The Installation Instructions for Build 009

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1 Operating environment

- OS
  - Windows XP SP2/3 or Vista
  - Mac OS X Tiger 10.4 or Leopard 10.5
- Software
  - Java Runtime Environment (J2SE 5.0 or above)
  - Flash Professional CS3/4, Flex Builder 3 or Flex 2/3 SDK[*1]
  - Processing v1.0[*2]
  - Ruby (1.8.6, not tested on 1.9)[*3] and OSC library[*4]
- Hardware
  - Gainer I/O module[*5][*6] or clones
  - Arduino Diecimila/Duemilanove/LilyPad/Nano/Pro/Pro Mini[*7] or clones like Boarduino
  - XBee 802.15.4 OEM[*8] or ZB ZigBee PRO[*9] RF modems
  - FIO (Funnel I/O) module[*10]

2 Contents of a distribution package

- `documents/` Specifications and manuals
- `hardware/` Hardware design data and firmware
- `libraries/` Software libraries
  - `actionscript3/` The software library and examples for AS3
  - `processing/` The software library and examples for Processing
  - `ruby/` The software library and examples for Ruby
- `LICENSE.txt` License information
- `README_en.txt` Overview in English
- `README_ja.txt` Overview in Japanese
- `server/` Funnel Server
  - `funnel_server.jar` Funnel Server's main file
  - `settings.txt` Funnel Server's settings file

[*1] http://www.adobe.com/products/flex/flexdownloads/index.html
[*2] http://processing.org/download/index.html
[*3] http://www.ruby-lang.org/en/downloads/
[*4] http://raa.ruby-lang.org/project/osc/
[*5] http://www.triggerdevice.com/items/
[*6] http://www.sparkfun.com/commerce/product_info.php?products_id=8480
[*7] http://www.arduino.cc/en/Main/Hardware
[*8] http://www.digi.com/products/wireless/point-multipoint/xbee-series1-module.jsp
[*9] http://www.digi.com/products/wireless/zigbee-mesh/xbee-zb-module.jsp
[*10] http://www.sparkfun.com/commerce/product_info.php?products_id=8957

3 How to install a device driver

Gainer I/O modules, Arduino I/O boards, XBee RF modems, FIO modules and most USB-to-XBee bridge modules [*11] are equipped with an FTDI's FT232RL (a very famous USB-to-UART bridge chip). So you can use virtually all hardware devices by installing the device driver for the bridge chip[*12].

3.1 Windows XP/Vista

First of all, download the driver from the following location. Point your web browser to the following URL, and download a device driver for Windows XP or Vista.

http://www.ftdichip.com/Drivers/VCP.htm

Then extract the package, connect your I/O module, and follow the instructions of the installer.

3.2 Mac OS X

First of all, download the driver from the following location. Point your web browser to the following URL, and download a device driver for Mac OS X (Intel or PowerPC).

http://www.ftdichip.com/Drivers/VCP.htm

Then extract the package and follow the instructions of the installer.

4 Preparation for your hardware

4.1 Gainer I/O modules

In case of Gainer I/O modules, you have nothings to do. Just connect your module via a USB cable, and follow the instruction described below to launch Funnel Server.

4.2 Arduino I/O boards

To connect Arduino I/O boards, Firmata[*13] is needed. Firmata is a MIDI like protocol developed by Hans-Christoph Steiner. Since Arduino 0015 includes Firmata library by default, you can easily start using your Arduino I/O board as an I/O module for Funnel just uploading the example sketch as follows.

1. Choose an appropriate model in Tools/Board menu
2. Choose an appropriate serial port in Tools/Serial Port menu
3. Choose `StandardFirmata` in File/Sketchbook/Examples/Library-Firmata
4. Press the Upload button to upload the sketch to your board[*14]

The uploading process should be finished after 10 seconds or more. If you see error messages, please try again from the 4th step.

[*11] SparkFun Electronics: XBee Explorer USB (part number WRL-08687)
[*12] The drivers are also included in a '`drivers`' folder (e.g. `arduino-0015/drivers`) of an Arduino distribution package
[*13] http://www.arduino.cc/playground/Interfacing/Firmata/
[*14] You might have to press the reset button before press the Upload button

4.3 XBee RF modems

4.3.1 802.15.4 series

On Windows, you can get X-CTU[*15] from Digi's web site. Then write `coordinator.pro` in `hardware/xbee/multipoint` to a coordinator, and `enddevice.pro` to end devices. Please change parameters if needed.

