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EZBee™

2.4GHz Zigbee Serial Module

User Manual: Zigbee Module

Preliminary Version

EZ way to go wireless with ZigBee

Revision History: User Manual of EZBee™

Version	Document Number	Changed Contents	Date
Pre	EZB_manual_0927	Preliminary Version	09/26/2005

Module Version History

Part no.	Description	Version	Release Date
EZB-001	2.4GHz Zigbee Module Short Range	VER.C.0.9.1 VER.R.0.9.0 VER.E.0.9.0	Sept 26, 2005
EZB-001EK	EZB-001 Evaluation Kit	VER.C.0.9.1 VER.R.0.9.0	Sept 26, 2005

<EZB-001EK: EZB-001 Evaluation Kit>

To have more information on Evaluation Kit,

please refer to the user manual of EZB-001EK (Doc# EZB_EK_manual_0927)

Contents

1. About EZBee™

EZBee™ is a compact Zigbee single-board module which is compliant to the 2.45GHz Zigbee specification v1.0 of IEEE 802.15.4. With EZBee™, users may enable Zigbee wireless network easily without a professional knowledge on Zigbee protocol. EZBee™ is designed to be used as a serial RF module to a Host system.

<Fig. 1.1: EZBee™- EZB-001>

Using AT commands provided, users may communicate with EZBee™. Full AT commands available can be found in the from page 8.

EZBee™ can be operated as coordinator, router and end-device. Coordinators and routers are FFD (Full functional Device), so can be communicated peer-to-peer without beacon. But End-device module is RFD (Reduced Functional Device), so can be working only with Coordinator and routers and can be configured to work as low power mode.

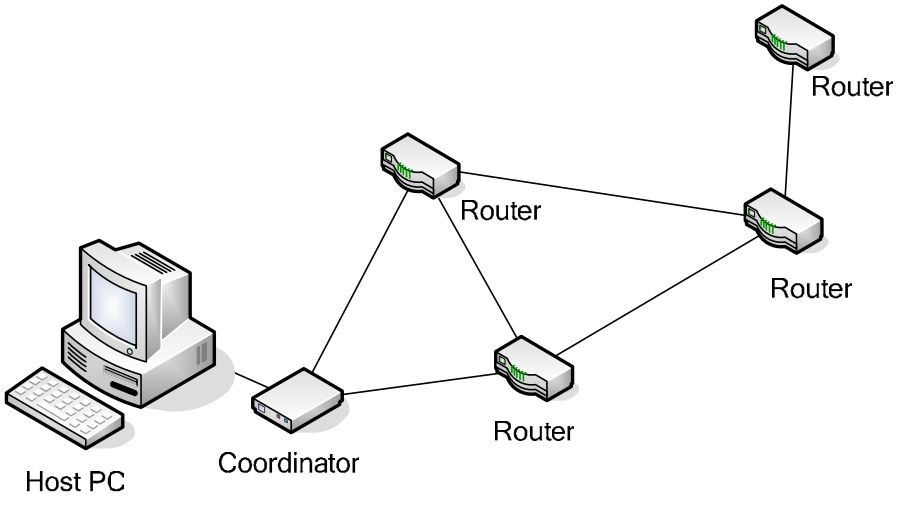


Figure 1.2 ZigBee Network With EZBee™

Key Features

- IEEE 802.15.4 compliant PHY and MAC
- Full Function Device (FFD)
- 16 x 33.5 x 3.3 mm compact shield module for SMD mounting
- 128KB Flash memory, 4KB SRAM, 4KB EEPROM
- UART, SPI and JTAG interface

- 16 Channels in the 2.45GHz ISM band
- Up to 250kbps
- Integrated chip antenna or External Antenna options
- 2.7 ~ 3.6V supply voltage
- -30°C to 85°C operating temperature
- Conforms with ETSI EN 300 440 (Europe), FCC CFR-47 part 15.247 and 15.249 (USA), ARIB STD-T66 (Japan)

