

EZURiO

BLUETOOTH® Version 2.0 + EDR USB Adaptor

General Description

EZURiO's Version 2.0 + EDR USB Bluetooth Adaptor is a fully qualified Class 1 Bluetooth solution designed for users and system integrators wishing to include high reliability Bluetooth functionality in their products. The Adaptor is qualified to Bluetooth Version 2.0+EDR, providing all of the latest Bluetooth security and interference coping features, as well as the benefits of Enhanced Data Rate and extended SCO. The Adaptor is ideal for designs where an integrated Bluetooth stack is being used.

The Version 2.0 + EDR USB Bluetooth Adaptor is designed to give a robust solution that is ideal for industrial automation and ruggedised handheld devices.

The Version 2.0 + EDR USB Adaptor is based on Cambridge Silicon Radio's BlueCore 04 chipset. The Adaptor contains all of the hardware and firmware for a complete Bluetooth solution up to the HCI interface, requiring no further components. The Adaptor has an integrated, high performance antenna which is matched with the Bluetooth RF and baseband circuitry to give excellent range with a low power consumption. The firmware integrated into the BC04 chipset presents an HCI interface over USB, which can be directly interfaced with an HCI compliant Bluetooth stack.

The Version 2.0 + EDR Bluetooth Adaptor is supplied in a compact USB enclosure (64.0mm x 20.0mm x 10.7mm), that plugs directly into a USB socket. The Adaptor includes a high sensitivity, high gain antenna which provides excellent range. Typical open field performance provides ranges of over 250 metres at transmit powers of 4mW.

Support is provided for extended Synchronous channels (eSCO), giving improved voice quality.

Support is provided for low power modes that make the Version 2.0 + EDR USB Bluetooth Adaptor particularly applicable to battery powered installations.

The Version 2.0 + EDR USB Bluetooth Adaptor is Lead-free and RoHS compliant and supports an industrial operating temperature range of -40°C to +85°C.

1.1 Applications

- POS Equipment
- Industrial Automation
- Vending Equipment
- Windows CE solutions
- Audio Applications
- Automotive Applications
- Telematics
- Medical
- Embedded Windows XP Applications

