OVERVIEW

The Badger® Data Industrial® Model 345WT wireless Modbus/pulse transceiver is designed to allow systems integrators the ability to communicate with remote locations while avoiding the costs associated with running low voltage wiring to multiple locations in a single or between multiple buildings. To meet these requirements, the Model 345WT provides the installer with all the tools necessary to install and configure the hardware and software with a minimum of time and investment.

Installation Checklist

A Model 345WT system installation has the following components:

Required hardware
- Two or more Model 345WT transceivers.

External hardware
- RS485 Modbus master system such as a Model 3700 or a PLC.
- Optional: RS485/Modbus slave devices such as power meters or IO modules.
- Optional: Pulse output transducers for measuring gas, electricity, water, etc. from existing meters and sensors. Make sure to obtain the pulse output scale, or multiplier for each device you will be using.

Hardware Overview

Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>60Mhz ARM7.</td>
</tr>
<tr>
<td>LED</td>
<td>2 x RF, 2 x RS 485, 2 x pulse, Alive, Alarm</td>
</tr>
<tr>
<td>Communications</td>
<td>RS485 Modbus</td>
</tr>
<tr>
<td>RF</td>
<td>900Mhz Frequency Hopping, ISM band, 100mw</td>
</tr>
<tr>
<td>Range up to</td>
<td>1500 ft indoor depending on obstructions</td>
</tr>
<tr>
<td>Power Requirement</td>
<td>110-120VAC</td>
</tr>
<tr>
<td>Power Supply</td>
<td>Included, 9VDC, class 2 transformer (included)</td>
</tr>
<tr>
<td>Pulse Inputs</td>
<td>2x dry contact (consumption/rate/min/max)</td>
</tr>
<tr>
<td>Size</td>
<td>6.5&quot; x 4.5&quot; x 2&quot;</td>
</tr>
</tbody>
</table>

Electrical Connection

- Test Button
- Modbus Address
- System Configuration
- Power
- Programming Connector
- Alarm LED
- Radio Status LEDs
- RS485 Status LEDs
- Alive LED
- Pulse Status LEDs
- Pulse Inputs

Hardware Connection

Step 1 - Unpack materials: Remove all materials from shipping box and verify all required components are available.

Step 2 - Mount the Model 345WT on the wall or other appropriate location.

Step 3 - Connect the pulse output devices.

Step 4 - Connect the RS485 Modbus terminals to your Modbus devices. This can include either the master device such as an Model 3700 or PLC, and it can include a slave device such as a power meter.

Step 5 - Attach the antenna and power connector to the Model 345WT.
Modbus Address
Before the Badger® Data Industrial® Model 345WT can be used, you must set the Modbus address. This address must be unique among all Modbus devices in the system including all devices that are connected on remote wireless links.

Select an address, and set the dipswitches to match.

The sum of the value of the switches is the address. In the example to the right, address 52 is set by placing switch 4, 16 and 32 to the on position.

Note: $4 + 16 + 32 = 52$

System Configuration
For most systems, set all of the system switches to the “off” position.

Radio channel: This option selects the channel number that can be used to isolate a group of Model 345WTs.

Programming: Set the Prog Enable and Prog RST En to Off for normal operation.

Port RS232 or RS485: Set the switch to the Off position for RS485 operation. The Model 345WT can communicate via the RS232 connection, however, most Modbus devices will need 485 terminals.

Baud Rate: This option sets the serial port speed for the Modbus devices connected to the Model 345WT. Set this option to Off for 19200. Set the switch to On for 9600 baud.

Reserved: Set this option to Off.

Status LEDs
The device should power up and be ready in a few seconds. The LEDs should blink in the following manner.

- The Alive LED should start to blink about once per second.
- The Alarm LED will blink when transmission errors occur.
- The RF TX/RX LEDs will blink when the radio is receiving or transmitting data.
- The RS 485 LEDs will blink for local Modbus activity.
- The Pulse input LEDs will light when the corresponding pulse input terminals are closed.

