TACHYON Official User Manual

Revision 1

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Setup

Standard kit contents:

- Tachyon base board
- 128x128p Color TFT LCD Display
- Infrared barrel sensor assembly
- Micro-Tamiya splitter cable
- 9v battery clip
- 1x M2 Screw
- Laser printed enclosure + side cover + rail clamp (Indiegogo "Complete Kit")
- 4x M3x35 mm screw and self-locking nuts
- 1x M2.5 screw
- High-Impact Polystyrene screen protector

Note: Before handling your weapon, make sure that the magazine is removed and chamber is empty. Mind your own safety and safety of those around you!

A detailed assembly video-guide is available on http://tachyon-esystems.com/

Steps:

1. Remove any muzzle devices if present. Note that on most weapons, the muzzle thread is inverted (counter-clockwise)!

2. Install the muzzle infrared sensor on the thread/barrel. If the spacing between the sensor and the barrel is too great, use tape or other spacers to ensure a good fit. Make sure that no parts of the barrel cover the holes on the inside of the sensor.

3. Tighten the clamp screw on the sensor

4. Plug in the splitter cable between the Weapon's battery and the Weapon's power input. (Or alternatively use a 9v battery clip)
   (Optional: Run the cable through the weapon's stock or other parts of preference for cosmetic purposes. This might require partial disassembly of the weapon)

5. Run the cables from the sensor, battery and reload button (+ auto-reload microswitch if used) through the hole on the bottom of the enclosure

6. Plug in the 22-pin display flat connector with contacts on top into the matching 22-pin flat connector on the base board

7. Plug in the cables into corresponding connectors on the Tachyon board

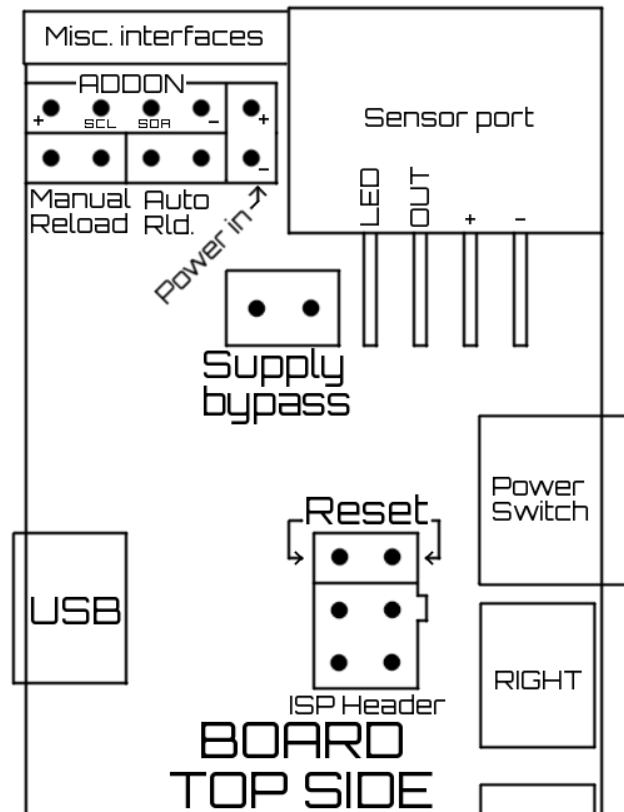8. (Optional) Plug in any I2C expansion boards if used