Applications

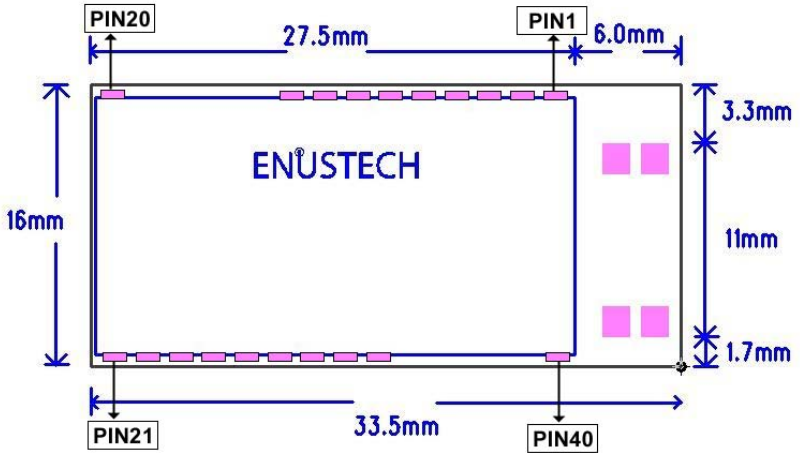
- Wireless remote control
- Building automation
- Personal area network
- Industrial control
- OEM equipment
- PC peripherals

2. Specification

Parameters	EZB-001
Performance	
Range (LOS)	30m
Output Power	-25dBm~0dBm (1mW)
Data Rate	250Kbps
Receiver Sensitivity (PER=1%)	-94dBm
Power Requirements	
Supply Voltage	2.7~3.6V
Tx Current (typical)	27mA
Rx Current (typical)	30mA
Power-down current	< 10uA
General	
Operating Frequency	2.4~2.4835GHz
Dimensions	16 x 33.5 x 3.3 mm
Operating Temp.	-30°C ~ 85°C
Antenna Options	Integrated / External
Networking	
Supported Network Topologies	Point-to-point, Point-to-multipoint, Mesh
Channels	16
Certifications	
FCC/CE	Pending

