The Smart Gun electronic tag board.

Designed by, built by, and obtainable from: Dave Bodger.

Installation Guide

This guide is to help you build the SmartGun circuit into your gun body. The latest version of this installation guide may be downloaded from <http://www.compulink.co.uk/~lasertag/> in future. Although the SmartGun circuit boards are of a "no solder" design and all external connections are by plug-in or screw-down connectors, it is likely that some soldering may be required on external components and wires to switches etc. If you are not experienced in soldering or simply do not have the necessary equipment, you will find that there are lots of people out there who can help. Just ask around. There is bound to be at least one "techie" in your club who can show you how. If you're not a member of a club then Firefight magazine (contact: The Editor, Firefight, c/o 141 The Moorfield, Coventry, CV3 1DJ) has a contacts list in the back.

Installation Instructions.

The wires that connect the battery to the main board, emitter, muzzle flash LED and speakers should be capable of passing 3 amps. All other wires and switches carry negligible current so can be what ever you like. The on/off switch should be capable of handling 3 amps at 12 volts DC.

Note that due to the power of the SmartGun circuit it should ideally be placed as far towards the front of the gun as possible and the wires connecting the emitter to the main board should be routed as far away from the back of the gun as is practical. This is because Starsensors are sensitive to the magnetic field generated around these wires when the circuit is triggered and this can cause phantom sensor hits.

The new SmartSensor will not be as susceptible to this effect as the old "Worlds of Wonder" kit that is affected in this way. Please contact me if this causes you serious problems as there is a modification that can be done to the Starsensor (and Starcap) to make it less sensitive to this effect (unfortunately it costs £5 in parts and 30 minutes to fit and involves a tricky desoldering job). The other option is to reduce the power of the SmartGun circuit by increasing the emitter resistor from 2.2Ω to 3.3Ω or 4.7Ω, but I suspect the idea of reducing output power will be less popular.

- Fit the two wires from the loudspeaker into the two screw-down connectors. Polarity is not important. The 8Ω Maplin Mylar speakers are a good choice.

- If using the UM3562 sound board, set the jumper to the position of the sound effect you prefer, either "Laser Zap" or "Rifle Bang" (see diagram for jumper position).

- Plug the sound board into the main board. Ensure the weight of the speaker wires does not pull the sound board out of the main board.

- You can use the fixing holes to screw both boards down to a piece of wood or other non-conductive material if you wish; packing the board in bubble-wrap is also acceptable as long as you leave the power amp chip on the sound board exposed to the air, as this is the chip that gets the hottest.

- Ensure the electrical connections on the back of the boards are not shorted out by any metalwork of the gun casing.

- Plug the 10 way ribbon cable onto the main board and the display board.

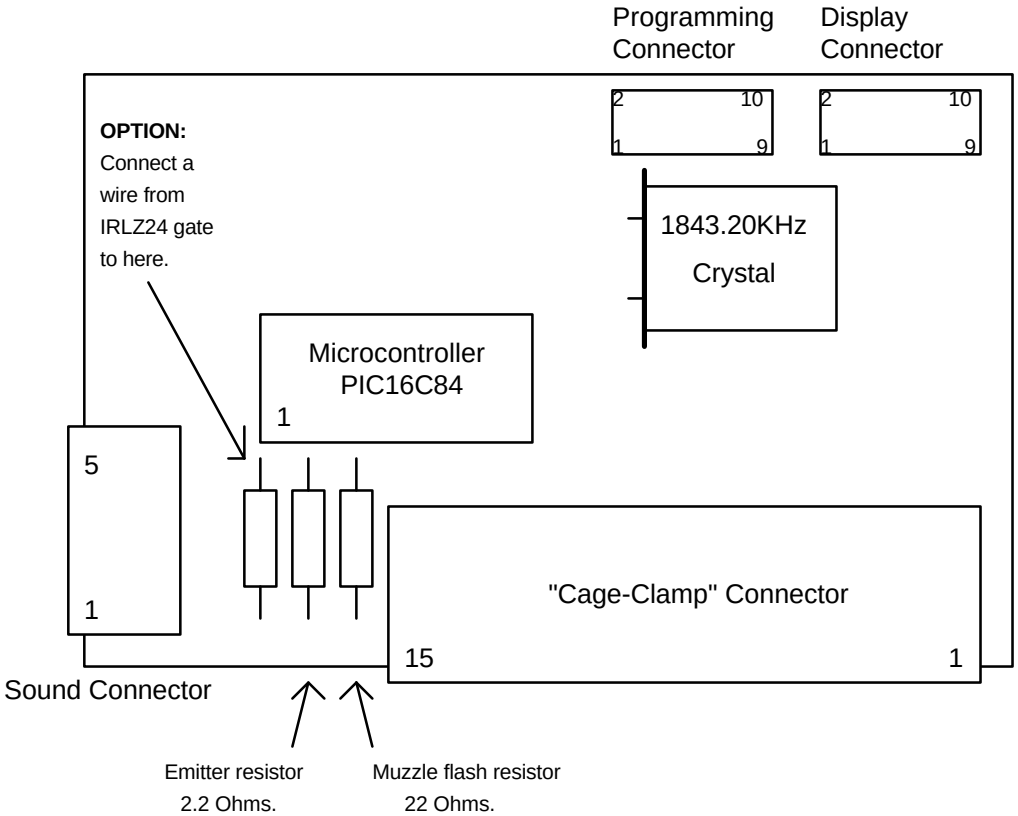
- **Read the warning in the user guide about not switching the power on and off rapidly (on first page).** View the power switch wiring diagram for recommended method of ensuring positive power off.