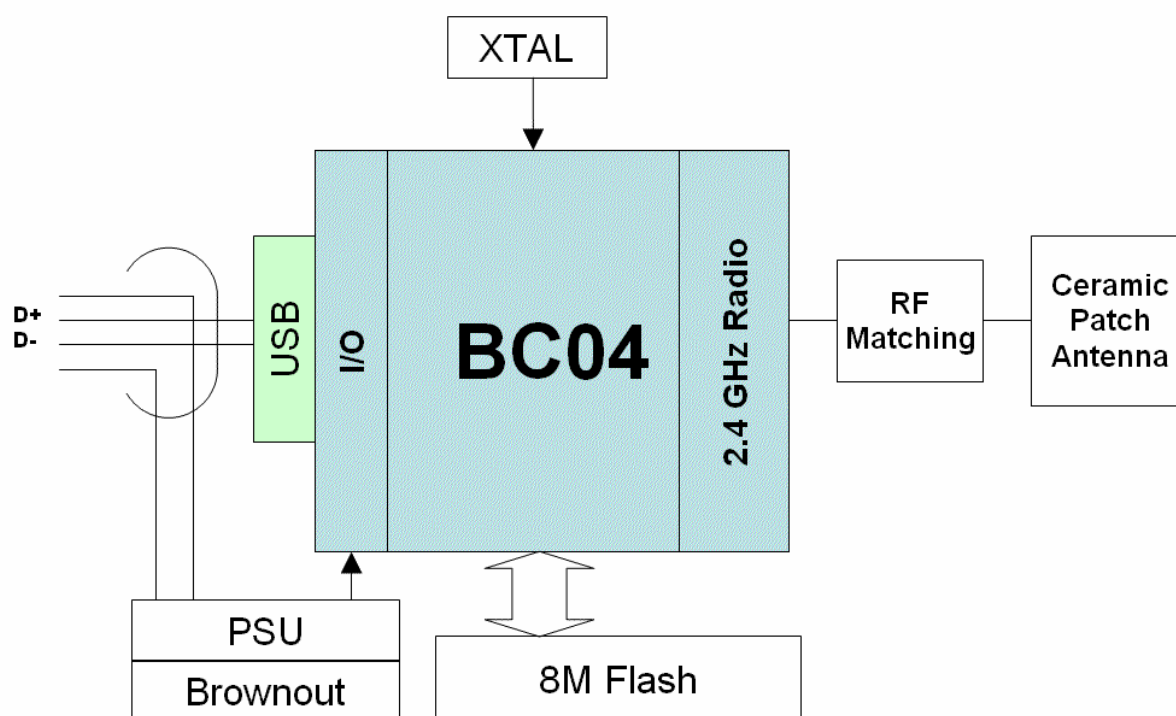


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2. Features

Feature	Implementation
Bluetooth Transmission	Class 1
Fully Bluetooth pre-qualified	Bluetooth 2.0
Range	250 metres typical (free space)
Frequency	2.400 – 2.485 GHz
Max Transmit Power	+6dBm
Min Transmit Power	-25dBm
Receive Sensitivity	Better than -86dB @ 25°C
Data Transfer rate	2.1 Mbps max data rate. 3.0 Mbps symbol rate
Interface	USB 1.2 compliant HCI Interface
Physical size	64.0mm x 20.0mm x 10.7mm, 12g
Current consumption	Less than 25mA during data transfer in standard power mode. Lower powers are attainable with a configurable low power mode.
Low power sniff mode	2.5mA typ
Temperature Range	Normal operation: -40°C to +85°C
Supply Voltage	USB line powered (3.3V – 6.0V)
Brown-out	Integrated brown out detection
Interface Levels	USB
Audio	Audio can be streamed over the HCI interface. eSCO is supported for enhanced audio applications.
Field upgradeable	Over USB interface
Lead free	Lead-free and RoHS compliant

3. Functional Block Diagram



3.1 Electrical Specifications

3.1.1 Absolute Maximum ratings

Absolute maximum ratings for supply voltage and voltages on digital and analogue pins of the Adaptor are listed below; exceeding these values will cause permanent damage.

Parameter	Min	Max	Unit
Peak current of power supply	0	100	mA
Voltage at POWER pin	3.6	7	V

3.1.2 Recommended Operating Parameters

3.1.2.1 Power Supply

Signal Name	Pin No	I/O	Voltage level	Comments
Vcc		I	3.6V to 6.0V	$I_{typ} = 30mA$

4. I/O Characteristics

4.1 Power Consumption

The hardware specification for the Adaptor allows for a voltage range of 3.6 to 6.0 at Vcc. Tests have shown that there is no significant difference in current draw when Vcc is 5 or 6V. Tests have shown that where power drain is an issue, it is best to keep Vcc at the lower end of the range.

With regards to operating mode the significant modes are; idle, waiting for a connection, inquiring, initiating a connection, sniff and connected. With connected mode, it is also relevant to differentiate between no data being transferred and when data is being transferred at the maximum rate possible.

The firmware within the USB Adaptor will always attempt to place the Adaptor into the lowest possible power configuration.

5. DC Characteristics

5.1 RF Performance

5.1.1 Transmit Power

Effective Transmit Power	min:-25dBm	Max: +6dBm
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Output power can be reduced by program control via the HCI interface

5.1.2 Receive Sensitivity

Effective Receive Sensitivity	-88dBm (at 25°C)
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6. Functional Description

The Version 2.0 + EDR USB / HCI Bluetooth Adaptor is a fully featured HCI Bluetooth product and requires only power and an external higher layer Bluetooth stack to implement full Bluetooth communication. The integrated, high performance antenna together with the RF and Base-band circuitry implement the Bluetooth wireless link, with the USB interface providing a connection to the host system.

6.1 Bluetooth Stacks

Most users will use the Version 2.0 + EDR USB / HCI Bluetooth Adaptor with a pre-qualified Bluetooth stack. The USB interface has been configured to present the device as a generic Bluetooth Adaptor. This allows it to be plugged directly into most upper layer Bluetooth stacks, where it will enumerate and start operating.

The Adaptor has been tested with the following stacks and requires no further drivers for these.

- Windows XP SP1 (we recommend the use of SP2)
- Windows XP SP2

- Windows XP embedded
- Windows CE
- Windows Vista (beta)

EZURiO can supply a Widcomm Windows stack that runs on Windows 98, 2000, ME and XP and which provides a wider range of profiles than the Microsoft stacks. There is an additional per machine license for the Widcomm stack.

