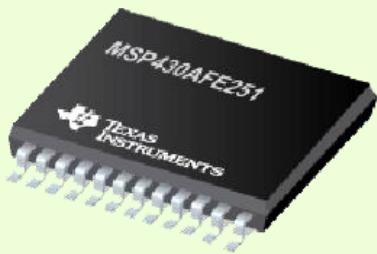


# EDGUN DIGITAL MEASURING SYSTEM

EDgun is proud to introduce a new innovative manometer; the EDgun Digital Measuring System (EDMS). The new EDMS is much more than a gauge that reads pressure. This system is designed to interface with the user on many levels. The EDMS will provide constant feedback on pressure, efficiency, shot count and the gun's performance. This groundbreaking device will help the user get the most out of the Pre-Charged Pneumatic airgun.

## EDMS Hardware



The EDMS is built around the MSP430AFE251 microcontroller with low power consumption. Controller MSP430AFE251 relates to the line of microcontrollers series AFE2xx from Texas Instruments. This microcontroller is a high-performance device and equipped with a built-in delta-sigma module

of a second-order converter with a dynamic range of more than 100 dB. This series of microcontrollers characterized by extreme accuracy and minimum power consumption.



The gauge uses a solid ceramic pressure sensor made of aluminum oxide ceramics from Metallux (Switzerland). On one of the inner sides of the sensor is a thick-film membrane. The housing contains contacts for connecting the wire leads. High accuracy of the sensor achieved through laser matching of the resistive bridge and temperature compensation. As a result, the error of the

output signal is  $\pm 0.1$  mV/V. Monolithic ceramic pressure sensors manufactured by Metallux, have stable output, possess resistance against various environments. Metallux sensors possess excellent mechanical properties widely used in analog measuring systems, and in pressure monitoring systems. These sensors commonly used in high-performance automobiles by famous manufacturers such as Audi and BMW.

The EDMS uses the Winstar OLED display with a resolution of 64x32 pixels. Displays built on OLED technology have several advantages over conventional LCD and VFD technologies.

