The Installation Instructions for Build 010

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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 board[*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.app` and `Funnel Server.exe` 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 boards and most USB-to-XBee bridge modules [*11] are equipped with an FTDI FT232RL (a very famous USB-to-UART bridge chip). So you can use virtually any hardware device by installing the device driver for the bridge chip[*12].

3.1 Windows XP/Vista

First, install the device driver from the following URL. 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 run the installer and follow the directions it provides.

3.2 Mac OS X

First, install the device driver from the following URL. Make sure to download the appropriate driver for your system (Intel or PowerPC).

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

Then extract the package, run the installer and follow the instructions.

4 Preparation for your hardware

4.1 Gainer I/O modules

In case of Gainer I/O modules, you have nothing to do. Just connect your module via 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 proposed by Hans-Christoph Steiner. Since Arduino 0017 includes the Firmata library by default, you can easily start using your Arduino I/O board as an I/O module for Funnel just by 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 upload process should finish after 10 seconds or so. 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-0017/drivers`) of an Arduino distribution package
[*13] http://www.arduino.cc/playground/Interfacing/Firmata/
[*14] You might have to press the reset button before pressing 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`. Default settings are described in table 1. You have to upgrade the firmware to 1.0.C.D to use the output side.

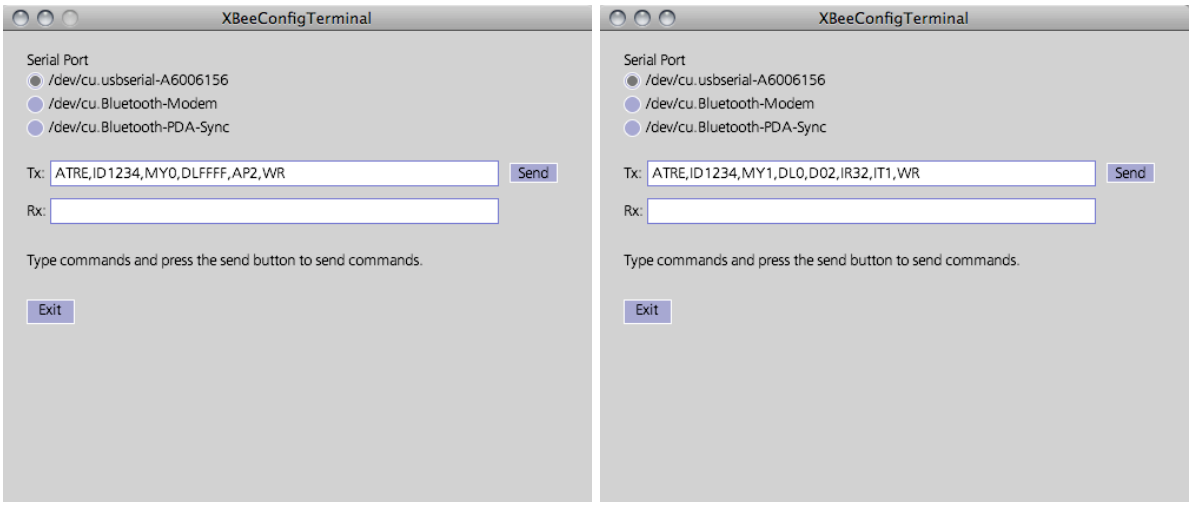

Figure 1 Screenshots of XBeeConfigTerminal: a coordinator side (left) and end devices side (right)

	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 Example settings for 802.15.4 series devices

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

4.3.2 ZB ZigBee PRO series

Write `coordinator.pro` in `hardware/xbee/zb` for a coordinator, and `router.pro` to a router. Please change parameters if needed. Change the firmware version to 21xx (Coordinator - API Operation) for a coordinator, and 22xx (Router - AT/Transparent Operation) for routers. Example 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.

	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 Example settings for ZB ZigBee PRO series devices

4.4 FIO boards

Since FIO is an Arduino clone I/O board with an XBee module based on the LilyPad Arduino Main Board v1.6[*16], you have to configure the XBee modem and upload sketches through the Arduino IDE. Though both XBee series are supported, we recommend that you to use the 802.15.4 series for simplicity and clarity.

