

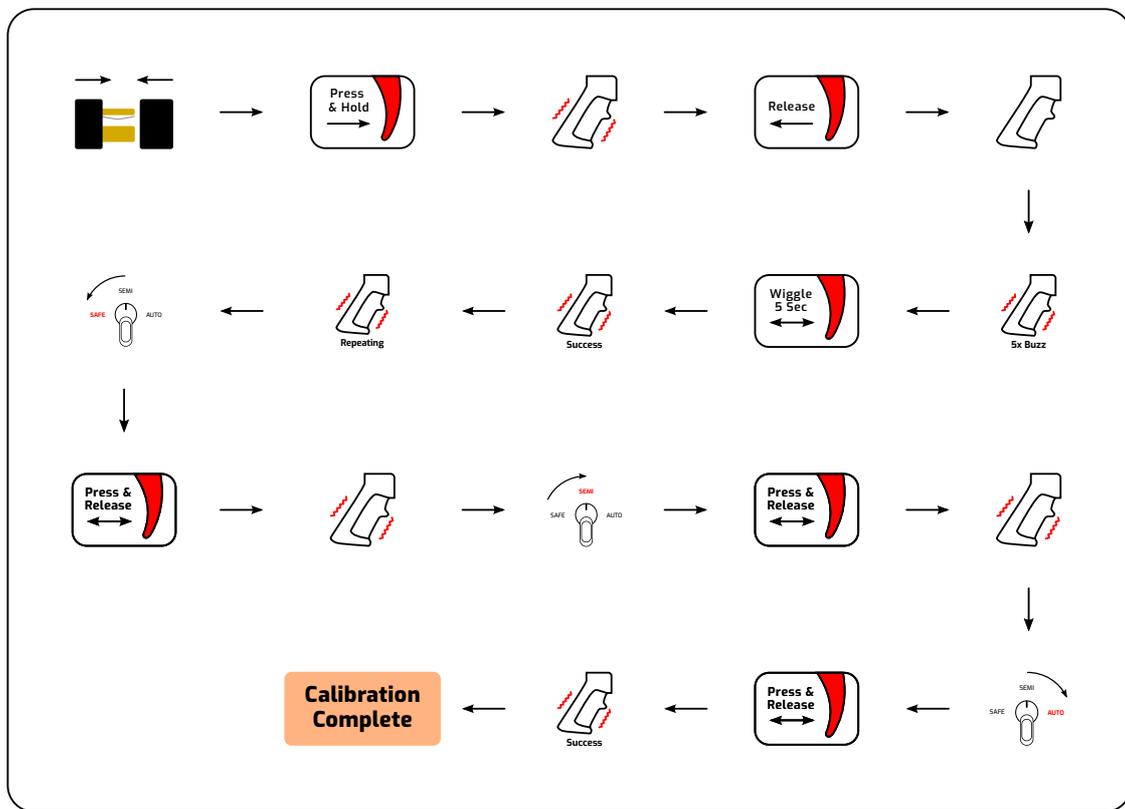
HyperDrive Mk1 User Manual - FW 0.3.0

Getting Started

If your HyperDrive isn't installed in your gearbox yet, refer to the HyperDrive Installation Guide to get your build running as quickly as possible. After you've installed your HyperDrive in your gun and are ready to try it out, you will need to calibrate the sensors. Calibration automatically adjusts the sensitivity of the sensors to account for mechanical tolerances in the trigger and selector plate.

1 | Calibration

1. Plug in battery and immediately press & hold trigger.
2. Release the trigger as soon as you hear a beep.
3. Wait for 5 sequential beeps. This indicates trigger needs to be calibrated.
4. As soon as the beeps end, slowly press and release the trigger several times.
5. After 5 seconds, you will hear a success tone if the calibration was accepted.
6. You will then hear a series of continuous short beeps. This indicates the selector switch is ready to be calibrated.
7. Rotate the selector switch to the 'SAFE' position.
8. Press and release trigger.
9. Rotate the selector switch to the 'SEMI' position.
10. Press and release trigger.
11. Rotate the selector switch to the 'AUTO' position.
12. Press and release trigger.
13. You will then hear a success tone indicating that the selector switch is calibrated.
14. Calibration is now complete!



