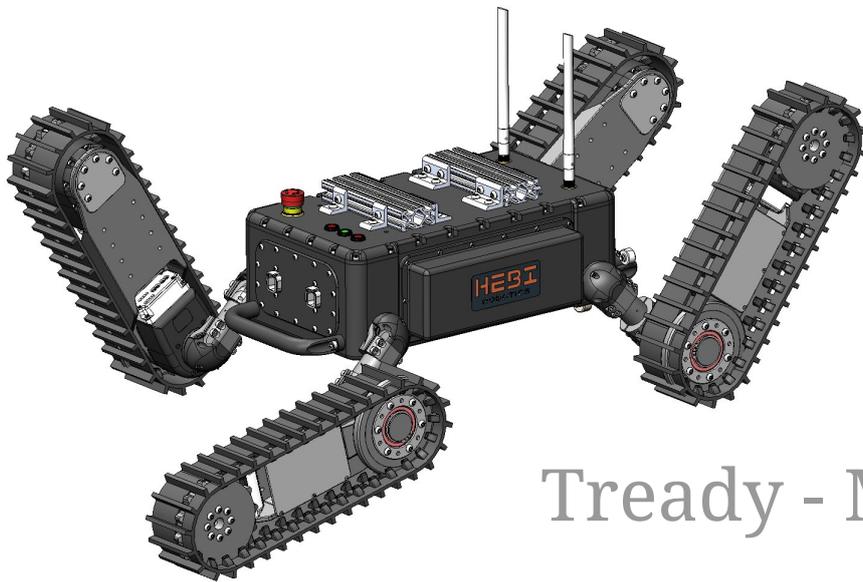


# HEBI

## ROBOTICS



## Tready - Manual

HEBI Robotics

Version 2.1, 7 Mar, 2025

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# Revisions

Rev.	Date	Author	Description
0.1	21 Nov, 2022	A Willig	Initial manual draft.
1.0	25 Feb, 2023	A Willig	Updated Drawings and Manual with newest Tready Design. Dual panel bulkheads front and back, updated bulkhead connectors. Official Release.
2.0	19 Aug, 2024	A Willig	Updated with newest Tready Design incorporating HEBI Wattman Batteries, long-range WiFi, and updated bulkheads.
2.1	7 Mar, 2025	A Willig	Updated startup and shutdown procedures. Added more notes and images about controls interface (with Voltage feedback).

# 1. Overview

This manual documents the setup and operation of the HEBI Tready Mobile Base Kit.

## 1.1. Videos

- Kit Release Video: <https://www.youtube.com/watch?v=RyusD0KFCp8>
- Inspection Robots Video: <https://www.youtube.com/watch?v=tEoKngE73xk>

## 1.2. Technical Specifications

*Specifications subject to change without notice.*

### Onboard Computer

**Computer Model:** Intel NUC Pro 13

**OS:** Ubuntu 22.04 Desktop

**Username:** hebi

**Password:** hebi1234

**IP Address (on robot network):** 10.10.1.2

### Onboard Router

**Router Model:** Mikrotik hEX RB750Gr3 Gigabit Router

**Configuration:** Ethernet ports bridged, DHCP server on bridge.

**IP Address:** 10.10.1.1

**Router Login:** admin

**Router Password:** hebi1234

[https://mikrotik.com/product/hap\\_ac3](https://mikrotik.com/product/hap_ac3)

**WiFi Access Point:** TP-Link EAP225 Outdoor

**Wifi Bands:** 2.4Ghz & 5Ghz (802.11a/b/g/n/ac)

**2.4Ghz Wifi Network Name:** Tready-<customer-name>

**5Ghz Wifi Network Name:** Tready-<customer-name>-5

**Wifi Password:** hebi1234

### Batteries:

<https://docs.hebi.us/hardware.html#battery>

4X HEBI Wattman Lithium Ion Battery

**Capacity:** 93.6 Watt Hours each (36V, 2.6Ah)

**Discharge Profile:** 7.8A continuous, 13A max each (27.5V Cutoff)

**Operating Time:** 2-3 Hours continuous operation

**Dimensions:** 206 x 80 x 25 mm

**Weight:** 650 g (1.43b) per battery

The system uses 4 HEBI Wattmann batteries (2 on each side) to provide approximately 400 Wh of energy and a minimum of 2 hours of continuous robot operation on a full charge.



Please refer to [Chapter 3](#) for instructions on working with the batteries in Tready.