- Connect up the wiring to the switches you have decided to fit to match the options you wish to be able to control.

When you switch on for the first time the display should read 'C.9.' and both decimal point indicators should be flashing. If instead the display reads 'J.C' with both the middle horizontal segments flashing, you have got one of the display cable sockets reversed. Simply turn either of the sockets round the other way to get the correct display. Reverse connection will not damage the display.

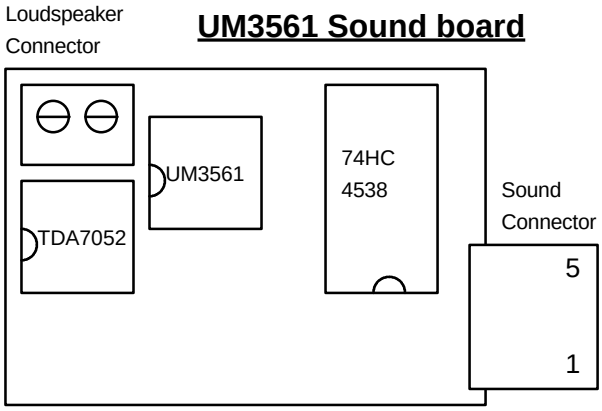
The SmartGun circuit should be turned off when not in use. The circuit only uses about 10mA when not in use, but when fired it consumes approximately 2.5 amps for the duration of each shot. Battery life is totally dependant on usage and brightness setting of the display, but I would expect it to last a couple of days on a fresh 7.2v 1.2AH race pack if turned off between games. Although the circuit will work on an alkaline or ni-cad PP3 you will not get best performance from it. Full power requires a minimum of C sized alkaline cells or AA sized ni-cads. A 7.2 volt battery pack will give perfectly adequate performance for most users; however for absolute peak performance use an 8.4 volt, 1.7 amp-hour (or better), ni-cad race pack, which will increase maximum range slightly. Note that you can generally get bigger increases in range by carefully adjusting the lens assembly than you can by increasing the battery voltage.

Circuit board connector identification

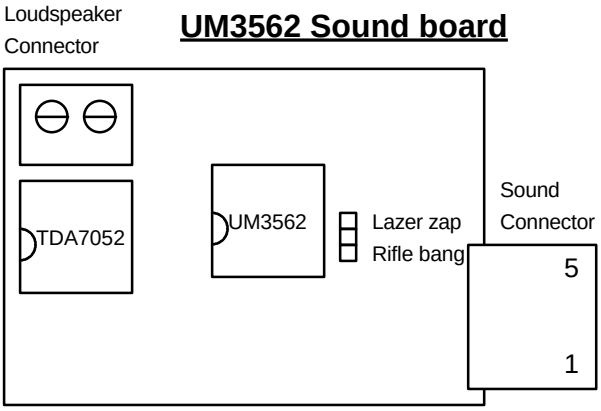


The Smart Gun electronic tag board.

Designed by, built by, and obtainable from: Dave Bodger.



N.B. use only 8 ohm or above speakers.



N.B. use only 8 ohm or above speakers.

Main board connections.

Sound Connector.

