Fox Thermal Instruments, Inc.

THERMAL MASS FLOW METER & TEMPERATURE TRANSMITTER

Model FT2A
Modbus & BACnet MS/TP

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This publication must be read in its entirety before performing any operation. Failure to understand and follow these instructions could result in serious personal injury and/or damage to the equipment. Should this equipment require repair or adjustment beyond the procedures given herein, contact the factory at:

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Fox FT2A Manuals:
- Model FT2A Instruction Manual
- Fox FT2A View™ Instruction Manual
- Fox FT2A Profibus, DeviceNet & Ethernet Manual
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Modbus Introduction</td>
<td>4</td>
</tr>
<tr>
<td>2. Modbus Protocol</td>
<td>4</td>
</tr>
<tr>
<td>3. RS485 Wiring for Modbus</td>
<td>5</td>
</tr>
<tr>
<td>4. FT2A Commands Supported by Modbus</td>
<td>6</td>
</tr>
<tr>
<td>5. Modbus Programming</td>
<td>13</td>
</tr>
<tr>
<td>6. BACnet Introduction</td>
<td>17</td>
</tr>
<tr>
<td>7. BACnet Protocol</td>
<td>17</td>
</tr>
<tr>
<td>8. RS485 Wiring for BACnet MS/TP</td>
<td>19</td>
</tr>
<tr>
<td>9. BACnet Programming</td>
<td>20</td>
</tr>
<tr>
<td>10. Glossary of Terms and Abbreviations</td>
<td>24</td>
</tr>
<tr>
<td>11. Index</td>
<td>25</td>
</tr>
</tbody>
</table>
Scope
Thank you for purchasing the Model FT2A Thermal Gas Mass Flow meter and Temperature Transmitter from Fox Thermal Instruments. The Model FT2A is one of the most technically advanced flow meters in the world. Extensive engineering effort has been invested to deliver advanced features, accuracy measurement performance and outstanding reliability.


Modbus Protocol
MODBUS Protocol is an application layer messaging protocol that provides client/sever communications between devices. MODBUS is a request/reply protocol and offers services specified by function codes.

The size of the MODBUS Protocol Data Unit is limited by the size constraint inherited from the first MODBUS implementation on Serial Line network (max. RS485 Application Data Unit = 256 bytes).

Therefore, MODBUS PDU for serial line communication = 256 – Server address (1 byte) – CRC (2 bytes) = 253 bytes.

RS485 ADU = 253 + Server address (1 byte) + CRC (2 bytes) = 256 bytes.

For more information on MODBUS go to the web site http://www.modbus.org/.

Command Request:
\(<\text{Meter Address}>\) \(<\text{Function code}>\) \(<\text{Register start address high}>\) \(<\text{Register start address low}>\) \(<\text{Register count high}>\) \(<\text{Register count low}>\) \(<\text{CRC high}>\) \(<\text{CRC low}>\)

Command Response:
\(<\text{Meter Address}>\) \(<\text{Function code}>\) \(<\text{Data byte count}>\) \(<\text{Data register high}>\) \(<\text{Data register low}>\) ... \(<\text{Data register high}>\) \(<\text{Data register low}>\) \(<\text{CRC high}>\) \(<\text{CRC low}>\)

Note: The data in shown in brackets \(<\>\) represents one byte of data.
RS485 Wiring

RS485 Wiring for Modbus

Wiring connections are made to terminal block TS2 for Modbus communication.

The Tx/Rx+ signal connects to pin 7, Tx/Rx- connects to pin 8 and communication common to pin 9 as shown in Figure 3.1.

Termination Resistor

Connect a termination resistor across the receive/transmit signals of the last device on the Modbus communication line. To connect the 121 ohm termination resistor on the FT2A, set jumper W1 to the TERM position.

Disconnect the termination resistor on all other external Modbus devices. The termination resistor of the FT2A is disconnected by setting jumper W1 to the NC (Not Connected) position.

