FUNNEL
http://funnel.cc

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, 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 NG/Diecimila/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 0012 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.

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[11] SparkFun Electronics: XBee Explorer USB (part number WRL-08687)
[12] The drivers are also included in a 'drivers' folder (e.g. `arduino-0012/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

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

	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.

	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

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[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 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
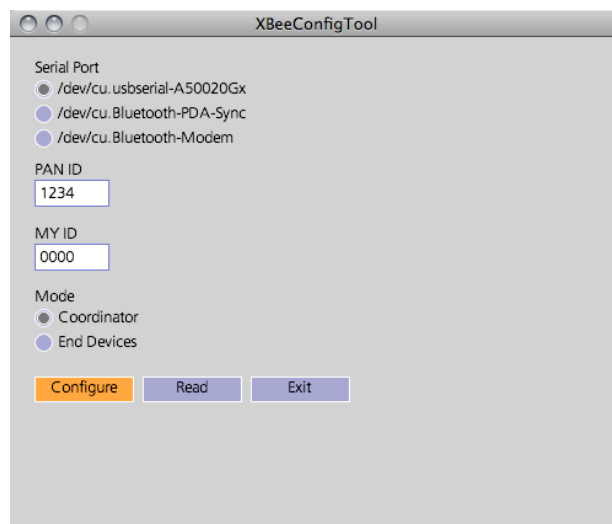
Figure 1   A typical screenshot of XBeeConfigTool

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.

[*17] 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 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 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 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 in the window. 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 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.
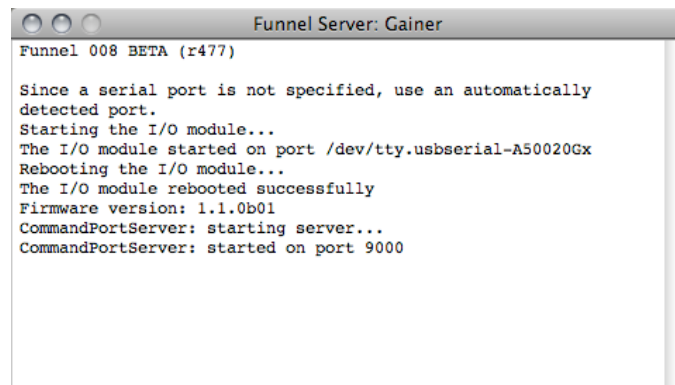
Figure 2　A typical screenshot when a Funnel Server connected to a Gainer I/O module launched

If you see messages as follows, please check the USB cable is connected to the PC, and the USB LED on the I/O module lights up.
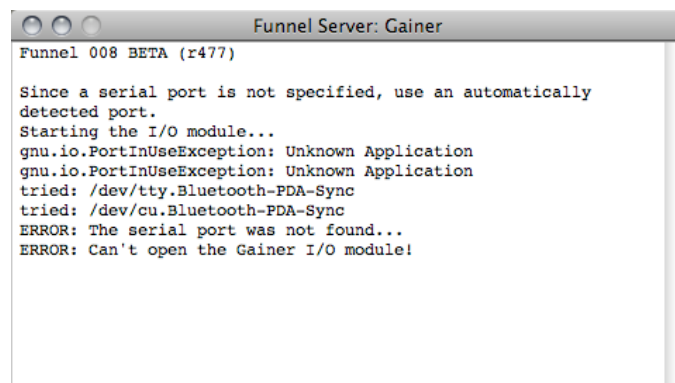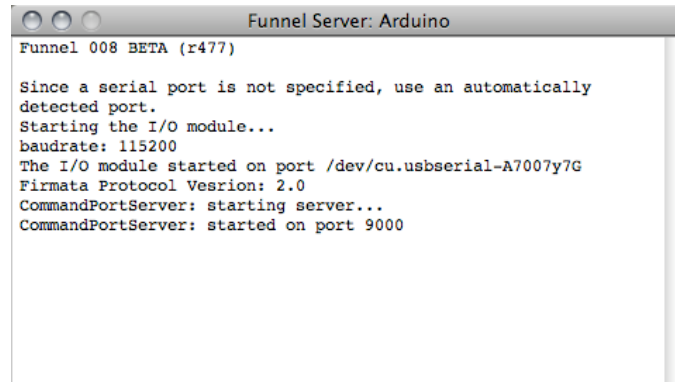
Figure 3　A typical screenshot when tried to launch a Funnel Server without connecting to a Gainer I/O module