## OLED Display Features:

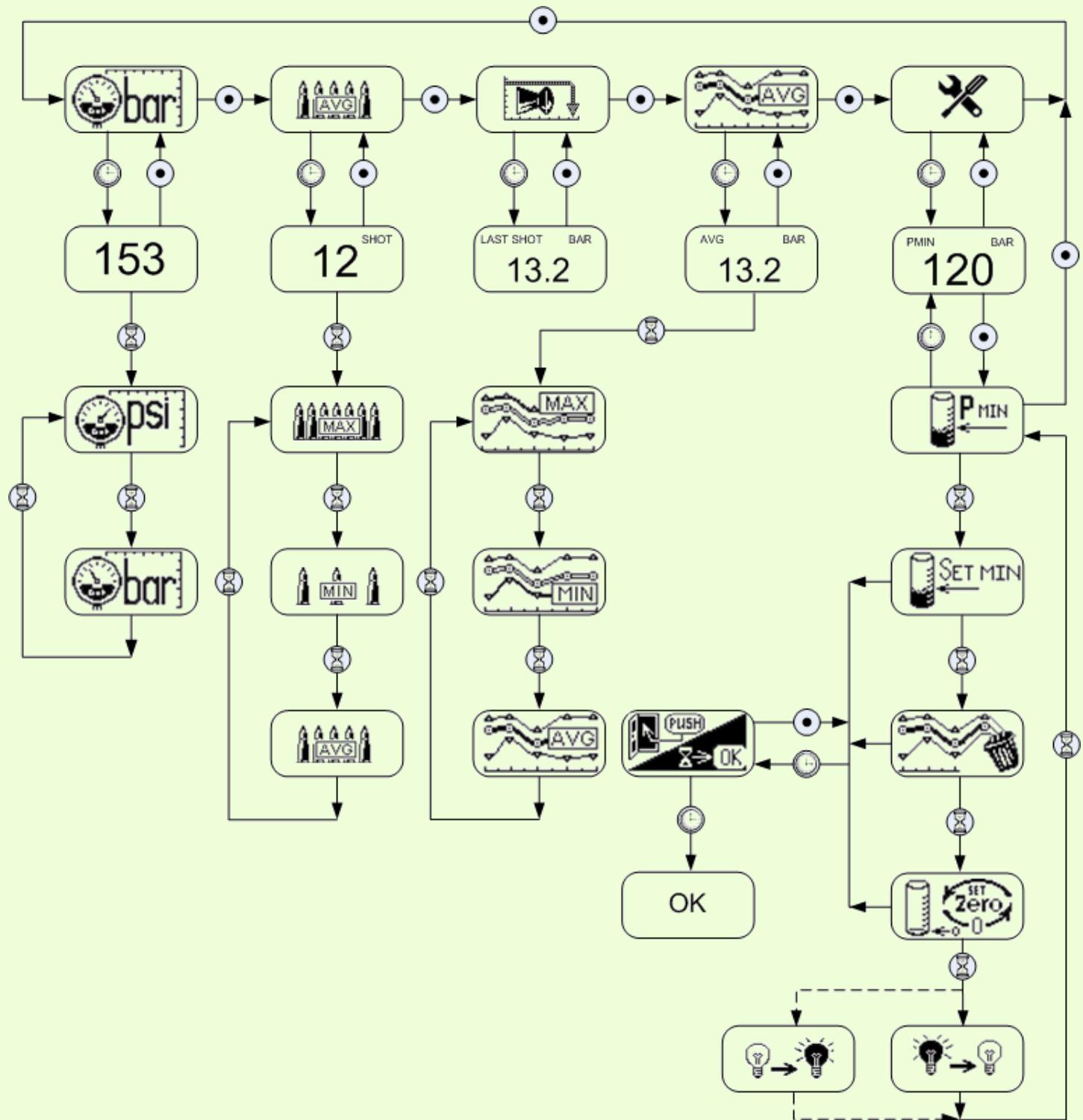
- OLED emits light, no backlight needed
- Wide viewing angle (over 175 degrees)
- Fast response speed
- High brightness
- High contrast
- Wide range of operating temperatures - 40° / + 85 °C;
- Lower energy consumption;
- Readable in sunlight.



## 1. EDMS Menu Layout

Browsing the menu of the gauge the EDMS, at first glance, seems overly complicated, however with some patience and this manual the user will find the new system extremely helpful.

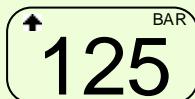
The logic of the manometer will work intuitively. After the user gains experience with the system, the information from the EDMS will provide the owner with valuable data that will help get the most out of the airgun.



● Push the button

⌚ Wait with the button pushed

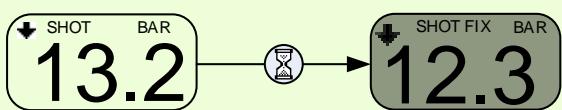
⌚ Wait



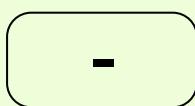
The "Filling" mode displays the pressure in the Bar or PSI. This works from any menu item except "Shots left" mode.



"Filling" mode displays the number of shots left. Works from the menu item "Shots left"



"Shot" mode. After the shot, the dynamic pressure difference before and after the shot is displayed. The thermodynamic equilibrium is established in the reservoir, the image is inverted and the fixed flow value is displayed in Bar or Psi



The statistics on the shots are not accumulated (at the first start after replacing the battery and resetting the statistics). It is displayed in the menu "Shots left" and "Statistics"



The pressure fell below the minimum. Displayed in the menu "Shots left"



Battery low

## 1. Activating the gauge

Turn on the pressure gauge by briefly pressing the button.

If the battery charge level falls below the threshold, the following image is displayed:



And the gauge will turn off.

Initially after turning on the animated screensaver is displayed:



After the animation finished, the menu item of the gauge is displayed. The EDMS mode will be where the user left it during its last use. This feature designed in the system so the user can choose their favorite setting and return to it without needing to scroll through the menu.

