Tadao ただお Technologies

Musashi 5 DM4/5/C Chip Instructions

Features

- Fully functional in the Dye DM4, DM5, and DMC markers with both LBI and non-LBI boards
- Based on the Musashi 5 software
- Includes five fire modes: uncapped semi-auto, adjustable semi-auto, PSP ramping, PSP burst, and NXL full-automatic
- Continuously monitors the trigger switch through the entire firing cycle
- Adjustable ABS programming prevents first shot drop-off
- AMB and CPF algorithms help to eliminate mechanical bounce and switch bounce
- Power efficient software lengthens battery life
- Programming mode allows changes to debounce, dwell, loader delay, AMB, ABS dwell, fire mode, fire mode max rate of fire, eye mode, cycle percentage filter, and ramp start
- All settings are stored in non-volatile memory so they are not lost when battery is disconnected
- One-touch startup enables the marker to fire instantly
- Automatic 15-minute idle power down saves batteries
- Force shot eye mode allows the marker to be fired when the eyes are enabled but no object is present in the breech
- Low battery indicator software when used with an LBI board
- Bad Membrane Recognition allows the user to keep playing when the eye button fails on the membrane pad
- Two eye modes: delayed and forced with force shot

Installation

Removal and installation of the chip on a DM4, DM5, or DMC must be carefully done to ensure the chip and the electronics are not damaged.

Begin by removing the grips from the right side of the marker. This will expose the entire circuit board. Unplug the battery. The stock 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, broken membrane or broken battery harness, you may have installed the chip backwards.

LED Indicator

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

Rapid Blinking Red	At startup this indicates an exhausted battery
Rapid Blinking Yellow	At startup this indicates a low battery
Rapid Blinking Green	At startup this indicates a good battery
Solid Blue	Ball in breech, ready to fire
Slow Blinking Blue	No ball in breech
Slow Blinking Yellow	Eye malfunction; clean eyes or make sure the gun is being fired with paint and air
Slow Blinking Red	Eyes disabled, rate of fire limited to 20 balls per second in mode 1; otherwise capped at fire mode max rate of fire for fire modes 2 and higher

Power Operation

Pressing and releasing the power button turns the marker on. The battery level will show a flickering red, yellow, or green LED. A blue LED in the grip frame will then indicate that the marker is ready to be fired. To turn 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. See “Battery Indicator” section for additional details.

Startup Sequence:

1. Press power button.
2. LED flickers red, yellow, or green to show the status of the battery if using an LBI board; otherwise go to step 3.
3. LED lights solid blue or blinking blue, depending on whether something is in the breech, ready to fire.

Eye Operation & Logic

The eyes are enabled when the marker is first turned on. The eyes can be toggled by using the eye button. Press and hold the eye button for 1 second and the LED will change colors to indicate the mode change.

If used, the eye system cycles the marker as fast as possible. During each shot the eyes watch for the bolt to return, ending the current firing cycle and starting another as quickly as the pneumatics allow. If the eye system is continually blocked (e.g. putting your finger in front of the eyes) and is unable to see the bolt return after every shot, the max rate of fire will be reduced to about 12 balls per second to prevent further chopping, and the LED will slowly blink yellow to indicate an eye malfunction. The only way to show the true speed of the M5 chip is to fire the marker with paint and air. When the eyes are off, the rate of fire is limited to 20 balls per second unless in fire mode 2-5, in which case the rate of fire is selected by the user.

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

Battery Indicator (for the LBI board)

This section does not apply to the non-LBI board. To determine if you have an LBI board, refer to the pictures at www.tadaotechnologies.com.

Newer boards that ship with the DM4, DM5, and DMC have the correct circuitry to utilize a battery indicator if the corresponding software exists on the microcontroller.

The battery indicator software is standard on the Musashi 5 DM4/5/C Chip. When the marker is turned on, the LED will briefly flicker red, yellow, or green to indicate the battery level if using an LBI board. If not using an LBI, board the marker will go straight into the firing mode.

Programming

The tournament lock must be disabled in order to change settings on the chip. The 4th dip switch functions as the tournament lock. To disable the tournament lock, make sure the 4th 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 sequence, then solid green.

