Tadao Technologies

ただお

Proto Matrix

Musashi 3 Upgrade Manual

THEMATRIXCENTER.COM

Musashi 3 Upgrade Instructions for Proto Matrix

Revised: February 25, 2005

Features

- Built on the Musashi code base (hybrid debounce scheme)
- Includes three fire modes: uncapped semi auto, capped semi auto, and modified NXL/PSP
- Continuously monitors the trigger switch throughout the entire firing cycle
- ABS programming prevents first shot drop off
- AMB algorithms help to eliminate mechanical bounce
- Power efficient software lengthens battery life
- Programming mode allows changes to debounce, dwell, loader delay, AMB, fire mode, and fire mode max rate of fire
- All settings are stored in non-volatile memory so they are not lost when power is disconnected
- One touch startup enables the marker to fire instantly
- Automatic 15 minute idle power down saves batteries
- Force shot allows the marker to be fired when the eyes are enabled but no object is present in the breech
- Low battery indicator software

LED Indicator

The multi-color LED that shines out the back of the grip panels shows which mode of operation the marker is currently in:

Solid Green	Ball in breech, ready to fire
Solid Red	No ball in breech
Slow Blinking Green	Eye malfunction, max rate of fire reduced
Slow Blinking Red	Eyes disabled, rate of fire limited to 20 balls per second in uncapped semi-auto, otherwise Fire Mode Max Rate of Fire for fire modes 2 and 3

Power Operation

Pressing and releasing the power button turns the marker on. A solid red or green LED in the grip frame indicates that the marker is ready to be fired. To turn it off, press and hold the power button until the LED turns off, then release. Every time the marker is turned on, the eyes are enabled. The marker can be turned off regardless of the state of the eyes. Additional details about the battery indicator can be found below.

Eye Operation

The eyes are enabled when the marker is first turned on. To disable the eyes use the eye button. To change modes, press and hold the eye button for 1 second. The LED will change colors to indicate the mode change.

To determine if the eyes are working correctly**,** insert an object into the breech. Check to see if the LED changes from red to green, and then back to red once the object is removed.

Battery Indicator

The battery indicator software is standard in the Proto Matrix Upgrade. When the marker is turned on, the LED will briefly flicker red to indicate a low battery. If it flickers red, the battery should be changed as soon as possible. Your battery may last for another case of paint, but it is close to failing. If the battery is fine, the software will go directly into the firing mode.

Programming

The tournament lock must be disabled in order to change settings on the chip. The 2nd dip switch functions as the tournament lock. To disable the tournament lock, make sure the 2nd dip switch is in the ON or UP position. While the marker is turned off, pull and hold the trigger and turn the marker on. This will initiate the programming mode, showing a rainbow color sequence. Then the LED will settle on green.

Pulling and releasing the trigger quickly will toggle between the different programming modes:

Color:	***Programming Mode***
Green	Debounce
Red	Dwell
Orange	Loader Delay
Flickering Green	AMB
Flickering Red	Fire Mode
Flickering Orange	Fire Mode Max Rate of Fire

When the LED is lit for the desired setting, press and hold the trigger until the LED goes out. When you release the trigger, the LED will blink to show the current setting. For example, if the current setting for debounce is 5, the LED will blink green 5 times. Once the LED stops blinking, you have 2 seconds to begin entering the new setting.

To enter the new setting, pull the trigger the desired number of times. For example, to set the debounce to 2, you must pull the trigger 2 times. Every time you pull the trigger the LED will light. After all settings have been changed, turn the marker off, using the power button.

Programming Example

If you want to set the dwell to 20, you should:

1. Make sure the marker is powered off and the tournament lock is disabled (4th dip switch in the UP/ON position).
2. Pull the trigger and push the power button to turn on the marker.
3. The LED shows green. This is the debounce mode.
4. Quickly pull and release the trigger one time to switch to the dwell mode. The LED will show red.
5. Pull and HOLD the trigger until the LED turns off.
6. Release the trigger. The LED will blink out the current setting.
7. When the LED stops blinking, enter the new setting by pulling the trigger 20 times.
8. Wait until the LED turns back on, indicating programming has been completed.
9. Turn the marker off.

Program Reset

To reset all settings back to factory defaults hold down the eye button for 10 seconds while in programming mode. The LED will rapidly cycle through every setting color to indicate that the process has completed.

Settings

Debounce – The Musashi software features a hybrid debounce scheme that uses microcontroller cycles to debounce the pull of the trigger and ½ ms time increments to debounce the release. This results in a very effective debounce algorithm that does not hinder the user at any setting. At low debounce settings, however, it may cause the marker to read switch bounce as additional pulls, falsely generating shots or near full automatic fire. The setting ranges from 1 to 50 and is defaulted at 5.