On Mac OS X, you can configure XBee modems using `XBeeConfigTerminal` in `hardware/fio/tool`. An example of settings are described in table 1. You have to upgrade firmware to 1.0.C.D to use output side.

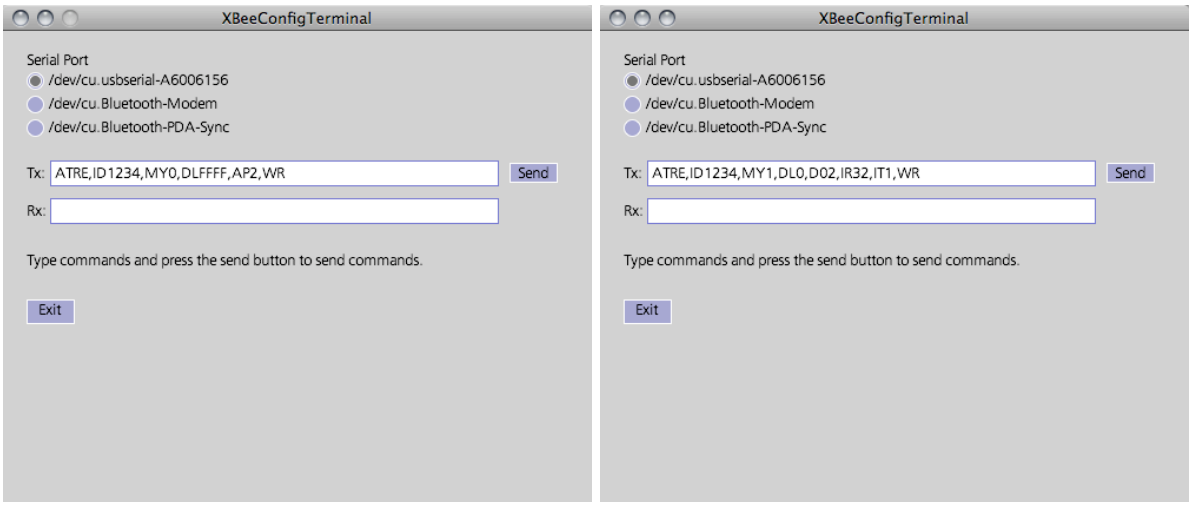

Figure 1 Screenshots of XBeeConfigTerminal: a coordinator side (left) and end devices side (right)

	Coordinator	End devices	Remarks
`ATRE`	-	-	reset settings
`ATID`	1234	1234	PAN ID
`ATMY`	0	1	
`ATDL`	FFFF	0	destination ID
`ATD0`	-	2	configure AD0/DIO0 as an analog input
`ATIR`	-	32	sampling interval is 0x32 = 50ms
`ATIT`	-	1	send each sample
`ATAP`	2	-	set API mode to 2
`ATWR`	-	-	write settings
`ATCN`	-	-	exit command mode

Table 1 An example of settings for 802.15.4 series

4.3.2 ZB ZigBee PRO series

Write `coordinator.pro` in `hardware/xbee/zb` to a coordinator, and `router.pro` to routers. Please change parameters if needed. Write firmware version 21xx (Coordinator - API Operation) to the coordinator, and 22xx (Router - AT/Transparent Operation) to routers. An example of settings are described in table 2. If you want to have a larger mesh network, please configure additional routers and end devices in the same manner.

[*15] http://www.digi.com/support/productdetl.jsp?pid=3352&osvid=57&tp=4&s=316

	Coordinator	Routers	Remarks
ATRE	-	-	reset settings
ATID	1234	1234	PAN ID
ATJV	-	1	check channels of the coordinator
ATDL	FFFF	0	destination ID
ATD1	-	2	configure AD1/DIO1 as an analog input
ATIR	-	32	sampling interval is 0x32 = 50ms
ATAP	2	-	set API mode to 2
ATWR	-	-	write settings
ATCN	-	-	exit command mode

Table 2 An example of settings for ZB ZigBee PRO series

4.4 FIO (Funnel I/O) modules

Since FIO is an Arduino clone I/O board with a XBee module based on LilyPad Arduino Main Board v1.6[*16], you have to configure XBee modems and upload a sketch by using Arduino IDE. Though both XBee series are supported, but we recommend you to use 802.15.4 series for simplicity.

4.4.1 How to configure XBee modems

On Windows, write `coordinator_auto_reset.pro` or `coordinator.pro` (if you don't want to enable the auto reset function) in `hardware/fio/xbee` to a coordinator, and `router.pro` to end devices (i.e. XBee modems for FIO modules) using X-CTU. Please change parameters if needed.