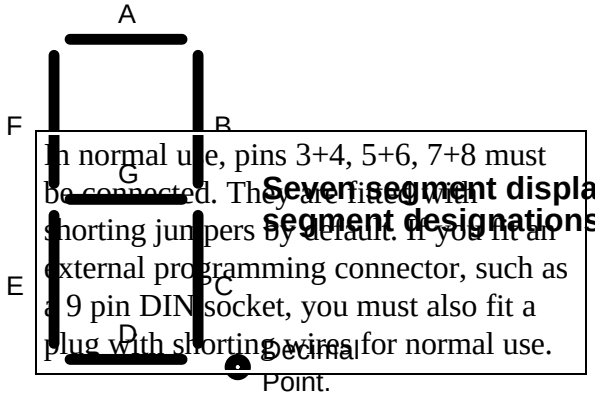
1. Reserved for grenade relay or other custom option.
2. Raw battery voltage
3. 0v earth (-ve)
4. +5v regulated - Max load 20 milliamps.
5. On (+5v) for duration of shot pulse (50 mS) - Max load 10 milliamps.

Display Connector.

1. Segment D
2. Segment C
3. "Ones" digit Common
4. Segment F
5. Decimal Point
6. Segment G
7. Segment E
8. "Tens" digit Common
9. Segment B
10. Segment A

Programming Connector.

1. +5v regulated (max load 10mA)
2. +5v regulated (max load 10mA)
3. PIC /MCLR signal
4. /MCLR pull-up resistor
5. RB.7 from PIC chip
6. RB.7 to main board circuitry
7. RB.6 from PIC chip
8. RB.6 to main board circuitry
9. 0v earth (-ve)
10. 0v earth (-ve)



Seven segment display segment designations.

In normal use, pins 3+4, 5+6, 7+8 must be connected. They are fitted with shorting jumpers by default. If you fit an external programming connector, such as a 9 pin DIN socket, you must also fit a plug with shorting wires for normal use.

The Smart Gun electronic tag board.

Designed by, built by, and obtainable from: Dave Bodger.

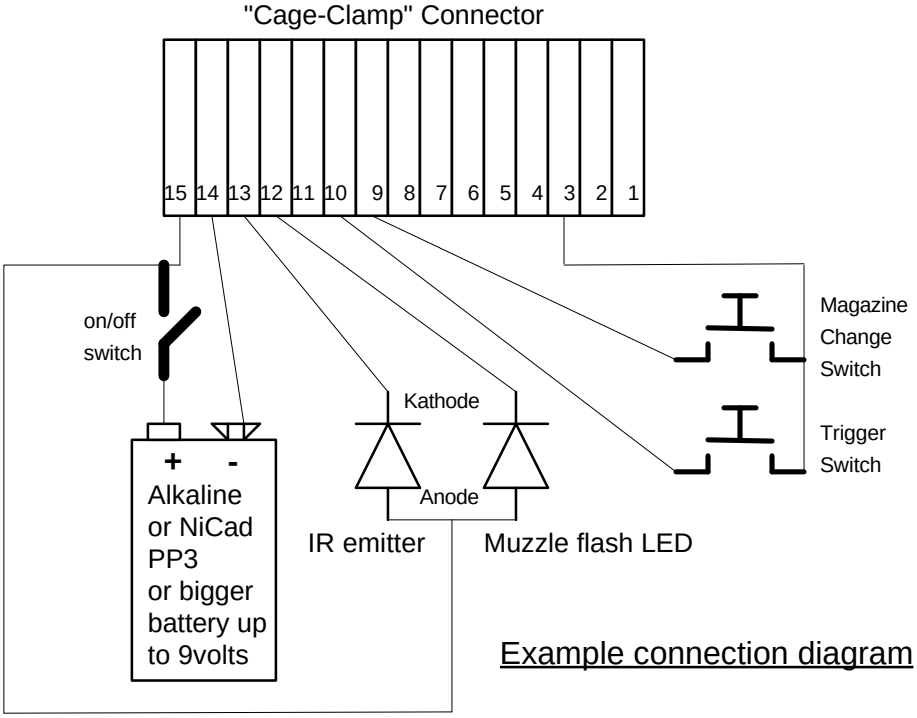
"Cage-Clamp" Connector.