9. Insert the board into the enclosure. Use a 2mm screw to affix the board.

10. Close the enclosure with the side cover. Use 3mm screws and nuts to mount the side cover.

11. Attach the whole assembly to a picatinny rail. Line up the screw holes with the rail notches.

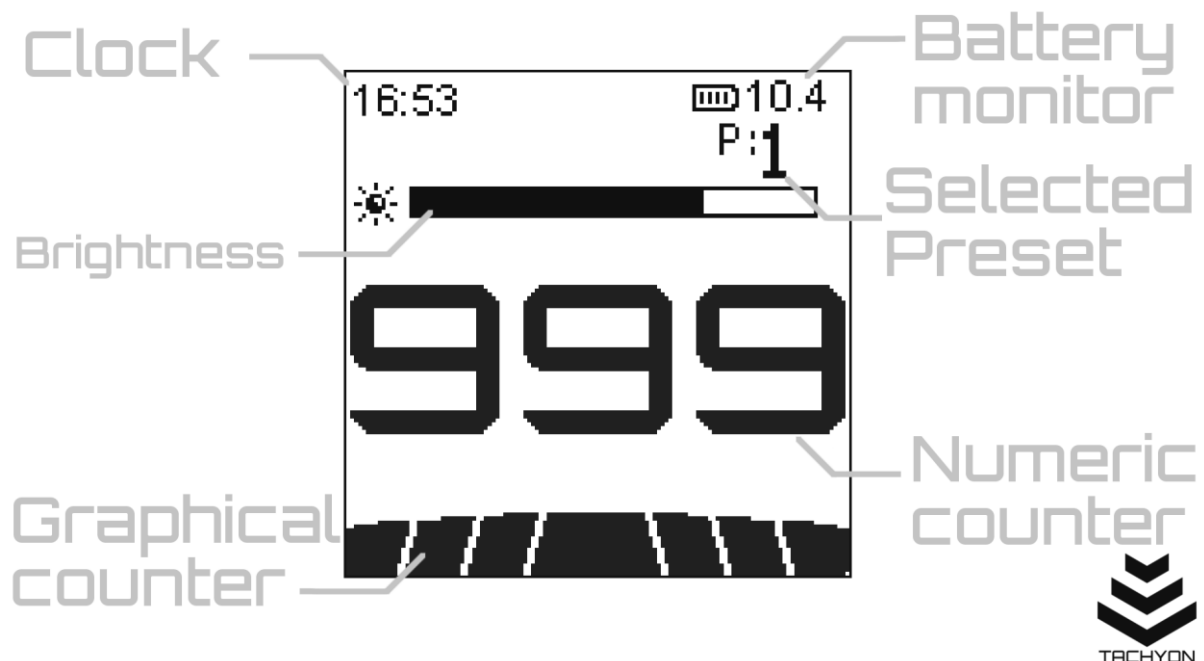12. Attach the rail clamp using 3mm screws and nuts.

13. Affix the manual reload button using any common glue or double-sided tape to a preferred location on the weapon (hot glue is recommended)

Misc. interfaces

ADDON

+ SCL SDA – +

Manual Auto
Reload Rld.

Power in ↗

Sensor port

LED OUT + –

Supply bypass

Reset

Power Switch

USB

ISP Header

RIGHT

BOARD
TOP SIDE

Using Tachyon

Interface and navigation

Upon powering up, you will see the main screen.

In the main screen, press the LEFT or RIGHT buttons to adjust screen brightness. By default, any changes in brightness will not be saved persistently. You can save brightness manually through the settings screen.

Press and release the CENTER button to enter into preset changing mode. After two arrows are displayed around the current preset indicator, press LEFT or RIGHT buttons to cycle through active presets. After a brief time of not pressing any buttons, the system will exit preset change mode and update the ammo counter according to the new selected preset.

Press and hold the CENTER button to open settings. Use LEFT and RIGHT buttons to navigate through listed options and CENTER to select.

While adjusting the color scheme or time settings, hold LEFT or RIGHT buttons to increment/decrement the edited value. User CENTER button to confirm the value.

Ammo counter

Through the settings, you have the option of saving up to 6 presets for 6 different ammo counts (magazines) you use. Setting any preset to 0 will make it disabled (**OFF**). Disabled presets will be skipped during preset selection. Setting any preset to -1 will set is as '**Count up**'. Count up presets will not display the ammo bar or color change, and upon firing, will count up until reaching 999**. To cycle between available presets**, press and *release* the CENTER button while on the main screen (thus entering the preset selection indicated by 2 arrows on sides of the preset indicator), following by pressing LEFT or RIGHT. After the correct preset is selected, *wait* until the device leaves the preset selection, after which the new preset will be applied.

Upon firing, the ammo count will decrease (or increase depending on setting). When the ammo count reaches 2/3 and 1/3 of the selected preset's full count, the color of the counter UI elements will change based on your settings (default: green -> orange -> red).

After the counter reaches 0, any additional shots will still be counted and displayed in negative. This accounts for imperfections in magazines or loading.

At any given time, you can press the manual reload button to reset the ammo count back to full.

Battery monitor

The battery monitor output is displayed on the main screen at all times. To get an accurate reading, make sure that the correct battery type is selected in the settings. Additionally, you can select "Raw output" to directly read the actual battery voltage instead of charge.

Note 1: Battery voltage will decrease as the battery is discharged, the manufacturer specified battery voltage is usually equal to voltage at half charge.

Note 2: While firing, the measured battery voltage (charge) will drop significantly. This is completely normal since the heavy current draw into the motor causes a significant voltage drop in the system.

Real-time clock

The device features a hardware Real-time clock (RTC), with output displayed on the main screen. Time on the clock can be set through the device settings. To experience full precision of the clock, calibration of the clock might be required (See USB Utilities section on page 6). Otherwise, a drift of up to 10 s per day might be observed. With calibration, is drops to 0.09 s per day (32 s/year).

While in shutdown, the clock is powered by a **CR1220** coin-cell battery with an estimated lifetime of 3-5 years. If you experience problems with persistence of timekeeping, it is possible that the backup cell needs replacement.