Fig. 3.1: Modbus Wiring

Note: W1 jumper will either be in the NC or TERM position. It should be in the TERM position on the last meter in the Modbus daisy chain.
FT2A Commands Supported by Modbus

FT2A Commands Supported

The FT2A supports the following commands:

1) Command 03: Read holding registers
2) Command 04: Read input register.
3) Command 06: Preset single register

Read Holding Registers (command 03)

This command reads the basic variable from the FT2A and has the following format:

Request:

\(<\text{Meter Address}> \ <\text{Command code}=03> \ <\text{Register start address high}> \ <\text{Register start address low}> \ <\text{Register count high}> \ <\text{Register count low}> \ <\text{CRC high}> \ <\text{CRC low}>\)

Response:

\(<\text{Meter Address}> \ <\text{Command code}=03> \ <\text{Byte count}> \ <\text{Data high}> \ <\text{Data low}> \ ... \ <\text{Data high}> \ <\text{Data low}> \ <\text{CRC high}> \ <\text{CRC low}>\)

Example:

Request data register at starting address 0x0000 and specifying only 1 register

\(<0x01> \ <0x03> \ <0x00> \ <0x00> \ <0x00> \ <0x01> \ <0x0a> \ <0x84>\)

Response:

\(<0x01> \ <0x03> \ <0x02> \ <xx> \ <xx> \ <\text{CRC high}> \ <\text{CRC low}>\)

Where xx xx is the data register value.

Table 4.1: FT2A Modbus Holding Registers

<table>
<thead>
<tr>
<th>Register Address</th>
<th>Modbus Address</th>
<th>Data Type</th>
<th>Scaling</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x00</td>
<td>40001</td>
<td>Flow in Eng units (low)</td>
<td>No</td>
<td>Mass flow in selected units</td>
</tr>
<tr>
<td>0x01</td>
<td>40002</td>
<td>Flow in Eng units (high)</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>0x02</td>
<td>40003</td>
<td>Total (low)</td>
<td>No</td>
<td>Total in selected units</td>
</tr>
</tbody>
</table>
# FT2A Commands Supported by Modbus