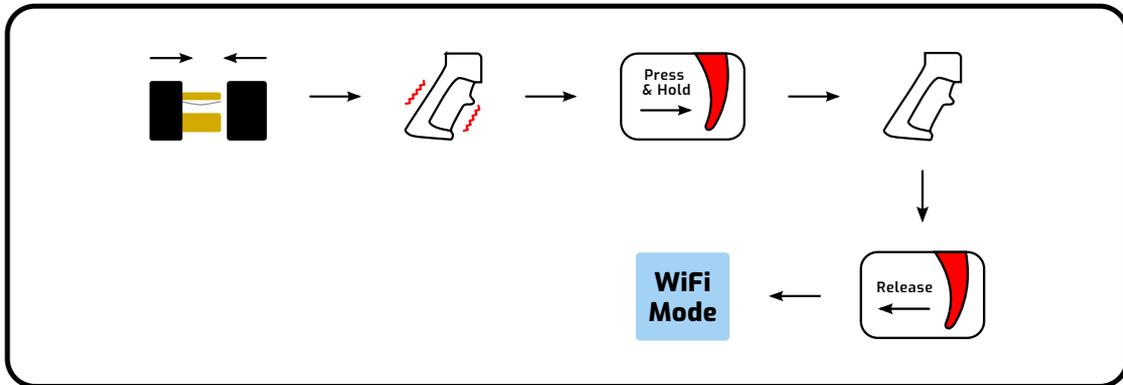
Once you've successfully calibrated the sensors, you will need to access the settings through the WiFi interface. Almost any device (phone, tablet, or PC) will work. You do not need an internet connection to access settings, so if needed you can tweak values in the field. Read the following steps to access the settings dashboard.

2 | Connecting to WiFi

1. Plug in battery and wait for 1.5sec tone.
2. Before the tone ends, press & hold trigger.
3. After the tone ends, you can release the trigger.
4. You should hear a success tone indicating unit is in WiFi Mode. If not, unplug battery and try again.
5. On your phone/PC, look for a WiFi access point called "HyperDrive".
6. Connect to the access point with the password "12345678".
7. Open your browser (Chrome, Safari, Edge, etc) and type "192.168.1.1" into the URL bar and press Enter. Alternatively, you can scan the QR code below to bring up the dashboard:



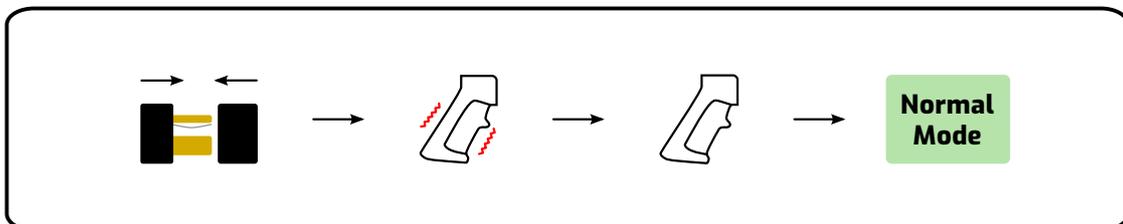
8. After a few seconds, the settings dashboard will load.
9. Bookmark the page in your browser for easier access next time.
10. You can now customize your HyperDrive to suit your needs. Settings are updated in real time, and automatically saved to memory.
11. Refer to the [Settings Reference](#) section for a more detailed description of settings.



When you've adjusted the settings to your liking and you're ready to use it in a game, just plug in the battery and wait for the tone to complete. All the settings are loaded from memory and it's ready for action!

3 | Normal Operation

1. For regular game use it is recommended to use normal mode, as standby power usage is less than in WiFi mode.
2. Plug in battery and wait for 1.5sec tone to end without touching trigger. During this time, trigger & selector calibrations are loaded from memory.
3. Your gun is now ready to use!



4 | Firmware Update

It is strongly recommended to perform firmware updates from a laptop or PC

1. Download the ZIP file of the most recent firmware update from <https://www.hyperbolic-labs.com/resources>
2. Unzip the file, and make a note of the file location
3. In the HyperDrive settings dashboard, click the 'Firmware Update' button
4. You will be redirected to a new page. Click the button called 'Choose File', and select the firmware file to apply (*.bin file)
5. Click the 'Update' button to the right.
6. The firmware update process will take ~1-2 minutes to complete. Make sure the device you're connected to is within 15ft to reduce the chance of a failed update. If it loses connection during the update process, you will need to disconnect the battery and start again.
7. If the update was successful, "OK" will be displayed on the screen. Disconnect the battery, and the new firmware has been updated successfully.
8. If unsuccessful, "FAIL" will be shown. Disconnect the battery from the Hyperdrive and start again, following the same steps above.

