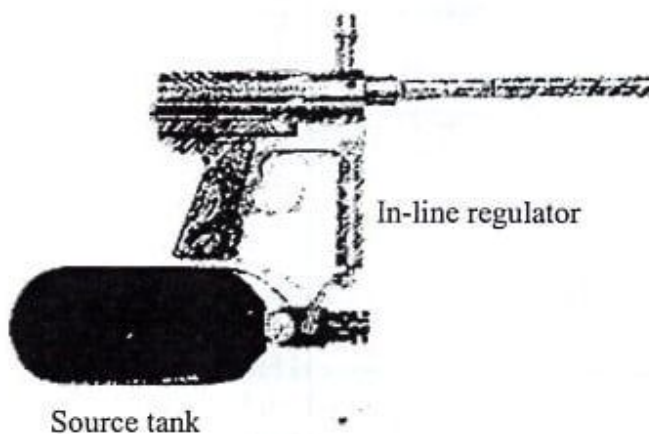


The Standard Matrix

In order to understand how the Standard Matrix works, we will trace the air from the source until it leaves the marker.

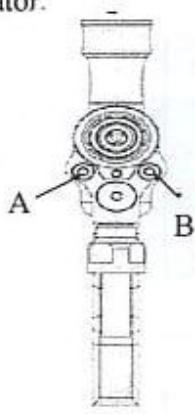
The source of air starts at the compressed air bottle. The output pressure should be regulated to approximately 500 PSI. A higher pressure is not necessary and will make the in-line regulator work harder to restrict the pressure down to an acceptable level.



From the source, the air travels to the in-line regulator. It is extremely critical that this regulator is consistent and does not spike. The consistency of this regulator directly determines how well your marker will shoot. A faulty in-line regulator causes 70% of velocity problems or leaks from the Matrix. The in-line regulator should be set at a maximum of 170 PSI. Higher pressures can cause the solenoid to lock up or be damaged.

After the air is released from the in-line regulator, it travels through the vertical adapter and enters the Transfer Spool area of the body. From this chamber, air is sent to two places.

Air travels down the tube on the right side of the marker (the right side is determined while holding the marker barrel away from you as if you were shooting). This passageway is called the transfer tube. The transfer tube extends all the way to the back of the marker where it enters the main body through a small hole. If you are holding the body without any internals installed, you can see this hole towards the back of the marker. The air that enters the back of the marker is the supply that will propel the paintball. The pressure of this supply air is exactly the same as the pressure set by the in-line regulator.



The chamber labeled "A" is the transfer chamber. This is where the air travels to fill up the supply chamber for the marker.

The chamber labeled "B" is a hollow chamber with no purpose. Some custom designers use it to add additional airflow while others use it to store wires for anti-chop eyes.

From the transfer spool, air is also directed to the 4-way valve.

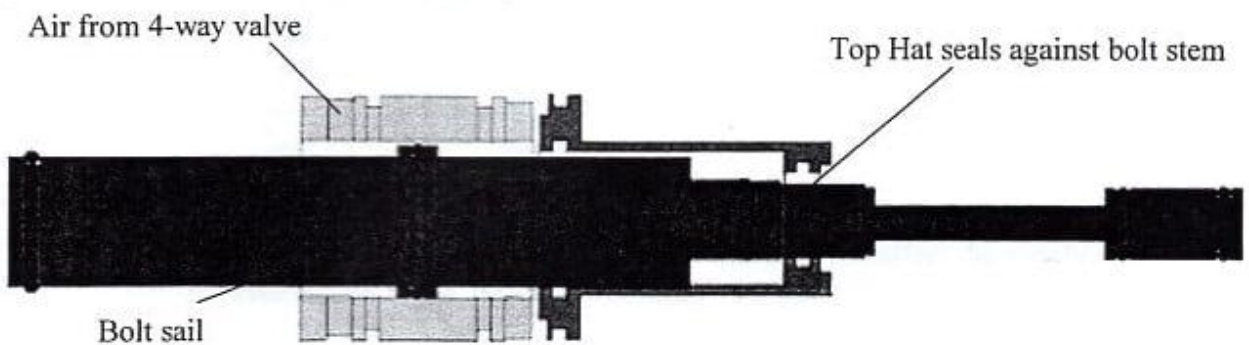
- The manifold is a metal plate that routes air flowing between the body of the Matrix and the four-way valve.
- Air enters the front of the manifold through the transfer plug on LED's and from the "low pressure regulator" on LCD models. Then it is routed to the four-way valve.
- From the four-way valve, the air is routed through two small holes to either the front or back of the cylinder, pushing the bolt sail forward or backward. These 2 holes can be seen near the front of the marker if you remove the bolt kit.

