shimmer
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If you have any further support questions, you can contact us via email: 'support at shimmer-research.com'.

Top Level Questions:

How do I start using a Shimmer device?

You should first read the Shimmer User Manual carefully. Registered users can download the manual from the documentation section of our website. You'll also find it on the Live Distribution in the NON-LIVE/DOCS folder. At minimum, chapter one will acquaint you with the device capabilities and basics of use, charging, and programming.

Probably the most gratifying first step, after reading the manual's Introduction, is to program the Shimmer 2 with Blink. An explanation of how to do this begins in section 1.5.

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What is the simplest way to solve a Shimmer-related problem?

If you're in a hurry, this FAQ may have a short answer. The User Manual is the best reference for usage issues. If you have an application development issue, you should post your question to the Shimmer mailing list at:

https://www.eecs.harvard.edu/mailman/listinfo/shimmer-users

You should subscribe to this list in any event, as it is where important Shimmer-related announcements are made.

If you have a BioMOBIUS-related problem, please visit:

http://biomobius.trilcentre.org/index.php?option=com_simplefaq&Itemid=21

Of course, if you're not sure what's causing trouble, you may contact 'support at shimmer-research.com'

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What do I need to install on my PC to use my Shimmer device?

Developers: Before installing development tools, you should first decide which environment you want to use for this work. The Bootable Live Distribution provides a Linux development environment but all changes are lost when you shutdown (it does not have non-volatile storage). There is also a VMware virtual machine image to allow you to run a pre-configured Linux image in tandem with your current OS. The alternative to these is a native Linux installation. Please consult chapter four of the User Manual for details.

End users: The BSL430 application included on the Live Distribution allows you to load applications on your Shimmer device. BSL430 runs under Windows.

You may also install additional PC application that communicate with your Shimmer device.

How do I start writing software for the Shimmer device?

The quickest path to developing applications on the Shimmer is to leverage the extensive amount of software already in open source release using TinyOS; this software is on the LiveDistribution, and is actively maintained and extended by Shimmer Research. It is all open source, meaning that the source code is available free of charge and may be used and modified at the developer's whim.

The LiveDistribution has extensive documentation of the TinyOS toolchain under NON-LIVE/DOCS, as well as documents describing Shimmer's microcontroller, the TI MSP430.

The easiest way to get acquainted with this software environment is to explore the source code and program the Shimmer with the applications in the source code tree provided, which comes from the main TinyOS repository on Sourceforge. There are two versions of TinyOS extant, 1.x and 2.x, and Shimmer is supported under both. As a frame of reference, the TinyOS-1.x code is the oldest, for that reason, the most extensive, but is under active development along with version 2.x. Shimmer platform code in version 1.x is found under the contrib/handhelds directory; version 2.x code is not-platform dependent, as Shimmer is now a mainstream TinyOS platform.

Shimmer is compatible with Labview ?

Yes. Is available a Labview DSC module that can be used to develop applications. More info can found on the module page.

Hardware Questions:

What is the power consumption of the Shimmer?

Power consumption is driven by an application's computational and data requirements as well as the daughter board configuration. The power management features of Shimmer allow developers to approach the optimum value for said requirements. For example:

Case	Regulator Current*	Notes
CPU Active	5mA	Worst case, high application load at 8MHz
CPU Active	.1mA	Typical use
CPU Idle	.02mA	Idle (TinyOS)
CPU Suspended	.002mA	Suspend to RAM—not supported by TinyOS
ADC Active	1mA	During S/H Operation
ADC idle	<.010mA	During power-down
Bluetooth™ Active	45mA	Worst case-- ~20mA once paired regardless of data payload
802.15.4 radio Active	20mA	Worst case per data sheet
802.15.4 Typical application	.9mA	Measured using IP-over-802.15.4 stack for device control and data transfer
802.15.4 radio in sleep mode	<.03mA	See CC2420 Datasheet for more detail
MicroSD Peak	47mA	Peak, Worst Case
MicroSD Typical application	3mA	40mA peak, linear rise/fall over 400uS per R/W
Flash Idle	.150mA	
Sleep	.140mA	Entire board

*Expected values

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What is the battery capacity?

Shimmer has a 280 mAh lithium-ion rechargeable battery.

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Does it have a power save mode and what is the battery life in this case?

Shimmer 2 has a new dual-mode button that acts as both a reset button and a power switch. A quick button-press resets Shimmer, but holding the button down for seven seconds powers Shimmer off completely, so battery life equals the battery's nascent shelf life. When Shimmer is off, a quick button-press turns it back on.

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Can I connect my own larger battery if I want to extend the battery life?

Yes, if you have the skills and equipment to do so, as long as you choose a compatible battery with under-voltage, over-voltage protection and over discharge-current protection built-in.

Can I develop my own daughter card for Shimmer?

Yes, if you have the skills and resources necessary to design and manufacture your own hardware. Connection data is listed in the manual.

Can I connect two daughter cards at the same time to a single Shimmer?

Shimmer may be configured with one internal and one external daughter card.

Can I use 802.15.4 and Bluetooth at the same time?

No, but a carefully-written application can use both in tandem with careful orchestrated mutually-exclusive startup and shutdown routines.

What is the range of the Bluetooth Radio?

Indoors, typically 10 meters. Performance will vary based on the orientation of both sides of the radio link.

What is the range of the 802.15.4 radio?

Indoors, typically 8-10 meters. Performance will vary based on the orientation of both sides of the radio link.

What is the memory on the TI MSP430?

The MSP430F1611 has 48 Kbytes of flash ROM and 10 Kbytes or RAM.