3. Hardware Structure

3.1 Mechanical Drawing



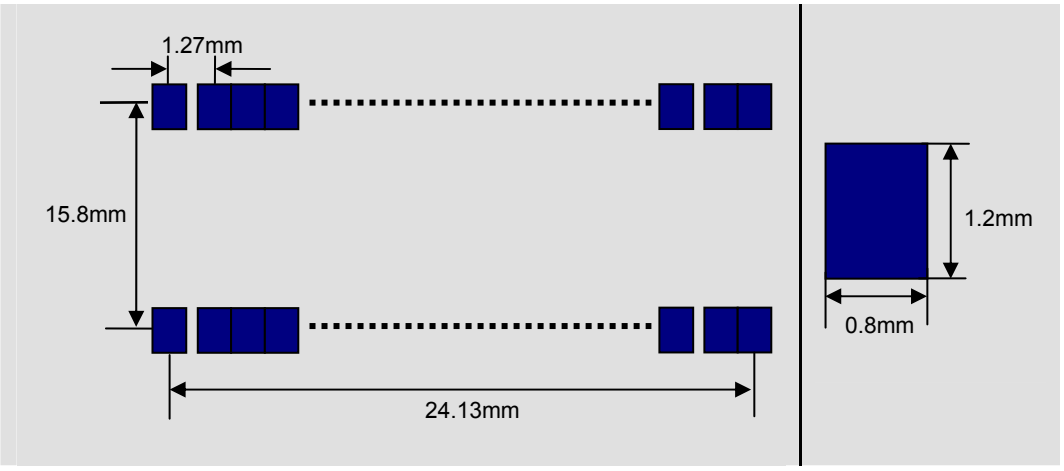
<Fig. 3.1 Mechanical drawing of EZBee™>

3.2 Pin Assignment

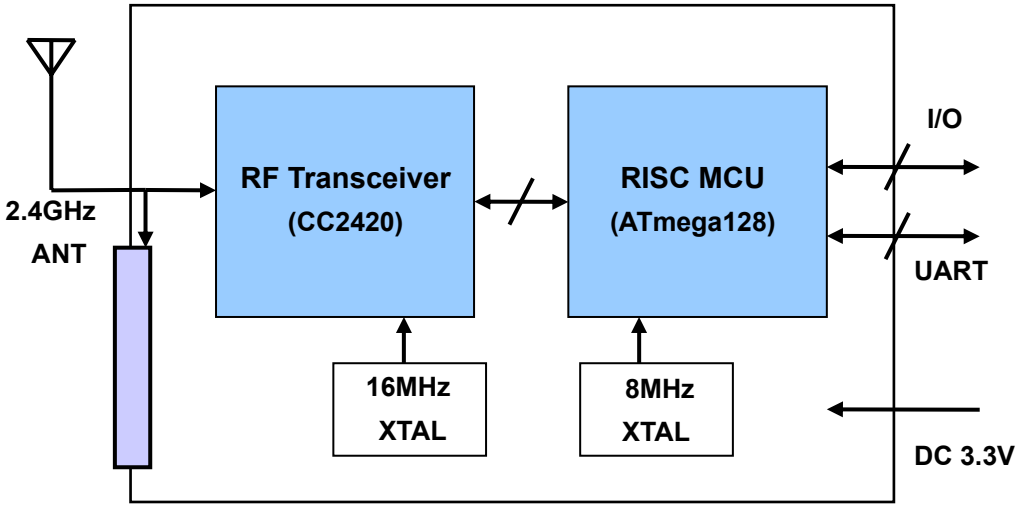
Pin no.	Description	Pin no.	Description
1	GND	40	INT5
2	RF_SIGNAL	39	INT4
3	GND	38	AIN1
4	VCC	37	AIN0
5	RXD	36	TXD485
6	TXD	35	RXD485
7	RTS	34	AREF
8	CTS	33	ADC0
9	DIO8 (A8)	32	ADC1
10	DIO9 (A9)	31	ADC2
11	DIO10 (A10)	30	ADC3
12	DIO11 (A11)	29	TCK
13	DIO12 (A12)	28	TMS
14	RESET	27	TDO
15	OC2/OC1C	26	TDI
16	OC0	25	GND

17	RI	24	DIO0
18	DCD	23	DIO1
19	DTR	22	DIO2
20	DSR	21	DIO3

3.3 PCB Layout



3.4 Block Diagram



4. Module Configuration

Users may configure EZBee™ series with simple and easy AT commands. Following AT commands set can be used with your module.

4.1 AT Commands

AT commands can be distinguished commands for Networking, Serial port configuration and System.

Default serial setting of EZBee™:
38,400bps / 8 Data bit / 1 Stop bit / Non Parity / No hardware flow control

AT commands Set

AT command	Category	Description	Parameter	Default
D	Network	Network start	None	
H	Network	Disjoin from PAN	None	
&MSG	Network	Send message	<short address>, <message>	
&SA	Network	Show 16-bit short address	None	
+EA	Network	Get/Set IEEE 64-bit extended address	<extended address>	Factory set
+PID	Network	Get/Set PAN ID	0~0x3FFF or 0xFFFF	0xFFFF
+BM	Network	Get/Set beacon mode	0~0xF	0xF
+CH	Network	Get/Set channel		
+AS	Network	Get/Set auto start module	0 or 1	0
+E	Serial Conf.	Serial echo off/ echo on	0 or 1	1
+BR	Serial Conf.	Set serial baud rate	2400, 4800, 9600, 14400, 19200, 38400	38400
Z	System	Module reset	None	
V	System	Show module version	None	
S	System	Show module status	None	
+PS	System	Get/Set power mode	0 or 1	0

***NOTE: AT+BM, AT+CH, and AT+PS will be available from Dec. 2005.**

Notification message

Message	Parameter		Description
$LST	None		Network lost
$JIN	<short address>, <ext address>		Network Join
$PNS	<short address>		PAN Start
$LEV	<extended address>		Network disjoin inform(Coordinator only)
$INT	None		Network stack init
$RST	None		Module reset
$MSG	<short address>, <message>,<LinkQuality>		Notify incoming message
	Parameter description	<short address>	Source address(0~0xFFFF)
		<message>	Variable even length
		<LinkQuality>	0~0xFF
$SND	OK / FAIL		Notify message send success or failure

4.2 Description of AT Commands

Full description and explanation on each AT command can be found as in below table.