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

Green	Debounce
Purple	Dwell
Yellow	Loader delay
Blue	AMB (anti-mechanical bounce)
Red	ABS dwell
White	Fire mode
Teal	Fire mode max rate of fire
Flickering Green	Eye mode
Flickering Purple	CPF (cycle percentage filter)
Flickering Yellow	Ramp start

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 a rainbow sequence, then solid green. This is the debounce mode.
4. Quickly pull and release the trigger 1 time to switch to the dwell mode. The LED will show purple.
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 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 10.

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 DM4, DM5, and DMC 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 (1 being off). AMB is only used in fire modes 1 and 2 (semi-automatic unlimited and capped).

ABS dwell – Amount of dwell time added for an ABS shot. The range is from 1 to 15 additional milliseconds of dwell. The default is 5. ABS can be disabled by setting the 1st dip switch to the down/off position. For a more detailed explanation of ABS see the "Additional Features" section.

Fire mode – Included are five different fire modes (default is 1):

1. Semi-automatic, unlimited rate of fire
2. Semi-automatic, adjustable rate of fire
3. PSP ramping, adjustable rate of fire
4. PSP burst, adjustable rate of fire
5. NXL full-automatic, adjustable rate of fire

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 limits the maximum balls per second that can be fired. The cap is set by the Max ROF setting.

Setting 3 is the first PSP fire mode that works as follows:

- The first 3 shots of a string are semi-automatic.
- After the 4th shot the marker will add shots as long as the user fires faster than the ramp start setting. For example, if the ramp start setting is 5, the user must pull 5 times per second or faster for the software to add additional shots.
- If the trigger is released, the marker will stop firing immediately.
- If the trigger is not pulled again within 1 second of release, the 3-shot semi-automatic count starts over.

Setting 4 is the second PSP fire mode that works as follows:

- The first 3 shots of a string are semi-automatic.
- After the 4th shot the marker will fire 2 or more shots per pull as long as the user continually pulls and releases the trigger.
- If the trigger is released, the marker will stop firing immediately.
- If the trigger is not pulled again within 1 second of release, 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 the max rate of fire. 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 4th shot it will resume a faster fire rate.

PSP ramping and PSP burst differ in that PSP ramping requires the user to maintain the ramp start rate of fire for software assistance, whereas the PSP burst mode will fire at least 2 shots per pull, regardless of rate of fire. Some players prefer multiple shots every time they pull the trigger after the initial 3 semi-automatic shots, while others like to shoot 1 ball at a time until they achieve a certain rate of fire.

Setting 5 is the NXL full-automatic fire mode. It functions similarly to the PSP fire modes except, after the 3rd semi-automatic shot, the user may pull and hold the trigger for the marker to fire in full-automatic.

Fire mode max rate of fire – The maximum rate of fire setting only applies to the 2nd 3rd, 4th, and 5th fire modes. The max rate of fire is adjustable from 14 to 20 balls per second in ¼ balls per second increments. It also has an unlimited setting for all modes. The default is 4, which is roughly 14.75 balls per second. Oscillator inconsistencies from chip to chip make it impossible to time perfectly, so the only true way to check rate of fire is to use 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
				26	Unlimited w/ eyes on

Eye mode – Two eye modes are available:

1. Delayed – The marker fires ½ second after every trigger pull regardless of a ball in the breech. This is useful for sound activated loaders because it insures that a shot is fired, even without paint, so the loader will continue to feed.
2. Forced with force shot – The marker only fires if paint is seen in the breech or the user pulls and holds the trigger for ½ second, thus initiating a force shot.