Signal Strength Test
When the Model 345WT is operating, the Test button can be used to report the signal strength received by the Model 345WT from another unit.

Press and hold the Test button. The status LEDs will light up as a bar graph display. Each LED is approximately 10% of scale. For example if PULSE 1 and 2 are on, the received strength is approximately 20% to 29%.

For useful signal reporting, it is important to turn off all but one other Model 345WT. When reporting the signal strength, the most recent wireless transmission received is displayed. If two Model 345WTs are transmitting, the display will only show the most recently received packet, and the user will not be able to determine which Model 345WT the signal strength being reported.

NOTE: The normal operation of the Model 345WT is suspended while the test button is pressed. No pulses are counted, Modbus communications and wireless transmissions are not processed.

MODBUS OVERVIEW
Register Listing

<table>
<thead>
<tr>
<th>Offset</th>
<th>Point</th>
<th>Type</th>
<th>Desc</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>40001</td>
<td>UINT32</td>
<td>pulse count 1 MSW</td>
</tr>
<tr>
<td>1</td>
<td>40002</td>
<td>UINT32</td>
<td>pulse count 1 LSW</td>
</tr>
<tr>
<td>2</td>
<td>40003</td>
<td>UINT32</td>
<td>pulse count 2 MSW</td>
</tr>
<tr>
<td>3</td>
<td>40004</td>
<td>UINT32</td>
<td>pulse count 2 LSW (same format as pulse count 1)</td>
</tr>
<tr>
<td>4</td>
<td>40005</td>
<td>UINT16</td>
<td>inst pulse 1 time (seconds)</td>
</tr>
<tr>
<td>5</td>
<td>40006</td>
<td>UINT16</td>
<td>inst pulse 2 time (seconds)</td>
</tr>
<tr>
<td>6</td>
<td>40007</td>
<td>UINT16</td>
<td>(R/W) min pulse 1 time (seconds) (write clears min/max)</td>
</tr>
<tr>
<td>7</td>
<td>40008</td>
<td>UINT16</td>
<td>(R/W) min pulse 2 time (seconds)</td>
</tr>
<tr>
<td>8</td>
<td>40009</td>
<td>UINT16</td>
<td>(R/W) max pulse 1 time (seconds)</td>
</tr>
<tr>
<td>9</td>
<td>40010</td>
<td>UINT16</td>
<td>(R/W) max pulse 2 time (seconds)</td>
</tr>
<tr>
<td>10</td>
<td>40011</td>
<td>UINT16</td>
<td>(R/W) inst pulse count size. (default 5)</td>
</tr>
<tr>
<td>100</td>
<td>40101</td>
<td>UINT16</td>
<td>Serial Number (bytes 1,2) (serial number)</td>
</tr>
<tr>
<td>101</td>
<td>40102</td>
<td>UINT16</td>
<td>Serial Number (bytes 3,4)</td>
</tr>
<tr>
<td>102</td>
<td>40103</td>
<td>UINT16</td>
<td>Serial Number (bytes 5,6)</td>
</tr>
<tr>
<td>103</td>
<td>40104</td>
<td>UINT16</td>
<td>firmware version (e.g. v1.03, high byte=minor, lowbyte=major, 0x8000 flag set for Beta)</td>
</tr>
<tr>
<td>104</td>
<td>40105</td>
<td>UINT16</td>
<td>boot count</td>
</tr>
<tr>
<td>105</td>
<td>40106</td>
<td>UINT32</td>
<td>mfg date MSW</td>
</tr>
<tr>
<td>106</td>
<td>40107</td>
<td>UINT32</td>
<td>mfg date LSW</td>
</tr>
<tr>
<td>107</td>
<td>40108</td>
<td>UINT16</td>
<td>radio group id setting (0-6)</td>
</tr>
<tr>
<td>108</td>
<td>40109</td>
<td>UINT16</td>
<td>alarm flags (0x01 = boot from watchdog)</td>
</tr>
<tr>
<td>109</td>
<td>40110</td>
<td>UINT16</td>
<td>max packet buffers used.</td>
</tr>
<tr>
<td>110</td>
<td>40111</td>
<td>UINT32</td>
<td>Radio up time (seconds) MSW</td>
</tr>
<tr>
<td>111</td>
<td>40112</td>
<td>UINT32</td>
<td>Radio up time (seconds) LSW</td>
</tr>
</tbody>
</table>
Register Functions