Using the Tachyon USB Utilities

Download

The official Tachyon Utilities software is available for download on http://tachyon-esystems.com/

Before using the USB-related functions of your device, make sure that you have the latest version of the USB Tool software, to ensure compatibility and full functionality of any new features.

Connecting

Connect your device to a computer through a standard Micro-USB cable and turn the board on.

The USB Port DOES NOT supply power! An external power source must be used in the same way as during standard operation (such as an airsoft battery).

Upon successful connection, your computer should detect a new device in form of a virtual COM (Serial) port and the device should become available in the USB Tool as COM*x*.

Common connection issues

If no reaction is observed after connecting to the computer:

- Make sure that the board is powered on and the display lights up
- Make sure that proper drivers are installed. (Drivers are included in the USB Tool package or available on http://www.ftdichip.com/Drivers/VCP.htm)
- If the options above did not solve the problem, inspect the USB port and surrounding circuitry for signs of damage.

- If a connection can be established, but is unreliable or behaving erratically, make sure that the power source has sufficient voltage - if using a battery make sure it is charged.

If the Tachyon Utilities software freezes after connection:

- terminate the process using task manager, and re-attempt connection with safe mode enabled.

Installing firmware

Note that installing the firmware incorrectly will NOT damage the board or make it unusable. Failures during firmware update will simply stop the upload and return the board into normal operation in the vast majority of cases.

1. Select the firmware to be installed inside the USB Tool's flash utility.
2. Make sure the board is connected and powered on
3. Alternative A: Disconnect the reload button and reconnect it across the reset pins.

    Alternative B: Bridge the reset pins using the included jumper. The board should freeze and the display might turn off.

    Make sure that you are bridging the correct two pins, as shown on the picture.

4. Be prepared to press the button or remove the jumper and start the upload
5. After the upload starts, you must either press and release the button or remove the jumper, disconnecting the reset pins. You have roughly a second to do this. Removing the jumper too soon or too late will result in the board returning to normal operation and will not modify the firmware in any way.
6. The board will now update and subsequently verify the firmware. After the upload finishes, the board will reboot and return to normal operation with the new firmware.
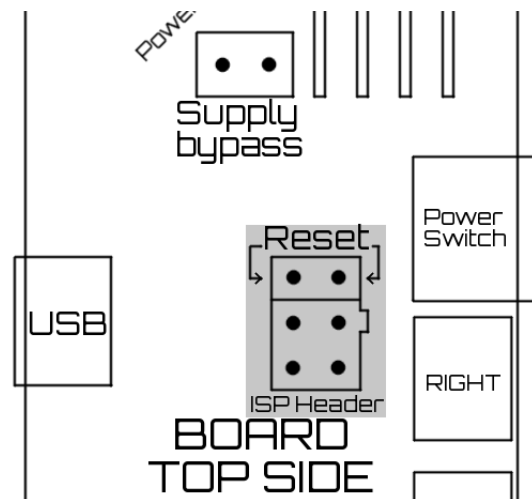
Time calibration

1. Open the Time calibration utility through the Tachyon utilities software.
       Note: if performing manual calibration, skip to step 5
2. Perform measurement 1. The current device and system time will be saved on your computer.
3. Wait for a considerable amount of time (at least 12 hours or more). The board can be disconnected, powered down, or used normally. The longer the time difference between measurements will be, the more accurate will the time calibration become.
4. After waiting, reconnect the board to your computer, and perform measurement 2. The device and system time will again be logged, and the time error will now be determined. The recommended calibration setting will also be calculated and set.
5. Click "Write calibration" to apply the calibration setting to your device.

The device's real time clock allows for calibration of ±127 ppm. The clock's timing function is $T_{output} = 32768 +/- (2 * CALREG)$ where CALREG is the saved calibration setting

(Refer to MCP79400 datasheet for more information)

Board reference

Board reset

is achieved by bridging the reset pin and ground pin (marked on the schematic as "RESET"). These pins are a part of a 6-pin ISP (In System Programming) Header.

Power supply

Supply power to the board by connecting a power source to the "Power In" pins. **The board is reverse-polarity protected and connecting the power source in incorrect polarity will not damage the board.**

The power is regulated by an integrated 5 V voltage regulator (NCP1117) with an input range of 6.2 to 12 volts

Supply bypass

If a power source with voltage matching the circuitry voltage (4.8 to 5.5 volts) is used, the voltage regulator will not function properly. Bridging the "Supply bypass" pins will bypass the regulator and tie the power source to the on-board power distribution directly. Be aware that in this configuration, the board is not overvoltage protected and connecting a source with voltage above 5.5 volts will result in permanent damage.

