



WT Modules

Frequently Asked Questions

Version 1.4

Friday, January 19, 2007

Copyright © 2000-2007 Bluegiga Technologies

All rights reserved.

Bluegiga Technologies assumes no responsibility for any errors, which may appear in this manual. Furthermore, Bluegiga Technologies reserves the right to alter the hardware, software, and/or specifications detailed herein at any time without notice, and does not make any commitment to update the information contained herein. Bluegiga Technologies' products are not authorized for use as critical components in life support devices or systems.

The WRAP is a registered trademark of Bluegiga Technologies

The *Bluetooth* trademark is owned by the *Bluetooth* SIG Inc., USA, and is licensed to Bluegiga Technologies.

All other trademarks listed herein are owned by their respective owners.

Contents:

1. Introduction	5
2. Getting Started.....	6
2.1 WT1x Evaluation Kits	6
2.2 WT-modules	6
3. Hardware interfaces	7
3.1 UART	8
3.2 USB.....	9
3.3 SPI.....	9
3.4 PCM.....	10
3.4.1 Audio usage with iWRAP.....	10
3.4.2 Audio usage with HCI	10
3.5 GPIO	11
4. Firmware.....	12
4.1 iWRAP	12
4.2 Custom	13
5. Firmware updates	14
5.1 OVER SPI	14
5.2 OVER UART	14
6. Miscalleous information	15
6.1 Writing Bluetooth software into a mobile phone with Java or Symbian.....	15
6.2 Which devices are compatible with iWRAP	15

VERSION HISTORY

Version:	Author:	Comments:
1.0	<i>MS</i>	<i>First version</i>
1.1	<i>PRi</i>	<i>Chapters 2-3 added</i>
1.2	<i>JP</i>	<i>Chapter 4-6 added</i>
1.3	<i>MSa</i>	<i>Minor fixes</i>
1.4	<i>MSa</i>	<i>Released version</i>

TERMS & ABBREVIATIONS

Term or Abbreviation:	Explanation:
<i>Bluetooth</i>	Set of technologies providing audio and data transfer over short-range radio connections
<i>FAQ</i>	Frequently Asked Questions
<i>GPIO</i>	General Purpose Input Output
<i>HCI</i>	Host Controller Interface
<i>iWRAP</i>	Interface WRAP – a trademark registered by Bluegiga Technologies
<i>PCM</i>	Pulse Code Modulation
<i>SPI</i>	Serial Peripheral Interface
<i>UART</i>	Universal Asynchronous Receiver Transmitter

<i>USB</i>	Universal Serial Bus
<i>WRAP</i>	Wireless Remote Access Platform
<i>WT</i>	WRAP THOR

1. INTRODUCTION

This FAQ provides answers to some basic questions and general advice regarding the hardware and firmware of WRAP THOR modules.

The question answer pairs are described like this:

Legend:

Q means question that has been asked

A is the answer to question above.

2. GETTING STARTED

This section provides information on how to get started with the WT-modules. This section is divided into two parts, Evaluation Kit and modules in general.

2.1 WT1x Evaluation Kits

- The Evaluation Kit comes with iWRAP firmware pre-installed. The settings for iWRAP in default mode is:
 - UART baud rate: 115200 bps
 - Data bits: 8
 - Parity: no parity
 - Stop bits: 1 stop bit
 - Hardware flow control: Enabled
- When you put the power on to the Evaluation Kit, a green LED should be lit and if you have connected the Evaluation Kit to terminal software (like HyperTerminal) with RS-232 cable, you should see the iWRAP start-up banner.
- To be sure that your iWRAP is running correctly, you can type command `INQUIRY 5` to iWRAP. This command executes a device search and you should see other Bluetooth devices answering to the device search.

Q2.1: The green LED is lit and I have correctly set up my terminal. I can't get a response from my Evaluation Kit? What's wrong?

A2.1: Please check that the two switches are correctly set on the Evaluation Kit. Press the 'reset' switch to be sure after resetting the switches.