The operating cycle of the manometer consists of three stages-modes:

### ***1. Operating mode, the screen is on***

The pressure gauge displays the current data, and after 5-7 seconds it turns off the screen and goes to the second stage "Operating mode, the screen is off."

Each press of the button prolongs the time of the manometer in the first stage.

### ***2. Operating mode, the screen is off***

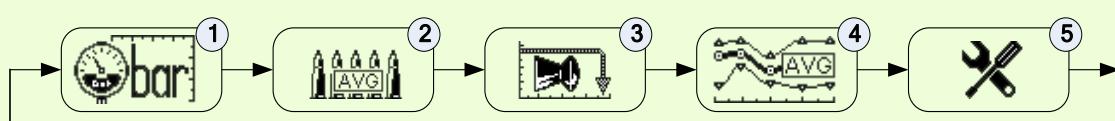
- a. The pressure gauge continues to function for another 40 seconds with the screen off (that is, it records the pressure change and, if any, turns on the screen).
- b. Pressing the button brings you to the first stage and activates the screen.
- c. If the stage time has expired, then the stage 3 - the "sleep" mode is engaged.

### ***3. Sleep mode stage***

- d. The pressure gauge goes into reduced consumption mode. The pressure sensor is not interrogated, the screen is off. That is, if the pressure changes (shot or pumping), the pressure gauge will not show a display.
- e. Exit the sleep mode by pressing the button.

## **2. Menu of the gauge**

The layout of the title menu is shown in the picture:



## Glossary of Terms:

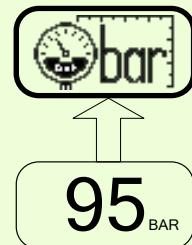
1. Display of the pressure value.
2. Displays of the number of remaining shots
3. Flow display for the last shot (Bar or Psi)
4. Statistics display.
5. Settings.

## Navigating the menu

- To switch between the menu items, press the button

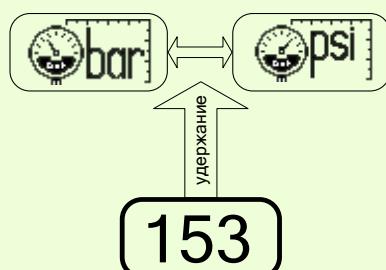


- After the menu item is displayed, the current value for this item is displayed.



- Pressing the button when the value is displayed returns to the current menu item.
- Pressing and holding the button while displaying the value will show the current menu item and then cycle through the display mode of this menu item.

For example, in the "Pressure value display" menu item, when you press and hold the button while the pressure value is displayed, you will cycle the pressure units bar or PSI.

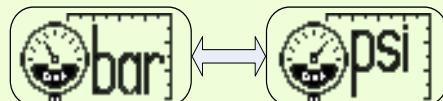


- The selected menu item held from the previous use, and the next time it starts, the display begins with the last display used. Exception - menu item "Settings."
- If the button held more than 10 seconds, the gauge is turned off. This feature prevents the possibility of accidentally pressing the pressure gauge button in (i.e. in the gun case) and completely discharging the battery.

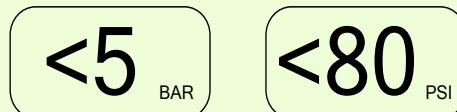
## **1. Menu item "Display pressure value"**



- Displays the pressure in the current unit (Bar or PSI)
- When the button is held down, the pressure value is displayed, the current unit is cyclically changed



- The selected unit applies to all output data in other menu items.
- If the current pressure level is less than 5 bar or 80 PSI, the corresponding symbol



## **2. Menu item "Display of the number of remaining shots"**



- Displays the forecast for the stock of shots.
- If you hold the button while the menu item is displayed, the current forecast is cyclically changed: MIN - minimum quantity (pessimistic), MAX - maximum amount (optimistic), AVG - average (most probable) shot stock



- If there is still no data to analyze (you have not made a single shot yet), a dash is displayed



- If the current pressure becomes less than the set as default Pmin (120 Bar by default, the user can change this value independently in the settings), a warning is displayed
- 



**Please pay attention** Please pay attention to the following feature: when the pressure rises, the temperature rises, when the pressure drops, the temperature drops. Thus, when the air pumped into the reservoir, the temperature inside it grows, and when you shoot your gun, it falls.

