

## **Board Features:**

- **Drop-in replacement for the factory fit board.**
  - It can produce flat power curves through calibration procedure
  - No modifications or soldering required
  
- **12 user defined power levels**
  - The power of each power level can be changed in two ways. 1)By adjusting the calibration points. 2) By adjusting the capacitor's voltage.
  - 20 calibration points for each power level
  - independent capacitor's voltage for each power level in 0.1v steps.
  - Step less power curvatures
  - Adjustable "number of shots remaining" function for each power level
  
- **Hand made assembly with complete quality control**
  - Each board is individually tested prior to shipment
- **Live pressure reading on main screen**
- **Atmel 328 Microprocessor**
- **High quality Power mosfets with 200% current capability compared to original board**
- **Hi ripple, low ESR capacitors (3000uf in total compared to 2460uf of original) can deliver more power at high pressure regions.**
- **Low power consumption, ~16mA-25mA**
- **User customizable boot screen**
  - Capability to write your own boot message

### **CAUTION!:**

This circuit board generates a voltage of about 70v across the capacitor's terminals.

This voltage remains for a long time period after disconnecting the battery.

Keep your hands away from the back of the board while it is powered on, or has powered on recently.

Avoid touching with wet hands!

Do not install or uninstall if the circuit board has been powered on recently.

The capacitor's voltage needs about 1 hour after battery disconnect, to drop to about 20v. Removing the battery 2-3 hours prior to working with the board is advisable.

This warning is also applicable to the factory board.

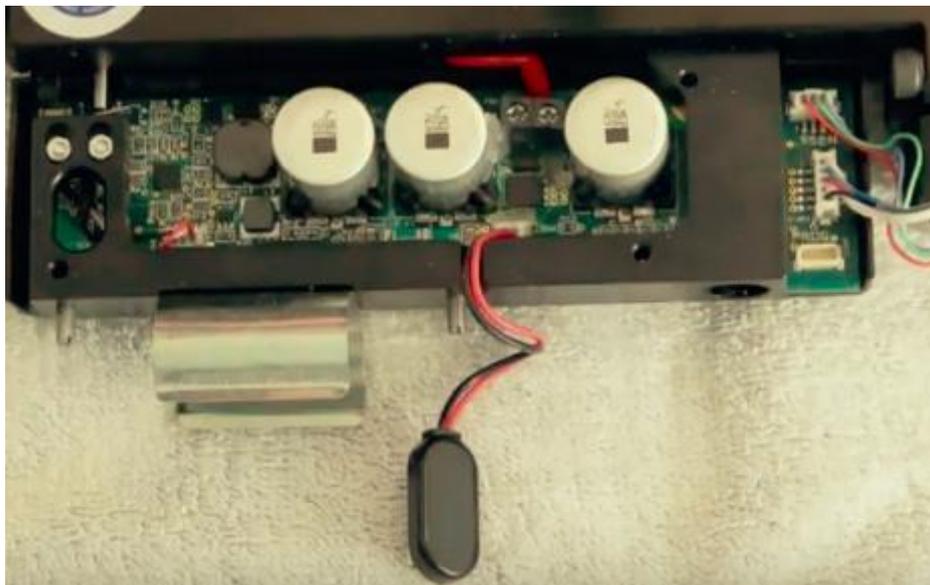
When installing and uninstalling the board, there may be some residual voltage. Be careful not to create a short circuit with a tool or loose screw!

## Installation Instructions

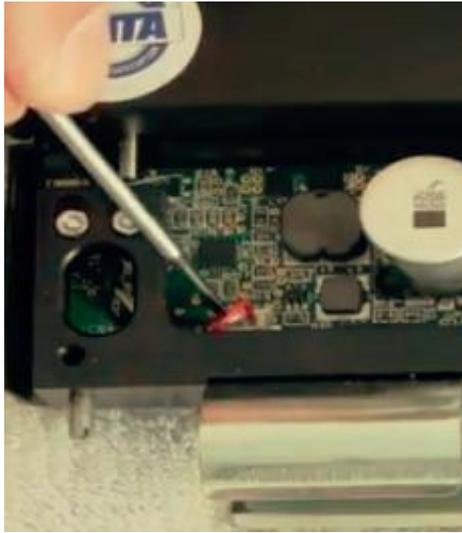
- 1) Remove the stock
- 2) Remove the battery, then wait at least 2 hours before removing the other connectors or you need to be extremely careful.



