The Installation Instructions for v1.0

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1 Operating environment

- OS
  - Windows XP SP2/3, Vista or 7
  - Mac OS X 10.4, 10.5 or 10.6
- Software
  - Java Runtime Environment (J2SE 5.0 or above)
  - Flash Professional CS3/4/5, Flex Builder 3, Flash Builder 4 or Flex 3/4 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 board[*7] or clones like Boarduino
  - XBee 802.15.4 OEM[*8] or ZB ZigBee PRO[*9] RF modems
  - Arduino Fio[*10] or FIO board

2 Contents of a distribution package

- `examples/` Examples for Arduino and Processing
- `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's main file (compressed, for Windows and Mac OS X)
- `tools/` Tools such as XBeeConfigTool (for Windows and Mac OS X)

[*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://arduino.cc/en/Main/ArduinoBoardFio

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/7

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 0018 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/Examples/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 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 `tools`. Default settings are described in table 1. You have to upgrade the firmware to 1.0.C.D or later to use the output side.

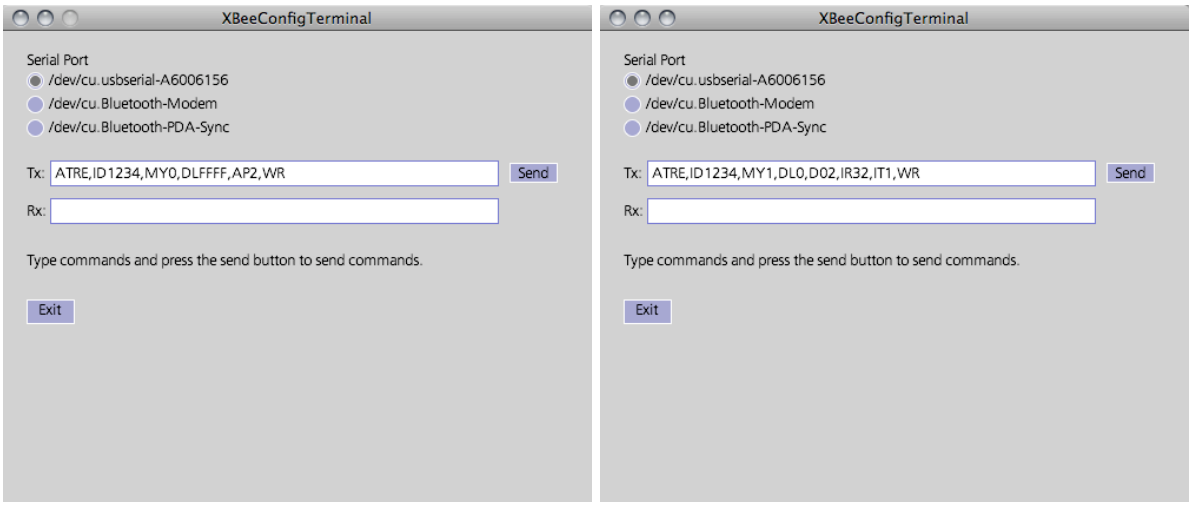

Figure 1 Screenshots of XBeeConfigTerminal: a coordinator side (left) and end devices side (right)

	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 Arduino Fio or FIO boards

FIO is an Arduino clone I/O board with an XBee module based on the LilyPad Arduino Main Board v1.6[*16]. Arduino Fio is based on FIO, and a member of Arduino boards. You have to configure the XBee modem to upload sketches wirelessly through the Arduino IDE. We strongly recommend that you to use the 802.15.4 series for simplicity and clarity.

4.4.1 How to configure XBee modems

On Windows and Mac OS X, XBeeConfigTool (available in `tools`) will be your friend. To use the tools you must:

1. choose a proper serial port
2. choose a proper mode (Programming radio or Arduino Fio radio)
3. choose a proper baud rate (57600bps for Arduino Fio boards, 19200bps for FIO boards)
4. set a proper PAN ID
5. set a proper MY ID (for end devices only)
6. press the Configure button to configure the XBee modem