The Bolt System

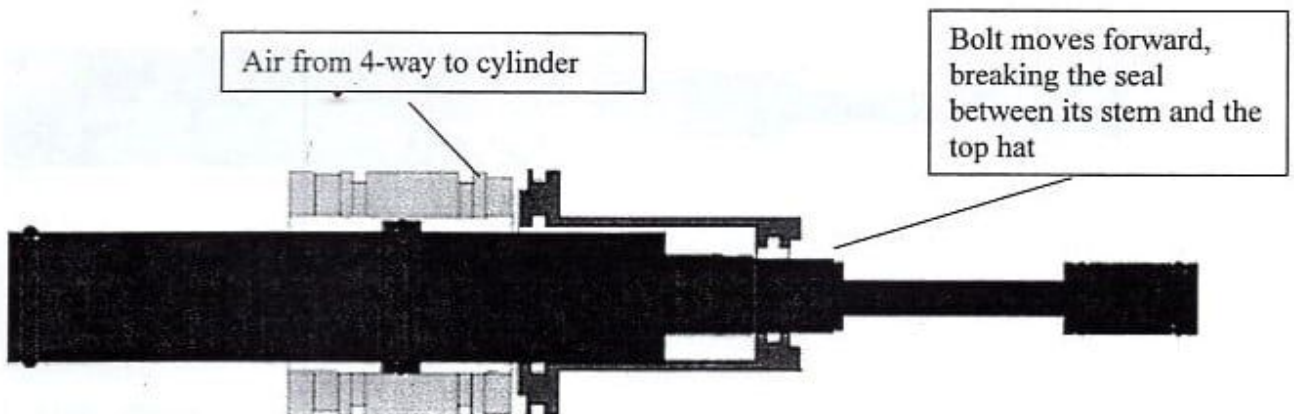
The Matrix uses a patented spool valve system consisting of a host of sleeves and spacers. The end result of this design is only one moving part, the bolt.

When the marker is gassed up. The air travels through the transfer tube and fills the supply chamber in the marker.

The four-way valve sends additional air to the front of the cylinder. This air pushes back against the bolt sail and holds the valve closed.



When the marker is fired, the trigger switch on the circuit board is pressed, telling the solenoid to switch the flow of air from the front of the cylinder to the rear of the cylinder. Air that enters the rear of the cylinder will push on the bolt sail, moving the bolt forward.



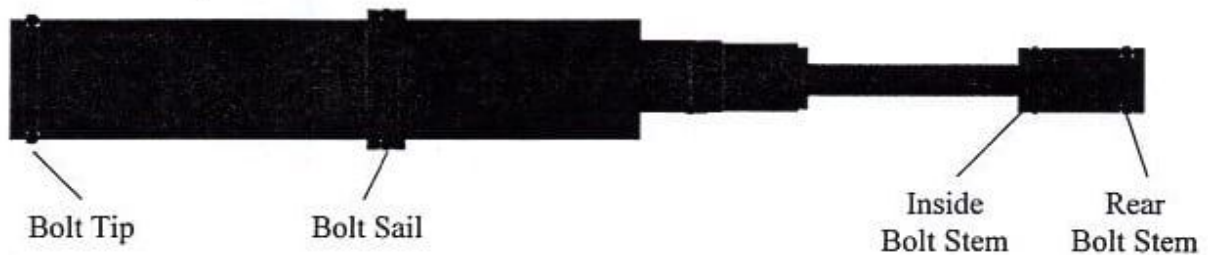
When the bolt moves forward, the tapered stem passes through a part called the Top Hat. The top hat is responsible for keeping air from escaping the supply chamber while the bolt is in the back position. When the bolt moves forward through the top hat, the tapered stem allows the air to pass, flow forward, and propel the ball.

Recap of the Cylinder

The cylinder directs the airflow from the solenoid in two ways.