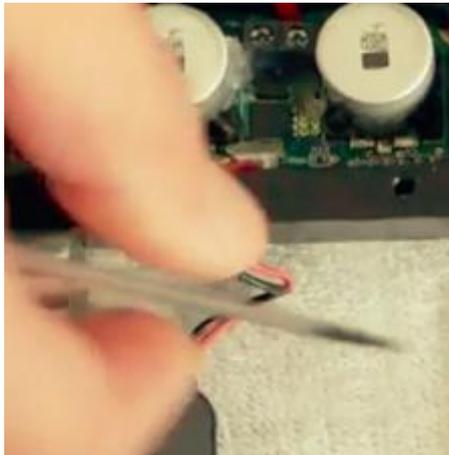
- 3) Remove three cover plate retaining screws;



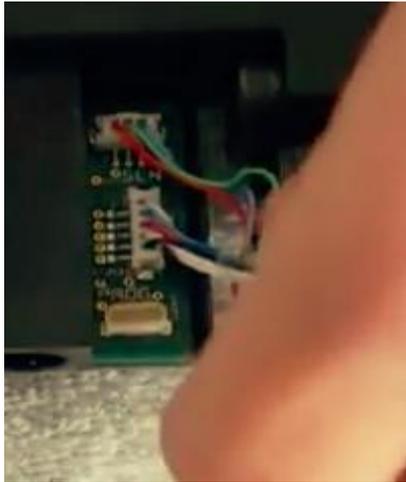
4) Carefully unplug the left side cable connector; (NOTE, depending on Pulsar model year, this connector maybe located as shown, or further up on the left hand side of the board, see second picture)



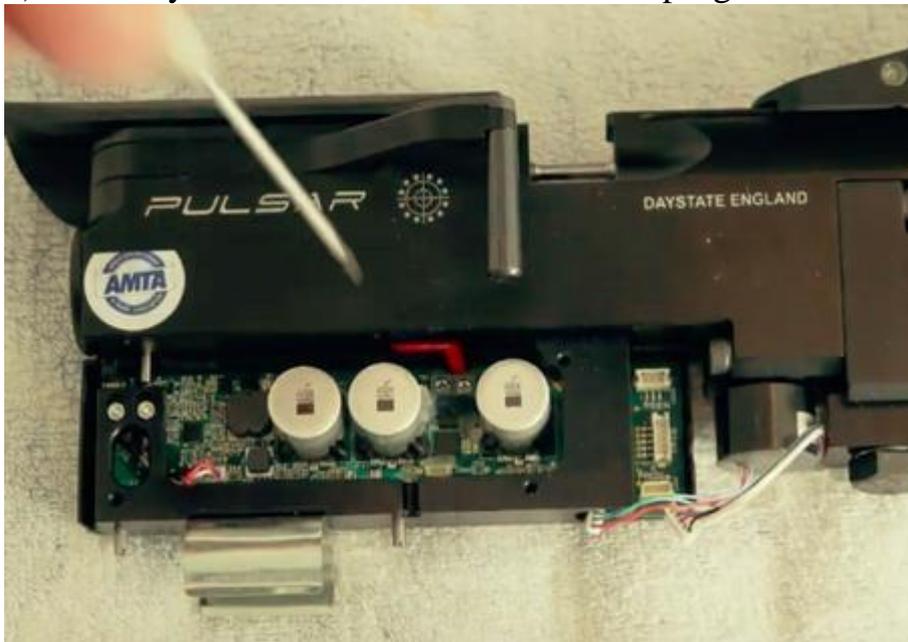
5) Remove the battery cable connector;



6) Remove the two cable connectors on the far right of the board;



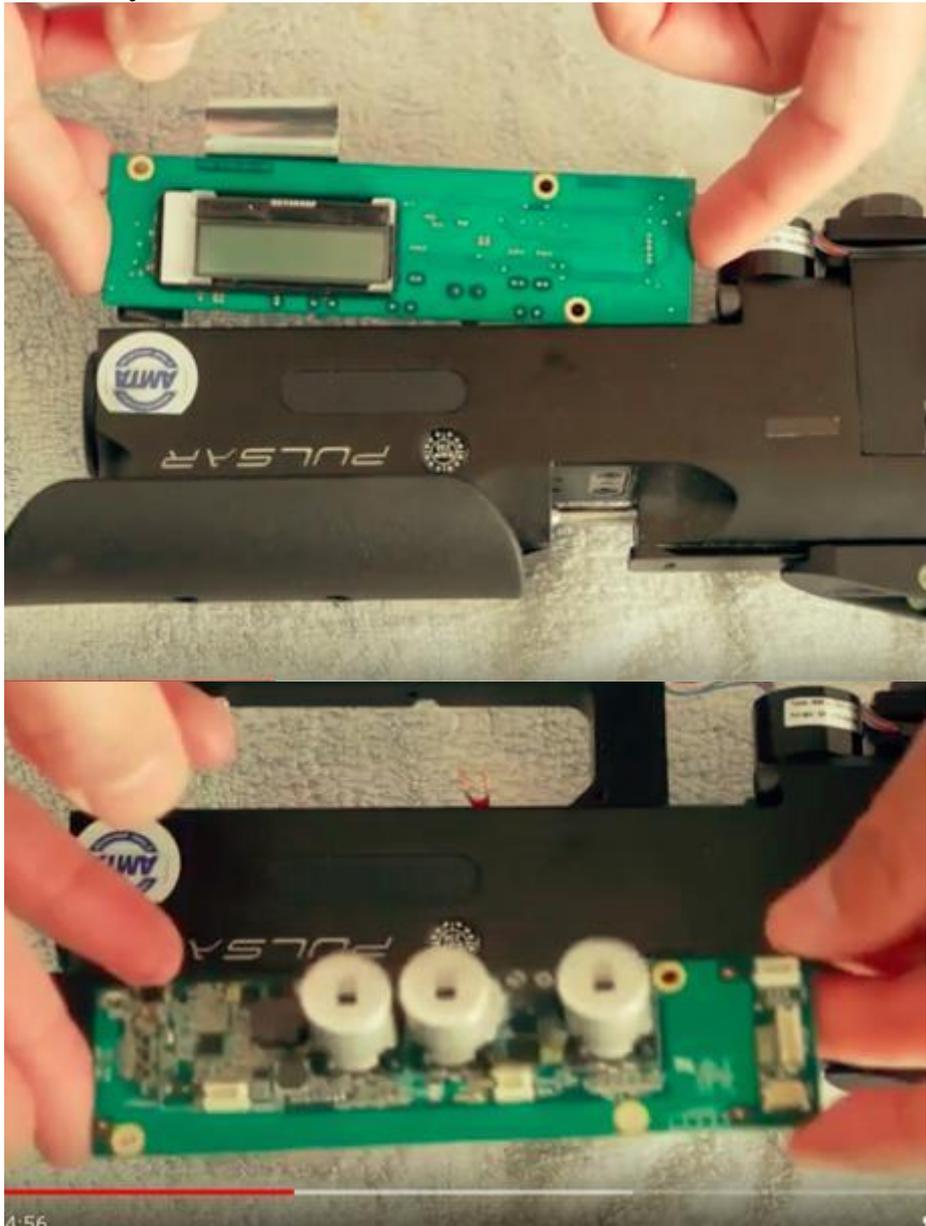
7) Carefully unscrew the two wires at the top right of the board;