6.1.1 Features of the HCI Stack

6.1.1.1 Standard Bluetooth v2.0 + EDR mandatory functionality:

- Adaptive frequency hopping (AFH), including classifier
- Faster connection - enhanced inquiry scan (immediate FHS response)
- LMP improvements
- Parameter ranges

6.1.1.2 Optional Bluetooth v2.0 + EDR functionality supported:

- Adaptive Frequency Hopping (AFH) as Master and Automatic Channel Classification
- Fast Connect - Interlaced Inquiry and Page Scan plus RSSI during Inquiry
- Extended SCO (eSCO), eV3 +CRC, eV4, eV5
- SCO handle
- Synchronisation

6.1.1.3 Standard Bluetooth components:

- Baseband (including LC)
- LM
- HCI
- Standard USB v1.1 HCI Transport Layer
- All standard radio packet types
- Full Bluetooth data rate, enhanced data rates of 2 and 3Mbps⁽¹⁾
- Operation with up to seven active slaves⁽¹⁾
- Scatternet v2.5 operation
- Maximum number of simultaneous active ACL connections: 7⁽²⁾
- Maximum number of simultaneous active SCO or eSCO connections: 3⁽²⁾
- Operation with up to three SCO / eSCO links, routed to one or more slaves
- All standard SCO voice coding, plus transparent SCO
- Standard operating modes: Page, Inquiry, Page-Scan and Inquiry-Scan
- All standard pairing, authentication, link key and encryption operations

- Standard Bluetooth power saving mechanisms: Hold, Sniff and Park modes, including Forced Hold
- Dynamic control of peers' transmit power via LMP
- Master/Slave switch
- Broadcast
- Channel quality driven data rate
- All standard Bluetooth test modes

(1) This is the maximum allowed by Bluetooth v2.0 + EDR specification.

(2) Supports all combinations of active ACL and SCO channels for both master and slave operation, as specified by the Bluetooth v2.0 + EDR specification.

6.1.1.4 Additional Stack Functionality

The firmware extends the standard Bluetooth functionality with the following features:

Hardware low power modes: Shallow Sleep and Deep Sleep. The chip drops into modes that significantly reduce power consumption when the software goes idle.

6.2 Interfaces

6.2.1 USB Interface

The Version 2.0 + EDR USB / HCI Adaptor contains a full speed (12Mbps/s) USB interface that is capable of driving a USB cable directly. No external USB transceiver is required. The device operates as a USB peripheral, responding to requests from a master host controller such as a PC. Both the OHCI and the UHCI standards are supported. The set of USB endpoints implemented can behave as specified in the USB section of the Bluetooth specification v2.0+EDR.

The Adaptor only operates as a USB slave.

The Adaptor contains inline resistors to provide a match for the characteristic impedance of a USB cable as defined by the USB standard.

The Adaptor contains a USB pull-up resistor. This pulls the USB+ pin weakly high when the USB interface is ready to enumerate. It signals to the USB host that it is a full speed (12Mbit/s) USB device. This pull-up is implemented as a current source, and is compliant with section 7.1.5 of the USB specification v1.2. It pulls USB+ high to at least 2.8V when loaded with a 15k Ω 5% pull-down resistor (in the hub/host) when VCC is 3.6V or higher. This presents a Thevenin resistance to the host of at least 900 Ω .

6.2.2 USB Enumeration

The Version 2.0 + EDR USB / HCI Adaptor enumerates with the following information:

Device Descriptor:

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bcdUSB:          0x0200
bDeviceClass:    0xE0
bDeviceSubClass: 0x01
bDeviceProtocol: 0x01
bMaxPacketSize0: 0x40 (64)
idVendor:        0x04BF
idProduct:       0x0320
bcdDevice:       0x2652
iManufacturer:   0x01
iProduct:        0x02
iSerialNumber:   0x00

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bNumConfigurations: 0x01
Current Config Value: 0x01
Device Bus Speed: Full
Device Address: 0x03
Open Pipes: 5

Endpoint Descriptor:

bEndpointAddress: 0x81
Transfer Type: Interrupt
wMaxPacketSize: 0x0010 (16)
bInterval: 0x01

Endpoint Descriptor:

bEndpointAddress: 0x02
Transfer Type: Bulk
wMaxPacketSize: 0x0040 (64)
bInterval: 0x01

Endpoint Descriptor:

bEndpointAddress: 0x82
Transfer Type: Bulk
wMaxPacketSize: 0x0040 (64)
bInterval: 0x01

Endpoint Descriptor:

bEndpointAddress: 0x03
Transfer Type: Isochronous
wMaxPacketSize: 0x0000 (0)
bInterval: 0x01

Endpoint Descriptor:

bEndpointAddress: 0x83
Transfer Type: Isochronous
wMaxPacketSize: 0x0000 (0)
bInterval: 0x01

7. Low Power Modes

The Version 2.0 + EDR USB / HCI Adaptor supports all of the standard low power modes as specified by the Bluetooth 2.0 + EDR standard.