<table>
<thead>
<tr>
<th>Register Address</th>
<th>Modbus Address</th>
<th>Data Type</th>
<th>Scaling</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x03</td>
<td>40004</td>
<td>Total (High)</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>0x04</td>
<td>40005</td>
<td>Temperature (low)</td>
<td>*10</td>
<td>Temperature in selected units * 10</td>
</tr>
<tr>
<td>0x05</td>
<td>40006</td>
<td>Temperature (high)</td>
<td>*10</td>
<td></td>
</tr>
<tr>
<td>0x06</td>
<td>40007</td>
<td>Elapsed time (low)</td>
<td>*10</td>
<td>Elapsed time in hours * 10</td>
</tr>
<tr>
<td>0x07</td>
<td>40008</td>
<td>Elapsed time (high)</td>
<td>*10</td>
<td></td>
</tr>
<tr>
<td>0x08</td>
<td>40009</td>
<td>Velocity (Low)</td>
<td>No</td>
<td>Velocity in nm/hr</td>
</tr>
<tr>
<td>0x09</td>
<td>40010</td>
<td>Velocity (high)</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>0x0A</td>
<td>40011</td>
<td>Flow in Eng units * 10</td>
<td>10</td>
<td>Mass flow in selected units * 10</td>
</tr>
<tr>
<td>0x0B</td>
<td>40012</td>
<td>Flow in Eng units *100</td>
<td>100</td>
<td>Mass flow in selected units * 100</td>
</tr>
<tr>
<td>0x0C</td>
<td>40013</td>
<td>Total *100</td>
<td>100</td>
<td>Total in selected units * 100</td>
</tr>
<tr>
<td>0x0D</td>
<td>40014</td>
<td>Total2 (low, 2 gas curves only)</td>
<td>No</td>
<td>Total #2 for 2 gas curves</td>
</tr>
<tr>
<td>0x0E</td>
<td>40015</td>
<td>Total2 (high, 2 gas curves only)</td>
<td>No</td>
<td>Total #2 for 2 gas curves</td>
</tr>
<tr>
<td>0x0F</td>
<td>40016</td>
<td>Status</td>
<td>No</td>
<td>Status</td>
</tr>
<tr>
<td>0x10</td>
<td>40017</td>
<td>Spare/ Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0x11</td>
<td>40018</td>
<td>Control Register (Write Only)</td>
<td>No</td>
<td>Control Register</td>
</tr>
<tr>
<td>0x12</td>
<td>40019</td>
<td>Spare/ Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0x13</td>
<td>40020</td>
<td>Flow in Eng units (float, upper 16 bits)</td>
<td>No</td>
<td>Mass flow in selected units</td>
</tr>
<tr>
<td>0x14</td>
<td>40021</td>
<td>Flow in Eng units (float, lower 16 bits)</td>
<td>No</td>
<td>Mass flow in selected units</td>
</tr>
<tr>
<td>0x15</td>
<td>40022</td>
<td>Total in Eng units (float, upper 16 bits)</td>
<td>No</td>
<td>Total in selected units</td>
</tr>
<tr>
<td>0x16</td>
<td>40023</td>
<td>Total in Eng units (float, lower 16 bits)</td>
<td>No</td>
<td>Total in selected units</td>
</tr>
<tr>
<td>0x17</td>
<td>40024</td>
<td>Total#2 for 2 gas curve (float, upper 16 bits)</td>
<td>No</td>
<td>Total in selected units</td>
</tr>
<tr>
<td>0x18</td>
<td>40025</td>
<td>Total#2 for 2 gas curve (float, lower 16 bits)</td>
<td>No</td>
<td>Total in selected units</td>
</tr>
<tr>
<td>0x19</td>
<td>40026</td>
<td>Temperature in selected units (float, upper 16 bits)</td>
<td>No</td>
<td>Temperature in selected units</td>
</tr>
<tr>
<td>0x1A</td>
<td>40027</td>
<td>Temperature in selected units (float, lower 16 bits)</td>
<td>No</td>
<td>Temperature in selected units</td>
</tr>
<tr>
<td>0x1B</td>
<td>40028</td>
<td>Elapsed time in hours (float, upper 16 bits)</td>
<td>No</td>
<td>Elapsed time in hours</td>
</tr>
<tr>
<td>0x1C</td>
<td>40029</td>
<td>Elapsed time in hours (float, lower 16 bits)</td>
<td>No</td>
<td>Elapsed time in hours</td>
</tr>
<tr>
<td>0x1D</td>
<td>40030</td>
<td>Velocity in selected units (float, upper 16 bits)</td>
<td>No</td>
<td>Velocity in selected units</td>
</tr>
<tr>
<td>0x1E</td>
<td>40031</td>
<td>Velocity in selected units (float, lower 16 bits)</td>
<td>No</td>
<td>Velocity in selected units</td>
</tr>
<tr>
<td>0x1F</td>
<td>40032</td>
<td>Spare/ Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0x20</td>
<td>40033</td>
<td>Spare/ Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0x21</td>
<td>40034</td>
<td>Spare/ Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0x22</td>
<td>40035</td>
<td>Spare/ Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0x23</td>
<td>40036</td>
<td>Spare/ Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0x24</td>
<td>40037</td>
<td>Total 24 hrs, Last total record, low register</td>