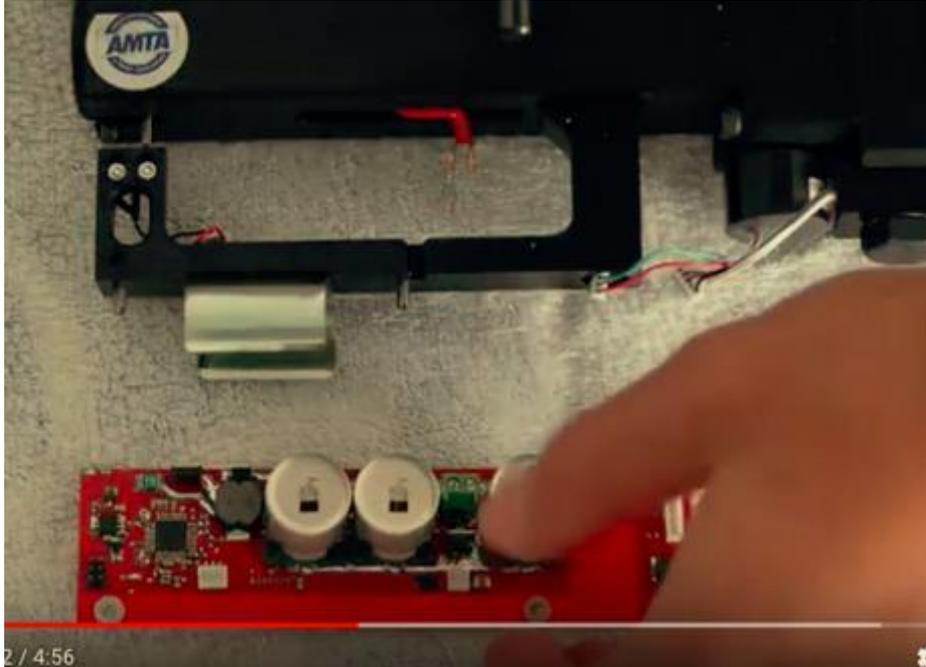
8) Carefully turn the rifle over and remove the three screws holding the LCD display side cover plate;



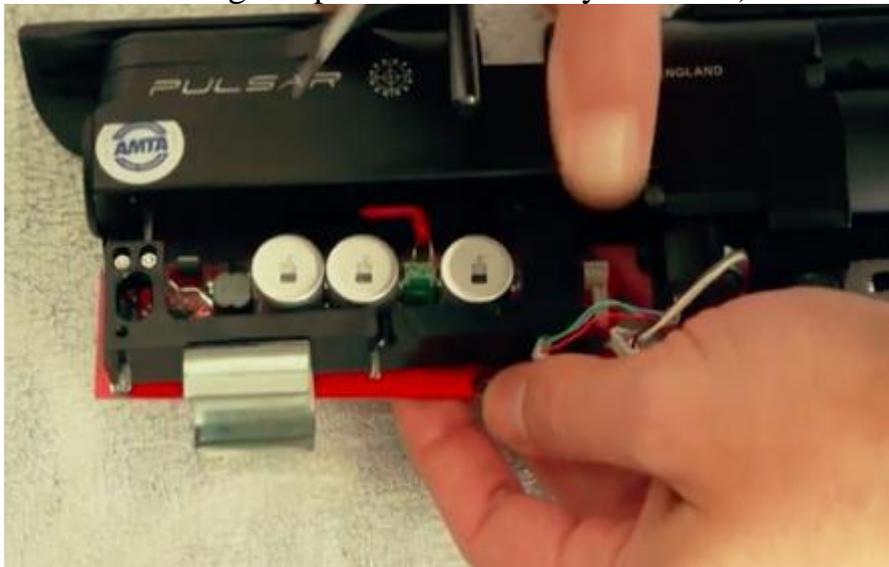
9) Gently remove the old board;