In addition the firmware contains power management which will automatically place the device in sleep modes whenever there is a period of inactivity.

8. Enhanced Data Rate

EDR has been introduced with Version 2.0 of the Bluetooth standard to provide 2x and 3x⁽¹⁾ data rates with minimal disruption to higher layers of the Bluetooth stack. EZURiO's Version 2.0 + EDR USB Adaptor provides support for both of these new data rates and is compliant with the Bluetooth v2.0+EDR specification.

At the baseband level EDR utilises both the same 1.6kHz slot rate and the 1MHz symbol rate as defined for the basic data rate. Where EDR differs is that each symbol in the payload portion of a packet represents 2 or 3-bits. This is achieved using two new distinct modulation schemes. These are summarised below. Link Establishment and management are unchanged and still use GFSK for both the header and payload portions of these packets.

(1) The inclusion of 3x data rates is optional. These are supported in EZURiO's High Speed USB Adaptor.

Data Rate Scheme	Bits Per Symbol	Modulation
Basic Data Rate	1	GFSK
EDR	2	$\pi/4$ DQPSK
EDR	3	8DPSK (optional)

Basic Rate

Access Code	Header	Payload
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Enhanced Data Rate

Access Code	Header	Guard	Sync	Payload	Trailer
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← $\pi/4$ DQPSK or 8DPSK →

Basic Rate and Enhanced Data Rate Packet Structure

9. Application Information

9.1 Antenna Position

The antenna used on the Version 2.0 + EDR USB Bluetooth Adaptor is designed to be largely immune from the effects of proximity detuning. Normally, antennas operating at 2.4GHz are affected by their surroundings, so that great care is needed in their placement and orientation.

The Version 2.0 + EDR USB Bluetooth Adaptor can be used in most locations and orientations and is only marginally affected by the presence of a significant ground plane in close proximity.

The antenna distribution is close to isotropic, which means that the orientation of mounting has only a limited effect on the overall range. However the optimum range is achieved when the two antennae are directly facing each other. This occurs when the black plastic "bulges" on the top of two EZURiO USB adaptors are facing each other.

The Adaptor should not be located in a sealed metal enclosure, as this will act as a Faraday cage and severely attenuate the radio signal.

9.2 Power Supply Considerations

The power supply for the Adaptor has to be a single voltage source of Vcc within the range of 3.6 V to 6.0 V. It must be able to provide sufficient current in a transmit burst. This can rise to 65mA. Most USB sockets should be able to power the adaptor.

10. Qualification

10.1 Bluetooth Qualification Process

The following safety precautions must be observed during all phases of the operation, usage, service or repair of any application incorporating this Adaptor. Manufacturers of the RF equipment are advised to convey the following safety information to users and operating personnel and to incorporate these guidelines into all manuals supplied with the product. Failure to comply with these precautions violates safety standards of design, manufacture and intended use of the product. EZURiO assumes no liability for customer failure to comply with these precautions.

10.2 Safety Information:

Switch off the Bluetooth device before boarding an aircraft. Make sure it cannot be switched on inadvertently. The operation of wireless appliances in an aircraft is forbidden by many airlines to prevent interference with communications systems. Applications that could result in use on aircraft should carry appropriate warnings.

Some airlines may not permit use of Bluetooth. Check before use.

10.3 Qualifications

10.3.1 RF approvals

The Version 2.0 + EDR USB Bluetooth Adaptor is qualified as a Bluetooth Subsystem. This means that if it is combined with a higher level Bluetooth stack that is also qualified as a Subsystem, then no further qualification is required. Final products incorporating Bluetooth technology should be listed with the Bluetooth qualification body according to the guidelines available on www.bluetooth.org.

The manufacturer must state the EZURiO part number and product reference in his literature in order to meet the requirements of the Bluetooth and regulatory approvals.

A list of the countries where the Adaptor is approved will be provided by EZURiO as required. As a minimum the product is listed in Europe, Scandinavia and USA. EZURiO assumes no liability for customer failure to comply with national RF approvals.

