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Chapter 1. USB ZigBee Adapter

ZigBee is a low power, wireless mesh network standard, largely used in the areas of home automation, medical data collection and industrial control. The USB ZigBee Adapter connects a PC or any USB capable host to a ZigBee network.

At the core of the USB ZigBee Adapter is the XBee module from Digi, which implements the ZigBee stack. Once connected to the PC, the USB ZigBee Adapter is visible as a virtual COM port. The user can interact with the ZigBee stack, by sending commands through the virtual COM port.

The USB ZigBee Adapter also doubles up as an XBee Module Programmer for firmware upgrades.

1. Features
   - USB Powered
   - Built in +3.3V regulator for XBee module
   - XBee ZB and XBee-PRO ZB compatible
   - LEDs for TX/RX and ZigBee state
   - Debug LED and Key
   - Local and remote loopback

2. Wireless Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>XBee ZB</th>
<th>XBee-PRO ZB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data rate</td>
<td>250Kbps</td>
<td>250Kbps</td>
</tr>
<tr>
<td>Indoor range</td>
<td>40m</td>
<td>90m</td>
</tr>
<tr>
<td>Line of sight</td>
<td>120m</td>
<td>1500m</td>
</tr>
<tr>
<td>Tx. Power</td>
<td>1.25mW / 2mW</td>
<td>63mW</td>
</tr>
</tbody>
</table>

The international variant of XBee-Pro ZB are limited to 10mW Tx. Power
Chapter 2. Board Design

1. Overview

The devices available on the board, is shown in the following block diagram. Each device is described in detail in the following sections.

Figure 2.1. Block Diagram

2. Locating Components

The location of the components on the board is indicated in the following diagram.

Figure 2.2. Front View

3. Power Supply

The USB ZigBee Adapter is powered from a PC USB port, and does not require an external power supply. Detailed power supply specifications are available in section Specifications.
4. XBees Module

The XBees ZB Module or XBee-PRO ZB Module can be mounted on the USB ZigBee Adapter. The module provides a UART interface through which the host PC can send and receive data. The module can also be configured through the serial interface.

5. USB Serial

The USB ZigBee Adapter has a FT232R USB to serial UART converter, for communication between the host PC and the XBees modules. The OS detects the USB Serial device as a Virtual COM port. Any standard serial terminal application should be able to communicate with the XBees module, using the Virtual COM port.

The RTS and CTS signals of the USB serial converter are connected to the XBees module, for optional hardware flow control. The DTR signal of the USB serial converter is also connected to the XBees module, for switching the module into firmware upgrade mode, during module power up.

6. Status LEDs

The status LEDs indicate the following information.

- RXD LED: Blink indicates data has been received by the module from the host.
- TXD LED: Blink indicates data has been transmitted by the module to the host.
- ASC LED: Continuous blinking indicates associated with a network, in case of a router or end device. And PAN ID and radio channel has been selected in the case of coordinator.
- SIG LED: Brighter LED indicates a more stable link. In other words, shows the received signal strength of the last received packet.
- NAP LED: On indicates device has woken up from sleep state.

7. Debug Key & LED

A Debug Key and Debug LED is provided for testing the local and remote IOs. The Debug Key is connected to the pin DIO11 of the XBees module. The Debug LED is connected to the pin DIO4 of the XBees module.

8. Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB Power Supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>5V</td>
<td></td>
</tr>
<tr>
<td>Max. Current</td>
<td>100mA</td>
<td>With XBee ZB Module</td>
</tr>
</tbody>
</table>
Chapter 3. Board Usage

1. AT Mode and API Mode

The XBee modules can communicate using two protocols with the host.

1. AT Mode
2. API Mode

In AT mode, the module provides an AT command interface, similar to AT modem commands, for configuration. The AT mode also supports transparent mode of operation in which serial data sent to the module, is transmitted over the air to a remote ZigBee node.