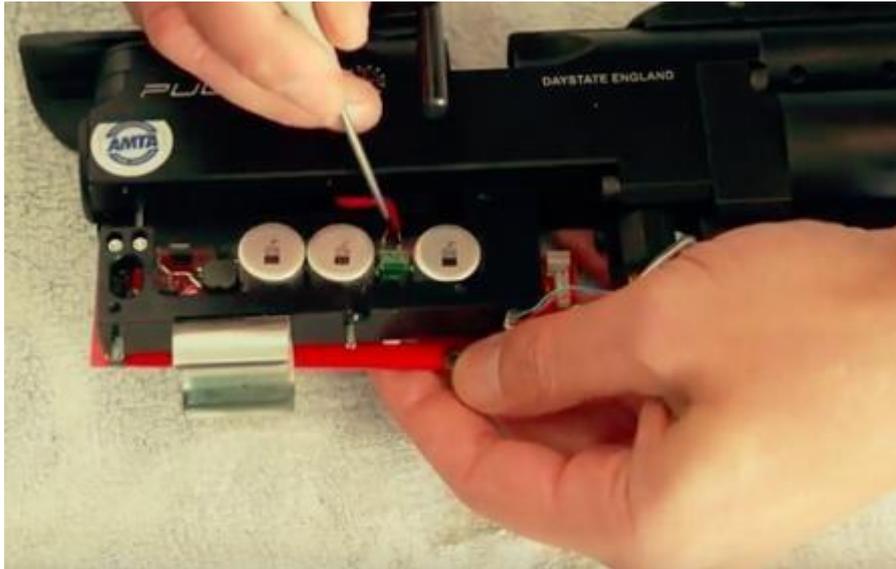


10) Gently turn the rifle over and place the new board in place;



11) With the new board in situ, reconnect the two wires at the top right of the board with the screwdriver, do not over tighten; (Note, they can be a bit fiddly to get into the holes, slacken off the screws some more to make the holes as large as possible and take your time!)





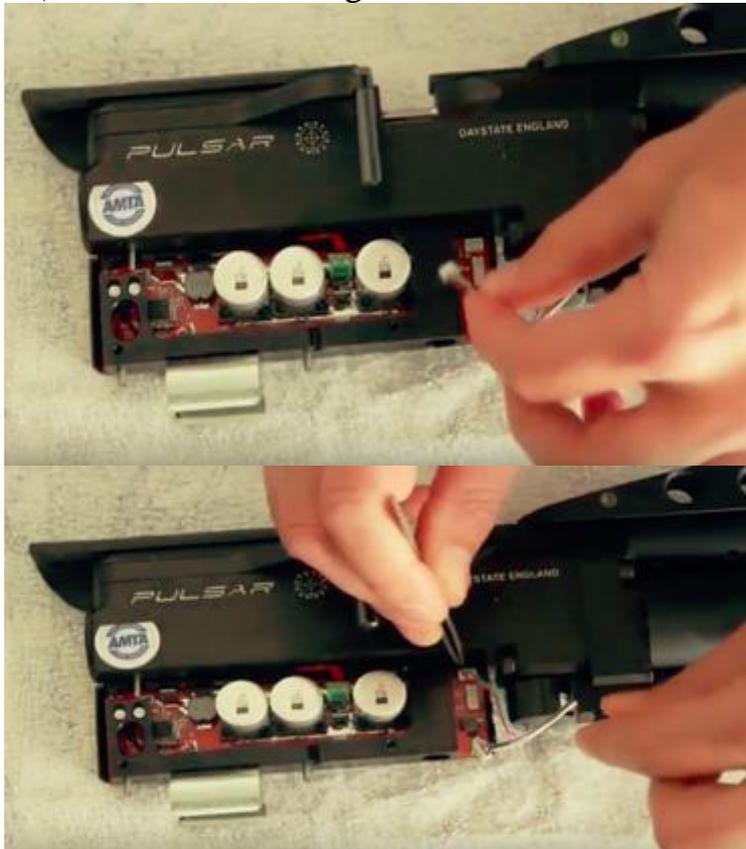
12) Gently turn the rifle over and reconnect the LCD display side cover;



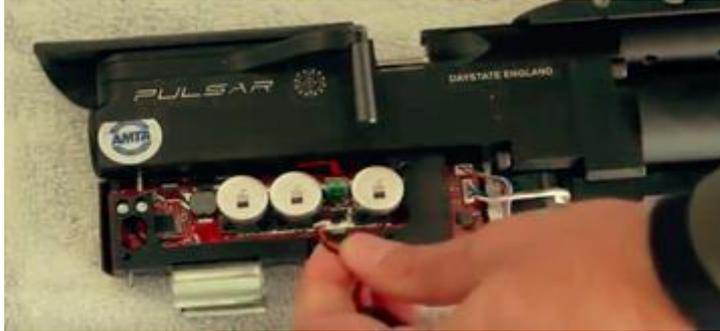
13) Once LCD display side cover secure, gently turn the rifle over and reconnect the far left cable connector;