10.3.1.1 Radio.

R&TTE EN 300 328-2 V1.1.1 (2000-07)

EN 301 489-1 V1.3.1 (2001-09)

10.3.1.2 EMC Emissions.

FCC15B Class B

EN55022 Class B

10.3.1.3 EMC Immunity.

EN55024 Class

10.3.1.4 Environmental.

EN300 019-2-4 v2.2.2 (2003-2004)

10.3.1.5 Automotive

SAE1455:REVAug94 Paragraph 4.10.4 (shock)

SAE1455:REVAug94 Paragraph 4.9.4.2 (random)

10.4 Safety and Regulatory Statements

10.4.1 Europe – EU Declaration of Conformity

EZURiO

DECLARATION OF CONFORMITY

In accordance with Annex IV of the EU directive 1999/5/EC

EZURiO declare under our responsibility that the Bluetooth Adaptor

complies with the appropriate essential requirements of the Article 3 of the R&TTE and the other relevant provisions, when used for its intended purpose.

Health and Safety requirements contained in Article 3 (1) a)

EN 60 950: 1992 Safety of information technology equipment + Amendment A1:1993, Amendment A2:1993, Amendment A3:1995, Amendment A4:1997, Amendment A11:1997

EN 50371: Generic standard to demonstrate the compliance of low-power electronic and electrical apparatus with the basic restrictions related to human exposure to electromagnetic fields (10 MHz - 300 GHz) – General public

Protection requirements with respect to electromagnetic compatibility Art.3 (1) b)

EN 301489-17 V1.1.1 (09-2000), Electromagnetic Compatibility and radio spectrum Matters (ERM); Electro Magnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for wideband data HiperLAN equipment

Means of the efficient use of the radio frequency spectrum

EN 300328-2 V1.2.1 (11-2001), Radio Equipment and Systems (RES); Wideband transmission systems; Technical characteristics and test conditions for data transmission equipment operating in the 2,4 GHz ISM band and using spread spectrum modulation techniques. Part 2: Harmonized EN covering essential requirements under article 3(2) of the R&TTE directive.

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10.4.2 FCC and Industry Canada Statements

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

10.4.2.1 FCC Labelling requirement

If the FCC ID is not visible when the Adaptor is installed inside another device, then the outside of the device into which the Adaptor is installed must also display a label referring to the enclosed Adaptor. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: PI401B" or "Contains FCC ID: PI401B." Any similar wording that expresses the same meaning may be used.