On Mac OS X, XBeeConfigTool (available in `hardware/fio/tool`) will be your fried. The usage of the tools is as follows:

1. choose a proper serial port
2. set a proper PAN ID
3. set a proper MY ID
4. choose a proper mode (Coordinator or End Devices)
5. press the Configure button to configure the XBee modem

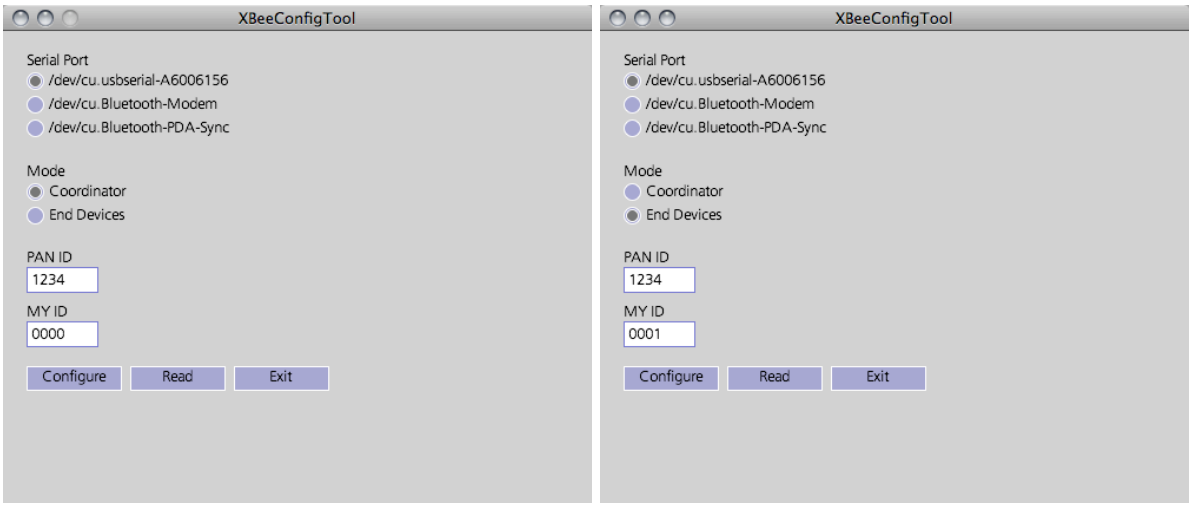

Figure 2 Screenshots of XBeeConfigTool: a coordinator side (left) and end devices side (right)

The baud rate setting in configuration files and the table is 19,200 bps, since the baud rate is used by boot loader in Arduino IDE. If you have to handle several FIO modules and the baud rate is not enough, change the baud rate of the coordinator to higher (e.g. 57,600 bps). Please don't forget to revert the baud rate to 19,200 bps to upload sketches to FIO modules.

[*16] http://www.sparkfun.com/commerce/product_info.php?products_id=8465

	Coordinator	End devices	Remarks
ATRE	-	-	reset settings
ATBD	4	4	set baud rate to 19,200 bps
ATID	1234	1234	PAN ID
ATMY	0	1	
ATDL	FFFF	0	destination ID
ATD3	3	5	set DIO3 as input / set DIO3 as output high
ATIC	8	-	set DIO Change Detect to detect changes on DIO3
ATIU	-	0	disable I/O Output
ATIA	-	FFFF	set the I/O Input Address to FFFF
ATWR	-	-	write settings
ATCN	-	-	exit command mode

Table 3 An example of settings for FIO (XBee 802.15.4)

4.4.2 How to upload firmware

Please follow instructions below to upload the firmware to FIO modules.

1. Choose 'Arduino Pro or Pro Mini (8MHz)' in Tools/Board menu
2. Choose an appropriate serial port in Tools/Serial Port menu
3. Open `FioStandardFirmata` in `hardware/fio/firmware/`
4. Turn off and on the power switch of your FIO module, or press the reset button, then press the Upload button to start uploading

The uploading process should be finished after 10 seconds or more. If you see error messages, please try again from the 4th step.

5 Preparations for each software library

5.1 ActionScript 3

The folder `libraries/actionscript3/examples/` contains examples for each hardware. For instance, an example source file for Gainer I/O modules is `GainerTest.as`, a Flash file is `GainerTest.fla` and pre published file for Flash Player is `GainerTest.swf`. If you use an development environment other than Flash IDE, please add `libraries/actionscript3/src/` to source paths.