1. TXD signal RS232 serial data input via 22K ohm resistor which **must** be fitted to the cage clamp.
2. RXD signal RS232 serial data output.
3. Switch matrix signal RB.0
4. Switch matrix signal RB.1
5. Switch matrix signal RB.2, also Lockout signal input.
6. Switch matrix signal RB.3
7. Switch matrix signal RB.4
8. Switch matrix signal RB.5
9. Switch matrix signal RB.6
10. Switch matrix signal RB.7
11. 0v earth (-ve)
12. Muzzle flash LED -ve.
13. IR emitter diode -ve.
14. 0v earth (-ve).
15. Battery +ve (common for IR emitter and Muzzle flash LED).

Switch matrix connections.

	pin 6	pin 5	pin 4	pin 3
pin 7	**1** Load/eject Grenade	**2** Reload Grenades	**3** Show clips and fire sel.	Fire select UP
pin 8	**4**	**5** Safety	**6**	Fire select DOWN
pin 9	**7** Fire select UP	**8** Silencer	**9** Fire select DOWN	Magazine change
pin 10	***** Brightness UP	**0** Display OFF	**#** Brightness DOWN	Trigger

Battery voltage should be 7.2v to 9v, i.e. Ni-Cad race pack or PP3 battery.
Specially adapted boards are required for 6v and 12v operation. Contact Dave Bodger.

