Angel Force Tadao Speed Board Instructions

Features

- Fully functional in the WDP Angel 05 Speed
- Based on the Musashi 7 software
- Includes twelve (12) fire modes: uncapped semi-auto, capped semi-auto, PSP auto-response, PSP mild ramping, PSP max ramping, PSP z-burst, NXL full-automatic, auto-response, mild ramping, max ramping, z-burst, and full-automatic
- Asynchronously monitors the trigger switch using an interrupt based scan at 2 million times per second
- Gangster setting allows 3 different options for every fire mode, giving 36 different "breakout" style modes
- Adjustable ABS programming prevents first shot drop-off
- AMB (anti-mechanical bounce) and CPF (cycle percentage filter) algorithms help to eliminate mechanical bounce and switch bounce
- Power efficient software and hardware 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, CPF, ramp start, gangster mode, and LED colors
- 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 to safe mode saves batteries
- Three eye modes: delayed, forced with force shot, and test mode with rate of fire indicator
- Fully adjustable color schemes
- Low battery indicator hardware and software shows battery level each time the marker is turned on and during use at the push of a button

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. The default color scheme is:

Rapid Blinking Red	At start this indicates an exhausted battery
Rapid Blinking Yellow	At start this indicates a low battery charge
Rapid Blinking Green	At start this indicates a full battery charge
Solid Blue	Ball in breech, ready to fire
Slow Blinking Blue	No ball in breech
Slow Blinking Yellow	Eye malfunction, max rate of fire reduced to 12.5 bps; clean eyes or make sure the gun is 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 – 12

Power Operation

The marker is turned on using the power toggle switch. The battery indicator will show the current power level of your battery with a flickering red, yellow, green, blue, or purple LED. After, it will show a solid or blinking blue LED (unless changed from the default). To turn off, flick the power switch to the off position. 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.

Eye Operation and Logic

The eyes are enabled when the marker is first turned on. The eyes can be toggled on and off by pulling and holding the trigger for 3 seconds. 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 blink the eye malfunction color (yellow by default). The only way to show the true speed of the 05 Speed board 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 2-12, 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 (if using default colors) once the object is removed.

Battery Indicator

Battery indicator software and hardware are standard on the 05 Speed board. When the marker is turned on, the LED will briefly flicker red, yellow, or green to indicate the status of your battery. If it flickers red, the battery is exhausted and should be charged as soon as possible. If it flickers yellow, the battery may last for another case of paint, but it is close to failing.

Programming

The tournament lock must be disabled in order to change settings on the board. The push button switch on the lower right side of the board toggles the tournament lock. While the marker is turned on and in the normal firing mode (eyes on or off) push and hold the lock button. The LED will flash a red/green sequence, ending with either red or green to indicate the status of the lock. Red means the lock is on, while green means the lock is off. While the lock and the marker are off, pull and hold the trigger, then flip the power switch. The marker will boot into programming mode, showing a rainbow sequence before stopping at solid green. Programming mode can be exited by turning the marker off.

Pulling and releasing the trigger quickly will cycle 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
Flickering Blue	Gangster mode
Flickering Red	Eye enabled color
Flickering White	Eye disabled color
Flickering Teal	Eye malfunction color
Flashing Blue/Red	Intellifeed dwell

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 switch.

Programming Example

If you want to set the dwell to 12, you should:

1. Make sure the marker is powered off and the tournament lock is disabled.
2. Pull the trigger and push the power button to turn on the marker.
3. The LED shows a rainbow sequence then stops on 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 12 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 lock 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 05 Speed board features an interrupt based debounce algorithm that effectively "scans" the trigger over 2 million times per second. It runs this completely independent of code execution on the microcontroller so your trigger pulls are always registered. The debounce setting is in increments of ½ milliseconds. Users should be aware that low debounce settings 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 (5 ms).

Dwell – The amount of time the solenoid is energized each time the marker is fired. The default is 11 ms. The range is 5 to 25 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 25.

AMB (Anti-mechanical bounce) – Allows the user to adjust the anti-mechanical bounce feature. Mechanical bounce occurs due to the kick generated during each shot and can cause the marker to "run away" on the first few shots. 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 adjustable).

ABS dwell – Amount of dwell time added for an ABS (anti-bolt stick) shot. The range is from 1 to 15 additional milliseconds of dwell. The default is 1, which is off. ABS 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.

Fire mode – Included are twelve (12) different fire modes (default is 1):

1. Semi-automatic, unlimited rate of fire
2. Semi-automatic, adjustable rate of fire
3. PSP auto-response
4. PSP mild ramping, adjustable ramp start
5. PSP max ramping, adjustable ramp start
6. PSP Z-burst
7. NXL full-automatic
8. Auto-response
9. Mild ramping
10. Max ramping
11. Z-burst
12. Full-automatic

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 an adjustable rate of fire. It limits the maximum balls per second that can be fired. The cap is set by the max rate of fire setting.

Setting 3 is the PSP auto-response fire mode that works as follows:

- The first 3 shots of a string are semi-automatic
- After the 4th shot the marker will fire on the pull and release in auto-response mode
- If the user stops firing for more than 1 second, the 3-shot semi-automatic count starts over

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

- The first 3 shots of a string are semi-automatic
- After the 4th shot the marker will ramp based on the speed of the trigger pulls as long as the user pulls the trigger faster than the ramp start setting.
- If the user stops firing for more than 1 second, the 3-shot semi-automatic count starts over

Setting 5 is the PSP max ramping fire mode that works as follows:

- The first 3 shots of a string are semi-automatic
- After the 4th shot the marker will ramp up to the loader's maximum speed or the maximum rate of fire as long as the user pulls the trigger faster than the ramp start setting.