List 1 An example of compile option for mxmlc

```
$ mxmlc GainerTest.as -sp ../src
```

Then point your web browser to http://tinyurl.com/ex6fd[*17], choose 'Global Security Settings Panel' and add the folder to allow access. Or your Flash Player can't communicate with a Funnel Server.

5.2 Processing

1. Create `funnel/` in `Processing/libraries/` in your document folder[*18]
2. Copy `library/` and `sketch_samples/` of `libraries/processing/` into the folder.
3. Launch Processing to confirm that 'funnel' is displayed as a menu item of Sketch/Import Library... menu. If you can't see, please confirm about the previous steps.

5.3 Ruby

The folder `libraries/ruby/examples` contains examples for Gainer, Arduino, XBee and FIO. If you are interested in examples action-coding in `libraries/ruby/examples/action-coding/`, please set-up an action-coding environment reffering http://code.google.com/p/action-coding/wiki/HowToUse.

[*17] http://www.macromedia.com/support/documentation/en/flashplayer/help/settings_manager04.html
[*18] "My Documents" on Windows XP, "Documents" on Windows Vista and Mac OS X

6 How to configure and run Funnel Server

Regarding ActionScript 3 and Ruby, the files mentioned below are located in `server/`. If you are using Processing, the files are are located in the library folder (i.e. `Processing/libraries/funnel/`).

6.1 Configure settings (except for Gainer I/O modules)

By default, Funnel Server is configured to use with Gainer I/O modules. So you have to configure settings file to use Funnel with other types. For your reference, example files are included in a distribution package as follows.

- `settings.arduino.txt` for Arduino I/O boards
- `settings.fio.txt` for FIO modules
- `settings.gainer.txt` for Gainer I/O modules
- `settings.xbee.txt` for XBee modems

Funnel Server will use single network port, and the default value is 9000. If the other application already uses 9000, please choose an unused network port. On Windows, you have to configure io/com setting. On Mac OS X and your I/O module is equipped with a FTDI's USB-to-UART bridge chip, Funnel Server try to open an appropriate port. So you might not need to configure serial port setting.

List 2 An example of settings.txt for Gainer I/O modules

```
server:
  port: 9000

io:
  type: Gainer
  com:
  baudrate:
```

List 3 An example of settings.txt for Arduino I/O boards (Mac OS X)

```
server:
  port: 9000

io:
  type: Arduino
  com: /dev/cu.usbserial-A*******
  baudrate: 115200
```

List 4 An example of settings.txt for Arduino I/O boards (Windows)

```
server:
  port: 9000

io:
  type: Arduino
  com: COM3
  baudrate: 115200
```

6.2 Start-up

If you finished configurations, double click on `funnel_server.jar` to launch Funnel Server. Funnel Server will connect with a hardware, and print messages in the window. If Funnel Server won't run, please confirm that a Java runtime environment (J2SE 5 or above) is installed.

6.3 Gainer I/O modules

If a Funnel Server launches successfully, messages will be printed as follows. If you find any error messages, please check your environment (i.e. settings file and hardware) referring to error messages.

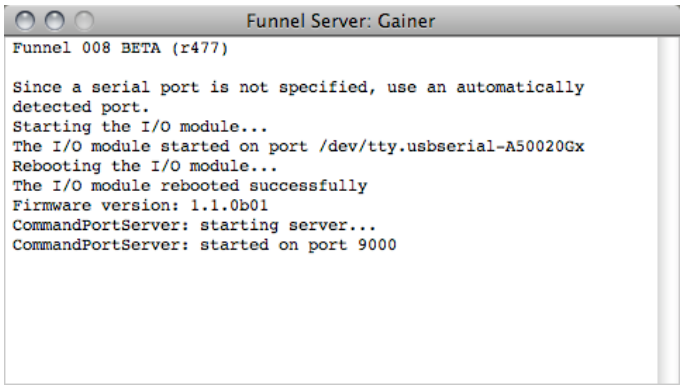

Figure 3 A typical screenshot when a Funnel Server connected to a Gainer I/O module launched

If you see any error messages, please make sure about following points:

- The FTDI USB driver is installed
- The USB cable is connected to the PC and the I/O board
- The power LED on the I/O board lights up
- The appropriate type (i.e. Gainer) is specified
- An appropriate serial port (e.g. COM3) is specified (if needed)