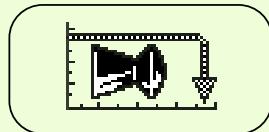
As a result, We decided to artificially limit the "monitoring" time for changing the pressure to give the user the opportunity to receive data without long waiting.

Thus, if you are conducting "tempo" shooting, the gauge will not be able to track the actual pressure drop (without taking into account the temperature dependence), and there may be errors in calculating the remaining number of shots.

The EDMS will predict the efficiency based on the gun's current usage. Like a car predicts the number of miles left in your tank as you're driving. The anticipated miles will change if you travel on the highway versus stop and go city driving. The same methodology applies to the EDMS tracking. The EDMS understands the ratio of pressure increase and heat. Therefore the EDMS slightly overstates the pressure drop per shot. And if, for example, to make ten shots and sum up the pressure drops for each shot, this amount will be slightly more significant than the difference between the initial pressure and the pressure after the 10th shot, because as long as ten shots fired, the tank continuously exchanged heat with the environment.

To whom the foregoing seemed difficult, simple advice, for a more accurate assessment of the number of shots, let the tank level the temperature, that is, do not shoot quickly ☺

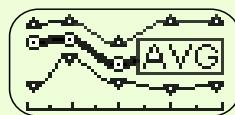
### **3 The menu item "Displays the usage for the last shot"**



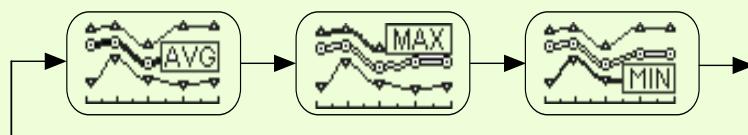
- The pressure difference before and after the shot is displayed.

***Please pay attention***, that the "air consumption per shot" is shown in the units you have chosen and is not a universal value, but only shows the pressure drop in the tank in this particular rifle, when firing at specific settings, with the chosen ammunition.

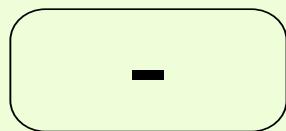
### **4 Menu item "Statistics display"**



- The flow statistics are displayed.
- The user holds the button while the menu item displayed on the EDMS. The current mode of statistics display cyclically changed: MIN is the minimum value of the air consumption for the shot, MAX is the maximum value of the air consumption for the shot, AVG is the average value of the air consumption for the shot..



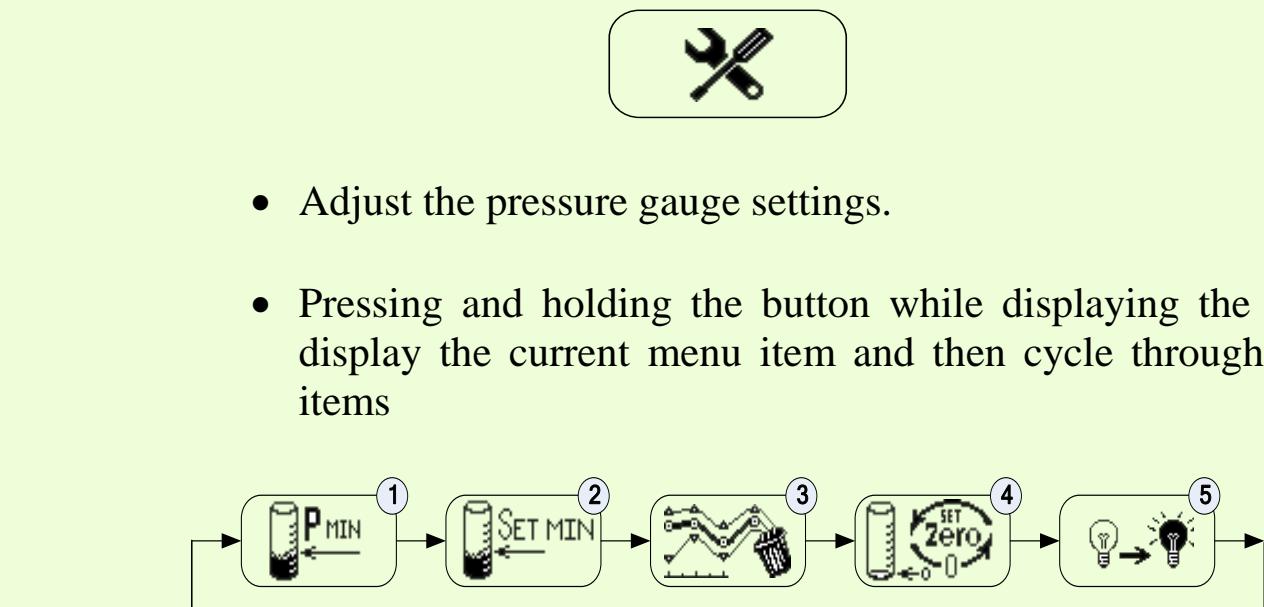
- If there is still no data to analyze (you have not made a single shot yet), a dash is displayed