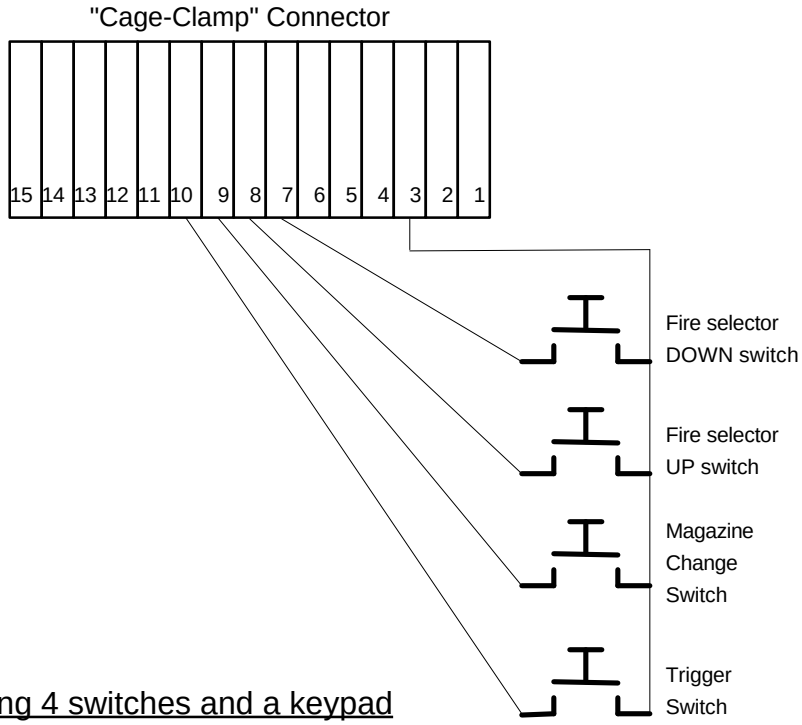


Example connection diagram

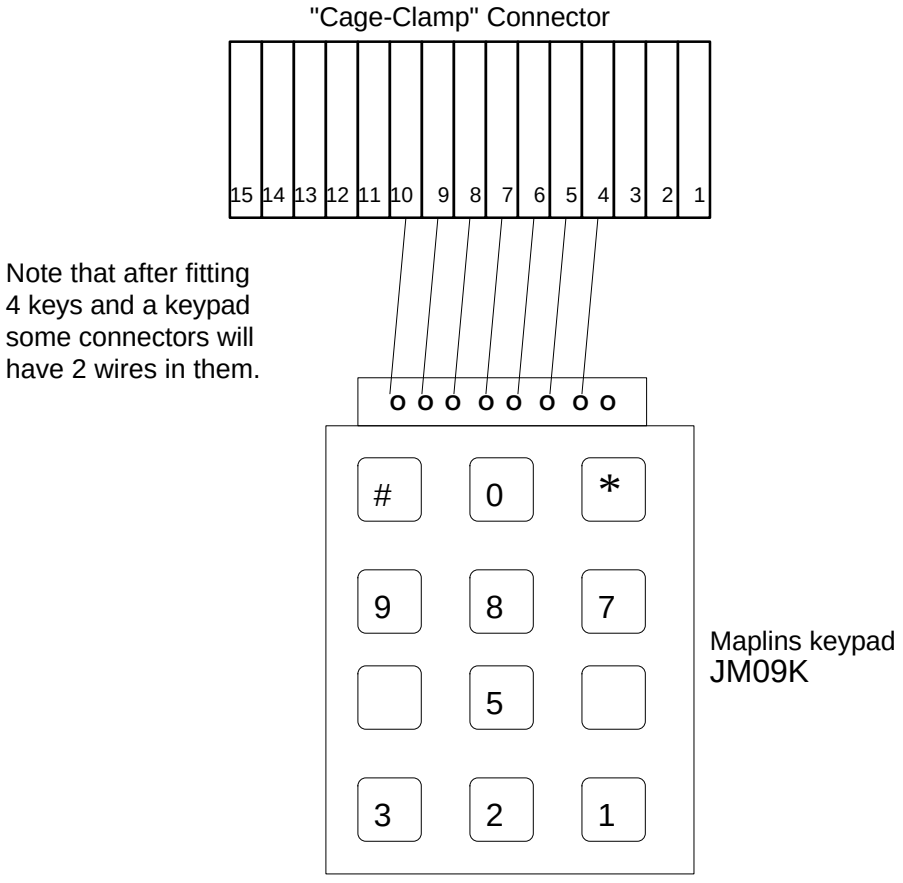
The cage-clamp connectors are operated by pushing down the operating lever with a small screwdriver or other pointed instrument, inserting the wire in the exposed hole and releasing the operating lever.

The Smart Gun electronic tag board.

Designed by, built by, and obtainable from: Dave Bodger.

