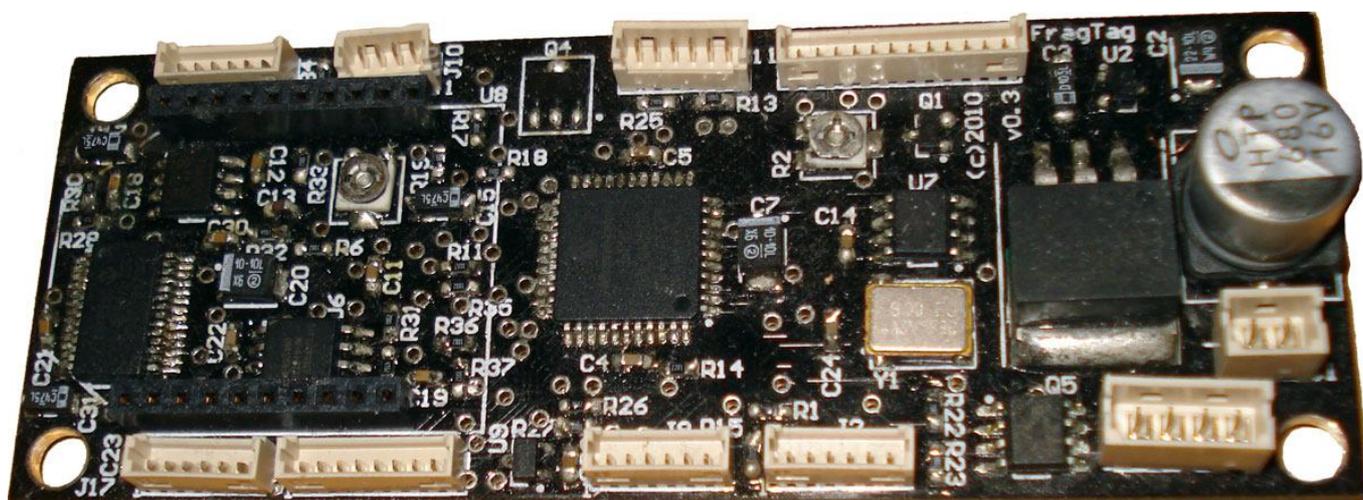




FragTag ProTag Users Manual

Version 1.4 FragTag 05-08-2013



FragTag Mainboard User Manual

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May 2013 Melbourne, Australia.

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Introduction

Welcome to FragTag©, a highly advanced, dual format commercial 'laser' tag combat simulation system that follows open standards. The FragTag ProTag system is a hardware and software package that uses state of the art electronics to receive, process and transmit low power infra red (IR) light signals tens to hundreds of meters. These signals carry coded data that details such things as the transmitting player identification and associated team membership among other things.

Mainboard Layout

Dimensions & Installation

ProTag Mainboard

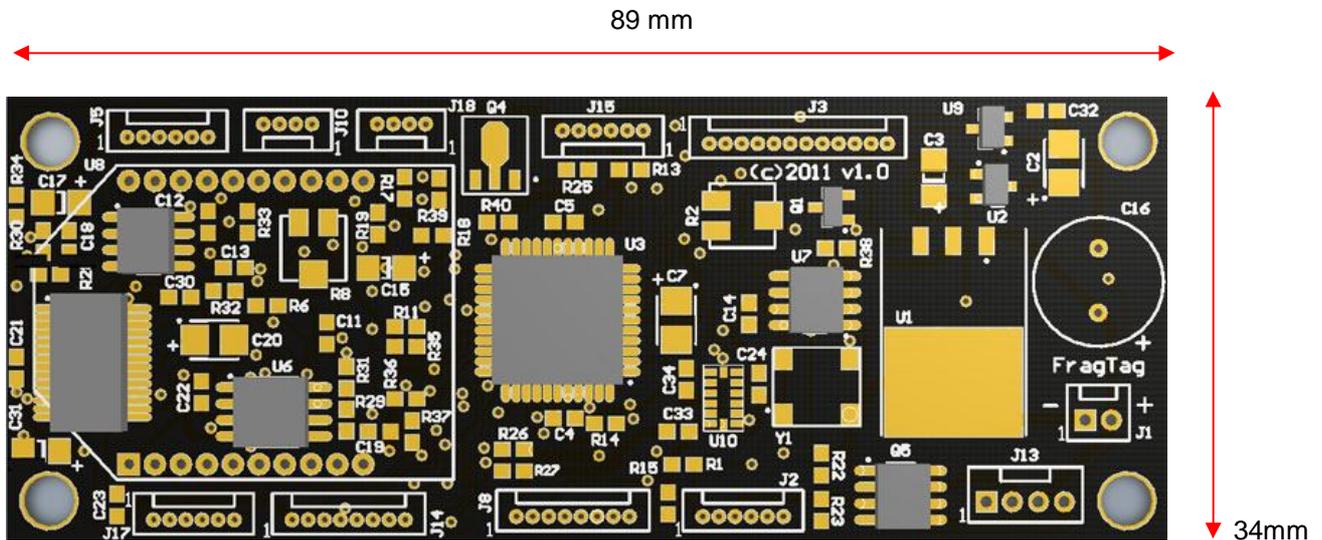


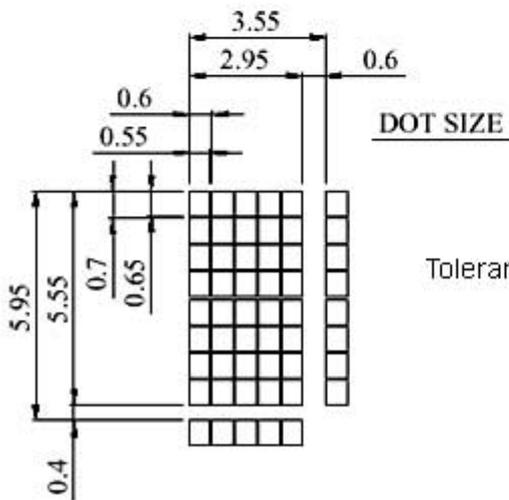
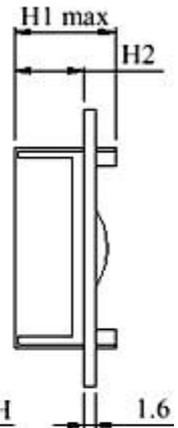
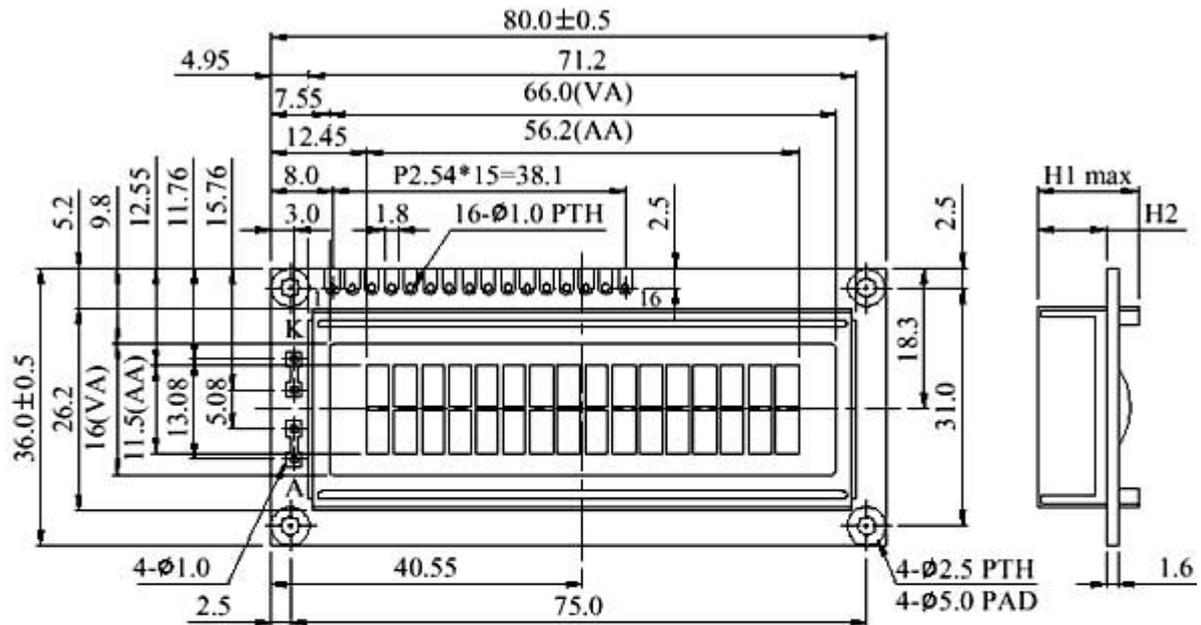
Figure 1. Mainboard dimensions (all dimensions in mm).

The mainboard requires approximately 15mm of vertical height, including room for the cables.

The mainboard is provided with 4 (M4) mounting holes. Insulating washers (i.e. not electrically conductive) must be used on both surfaces of the mounting holes to prevent the mainboard from shorting to any conductive surface inside the tag gun casing. Care must also be taken not to over tighten mounting screws to prevent damage to the mainboard. Failure to follow these instructions will void the limited warranty.

LCD Display

Dimensions (Millimeters)



DOT SIZE

LED B/L	
H1	12.1
H2	7.5

Tolerance is ± 0.3 mm unless specified.

Hardware Installation and Configuration

Volume Control

The volume can be set by adjusting this trimpot. It is recommended that the volume be adjusted to prevent distortion at the speaker. The actual level will be determined by the specifics of the speaker that is connected.

If a Radio module is fitted, it will be necessary to remove the module to access the volume control. To do this, grasp the module at either end, and carefully lift it vertically. Once the adjustment is complete, replace the Radio module by lining up the pins and carefully pushing it down vertically. Ensure that the Radio module pins do not get bent, and that the Radio module is correctly oriented (refer to overlay marking on PCB; the angled side is positioned towards the closest edge of the board.)

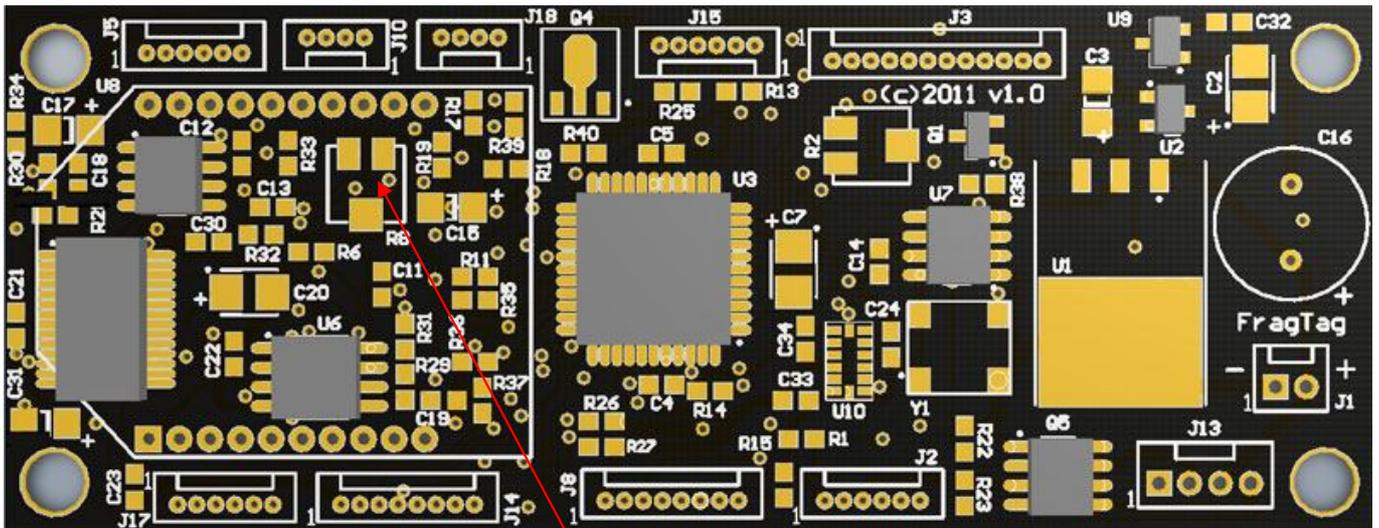


Figure 2. Volume Control Trimpot

LCD Contrast Adjustment

The contrast of the LCD display may be set by adjusting this trimpot. This adjustment will be set during manufacturing, but may be adjusted to suit the particular LCD model being used.

If necessary, this control can be adjusted to control how dark the LCD display text is. If it is set too high, the display will appear totally black. If set too low, the display will be totally invisible. Adjust it such that the text is clearly visible.