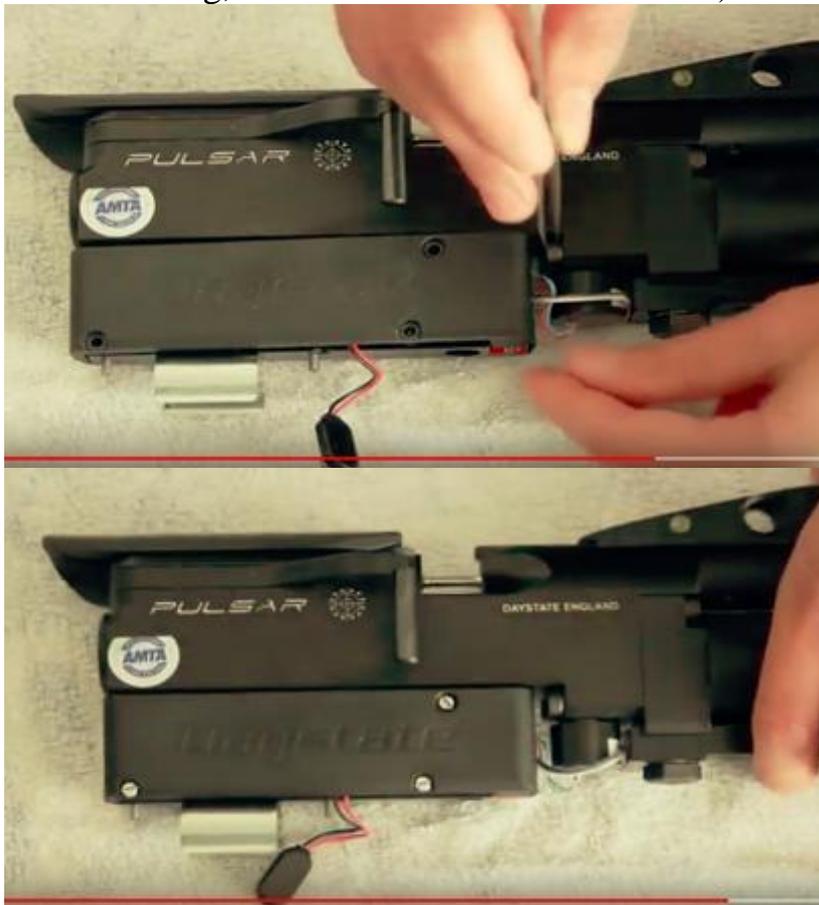
14) Then the two far right connectors;



15) Reconnect the battery cable



16) Now secure the cover; (NOTE, this cover has cut outs for the cables, when securing, ensure cables are in the cut outs)



17) Reconnect the battery.



### **Usage Instructions:**

This board has a Main Screen and the following 10 menu options:

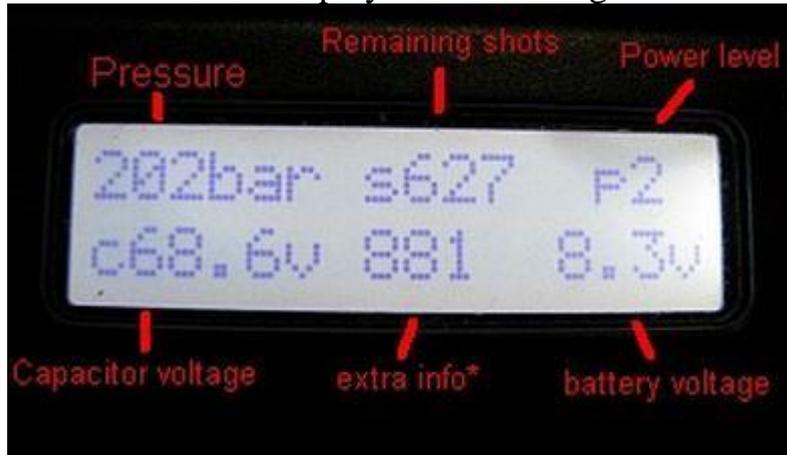
- 1) Set power level
- 2) Px capacitor voltage\*
- 3) Laser
- 4) LCD light
- 5) LCD extra info
- 6) Reduce shots

- 7) Px calibration\*
- 8) Px shots remaining calculator\*
- 9) Welcome screen
- 10) Text

\* x corresponds to the selected power level.

## Main Screen

The Main Screen displays the following information:



**Pressure:** Reservoir pressure in bars. This value is updated at about 2 times per second.

**Remaining shots:** This is an estimate based on the power level selection and reservoir pressure. This value can be adjusted in the Px shots remaining menu. If reservoir pressure is lower than the minimum for the specific power level, remaining shots will be equal to 0.