- Air can push against the bolt sail to keep the bolt back or air can push the sail in order to move the bolt forward.
- When the bolt is held back, the supply air is sealed by the connection between the top hat o-ring and the bolt stem.
- When the 4-way valve directs air against the sail to move the bolt forward, the air at the front of the cylinder is vented.
- The bolt begins to move forward and the tapered stem passes through the top hat until the diameter of the stem will no longer seal with the top hat o-ring. This allows the supply air to flow through the Venturi-style ports in the bolt and out the front of the marker, propelling the paintball.
- When the bolt is in the forward position, the inside rear stem o-ring seals inside the back wall so additional air from the transfer tube does not affect the supply chamber. This feature helps the marker shoot more efficiently.

The Bolt



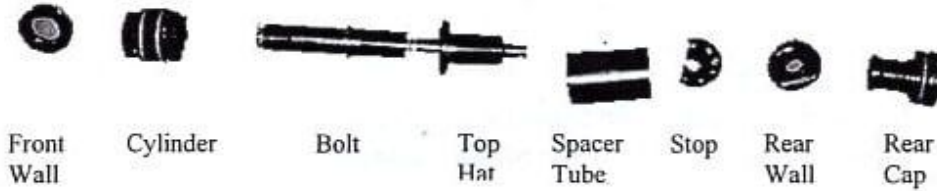
Bolt tip- pushes the ball into the barrel




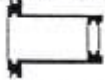




Bolt Sail- Sits within cylinder and pushes bolt based on which direction the air is flowing.

Inside bolt stem o-ring- Seals within rear wall when bolt is forward to stop additional flow.

Rear bolt stem o-ring- Seals within rear cap. Will fail as a safety device to let air vent out of the back when over pressurized.

Bolt parts



<p>The Front Wall is the part of the bolt system that rests against the body-retaining clip to keep the internals from leaving the front of the marker. The front wall contains an o-ring that seals the front cylinder air from escaping the marker.</p> 	<p>The Cylinder is the part of the bolt system that channels the air sent from the 4-way valve to operate the bolt moving back and forth. From each o-ring to the end of the part is a different length. The longer length points forward.</p> 
<p>The Bolt is the only moving part of the internals. The air from the 4-way pushes the bolt sail. The bolt stem interacts with the top hat to release and seal the supply air. The "rear stem o-rings" seal inside the rear wall. The bolt tip pushes the ball into the barrel while the air propels it.</p> 	<p>The smaller part of the top hat seals on the bolt stem. As the tapered stem passes through the top hat, the diameter of the stem gets smaller until the seal is no longer valid and the supply air can escape. The larger o-ring in the top hat keeps the cylinder air from escaping the marker.</p> 
<p>The Spacer is the sleeve that sits between the top hat and the stop. This hollow tube encases the supply air that is used to propel the ball when the bolt moves forward.</p> 	<p>The Stop sits behind the spacer tube. The purpose of this just as its name implies. It stops the forward movement of the bolt. The Indented side of the stop faces the spacer tube.</p> 
<p>The Rear Wall sits between the stop and the rear cap. The rear wall seals against the "inside bolt stem o-ring" when the bolt is in the forward position. This keeps additional air in the transfer tube from entering the supply chamber. The raised portion faces the rear cap.</p> 	<p>The "Rear Cap" is threaded into the body of the Matrix. This part should be screwed in all the way and then loosened approx. 1/4 turn. If this is too tight, you can damage your bolt. This part can also vent air from over pressurizing.</p> 

Electronics

The Matrix features an electronic board housed within the grip frame. A 9-volt battery within the body powers this board. Taking off the back plate of the marker will reveal the battery compartment.

The board features a micro switch that is activated by pulling the trigger. When depressed, this switch communicates with the solenoid the variables needed to fire the marker.

There are two questions that the solenoid needs answered by the board.

1. How long should the solenoid deliver air to keep the bolt in the forward position?
This length of time is referred to as the "forward pulse".
2. How long should the bolt remain backwards before it is allowed to fire again?
This length of time is referred to as the "back pulse".

The forward and back pulses are both measured in milliseconds. These variables are adjustable by changing the dipswitch settings on the board. The chart below defines the settings and effects.