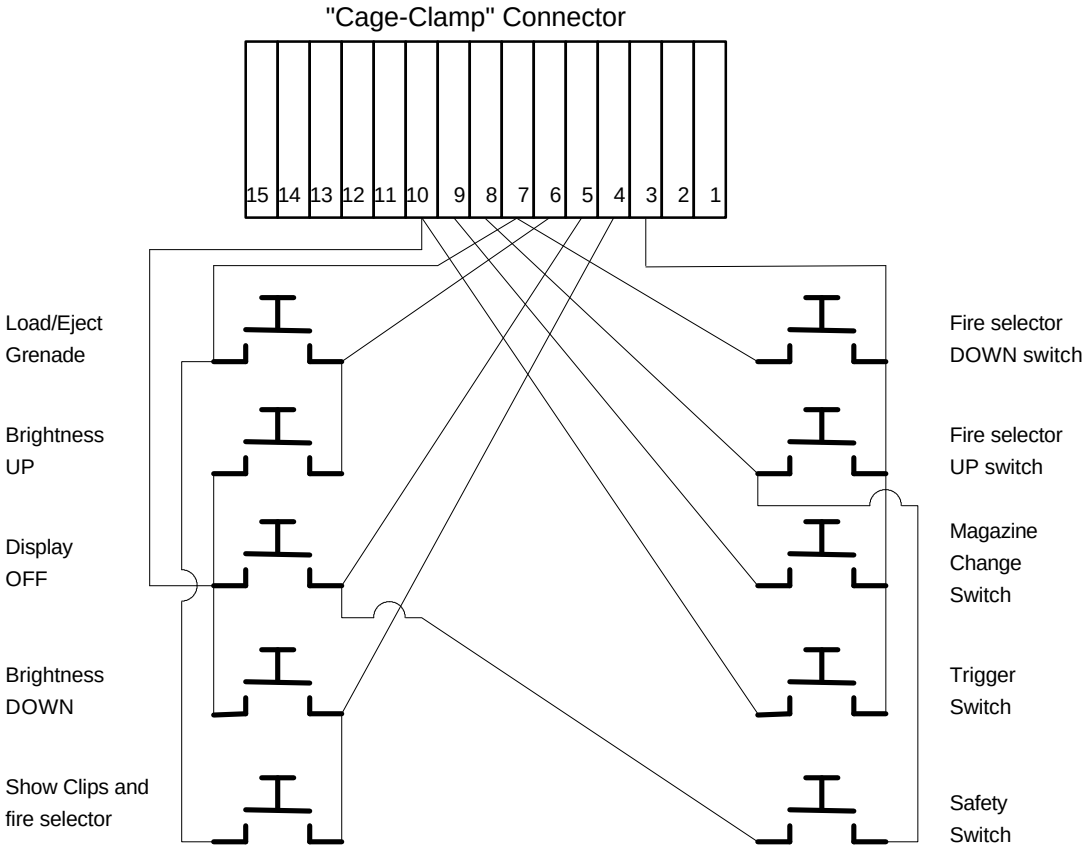


Example of fitting 4 switches and a keypad

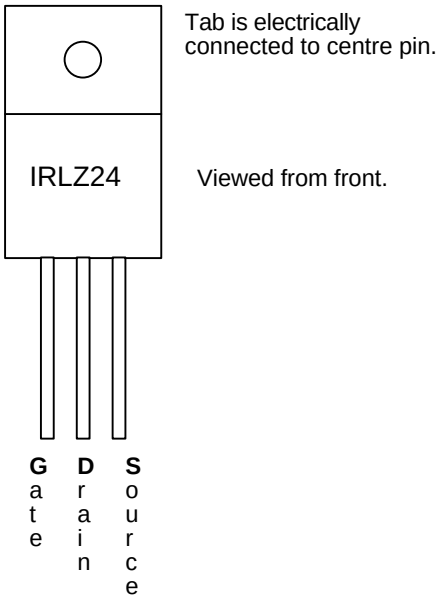


The Smart Gun electronic tag board.

Designed by, built by, and obtainable from: Dave Bodger.



Example of fitting 10 seperate control switches

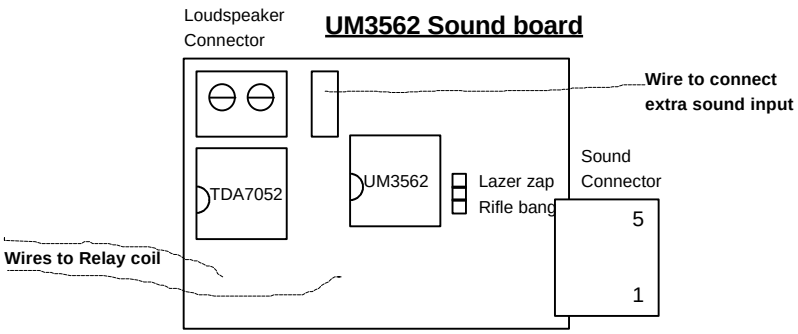


The Smart Gun electronic tag board.

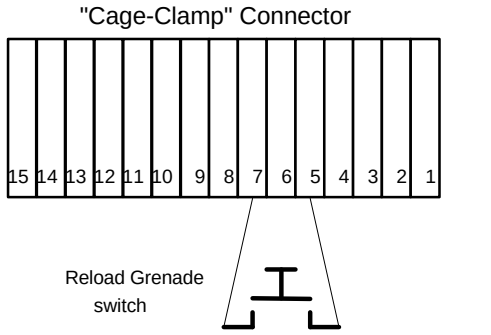
Designed by, built by, and obtainable from: Dave Bodger.

Custom Configuration for Two Lens Assemblies

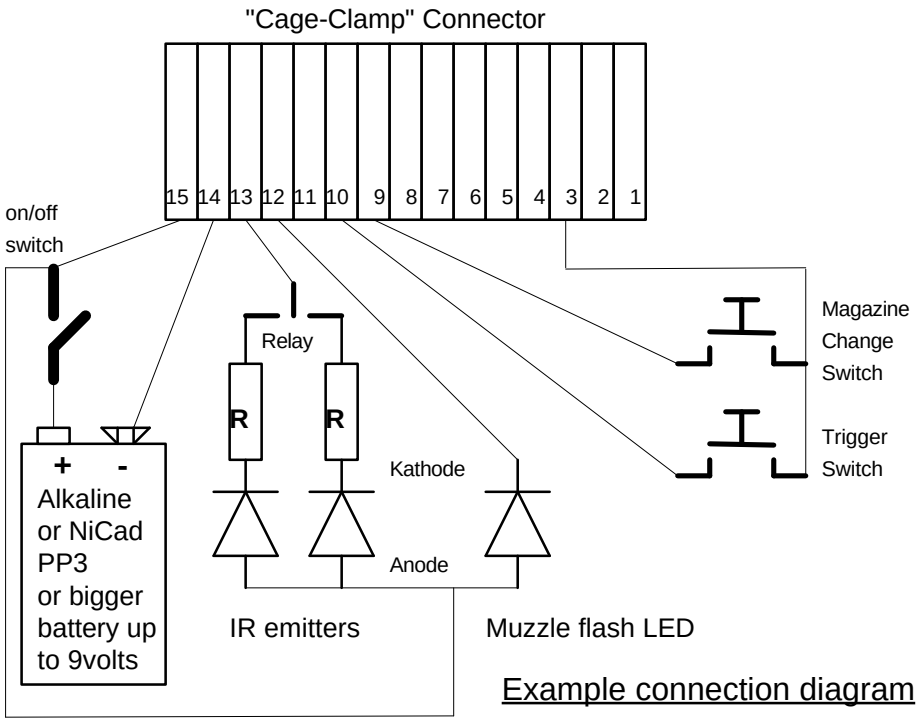
(Requires specially modified circuit boards)