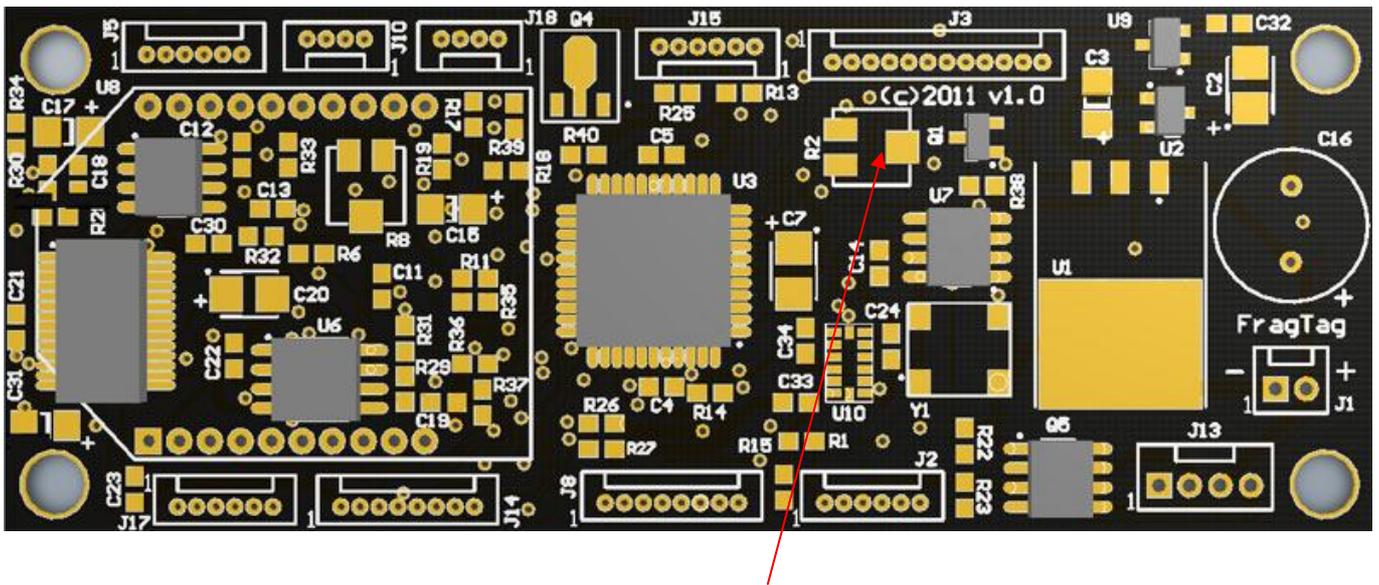


Figure 3. LCD Contrast Control

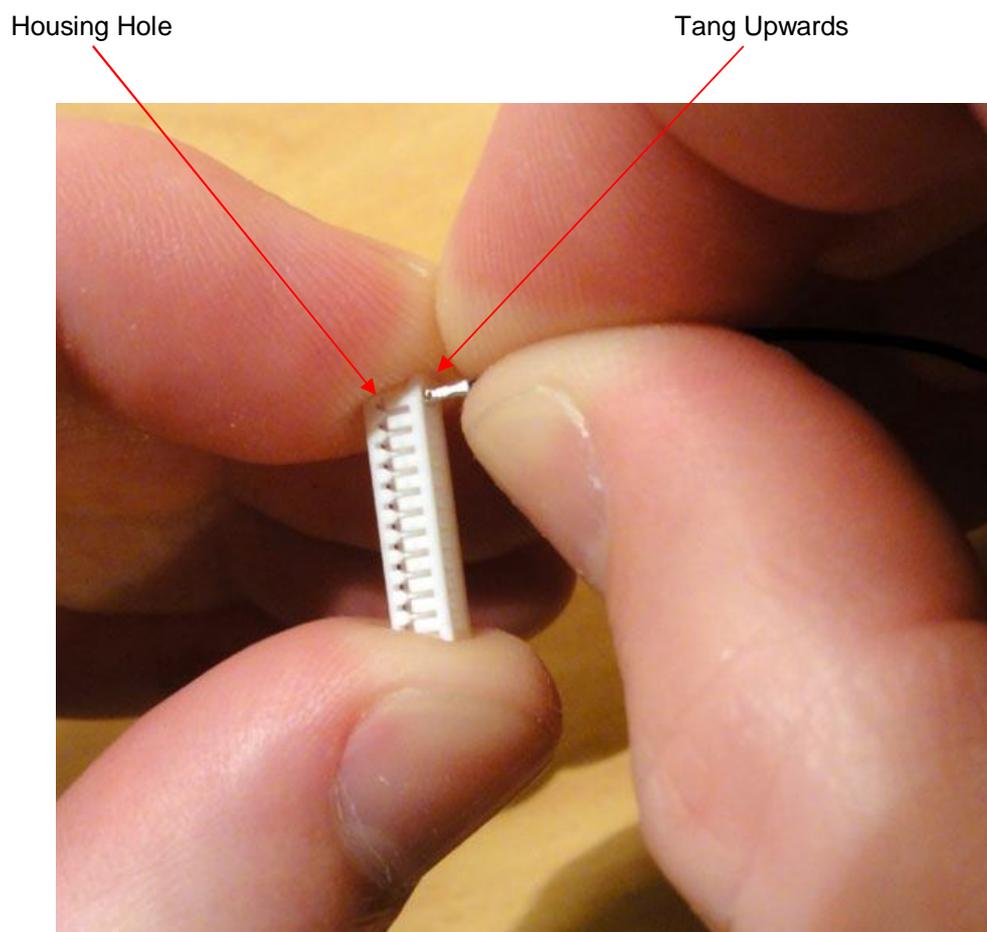
Cable Set Assembly

The connectors used on the mainboard utilise a system with a housing and crimped wires.

It is necessary to insert the crimped wires into the housings, in order to build the cable sets needed to allow the system to be wired.

The crimps have a small metal tang, and must be inserted into the housing with the tang facing towards the hole in the housing.

Refer to the following photos.



J1 – Power Connector

J1 requires a 2-way polarised and locking header socket. The FragTag mainboard requires a battery source of between 6 and 12 volts (7.2v recommended) and is connected here to J1.

Pin	Function
1	Negative
2	Positive

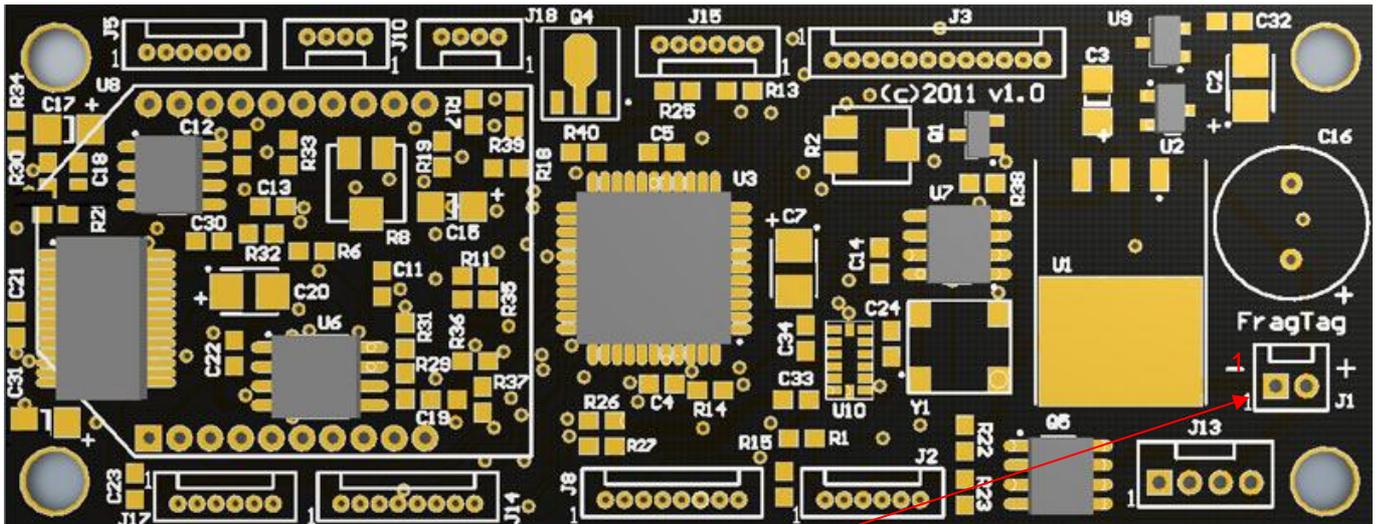


Figure 4. J1 - Power Connector

Warning! Connecting the power wires backwards (battery negative to positive, and battery positive to negative) may cause permanent damage to the board. This damage will not be covered under warranty. Check **very carefully** before applying power.

We recommend the use of a 7.2v rechargeable NiMh battery pack commonly used in radio controlled cars (refer Figure 5). We suggest obtaining a battery pack with a capacity of at least 3000 mAh. This will allow for approximately 12 – 15 hours of game play.



Figure 5. Suggested Battery supply. A typical RC model car 'racing pack'

It is suggested that a keyswitch be mounted in the tagger to turn off the power supply to the mainboard and a DC jack port be installed for charging the batteries without having to remove them from your tagger casing. We provide a schematic for your reference of the suggested power sub-circuit.

This recommended configuration ensures that the charging jack does not have power on it when the gun is switched on, so that players cannot cheat by shorting out the charging jack and resetting the system. It also protects the PCB from voltages produced by the charger.

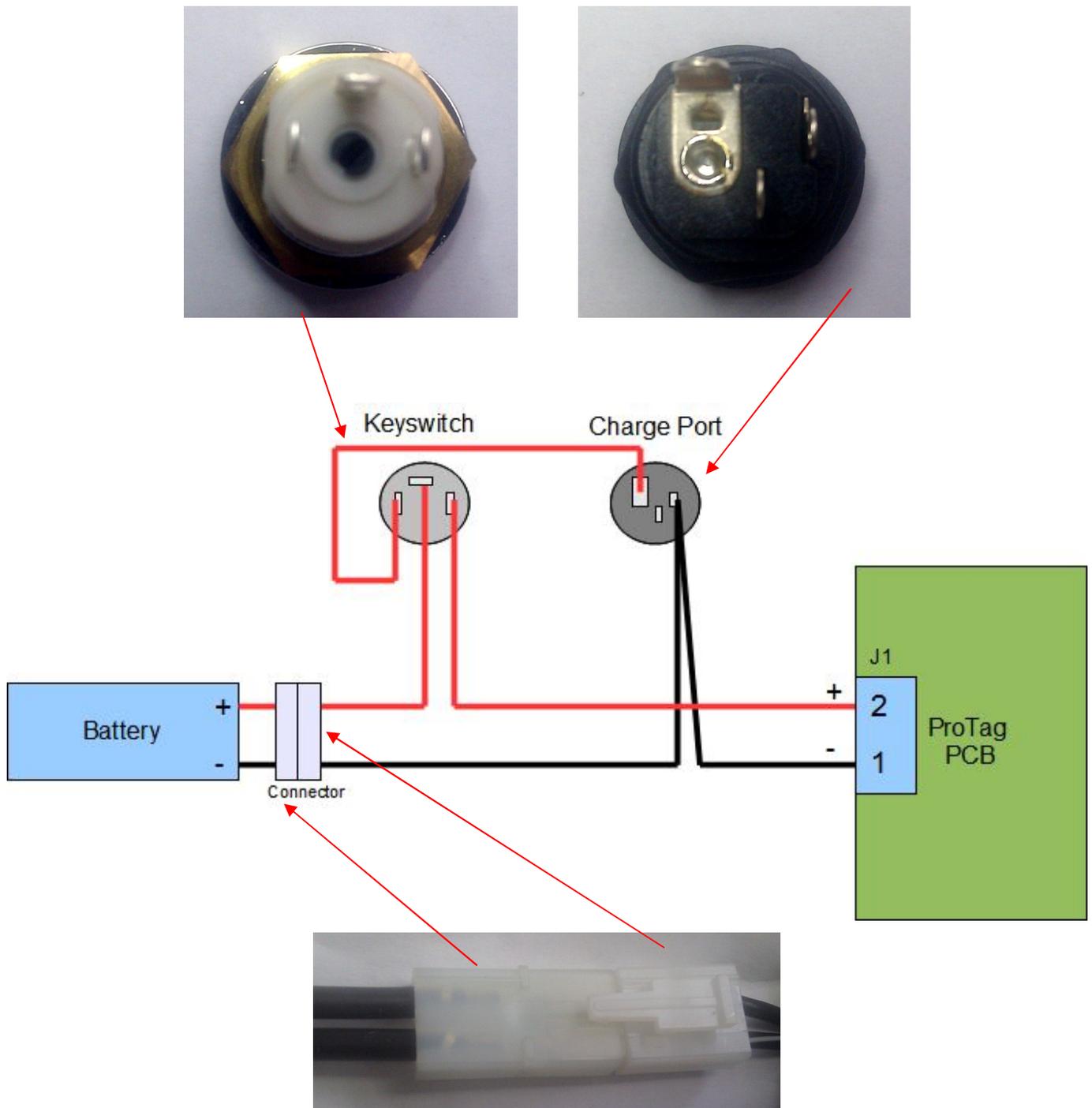


Figure 6. Suggested Power sub-circuit.

J14 – Controls Connector

J14 requires a 8-way polarised and locking header socket. J14 is the connection for all the controls of the gun. The FragTag ProTag system supports up to 6 switches. The buttons for Primary fire (Trigger), Primary Reload and Fire Mode also operate other functions (as described later under software operation). However, if secondary fire is not required then button for this function is optional (not required for system functions). All switches for these controls need to be momentary action, normally open switches (e.g. common momentary action pushbutton switches).

The switches need to connect the relevant pin to Ground when pressed.

The pinouts for J14 are:

Pin	Function
1	Ground
2	Primary Fire button
3	Secondary Fire button
4	Primary Reload button
5	Primary Fire Mode button
6	Expansion
7	Weapon Special Output
8	Ground

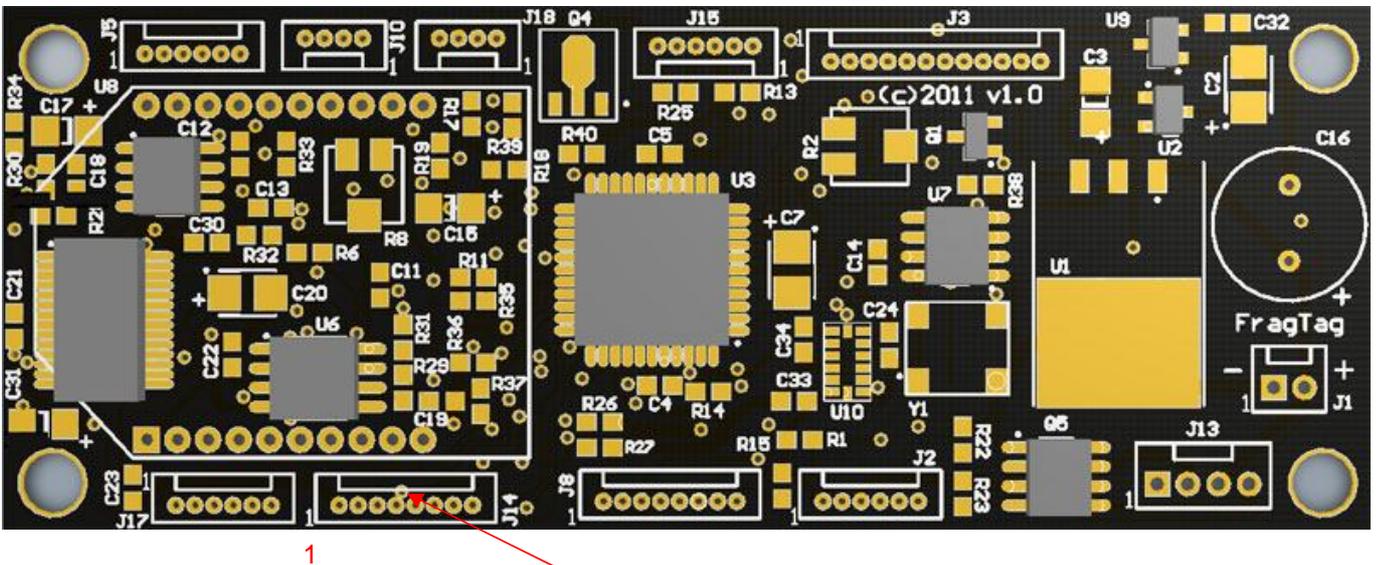


Figure 7. J14 Controls Connector

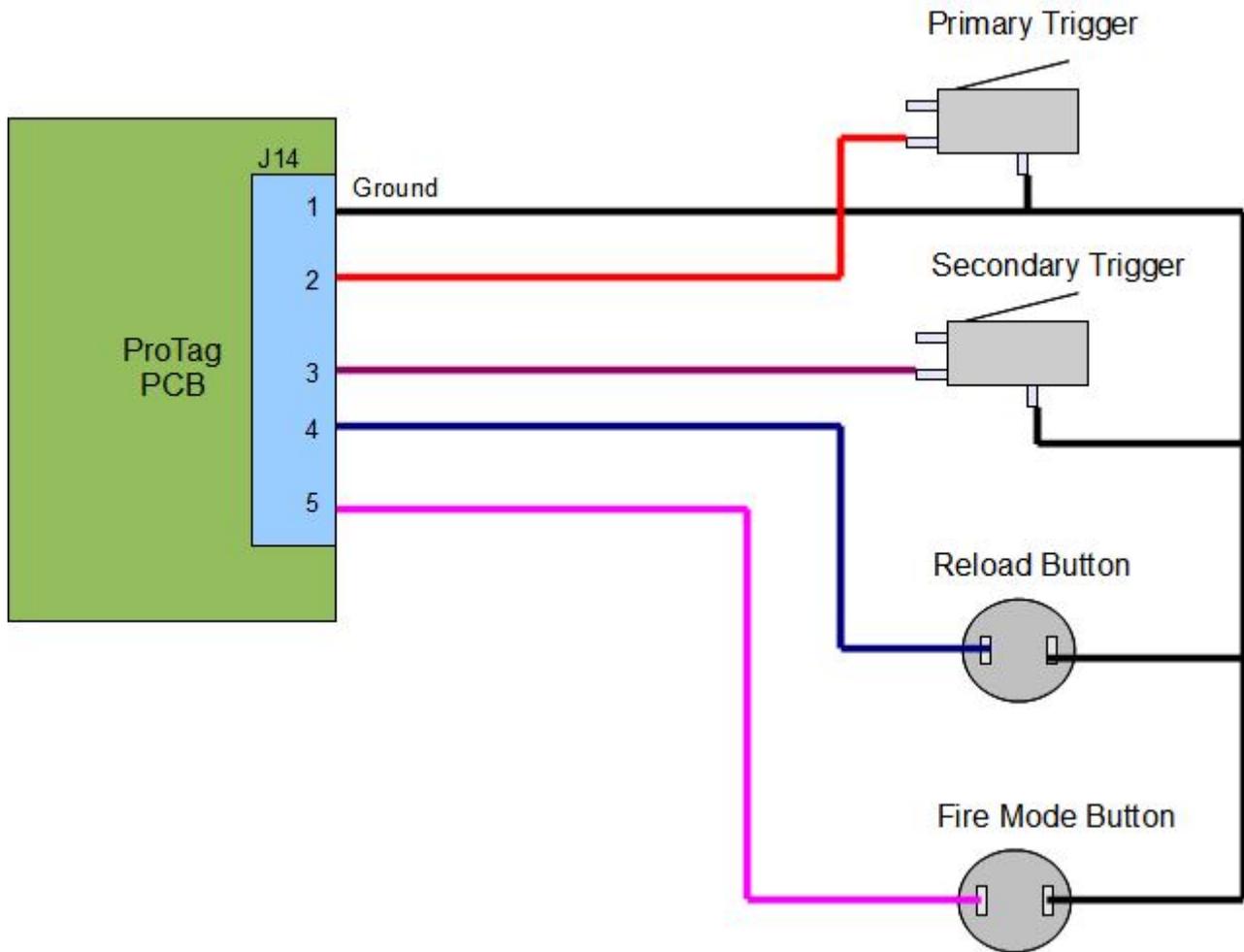


Figure 8. Suggested Button Wiring (colours for illustrative purpose only)

Weapon Special Output

The Weapon Special Output can be configured in the menus for various functions. Refer to the software section for details.