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 boards) using X-CTU. Please change parameters if needed.

On Mac OS X, XBeeConfigTool (available in `hardware/fio/tool`) will be your friend. To use the tools you mush:

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

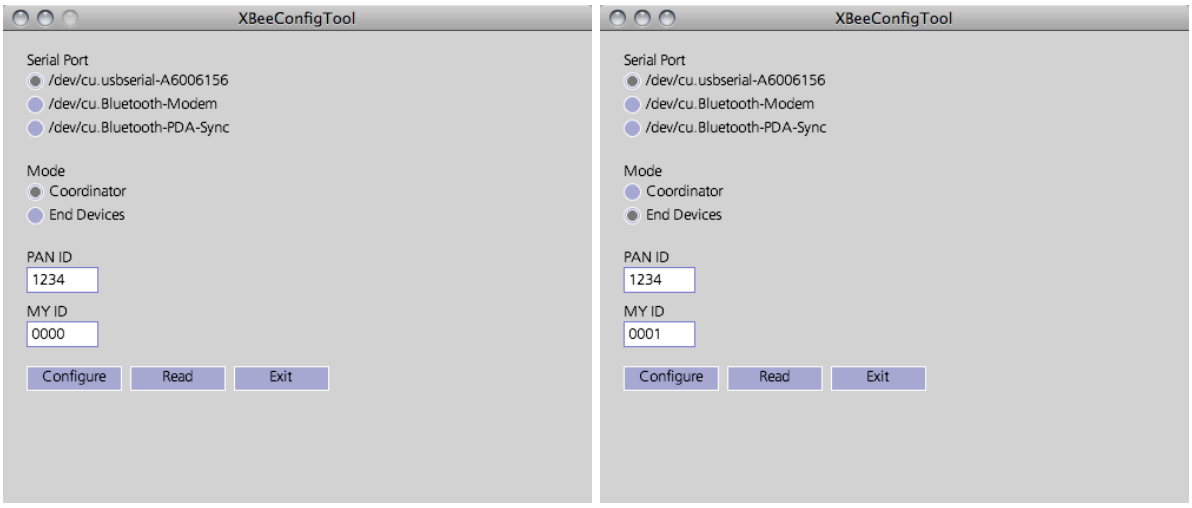

Figure 2 Screenshots of XBeeConfigTool: a coordinator side (left) and end devices side (right)

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

[*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 Example settings for FIO (XBee 802.15.4) boards

4.4.2 How to upload firmware

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

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 upload process should finish after 10 seconds or so. 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 options using 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 `examples/` 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 the settings file to use Funnel with other boards. 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 boards
- `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 another application is already using port 9000, please choose an open port. On Windows, you have to configure io/com setting. On Mac OS X, if your I/O module is equipped with FTDI's USB-to-UART bridge chip, Funnel Server will try to open an appropriate port. So you might not need to configure the serial port settings.

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: 57600
```

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

