FUNNEL
http://funnel.cc

**The Installation Instructions for Build 008**

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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, Flex Builder 3 or Flex 2/3 SDK[*1]
  - Processing (0148 BETA)[*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 NG/Diecimila/LilyPad/Nano/Pro/Pro Mini[*7] or Arduino clones like Boarduino
  - XBee 802.15.4 OEM RF module[*8]
  - XBee ZB ZigBee PRO RF module[*9] (experimental support)
  - 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/jp/products/flex/sdk/
[*2] http://processing.org/download/index.html
[*3] http://www.ruby-lang.org/ja/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-intl.co.jp/digi/wireless/zigbee/xbee-series1-module.html
[*9] http://www.digi-intl.co.jp/digi/wireless/zigbee-mesh/xbee-zb-module.html
[*10] The schematic, board design data and firmware are included as a part of Funnel 008 distribution package

# 3 How to install a device driver

Gainer I/O modules, Arduino I/O boards, XBee modules, Fio and most USB-to-XBee bridge modules [*11] are be 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.

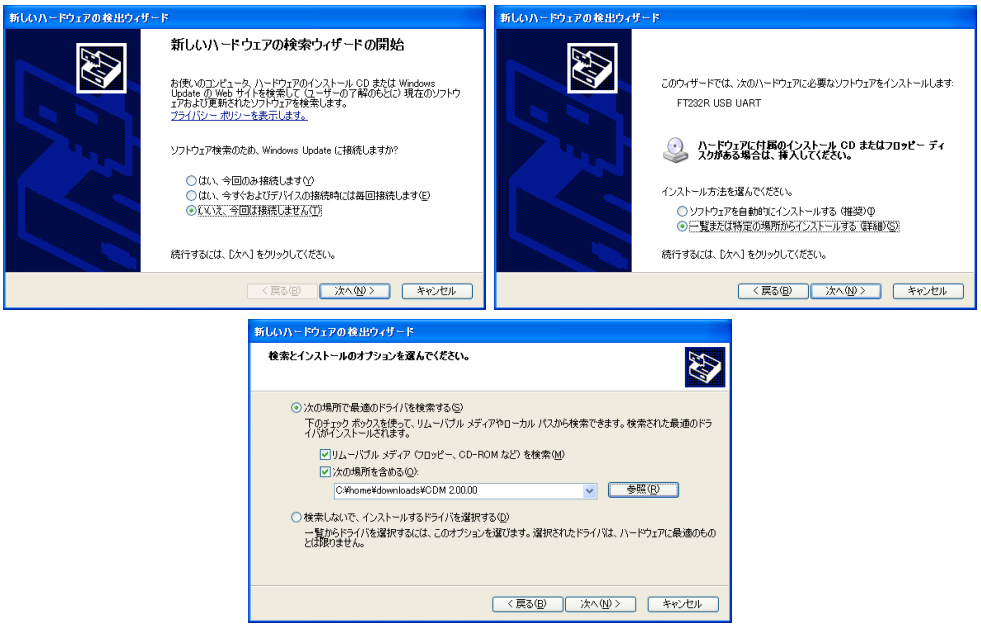


Figure 1 Typical screenshots of driver installation (Windows XP SP2)

[*11] SparkFun Electronics's XBee Explorer USB (part number WRL-08687)

[*12] The drivers are included in a 'drivers' folder (e.g. `arduino-0012/drivers`) of an Arduino distribution package

### 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 0012 includes Firmata library be default, you can easily start using your Arduino I/O board as an I/O module for Funnel just uploading an example sketch as follows.

1. Choose an appropriate model in Board menu item in Tools menu
2. Choose an appropriate serial port in Serial Port menu of Tools menu
3. Choose StandardFirmata in File/Sketchbook/Examples/Library-Firmata
4. Press 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.

[*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

Write coordinator.pro in hardware/xbee/multipoint to a coordinator, and enddevice.pro to end devices. Please change parameters if needed. If you are running Windows, you can get X-CTU[*15] from Digi's web site. If you are running Max OS X, XBee Terminal[*16] by Tom Igoe, distributes as an example for Making Things Talk, will be your friend. You can configure XBee modems by entering AT commands manually. An example of settings are described in figure 1. You have to upgrade firmware to 1.0.C.5 to use output side.

| | Coordinator | End devices | Remarks |
|---|---|---|---|
| ATRE | - | - | reset |
| 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 | - | API mode |
| 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 figure 2. If you want to have a larger mesh network, please configure additional routers and end devices.

| | 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

[*15] http://www.digi.com/support/productdetl.jsp?pid=3352&osvid=57&tp=4&s=316
[*16] http://www.makingthingstalk.com/chapter6/31/

## 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[*17], you have to configure XBee modems and upload a sketch by your 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

If you are running Windows, write coordinator.pro in hardware/fio/xbee to a coordinator, and router.pro to end devices (i.e. Fio modules) using X-CTU. Please change parameters if needed. If you are running Mac OS X, configure XBee modems manually using XBee Terminal references from table 3.