## 1.3. Main Components and Features

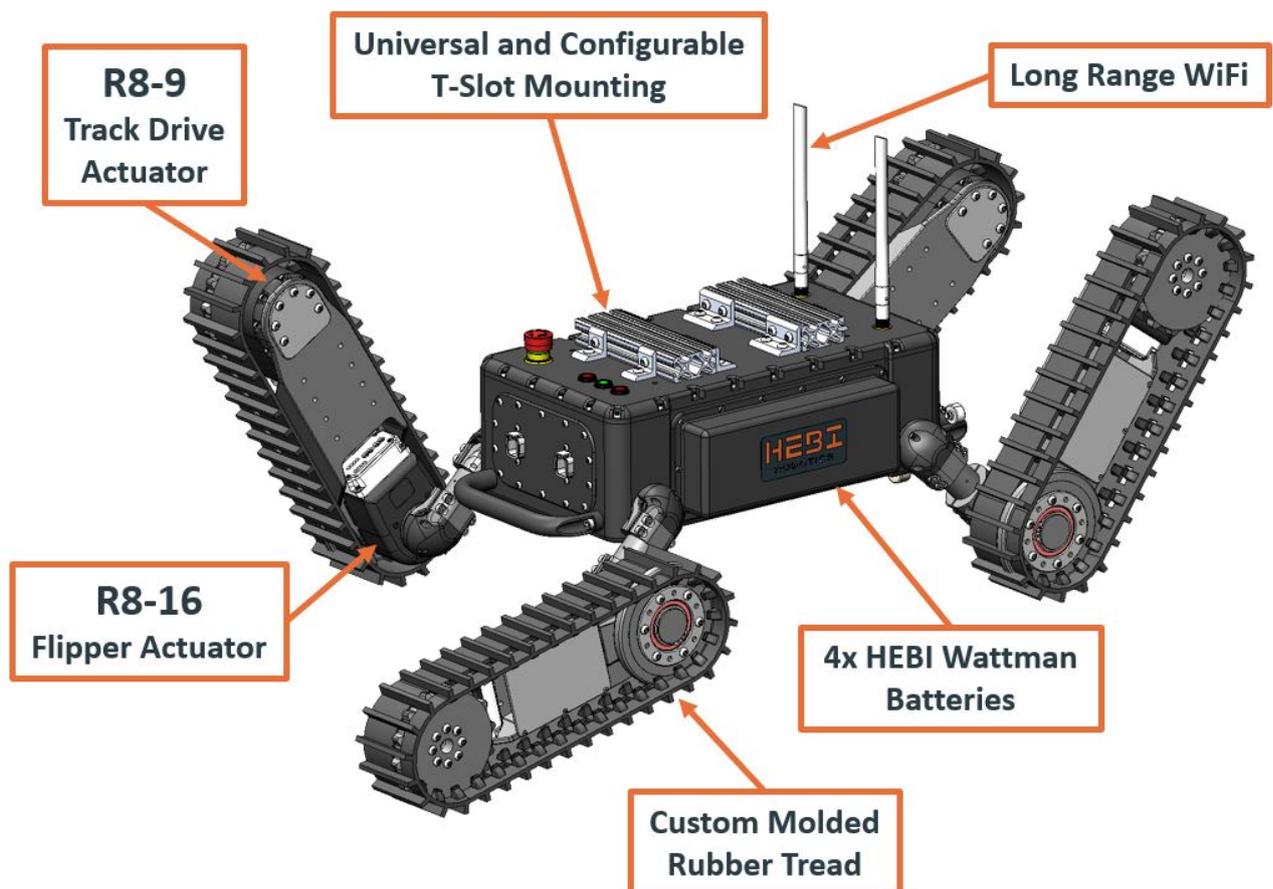
The Tready Mobile Robot Kit comes standard with an IP67 field deployable chassis that includes:

- ergonomic handles to assist with handling the robot
- sealed bulkheads for all connections required for connecting power and communications to additional components or external computers
- universal and configurable T-Slot mounting to the top of the robot using an optical bench style mechanical interface
- 4 mounted HEBI Wattman Lithium Ion batteries

In addition to the field chassis, Tready comes with 4 modular track units that includes:

- an R8-16 Actuator to control the independant flipper motion
- an R8-9 Actuator to control the driving of the track (swappable to R8-3 for higher speed, but reducing overall payload capability)
- a custom designed molded track.