2.2 WT-modules

- Unless you have specified your order, you will receive the WT-modules pre-installed with the current version of iWRAP. The settings are the same as described in section 2.1 above.
- Please remember to read the design guide for WT-modules (www.bluegiga.com/techforum) before making a test board or full design. Also, please have a look at the reference design material. Feel free to copy the designs from our material.
- Especially, please keep in mind the RF design principles!
- With your own designs, you can always ask for schematic and layout review help from Bluegiga Support Team.

3. HARDWARE INTERFACES

Q3.1: What's the difference between different interfaces in the module, like UART, USB and iWRAP?

A3.1: There are four physical interfaces in the module, plus PIO pins. In addition there are several protocols for data transmission and a software interface called iWRAP, which is developed by Bluegiga. Physical interfaces contain UART, USB, SPI and PCM. Below you can find a short description of all of these:

UART: iWRAP is supported only via UART. In short, iWRAP is an ASCII based command line interface that utilizes the whole Bluetooth stack inside a single module. UART access is also provided by following HCI-protocols: BCSP, H4 and H5. HCI stands for *Host Controller Interface*, which means that upper part of the Bluetooth stack has to be run in the host processor.

USB: This interface provides only HCI-level access to the module. Basically, when using USB the module works as a regular Bluetooth USB dongle.

SPI: This interface is dedicated for firmware upgrades and parameter changes. It can't be used for data transmission.

PCM: This interface is used in audio applications, for example to utilize HFP (Hands Free Profile).

Q3.2: How can I change the operating mode from iWRAP to USB? Are there any other possible host interfaces available?

A3.2: There are basically five host interfaces possible in our modules: iWRAP, USB, BCSP, H5 and H4. iWRAP is the default, ASCII-based interface developed by Bluegiga. The rest are used with our module in HCI-mode. To change between modes:

- Start PSTool software (see Q3.4 how to get PSTool).
- Locate parameter "Initial bootmode".
- Change to a value corresponding the interface you wish to use:

Value Interface

0	iWRAP
1	UART link running BCSP, 115200 bps, CSR defaults
3	HCI with USB host transport
4	HCI with H4 host transport, 115200,8n1

After you have changed the value, click "Set" and then click "BC Reset" two times. Now module's host interface has been changed.

If you wish to use **H5** as host interface, you'll need to follow these steps:

- Start PSTool
- Choose "Entry -> Canned Operations -> @h5" and accept changes
- Choose "Entry -> Canned Operations -> @vm_disable" and accept changes
- Choose "Entry -> Canned Operations -> @hci_external" and accept changes
- Click "Reset BC" and exit PSTool

NOTE: If you order HCI firmware, be sure to exactly specify the UART settings.

3.1 UART

Q3.3: Do I have to use Hardware Flow Control in my design, i.e. RTS/CTS signaling?

A3.3: It's not mandatory, but strongly recommended by Bluegiga! Flow control is enabled by default in our modules. Even though Bluetooth is often used for serial cable replacement, wireless transmission differs from using actual cables. If the hardware flow control is not used it may happen that the buffers in the Bluetooth module are filled up and data is lost. In worst case the buffers are filled up and the module resets. This can happen for example in situations when the receiving end goes out of range. HW flow control in the UART interface takes care of these situations and therefore it should be used in all designs.

There are two ways to disable HW flow control:

1. Configure parameter "UART configuration when XXXX" (XXXX defines the host interface at use) with PSTool and disable HW flow control (see parameter description in PSTool).
2. Connect CTS to ground and leave RTS floating (needed only if flow control is not disabled via PS-keys)

Q3.4: Can I change parameters via UART?