Settings Reference

Trigger

- Trip Point - Sensitivity of the trigger. Lower values mean higher sensitivity. Recommended range is 15-50, but values from 1-100 are accepted. Be aware that setting the sensitivity very high could cause trigger jams.
- Release Point - Trigger is disengaged when the released below this value, so pick a number equal or less than trip point.
- Input Buffer - This feature is not yet implemented.
- DMR Delay - Introduces configurable dead time after a shot (SEMI only). Any trigger pulls during this time period will be blocked. Valid entries range from 0 - 10,000 milliseconds.
- Jam Timeout - This feature is not implemented yet.

Cycle Settings

- Cutoff Angle - This setting adjusts the angle when power is cut off to the motor. Valid entries range from 10-350 degrees. Try 120 degrees as a baseline, then adjust +/- according to the precocking level you desire. If you have issues with overspin or double shots, try reducing the cutoff angle.
- Active Braking - Sets the strength of the active brake in milliseconds. Higher values will make cycling more consistent, but will increase motor wear and cause additional heating. Typical values are 1-10 milliseconds.
- Burst Size - Configure the number of shots per burst. Valid inputs range from 3 - 50 shots per burst.

RoF Limiting

- Motor Power - This feature is not implemented yet.
- Cycle Delay - Adds an additional delay after each cycle. This delay is applied to all modes except SEMI and BINARY. Use this setting to reduce your RoF if needed.
- 1st Cycle Boost - This feature is not implemented yet.

Battery

- E-Fuse Protection - Protects the motor and electronics from accidental shorts. If the current rises above this level, power to the motor is instantly cut off to prevent damage. Typically this will be set to somewhere in the 50-200 amp range.
- Low Level - When the cell voltage in your battery reaches this level, it triggers an alert (if enabled) to notify that your battery is running low. Typical values are 3300-3600mV.
- Empty Level - When the cell voltage in your battery reaches this level, HyperDrive will go into hibernation mode to prevent damage to the battery. Typical protection levels range from 3100mV-3400mV per cell for LiPo/Lilon. Note that HyperDrive still consumes a small amount of power in hibernation, so it is not recommended to leave the battery connected for long periods of time.
- Sleep Timer - After this period of time without any trigger events, HyperDrive will enter sleep mode where standby power consumption is reduced to a minimum. To resume normal operation, press and hold trigger for up to 5 seconds until you hear a tone (see Alerts section for tone options). After waking from sleep, it will enter normal mode. You will need to perform a power cycle to re-enter WiFi mode.

Game

- Simulated Magazine - Check this box to enable simulated magazine function.
- Magazine Capacity - number of rounds simulated magazine holds.
- Magazine Low Level - Enter the number of rounds to trigger magazine low alert.
- Reload Lockout - Number of seconds firing will be disabled during simulated magazine reload. After reload duration is complete, it will trigger a mag reload alert (see Alerts section).
- Enable Game Timer - Enables countdown timer for a timed game. When timer runs out, 'Game Timer End' alert will sound. To reset timer hold down trigger for 5 seconds, you will then hear 'Game Timer Start' alert (see Alerts section). Game timer is also reset by disconnecting battery.

- Timer Duration - Duration of game timer in minutes.

Counters

- Shots Since Powered On - Counts the number of rounds fired since battery was connected
- Total Shots - Cumulative total number of shots fired. This number is never reset.
- User Shot Counter - This counter counts cumulative shots until reset by user (reset button below).
- Reboot Cycles - Number of battery connect/disconnect cycles.
- Up Time - Duration unit has been powered on.
- Total Up Time - Cumulative total duration unit has been powered on. This number is never reset.

About

- Serial Number - 7 character code used to uniquely identify your device.
- Firmware Version - Check this number to make sure your firmware is up to date with the most recent version.
- Hardware Revision - Tracks which specific hardware version you have. Rev. G has a purple light, Rev. F does not. For all other practical purposes they are identical.
- Mfg Date - The date that the unit was assembled and tested.
- MAC ID - Unique identification number for the HyperDrive WiFi access point.
- FW Update - Click this button to update the firmware your HyperDrive is running.

Modes

- Selector Type - Set to 3 position for most builds. 5 position selector is an experimental feature that requires tight tolerance selector plate & cam (no backlash) in order to work reliably.
- Position 1 - Change this value to set the mode when the selector is in the 'SAFE' position.
- Position 2 - Change this value to set the mode when selector is between 'SAFE' and 'SEMI' positions (5 position selector only).
- Position 3 - Change this value to set the mode when the selector is in the 'SEMI' position.
- Position 4 - Change this value to set the mode when selector is between 'SEMI' and 'AUTO' positions (5 position selector only).
- Position 5 - Change this value to set the mode when the selector is in the 'AUTO' position.