```
server:
  port: 9000

io:
  type: Arduino
  com: COM3
  baudrate: 57600
```

6.2 Start-up

If you finished setting up your configurations, double click on `Funnel Server.app` or `Funnel Server.exe` to launch Funnel Server. Funnel Server will connect with the hardware, and print messages in the terminal 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) using the error messages as reference.

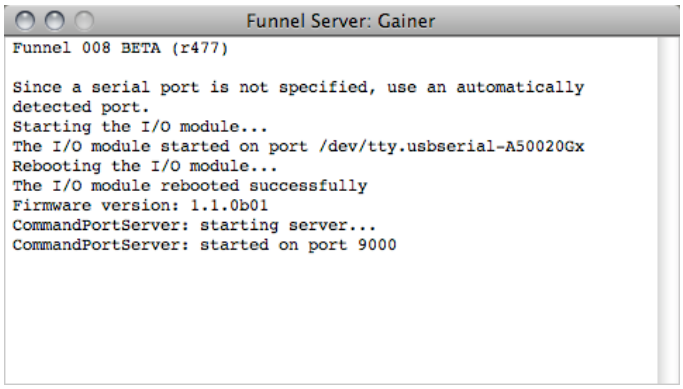

Figure 3 A typical screenshot of a Funnel Server launching with a Gainer I/O module connected

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)

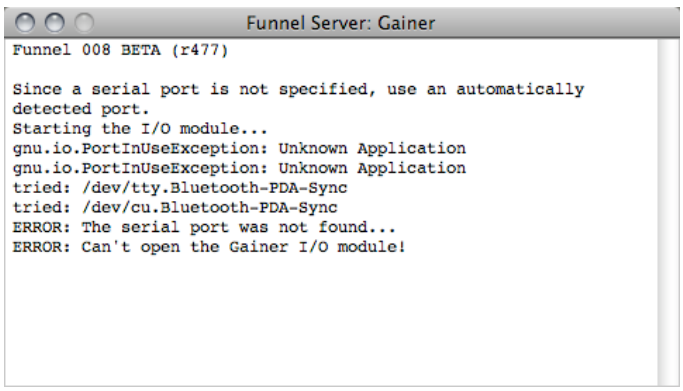

Figure 4 A typical screenshot of a Funnel Server launching without a Gainer I/O module attached

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) using the error messages as reference points.

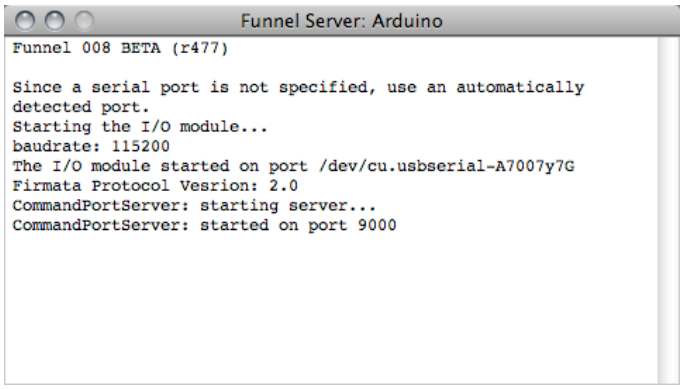

Figure 5 A typical screenshot of a Funnel Server launching with an Arduino I/O board attached

If you can't see a string like '`Firmata Protocol Version: 2.1`', the firmware might have failed to upload. Please refer the section **??** to try again. If you see any error messages, please make sure that:

- 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. 57600) is specified

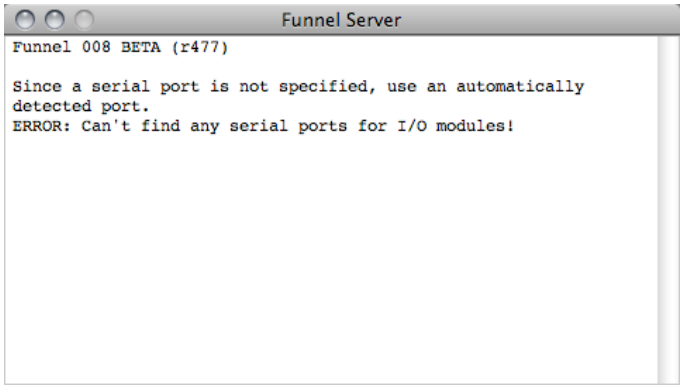

Figure 6 A typical screenshot of a Funnel Server launching without an Arduino I/O board attached

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) using the error messages as reference points.