A3.4: iWRAP has a feature called AutoBCSP. This means that iWRAP automatically recognizes BCSP (BlueCore Serial Protocol) traffic and is able to interpret it. BCSP can be used to change the internal parameters and is supported also by the PSTool software. To change the internal parameters, do the following:

- Connect RS-232 cable between the WRAP THOR and your PC
- Power up the module
- Start PSTool
- Use connection settings (default): **BCSP**, **COMn** and **115200**
- Change the needed parameters (Remember to press "SET" after changing the parameter value)
- Close PSTool and reset the module

NOTE:

*) UART baud rate when using BCSP is NOT dependent on the "SET CONTROL BAUD" iWRAP command, but is defined by PS-key "PSKEY_UART_BAUD_RATE". By default the parameter is

115200 bps. AutoBCSP feature works only if PSKEY_UART_BAUD_RATE and "SET CONTROL BAUD" have same values!

3.2 USB

Q3.5: I've connected the module to my PC with USB cable, but I can't see it even in Device manager. Why doesn't it install properly?

A3.5: There are two possible reasons: you haven't installed USB driver for the module or the module is not in USB-mode. You can get the USB driver from our Tech forum, www.bluegiga.com/techforum. If this doesn't solve the problem you need to verify that parameters are in order, see Q3.2.

3.3 SPI

Q3.6: How can I access SPI interface to change the module parameters or upgrade the module firmware?

A3.6:

- Install latest BlueSuite software to your Windows PC (available at www.bluegiga.com/techforum).
- Connect the module to the parallel port of your PC with Onboard Installation kit, which you can buy or build yourself, schematics are available in our Tech forum.

Now you have all the tools needed for parameter changes. To change parameters you'll need to use PSTool software. Select "SPI BCCMD" as transport and correct "Port" (usually LPT1), and then click "OK".

Now you can see all the module parameters, but do not change any setting if you don't know exactly what you're doing! To change values in parameters, choose correct parameter and insert the value. Then click "Set" and finally click "Reset BC". Then you can exit PSTool.

To upgrade module firmware you usually need to download latest firmware from www.bluegiga.com/techforum. Then you can use the "iWRAP update client" to perform the upgrade. **WARNING:** Do not use BlueFlash software unless you're specifically told to do so.

Q3.7: SPI interface is not working. I've connected Onboard Installation kit between the module SPI interface and the parallel port of my PC, but it doesn't work.

A3.7: First you should check you have connected Onboard Installation kit correctly. For example if you connect it the wrong way in our evaluation kit, it will result in error.

If this doesn't solve the problem, you need to install the latest version of BlueSuite software. You can download it from our Tech forum. If problems still exist, run file "InstParSpi.bat" located in the Bluesuite installation directory (usually C:\Program Files\CSR\BlueSuite) and reboot your PC. The last resort is to check the operating mode of the parallel port in your PC, which you can do in BIOS. "ECP" mode should work ok.

3.4 PCM

Q3.8: I want to use the PCM interface in my audio application, how should I proceed?

A3.8: In WT1x modules, there is a PCM interface. This interface is to be used with Head Set or Hands Free profiles. In your application, you'll need to use a PCM codec if you want to connect a microphone and headphones to the WT1x module. Bluegiga has reference designs for the following codec's:

- OKI MSM7702-01
- ST STW5093
- Freescale MC145483

At the moment Bluegiga modules don't support A2DP profiles.

3.4.1 Audio usage with iWRAP

Q3.9: How do I use audio with iWRAP?

A3.9: In order to use the audio profiles, two important settings need to be done.

- Give iWRAP command "SET CONTROL CONFIG 100"
- Enable the audio profile(s) with command "SET PROFILE [profile]"

NOTE: The "SET CONTROL CONFIG 100" means that you have not set any other configuration bits than the "audio enabled" bit. Please see iWRAP manual for description of "SET CONTROL CONFIG" command.

In iWRAP 2.2.0 manual, chapters 15.7 and 15.8, iWRAP audio configuration is described in good detail with flow diagrams.

3.4.2 Audio usage with HCI

Q3.10: How do I use audio in HCI-mode?

