the correct position of jumpers on the Model 340MB transmitter. For the final transmitter in a given Modbus 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 Modbus Network found on page 5.

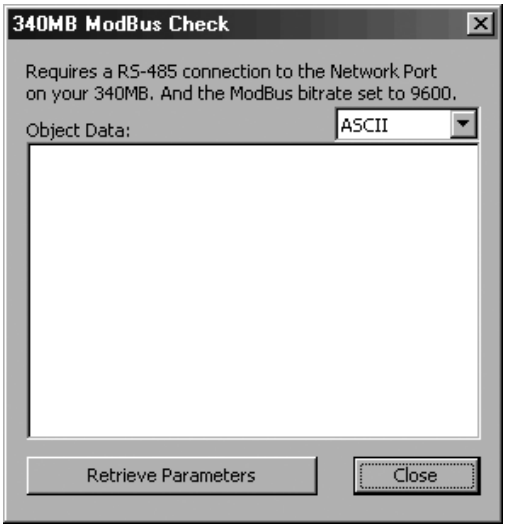
3. Open the Badger Meter Combo PC Software.

4. Follow steps 5 through 7 found on page 6 to open the Model 340MB 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 340MB transmitter object data as shown below.

The LED located next to the 340MB network port, labeled "Comm LED", will flash once to visually confirm communication between the 340MB transmitter and Modbus master controller.

Use the scroll bar to view all object data.

If the 340MB transmitter fails to communicate with the Modbus 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 Modbus master controller.

Press the Close button to return to the Main Screen.

NETWORK SET-UP

The following Register Map is provided to assist in the programming of the Modbus network.

MODEL 340MB REGISTER MAP

Register Name	Address	Data Type	R/W
Inlet Temperature	0	IEEE754 Float	Read Only
Outlet Temperature	2	IEEE754 Float	Read Only
Input Frequency	4	IEEE754 Float	Read Only
Total Volume	6	IEEE754 Float	R/W
Total Energy	8	IEEE754 Float	R/W
Flow Rate	10	IEEE754 Float	Read Only
Energy Rate	12	IEEE754 Float	Read Only
K Factor	14	IEEE754 Float	R/W
Offset	16	IEEE754 Float	R/W
Temperature Calculation Mode	18	IEEE754 Float	R/W
Flow Filter Coefficient	20	IEEE754 Float	R/W
Temperature Filter Coefficient	22	IEEE754 Float	R/W
Specific Heat Capacity	24	IEEE754 Float	R/W
Fluid Density	26	IEEE754 Float	R/W
Temp In A Coefficient	28	IEEE754 Float	R/W
Temp In B Coefficient	30	IEEE754 Float	R/W
Temp In C Coefficient	32	IEEE754 Float	R/W
Temp In Offset	34	IEEE754 Float	R/W
Temp Out A Coefficient	36	IEEE754 Float	R/W
Temp Out B Coefficient	38	IEEE754 Float	R/W
Temp Out C Coefficient	40	IEEE754 Float	R/W
Temp Out Offset	42	IEEE754 Float	R/W

All variables above take two Modbus register locations.
(4 bytes). Note some registers are read only.

MODEL 340MB FACTORY DEFAULT SETTINGS

The table below is a list of factory default setting for all 340MB 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.

Factory Default Settings - Model 340MB

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	thermistor	
Energy Rate	kBTU/hr	
Energy Total	BTU	
Flow Filter Coefficient	5	
Energy Filter Coefficient	1	

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 kΩ 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 @ 500Ω Source Impedance

Temperature Sensor Input

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

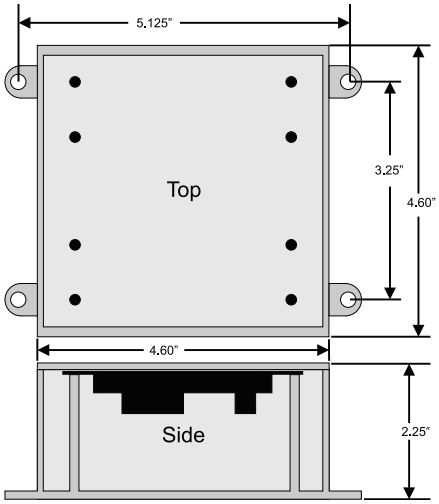
Temperature Units

Fahrenheit, Centigrade

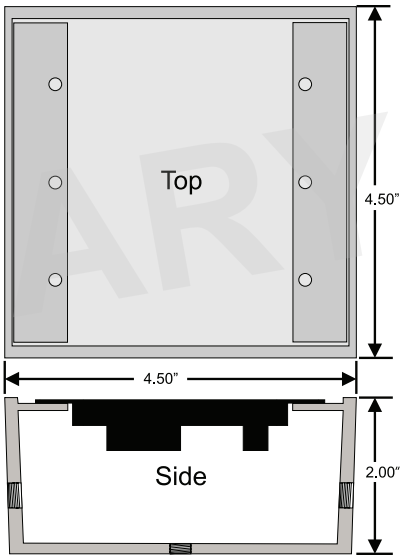
PROGRAMMING

Requires PC or laptop running Windows® 2000, XP

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



Plastic Enclosure Dimensions



Metal Enclosure Dimensions

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Data Industrial®

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

Due to continuous research, product improvements and enhancements, Badger Meter reserves the right to change product or system specifications without notice, except to the extent an outstanding contractual obligation exists.

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