<td>No</td>
<td>Tot24hrs: Last total record</td>
</tr>
<tr>
<td>0x25</td>
<td>40038</td>
<td>Total 24 hrs, Last total record, high register</td>
<td>No</td>
<td>Tot24hrs: Last total record</td>
</tr>
<tr>
<td>0x26</td>
<td>40039</td>
<td>Total 24 hrs, Current Day (0-6)</td>
<td>No</td>
<td>Tot24hrs: Current Day</td>
</tr>
<tr>
<td>Register Address</td>
<td>Modbus Address</td>
<td>Data Type</td>
<td>Scaling</td>
<td>Comment</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------</td>
<td>----------------------------------</td>
<td>---------</td>
<td>----------------------</td>
</tr>
<tr>
<td>0x27</td>
<td>40040</td>
<td>Total 24 hrs, Current Hour (0-23)</td>
<td>No</td>
<td>Tot24hrs: Current Hour</td>
</tr>
<tr>
<td>0x28</td>
<td>40041</td>
<td>Total 24 hrs, Record day 1, low register</td>
<td>No</td>
<td>Tot24hrs: Record day 1</td>
</tr>
<tr>
<td>0x29</td>
<td>40042</td>
<td>Total 24 hrs, Record day 1, high register</td>
<td>No</td>
<td>Tot24hrs: Record day 1</td>
</tr>
<tr>
<td>0x2A</td>
<td>40043</td>
<td>Total 24 hrs, Record day 2, low register</td>
<td>No</td>
<td>Tot24hrs: Record day 2</td>
</tr>
<tr>
<td>0x2B</td>
<td>40044</td>
<td>Total 24 hrs, Record day 2, high register</td>
<td>No</td>
<td>Tot24hrs: Record day 2</td>
</tr>
<tr>
<td>0x2C</td>
<td>40045</td>
<td>Total 24 hrs, Record day 3, low register</td>
<td>No</td>
<td>Tot24hrs: Record day 3</td>
</tr>
<tr>
<td>0x2D</td>
<td>40046</td>
<td>Total 24 hrs, Record day 3, high register</td>
<td>No</td>
<td>Tot24hrs: Record day 3</td>
</tr>
<tr>
<td>0x2E</td>
<td>40047</td>
<td>Total 24 hrs, Record day 4, low register</td>
<td>No</td>
<td>Tot24hrs: Record day 4</td>
</tr>
<tr>
<td>0x2F</td>
<td>40048</td>
<td>Total 24 hrs, Record day 4, high register</td>
<td>No</td>
<td>Tot24hrs: Record day 4</td>
</tr>
<tr>
<td>0x30</td>
<td>40049</td>
<td>Total 24 hrs, Record day 5, low register</td>
<td>No</td>
<td>Tot24hrs: Record day 5</td>
</tr>
<tr>
<td>0x31</td>
<td>40050</td>
<td>Total 24 hrs, Record day 5, high register</td>
<td>No</td>
<td>Tot24hrs: Record day 5</td>
</tr>
<tr>
<td>0x32</td>
<td>40051</td>
<td>Total 24 hrs, Record day 6, low register</td>
<td>No</td>
<td>Tot24hrs: Record day 6</td>
</tr>
<tr>
<td>0x33</td>
<td>40052</td>
<td>Total 24 hrs, Record day 6, high register</td>
<td>No</td>
<td>Tot24hrs: Record day 6</td>
</tr>
<tr>
<td>0x34</td>
<td>40053</td>
<td>Total 24 hrs, Record day 7, low register</td>
<td>No</td>
<td>Tot24hrs: Record day 7</td>
</tr>
<tr>
<td>0x35</td>
<td>40054</td>
<td>Total 24 hrs, Record day 7, high register</td>
<td>No</td>
<td>Tot24hrs: Record day 7</td>
</tr>
<tr>
<td>0x36</td>
<td>40055</td>
<td>Total 24 hrs, Last Total, low register</td>
<td>No</td>
<td>Tot24hrs: Last Total</td>
</tr>
<tr>
<td>0x37</td>
<td>40056</td>
<td>Total 24 hrs, Last Total, high register</td>
<td>No</td>
<td>Tot24hrs: Last Total</td>
</tr>
<tr>
<td>0x38</td>
<td>40057</td>
<td>Reserved</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>0x39</td>
<td>40058</td>
<td>Reserved</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>0x3A</td>
<td>40059</td>
<td>Reserved</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>0x3B</td>
<td>40060</td>
<td>Reserved</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>0x3C</td>
<td>40061</td>
<td>Reserved</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>0x3D</td>
<td>40062</td>
<td>Reserved</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>0x3E</td>
<td>40063</td>
<td>Reserved</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>0x3F</td>
<td>40064</td>
<td>Reserved</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>0x40</td>
<td>40065</td>
<td>Reserved</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>0x41</td>
<td>40066</td>
<td>Reserved</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>0x42</td>
<td>40067</td>
<td>Reserved</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>0x43</td>
<td>40068</td>
<td>Reserved</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>0x44</td>
<td>40069</td>
<td>Reserved</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

