



## Musashi 3 Upgrade

### Tadao 1.1 Matrix Board

#### 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 through 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, and fire mode
- 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 breach

#### Installation

**Upgrade Chip Installation** – Removal and installation of the chip on a Tadao 1.1, Matrix board must be carefully done to ensure the chip and the electronics are not damaged. Begin by removing the grips from the left side of the marker. This will expose the entire circuit board. The chip is located in a socket near the bottom of the grip frame. To remove, gently pry under each end with a small flathead screw driver. Alternate sides until it is far enough out to remove with your fingers. Insert the new chip, making sure it is aligned properly. A notch in one end of the chip lines up with a notch in the socket and the white drawing on the surface of the board. If the marker will not turn on and it is not due to a low battery or broken battery harness, you may have installed the chip backwards.

#### LED Indicator

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

Solid	Eyes enabled
Slow Blinking	Eyes disabled, rate of fire limited to 20 balls per second in mode 1; otherwise capped at 15 balls per second for fire modes 2 and 3

#### Power and Eye Operation

Pressing and releasing the power button turns the marker on. It will show a solid color LED in the grip frame to indicate that the marker is ready to be used.

The eyes are enabled when the marker is first turned on. To disable the eyes press and hold the power button for 1 second. The LED will start slowly blinking to indicate the eyes are turned off.

To turn the marker off, press and hold the power button for 1 second again. The marker will power down.

#### Power Button Sequence

1. Press and release power button.
2. LED lights solid to indicate the eyes are on.

3. To disable eye system, press and hold power button for 1 second.
4. Eye system turns off, LED slowly blinks to indicate eyes off mode.
5. To turn off, press and hold power button for 1 second.
6. Marker turns off.

Note that the eye logic can tell the difference between paint being fired and an object constantly blocking the eyes. The eyes watch for the bolt to return every shot, so if this does not happen, it will slow down the maximum rate of fire to prevent additional ball breakage.

#### Programming

The user may enter programming mode by shorting the lower right pins on the chip while the marker is off. A conductive object such as a hex wrench must be used.



When pins 5 and 6 are shorted together, the board will boot into programming mode, which is indicated by a rapidly flashing LED.

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

One Pulse	Debounce
Two Pulses	Dwell
Three Pulses	Loader Delay
Four Pulses	Fire Mode

When the LED is pulsing 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 5 times. Once the LED stops blinking, you have 3 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:

- Make sure the marker is powered off.
- Ground pins 5 and 6 on the microcontroller.
- The LED will blink rapidly to indicate the board is in programming mode.
- After blinking, the LED will pulse once every second. This indicates that you are in the debounce mode.
- Quickly pull and release the trigger one time to switch to the dwell mode.
- The LED will now pulse two times every second.
- Pull and HOLD the trigger until the LED turns off.
- Release the trigger. The LED will blink out the current setting.
- When the LED stops blinking, enter the new setting by pulling the trigger 20 times.
- Wait until the LED flashes rapidly to confirm the new setting.
- Turn the marker off.

#### 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. Debounce is only used in fire modes 1 and 2 (semi-automatic unlimited and capped). In modified NXL/PSP mode the debounce is locked at a high setting.

**Dwell** – The amount of time the solenoid is energized each time the marker is fired. The default is 15 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.

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

1. Semi-automatic, unlimited rate of fire
2. Semi-automatic, capped rate of fire at 15 bps
3. Modified NXL/PSP, capped rate of fire at 15 bps

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.

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 to 15 balls per second.

Setting 3 is a modified NXL/PSP fire mode that works as follows:

- The first 3 shots of a string are semi-automatic
- After the 4<sup>th</sup> shot the marker will add shots as long as the user continues to pull the trigger
- If the trigger is released, the marker will stop firing immediately
- If the trigger is not pulled after releasing within 1 second, the 3-shot semi-automatic count starts over

In normal operation, continually pulling the trigger faster than 5 to 6 pulls per second will effectively give the user full automatic at 15 balls per second. If the user stops shooting then resumes within 1 second, the marker will return to the max rate of fire. If the user stops shooting for more than 1 second, the next 3 shots will be semi-automatic. On the 4<sup>th</sup> shot it will resume a faster fire rate.

## 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 Matrix, this should not increase velocity if the low pressure regulator is set correctly and all o-rings are intact.

**Additional Information**  
[www.tadaotechnologies.com](http://www.tadaotechnologies.com)