N.B. use only 8 ohm or above speakers.



Example of fitting a 'Reload Grenades' switch.



Example connection diagram

R = Emitter resistors (see table for value).

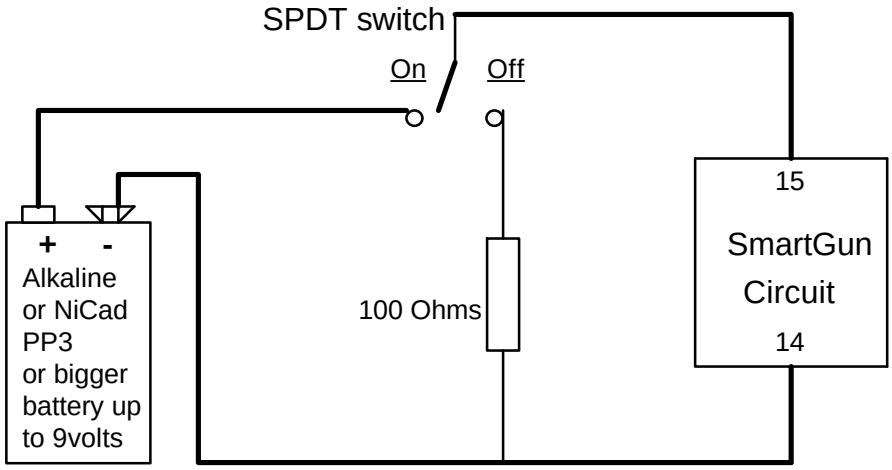
N.B. This board **MUST** be fitted with external emitter resistors. Direct connection can destroy components.

Battery Voltage	Emitter Resistor value in Ohms	Type of relay to be fitted
7.2	1.5	FJ42V
8.4	2.2	FJ42V
9.6	2.7	FJ42V
12	3.9	FJ43W

Maplins relays:- FJ42V Min 6V 6A Relay, FJ43W Min 12V 6A Relay.

The Smart Gun electronic tag board.

Designed by, built by, and obtainable from: Dave Bodger.



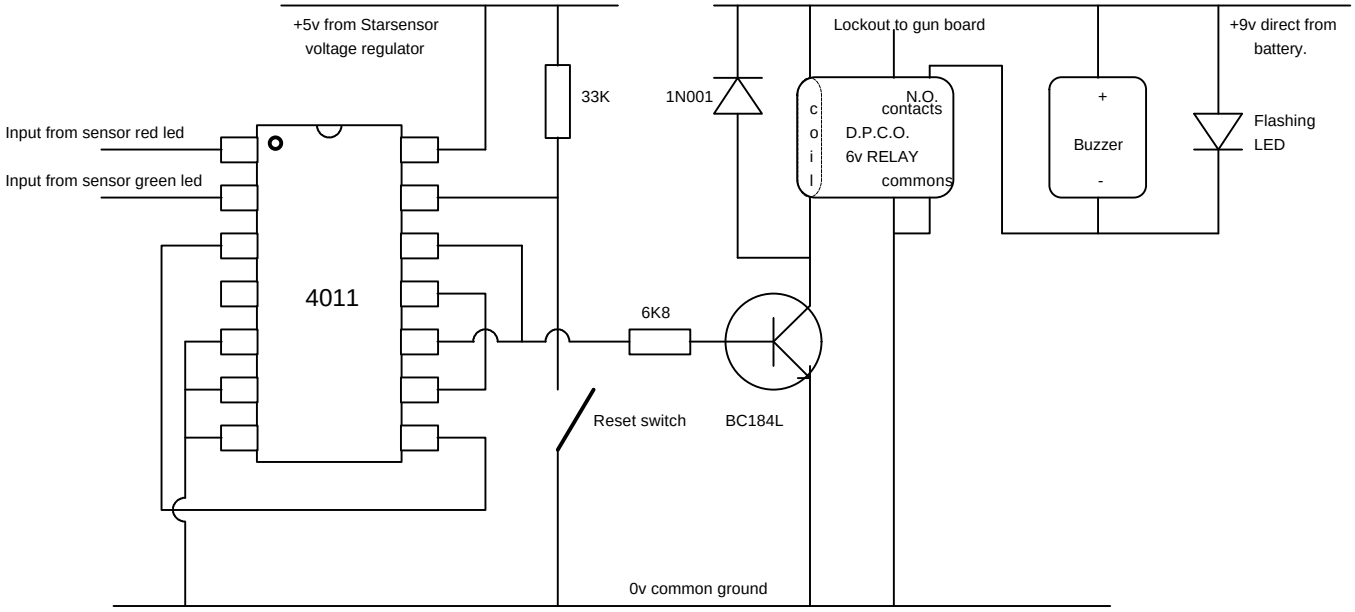
Power Switch detailed wiring diagram.