**Power level:** There are 12 Power Levels available to select. The levels are pre-programmed from about 6fpe to 37-40fpe. NOTE: The pre-programmed levels may not perfectly match your rifle. The actual performance will vary depending on caliber, reservoir volume, pellet selection, individual gun condition, etc. However, individual adjustment of the power level is possible through the Px calibration menu.

### **Capacitor voltage:**

The capacitor voltage may be adjusted through the set capacitor voltage menu. It is not recommended to increase capacitor's voltage above 73v, as it may shorten the component life span.

**Extra info:** This is optional information that can be turned off through the LCD extra info menu. In most applications, you will use this option to help you adjust the calibration of the power levels.

**Battery voltage:** This is the actual voltage of the battery. It is recommended that the battery be changed when the voltage drops below 6.8v (a fully charged nimh battery pack should read about 9.0v).

## **Menu Options**

To access the menu options, turn the power on (safety) switch while holding the trigger. Keep holding the trigger until the desired menu is displayed. Once you are in the desired menu, release the trigger. NOTE: this is different from the Pulsar manual, no operation of the cocking lever is necessary!

There are two types of trigger presses:

- 1) **Press** - The trigger is quickly pressed and released
- 2) **Hold** - The Trigger is pressed and held for about 3 seconds

### **1) Set power level**



**Hold** the trigger while switching on. Release when power level menu appears.

**Press** the trigger until the desired power level shows on screen.

**Hold** to save power level. A “saved” screen will appear and then a “turn switch off” screen. For safety reasons the air gun is locked. Switch off and back on again to start shooting.

### **2) Set Capacitor Voltage Px**



**Hold** the trigger while switching on. Release when capacitor voltage menu appears.

**Press** the trigger until desired voltage shows. The voltage will increment in 0.1v steps. Once the maximum setting is reached, the screen will return to the minimum voltage.

Minimum voltage = 62v. Maximum voltage = 76v.

**Hold** to save voltage level. A “saved” screen will appear and then a “turn switch off” screen. NOTE: This setting affects power levels independently. If you calibrate a power curve and then change this setting, your calibration may be off depending on how big the change was. Approximately 69-70v is the default voltage. If absolute maximum power is desired, it may be necessary to increase the capacitor voltage for one or more levels. Likewise, if lower power levels are desired, you can reduce the capacitor voltage. The pre-programmed curves are based on a capacitor voltage of 69v-70v. It is not recommended to increase voltage over 73v as it can shorten capacitor’s life.

When you switch from a level that uses higher capacitor voltage to a level with a lower one, the capacitor will discharged through solenoid producing some audible noise.

### **3/ Laser**

**Hold** the Trigger while switching on. Release when laser menu appears.

**Press** the trigger until desired mode shows.

Modes are

- 1) ‘on’
- 2) ‘off’
- 3) ‘off after shot’

**Hold** to save laser setting. A “saved” screen will appear and then a “turn switch off” screen.

#### 4) LCD Light



**Hold** the Trigger while switching on. Release when LCD light menu appears.

**Press** the trigger until desired mode shows.

**Hold** to save mode.

The available modes are

- 1) Continuously on.
- 2) On for 4 seconds after powering on, then permanently off.
- 3) On for 4 seconds after powering on and after a shot is taken.
- 4) Continuously off.

#### 5) LCD Extra Info



**Hold** the trigger while switching on. Release when LCD extra info menu appears.

**Press** the trigger until desired mode shows.

**Hold** to save mode.

The available modes are:

- 1) Off
- 2) pulse\_W - The pulse width (in microseconds) value shows in the second line of the main screen.
- 3) pulse\_W+Rp - The pulse width value shows in the second line of the main screen and the pressure reading changes from bar to the raw data from the pressure sensor.

## 6) Reduce Shots



**Hold** the Trigger while switching on. Release when reduce shots menu appears.

**Press** the trigger until desired number shows.

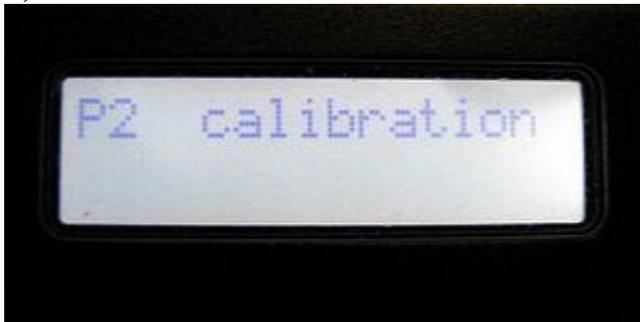
**Hold** to save number. A “saved” screen will appear and then a “turn switch off” screen. This option affects all power levels. It is intended to set the maximum number of shots that can be taken before the power/safety switch needs to be cycled to reset.

The options are:

- 1) Unlimited
- 2) 1-50: One could select “1” for single shot, “10” for a full magazine, “5” so you don’t overdo it when doing groupings, etc.

When the selected number is reached you need to turn off the main switch and on again to keep shooting.