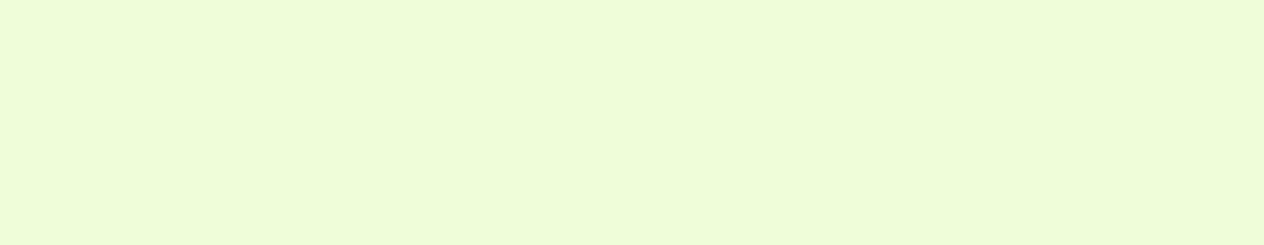
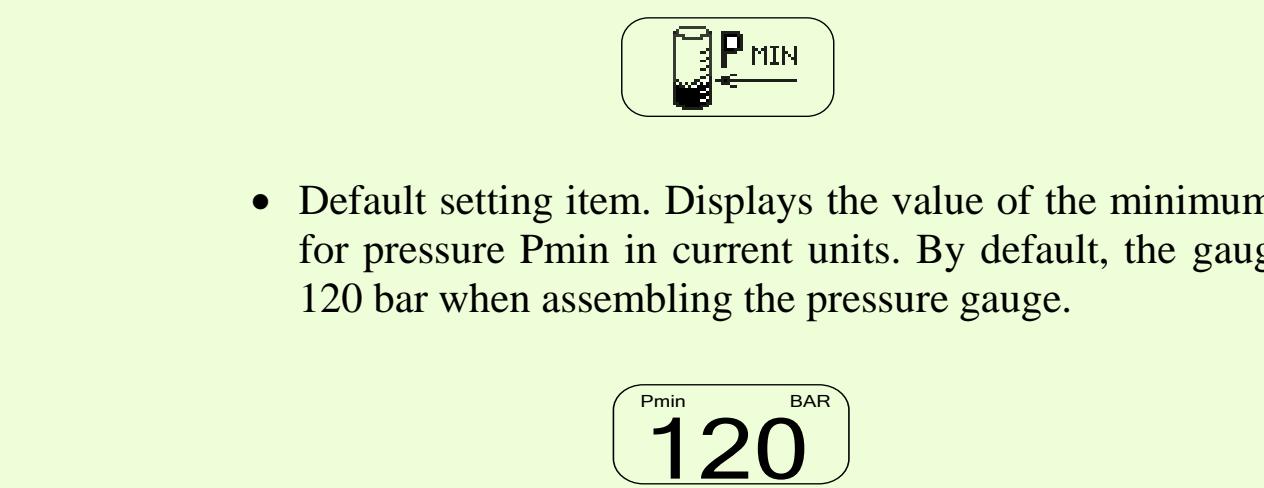
That is, if you change any component, the data will also change. Therefore, we recommend that you reset the statistics to zero, in case you are rebuilding your gun (change speed, ammo, install new Pmin, and so on), so that the gauge displays the correct data.