ATD (Start PAN/Join PAN)	ATD is to start operation of Coordinator or Router. Via ATD command, An End-device may join nearby PAN.	
	Module	**Result Code**
	Coordinator	$PNS=COORD or $PNS=FAIL
	Router	$PNS=<short address> or $PNS=FAIL
ATH (Halt)	ATH can be used when disjoining a Router from PAN. ATH can be applied to only Router and End-device.	
	Module	**Result Code**
	Router	OK $INT
	Coordinator	$LEV=<router's extended address>
AT&MSG (MeSsaGe)	AT&MSG can be used when transmitting message from a Coordinator or a router.	
↓ Cont'd	**Syntax:** AT&MSG=<destination addr(saddr/eaddr)>,<message in ASCII hex number>	

<table>
<tr><td rowspan="6">AT&MSG</td><td>Example Command</td><td colspan="3">Description</td></tr>
<tr><td>AT&MSG=COORD,13EF3970</td><td colspan="3">A Coordinator sends message “0x13ef3970”</td></tr>
<tr><td>AT&MSG=BROAD,3F23091DE8</td><td colspan="3">Broadcasts message “0x3F23091DE8”</td></tr>
<tr><td>AT&MSG=3E,13EF29AB</td><td colspan="3">Sends message “0x13EF29AB” to device with Short address 0x3E.</td></tr>
<tr><td>Module</td><td colspan="3">Result Code</td></tr>
<tr><td>Source</td><td colspan="3">OK
$SND=OK or $SND=FAIL</td></tr>
<tr><td>Destination</td><td colspan="3">$MSG=<source short addr>,<incoming message>,<LinkQuality></td></tr>
<tr><td rowspan="3">AT&SA (Short Address)</td><td colspan="4">Shows Short Address currently assigned.</td></tr>
<tr><td>Example Command</td><td colspan="3">Description</td></tr>
<tr><td>AT&SA</td><td colspan="3"><Short address></td></tr>
<tr><td rowspan="4">AT+EA (Extended Address)</td><td colspan="4">Shows/Configures 64-bit IEEE extended address.</td></tr>
<tr><td>Example Command</td><td>Description</td><td colspan="2">Result Code</td></tr>
<tr><td>AT+EA?</td><td>Shows current address.</td><td colspan="2">00124b00000002f1</td></tr>
<tr><td>AT+EA=00124B00000002F1</td><td>Configure the address as 0x00124B00000002F1</td><td colspan="2">OK / FAIL</td></tr>
<tr><td rowspan="4">AT+PID (Pan ID)</td><td colspan="4">Configures Group ID of PAN. PID can be configured in the ranges of 0~0x3FFF or 0xFFFF. Once PAN has configured PID (except PID of 0xFFFF), only devices with same PID may join the designated PAN.</td></tr>
<tr><td>Example Command</td><td>Description</td><td colspan="2">Result Code</td></tr>
<tr><td>AT+PID?</td><td>Shows currently assigned PID</td><td colspan="2"><PID></td></tr>
<tr><td>AT+PID=003F</td><td>Configure PID as 0x003F.</td><td colspan="2">OK / FAIL</td></tr>
<tr><td rowspan="6">AT+BM (Beacon Mode)

Available from Dec., 2005</td><td colspan="4">Configures Beacon mode of Coordinator/Router.
Range of Beacon mode: 0~0xF.</td></tr>
<tr><td colspan="4">Beacon mode description</td></tr>
<tr><td>Mode</td><td>Beacon order</td><td>Mode</td><td>Beacon order</td></tr>
<tr><td>F</td><td>No beacon</td><td>7</td><td>2 sec</td></tr>
<tr><td>E</td><td>4 min</td><td>6</td><td>1 sec</td></tr>
<tr><td>D</td><td>2 min</td><td>5</td><td>480 msec</td></tr>
</table>