In API mode, the module uses a binary packet interface for communicating with the host. The available packets and their formats is described in the module user manual.

2. Communicating in AT mode

The module is first updated with an AT mode firmware. AT commands can then be sent to the device using a terminal software, like putty, hyperterminal or minicom.

When the device is connected to the host system, it is detected a Virtual COM device in Windows, and a USB serial device in Linux.

Open a serial communication software like hyperterminal, teraterm, putty, etc. and configure the following parameters.

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Baudrate</td>
<td>9600</td>
</tr>
<tr>
<td>2</td>
<td>Data Bits</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>Stop Bits</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Parity</td>
<td>None</td>
</tr>
<tr>
<td>5</td>
<td>Flow Control</td>
<td>None</td>
</tr>
</tbody>
</table>

By default the module will be in transparent mode of operation, to enter AT command mode type `+++`. A one second gap, called the guard time, should be provided before and after the `+++` sequence. The module on entry into AT command mode, responds with `OK\r`. After which AT commands can be sent to the device.

For example, to get the firmware version (`VR`), the following sequence of commands can be used.

```
U: +++
M: OK
U: ATVR
M: 2070
```

The character `+` used for entering the AT command mode, is called the Command Character. The guard time and command character is configurable using AT commands. The default is 1 second and `+`, respectively.

The module can be put back to transparent mode of operation manually using the `CN AT command. The module also switches back to transparent mode of operation after a timeout, 10 seconds by default. The command mode timeout is also configurable using the `CT AT command.
3. Sending and Receiving Data in Transparent Mode

Transparent mode of operation is demonstrated using a two node network, consisting of a coordinator and router. The following sequence shows how to send a message from the coordinator to the router.

1. Update the coordinator AT firmware in module A, and router AT firmware in module B.
2. Connect the ZigBee Adapters to the host PC. Ensure the ASC LED is blinking in both the modules.

**Figure 3.1. Two Node Network**

3. Note down the 64-bit MAC address specified in the module B. The 64-bit MAC of the module can be obtained from the label on the back of the module. The 64-bit MAC can also be obtained using the `SH` and `SL` AT commands.

**Figure 3.2. Obtaining MAC address**

4. In module A, set the destination addressing using the `DH` and `DL` AT commands. `DH` is used to specify the higher order 32 bits and `DL` is used to specify the lower order 32 bits.
Figure 3.3. Setting the Destination

5. Switch both the module into transparent mode of operation, using the `CN AT` command. Type a message to be sent to module B, the message should appear on module B’s serial output.

Figure 3.4. Sending and Receiving Message
Appendix A. Legal Information

1. Copying

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2. Limited Hardware Warranty

The warranties provided by Zilogic Systems in this Limited Hardware Warranty apply only to Hardware Products you purchase for your use, and not for resale. The term "Hardware Product" means a computing device with a specific function and limited configuration ability.

2.1. LIMITED HARDWARE WARRANTY

Zilogic Systems warrants that the hardware components of its Hardware Product shall be free from material defects in design, materials, and workmanship and will function, under normal use and circumstances, in accordance with the documentation provided, for a period of one (1) year from the date of purchase of the Hardware Product.

Your sole and exclusive remedy, and Zilogic Systems' sole and exclusive liability for defective hardware components, shall be that Zilogic Systems, subject to the terms and conditions of this Section, and solely upon confirmation of a defect or failure of a hardware component to perform as warranted, shall at its sole option, either repair or replace the nonconforming hardware component. All replacement parts furnished to you under this warranty shall be refurbished and equivalent to new, and shall be warranted as new for the remainder of the original warranty period. All defective parts, which have been replaced, shall become the property of Zilogic Systems. All defective parts that have been repaired shall remain your property.