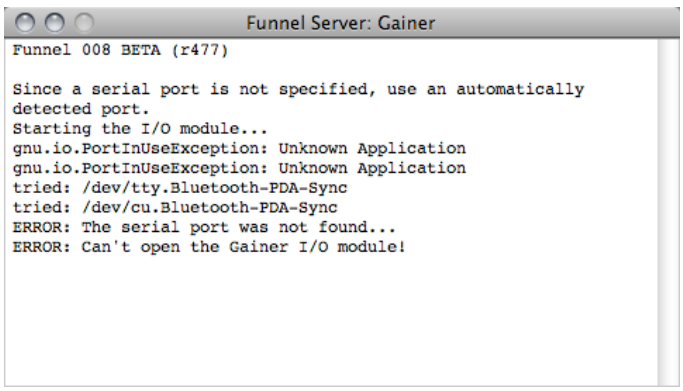

Figure 4 A typical screenshot when tried to launch a Funnel Server without connecting to a Gainer I/O module

6.4 Arduino I/O boards

If a Funnel Server launches successfully, messages will be printed as follows. If you find any error messages, please check your environment (i.e. settings file and hardware) referring to error messages.

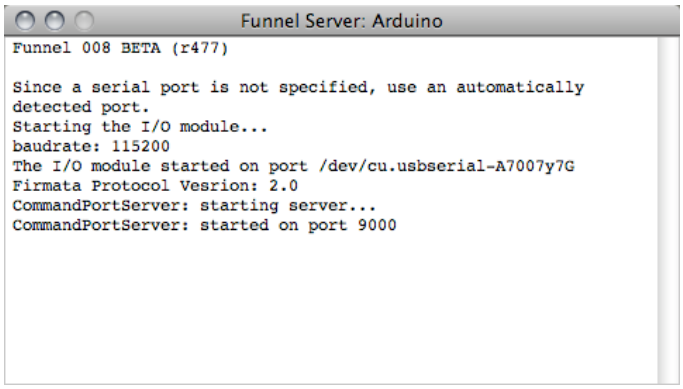

Figure 5 A typical screenshot when a Funnel Server connected to an Arduino I/O board launched

If you can't see a string like '`Firmata Protocol Version: 2.0`', you might failed to upload a firmware. Please refer the section 4.2 to try again. If you see any error messages, please make sure about following points:

- The FTDI USB driver is installed
- The USB cable is connected to the PC and the I/O board
- The power LED on the I/O board lights up
- The appropriate type (i.e. Arduino) is specified
- An appropriate serial port (e.g. COM3) is specified (if needed)
- An appropriate baud rate (e.g. 115200) is specified

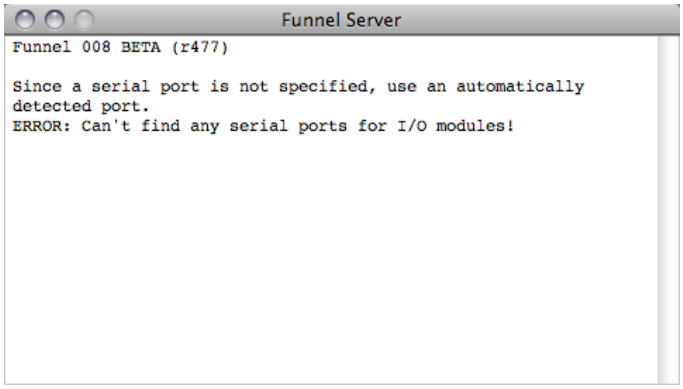

Figure 6 A typical screenshot when tried to launch a Funnel Server without connecting to an Arduino I/O board

6.5 XBee RF modems

If a Funnel Server launches successfully, messages will be printed as follows. If you find any error messages, please check your environment (i.e. settings file and hardware) referring to error messages.

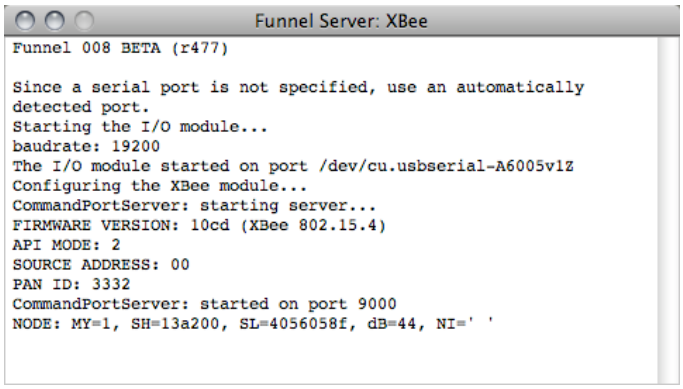

Figure 7 A typical screenshot when a Funnel Server connected to a XBee RF modem launched