## 6) Px Calibration



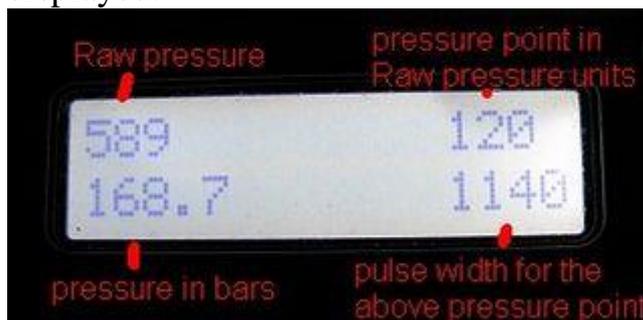
Before discussing the settings in this menu, we will cover some theory on how the board works. This will help you understand what the settings do and how to use them to customize each of the 12 power levels to your specific gun, pellet and power preference.

As you probably know, this system works by reading the pressure in the air reservoir and then sending a pulse of current through a solenoid for a predetermined amount of time. That amount of time is the “pulse width”. The pulse width will affect how hard the hammer strikes the air reservoir valve. By “mapping” the reservoir pressure to a pulse width, it is possible to strike the reservoir valve with just the right amount of momentum to maintain a constant pellet velocity.

The relationship between the pressure and the pulse width is not linear and can vary depending on the desired power, the pellet weight, caliber,

etc. This board uses 20 pairs of pressure and pulse widths (for each power level) to define the relationship. The pressure for the 20 pairs of data range from about 55 to 245 bar in even increments. The pulse width for each pair is user adjustable. The ability to perform this adjustment is what enables this board to tailor each power level to the needs of the user giving an enormous amount of flexibility not present in the factory board. In this menu, you will also see the “raw” pressure data from the electronics on the board. Raw pressure is measured in the native 10bit analogue to digital mcu converter scale . It gives values from 0 to 1023. As you may remember, one of the prior options was to display this raw data on the main screen instead of bar. In order to achieve the best possible accuracy, calculations are done with the raw data. The ability to display the raw pressure data on the main screen was done with the intent to provide the maximum amount of accuracy available (one “raw” pressure unit is equivalent to about 1/4 of a bar. Accurate conversion is : bars = 0.244\*raw pressure +25 ).

After selecting the Px Calibration menu, the following screen is displayed:



**Hold** the Trigger while switching on .Release when calibration Menu appears.

**Press** the trigger repeatedly to cycle though the 20 pressure & pulse width calibration points.

On the left side of the screen you can see the actual reservoir pressure in raw and bar format. This is a live reading of the pressure in your gun’s reservoir. If you were to fill or drain air, you’ll see this number change.

On the right side of the screen you can see the selected raw pressure value and below it, the corresponding user adjustable pulse width.

To make changes:

**Hold** the trigger to edit the pulse width of the selected point. A single index number will be shown in the middle of the second line and **Press** the trigger to modify the first digit of the 4 digit number. **Hold** the trigger to temporarily save this digit and do the same for the next 3 digits. When you save the last digit a “press & hold to save” screen will appear. If you

know that this is the right value **Hold** the trigger to save number. A “data saved” screen will appear and then will return to the calibration menu. At this point, the board has a feature to allow “real time” adjustment of the values. If you want to use this feature, fill the reservoir to the pressure setting you are about to adjust. Have your pellets ready and be in an area where it is safe to shoot.

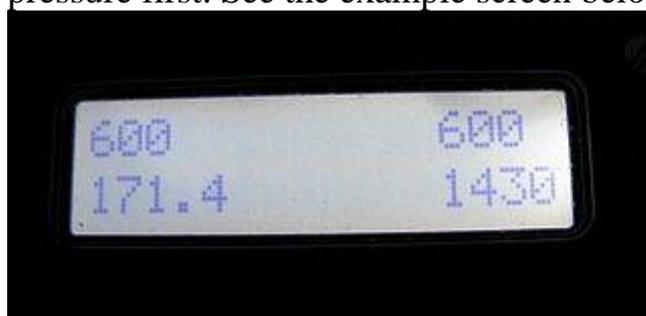
**Caution!! Always keep the muzzle pointing in a safe direction.**

To enter this feature, rather than doing a trigger **Hold**, do a trigger **Press**. A “Press & hold for test shot” screen will appear. If you now **Hold** the trigger a “Ready to shoot!” warning screen will appear. You may now take a test shot.

**Caution!! Always keep the muzzle pointing in a safe direction.**

After the test shot is taken a “press & hold to save” screen will appear. If the velocity of the pellet was good enough **Hold** to save the value. If not, **Press** the trigger and you will get back in the calibration menu and not save the value you entered. For the power calibration procedure, you will need a chronograph and good quality pellets. It is recommended the use of weighted pellets.

In the case that you are trying test shots to find the right pulse width value for a specific pressure point you must fill the gun with air at the right pressure first. See the example screen below.



Note how the left hand side live pressure reading (raw units) matches the right hand side pressure point for the curve. It is not critical filling to the exact pressure ,but close enough (2-3 units).

Example : You want to build a curve that shoots the 18.1gn jsb’s @ 260m/s.