↓ Cont'd AT+BM	C	1 min	4	240 msec
	B	31 sec	3	120 msec
	A	15 sec	2	60 msec
	9	7.5 sec	1	30 msec
	8	4 sec	0	15 msec
	Example Command		**Description**	**Result Code**
	AT+BM?		Shows current beacon value.	<beacon value>
	AT+BM=F		Configures not to use Beacon mode.	OK / FAIL
AT+AS (Auto Start mode)	When the module is reset, users may configure Coordinator restart PAN, or Router/End device joins PAN automatically.			
	Example Command		**Description**	**Result Code**
	AT+AS?		Shows current value	1 / 0
	AT+AS1		Sets PAN automatically restarts	OK / FAIL
	AT+AS0		Sets PAN does not start automatically.	OK / FAIL
AT+E (Serial Echo on/off)	Turns ON/OFF echo of Serial port.			
	Command		**Description**	**Result Code**
	AT+E?		Show current echo mode.	0 / 1
	AT+E0		Turns OFF each of Serial port.	None
	AT+E1		Turns ON each of Serial port.	None
AT+BR (Set serial baud rate)	Configures baud rate of Serial port. Possible ranges: 2400, 4800, 9600, 14400, 19200, and 38400. Default value: 38400bps.			
	Example Command		**Description**	**Result Code**
	AT+BR?		Shows current baud rate.	<baud rate>
	AT+BR=19200		Configures baud rate to 19200.	OK / FAIL
ATZ	RESET the Module (Software reset)			
	Example Command		**Description**	**Result Code**
	ATZ		RESET the module	$RST

<table>
<tr><td>ATV</td><td colspan="5">Shows version of the module</td></tr>
<tr><td></td><td colspan="2">Example Command</td><td>Description</td><td colspan="2">Result Code</td></tr>
<tr><td></td><td colspan="2">ATV</td><td>Shows version of the module (Coordinator)</td><td colspan="2">VER.C.0.9.1</td></tr>
<tr><td></td><td colspan="2">ATV</td><td>Shows version of the module (Router)</td><td colspan="2">VER.R.0.9.0</td></tr>
<tr><td></td><td colspan="2">ATV</td><td>Shows version of the module (End dev)</td><td colspan="2">VER.E.0.9.0</td></tr>
<tr><td>ATS</td><td colspan="5">Shows current status of the module</td></tr>
<tr><td></td><td colspan="5">Field meaning</td></tr>
<tr><td></td><td>Module type (C/R/E)</td><td>start or stop (S/T)</td><td>Total memory</td><td>Current used memory</td><td>Highly used memory</td></tr>
<tr><td></td><td>Example Command</td><td colspan="2">Result Code</td><td colspan="2">Description</td></tr>
<tr><td></td><td>ATS</td><td colspan="2">R.S.1280.159.307</td><td colspan="2">Router started, total memory 1280 bytes, 159 bytes current use, 307 bytes highly used.</td></tr>
<tr><td></td><td></td><td colspan="2">C.S.1280.159.307</td><td colspan="2">Coordinator started. Total memory 1280 bytes, 159 bytes current use, 307 bytes highly used.</td></tr>
<tr><td></td><td></td><td colspan="2">R.T.1280.50.60</td><td colspan="2">Router stop</td></tr>
<tr><td></td><td></td><td colspan="2">C.T.1280.50.60</td><td colspan="2">Coordinator stop</td></tr>
<tr><td></td><td></td><td colspan="2">E.S.1280.140.300</td><td colspan="2">End device start</td></tr>
<tr><td></td><td></td><td colspan="2">E.T.1280.50.60</td><td colspan="2">End device stop</td></tr>
<tr><td>AT+PS (Power Save mode)

Available from Dec., 2005</td><td colspan="5">Configures Power save mode. Only applicable to End device.</td></tr>
<tr><td></td><td colspan="2">Example Command</td><td>Description</td><td colspan="2">Result Code</td></tr>
<tr><td></td><td colspan="2">AT+PS?</td><td>Shows current Power mode</td><td colspan="2">1 / 0</td></tr>
<tr><td></td><td colspan="2">AT+PS1</td><td>Configures Power Save mode.</td><td colspan="2">OK / FAIL</td></tr>
<tr><td></td><td colspan="2">AT+PS0</td><td>Configures General mode.</td><td colspan="2">OK / FAIL</td></tr>
</table>

*__NOTE: Commands AT+BM and AT+PS will be available from Dec. 2005__

5. Legal Notice & Contact

About this Document

This document provides introductory instructions on how to set up and manage EZBee™-DK001 within your networking environment. Should you require more information, please refer to website at www.widecastint.com .

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