* The data in registers with scaling must be multiplied by 10 or 100 as indicated to be scaled properly.

Note: Registers A, B & C are provided to get more resolution for low flow and total. When value exceeds the 16 bit registers, they will be frozen with all 16 bits set. It is also possible to use the velocity to calculate the flow in engineering units by using the pipe area and conversion factor for the selected units.
Read Input Register  

**Read Input Register (FT2A Status, Command 04)**

This command is used to report the FT2A status information.

**Request:**

<Meter Address> <Command code=04> <Register address =0> <Register address =0> <Register count =0> <Register count =1> <CRC high> <CRC low>

**Response:**

<Meter Address> <Command code=04> <Byte count =2> <Status High><Status Low> <CRC high> <CRC low>

*Table 4.2: Status Bits Definitions for Command 04, Modbus Address 30001*

<table>
<thead>
<tr>
<th>Bit</th>
<th>Definition</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Power up indication</td>
<td>Cleared when out of the power up sequence</td>
</tr>
<tr>
<td>1</td>
<td>Flow rate reached high limit threshold</td>
<td>Set limit to zero to disable</td>
</tr>
<tr>
<td>2</td>
<td>Flow rate reached low limit threshold</td>
<td>Set limit to zero to disable</td>
</tr>
<tr>
<td>3</td>
<td>Temperature reached high limit threshold</td>
<td>Set limit to zero to disable</td>
</tr>
<tr>
<td>4</td>
<td>Temperature reached low limit threshold</td>
<td>Set limit to zero to disable</td>
</tr>
<tr>
<td>5</td>
<td>Sensor reading is out of range</td>
<td>Check sensor wiring</td>
</tr>
<tr>
<td>6</td>
<td>Velocity flow rate outside of calibration table</td>
<td>Check sensor wiring</td>
</tr>
<tr>
<td>7</td>
<td>Incorrect Settings</td>
<td>Check settings</td>
</tr>
<tr>
<td>8</td>
<td>In simulation mode</td>
<td>Set simulation value to 0 to disable</td>
</tr>
<tr>
<td>9</td>
<td>Frequency output is out of range</td>
<td>Check frequency output settings</td>
</tr>
<tr>
<td>10</td>
<td>Analog 4-20 mA for flow is out of range</td>
<td>Check analog output settings</td>
</tr>
<tr>
<td>11</td>
<td>Analog 4-20 mA for temperature is out of range</td>
<td>Check analog output settings</td>
</tr>
<tr>
<td>12</td>
<td>Anybus error</td>
<td>Replace display board</td>
</tr>
<tr>
<td>13</td>
<td>Bridge Shut Down</td>
<td>Check sensor wiring</td>
</tr>
<tr>
<td>14</td>
<td>CRC error</td>
<td>Check parameters and reset CRC</td>
</tr>
<tr>
<td>15</td>
<td>Error in Total</td>
<td>Reset total to clear alarm</td>
</tr>
</tbody>
</table>
FT2A Commands Supported by Modbus

Table 4.3: Status 2 Bits Definitions for Command 04, Modbus Address 30002

<table>
<thead>
<tr>
<th>Bit</th>
<th>Definition</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Not used</td>
<td>Not used</td>
</tr>
<tr>
<td>1</td>
<td>Busy</td>
<td>Busy</td>
</tr>
<tr>
<td>2</td>
<td>Not used</td>
<td>Not used</td>
</tr>
<tr>
<td>3</td>
<td>Curve #2 Selected (for 2 gas curves only)</td>
<td>Curve #2 Selected (for 2 gas curves only)</td>
</tr>
<tr>
<td>4</td>
<td>Not used</td>
<td>Not used</td>
</tr>
<tr>
<td>5</td>
<td>Not used</td>
<td>Not used</td>
</tr>
<tr>
<td>6</td>
<td>Not used</td>
<td>Not used</td>
</tr>
</tbody>
</table>
Preset Single Register (Command 06)

This command is used to perform miscellaneous functions such as clearing the totalizer and elapsed time. The register address is Modbus=40018 and the data to write is described below.