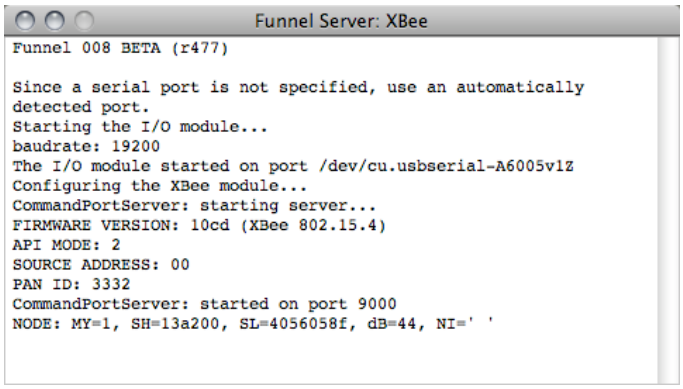

Figure 7 A typical screenshot of a Funnel Server launching with an XBee RF modem attached

If you see any error messages, please make sure that:

- 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. 57600) is specified

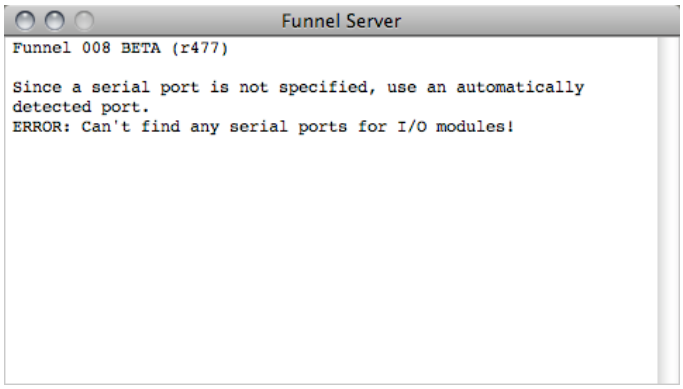

Figure 8 A typical screenshot of a Funnel Server launching without an XBee RF modem attached

6.6 FIO 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) using the error messages as reference points.

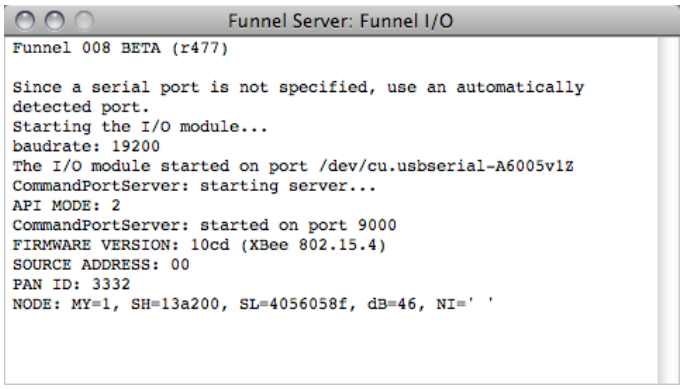

Figure 9 A typical screenshot of a Funnel Server launching with a FIO board attached

If you can't see a string like '`Firmata Protocol Version: 2.1`', the firmware might have failed to upload. Please refer the section **??** to try again. If you see any error messages, please make sure that:

- 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

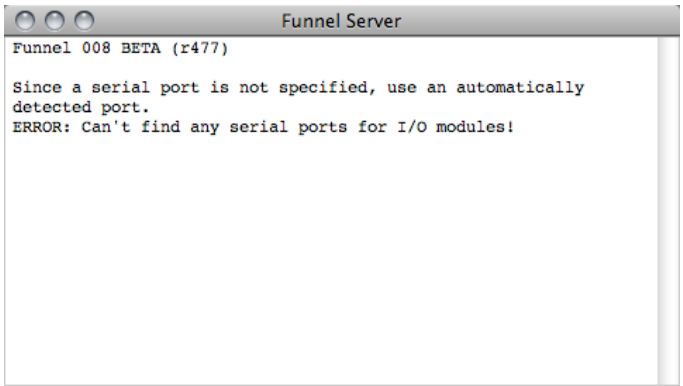

Figure 10 A typical screenshot of a Funnel Server launching without an FIO board attached

7 Testing the software libraries

7.1 ActionScript 3

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

7.2 Processing

Close Funnel Server application if running. Click on the Open button, choose an appropriate example in the `examples` folder. As for details, please refer to the comments in each sketch.

7.3 Ruby

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