Dwell – The amount of time the solenoid is energized each time the marker is fired. The default is 18 ms. The range is 10 to 30 ms. Too low of a dwell may lead to inconsistency or drop off. Too high of a dwell can cause bad air efficiency.

Loader Delay – Adds a slight delay after the eye has seen a ball and the bolt is cycled, causing the gun to fire. If not using force fed loaders, it may be necessary to increase this setting to prevent chopping. A setting of 1 means no loader delay, which is the fastest. The default is 2 and may be set from 1 to 50.

AMB – Allows the user to adjust the anti-mechanical bounce feature. Mechanical bounce occurs with the DM5 or DM4 due to the kick generated during each shot and can cause the marker to "run away," firing even after the trigger has been released. AMB helps stop markers from going full auto when the trigger is pulled very slowly. The default is 2 and may be set from 1 to 5. AMB is only used in fire modes 1 and 2 (semi-automatic unlimited and capped). In modified NXL/PSP mode AMB is disabled.

Settings (con't)

Fire Mode – Included are three different fire modes (default is 1):

1. **Semi-Automatic, unlimited rate of fire**
    a. Setting 1 is normal semi-automatic with an unlimited rate of fire while the eyes are enabled. When the eyes are turned off the max rate of fire is set to 20 balls per second.
2. **Semi-Automatic, capped rate of fire**
    a. Setting 2 is semi-automatic with a capped rate of fire. It simply limits the maximum balls per second that can be fired. The cap is set by the Max ROF setting.
3. **Modified NXL/PSP, capped rate of fire**
    a. Setting 3 is a modified NXL/PSP fire mode which works as such:
        i. The first 3 shots of a string are semi automatic
        ii. After the 4th shot the marker will add shots as long as the user continues to pull the trigger
        iii. If the trigger is let go the marker will stop firing immediately
        iv. If the trigger is not pulled after letting go within 1 second, the 3 shot semi automatic count starts over

In normal operation continually pulling the trigger faster than 5-6 pulls per second will effectively give the user full automatic at the max rate of fire. If the user stops shooting, then starts again within 1 second the marker will jump right back to the max rate of fire. If the user stops shooting for more than 1 second, the next 3 shots will be semi automatic, then on the 4th it will resume helping the user fire faster.

Fire Mode Max ROF – The maximum rate of fire setting only applies to the 2nd and 3rd fire modes. The max rate of fire is adjustable from 14 to 20 balls per second in ¼ balls per second increments. The default is 3, which is roughly 14.5 balls per second. Oscillator inconsistencies from chip to chip make it impossible to time perfectly, so the only way to truly check rate of fire is using a Pact Timer or ballistic chronograph. The red radar chronographs commonly found at fields are NOT reliable.

Setting	BPS	Setting	BPS	Setting	BPS
1	14.0	9	16.0	17	18.0
2	14.25	10	16.25	18	18.25
3	14.5	11	16.5	19	18.5
4	14.75	12	16.75	20	18.75
5	15.0	13	17.0	21	19.0
6	15.25	14	17.25	22	19.25
7	15.5	15	17.5	23	19.5
8	15.75	16	17.75	24	19.75
				25	20.0

Dip Switches

- Dip 1 ABS Toggle, UP/ON for ABS enabled
- Dip 2 Tournament lock, UP/ON for lock disabled

Additional Features

Force Shot – In the event the eyes are enabled, the breech is empty, and the user wants to fire a clearing shot, a force shot can be initiated by pulling and holding the trigger for ½ second. This is useful with force fed loaders that sometimes push a ball slightly into the detents where the eyes are unable to see it. After force firing, the next ball will load, and operation will continue as normal.

ABS – ABS (anti-bolt stick) programming helps to eliminate first shot drop off. First shot drop off occurs when the lube and o-rings settle or "stick" inside the marker after it has been sitting. The next shot fired will be lower in velocity because the bolt has to break free. ABS will slightly increase the dwell to compensate if the marker is left sitting for 15 seconds. Due to the design of the Proto Matrix, this should not increase velocity if the low pressure regulator is set correctly and all o-rings are intact.

Debounce / AMB Setting Tips **- A tip for setting the debounce and AMB** – Although AMB is meant as a safety feature to stop run-away markers, it also has the unfortunate side effect of hiding bounce. To test your marker for bounce, shoot it as fast as possible with a single finger. If you have bounce, you'll see and hear double shots for individual pulls. This means you need to turn up your debounce. The slow pull test in use by some judges is not realistic for finding guns that have the debounce set too low.

Contact Information

The Matrix Center
http://www.thematrixcenter.com
The Matrix Center
209-E Creek Ridge Rd.
Greensboro, NC 27406
(336) 275-3458

Additional Information
www.tadaotechnologies.com