Critical Note: this output provides for a **low current output** only. Do not draw more than 20 mA from this output. Failure to observe this limit may cause permanent damage to the circuitry and will not be covered under warranty.

J13 IR Output Connector

J13 requires a 4-way polarised and locking header socket. J13 is the connection for the LED outputs for the primary fire and secondary fire (if supported) as well as any muzzle flash LED (optional).

* **NOTE** * All LED's require a load resistor to be connected in series with the respective LED. Load resistors are not installed on the mainboard. The pinouts for J13 are:

Pin	Function
1	Primary Fire Output LED +ve
2	Primary Fire Output LED -ve
3	Secondary Fire Output +ve
4	Secondary Fire Output -ve

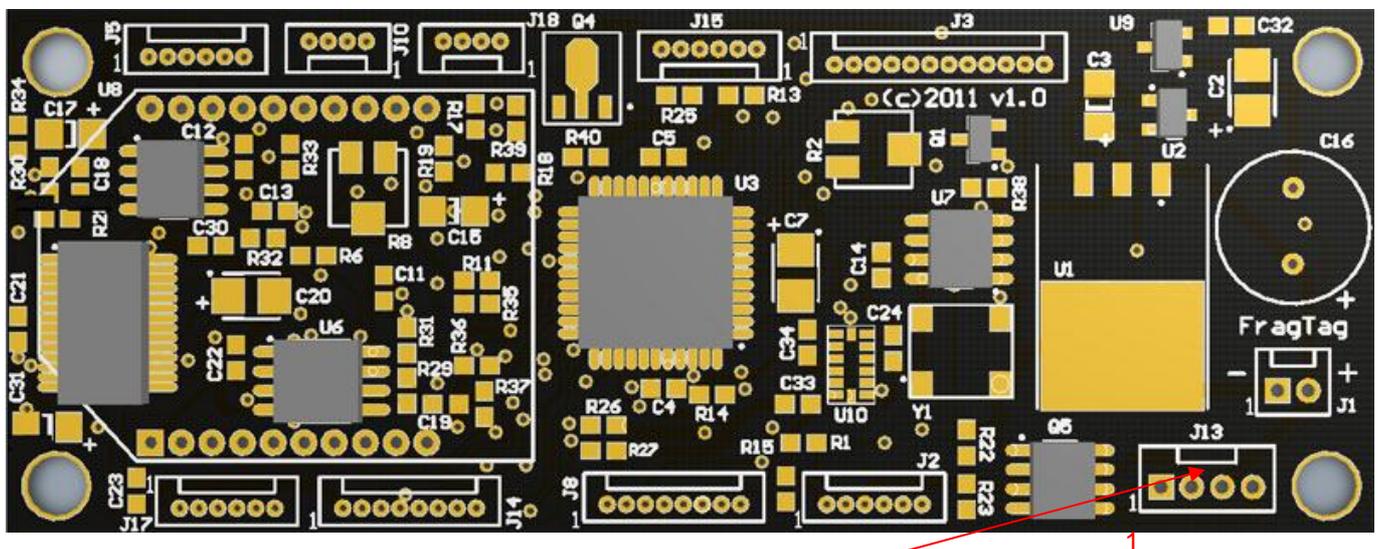


Figure 9. J13 Output Connector

The suggested IR LED to be used with the FragTag Mainboard is the TSAL6100. **External resistors must be used to limit the current through the LED to prevent overdriving and damaging it.** Muzzle flash LED's can be simply connected in parallel to the respective IR LED.

Note that muzzle flash LEDs also require a load resistor to be connected in series with the LED.

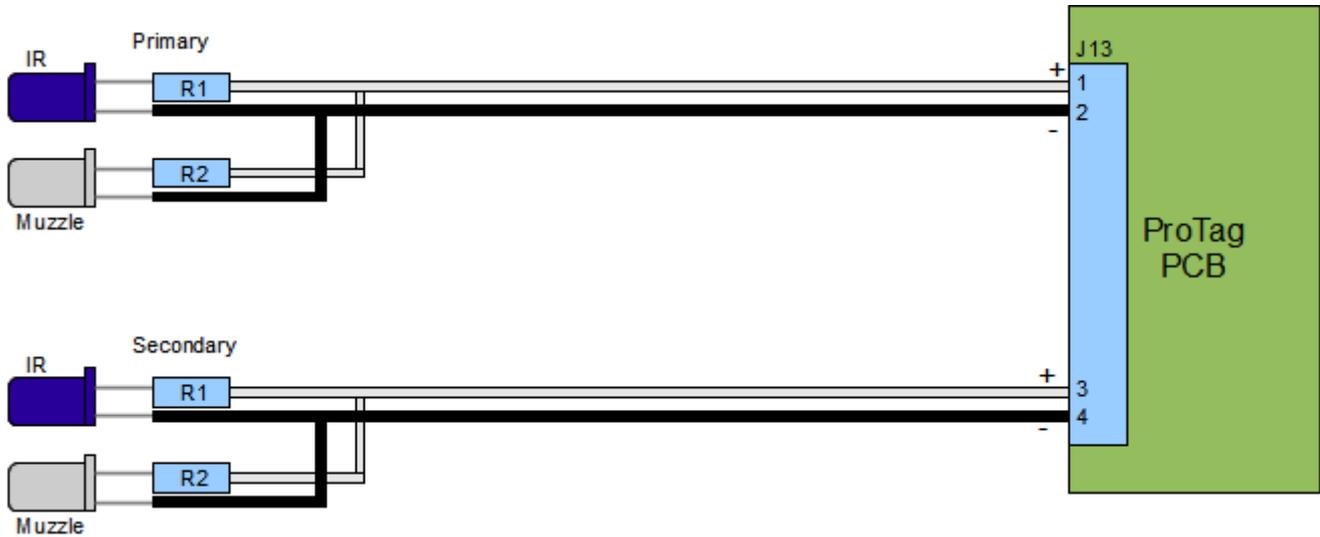


Figure 10. Suggested LED Wiring

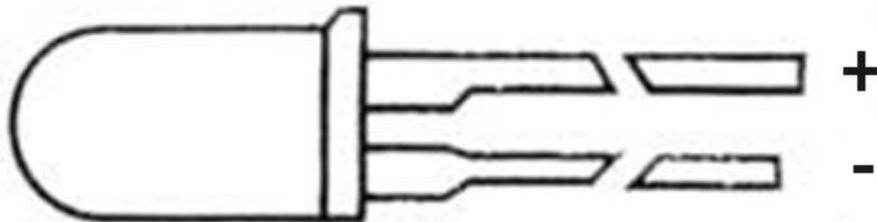


Figure 11. Muzzle Flash LED (clear) and Infrared LED (purple/blue)

Fire Rate (rounds per minute)	Suggested IR LED resistor value
Sniper, single shot	2.2 ohm
Less than 370	3.3 ohm
370 to 450	4.7 ohm
Above 450	6.8 ohm

The recommended value for R2 Muzzle Flash LED resistor, to suit our standard LED, is 43 ohms. Other LEDs may require a different value.

Notes about the Alternating Fire Special Config

** Note ** the following information only applies to mainboard software configurations in which the Alternating Fire option is enabled.

The dual outputs of the FragTag mainboard can be used together instead of in a primary/ secondary type arrangement. If the alternating fire config is used, the secondary outputs are connected to a second IR LED output (double barrel type.)

J10 Sensor Connector

J10 requires a 4-way polarised and locking header socket. J10 is the connection point for the IR sensors and optional hit-LEDs. The board can support a number of sensors (connected in parallel). The minimum required is 1, but 2 is recommended (1 front and 1 back). The pinouts for J10 are:

Pin	Function
1	Hit Led +5v
2	Data
3	GND (Vss)
4	+5v (Vdd)

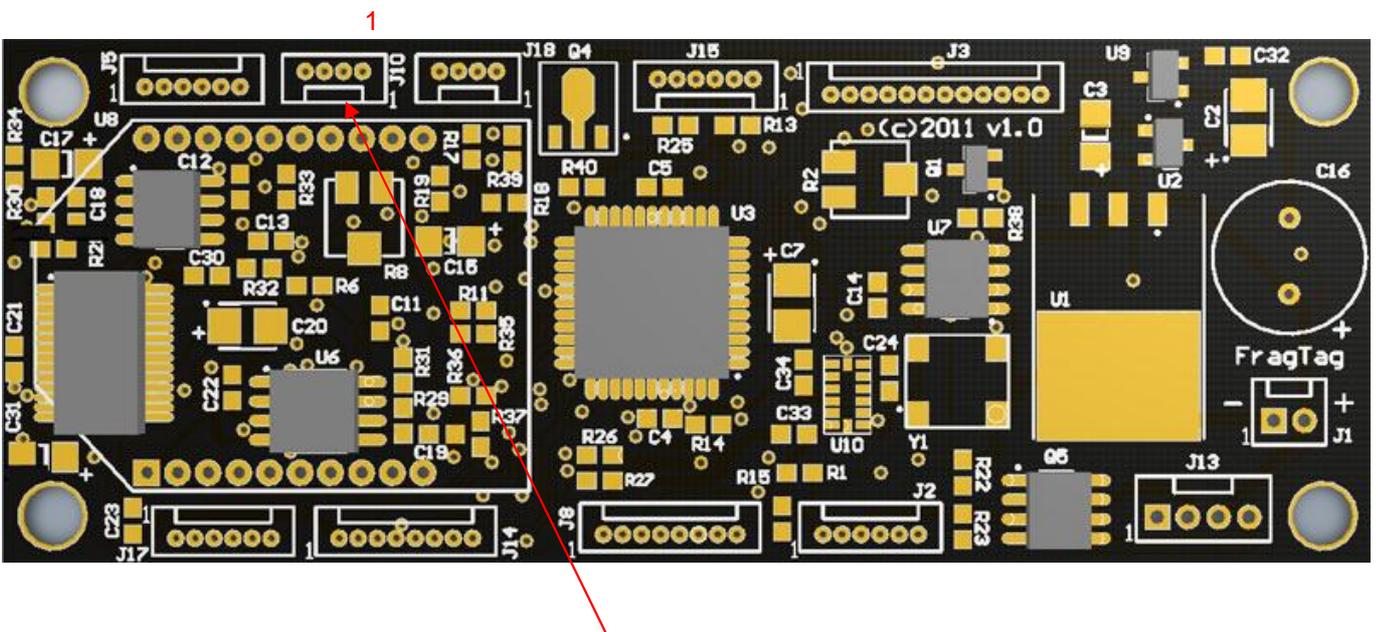


Figure 12. J10 Sensor Connector

The FragTag Mainboard requires TSOP sensors to be connected at J10 for proper function of the system. Sensor cable failure (unplugged or broken wire) is sensed by the system and an audible alarm is sounded until either power is disconnected from the mainboard or a sensor is reconnected. A FragTag Sensor is recommended.

Typically this connector is wired to an RJ11 pigtail connector, suitable for plugging in a standard FragTag sensor. Note that the wiring order depends on which model of FragTag sensor is fitted. Refer to the following diagrams.

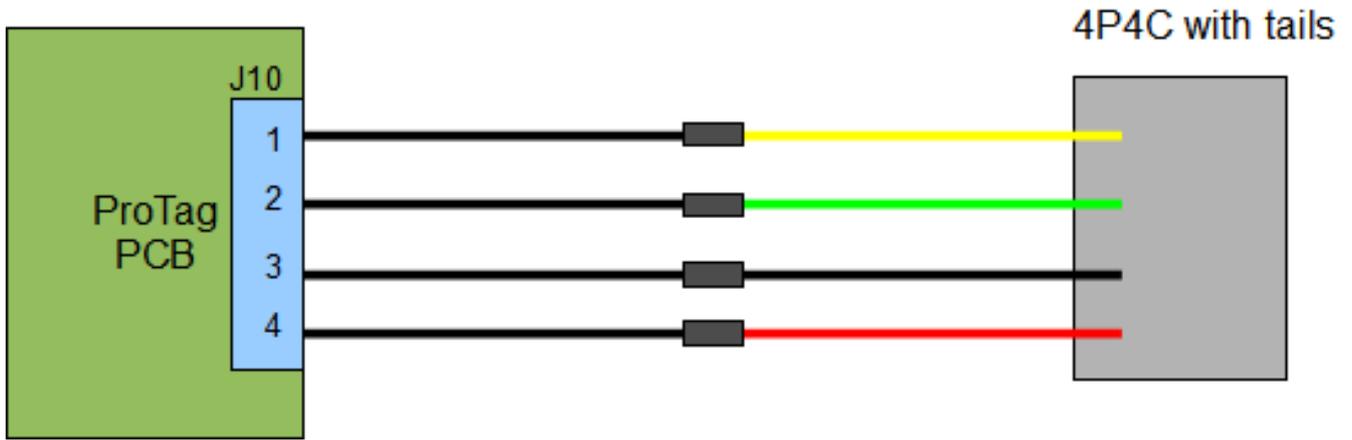


Figure 13. Sensor Wiring for FragTag Kit Sensor and Helios fitted with 6 core cable