A3.10: If you use an external Bluetooth stack and you want to use the PCM interface, one parameter needs to be set so that you can have the PCM interface working for audio.

The PSKEY parameter to change is

- Map SCO over PCM

When this PSKEY is set to TRUE, all SCO (Synchronous Connection Oriented, i.e. an audio link) data is mapped to the PCM interface directly and not to the host interface you are using to connect your stack to WT1x.

3.5 GPIO

Q3.11: How do I use GPIO pins in the module?

A3.11: In WT1x modules there are 6 GPIO pins you can use. These pins can be configured to:

- Work as a carrier detect signal (indicate a Bluetooth link and/or data mode)
 - "SET CONTROL CD" command in iWRAP
- Be full interface to all UART signals (MSC interface)
 - "SET CONTROL MSC" command in iWRAP
- Bind different commands to GPIO activity
 - "SET CONTROL BIND" command in iWRAP
- Switch from data mode to command mode
 - "SET CONTROL ESCAPE" command in iWRAP

The GPIO's have voltage level of 3.3V and depending on the configuration, they are configured as input or output.

4. FIRMWARE

4.1 iWRAP

Q4.1: How to reset 115200 baudrate to iWRAP?

A4.1: Start PSTool software and locate parameter "User configuration data 26". Delete this parameter and click "Reset BC", then exit PSTool. Now the module is set back to default baudrate (115200,8N1).

Q4.2: How to determine if iWRAP is master or slave?

A4.2: This setting can be determined with command "SET BT PAGEMODE". In default setting, the iWRAP will be master when it's calling and doesn't request master-slave switch when answering a call. Remember that master devices consume less power than slave devices since the slaves listen to the master continuously.

Q4.3: Why can't I connect more than one device to iWRAP?

A4.3: You probably have to change the pagemode parameter in iWRAP. The default pagemode setting makes iWRAP visible in inquiry and allows incoming connections from remote Bluetooth devices. But when there is one active connection, iWRAP changes its state to non-visible and it doesn't any longer accept incoming connections.

You can change this by giving command "SET BT PAGEMODE 3". Then the module is always visible in inquiry and always allows incoming connections. More pagemode options are available and they can be found in the iWRAP User guide, which you can download from our website.

Q4.4: I have established a connection between WT-modules running iWRAP firmware. If I power off one of the devices (or it goes out of range), the link seems to be open for 20 seconds still.

A4.4: The reason for this behavior lies in the link supervision timeout setting. As default link supervision timeout is set to 20 second. The reason for this long time is that the link will not be dropped if the other device is temporarily out of range. If you want to shorten (or lengthen) this time, you need to have a look at the command "SET BT ROLE" from iWRAP User guide. Also, please remember that the link supervision timeout is set by the master device.

Q4.5: What is the difference between "SET BT AUTH" and "SET BT PAIR" in iWRAP?

A4.5: With "SET BT AUTH" you can set the PIN code for authenticating communication between Bluetooth devices. When you have the PIN code set, it also means that the communications link is encrypted. When using PIN code, the first successful connection establishment will automatically create "SET BT PAIR" information to iWRAP settings, for example "SET BT PAIR 00:07:80:81:3a:e5 0fa97034c44a650fe5b007263913bedd". After this these two devices will use the 32 characters long *link key* for authentication and encryption, so PIN code can be changed if needed for some other Bluetooth device.

If you need to remove a single pairing, you can use command "SET BT PAIR *bd_address*". For example to remove the example pairing above, the command would be "SET BT PAIR 00:07:80:81:3a:e5". To remove all pairings at once, command "SET BT PAIR *" will do the trick.

Q4.6: Why can't I connect the Bluetooth module with my own Bluetooth device, I get some kind of "authentication failed" error?

A4.6: First thing to check is that you're using the same PIN code in both devices, otherwise they can't establish a connection. If you don't want to use PIN codes, you must disable it from iWRAP too. Some Bluetooth devices require PIN code to be used, no matter what. For example many mobile phones always require a PIN code. It's also very common that a Bluetooth device has a fixed PIN code and then it has to be used in iWRAP too. Good examples of such devices are Bluetooth headsets and other hands-free devices.