Request:

\[
<\text{Meter Address}> <\text{Command code}=06> <\text{Register address high}=0x00> <\text{Register address low}=0x11> <\text{Register data high}=0x00> <\text{Register data low}=0x02> <\text{CRC high}> <\text{CRC low}>
\]

Response:

\[
<\text{Meter Address}> <\text{Command code}=06> <\text{Register address}=0x00> <\text{Register address}=0x11> <\text{Register data}=0x00> <\text{Register data}=0x02> <\text{CRC high}> <\text{CRC low}>
\]

Reset Total:

Address = 40018, data = 0x02
This command is used to clear the Totalizer and elapsed time registers

Reset 24 hours Total:

Address = 40018, data = 180 (0xB4)
This command resets the 24 hours 7 days record including the day and hours counters

Reset 24 hour time:

Address = 40018, data = 181 (0xB5)
This command resets the 24 hours day and hours counters

24 hours Event:

Address = 40018, data = 182 (0xB6)
This command generates a 24 hours event, the same way as when the 24 hours counter rolls over.

This may be useful to record total over a shorter period.
FT2A Commands Supported by Modbus

Preset Single Register

Switch to Curve #1:

Address = 40018, data = 170 (0xAA)

This command initiates a command to switch to gas curve 1 when configured for 2 gas curves.

Make sure that the input contact is not programmed for curve switching.

Switch to Curve #2:

Address = 40018, data = 171 (0xAB)

This command initiates a command to switch to gas curve 2 when configured for 2 gas curves.

Make sure that the input contact is not programmed for curve switching.
Enter the Programming Mode
Press the F1 or the F2 key repeatedly, in the normal running mode, until the following screen is shown. This enters the programming mode:

```
SET PARAMETERS?
NO YES
F1 F2 F3 F4
```

Press YES (F4) and then the following screen will prompt the user to enter the password if enabled:

```
PASWD: _
UP DN NXT OK
F1 F2 F3 F4
```

Enter the correct password. Default password for Level 1 is 1234.

Press the UP (F1) or DN (F2) key to select a new digit or character, the cursor points to the selected digit. Press NXT (F3) to select the next digit and OK (F4) to accept the entry.

If the wrong password is entered, the message “Wrong Password” will be displayed for a few seconds and then return to the programming entry screen. If the password is accepted, the following screen will be shown:

```
SET PARAMETERS?
I/O FLO DSP EXIT
F1 F2 F3 F4
```

This is the base screen for the programming mode. To exit the programming mode, press EXIT (F4) repeatedly until “Normal Mode” is seen briefly.
Fig. 5.1: Menu Tree: Comm Selection and Programming

Enter menu by scrolling to display 4 and entering the password

Set Parameters

I/O FLO DSP EXIT

Set I/O

COM I/O 420 EXIT

None

Modbus

BACnet

Ethernet

Profibus

DeviceNet

Comm=Modbus NXT OK

Baud=9600 NXT OK

Parity=EVEN NXT OK

Address=02 CHG OK

Modbus only

1200 19200
2400 38400
4800 57600
9600 76800
115200

NONE ODD EVEN

01-247
Modbus Programming

Modbus Communication Parameters

Communication Protocol and Parameters
To program the communication parameters, press I/O (F1) key from the base menu.

```
SET I/O
I/O FEQ 420 EXIT
F1 F2 F3 F4
```

Then press I/O (F1) again:

```
SET I/O
COM CTC EXIT
F1 F2 F3 F4
```

Then press COM (F1) to select communication parameters.

Set Bus protocol for Modbus:

```
Bus=Modbus
NXT OK
F1 F2 F3 F4
```

Press NXT (F1) repeatedly until Modbus is selected as shown and then press OK (F4) to accept the setting.

The following communication parameters are only available for MODBUS:

```
Baud=9600
NXT OK
F1 F2 F3 F4
```

Press NXT (F1) repeatedly until the correct selection is shown and then press OK (F4) to accept the setting.

Selections are:

"115200"
"76800"
Modbus Programming

Modbus Communication Parameters

- "57600"
- "38400"
- "19200"
- "9600"
- "4800"
- "2400"
- "1200"

Press NXT (F1) repeatedly until the correct selection is shown and then press OK (F4) to accept the setting.