Manual reload and Auto reload

Use these pins to connect the manual and/or automatic reload switches. Polarity of these pins is universal and will work with any connector orientation.

Sensor port

Use this port to connect the infrared sensor. Pin 1 of the sensor port is used to power the IR LED through a current limiting power resistor. Pin 2 is used as the sensor output. Pins 3 & 4 are used for 5 V power supply of the IR phototransistor.
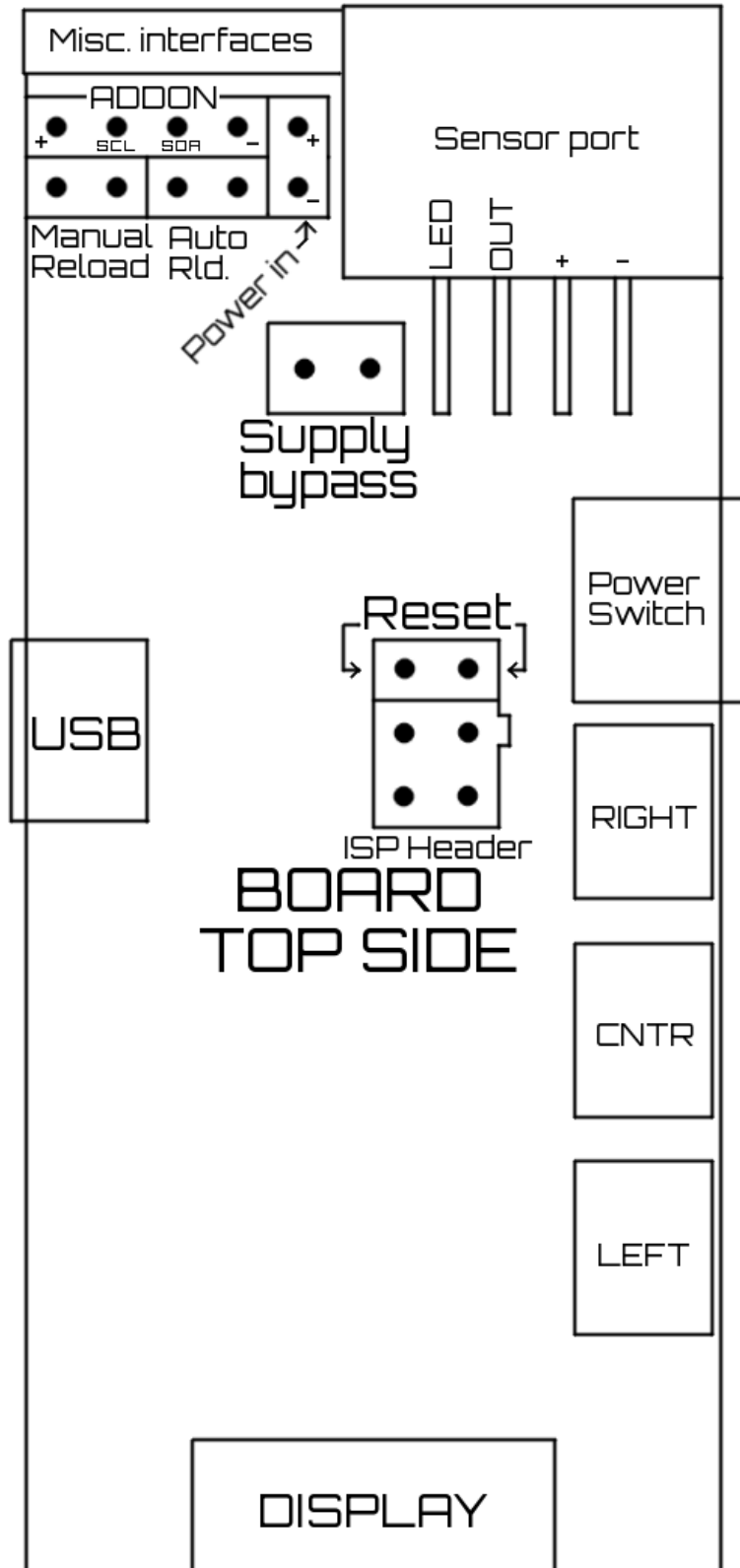
Addon interface

is used to connect any addon boards. Pins 1 & 4 are used as 5 V power supply while pins 2 & 3 are used as Serial Clock (SCK) and Serial Data (SDA) of the board's Two-Wire (I^{2}C) interface. With the proper firmware modification, it is possible to interface the board with other electronics through this interface.

Up to 127 devices can be connected on the Addon interface in a parallel configuration at the same time.

ISP Header

Can be used to program the board's microcontroller directly through its SPI Interface. Should the board's USB interface get damaged or the microcontroller's bootloader be corrupted, this interface can still be used to program the board.

Board layout schematic