If you see any error messages, please make sure about following points:

- The FTDI USB driver is installed
- The USB cable is connected to the PC and the I/O board
- The power LED on the XBee-to-USB module lights up
- The appropriate type (i.e. XBee) is specified (if needed)
- An appropriate serial port (e.g. COM3) is specified
- An appropriate baud rate (e.g. 115200) is specified

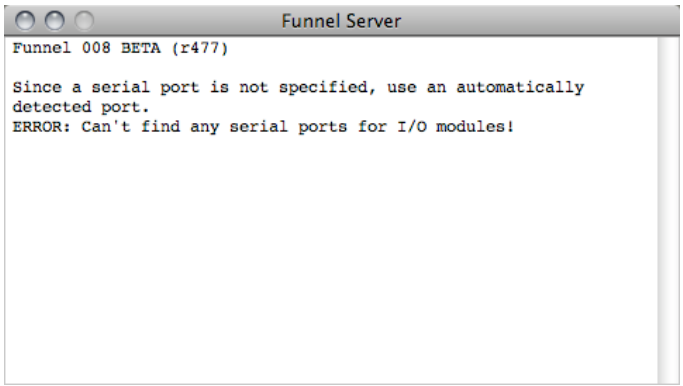

Figure 8 A typical screenshot when tried to launch a Funnel Server without connecting to a XBee RF modem

6.6 FIO modules

If a Funnel Server launches successfully, messages will be printed as follows. If you find any error messages, please check your environment (i.e. settings file and hardware) referring to error messages.

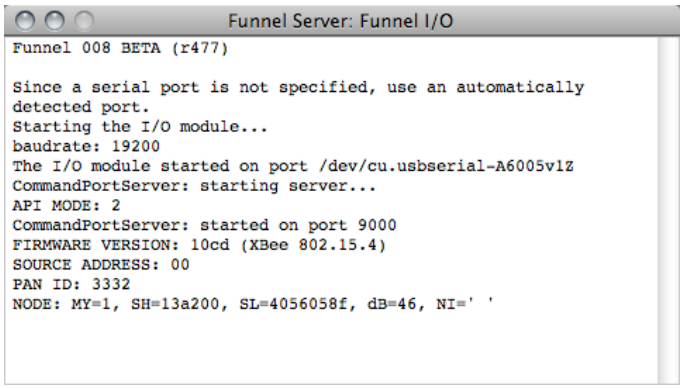

Figure 9 A typical screenshot when a Funnel Server connected to a FIO module launched

If you can't see a string like '`Firmata Protocol Version: 2.0`', you might failed to upload a firmware. Please refer the section 4.4.2 to try again. If you see any error messages, please make sure about following points:

- The FTDI USB driver is installed
- The USB cable is connected to the PC and the I/O board
- The power LED on the XBee-to-USB module lights up
- The appropriate type (i.e. FIO) is specified
- An appropriate serial port (e.g. COM3) is specified (if needed)
- An appropriate baud rate (e.g. 19200) is specified

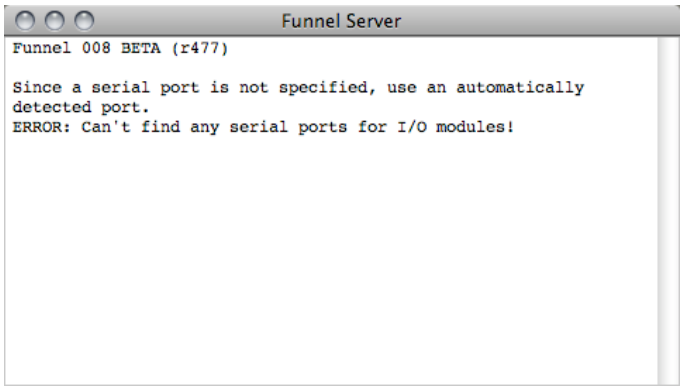

Figure 10 A typical screenshot when tried to launch a Funnel Server without connecting to a FIO module

7 Checking of operations for each software library

7.1 ActionScript 3

Run an appropriate example in `libraries/actionscript3/examples/` with a Flash Player. As for details, please refer to the comments in examples.

7.2 Processing

Click on the Open button, choose an appropriate example in `sketch_samples` folder. As for details, please refer to the comments in each sketch.

7.3 Ruby

Run an appropriate example in `libraries/ruby/examples/` folder. As for details, please refer to the comments in each script file.