5.4   Arduino I/O boards

If 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 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
- The appropriate type (i.e. Arduino) is specified
- An appropriate serial port (e.g. COM3) is specified (if needed)
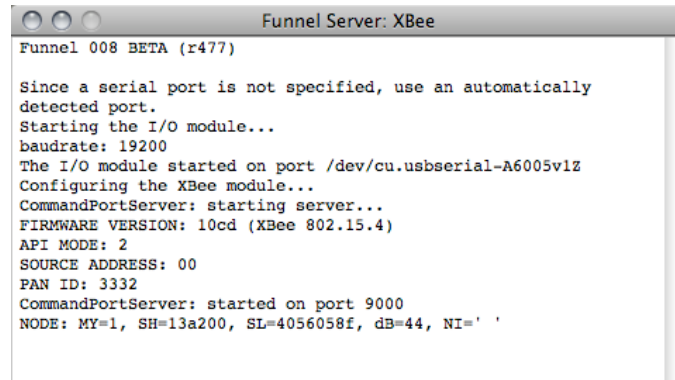- An appropriate baud rate (e.g. 115200) is specified

Figure 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 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.
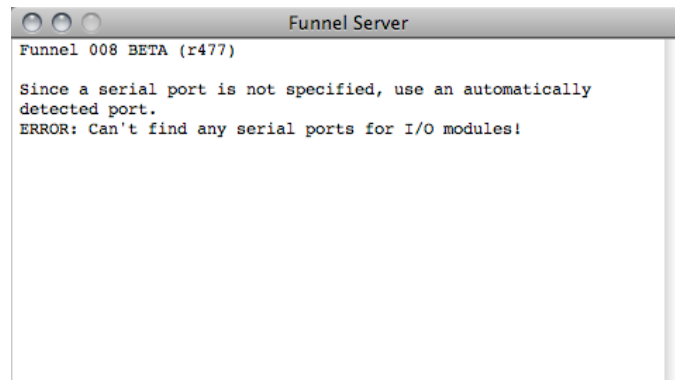
```
○ ○ ○                    Funnel Server: XBee
Funnel 008 BETA (r477)

Since a serial port is not specified, use an automatically
detected port.
Starting the I/O module...
baudrate: 19200
The I/O module started on port /dev/cu.usbserial-A6005v1Z
Configuring the XBee module...
CommandPortServer: starting server...
FIRMWARE VERSION: 10cd (XBee 802.15.4)
API MODE: 2
SOURCE ADDRESS: 00
PAN ID: 3332
CommandPortServer: started on port 9000
NODE: MY=1, SH=13a200, SL=4056058f, dB=44, NI=' '
```

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
- 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. 119200) is specified
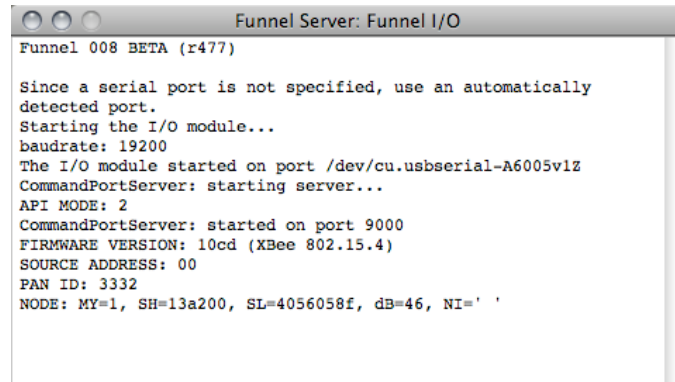
```
○ ○ ○                       Funnel Server
Funnel 008 BETA (r477)

Since a serial port is not specified, use an automatically
detected port.
ERROR: Can't find any serial ports for I/O modules!
```

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

5.6 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.
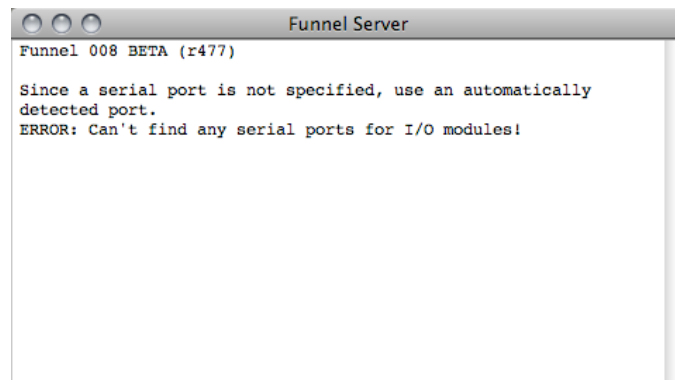

Figure 8   A typical screenshot when a Funnel Server connected to a FIO module launched

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
- 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 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. Copy `funnel_009/libraries/processing/library/` as `My Documents/Processing/libraries/funnel/library/` (on Windows) or `Documents/Processing/libraries/funnel/library/` (on Mac OS X).
2. Copy `libraries/processing/sketch_samples/` into the document 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 step.

6.2.2 Checking of operations

Click on the Open button, choose an example for your hardware 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 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.

6.3.2 Checking of operations

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

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