11. Environmental

11.1 Operating temperatures

Parameter	Min	Typ	Max	Unit
Operating temp (standard product)	-40	25	+85	°C

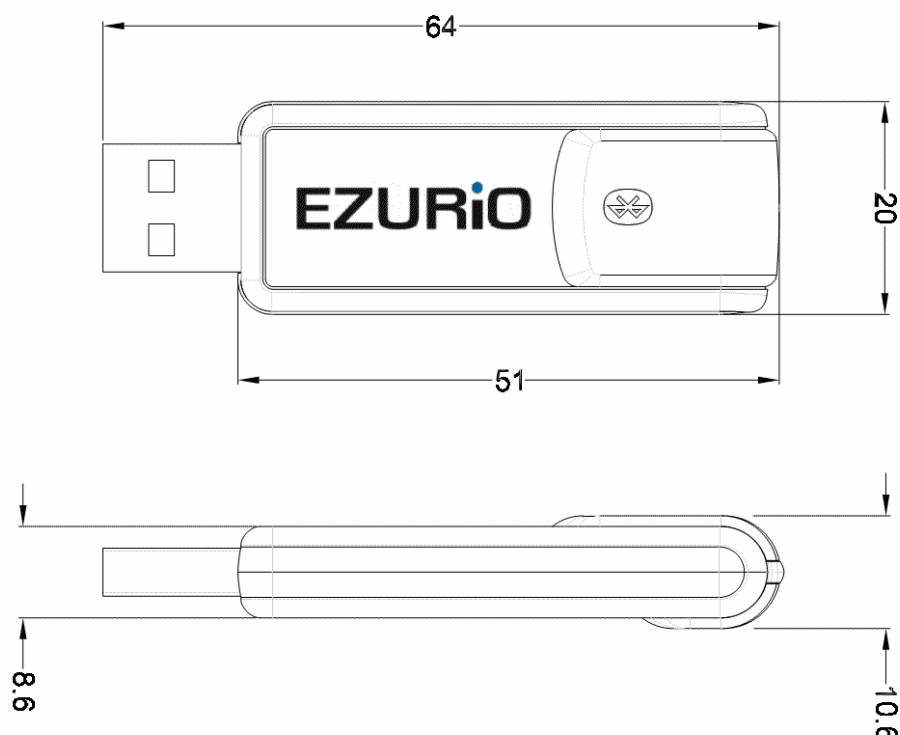
11.2 Storage temperature

Parameter	Min	Max	Unit
Storage temp	-40	+125	°C

11.3 Reliability

Parameter	Test	Comment
Thermal Shock	200 cycles -40°C /+85°C 30 min	1 cycle/hour
Vibration	Continuous operation at 60 Hz, 2mm stroke	15g max sine wave, 12 hours
Shock	50G 11ms Half Sine Wave	6 axis x 3 cycles each axis
Moisture Resistance		
High Temp Storage	125°C, 360 hours	
Low Temp Storage	-40°C, 240 hours	
High Temp/Humidity Operation	60°C, 90%RH, 360 hours	
Thermal shock	-40 to 60°C in 30min	200 cycles with continuous operation
Electro Static Discharge	EN55024:1998 & IEC61000-4-3	
Drop Test	75cm to concrete, 3 axis x 2 cycles per corner	

12. Physical Dimensions (all dimensions in mm)



12.1 Labelling

The Adaptor has a label indicating the part number and the unique Bluetooth address of the Adaptor.

12.2 Ordering Information

Part Number	Description
BRBLU03-010A0	Version 2.0 + EDR USB Bluetooth Adaptor
TRBLU03-01000	Version 2.0 + EDR USB Bluetooth Adaptor with Widcomm Bluetooth stack

13. Related Documents

The firmware incorporated into the Version 2.0 + EDR HCI/USB Bluetooth Adaptor is more fully described in Firmware release notes available from Cambridge Silicon Radio. Details of the HCI interface are provided in the Bluetooth specification.

- High Speed Bluetooth USB Adaptor & PC Card – User Guide. Provide installation information for use with a Widcomm stack.
- http://www.ezurio.com/files/Microsoft_Bluetooth_Stack.pdf. Information on using the USB adaptor with Microsoft XP SP2 Bluetooth stack.
- Bluetooth Core 2.0 Specification – www.bluetooth.org
- Bluecore4-External Datasheet for BC417143B-IQN-E4 July 2005 - CSR

14. Disclaimers

EZURiO'S BLUETOOTH PRODUCTS ARE NOT AUTHORISED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE MANAGING DIRECTOR OF EZURiO LTD.

The definitions used herein are:

a) Life support devices or systems are devices which (1) are intended for surgical implant into the body, or (2) support or sustain life and whose failure to perform when properly used in accordance with the instructions for use provided in the labelling can reasonably be expected to result in a significant injury to the user.

b) A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

EZURiO does not assume responsibility for use of any of the circuitry described, no circuit patent licenses are implied and EZURiO reserves the right at any time to change without notice said circuitry and specifications.

14.1 Data Sheet Status

This data sheet contains data from the Preliminary specification. Supplementary data will be published at a later date. EZURiO Ltd reserves the right to change the specification without notice in order to improve the design and supply the best possible product.

Where reference is made to related products from other suppliers, EZURiO takes no responsibility for the information, availability or performance of such products.

Please check with EZURiO Ltd for the most recent data before initiating or completing a design.

14.2 Warranty

EZURiO warrants that its products shall conform to EZURiO's published specifications and remain free from defects in materials and workmanship under normal, proper and intended use for a period of two (2) years from date of purchase, provided that proof of purchase be furnished with any returned equipment.

If during the warranty period any component part of the equipment becomes defective by reason of material or workmanship, and EZURiO is immediately notified of such defect, EZURiO shall at its option supply a replacement part or request return of equipment, freight prepaid, to its designated facility for repair. In the event no trouble is found on products returned for repair, EZURiO reserves the right to charge the customer its standard published repair charge.

This warranty shall not apply to any products that have been subject to misuse, bending, twisting, neglect, alteration, improper installation, testing or unauthorized repair performed by anyone other than an EZURiO designated repair facility. Any non-warranty repairs or maintenance shall be at EZURiO's standard rates in effect at the time.

This warranty is in lieu of all other warranties, whether expressed, implied, or statutory, including but not limited to, implied warranties or merchantability and fitness for a particular purpose. In no event shall EZURiO be liable, whether in contract, in part, or on any other basis, for any damage sustained by its customers or any other person arising from or related to loss of use, failure or interruption in the operation of any products, or delay in maintenance, or for incidental, consequential, in direct, or special damages or liabilities, or for loss of revenue, loss of business, or other financial loss arising out of or in connection with the sale, lease, maintenance, use, performance, failure, or interruption of these products.