Pulse Count: The pulse count is stored as an unsigned 32-bit integer. This allows for $2^{32}$ pulses (4.2 billion) to be counted before rollover. On Modbus systems that do not allow you to read 32-bit values, you can calculate the pulse count as follows:

$$\text{count} = (\text{MSW} \times 65535) + \text{LSW}$$

Instantaneous Pulse Rate: The pulse rate values for instantaneous, min and max rates are calculated based on the time between arriving pulses. For example, if InstPulse1 = 30, and inst pulse count size is 5, then the average rate for the last 5 pulses is 6 seconds per pulse. To convert the register values (in seconds) to a rate value, use the following formula.

$$\text{RatePerHour} = \left(\frac{\text{N} \times 60 \times 60}{\text{Inst Register}}\right)$$

Where InstRegister is any of the 6 register values 4 through 9. N is the instantaneous pulse count size at offset 10.

Min/Max pulse rate: These four registers are calculated from the instantaneous pulse rate. These latching registers are updated whenever the minimum or maximum rate fields are exceeded by the instantaneous rate. These four registers may be cleared by writing a zero to the register. Writing to one min/max register clears all four min/max registers.

FIRMWARE UPDATE

From time to time, Badger Meter may release firmware updates with additional features and system changes. To find out what firmware your Badger® Data Industrial® Model 345WT has installed, read the firmware version register with a Modbus utility, or use the Advanced Configuration page in the Model 3700 setup menu. Firmware update files may be obtained from Badger Meter Technical Support.

The firmware update process requires an RS232 serial port and a windows computer to run the firmware update utility. Before starting this process, verify your computer has a serial port available. You may need to deactivate other software such as the palm pilot utility or ups monitor software. USB connected serial ports may be used, however these are not as fast or reliable as standard computer serial ports and may fail to upgrade the firmware correctly.

To update the firmware, use the following procedure.

Step 1: Install the Philips LPC2000 software as provided by Badger Meter.

Step 2: Remove power from the Model 345WT. Attach the Model 345WT to your computer with an RS232 serial cable. The Model 345WT programming connector is the 9 pin RS232 connector to the side of the power jack.

Step 3: Set the following dip switches:

- Prog Enable = on
- ProgRstEn = on
- 485/232 = on

Step 4: Power up the Model 345WT. The Green Alive LED should light up and stay on solid.

Step 5: Run the LPC2000 Flash Utility. The following screen will be displayed.

Step 6: Set the following communications options:

- COM1 or COM2 depending on your computer serial port.
- Use baud rate: 38400 or slower.
- Check Use DTR/RTS for Reset
- XTL Freq[kHz] = 20000

Step 7: Click the Read Device ID button. The PartID and BootLoaderID fields will be shown if successful. Also, the Device dropdown menu should switch to LPC2124. The bottom of the window will display Read Part ID Successfully.

Step 8: Click the Filename... button. A dialog box will appear. Locate and select the Model 345WT firmware image file. In the example above, this is named R9120_v1.13b.hex.

Step 9: Click the Upload to Flash button. The firmware update will start, and a blue progress bar will be shown across the bottom of the screen.

Step 10: When the update is complete, disconnect power from the Model 345WT. Remove the RS232 serial cable. Turn off the three switches noted in step 3 above.

- Prog Enable = OFF
- Prog Rst En = OFF
- 485/232 = OFF

Step 11: Power up the Model 345WT. The new firmware should now operate. To confirm the new firmware is installed, use the Model 3700 device details page, click the Configure button, and then the Advanced button. The firmware version number will be displayed on the lower right side of the advanced details page.

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.