Selections are:
- "NONE"
- "ODD"
- "EVEN"

Press CHG (F1) to change the address and then press OK (F4) to accept the setting.

Selections are between 01 and 247.

Note: Power cycle is required for the new settings to take effect.
BACnet Introduction

Scope
Thank you for purchasing the Model FT2A Thermal Gas Mass Flow meter and Temperature Transmitter from Fox Thermal Instruments. The Model FT2A is one of the most technically advanced flow meters in the world. Extensive engineering effort has been invested to deliver advanced features, accuracy measurement performance and outstanding reliability.

This document describes the BACnet MS/TP implementation using RS485 serial communication physical layer for the Fox Thermal Instruments FT2A Mass flow meter.

BACnet Protocol

BACnet Protocol
BACnet MS/TP (Building Automation and Control Network /Master Slave Token Passing) is a data link layer protocol designed for communication between devices in building automation control systems. The protocol is based on devices, objects, properties, and services. Information inside a BACnet device is organized into a series of objects. Properties allow the data from the object to be written or read. The actions that a BACnet device uses to interact with another device are the services.

The FT2A Device profile: BACnet Smart Sensor (B-SS)

FT2A supports the following device binding methods:

Receive Who-Is, send I-Am (BIBB DM-DDB-B)
Receive Who-Has, send I-Have (BIBB DM-DOB-B)

Objects for FT2A:

Analog Input 1 = Flow
Analog Input 2 = Gas Temperature
Analog Input 3 = Total Flow / Reset Total
Analog Input 4 = Elapsed Time since reset
BACnet Protocol

Device object property identifiers and restrictions: (properties that are writable)

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object_Name</td>
<td>&lt; 10 bytes</td>
</tr>
<tr>
<td>Object_Identifier</td>
<td>Device Type only</td>
</tr>
<tr>
<td>Max_info_Frames</td>
<td>&lt;=255</td>
</tr>
<tr>
<td>Max_Master</td>
<td>&lt;=127</td>
</tr>
</tbody>
</table>

BACnet Interoperability Building Blocks (BIBB’S) provide function capabilities for data exchange between devices.

FT2A BIBB’s supported:

- DS-RP-B Read Property
- DS-WP-B Write Property
- DM-DDB-B Dynamic Device Binding
- DM-DOB-B Dynamic Object Binding
- DM-DCC-B Device Communication Control
- DS-RPM-B ReadPropertyMultiple
- DM-RD-B Reinitialize Device

MS/TP baud rates:

- 9600, 19200, 38400, 57600, 76800, 115200

FT2A Character sets supported:

- ANSI X3.4, UTF-8

Fox Thermal Instruments BACnet vendor ID: 650

For more information about BACnet visit http://www.bacnet.org/.
RS485 Wiring: BACnet MS/TP

Wiring connections are made to terminal block TS2 for BACnet MS/TP communication.

The Tx/Rx+ signal connects to pin 7, Tx/Rx- connects to pin 8 and communication common to pin 9 as shown in Figure 8.1.

Termination Resistor
Connect a termination resistor across the receive/transmit signals of the last device on the BACnet MS/TP communication line. To connect the 121 ohm termination resistor on the FT2A, set jumper W1 to the TERM position.

Disconnect the termination resistor on all other external BACnet MS/TP devices. The termination resistor of the FT2A is disconnected by setting jumper W1 to the NC (Not Connected) position.

Fig. 8.1: BACnet MS/TP Wiring

Note: W1 jumper will either be in the NC or TERM position. It should be in the TERM position on the last meter in the BACnet MS/TP daisy chain.
Enter the Programming Mode
Press the F1 or the F2 key repeatedly, in the normal running mode, until the following screen is shown. This enters the programming mode:

<table>
<thead>
<tr>
<th>SET PARAMETERS?</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F1</td>
</tr>
</tbody>
</table>

Press YES (F4) and then the following screen will prompt the user to enter the password if enabled:

<table>
<thead>
<tr>
<th>PASWD: _</th>
<th>UP</th>
<th>DN</th>
<th>NXT</th>
<th>OK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F1</td>
<td>F2</td>
<td>F3</td>
<td>F4</td>
</tr>
</tbody>
</table>

Enter the correct password. Default password for Level 1 is 1234.