Lockout Feature.

The gun lockout signal is simply a matter of connecting cage clamp connector pin 5 to earth (zero volts). When not in the 'locked out' state, the input should be 'high impedence' or not connected.

It is therefore best to construct your sensor lockout circuit to perform this function either via a relay or by using an 'open collector' type output.

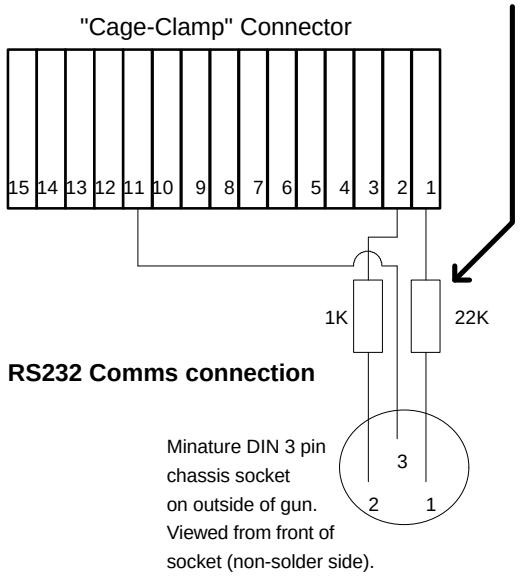
The standard buzzer board that some people use can be adapted so that it drives a double pole change over relay instead of driving the buzzer directly. One pole can then be used to activate the buzzer as usual and the other pole can be used to lockout the gun. The gun cannot fire until the sensor buzzer board is reset.



The Smart Gun electronic tag board.

Designed by, built by, and obtainable from: Dave Bodger.

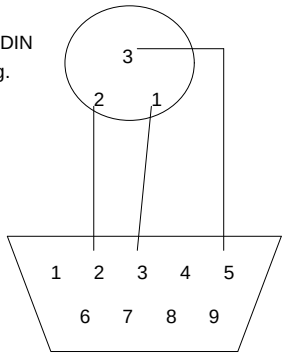
N.B. You MUST fit these resistors between the socket and the cage clamp connector or you may destroy the PIC microcontroller !



RS232 Comms connection

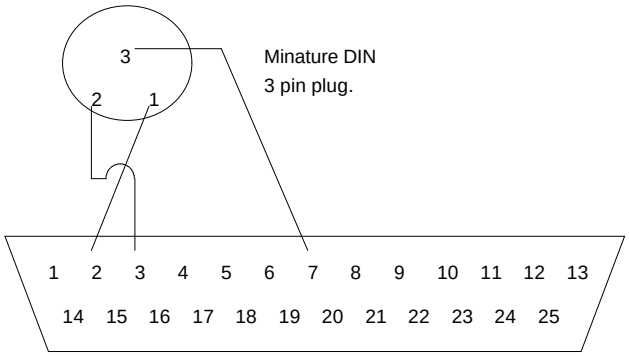
Minature DIN 3 pin chassis socket on outside of gun. Viewed from front of socket (non-solder side).

Minature DIN 3 pin plug.



Male 9 pin Din plug looking into the pins. Viewed from back (solder side).

Cable to connect to IBM PC serial port.



Male 25 pin Din plug looking into the pins. Viewed from back (solder side).

Cable to connect to IBM PC serial port.