## **5 Menu item "Settings"**

***Please pay attention*** that the settings of this item menu are intentionally made to be different from the logic of the rest of the menu items to minimize possible random changes.



### **1. Limit of the pressure**



## 2. Setting up the limit of the pressure

3.

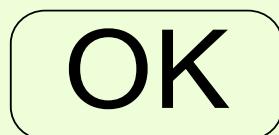
**Please pay attention**, that to use this menu item and change the minimum pressure, you must first pressurize in the tank.



- The release of the button on this menu item will select the feature
- After selecting a menu item, the picture "Cancel or confirm"



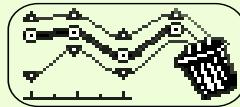
- Pressing the button will cancel the action (setting the threshold) and return to the default setting item (Pmin display). That is, if you accidentally come here, by clicking the button, then click it again, automatically, you just exit the menu, nothing will change.
- After waiting (that is, you understand what you are doing and do not press the button, but wait until the pressure gauge confirms the change), a message displayed.



- The current pressure level stored as the pressure threshold Pmin. The pressure gauge turns off.

If the user wants to change the default factory setting (120 BAR), then this procedure must be followed. First, determine the minimum bar setting desired. Second, fill the air reservoir to the desired setting on the EDMS. Then go back to the menu "SETTINGS." and change the value. For example, the desired setting is 100 bar. Reduce the air reservoir to 100 bar, go into settings and choose this pressure range.

#### 4. Resetting the statistics.



- Release the button on this menu item to select this menu item.
- After selecting a menu item, the picture "Cancel or confirm"



- Pressing the button will cancel the action (reset the statistics) and return to the default settings item (Pmin display).
- After waiting, a message is displayed



- Statistics are reset, the gauge is turned off.

#### 5. Setting the "zero" of the pressure sensor.

**Please pay attention:** The ceramic sensor ("sensor") sealed with an O-ring. In the event of failure of the O-ring, the pressure gauge will begin to leak air. To replace the O-ring, you will need to unscrew the sensor mounting nut, pull out the sensor, replace the O-ring and install the sensor back, and tighten the sensor pressure nut. Chances are you will not set the EDMS on the O-ring to the exact pressure as the factory. This change of seating the O-ring can lead to errors. If this rare failure occurs, there is a zero reset menu



- Release the button on this menu item to select this menu item.
- After selecting a menu item, the picture "Cancel or confirm"



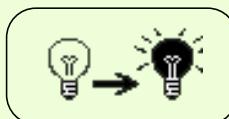
- Pressing the button will cancel the action (zero setting) and return to the default setting item (Pmin display).
- After waiting, a message is displayed



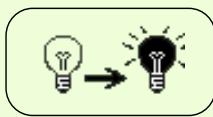
The current pressure level is taken as zero; the pressure gauge is turned off. Note that this action should be done at zero pressure. Otherwise, the actual pressure in the reservoir will be taken as zero.

## 6. Need to turn on the screen after the shot.

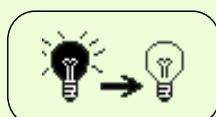
***Please pay attention*** to this feature. For example, you shoot in the dark and do not want the EDMS to give out your presence with light when turned on after the shot (the gauge typically stays lit 40 seconds after the last button press). Therefore, using this menu item, you can adjust the pressure gauge so that it displays values only after pressing the button, and not turned on automatically



- Displays the current state of the "Turn on screen after shot" setting.
- The EDMS will automatically turn on after the shot



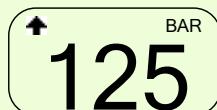
- The EDMS will not turn on after the shot



- The release of the button on this menu item changes the setting value.