Mode Options

- SAFE - Nothing happens when trigger is pulled.
- SEMI - 1 round is fired as soon as trigger is pulled. Unit then waits until trigger is released.
- BINARY - 1 round is fired as soon as trigger is pulled, then another once trigger is released. If the trigger is not released in 3 seconds, the second round will not be

fired.

- BURST - Fires a predetermined number of rounds as soon as trigger is pulled. Unit then waits until trigger is released.
- BURST (Interruptible) - Same as BURST, but firing will stop if trigger is released before all of the rounds have been fired.
- AUTO - Gun will continuously fire until trigger is released.
- BURST -> AUTO - Initiates a burst fire. If trigger is still depressed when burst is complete, switches to AUTO mode.

Alerts

- Volume - Sets the volume of alerts. Choose from Off, Low, Med, High, and Max.
- Battery Low - Sets the tone for low battery alert.
- Battery Exhausted - Sets the tone for battery dead alert.
- Trigger Release - Sets the tone when trigger is released (applies to SAFE, SEMI, BINARY, and BURST)
- Mode Change - Triggers a tone whenever firing mode is changed.
- Safety Alert - Sets tone when trigger is pulled in SAFE mode.
- Mag Low - Sets the tone when simulated magazine is low (see Game section).
- Mag Empty - Sets the tone when simulated magazine is empty.
- Mag Reload - Sets the tone when simulated magazine is reloaded.
- Game Timer Start - Sets the tone when game timer is reset (See Game section).
- Game Timer End - Sets the tone when game timer reaches zero.

Calibration

- Invert Magnet Polarity - If you installed the magnet on the sector gear backwards, the cycle detection algorithm won't work right. Checking this box will invert the polarity of the magnet in software so you don't have to disassemble the gearbox again. A reboot is required to apply this setting.
- Trigger - Click this button to initiate a new trigger calibration. Wait for the 5 consecutive beeps, then follow the same steps you would for a normal trigger calibration. When calibration is done, you will hear a short 'success' tone.
- Selector - Click this button to initiate a new selector calibration. Wait for a series of short consecutive beeps, then press/release the trigger in SAFE, SEMI, and AUTO positions respectively. For 5 position selector, press/release trigger for all 5 selector positions, starting with SAFE, and ending with AUTO. When calibration is done, you will hear a short 'success' tone.
- Sector AoE & AoR - This feature is not yet implemented.

Diagnostic

- Refresh - Click this button to refresh the diagnostic data and shot counters. Keep in mind, most fields are updated when the trigger is released.
- Error Code - If the HyperDrive detects any errors, the error code will be shown here. Refer to [Troubleshooting](#) to look up any error codes. A zero in this field means there are no errors

detected.

- Cell Voltage - Displays the volts per cell of the battery. Multiply this number by the number of series cells in your battery to determine the battery voltage. For example, 3.6V/cell * 3S battery = 10.8V.
- Series Cells - As soon the battery is plugged in, your HyperDrive will automatically detect the number of series cells in your battery and display that number here.
- Battery Level - A rough estimation of the remaining charge left in your battery. 4.2V per cell is considered 100% charge, and 0% charge is set to the Empty Level field under 'Battery'.
- FET Temperature - Temperature in °C of the main MOSFET. If this temperature goes above 65°C, power to the motor will be shut off until the unit cools off.
- Voltage Regulator Temperature - Temperature in °C of the voltage regulator. If this temperature goes above 70°C, power to the motor will be shut off until the unit cools off.
- Trigger Position - Displays the position of trigger. This number may fluctuate slightly due to imperfect mechanical tolerances of the trigger.
- Selector Position - Displays the current selector position. 0 = 'Safe' position, 2 = 'SEMI' Position, and 4 = 'AUTO' position.
- Selector Mode - Displays the current firing mode.
- Precock Level - Displays the level of precocking. Precocking level is set by adjusting cutoff angle and active braking.
- Est. Battery Resistance - This feature is not yet implemented.
- Trigger Latency - Duration of time (in milliseconds) from trigger being pulled to piston being released.
- Simulated Mag Level - Displays number of rounds left in simulated magazine.
- Peak Current - This value is the peak current draw of the motor. In the AUTO column, the peak value is taken from the last gearbox cycle.
- Avg. Current - Average current draw of the motor for SEMI/BINARY and AUTO/BURST. Use this number to gauge how efficient your gearbox is. Average SEMI current is only updated after an AUTO/BURST event.
- Cycle Duration - Number of milliseconds to complete a gearbox cycle. Semi cycle duration is only updated after an AUTO/BURST event.
- Rate of Fire - Calculated rounds per second. This number is derived from the cycle duration. SEMI rate of fire is only updated after an AUTO/BURST event.
- Est. mAh per Cycle - This experimental figure is calculated from cycle duration and average current, and provides an estimate of the amount of battery capacity used per cycle.