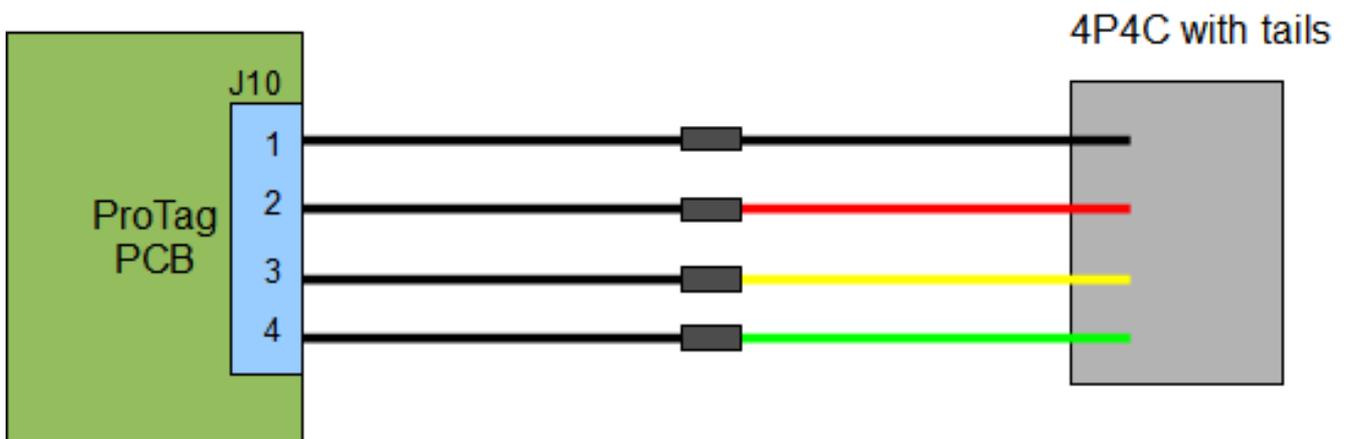


Figure 14. Sensor Wiring for FragTag Helios Sensor fitted with 4 core cable

J3 LCD Connector

J3 require a 12-way polarised and locking header socket. The FragTag ProTag system requires a 16x2 character LCD for displaying system messages. The LCD needs to be connected to the mainboard at J3. Most LCD displays follow a 16-pin convention. As the FragTag mainboard uses the 4-bit data transmission protocol for communicating with the LCD display, only 12 of the 16 pins are required. J3 pin outs are:

Pin	Function
1	Backlight Gnd
2	Backlight +5v
3	Data Bit 7
4	Data Bit 6
5	Data Bit 5
6	Data Bit 4
7	Enable signal
8	Read/Write
9	Register select
10	Contrast Adjust
11	Vcc (+5v)
12	Ground

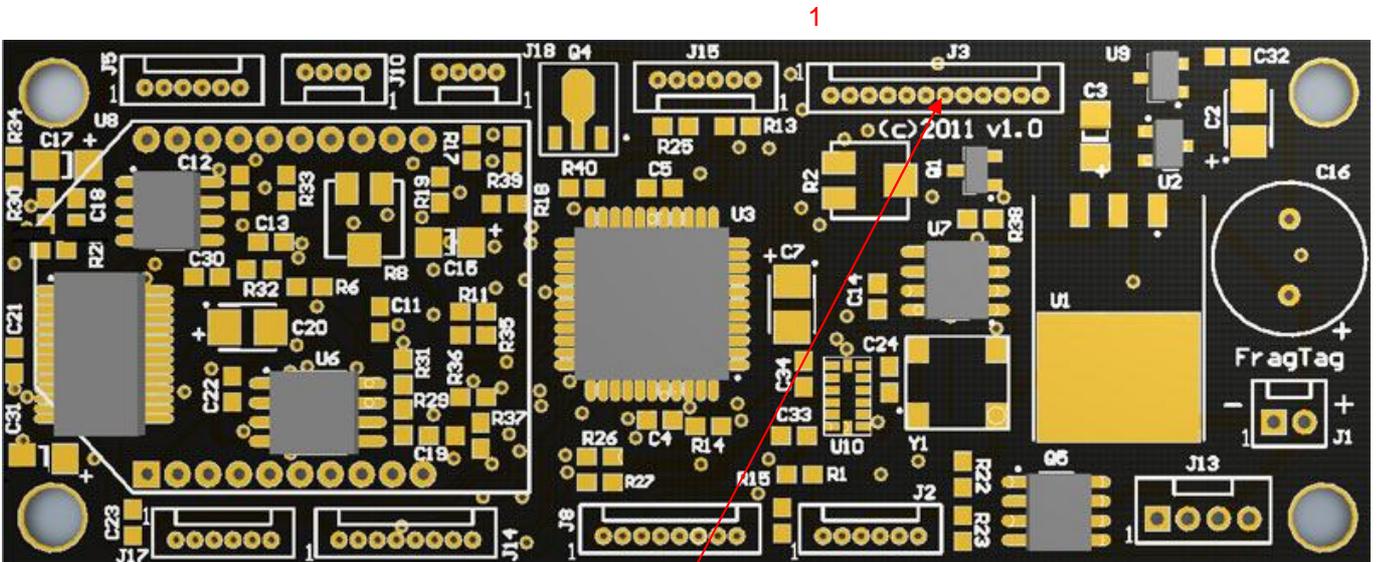


Figure 15. J3 LCD Connector

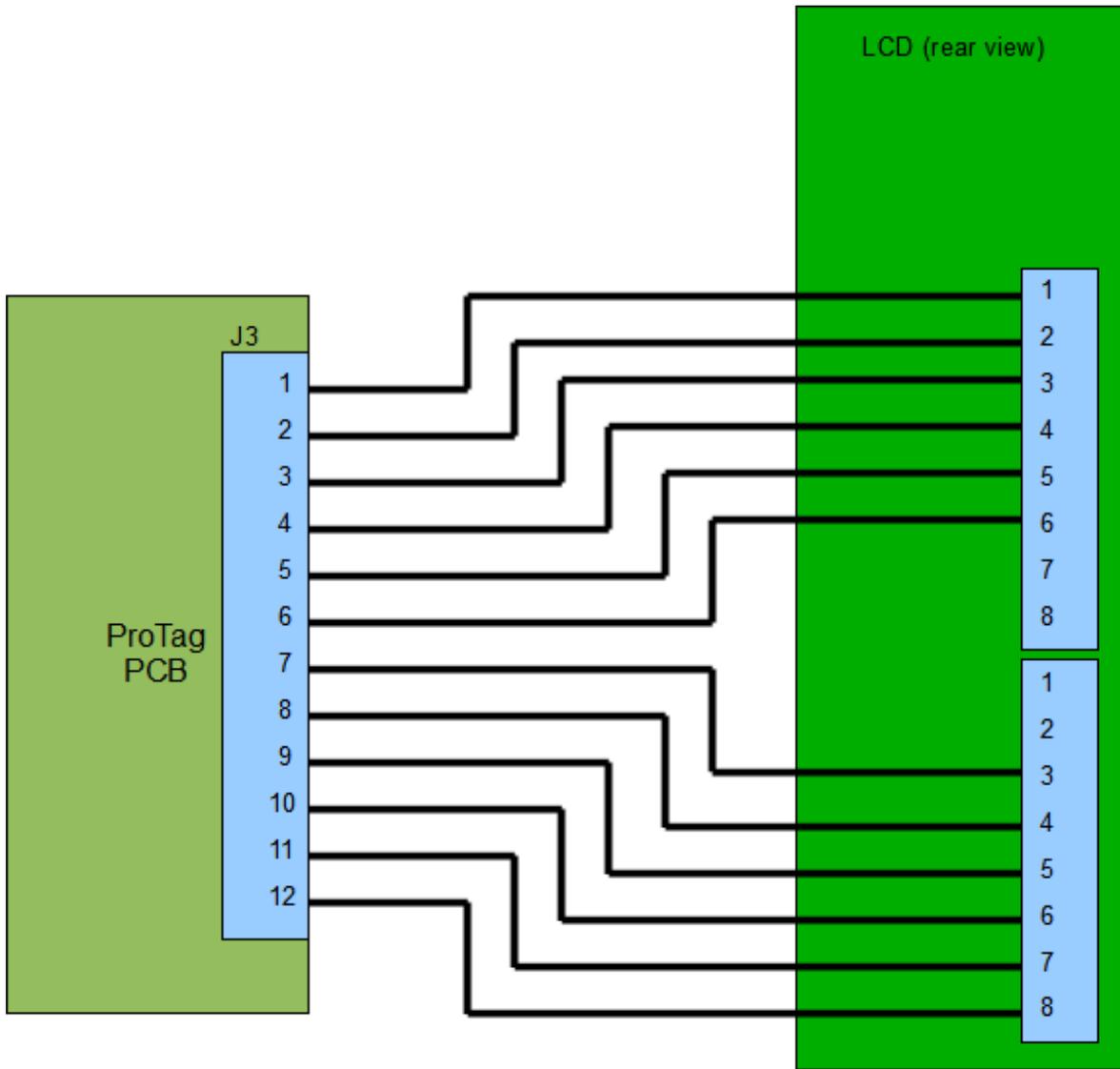


Figure 16. LCD Wiring

Provided below is a table of the LCD pinouts and corresponding mainboard connections for reference. Please note Each LCD module may not necessarily follow this convention and the documentation for your particular model should be consulted first.

Table 1. Common LCD pinouts & Corresponding Connections

LCD Pin*	Mainboard Pin	Function	LCD Pin*	Mainboard Pin	Function
1	J3-12	GND	9	Not Connected	
2	J3-11	VCC(+5V)	10	Not Connected	
3	J3-10	Contrast ADJ	11	J3-6	Data Bit 4
4	J3-9	Register Select	12	J3-5	Data Bit 5
5	J3-8	Read/Write	13	J3-4	Data Bit 6
6	J3-7	Enable Signal	14	J3-3	Data Bit 7
7	Not Connected		15	J3-2	Backlight +5v
8	Not Connected		16	J3-1	Backlight GND

* LCD pinouts listed are what is most common on a 16x2 LCD display; however check pinouts on your LCD to verify this first.

Pin outs of supplied LCD display:

Pin No.	Symbol	Level	Description
1	V _{SS}	0V	Ground
2	V _{DD}	5.0V (3V)	Supply Voltage for logic (3V option)
3	VO	(Variable)	Operating voltage for LCD
4	RS	H/L	H: DATA, L: Instruction code
5	R/W	H/L	H: Read(MPU→Module) L: Write(MPU→Module)
6	E	H,H→L	Chip enable signal
7	DB0	H/L	Data bit 0
8	DB1	H/L	Data bit 1
9	DB2	H/L	Data bit 2
10	DB3	H/L	Data bit 3
11	DB4	H/L	Data bit 4
12	DB5	H/L	Data bit 5
13	DB6	H/L	Data bit 6
14	DB7	H/L	Data bit 7
15	A		LED +
16	K		LED -

J5 Audio Connector

J5 requires a 6-way polarised and locking header socket. J5 is the connection point for a speaker, optional external amplifier, and audio programming. 4 or 8 ohm speakers can be used. Do not use a Speaker of less than 4 ohms.

It may be necessary to adjust the volume control, for the particular speaker to prevent distortion, or to suit your preference.

The pinouts for J5 are:

Pin	Function
1	Speaker +
2	Speaker – (note: this is not the same as Ground! This pin must not be grounded.)
3	Pre-amplifier output +
4	Pre-amplifier output Ground and Programming Ground
5	Audio Programming
6	Audio Programming

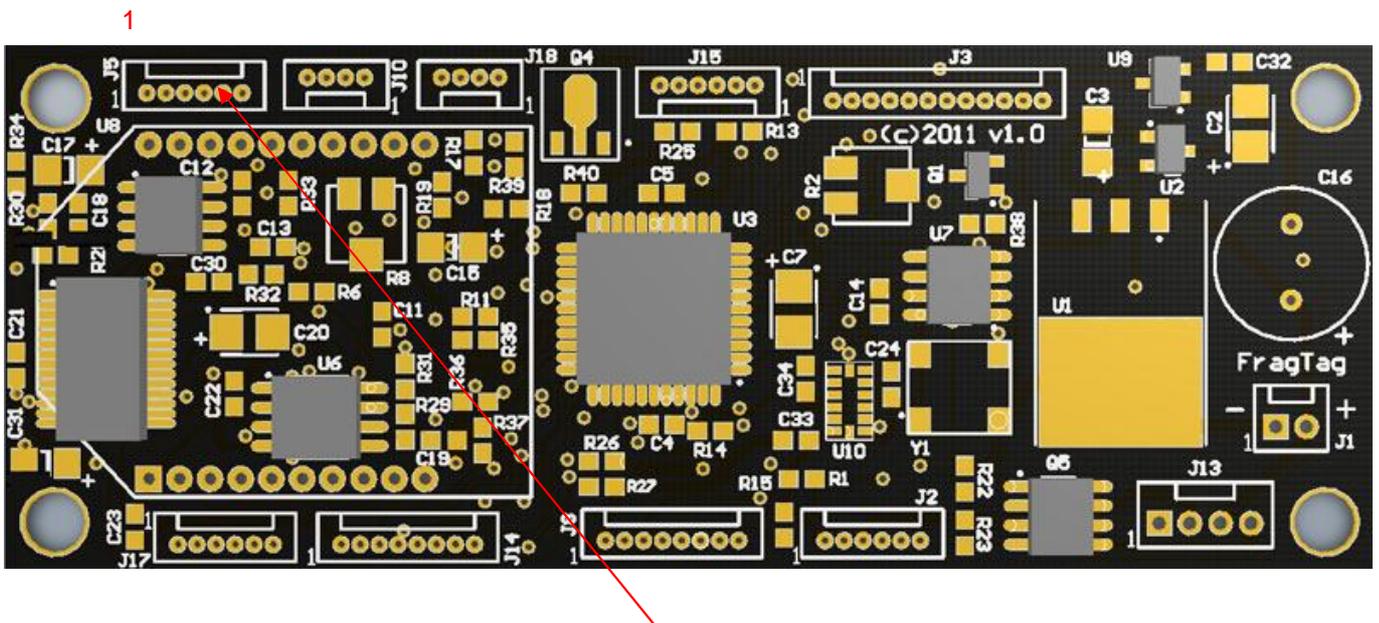


Figure 17. J5 Audio Connector

The pre-amplifier + and pre-amplifier ground pins may be used to connect an external amplifier. In this case, the onboard volume trimpot will not be functional and an external volume control must be used.