## Mode "Filling"

If the pressure increase is detected, the EDMS screen is automatically turned on (if it is in the second stage of "Operating mode, the screen is off, " and the current pressure level displayed in the existing units.



If the menu item "Showing the amount of shot left" was selected and there are statistical data in the memory of the gauge, the current pressure "in shots."



## Mode "Shot"

- If a sudden decrease in pressure is detected, the current flow rate of the shot is displayed



- After stabilizing the pressure, a drawdown is made (the image is inverted)



- The gauge screen automatically turned on if the "Screen after shot" setting is set.

***Please pay attention*** If you fill the tank from a minimum to a maximum (a substantial pressure difference), the air in the tank will be heated. If one were to close the valve on the filling hose immediately, the tank begins to cool down and the pressure in it to fall.

If the pressure drop rate of pressure is higher than 1 bar in 0.25 seconds, then the pressure gauge switches to the pressure drop measurement mode after the shot and fixes this value.

If this value is close to the average pressure drop per shot (AVG), which is already in the memory of the EDMS (after the previous series of shots), it will add to the statistics, and the best reading will not be available.

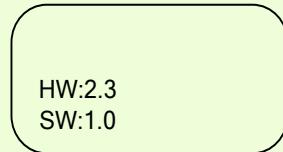
The easiest way to avoid this phenomenon is after a filling not to close the valve for a few seconds and allow the air in the tank to cool a little while being connected to the air in the air source (5-15 seconds, depends on the pressure drop and the volume of the vessel). Filling a PCP air tank slowly is an excellent practice to follow on all regulated guns.

It is essential to make the first shot correctly for the EDMS to record your gun's efficiency accurately. Before you start, it's better to reset the statistics. Statistics must reset when changing the rifle's settings, change the caliber, change the speed, or switch to other bullets.

***Please pay attention*** how to replace the battery.

1. To replace the battery, you will need an empty syringe with a volume of at least 5 cm<sup>3</sup>.
  2. Removing the sticker from the side of the gauge is necessary.
  3. Insert the nozzle of the syringe (not the needle) into the hole on the side surface of the pressure gauge, so that it fits tightly into the hole, push the plunger and catch the cap. When creating excess pressure under the cap, it flies out of its place.
  4. Replace the battery and assemble the pressure gauge in the reverse order.
  5. The gauge cover is cap inserted into its place, the window in the cap is aligned on the screen and snaps on the edges.
- If you need to rotate the screen (board with a display), for example, to align it for your specific rifle, it is better to take it out (like when changing the battery), turn it to the desired angle and insert it. Pay attention that under the battery there was no twisted wire (double thickness).

- After installing the battery, the screen is tested (all pixels are turned on), and then:



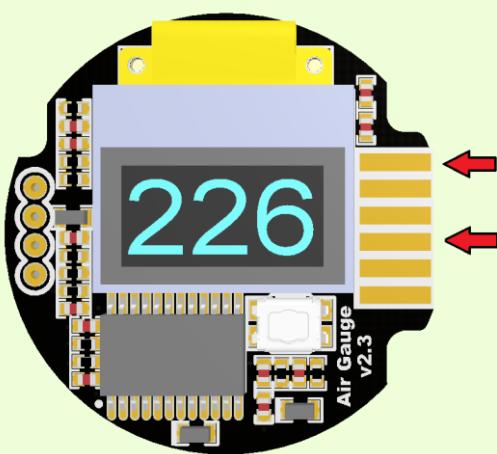
Where:

- HW: 2.3 (hardware) – version of the printed circuit board
- SW: 1.0 (software) – version of the software

**Please pay attention**, that when replacing the battery, you will need to remove the printed circuit board from the shell of the gauge, if you touch the contacts, you can short-circuit them, this does not lead to a breakdown of the pressure gauge, but the controller may "hang up."

In this case, you either need:

1. Remove and insert the battery.
2. Or short circuit the two contacts of the comb for programming (shown in red arrows).



Employees of "EDgun" company hope that our new product will be an excellent tool for you in the knowledge of your weapons and will allow you to customize it more carefully.

Thank you for the continued support of EDgun, customers are our most important asset. – Eduard