GUN 12 (Standard Chip)

1	2	3	4	Forward	Back	R/F
d	d	d	d	35	25	16.7
d	d	d	u	35	35	14.3
d	d	u	d	35	45	12.5
d	d	u	u	35	55	11.1
d	u	d	d	45	25	14.3
d	u	d	u	45	35	12.5
d	u	u	d	45	45	11.1
d	u	u	u	45	55	10.0
u	d	d	d	55	25	12.5
u	d	d	u	55	35	11.1
u	d	u	d	55	45	10.0
u	d	u	u	55	55	9.1
u	u	d	d	70	25	10.5
u	u	d	u	70	35	9.5
u	u	u	d	70	45	8.7
u	u	u	u	70	55	8.0

GUN 20 (Enhanced Chip)

1	2	3	4	Forward	Back	R/F
d	d	d	d	10	35	22.2
d	d	u	d	12	35	21.3
d	u	d	d	14	35	21.3
d	u	u	d	16	35	19.6
u	d	d	d	18	35	18.9
u	d	u	d	20	35	18.2
u	u	d	d	24	35	16.9
u	u	u	d	35	35	14.3
d	d	d	u	10	45	18.2
d	d	u	u	12	45	17.5
d	u	d	u	14	45	17.5
d	u	u	u	16	45	16.4
u	d	d	u	18	45	15.9
u	d	u	u	20	45	15.4
u	u	d	u	24	45	14.5
u	u	u	u	35	45	11.3

Decreasing the forward pulse will offer better efficiency and rate of fire.

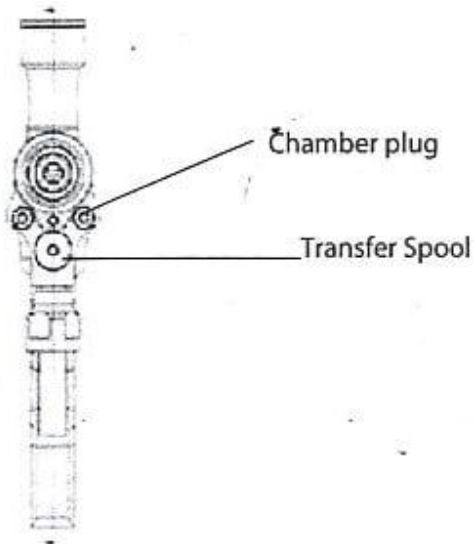
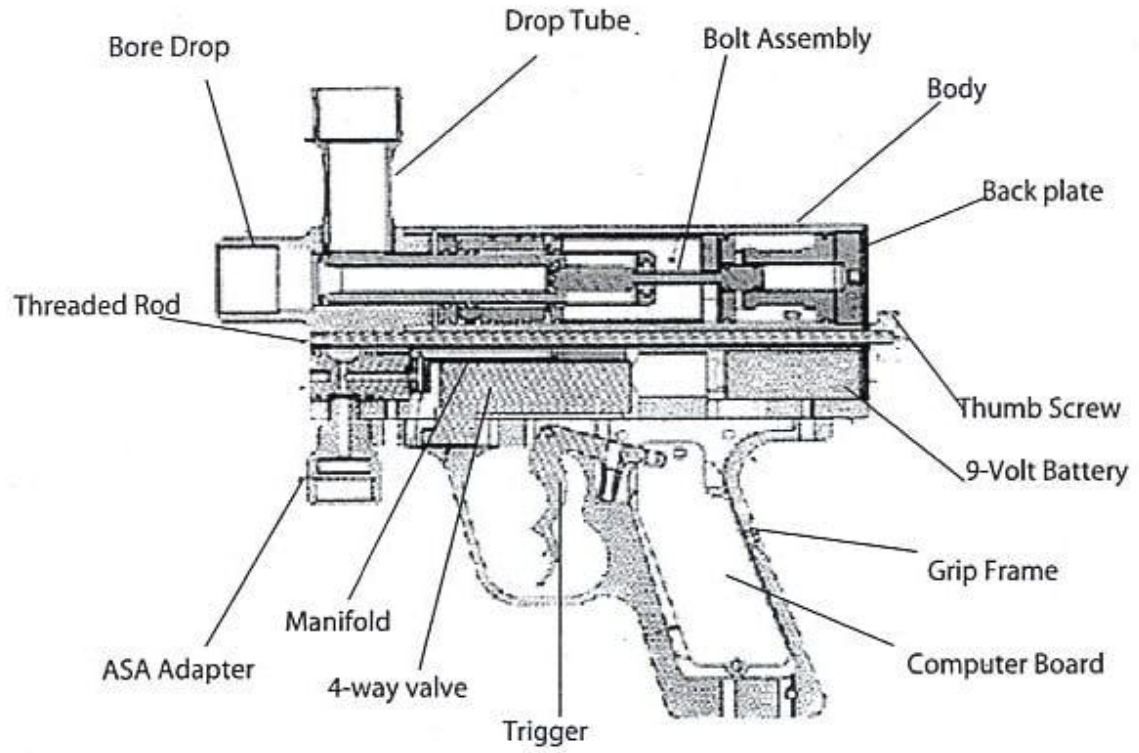
Increasing the forward pulse will offer more velocity.