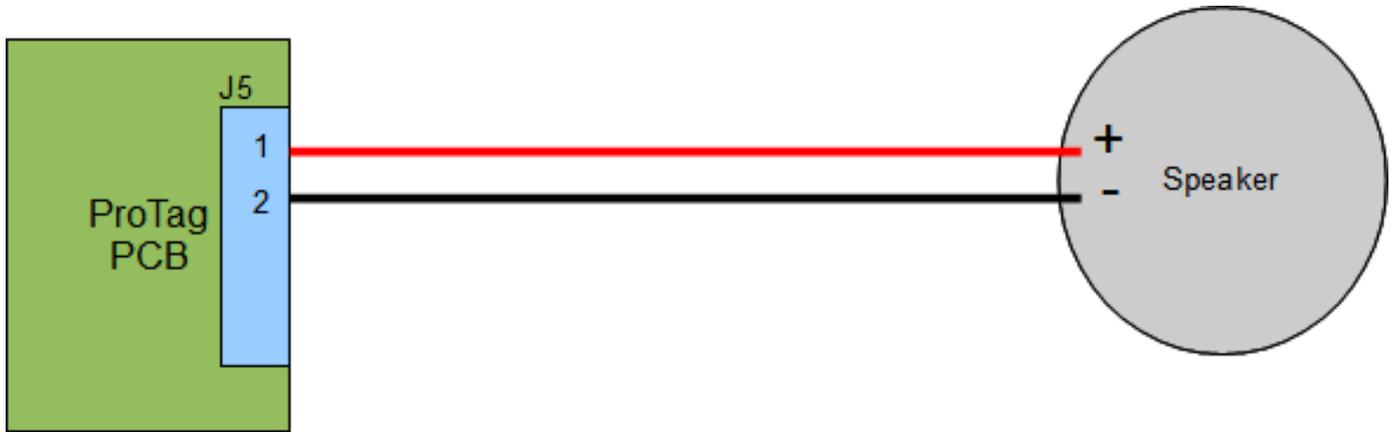


Figure 18. Speaker Wiring

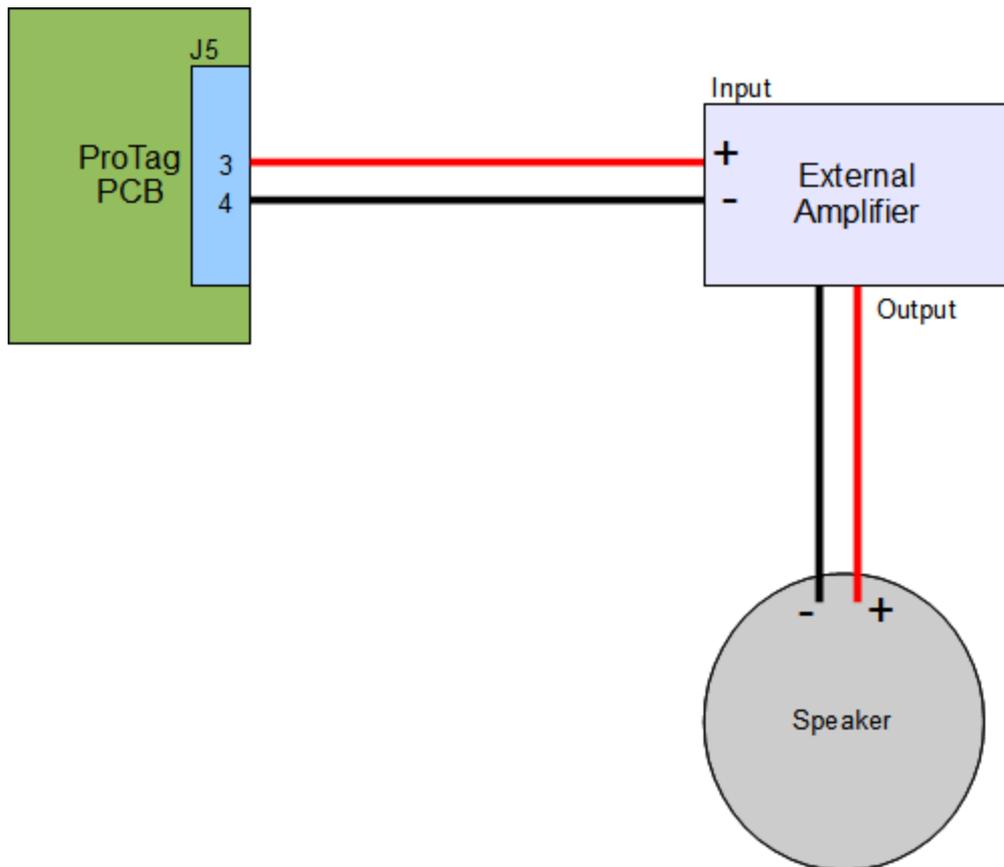


Figure 19. External Amplifier Wiring (Optional)

Audio Programming

The programming lines of J5 are used for programming Audio data digitally into the Sound processor, using our FragScore PC software. These lines can be wired to a 3.5mm audio socket and then connected to a USB port using a standard FragTag USB serial adaptor.

It is not necessary to fit this socket to a Tag gun. It is recommended to connect the cable when needed, and disconnect when not needed.



Figure 20. Typical 3.5mm stereo audio socket

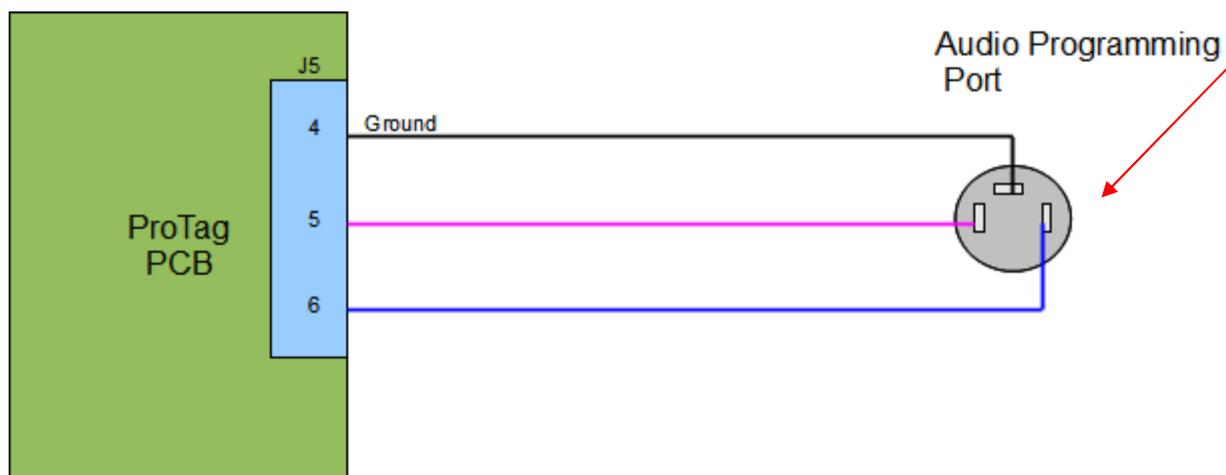


Figure 21. Audio Programming Connector Pinouts

J8 Expansion Connector

J8 requires a 8-way polarised and locking header socket. The FragTag ProTag system can be further expanded through the expansion connection to support future uses and as a low power connection point for gun accessories like Red Dot scopes and Illuminated Zoom Scopes.

All these optional accessories are connected to the mainboard at J8. The pinouts for J8 are:

Pin	Function
1	Ground
2	Reserved for expansion
3	Serial data
4	Serial clock
5	+5 v
6	Battery voltage
7	Reserved for expansion
8	Reserved for expansion

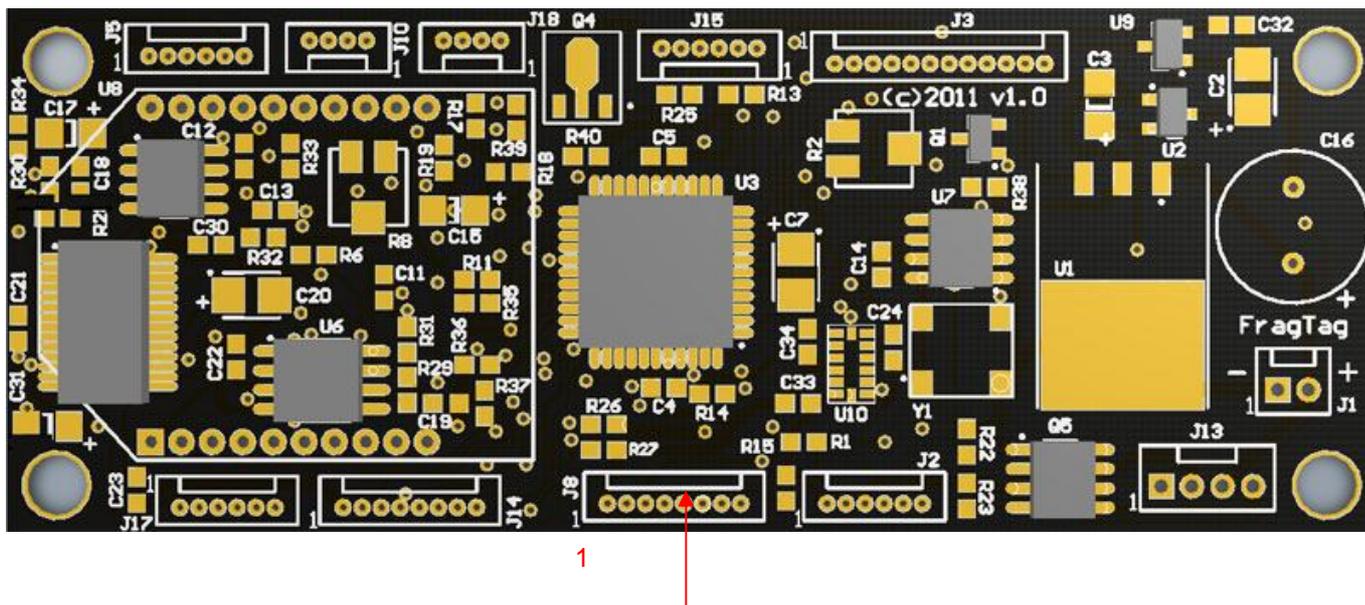


Figure 22. J8 Expansion Connector

J15 Communications Connector

J15 requires a 6-way polarised and locking header socket. The FragTag ProTag system can be connected to our Odin Master Controller, and also connected to a iButton port for supporting accessories.

These are connected to the board at J15. The pinouts for J15 are:

Pin	Function
1	Odin Clock
2	Odin Data
3	Ground
4	+5v
5	iButton +
6	iButton Ground

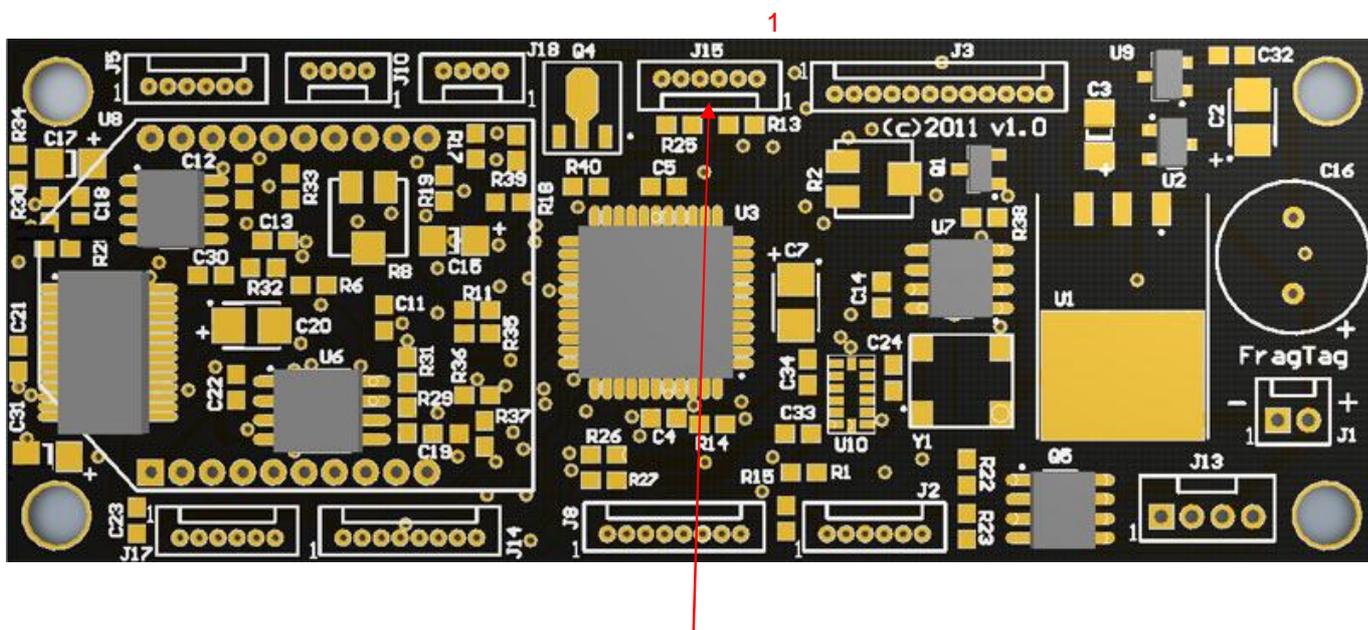


Figure 23. J15 Communications Connector

Odin Master Controller Connections

If the optional Odin Master Controller is also being used with the Mainboard (for Odin data uploading), a 3.5mm stereo audio socket is required to be mounted on the gun.

This port is also used for Firmware updates.



Figure 24. Typical 3.5mm stereo audio socket

This socket will need to be connected to pins 1, 2 and 3 of J15 as shown below.

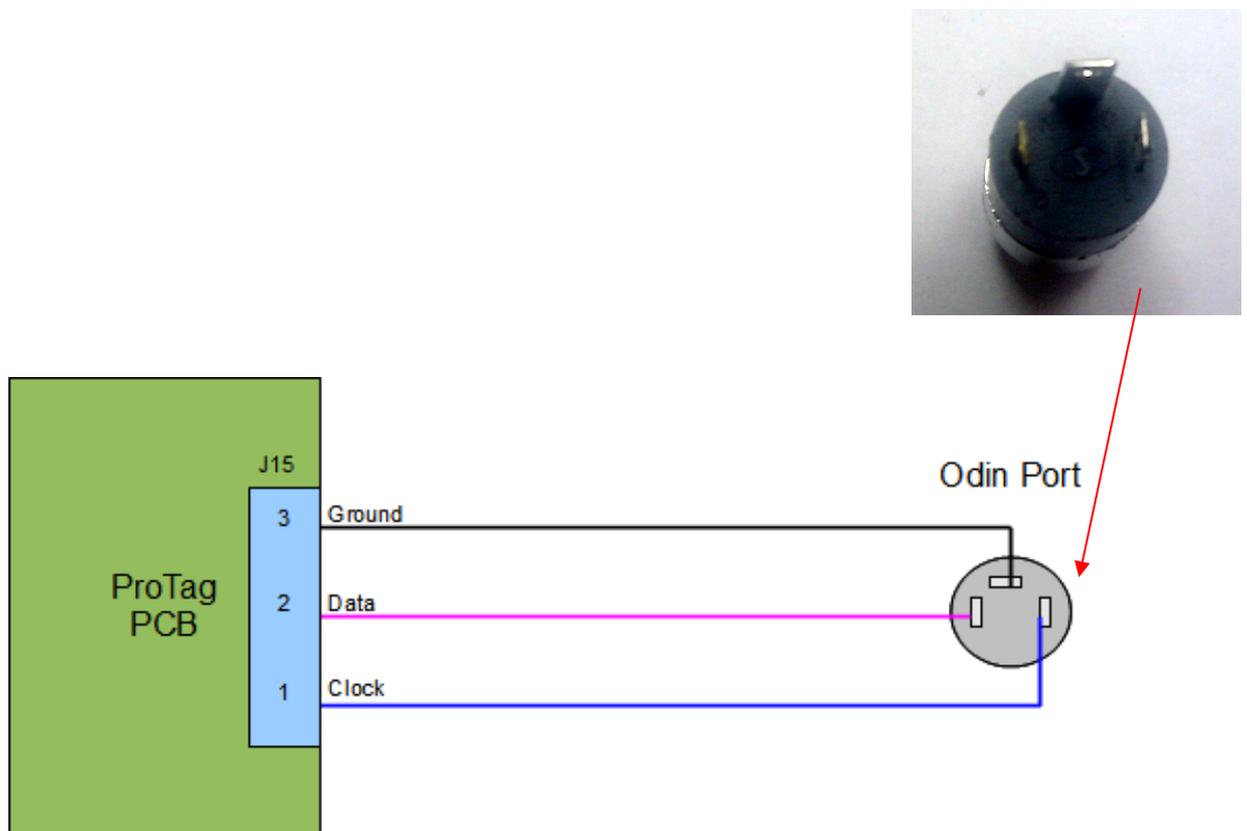


Figure 25. Odin Data Connector Pinouts

iButton Connections

The optional iButton system allows for Membership and other Accessories, such as Bandage Packs and Physical Magazines. Membership allows players to be allocated with small disc-shaped “buttons” that contain a globally unique large number. The button can be “swiped” on the gun (held briefly against an external port) which can then be used to identify the player when the score data arrives back in the FragScore PC scoring application.

This can then automatically print the player’s name and details on their score sheet, and keep track of their data over multiple games.