Troubleshooting

Symptom	Fixes
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Symptom	Fixes
No tone when battery plugged in	<ul style="list-style-type: none"> Charge or replace battery Check wires for damage Damaged spade connectors to motor Make sure circuit boards aren't damaged
Frequent trigger jams	<ul style="list-style-type: none"> Reduce trigger sensitivity & re-calibrate Shim trigger to reduce axial slop Upgrade trigger to CNC aluminum for better mechanical tolerance Trigger has damaged circuit board traces Make sure upper circuit board isn't damaged
Incorrect mode selected	<ul style="list-style-type: none"> Re-calibrate selector sensor Dirty or wet selector sensor Replace selector plate Replace selector switch cam for less mechanical slop Damaged selector sensor
Frequent overheating	<ul style="list-style-type: none"> Verify ETU is mounted flush with gearbox with good thermal contact Improve gearbox shimming/mechanical efficiency
Overspin/Double shot on SEMI	<ul style="list-style-type: none"> Reduce cutoff angle Increase active braking level Reduce motor power Reduce battery voltage Change to stiffer spring
Overspin on BURST/AUTO	<ul style="list-style-type: none"> Reduce cutoff angle Increase active braking level
Disconnecting from WiFi	<ul style="list-style-type: none"> Move ETU closer to connected device Disable AUTO-connecting to your home network
Randomly waking from sleep	<ul style="list-style-type: none"> Re-calibrate trigger
Not responsive after SEMI cycle	<ul style="list-style-type: none"> Reduce DMR delay setting Reduce cycle delay setting Increase trigger trip & release points
Gearbox unable to complete cycle	<ul style="list-style-type: none"> Check shimming Change or replace battery Switch to higher torque motor Switch to battery with higher voltage or capacity Check for damaged wiring
Motor only clicks when trigger pressed	<ul style="list-style-type: none"> Check wiring for shorts or damaged insulation Charge or replace battery Replace motor ETU has overheated, wait for it to cool down

Symptom	Fixes
Multiple shots fired on SEMI	Check for damaged or missing sector magnet Check for damaged circuit board
Fires continuously when power is applied	Check wiring and motor for shorts

Error Code	Description	Possible Causes
0	No Errors Detected	
-1	E-Fuse Tripped	Shorted wiring or gearbox jam
-2	Cycle Timeout	Motor disconnected or gearbox jam
-3	MOSFET Overheated	Heavy use with high ambient temperature
-4	Regulator Overheated	Inadequate heatsinking to gearbox shell with 4S battery
-5	Low Voltage	Battery exhausted, damaged wiring, or failing motor
-6	Trigger Jam	Trigger sensitivity too high
-7	Decock Failed	Battery level too low, motor disconnected, or gearbox jam
-8	Sector Sensor Fail	Damaged circuit Board, cracked or missing sector magnet
-9	Other	N/A

Miscellaneous Notes

- To decock the piston, press and hold the trigger for 5 seconds in SAFE, SEMI, BINARY, or BURST mode. The piston will be towards the front of the gearbox with the spring stretched out. It is recommended to decock when storing the gun for long periods of time, as the gearbox components are under less stress.
- When an error occurs during operation, you will hear a low frequency tone for 1sec, then a series of short beeps indicating the error code. For example, an over temperature error (-3) will register as 3 consecutive beeps.

- You may hear an faint clicking sound coming from the ETU. This is a completely normal side effect from the way some of the components are manufactured.
- Keeping your HyperDrive in WiFi mode during a game may cause it to enter thermal protection mode, especially when using a 3S or 4S battery.

Technical Specifications

- Operating voltage range: 4.0V - 17.0V
- Current consumption: WiFi ON - 150mA, WiFi OFF - 50mA
- Operating temperature range: -20°C - 50°C
- Maximum current capability: 325A
- Dimensions: 46mm x 29mm x 10mm
- Weight: 25g / 0.88oz