Press the UP (F1) or DN (F2) key to select a new digit or character, the cursor points to the selected digit. Press NXT (F3) to select the next digit and OK (F4) to accept the entry.

If the wrong password is entered, the message “Wrong Password” will be displayed for a few seconds and then return to the programming entry screen. If the password is accepted, the following screen will be shown:

<table>
<thead>
<tr>
<th>SET PARAMETERS?</th>
<th>I/O</th>
<th>FLQ</th>
<th>DSP</th>
<th>EXIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F1</td>
<td>F2</td>
<td>F3</td>
<td>F4</td>
</tr>
</tbody>
</table>

This is the base screen for the programming mode. To exit the programming mode, press EXIT (F4) repeatedly until “Normal Mode” is seen briefly.
Enter menu by scrolling to display 4 and entering the password

- **SET PARAMETERS**
  - I/O
  - FLO
  - DSP
  - EXIT

- **SET I/O**
  - COM
  - I/O
  - 420
  - EXIT

- **Comm=BACnet**
  - NEXT
  - OK

- **Baud=9600**
  - NEXT
  - OK

- **MAC_ADD=23**
  - CHG
  - OK

- **MAX_MASTER=127**
  - CHG
  - OK

- **ID=12531**
  - CHG
  - OK

- **NAME=FT2A_FLOW**
  - CHG
  - OK

**BACnet only**

---

**Menu Tree**

*Fig. 9.1: Menu Tree: Comm Selection and Programming*
BACnet Programming

Communication Protocol and Parameters
To program the communication parameters, press I/O (F1) key from the base menu.

Then press I/O (F1) again:

Then press COM (F1) to select communication parameters

Set Bus protocol for BACnet:

Press NXT (F1) repeatedly until BACnet is selected as shown and then press OK (F4) to accept the setting.

Press NXT (F1) repeatedly until the correct selection is shown and then press OK (F4) to accept the setting.

Selections are:

“9600”
“19200”
“38400”
“57600”
“76800”
“115200”
Next select the MS/TP Mac address. The selection is from 0-127. Please note that only one device can be on a MS/TP Mac address.

Next select the MS/TP Max Master. The selection is from 0-127.

Next input the device object instance. Selection is from 0-4194303.

Next enter the device object name (9 characters maximum).

Note: Power cycle is required for the new settings to take effect.
Definitions

Glossary of Terms and Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADD</td>
<td>Address</td>
</tr>
<tr>
<td>ADU</td>
<td>Application Data Unit</td>
</tr>
<tr>
<td>B-SS</td>
<td>BACnet - Smart Sensor</td>
</tr>
<tr>
<td>BIBB</td>
<td>BACnet Interoperability Building Blocks</td>
</tr>
<tr>
<td>COM</td>
<td>Communication</td>
</tr>
<tr>
<td>CRC</td>
<td>Cyclic Redundancy Check</td>
</tr>
<tr>
<td>NC</td>
<td>Not Connected</td>
</tr>
<tr>
<td>PC</td>
<td>Personal Computer</td>
</tr>
<tr>
<td>PDU</td>
<td>Protocol Data Units</td>
</tr>
<tr>
<td>NRT</td>
<td>Non Resetting Totalizer</td>
</tr>
<tr>
<td>TERM</td>
<td>Terminal</td>
</tr>
</tbody>
</table>
Index

BACnet
- Programming, p. 20
- Protocol, p. 17
- Wiring, p. 19

Modbus
- FT2A Commands Supported, p. 6
- Preset Single Register, p. 11
- Programming, p. 13
- Protocol, p. 4
- Read Holding Registers, p. 6
- Read Input Registers, p. 9
- Status Bits, p. 9
- Wiring, p. 5

Programming
- BACnet, p. 22
- Menu Tree, p. 14; p. 21
- Modbus, p. 15

RS485 Wiring
- BACnet, p. 21
- Modbus, p. 5

Termination Resistor, p. 5

Wiring,
- BACnet, p. 21
- Modbus, p. 5
Information

Caution

Wiring

Definition of Terms