Figure 26. iButton Reader Port

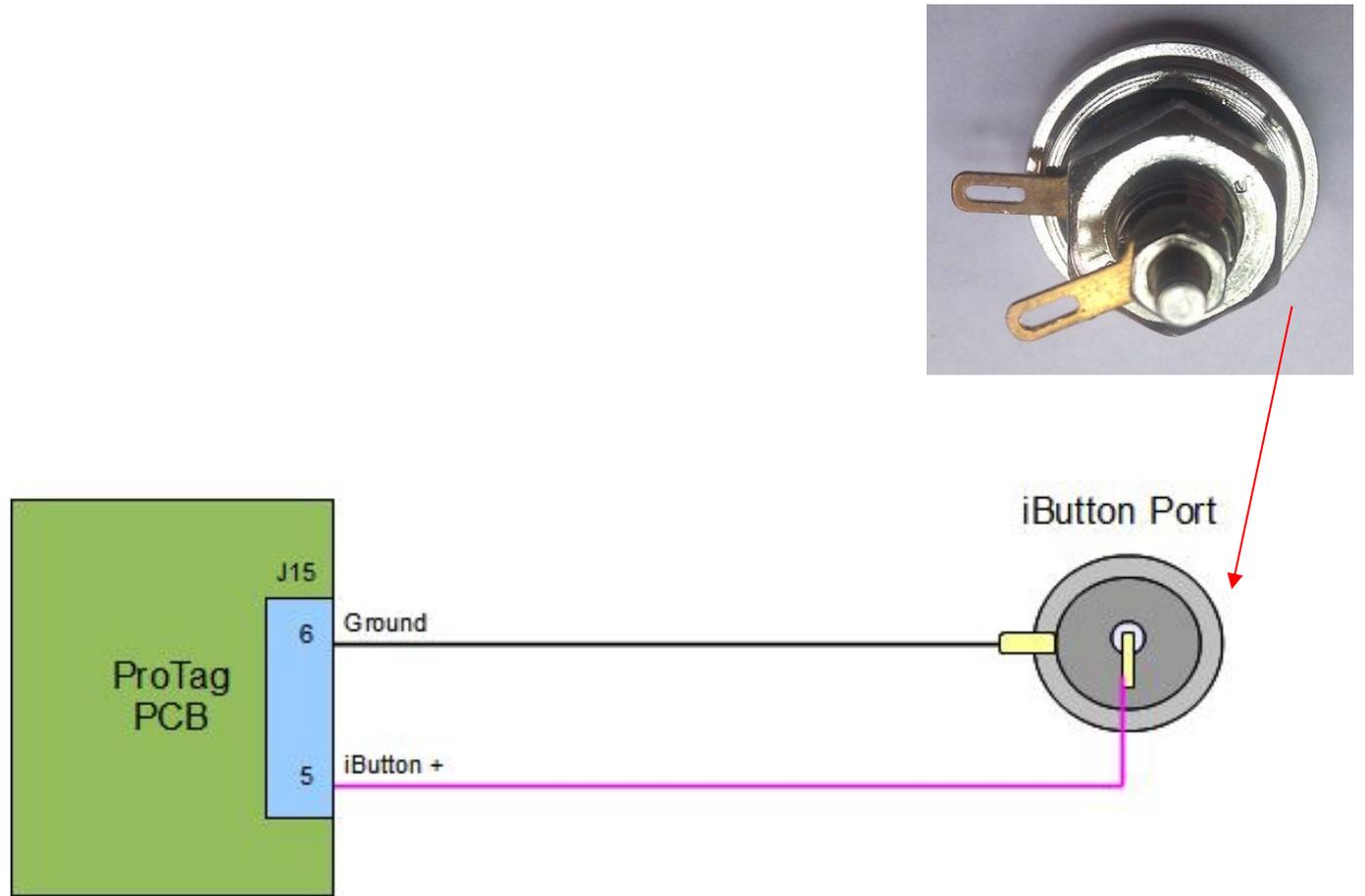


Figure 27. iButton Wiring

J2 and J17 Manufacturer Connectors

J2 and J17 are for manufacturer usage only. Do not connect anything to these connectors.

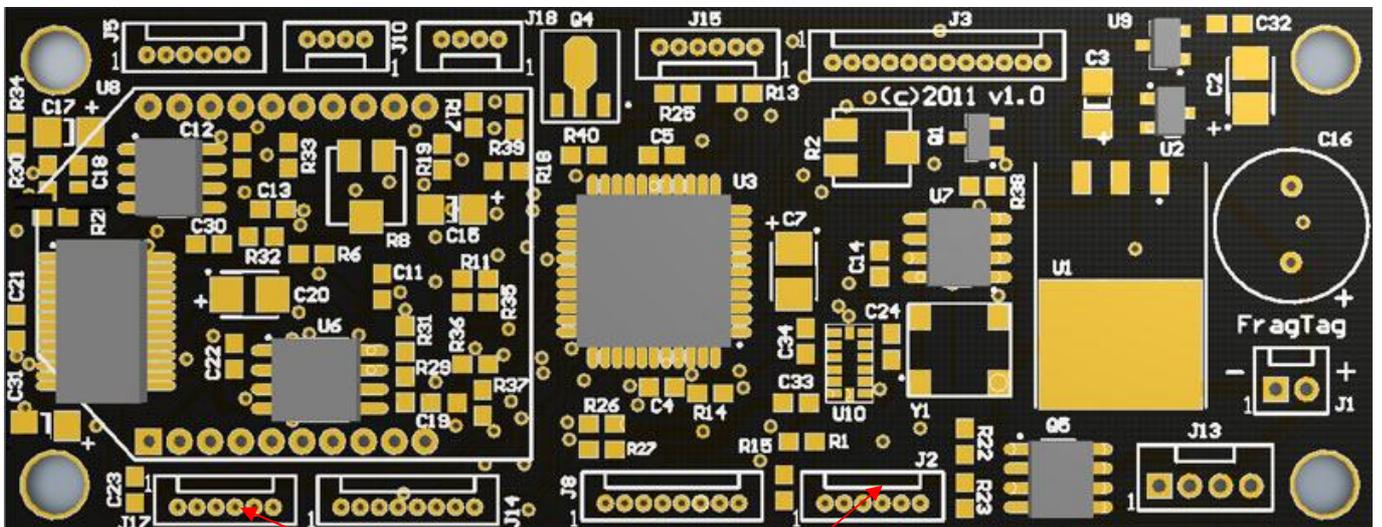


Figure 28. J2 and J17 Manufacturer Connectors

Software Users Guide

This section describes the operation of the ProTag software.

Version Number

When the mainboard is first switched on, it will display the software version that is running, and a counter in hours and minutes that shows how long the gun has been running for. This is useful for an operator to perform auditing and ensure that all use of equipment is accounted for.

```
FragTag.com.au  
V3.34 RN0019:11
```

Version

Time that the gun has been active for, in hours:minutes

Configuration Data

Configuration data refers to the values and settings that control the operation of the gun.

The configuration data parameters are stored in such a manner that they are not cleared when the power is turned off, so the system will remember the last used configuration automatically.

Configuration Summary

When power is first applied to the system, the LCD display will show the software version, and a display showing the number of hours and minutes that the system has been running for. After 1 second you will be presented with a screen like the following:

```
*FIRE TO CONFIG*
H100 M15 F RED20
```

The upper line informs you that you must pull the trigger in order to enter the configuration menus. If the trigger is not pulled within 4 seconds, it will time-out and begin to run normally, ready for game play.

The second line shows a summary of the current configuration. It can be interpreted as follows:

H Initial Health	M Initial Clips	Signal Format/Game style	Team colour	Player ID number
------------------	-----------------	--------------------------	-------------	------------------

- The first item is the currently configured health. The letter "H" is followed by a value; the value is the amount of health that the player will begin the game with
- The second item is the number of primary mags. The letter "M" is followed by a value; the value is the amount of clips the player will begin the game with
- The third item firstly shows the signal format. The letter "W" signifies that the system is running in "Worlds Of Wonder" mode (WOW mode) and the letter "F" signifies that the system is running in "FragTag" mode. After 2 seconds this item will change to show either an "A" to signify that it is running in Arcade style or "R" to signify Realistic style. Refer below for details about these styles and formats.
- The fourth item is a 3-letter code representing your team colour (eg RED, YEL, BLU etc.)
- The fifth item is a number representing your player ID number

Upon pulling the trigger, the configuration menus will be entered.

Configuration Menus

In all configuration menus, the following buttons and functions apply:

Button	Function
Trigger	Enter Button: Accept current value and advance to next item
Primary Reload	Down Button: Move down through allowed values for current item
Primary Fire Mode	Up Button: Move up through allowed values for current item

Game Style

ENTER MODE: REAL
(FIRE TO ACCEPT)

This menu allows the setting of the style of game play.

Game Style	Description
Easy	Suited to kids. You can be hit once every 3 seconds, you have unlimited ammunition, and you take only half damage.
Arcade	Suited to younger or less experienced players. In this mode, you can only be hit once every 3 seconds. You will typically be given lots of ammunition.
Realistic	Suited to military simulations, this mode allows you to be hit once every 0.25 seconds. You will typically be given more realistic (smaller) amounts of ammunition to more closely simulate real-world clip sizes.
Simulation	Advanced Military simulation mode. Hits can be taken at a high rate, with the optional addition of Bleed simulation, Damage multiplication, and Physical Magazines. Healing takes time.

Each press of the Up/Down buttons steps to the next style.

Health

ENTER HEALTH:100
(FIRE TO ACCEPT)

This menu allows the setting of the player's initial health. Each press of the Up/Down buttons steps in 10 points. Minimum allowed value is 10, maximum is 100.

Magazines

ENTER MAGS:10
(FIRE TO ACCEPT)

This menu allows the setting of the player's initial number of ammo mags. Each press of the Up/Down buttons steps in 1 mag. Minimum allowed value is 1, maximum is determined by the weapon configuration (refer to the Weapon Library setting below.)

Sound Set

ENTER SOUND: PRI
(FIRE TO ACCEPT)

This menu allows the setting of the style of fire sounds that would like to use. The actual sounds used can be customised by the user when recording sounds.

Sound Set	Description
PRI (primary)	This sound set is typically used for the standard set of gun sounds.
SEC (secondary)	This set is typically used for silenced gun sounds.

Each press of the Up/Down buttons steps to the next set.

Signal Format

ENTER FORMAT:FTG
(FIRE TO ACCEPT)

This menu allows the setting of the signal format to use. Each press of the Up/Down buttons steps to the next available signal format. Currently the supported formats are Worlds or Wonder (abbreviated as WOW) and FragTag (abbreviated as FTG).

Team

ENTER TEAM: RED
(FIRE TO ACCEPT)

This menu allows the setting of the player's team, for FragTag mode. Each press of the Up/Down buttons steps to the next available team colour, from the following list:

Display (3 character abbreviation)	Team
RED	Red
BLU	Blue
YEL	Yellow

Note that if you select Wow mode in the Signal Format, this menu item will be skipped.

Player ID

ENTER PLAYER:1
(FIRE TO ACCEPT)

This menu allows the setting of the player's ID number. Each press of the Up/Down buttons steps to the next ID, between 0 and 95 for Red and Blue teams, and 0 to 31 for Yellow team.

Warning: When playing in FragTag mode, each player must be assigned a unique Team and Player ID. If any player's have duplicate settings, they will not be able to hit each other due to the self-hit prevention feature.

Note that if you select Wow mode in the Signal Format, this menu item will be skipped.

Team and Player IDs are not relevant when using WOW mode.

Advanced Configuration

ADVANCED CONFIG?
(FIRE TO ACCEPT)

The Advanced Configuration menu allows you to set a number of Advanced configuration items. To enter this menu, press either the Up or Down buttons. To skip this menu, press the Enter button.

Advanced Config: Friendly Fire

DISABLE FF: NO
(FIRE TO ACCEPT)

This menu allows the enabling or disabling of “Friendly Fire”; if Friendly Fire is enabled (default), Players can hit members of there own Team. If it is disabled, they cannot hit members of there own Team

Press Up or Down buttons to change the setting.

Advanced Config: Range

RANGE: LONG
(FIRE TO ACCEPT)

This menu allows the Range of the gun to be adjusted. The available settings are “Long”, for full power Outdoor use; and “Short”, for reduced power Indoor use.

Press Up or Down buttons to change the setting.

Advanced Config: Game A/B

GAME : A

(FIRE TO ACCEPT)

This menu allows the setting of one of two different Game settings. This allows two games to be run side by side with minimal interference. Guns set to Game A cannot hit guns set to Game B, and vice versa.

If a Gun is set to Game A, shooting a Gun set to Game B will result in a Near Miss ricochet sound effect.

Press Up or Down buttons to change the setting.

Advanced Config: Safety Fire Mode enable

For enhanced realism, guns can utilise a Safety fire mode, where the gun can be placed into a Safety mode and cannot fire.

ENABLE SAFE : NO

(FIRE TO ACCEPT)

Press Up or Down buttons to change the setting.

Advanced Config: Disable Hit Led

DISABLE HLED : NO

(FIRE TO ACCEPT)

When a Gun is hit by another Gun, it will flash its Hit Led in the sensor to inform the Shooting player. During Night missions, this may give away a Player's position and be undesired.

This menu allows the Hit Led flashing to be disabled

Press Up or Down buttons to change the setting.

Advanced Config: Death Time

DEATH TIME: 0

(FIRE TO ACCEPT)

The Death Timer is a Timer that begins when a player is killed. It is intended for Game play styles that require the Player to remain still for a timer period after being Killed. This setting is in minutes.

Press Up or Down buttons to change the setting.

Advanced Config: Respawn Time

RESPAWN TIME: 0

(FIRE TO ACCEPT)

The Respawn Timer is a Timer that begins when a player is Respawned. This timer prevents the Player from shooting or being killed until the timer expires. This setting is in seconds.

Press Up or Down buttons to change the setting.

Advanced Config: Simulation: Bleed Effect

SIM BLEED: NO

(FIRE TO ACCEPT)

The Simulation Bleed enable controls whether or not in Simulation Mode, the Bleed Simulation is active.

If the Bleed Effect is enabled, when a player is hit, they will begin Bleeding, and require Bandaging to stop the Bleed.

Press Up or Down buttons to change the setting.

Advanced Config: Simulation: Damage Multiplier

SIM DAM MLT: NO

(FIRE TO ACCEPT)

The Simulation Damage Multiplier enable controls whether or not in Simulation Mode, the Damage Multiplier is active.

If the Damage Multiplier is enabled, hits to the Player will be multiplied by a scaling factor, that gets progressively higher if multiple hits occur in a short time period. This can increase the difficulty of game play.

Press Up or Down buttons to change the setting.

Advanced Config: Physical Magazines

PH. MAGS: NO

(FIRE TO ACCEPT)

The Physical Magazine enable controls whether or not physical magazines are active.

If Physical Magazines are enabled, the normal Reload button is disabled, and Player's must carry physical ammunition magazines.

Press Up or Down buttons to change the setting.

Advanced Config: Auto Respawn

AUTO RSPN: 0005

(FIRE TO ACCEPT)

The Automatic Respawn feature allows the Gun to automatically respawn itself when dead, after a configurable time delay. The value is shown in seconds, and can be changed in 5 second increments.

Press Up or Down buttons to change the setting.

Confirming Settings

At the completion of the configuration menus, you will be asked to confirm them. Pressing Fire will accept the settings, or pressing Reload or Fire Mode will go back to the start of the menus and allow you to correct any needed values.

CONFIRM SETTINGS
(FIRE TO ACCEPT)

Loading Default Configuration

If for some reason you wish to restore the default configuration, this can be achieved by switching off the power, pressing and holding the primary reload button, and switching on the power. When you see the message "LOAD DEFAULTS", release the button, and the display will change to "DEFAULT CONFIG LOADED."

Once this procedure has been performed, the configuration parameters are restored to the default values.

This procedure will happen automatically if the system detects that the configuration is invalid, which happens when the system's CPU is first programmed.

After performing this procedure, you will be taken to some additional configuration menus that allow for low level settings that would not normally need to be changed frequently.