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.

| | Coordinator | End devices | Remarks |
|---|---|---|---|
| ATRE | - | - | reset settings |
| ATBD | 4 | 4 | set the baud rate to 19,200 bps |
| ATID | 1234 | 1234 | PAN ID |
| ATMY | 0 | 1 | |
| ATDL | FFFF | 0 | destination ID |
| 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 an instruction below to upload firmware to Fio modules.

1. Choose Arduino Pro (8MHz) in Tools/Board
2. Choose an appropriate serial port in Tools/Serial Port
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 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.

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

# 5 How to configure and run Funnel Server

## 5.1 Configure settings (except for Gainer I/O modules)

By default, Funnel Server is configured to use Gainer I/O modules. So you have to configure settings file to use Funnel with other type I/O modules. 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 a unused network port. If you are running Windows, you have to configure io/com setting. If you are running 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 don't have to configure serial port setting.

List 1 An example of settings.txt for Gainer I/O modules

```
server:
  port: 9000

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

List 2 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 3 An example of settings.txt for Arduino I/O boards (Windows)

```
server:
  port: 9000

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

## 5.2 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. If Funnel Server won't run, please confirm that a Java runtime environment (J2SE 5 or above) is installed.

## 5.3 Gainer I/O modules

If 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 2 A typical screenshot when a Funnel Server connected to a Gainer I/O module launched

If you see messages as follows, please check a USB cable is connected to a PC, and USB LED on an I/O module lights up.

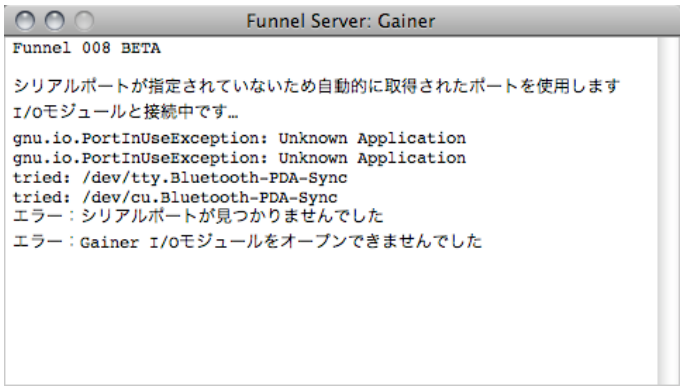


Figure 3 A typical screenshot when tried to launch a Funnel Server without connecting to a Gainer I/O module

## 5.4 Arduino I/O boards

If 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.

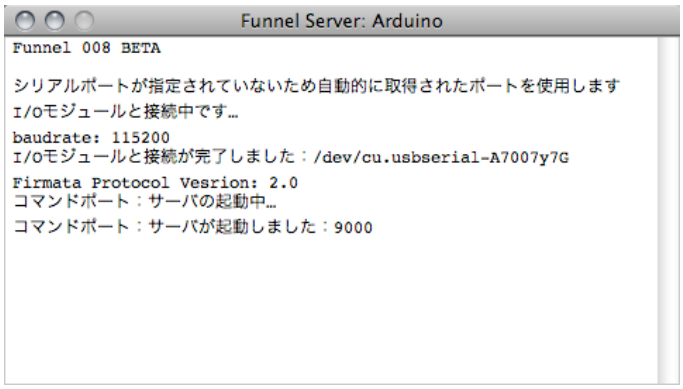


Figure 4 A typical screenshot when a Funnel Server connected to an Arduino I/O board launched

If you can't see 'Firmata Protocol Version: 2.0' string, 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 that following issues:

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


Figure 5 A typical screenshot when tried to launch a Funnel Server without connecting to an Arduino I/O board

## 5.5 XBee RF modems

If 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.

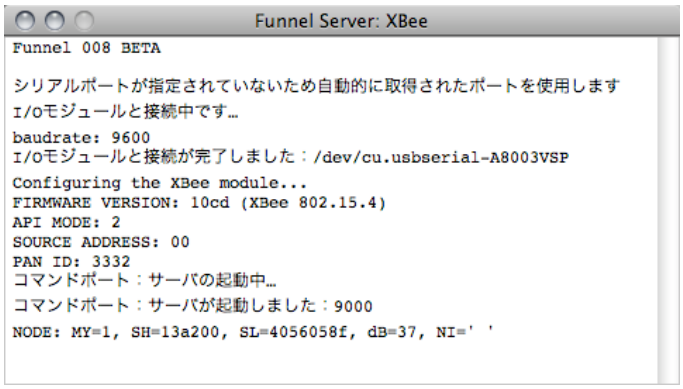


Figure 6 A typical screenshot when a Funnel Server connected to a XBee RF modem launched

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

- The USB cable is connected to the PC and the I/O board
- The power LED on the XBee-to-USB module lights up
- An appropriate type (i.e. XBee) is specified
- An appropriate serial port (e.g. COM3) is specified
- An appropriate baud rate (e.g. 119200) is specified