Cycle percentage filter (CPF) – The cycle percentage filter allows adjustment of the point within the current firing cycle that a new buffered shot is allowed. Almost all electronic paintball markers allow a single shot to be buffered in the event the user is fast enough to release the trigger and pull again during the current firing cycle. The CPF setting is adjustable from 1 to 10. Setting 1 turns the CPF off, allowing buffered shots at any point in the firing cycle. Setting 2 through 10 sets the percentage of the firing cycle that must pass before shots may be buffered:

1. CPF turned off
2. 10% of the firing cycle must pass before a buffered shot is allowed
3. 20%
4. 30%
5. 40%
6. 50%
7. 60%
8. 70%
9. 80%
10. 90%

A higher CPF setting results in less unintentional bounce. For instance, it is possible that if your debounce setting is border line, you can fire the marker a few times then hold it loosely and allow it to brush against your finger, going full-automatic. Since most switch bounce from either a low debounce setting or mechanical bounce occurs almost immediately after the trigger is released, CPF can be very effective in eliminating falsely generated trigger activity.

Ramp start – The ramp start setting is only used for the PSP ramping fire mode (mode 3). It sets the minimum pulls per second that must be maintained for the software to add shots or ramp up to the maximum rate of fire setting. The default is 5 and is adjustable from 4 to 12 pulls per second.

Dip Switches:

Dip 1 ABS toggle, UP/ON for ABS enabled
Dip 2 Not used, leave UP/ON
Dip 3 Not used, leave UP/ON
Dip 4 Tournament lock, UP/ON for lock disabled

Additional Features

Bad Membrane Recognition – If the eye button on the membrane pad fails, the software recognizes it at boot-up and disables it completely. This allows the user to continue playing with the eye system enabled. It is not necessary to check the power button on the membrane pad. If it goes bad, the marker cannot be turned on.

Force Shot feature – If using the forced eye mode and 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 can 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.

A tip for setting the debounce, AMB, and CPF – This only applies to semi-automatic fire modes (modes 1 and 2) since AMB is disabled in the PSP fire modes or NXL mode.

Debounce, AMB, CPF setup steps, while using air (no paint):

1. Turn AMB and CPF off (set both to 1).
2. Starting at debounce 1-3, raise the debounce setting a notch at a time until excessive trigger bounce goes away. The goal is to have one pull, one shot, regardless of rate of fire. Do NOT slow pull test for bounce during this phase. Instead, pull the trigger rapidly or walk it, listening for double or triple fires.
3. When it appears that it is only one shot, one pull for solid trigger pulls, try the slow pull test. Holding the marker steady, slowly pull the trigger and see if multiple shots can be generated from the single pull.
4. Increase the CPF setting a notch at a time until the slow pull bounce starts to disappear. An additional test is to fire a few rounds quickly, then hold the trigger right on the activation point to see if the marker will run away.
5. If you reach setting 10 with CPF and the marker can still be slow pulled to fire full-automatic, then your debounce setting is probably too low. Go back to step 2.
6. AMB should not be set above 3, if possible, since it is not as transparent to the user as CPF. Even a CPF setting of 10 will not be noticed by the user.

Example Setting Profiles:

1. Tournament legal semi-automatic (NPPL)
    a. Fire mode 1 or 2 (semi-automatic unlimited or capped)
    b. Debounce 5-20
    c. AMB 2
    d. CPF 2-5
    e. Loader delay set to match your loader (1-4 for Halo, 4-10 for gravity feed)

2. PSP X-Ball, CFOA, Millennium
    a. Fire mode 3 or 4 (Millennium requires mode 3)
    b. Max rate of fire set to 3-5, depending on Pact Timer readings. To be safe use setting 3 (14.5 balls per second).
    c. Debounce 5-20
    d. Ramp start 5 or higher if using PSP ramping
    e. Ramp start 8 or higher if playing Millennium
    f. Loader delay set to match your loader (1-4 for Halo, 4-10 for gravity feed)

3. NXL
    a. Fire mode 5 (NXL full-automatic)
    b. Max rate of fire set to 3-5, depending on Pact Timer readings. To be safe, use setting 3 (14.5 balls per second).
    c. Debounce 5-20
    d. Loader delay set to match your loader (1-4 for Halo, 4-10 for gravity feed)

4. Ludicrous Speed (absolute fastest/bounciest)
    a. Any fire mode
    b. Max rate of fire set to 26 (unlimited)
    c. Debounce 1
    d. AMB 1 if using semi-automatic
    e. CPF 1
    f. Ramp start 4 if using PSP ramping
    g. Loader delay 1

Additional Information

www.tadaotechnologies.com