Setting the Weapon Parameters

The first menu to be shown after resting to the default parameters is the Weapon Library.

The Weapon Library is a built in collection of guns that can be selected independently for both primary and secondary. That is, you could select for example a sub machine gun for your main (primary) weapon, and a pistol as your backup (secondary) weapon.

The weapons in the library will depend on what type of software you are running. The FragTag mainboard software is available in two types; "player carried" containing weapons for normal players to use, and "emplaced weapons" that are larger and more powerful, intended for fixed installations.

Refer to this document for a full listing of the available weapons:

http://www.fragtag.com.au/downloads/FragTag_weapon_library.pdf

To select a weapon, use the Primary reload and Fire Mode buttons to move up or down through the list, and pull the trigger to accept.

Example of setting the primary weapon to Assault Rifle 2:

```
P.WPM:4 ASSLT2  
(FIRE TO ACCEPT)
```

Example of setting the secondary weapon to Pistol1:

```
S.WPM:1 PSTL1  
(FIRE TO ACCEPT)
```

Setting the iButton enable

After the weapon parameters have been selected, you will be given the option to enable the iButton system. If you wish to use membership buttons, or bleed simulation, or real ammo mag carrying, and you have fitted the port and resistor as detailed in the hardware section, then use the Primary reload and Fire Mode buttons to select YES and then Fire to accept.

Otherwise, select NO.

```
ENABL iBUTTON:NO  
(FIRE TO ACCEPT)
```

Setting the Weapon Special Output Mode

The Weapon Special Output (J14-7) can be configured to be driven at one of a number of different times. This can allow for Recoil, external muzzle flash systems, or other external accessories.

Select the index according to the table below, and then Fire to accept.

Weapon Special Index	Function
0	Disabled
1	Output pulses briefly low at the start of a Shot, and idles high. Used for 5 channel external firing system ("Doppelganger").
2	Output switches on continuously when firing is occurring, and off otherwise
3	Output switches on briefly (approx 35 msec) once for every shot. Suitable for Recoil.

Weapon Spec: 1

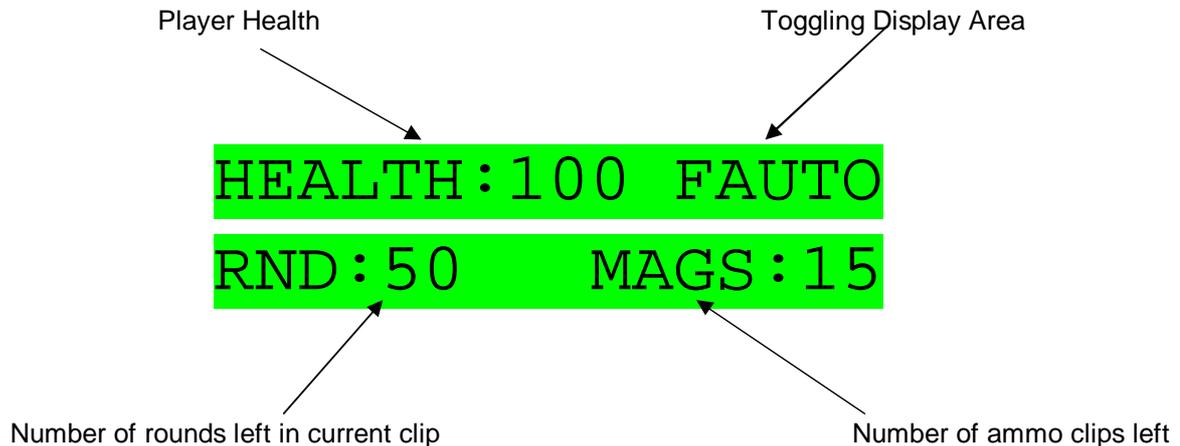
(FIRE TO ACCEPT)

PLAY MODE

At the completion of the boot up stage, the system is ready to begin playing. The display will change to the main screen.

Main Screen

The main screen shows a summary of the current player status:



When this screen is active, pulling the trigger will begin to shoot rounds. The number of rounds fired depends on what *Fire Mode* you have selected.

- ❖ The "HEALTH" value shows the amount of health the player has left. The FragTag system uses health in a similar manner to a PC game; 100 health is the normal full value, and 0 health is dead. This is done due to the variable damage system; the more commonly used laser tag concept of "lives" is not suitable for variable damage systems as we take away a different amount of health for each gun (which gives far more realism.)
- ❖ The "RND" value shows the amount of rounds (or virtual bullets) remaining in the current magazine. When this gets to zero, you can no longer fire and need to Reload
- ❖ The "MAGS" value shows the number of remaining Magazines. This number is decreased by one each time you reload, and when it gets to zero you are out of ammo and can no longer shoot.

Toggling Display

The upper right corner of the display "toggles" (ie changes automatically every 2 seconds) between a number of different lines of information:

- ❖ Fire Mode: Refer to following section
- ❖ Game Time: If you are playing a Timed Game, you will see the time remaining before the current game ends. It will be shown as ">1 HR" if there is more than 1 hour to go, or a display of minutes and seconds if there is less than 1 hour to go eg. "12:10" means 12 minutes and 10 seconds to go. If you are not playing a timed game, this will show as "UNLMT" meaning Unlimited game time.
- ❖ Player ID: the player's Team and ID value are shown, eg "RED 20"
- ❖ Armour value
- ❖ Battery Level in percentage, eg "B90%"
- ❖ If fitted, the Wireless sensor battery level in percentage, eg "S95%"

Fire Modes

The available Fire Modes depends on the weapon type that you have selected in the Weapon Selection Menu.

Mode	Display	Description
Safety	SAFTY	Shots cannot be fired when the Safety is on (note that the use of Safety fire mode is optional and is set in Advanced Config menu.)
Full Automatic	FAUTO	Shots are fired continuously for as long as the trigger is held down (and the clip has ammo.) Typically used on machine guns and assault rifles.
Burst Fire	BURST	For each trigger pull, a burst of multiple rounds is fired. The number of rounds in a burst is part of the weapon configuration. Only one burst will be fired for each press of the trigger. Typically used on sub machine guns.
Single Shot	SINGL	One single shot is fired for each press and release of the trigger. Holding the trigger down will produce only one shot. This is typically used on Sniper Rifles.

Each available Fire Mode can be cycled through by pressing the Primary Fire Mode button. It will advance one mode for each button press and release.

Reloading

Once you have fired all of the rounds in the current clip, the main screen will change to show that your clip is empty:



** MAG EMPTY **



At this time, pulling the trigger will play a sound to indicate you have no ammo left. When this occurs, it is necessary to press the Primary Reload button, to reload the gun with a new clip. Provided you have some primary clips left, the display will change to the following:



** RELOADING **



The bar graph at the bottom will advance along from left to right showing the progress of the reload; when it gets to the right side the reloading is complete, and the display will change back to the normal main screen (a sound effect will be heard at this time too.)

The time taken to reload is set by the selected Weapon.

Secondary Weapons

If you have selected a Secondary Weapon in the weapon selection menu, you can fire this by pressing the “Secondary Fire” button. This will fire a round from the secondary weapon, and the main display will change to show “SCND” as the fire mode, and the Rounds and Clips values will change to the secondary values.

Pressing the primary trigger button will change back to the primary weapon.

When the secondary weapon runs out of rounds, it will reload automatically (there is no secondary reload button.)

Taking Hits

If an opposing player hits you, your display will change to show “OUCH” and a sound effect will be heard.

If you are running in MilesTag mode, the second line of the display will show the team/player ID that hit you, and how many points of damage you took (i.e. how much of your health was taken away.)



The image shows two lines of text on a black background. The first line reads "**** OUCH! ****" and the second line reads "RED 1 10 PTS".

If your Health is above zero, after a time delay (the delay depends on if you have set Arcade or Realistic modes) the LCD returns to the main display, and you can continue playing. When your health reaches zero, you are dead.

The Hit LED

When you are hit, the “Hit Led” on the sensor will flash quickly to alert other players that they have been successful in hitting you.

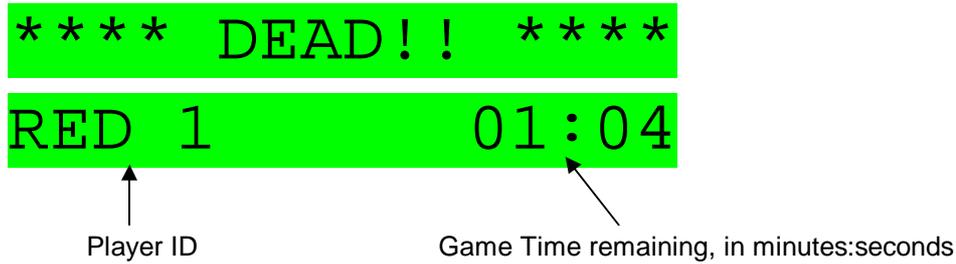
When you die, the Hit Led will stay on continuously for a time period of 4 minutes, and then it will automatically switch off to conserve battery power.

During Respawn delay, or start delay for a timed game (refer to Odin User Manual for more details about timed games) the Hit Led will flash slowly.

Flashing of the Hit Led when hit can be disabled in the Advanced Config menu.

Dieing

When your last amount of health is used, the screen will change to show "DEAD" and a sound effect is played.



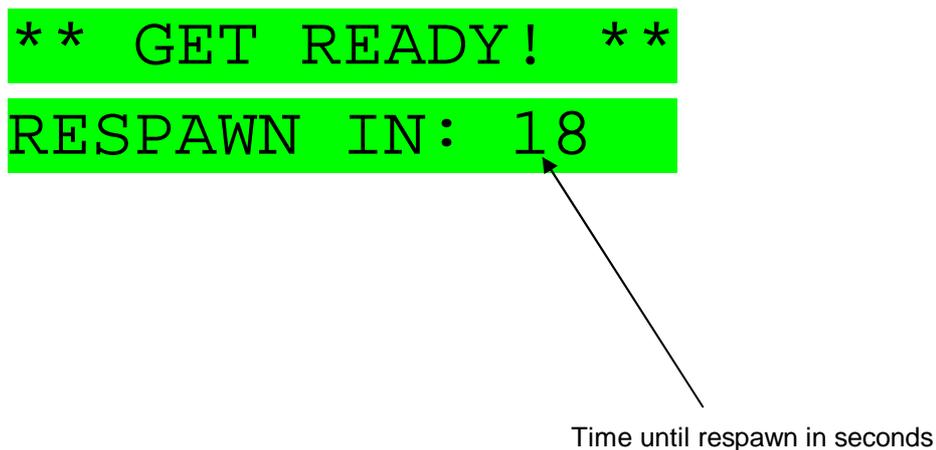
At this point you are out of the game.

You will see the time remaining in the current game on the second line of the display, and if you are running in MilesTag mode the bottom line of the display will also show your own team and player ID.

Respawning

When you are dead, you can be bought back to life (respawned) by a FragTag Master Controller or Utility Box device, or by using the power key to switch the power off and then on again. When this happens from a controller or box, the display will change to show a countdown until you can rejoin the game.

This countdown value is set to 2 seconds by default, but can be changed from the Master Controller device, or from the Advanced Config menu.



ADVANCED TOPICS

LCD Backlight

This is considered an advanced function, and is not essential to the use of the system. Some players may find it difficult to remember how to operate; in this case just ignore this function.

The LCD display has a backlight that allows the screen to be seen clearly in darkness. The backlight consumes battery power, so by default it is switched off. If the ambient light is not sufficient to view the screen, you can turn on the backlight by pressing and holding the primary fire mode button. After holding it for 1 second, the display will change to the next backlight mode.

The backlight should be used sparingly to prevent draining your batteries too quickly.

Backlight Mode	Description
TIME	The backlight will turn on after any button push or hit, and then turn off after 5 seconds of inactivity.
ON	The backlight will remain on at all times.
OFF	Backlight is always off.

Each mode is cycled in turn, for each 1-second press/hold/release of the button.

The backlight mode is reset back to OFF when the power to the system is turned off.

The screen will change to show the currently selected backlight mode as it is selected, and return to the main screen 1 second after you release the button.

BACKLIGHT MODE :

ON

BACKLIGHT MODE :

OFF

Near Miss

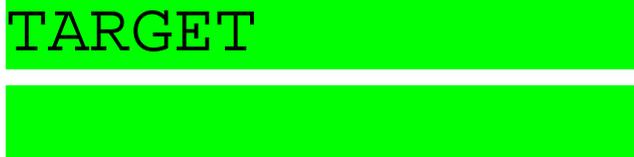
If your gun receives a hit signal that is not quite fully intact (for example, you may have just got the end of a signal, or a reflection) then you may experience a “near miss.” A sound effect will be played (a ricochet) and your firing may pause briefly. You will not take any damage from this, and it serves as a warning that you are under fire and should seek cover immediately.

Target

All FragTag mainboards have the option to be configured as a Target, by setting the Target weapon type in the weapon library (refer to the configuration section for details.)

The Target mode can be used for simple target practice, range testing, sensor/gun testing, or scope calibration.

In this mode, the main Idle screen will show “Target” and you will not be able to fire. Hits will be taken from any Player ID (including from the same player ID as the Target itself ie self hits are not prevented) but no damage will be taken (ie the Target cannot be killed and doesn’t need to be respawned.)



TARGET

Timed Games and Remote Configuration

The FragTag mainboard allows full remote configuration and remote game control by using our Odin Master Controller. Refer to the Odin user manual for full details.

When playing timed games, the main display may change to a number of different screens depending on what is happening. Some examples:

Idle Display:

HEALTH:100 01:43

RND:40 CLIP:10

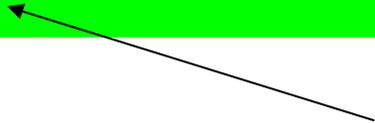
Time remaining, minutes:seconds



GAME STARTS IN:

00:28

Before a game starts, counting down (no firing or hits allowed during this time.)



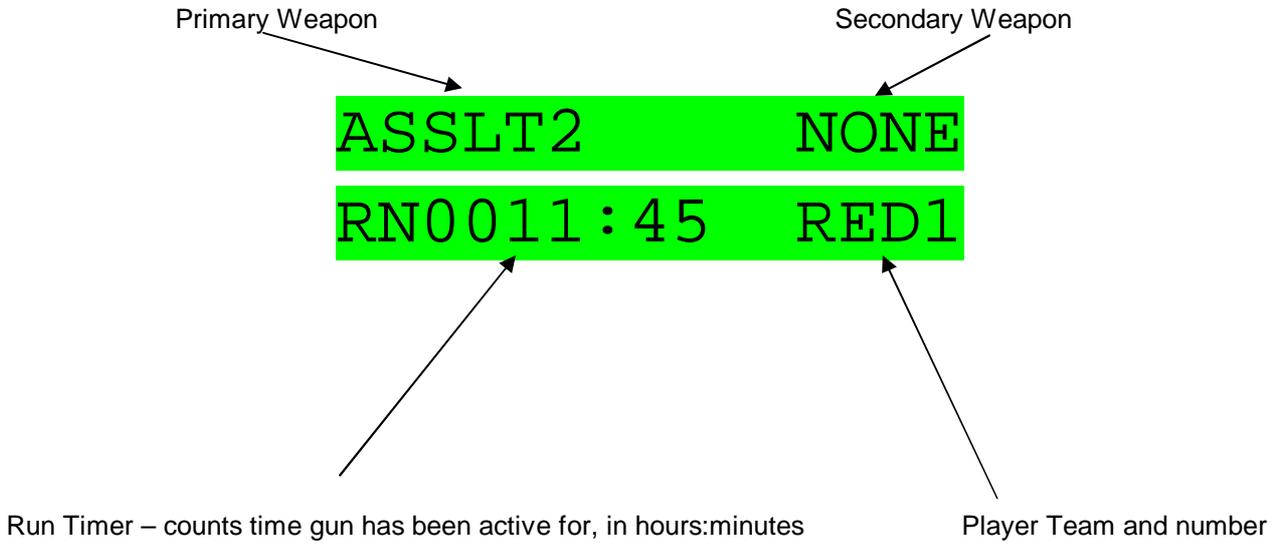
Game Over, after the configured game duration has expired:

** GAME OVER! **

YOU ARE RED 1

Gun Status

The Odin Master Controller can request the gun to show its status. If this is done, the following screen will be shown for 4 seconds:



iButton System

If the hardware has been fitted (refer to Hardware section) and you have enabled the iButton system (refer to configuration section) then a Membership button, or Field Bandage may be used.