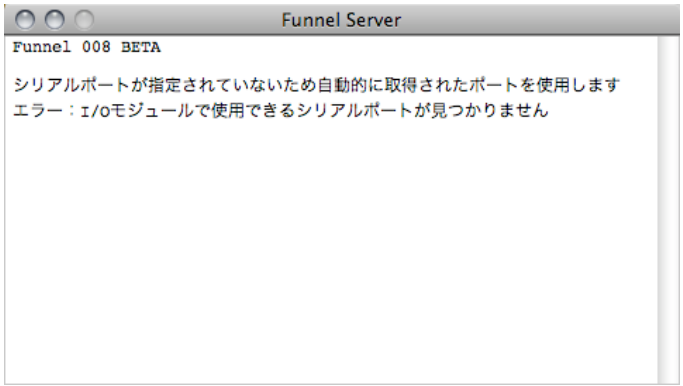


Figure 7 A typical screenshot when tried to launch a Funnel Server without connecting to a XBee RF modem

## 5.6 Fio modules

If 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.

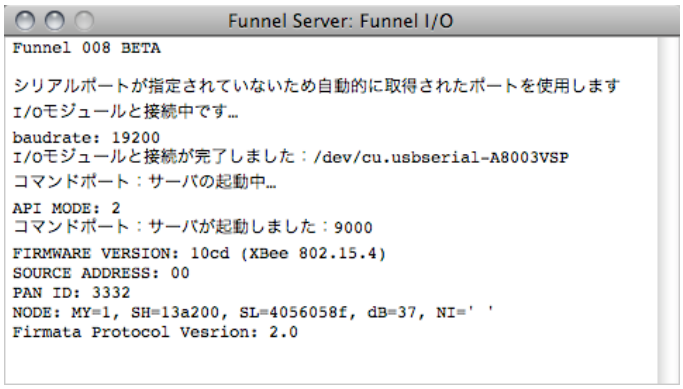


Figure 8 A typical screenshot when a Funnel Server connected to a Fio module launched

If you can't see 'Firmata Protocol Version: 2.0' string, 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 that following issues:

- The USB cable is connected to the PC and the I/O board
- The power LED on the XBee-to-USB module lights up
- An appropriate type (i.e. XBee) is specified
- An appropriate serial port (e.g. COM3) is specified
- An appropriate baud rate (e.g. 119200) is specified

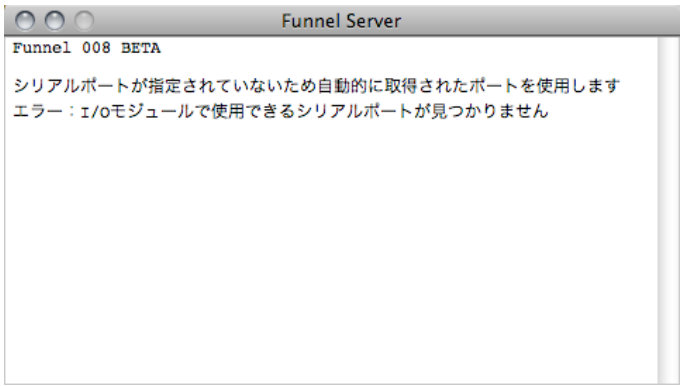


Figure 9 A typical screenshot when tried to launch a Funnel Server without connecting to a Fio module

# 6 Preparations and checking of operations for each software libraries

## 6.1 ActionScript 3

### 6.1.1 Preparations

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 4 An example of compile option for mxmlc

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

Then point your web browser to http://tinyurl.com/ex6fd*[18], choose 'Global Security Settings Panel' and add the folder to allow access. Or your Flash Player can't communicate with a Funnel Server.

### 6.1.2 Checking of operations

Run `libraries/actionscript3/examples/*Test.swf` with a Flash Player. As for details, please refer to the comments in `*Test.as`.

## 6.2 Processing

### 6.2.1 Preparations

1. If you have not installed Processing, please download an appropriate file for your operating system. then extract.
   http://processing.org/download/
2. Copy `funnel_008/libraries/processing/library/` as `Processing 0148/libraries/funnel/library/`
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 step. If confirmed, quit Processing.
4. A document folder should be created (Windows: My Documents/Processing, Mac OS X: Documents/Processing), so copy `libraries/processing/sketch_samples/` into the document folder. Then launch Processing again.

### 6.2.2 Checking of operations

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

## 6.3 Ruby

### 6.3.1 Preparations

The folder `libraries/ruby/examples` contains examples for Gainer, Arduino, XBee and Fio. If you have not installed Ruby environment, please install before running an example. If you are interested in examples action-coding in `libraries/ruby/examples/action-coding/`, please set-up action-coding environment reffering http://code.google.com/p/action-coding/wiki/HowToUse.

*[18] http://www.macromedia.com/support/documentation/en/flashplayer/help/settings_manager04.html

### 6.3.2 Checking of operations

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