Increasing the back pulse will allow balls to feed better.

Decreasing the back pulse will allow a faster rate of fire.

The goal is to use settings that work best for you and the paint you shoot.

Matrix Parts



The LCD Difference

The LCD version of the Matrix is very similar to the Standard but does have the following differences:

- The LCD has a feature filled display screen in the handle.
- The LCD uses separate wiring harnesses to connect the solenoid (component on the 4-way valve) and the battery to the board. This makes replacement of the battery lead simple.
- The LCD utilizes a low-pressure regulator system (LPR).
- The LCD features a high efficiency bolt.

Low Pressure Regulator

The low-pressure regulator is installed in the front of the Matrix where the Standard has a transfer spool. Earlier, we mentioned that air from the vertical travels to the transfer tube and to the 4-way valve. On a Standard Matrix, the chamber where this air is sent to its different destinations is plugged with a transfer spool. On the LCD, the transfer spool is removed and the low-pressure regulator (LPR) is screwed into its place. What the LPR does is allow the air to continue to flow directly to the transfer tube but redirects the 4-way flow through the LPR where the pressure is lowered before it gets to the 4-way. The result of a lower pressure airflow going to the 4-way has many advantages.

First, the lower pressure to the 4-way results in the bolt operation being very gentle on the paint. This is because the 4-way pressure determines how hard the bolt moves back and forth and how much resistance it will take to stop the bolt with an object in the way. The main advantage is less ball breakage and the ability to shoot more brittle paint.

The second advantage of using the LPR is it allows the pressure of the supply chamber air to be raised higher. Remember, we established that the 4-way would fail if too much pressure were put into it. By routing the air to the LPR, we can raise the pressure of the in-line regulator without worrying about over pressurizing the 4-way.

This is where the upgraded bolt system comes into play. By allowing the supply chamber to host a higher pressure, we are capable of using a bolt that will offer better efficiency. A Standard Matrix can achieve an average of 700 shots from a 68 cubic inch 4500 PSI tank while the same tank with an LCD can achieve 1100 shots. The main difference between a Standard bolt and the upgraded version (referred to as the Gen E Image Bolt) is: The LCD cylinder has reduced air passages to offer better efficiency. The LCD top hat has a larger diameter for better flow. The LCD bolt stem uses two #9 o-rings instead of one #9 and one #10. The bolt shaft design offers resistance on the top hat creating a "crisper" release that allows the LPR to have a more consistent effect.

The LCD Screen Options

The LCD board offers many useful features that are easily controlled by the three buttons at the back of the grip frame.

Press and hold the top button on the grip frame until the LCD screen turns on. The marker will always default to the safe mode. Press and hold the middle button on the grip frame to place the marker into firing mode. To return to safe mode, press and hold the middle button again until the LCD display reads "safe". To turn the marker off, press and hold the top button on the back of the grip frame until the LCD screen turns off.

To enter the graphic menu, from SAFE mode, hold the bottom button for two seconds or until the graphic menu appears. Highlighted, will be the Timer icon. Pressing either of the two bottom buttons will scroll through the different features. After an icon is highlighted, you may select it by pressing the top (on/off) button. This will bring you into the edit mode of the icon that was selected. Exiting edit mode is as simple as pressing the top button again.

Once in the edit mode, the following features can be changed by:

TEMPERATURE: Temperature can be displayed in degrees F or degrees C by toggling the middle or bottom buttons.