The gun must have a reader port fitted in such a manner that it can be easily reached by the player, for example:



To use the Membership system, the player must touch and hold his ID button to the port for approximately 1 second. If the button is ready correctly, the screen will change to show a welcome message, and a welcome sound effect is played.

If the button is not read correctly, an error screen will be shown and the alarm will sound.

If this occurs, hold the button against the port again. Be careful not to move it around for the time period. If you continue to have errors, ensure that both the button and the port are clean and free of any mud or dirt.

If problems persist on all buttons tried, you may need to check the internal wiring or replace the reader port.

Important Note: if the Membership system has not been enabled, the system will completely ignore any buttons held against the port. Refer to the configuration section for details of how to enable the Membership system.

Bleed Simulation

In Simulation mode, when you are hit, you will start to “bleed.” Every 10 seconds, you will lose additional health points, the amount of which depends on how severe the hit was.

To stop the bleeding, it is necessary to use a “FragTag Field Bandage” device, which simulates a bandage and will stop the bleeding. To use the bandage, press and hold it against the iButton port, and watch the LCD and/or listen to the sound effects. Bandaging takes approximately 10 seconds, and the screen will show a bar graph during this time. Sound effects of bandaging will be heard, until the end when an “ahhhh” sound will be heard.

If a bandage is not applied, you will eventually bleed out and die. Note that bandaging does not restore any health points, it just prevents additional points from being lost. A Medic Box accessory can be used to restore Health points.

The Field Bandage has a set number of uses, typically 5. Each time it is used, the number of uses is decreased, until it gets to 0, when it will no longer function. To recharge it, hold it against the iButton port of a Medic Box device until a beep is heard. This will restore it to 5 uses.

The Odin Master Controller device can also recharge Field Bandages.

At the beginning of a new game, all Bandage devices should be recharged (unless the scenario calls for otherwise.)



FragTag Field Bandage

You can check the number of uses of the Bandage left by holding it against your gun's iButton port when you are not bleeding. You will see the number of uses left on the LCD display.

Stuns

The system supports “Stuns” for example from a “Flash-bang” grenade. When this signal is received, the display will show “Stunned!” and you cannot fire for a time period. You can still take hits in this state.

HEALTH: 33 RED1

*** STUNNED! ***

Explosive and Radiation Damage

Certain FragTag products generate signals that simulate Explosive or Radiation damage (for example, Thor's Hammer time bomb.)

If the mainboard receives this type of damage, the value and type will be displayed on the screen.

**** OUCH!! ****

EXPLOSIVE 54

**** OUCH!! ****

RADIATION 2

Anti-Cheat Functions

Power Logging

The mainboard software logs any occurrences of the power being switched off during a game, to detect cheating by players respawning themselves (a common problem for our competitor's systems.)

If this occurs on a FragTag system, the score data uploaded at the end of the game will be marked as having a power off event.

Sensor Failure

If a sensor fails (or is disconnected on a system that allows unpluggable sensors) then an alarm will sound and the system will cease to function until the problem is rectified.

** ERROR! **

** NO SENSOR **

In certain circumstances failure of a single wire within a connecting cable may cause the sensor to stop functioning yet not be detected. This is a limitation of the sensor modules and cannot be changed, however this would be a very rare occurrence.

Field Code

Guns can be configured via the Odin Master Controller to accept Respawn, Healing and Ammo signals from certain authorised devices only, and reject signals from unauthorised devices. Refer to the Odin User Manual for more details.

Important note: If the gun plays the alarm warning four times and shows a message "Invalid Field Code", it received a signal that did not contain the correct Field Code. In this case, use Odin to configure the Gun and/or Utility Box and/or Odin to the correct setting that is consistent in all devices that need to be used together.

Data Logging and Scoring

The FragTag mainboard has the outdoor tag industry's most comprehensive data logging and scoring system. For every player (224 total supported) the following items are logged for each game:

- Hit Data (who you hit and who hit you)
- Shots Fired
- Total Damage inflicted
- Calculated Soldiering score (this is a value calculated from Damage inflicted, accuracy, respawns and heals)
- Number of times healed
- Number of times ammo was added
- Number of times the Administrator killed you
- Number of times respawned
- Number of times player died
- Health remaining at the end of the game
- Clips remaining
- Ammo remaining
- Primary damage value
- Secondary damage value
- Accuracy percentage
- Run Counter (number of minutes the gun has been switched on for)
- Rank among the other players in the game
- Membership ID code
- Bonus points awarded
- Explosive damage taken
- Radiation damage taken
- Number of stuns
- Detection for power cycling (cheating via key off, flat batteries etc.)

This data is uploaded from each gun at the end of a game using the FragTag Odin Master Controller. Odin collects all the data and can then pass it on to a PC, using the FragTag FragScore PC application.

FragScore displays all information and can print Score Cards for each player.

Sample display of FragScore, from a 24 hour game at Lazer Storm 2006:

Team Rank

Rank	Team	Soldiering
1	Yellow	15090
2	Red	11625
3	Blue	3747

Active Mission
None

FRAGTAG

Player Rank

Rank	Player	Soldiering	Accuracy	Damage	Shots Fired	W.I.A.	K.I.A.	Ammo Adds
1	Yellow 3: Bingers	4357	11.52%	1464	1304	9	10	1
2	Red 1: Thorin	3070	20.17%	1059	898	43	1	21
3	Yellow 0: Callan	2330	6.30%	784	921	0	11	0
4	Yellow 1: Colin	2149	7.65%	728	863	5	11	4
5	Red 0: BJ	2134	7.54%	746	1025	56	2	11
6	Blue 3: Baatzbub	2089	5.16%	698	469	1	2	0
7	Yellow 10: Gimley	1940	10.20%	654	296	0	8	4
8	Red 4: Abacus	1928	6.52%	672	798	43	9	4
9	Red 7: Chipmonk	1863	10.88%	660	294	54	6	16
10	Red 5: 00	1512	6.84%	546	629	67	6	9
11	Yellow 8: Bunning	1104	8.06%	378	335	11	6	1
12	Yellow 5: Snake	1008	4.67%	350	535	11	12	1
13	Red 6: CS	809	1.85%	312	771	60	5	18
14	Yellow 2: Stone	807	9.37%	272	698	4	1	1
15	Blue 0: Pooh	710	2.26%	240	759	2	3	1
16	Yellow 4: Khidd	622	3.79%	214	509	0	10	0
17	Blue 2: Bully	590	8.10%	210	210	0	20	0
18	Yellow 7: 007	435	1.91%	154	787	6	7	3
19	Red 2: Wilty	422	3.96%	168	505	42	3	9
20	Blue 1: Owl	358	6.06%	120	99	0	1	0
21	Yellow 6: Angel	338	2.14%	120	187	2	9	1
22	Red 9: Pete	258	1.36%	90	220	0	6	0
23	Red 3: Piglet	-371	6.03%	-98	1145	35	2	14

Refer to the Odin and FragScore user manuals for further details of the scoring and data logging system.

Sample Soldier's Scorecard:



Greg Smith

HISTORY

TOTAL MISSIONS: 2

AVG. ACCURACY: 3.17%

AVG. DAMAGE: 252

AVG. SOLDIERING: 1756

SOLDIER SCORECARD

FRAGTAG TEST FIELD
24/09/05 1:00PM

MISSION: Johnny on the spot	RANK	SOLDIERING
CLAN: None	1	1852
PLAYER ID: Red 1		

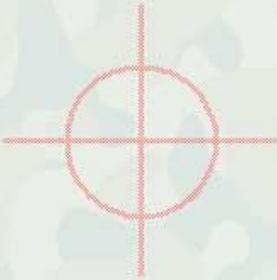
TOTAL DAMAGE	SHOTS FIRED	ACCURACY	W.I.A.	K.I.A.	AMMO ADDS
284	167	12.15%	0	0	0

PLAYERS THAT YOU HIT:

Blue 0: 112 (Robin Marston)

Blue 1: 112 (Ron Jones)

Blue 10: 60 (Aaron Sawyer)



PLAYERS THAT HIT YOU:

Blue 0: 70 (Robin Marston)

Blue 1: 14 (Ron Jones)

Blue 10: 20 (Aaron Sawyer)



www.fragtag.com.au

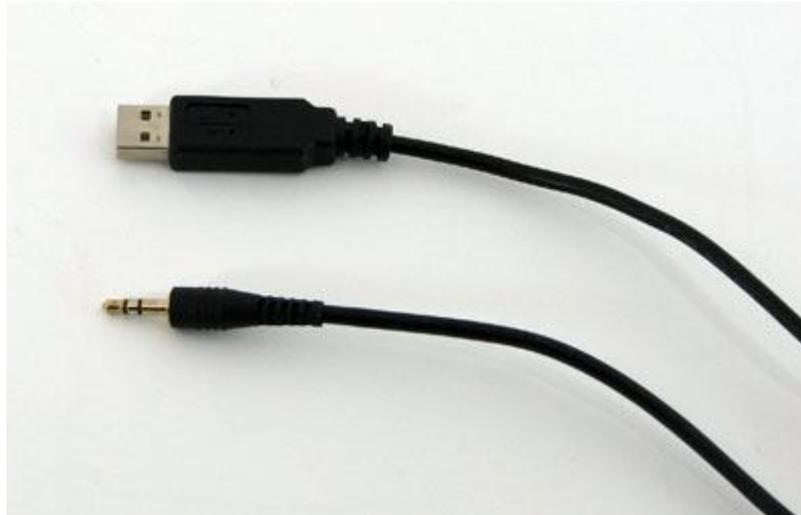
Upgrading the Firmware

The FragTag mainboard has the ability to have its internal software updated by the owner, without opening the gun casing, in approximately 60 seconds per gun. In this manner you can maintain and upgrade your fleet yourself without the need for expensive or time consuming replacing of chips.

Items Needed

You will need the following items to perform this procedure:

- ❖ A USB interface cable can be used, available from our Store.



- ❖ A installed copy of FragScore, available from our web site.

Procedure

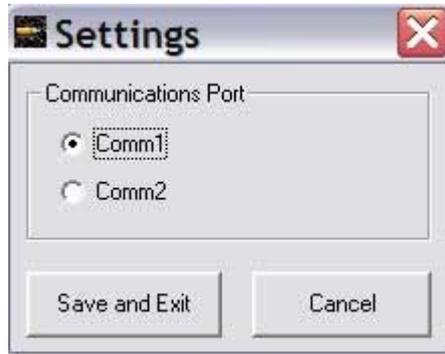
Be sure to follow all steps carefully, or malfunction may result.

Step 1: Download the firmware file that you wish to update to, from our web site Product Page. This will be a small file with a “.ftg2” extension on it, for example “mainboard_3.26_pw.ftg2”

Step 2: Switch off power to the gun. Connect the USB cable to the Gun’s Odin port, and the other end to the PC.

Step 3: Start the FragScore PC application, and select the “Settings” menu, and then “Communications Port”.

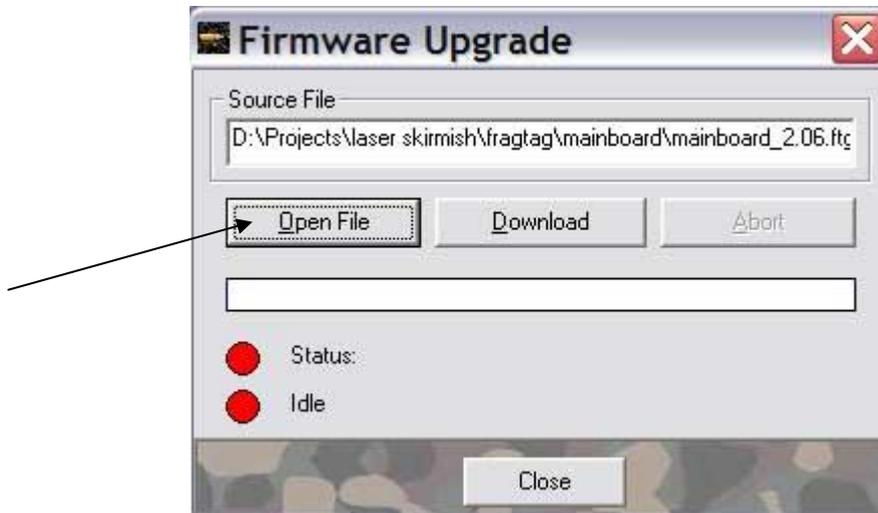
In the window that appears, select the communication port number corresponding to your USB cable. If you are unsure, it will usually be a number higher than 2. It may take some guess work and trying of some settings to see which one works. When you have made your selection, press “Save and Exit.”



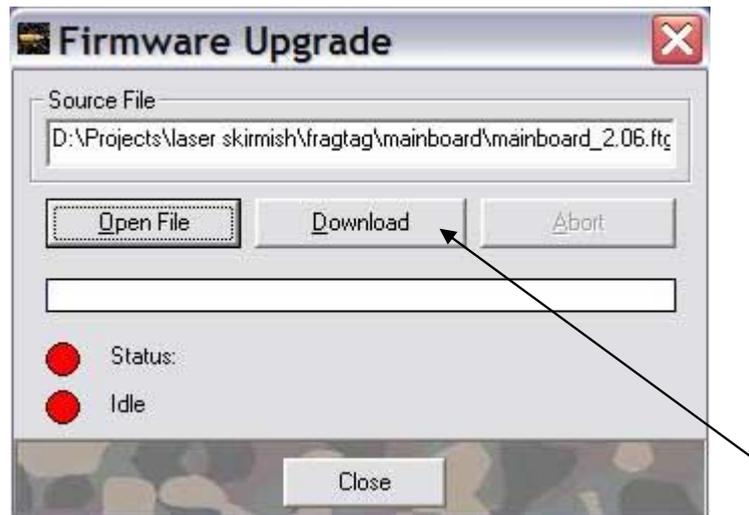
Step 4: Select the “Tools” menu, and then “Firmware Update”



Step 5: In the window that appears, select the “Open File” button, and browse to the firmware file downloaded in Step 1.



Step 6: Press the “Download” button.



Step 7: Switch on the gun. After a short time, the FragScore display should show that it has connected, and the progress bar will begin to move across the screen. At this time, the gun display will be blank, and the hit led will be illuminated.

Step 8: After approximately 60 seconds, the progress bar will reach 100% and the gun will start up automatically, and you will be taken to the configuration menus (refer to configuration section.) Unplug the stereo audio cable from the gun.

This completes the update procedure. Additional guns can be updated by plugging in a new gun (with the gun power off) and repeating steps 6 to 8.

At the completion of all updates, exit from FragScore and unplug the cable.

Troubleshooting

If the above procedure does not work, check these items:

- ❖ Try a different comm port number in the step 3. It can be difficult to identify which port the USB cable adopts on the PC
- ❖ Double check all of your connections and cables, including the connection between the mainboard and the Odin port inside the gun (refer to Hardware section.)

If all of the above still fail to work, contact us on techsupport@fragtag.com.au