How many ADC channels are on the device?

The MSP430F1611 has eight ADC channels; three are directly connected to the on-board accelerometer.

Why are there two serial ports when I plug in the dock or Span? What do they do?

The shimmer dock exposes two serial ports; the host computer's operating system will enumerate them sequentially, either as two com ports (in windows), ttyUSB ports (in linux), or tty.usbserial-FTT ports (in Mac OS).

What do the two ports do? The first is tied to programming pins on the Shimmer; the second accesses its uart0 pins.

So, when you dock the shimmer, if you have com21 and com22, or /dev/ttyUSB0 and /dev/ttyUSB1, or /dev/tty.usbserial-FTT910SHA and /dev/tty.usbserial-FTT910SHB you program the shimmer thus:

```
make shimmer2r install bsl,com21
or
make shimmer2r install bsl,/dev/ttyUSB0
or
make shimmer2r install bsl,/dev/tty.usbserial-FTT910SHA
```

If you wish to communicate with the Shimmer's serial port with host-side software, you would open the second port.

I have a unique requirement, can Shimmer Research design & develop custom hardware / daughter cards?

Yes.

Where is Shimmer manufactured?

EU / Ireland.

Software Questions:

I have an application idea, can Shimmer Research design & develop my application to run on Shimmer?

Yes.

Can I develop my own application to run on the device?

Shimmer platform and application support are written in TinyOS and released as open source in the TinyOS repository at Sourceforge. Two versions of TinyOS are actively

maintained. In TinyOS-1.x, our codebase resides under contrib/handhelds; in TinyOS-2.x, platform support is in the main tree, with sample applications in tinyos-2.x-contrib/shimmer.

TinyOS is written in nesC, which is a dialect of C.

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Is TinyOS the only alternative for writing Shimmer firmware?

No, TinyOS is just one development environment; the choice is yours.

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Should I use TinyOS 1.x or 2.0 with my Shimmer device?

The original platform and application development took place under TinyOS-1.x, and still does, but strictly under the contrib/handhelds branch. This branch predates the Shimmer platforms and contains a wealth of sophisticated software for MSP430-based devices. Shimmer is now an officially-supported device under TinyOS-2.x, so it will enjoy the benefits of the latest development efforts in the community. In short: your choice!

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Why don't the timers provide precise timing frequencies?

TinyOS timers' interval argument is not actually counted in milliseconds, but 1/1024 seconds, because it is based upon crystal-based hardware timers. So, an attempt to have a software timer trigger an event at 50Hz – by setting the interval at 20 – will actually produce a frequency of 51.2Hz.

Sample Rate Actual Sample Rate

10 : 10.24

50 : 51.2

100 : 102.4

125 : 128

200 : 204.8

250 : 256

500 : 512

1000 : 1024

One more note about timer precision: Shimmer's clock crystal drifts approximately 22 parts-per-million, so long-term timings will drift about +/- 1.32 ms every minute, or about 79 ms per hour.

What should I do if my TinyOS program compiles correctly but I get an error when the firmware is written to the Shimmer?

First check to see if the Shimmer is on; a quick press of the power button will do this. If that's not the trouble, confirm that the compile command has the correct serial ports for the dock by removing the Shimmer from the dock; unplugging the dock's cable; noting the results doing ls -l /dev/ttyUSB* at a shell prompt; then plugging the dock back in and repeating the 'ls -l' command. The compilation command should point to the first of the two dock ports. See the User Manual for a complete explanation.

How do I get my data on the SD-card or from the SD-card to a PC ?

Data written into files on a FAT-formatted card will be visible on your PC when you dock a running Shimmer; this is a new feature of Shimmer 2. TinyOS-1.x – and, by late fall, 2009, TinyOS-2.x – has application support for FAT.

What radio protocols are available on Shimmer?

Shimmer has two radios: the Bluetooth module supports the Serial Port Protocol. The 802.15.4 radio implements its IEEE physical and link layers; higher-level open-standard network protocols, including several mesh, ad-hoc, and IP protocols (v4 and v6), are implemented in software between the two versions of TinyOS.

What values do the data values I receive from the Shimmer represent?

When running most of the BioMOBIUS applications the value you are getting is the raw ADC value. As an example, if you are using the EMG daughter card and you want to convert the value you are receiving to volts you use the formula in section 17.2.1 of the MSP430 user guide.

$$N_{ADC} = 4095 \times \frac{V_{in} - V_{R-}}{V_{R+} - V_{R-}}$$

If you are using the "BioMOBIUS EMG" image, then, by default, VR+ is set to AVcc (3.0V) and VR- is set to AVss(gnd). You also have to account for the scale factor on the EMG board, which you can find in the "Shimmer Biophysical Expansion User Guide", but, in short, the gain is 682.

I am receiving a timeout or NAK when trying to program my Shimmer. How do fix it?

There are a couple of possibilities to explain what is going on.

Firstly, occasionally a shimmer will fail to program, but approx. 90% of the time simply resetting the shimmer will solve the problem. For the remaining 10% it might take two or three resets, or powering off the shimmer for a few seconds and turning it back on.

Secondly, are you sure the Shimmer is powered on? Unlike the shimmer1 the shimmer2r (and shimmer2) can be completely powered off (by holding down the reset button for 7 seconds). If you try to program the shimmer when it is powered off you will receive this error. Tapping the reset button will power it back on.

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If the code is open source, what part of it does Shimmer Research support?

We support it until you change it.

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How do I run the IP Stack on Shimmer?

Please see the following video demonstration and guide: microIP example

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