2.2. EXCLUSIONS

The foregoing warranties and remedies shall be void as to any Hardware Products damaged or rendered unserviceable by one or more of the following: (1) improper or inadequate maintenance by anyone other than Zilogic Systems or Zilogic Systems' authorized engineers, (2) interfacing supplied by anyone other than Zilogic Systems, (3) modifications, alterations or additions to the Hardware Products by personnel not certified by Zilogic Systems or Zilogic Systems' authorized engineers to perform such acts, or other unauthorized repair, installation or other causes beyond Zilogic Systems' control, (4) unreasonable refusal to agree with engineering change notice programs, (5) negligence by any person other than Zilogic Systems or Zilogic Systems' authorized engineers, (6) misuse, abuse, accident, electrical irregularity, theft, vandalism, fire, water or other peril, (7) damage caused by containment and/or operation outside the environmental specifications for the Hardware Products, (8) alteration or connection of the Hardware Products to other systems, equipment or devices (other than those specifically approved by Zilogic Systems) not in accordance to the board and on-board device specifications (9) any use that is inconsistent with the user manual supplied with the Hardware Product. The warranty period is not extended if Zilogic Systems repairs or replaces a warranted product or any parts. Zilogic Systems may change the availability of limited hardware warranties, at its discretion, but any changes will not be retroactive.

2.3. HARDWARE RETURN PROCEDURES

If a Hardware Product or one of its component parts does not function as warranted during the warranty period, and such nonconformance can be verified by Zilogic Systems, Zilogic Systems, at
its election, will provide either return and replacement service or replacement with a refurbished part/unit for the Hardware Product under the type of warranty service Zilogic Systems designates for that Hardware Product. A defective Hardware Product or one of its component parts may only be returned to Zilogic Systems upon Zilogic Systems' prior written approval. Any such approval shall reference an RMA number issued by an authorized Zilogic Systems service representative. If you do not register the Hardware Product with Zilogic Systems, you may be required to present proof of purchase as evidence of your entitlement to warranty service. The Hardware Product's serial number will be required for all RMA cases.

Transportation costs, if any, incurred in connection with the return of a defective item to Zilogic Systems shall be borne by You. Any transportation costs incurred in connection with the redelivery of a repaired or replacement item to You by Zilogic Systems shall be borne by Zilogic Systems; provided, however, that if Zilogic Systems determines, in its sole discretion, that the allegedly defective item is not covered by the terms and conditions of the warranty or that a warranty claim is made after the warranty period, the cost of the repair by Zilogic Systems, including all shipping expenses, shall be reimbursed by You.

2.4. HARDWARE REPLACEMENT PROCEDURES

Zilogic Systems will attempt to diagnose and resolve your problem over the phone or e-mail. Upon determination of the hardware issue is related to a malfunction of one of the Hardware Product components, an RMA process will be initiated by Zilogic Systems.

For Warranty Replacement service, it is required that you deliver the faulty unit to a location Zilogic Systems designates, and provide courier name and tracking number to Zilogic Systems. After the Faulty unit is returned to Zilogic Systems, Zilogic Systems will use commercially reasonable efforts to ship the replacement hardware within fourteen (14) business days. Actual delivery times may vary depending on availability of the spares and customer's location.

2.5. ADDITIONAL RESPONSIBILITIES

You agree:

- To provide Zilogic Systems or its partner with sufficient and safe access to your facilities to permit Zilogic Systems to fulfill its obligations.
- To ship back the faulty Hardware Product (or replaceable unit) suitably packaged, quoting the RMA number, to the Zilogic Systems designated location.
- You shall ship the faulty Hardware Product once Zilogic Systems approves the RMA and provide the courier name and tracking number.
- To securely erase from any Hardware Product you return to Zilogic Systems for any reason all programs and data not provided by Zilogic Systems with the Hardware Product. You acknowledge that in order to perform its responsibilities under this Limited Hardware Warranty, Zilogic Systems may ship all or part of the Hardware Product or its software to third party locations around the world, and you authorize Zilogic Systems to do so.

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