CONTRAST: This feature is locked from the outside, but can be unlocked by pressing the white reset button on the board. It can then be changed for certain light conditions. Once exiting the EDIT menu, the feature will be automatically locked.

SERIAL NUMBER: Your board's serial number is for identification purposes only and cannot be tampered with. Once in the edit, the version of the board will also be displayed. Note: the board serial number will not match the serial number stamped into the body of your marker.

FORWARD PULSE: This feature controls the amount of time the bolt takes to reach the forward position. Once it reaches the forward position, the marker will fire. Generally, the best operating range for forward pulse is 12 to 16 (represented in milliseconds). Generally, the lower the forward pulse, the better air efficiency achieved. However, a marker that is not optimal, i.e. not lubricated well, may need a higher forward pulse to perform at the same level. Since this feature can affect velocity, it is locked and can only be adjusted by unlocking it with the white reset button located on the board.

















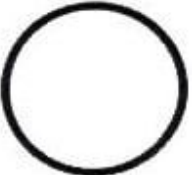
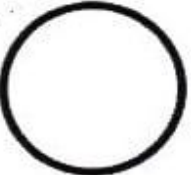
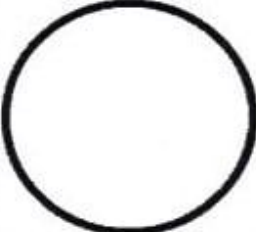
BACK PULSE: This feature controls the amount of time the bolt stays back to allow a paintball to drop into the breech. The optimal setting is between 35 and 45 milliseconds. A longer back time can be effective if a marker is having feeding problems.

EXIT: Selecting this feature allows you to get out of the graphic menu.

The battery indicator is linear which means it shows the actual battery power left. To avoid damage, keep your LCD board away from direct contact with water or extreme heat.

TROUBLESHOOTING GUIDE

Leaks from chamber plug	Replace and grease # 10 o-ring
Leaks from Transfer Spool	Replace and grease #15 o-ring
Leaks from vertical adapter	<ul style="list-style-type: none"> ▪ Make sure ASA is screwed into body ▪ Remove regulator, remove ASA screw, and replace with #14 o-ring. Use blue loc-tite on the ASA screw when reinstalling.
Leaks down the center of the bolt	<ul style="list-style-type: none"> ▪ LCD bolt- replace #13 o-ring in top hat ▪ Standard bolt- replace #12 o-ring in top hat ▪ Check for scratches on bolt stem. ▪ LCD bolt- replace #17 quad in top hat. ▪ Standard bolt- replace #17 in top hat. ▪ always check regulator for spiking after a bolt leak.
Leaks from front between front wall and bolt.	<ul style="list-style-type: none"> ▪ LCD bolt- replace #17 quad o-ring ▪ Standard bolt- replace #17 o-ring ▪ Check for scratches on the front part of the bolt.
Leaks between the front wall and the body.	<ul style="list-style-type: none"> ▪ Replace and grease the #23 O-ring on the front wall ▪ Make sure there are no scratches on the inside diameter of the body where the front wall sits.
Leaks from the grip frame	<ul style="list-style-type: none"> ▪ Remove the grip frame to diagnose ▪ You may use soapy water to identify source of leak
Leaks in front of 4-way	<ul style="list-style-type: none"> ▪ Check the #15 (transfer spool) ▪ Check #9 on transfer spool or #8 on LPR
Leak from manifold vents	<ul style="list-style-type: none"> ▪ Check #15 on bolt seal
Leak from manifold base	<ul style="list-style-type: none"> ▪ Check #3 o-rings ▪ Check 4-way gasket
Leak from back of 4-way (the back is labeled B on the 4-way)	<ul style="list-style-type: none"> ▪ Remove 4-way and check to see if the B-side has a gasket sticking out of the B-side plate. If so, remove B-plate and reset gasket. This is caused by 4-way being overpressurized.
Leak from Allen keyhole at back of bolt	<ul style="list-style-type: none"> ▪ LCD replace both #9's on rear stem ▪ Standard replace #9 and #10 o-rings on rear stem
Leaks between Body and rear cap	<ul style="list-style-type: none"> ▪ Replace #23 o-ring on rear cap
Leak from LPR knob hole	<ul style="list-style-type: none"> ▪ Replace #9 o-ring on piston
Leak from side hole on LPR	<ul style="list-style-type: none"> ▪ Replace regulator seat in LPR
In-line regulator is venting out of the bottom hole	<ul style="list-style-type: none"> ▪ Replace #16 piston o-ring ▪ Replace regulator seat
Regulator spikes or overpressurizes	<ul style="list-style-type: none"> ▪ Confirm elbow fitting in not in gauge side of regulator. ▪ Replace regulator seat
The marker will not fire	<ul style="list-style-type: none"> ▪ Standard- if the LED light flashes, the trigger is pushed too far against the microswitch on the board. Adjust it back so the switch can activate. ▪ LCD- check the trigger settings to make sure the switch can activate.
Board Failure	<ul style="list-style-type: none"> ▪ The LCD to lights up without a display- replace battery. ▪ The LED continually turns off- replace battery. ▪ The LCD does not maintain its settings- replace battery or board.
OTHER IMPORTANT NOTES	<ul style="list-style-type: none"> ▪ A low battery can cause the 4-way to operate sluggishly resulting in inconsistent velocity. ▪ The battery must be installed properly. Reversing the + and - terminals can fry the board. ▪ The in-line reg has an input port and an output port. Do not reverse these. The elbow side is to the left if you are staring at the burst disc hole. ▪ To remove the bolt system, push the bolt from the front to the back of the marker. Pulling on the stem can cause it to bend and break.