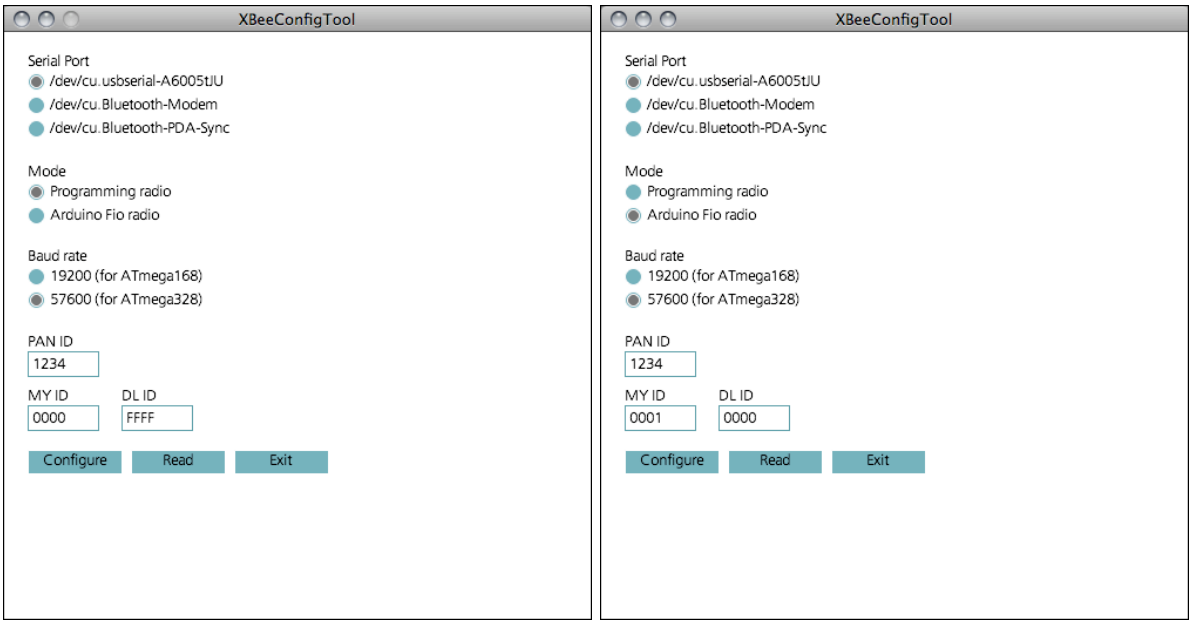

Figure 2 Screenshots of XBeeConfigTool: a programming radio side (left) and a Fio radio side (right)

On Windows, using X-CTU will be an alternative way to configure XBee modems. 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 programming radio, and `router.pro` to a board radio (i.e. XBee modems for Arduino Fio or FIO boards) using X-CTU. Please change parameters if needed.

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

	Coordinator	End devices	Remarks
ATRE	-	-	reset settings
ATBD	6 or 4	6 or 4	set baud rate for Arduino Fio boards (BD6: 57,600 bps) or FIO boards (BD4: 19,200)
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) w/ ATmega328' for Arduino Fio boards or 'Arduino Pro or Pro Mini (8MHz) w/ ATmega168' for FIO boards in Tools/Board menu
2. Choose an appropriate serial port in Tools/Serial Port menu
3. Open `StandardFirmataForFio` in `hardware/fio/firmware/`
4. Turn off and on the power switch of your Arduino Fio or FIO board, 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

6.2 Start-up

Double click on `Funnel Server` to launch Funnel Server. Then select a proper board type (e.g. 'Arduino (StandardFirmata)') in the left menu then select a proper sereial port in the right menu. 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.

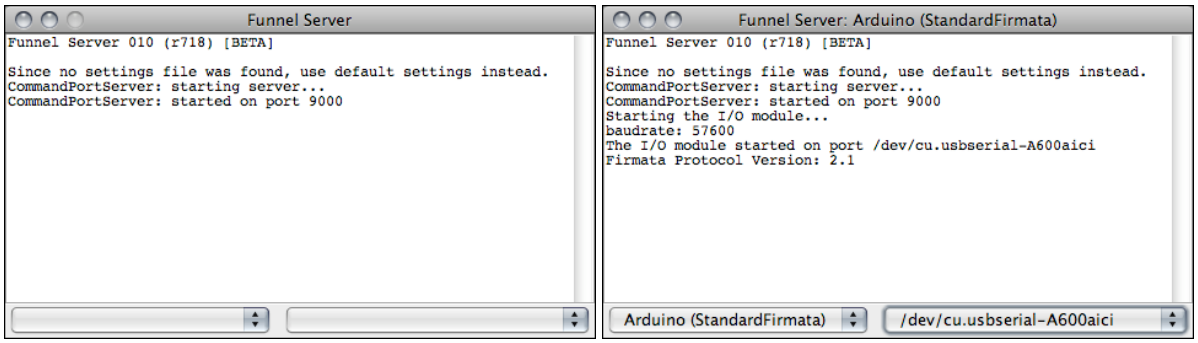

Figure 3 A typical screenshot of a first launch of a Funnel Server (left) and when connected to an Arduino board (right)

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)

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.