Q4.7: I established a Bluetooth connection to iWRAP and now I can't give any commands to iWRAP anymore!

A4.7: When a connection is established, iWRAP automatically enters so-called data mode. Then the module can transmit and receive data like a normal serial cable. You can exit data mode by typing "+++", which is the default escape sequence. Other way is to use DTR signaling, which enables you to exit data mode with a single PIO. You will see a "READY." prompt when you successfully exit data mode and then you're back to command mode, and you can issue iWRAP commands as usual. To get back to data mode you'll need to use command "SELECT *link_id*", where *link_id* is the sequence number of the Bluetooth connection. First established connection has *link_id* = 0, second connection has *link_id* = 1 and so on.

4.2 Custom

Q4.8: Can I order modules with custom parameters?

A4.8: It is possible to order WT1x modules with so-called "custom firmware". This means you can order the module with your own parameters pre-installed, such as PIN code, host interface, UART baud rate and so on.

In order to receive your modules with your own iWRAP or HCI settings, you need to consult your sales contact and you also need to fill out a "custom firmware order form" where you specify the settings accurately.

In some cases we have also made software projects to our customers where iWRAP has been modified to meet specific requirements. With these requests, please contact your sales representative.

5. FIRMWARE UPDATES

5.1 OVER SPI

Q5.1: I downloaded "iWRAP Update client" from your Tech forum and connected Onboard Installation kit between the module and my PC. When I try to update the firmware, I get error "Update failed!". How I can get it working?

A5.1: This is most likely caused by old version of BlueSuite software. See questions 3.4 and 3.5 for more information.

5.2 OVER UART

Q5.2: Can I upgrade the module via UART?

A5.2: The firmware can also be updated over UART or RS232 interface. A method called Device Firmware Upgrade (DFU) is needed. Bluegiga has a DFU Wizard tool, which allows the updates to be made from a Windows™ based PC in a similar way as with BlueFlash. There is also a possibility to write the DFU support into a host processor connected to the module. In this way the firmware can be updated even if the module cannot be accessed from a PC.

DFU protocol is open and the description be requested from Bluegiga's support.

DFU file sizes:

- iWRAP update: ~20-30kB
- Bluetooth stack update: ~700kB
- Full update (max DFU size): ~1MB

6. MISCELLANEOUS INFORMATION

6.1 Writing Bluetooth software into a mobile phone with Java or Symbian

Unfortunately Bluegiga does not supply any Bluetooth sample code to mobile phones, because the implementation is very phone dependent.

The easiest way of implementing Bluetooth applications into mobile phones is with Java because same code can be used on different platforms like Nokia, Sony-Ericsson, Samsung etc. You can find many Java examples from the Internet. You just need to check that the phone supports Java JSR-82 API.

For symbian some examples can be found from here:

http://www.newlc.com/article.php3?id_article=256

And for Java some examples can be found from here:

<http://java.sys-con.com/read/47688.htm?CFID=102920&CFTOKEN=106D78A2-1404-667D-69F9C73703842E90>

A brief (but incomplete) list of JSR82 devices:

<http://www.javablueetooth.com/jsr82devices.html>

6.2 Which devices are compatible with iWRAP

Bluetooth is a global standard and in general devices supporting the same Bluetooth profiles work together. You can go to <http://qualweb.bluetooth.org> and check the Bluetooth profiles the devices support. At the time of writing this document iWRAP support the following Bluetooth profiles:

- Serial Port Profile (SPP)
- Hands-Free Profile v.1.5 (HFP)
- Hands-Free Audio Gateway Profile v.1.5 (HFP-AG)
- Dial-Up Networking profile (DUN terminal support) (DUN)
- OBEX Object Push Profile (receiving end) (OPP)