Rear frame screw 8-32 	Front frame screw 8-32 	Trigger set screw 8-32 	Board screw 6-32 
Manifold screw 4-40 	Trigger dowel pin 1/8 	Trigger Spring	Grip cover screw 8-32 
Rear Cap 1 5/16-20 	Drop Tube 15/16x32	Chamber Plug 3/8x24	Barrel thread 15/16-20
#3 o-ring 	#8 o-ring 	#9 o-ring 	#10 o-ring 
#12 o-ring 	#13 o-ring 	#14 o-ring 	#15 o-ring 
#17 o-ring 	#17quad o-ring 	#23 o-ring 	Allen sizes Rear cap 1/4 Frame 3/32 Manifold 3/32 Grip cover 3/32 Board screw 5/64

Part	Standard	LCD
Front wall (outside)	#23	#23
Front wall (inside)	#17	#17quad
Bolt nose (Front)	#14	#14
Bolt sail (middle)	#15	#15
Bolt stem (back)	#9	#9
Bolt stem (inside)	#10	#9
Top hat outside	#17	#17

Part	Standard	LCD
Top hat large inside	#17	#17quad
Top hat small inside	#12	#13
Rear wall	#23	#23
Rear cap outside	#23	#23
Manifold	#3	#3
LPR tip (if used)	#8	#8
Vertical adapter o-ring	#14	#14

The Low Pressure Regulator

The low pressure regulator, referred to as the LPR, replaces the transfer spool on the Standard Matrix. The purpose of the LPR is to send a lower pressure air to the 4-way valve than is being sent to the supply that propels the paintball. The benefits of this lower pressure are better efficiency and a bolt operation that is gentler on the paintballs.

While using a LPR has advantages, if it not set properly, you may experience problems. If your bolt pressure is set too high, you may break more paint. If it is set too low, your bolt will operate sluggishly.

This is the best way to set your low-pressure regulator. You'll need a chronograph, a set of Allen keys, your Matrix, a set of goggles and some paint.

Step one.

Before airing up your marker, back the reg. adjuster out 2-4 complete turns, so it isn't allowing any pressure through.

Step two.

Air up your Matrix, and turn it on. Be sure to put your goggles on. Do not put any paint in the marker yet.

Step three.

Pull the trigger, if the bolt does not cycle, turn the adjuster in a quarter of a turn, do this until the bolt cycles completely.

Step four.

Attach a loader, with paint in it and take a couple shots over the chrono, turn the regulator pressure up a eighth of a turn and chrono again, if the velocity has gone up more than 10 FPS, repeat this step until the velocity doesn't change more than 3-5 FPS.

Step five.

Lock adjuster using the set-screw on the front of the adjustment knob. If you don't do this, your velocity and marker performance will be affected.