You have selected the power level of your choice and you are in the screen show above.

Fill the gun to the maximum pressure of about 230 bars. This is equivalent to “840” in raw units. Select the pressure point “840”. Set a

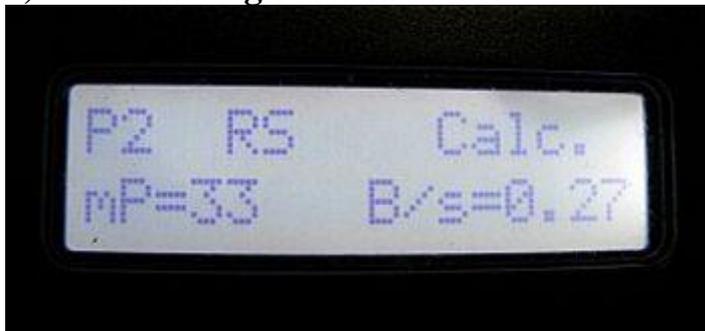
pulse width and make a test shot. If the velocity is not close enough to 260m/s refill air to 840 and repeat the procedure. When you find the right pulse width that produces the desired speed save it. Make some blank shots to drop the pressure to 800raw units and go to the next lower pressure point, 800. Repeat until you get to the pressure that is not capable of producing the selected velocity. Fill all the lower points with the same last pulse width value.

You can also start from a low pressure point and go upwards.

Note: Calibration points are provided for raw values above 840 for unique circumstances and it is not advised to try to exceed the manufacturer's pressure recommendation. You should fill these values with the same pulse width as you found worked for 840, or a bit higher. However, as with other things in this board, those values are provided for maximum flexibility should you want to calibrate at higher pressures.

In summary, the 12 power levels are pre-filled with values that should get you close to a decent calibration. Experiment with your own gun first and see if this meets your needs. If not, find one of the pre-filled power levels that is close to your needs. Get in the calibration menu and write down the data pairs for an easy review. You can then modify the values to create a flat curve.

### 8)Px Remaining shots calculator



This menu allows you to make adjustments to the remaining shots calculator for each power level.

You need to provide 2 values;

- 1) Minimum Pressure (mP) – This is the lowest pressure in bar that delivers the desired power for a particular power level (Ex. After calibration you find out that 150bar is the lowest pressure you can shoot at 35fpe).

2) Bars/shot (B/s) – This is the average air consumption for your power level.

**Hold** the Trigger while switching on .Release when remaining shots Menu appears. **Press** the trigger until the desired Minimum Pressure (mP) shows. **Hold** the trigger to save value. Then **Press** the trigger until the desired air consumption (B/s) shows. **Hold** the trigger to save value.

You can measure the air consumption by shooting 10 shots and applying (initial pressure – final pressure) / 10. It is better doing that in the middle of the working pressure spectrum for the specific level, as air consumption is lower at high pressure and higher at low pressure. You can also choose to shoot from your highest to lowest calibrated value, count the number of shots and determine the average consumption for your power level. This may use more air and time but would be more accurate. NOTE: This setting provides an estimate and may not be 100% accurate. Ultimately, your minimum calibrated pressure will dictate how many consistent shots you can get.

## 9) Welcome screen



**Hold** the Trigger while switching on .Release when welcome screen Menu appears. **Press** the trigger until desired mode shows. **Hold** the trigger to save the selection.

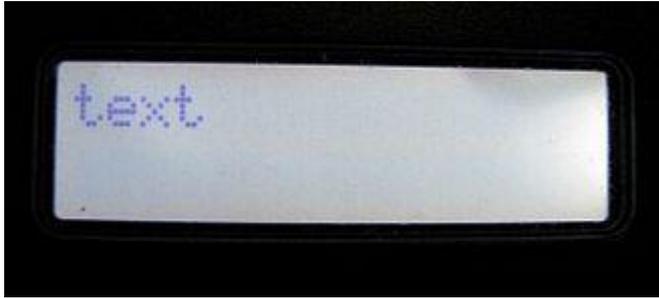
The available modes are:

- 1) Disable
- 2) Enable 0.5 seconds
- 3) Enable 1 second
- 4) Enable 2 seconds.

NOTE: Welcome Screen text is set in menu 10 “Text”.

## 10) Text

Text that appears in the welcome screen, if it is enabled.



**Hold** the Trigger while switching on .Release when text menu appears. After releasing the trigger in the text menu, the previous saved text is shown for 2 seconds and then a blank screen. **Press** the trigger until the desired character shows on screen.

**Hold** the trigger to save the selected character and go to the next. The first 2 trigger **presses** are spaces. You can save them too in order to have separate words. If you save by mistake a wrong character you must start the procedure from the beginning.

## Troubleshooting

1)The board gets in menu mode after a shot is taken:

The calibration menu allows a wide selection of pulse widths in order to be compatible with a wide range of solenoids. If you set a very long pulse width in regards to your solenoid, the power capacitors will completely discharged through solenoid and then power will be consumed directly from the battery. This will cause an automatic Mcu reset. Modify pulse width values in the calibration menu. Pulse duration above 3500us is probably too much.