- If the user stops firing for more than 1 second, the 3-shot semi-automatic count starts over

Setting 6 is the PSP Z-burst fire mode that works as follows:

- The first 3 shots of a string are semi-automatic
- After the 4th shot the marker will burst fire from 2-3 shots per pull depending on how quickly the trigger is pulled and released
- If the user stops firing for more than 1 second, the 3-shot semi-automatic count starts over

Setting 7 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.

Setting 8 is the normal auto-response fire mode. The marker will fire on each pull and release of the trigger, generating two shots per full pull cycle.

Setting 9 is the normal mild ramping fire mode. The marker will fire in semi-automatic unless the user pulls the trigger faster than the ramp start setting. Once the ramp start setting has been achieved the marker will mildly ramp, generating additional shots depending on how fast the user pulls the trigger.

Setting 10 is the normal max ramping fire mode. The marker will fire in semi-automatic unless the user pulls the trigger faster than the ramp start setting. Once the ramp start setting has been achieved the marker will ramp up to the maximum feed rate of the loader or the maximum rate of fire setting, whichever is lower.

Setting 11 is the normal Z-burst fire mode. The marker will burst fire 2 times or more for every pull and release of the trigger, depending on how fast the user pulls the trigger.

Setting 12 is the normal full-automatic fire mode. As long as the trigger is depressed the marker will fire in full-automatic.

Fire mode max rate of fire – The max rate of fire setting applies to the 2nd – 12th fire modes. The max rate of fire is adjustable from 10 to 25 balls per second, and has an unlimited setting for maxing out the loader system. The default is 7, which is roughly 13 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
1	10.0	12	15.5
2	10.5	13	16.0
3	11.0	14	17.0
4	11.5	15	18.0
5	12.0	16	19.0
6	12.5	17	20.0
7 (default)	**13.0**	18	21.0
8	13.5	19	22.0
9	14.0	20	23.0
10	14.5	21	24.0
11	15.0	22	Unlimited eyes on, 25.0 bps eyes off

Eye Mode – Three eye modes are available:
1. Delayed – If the eye system does not detect a ball in the breech for ½ second, the marker automatically fires. This is useful for sound activated loaders because it ensures 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, thereby initiating a force shot. This is the default and the same as the stock DM4, DM5, or DMC software's eye mode.
3. Test – This mode is specifically for seeing how fast the user can fire the marker, or how fast the pneumatics can actually cycle. The eyes work to prevent firing if they are blocked. This mode is only for dry firing. The LED is used to show the fastest achieved rate of fire:

Red	less than 10 bps
Yellow	between 10 and 15 bps
Green	between 15 and 20 bps
Blue	between 20 and 25 bps
White	25 bps or greater

As long as the user continues to fire, the fastest achieved rate of fire will continue to be displayed on the LED. If the user stops firing for 1 second, the LED will cycle back through the rate of fire colors.

Note: The test eye mode works with any fire mode selected. The fire mode max rate of fire is set to unlimited while in test eye mode.

CPF (Cycle percentage filter) – 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 – This setting is only used for the four ramping fire modes (PSP mild and max ramping, and normal mild and max ramping). 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 14 pulls per second.

Gangster mode – The 05 Speed board includes a special mode that can be applied three different ways to each of the 12 fire modes, giving 36 "breakout" style combinations. Gangster mode gives the user full-automatic with an unlimited rate of fire for a single pull, for use at the start of the game. The setting is defaulted at 4, which turns gangster mode off. A setting of 1-3 dictates at which pull that gangster mode will become active. If set to 1, the first shot after you turn on the marker will be full-automatic with an unlimited rate of fire for as long as you hold down the trigger. As soon as you release the trigger, the marker will stop shooting and default back to your selected fire mode. If set to 3, the gangster mode will be active on the third shot after the marker is turned on. Regardless of the fire mode selected, the shots before the gangster mode will be semi-automatic. Gangster mode can only be used once for each time the marker is turned on.

Note: The gangster mode is illegal for use in all tournament series. Tadao Technologies LLC takes no responsibility for the user's choice in using the gangster mode.

Color scheme settings – The LED color scheme is fully adjustable. The following three settings are adjustable from 1 to 7 for these colors:
1   Green
2   Purple
3   Yellow
4   Blue
5   Red
6   White
7   Teal

Eyes enabled color – This setting allows the user to change the color of the LED while the eye system is enabled. The default is blue (4).
Eyes disabled color – This setting allows the user to change the color of the LED while the eye system is disabled. The default is red (5).
Eye malfunction color – This setting allows the user to change the color of the LED when the eye system detects a malfunction. The default is yellow (3).

Intellifeed Dwell – Included on the Tadao 05 Speed board is an intellifeed socket for use with intellifeed capable loaders. The intellifeed socket outputs a signal that can trip a relay that will run the loader every pull of the trigger. **The socket CANNOT power a loader**. The intellifeed dwell setting is adjustable from 1 to 10. 1 is off, while each successive setting is an additional 25 ms that the intellifeed socket will generate a signal during each shot. A setting of 2 would give 25 ms of intellifeed, on up to setting 10 for 225 ms of intellifeed. The intellifeed socket is disabled while Test eye mode is in use.

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.

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 paint and air:
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, 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-auto 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
   a. Fire mode 3, 4, 5, or 6
   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 mild/max ramping
   e. Loader delay set to match your loader (1-4 for Halo, 4-10 for gravity feed)
3. Millennium
   a. Fire mode 4 or 5 (PSP mild or max ramping)
   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 8 or higher
   e. Loader delay set to match your loader (1-4 for Halo, 4-10 for gravity feed)
4. NXL
   a. Fire mode 7 (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)
5. 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 any ramping modes
   g. Loader delay

Additional Information
www.tadaotechnologies.com