### a. Tready Robot Main Features



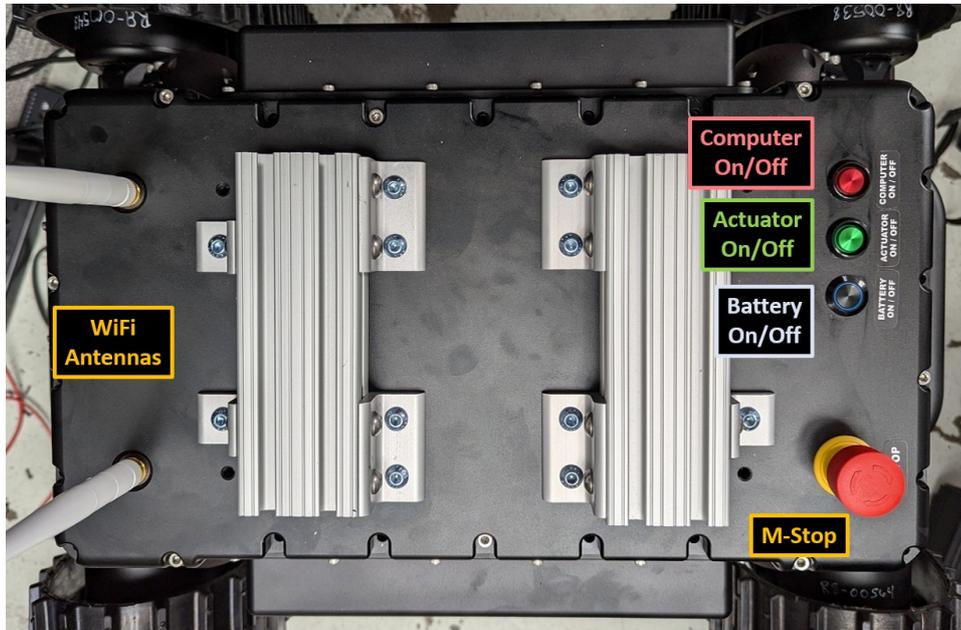
b. Robot example addition - 6-DoF R-Series Arm with Gripper



## 1.4. Buttons and Bulkheads

The following figures depict the various buttons and bulkheads on the main robot chassis and their function. Additionally, Tready's front and rear bulkhead panels can be customized different from the standard configurations shown in this manual to better fit the specific application the platform will be used for. Please contact [engineering@hebirobotics.com](mailto:engineering@hebirobotics.com) for more information on customizing these bulkheads.

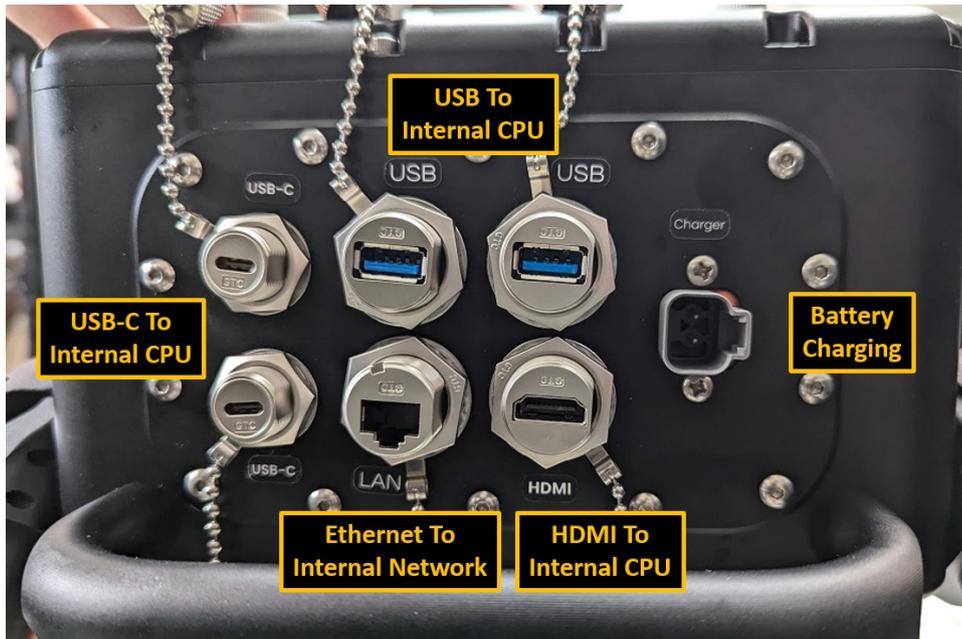
- a. Top view of robot chassis and associated buttons and bulkhead components.



- b. Front view of robot chassis and associated bulkhead components.  
 (1: V+ | 6: GND | 2: MS+ | 5: MS- | 3-4: Plastic Optical Fiber Data)



c. Rear view of robot chassis and associated bulkhead components.

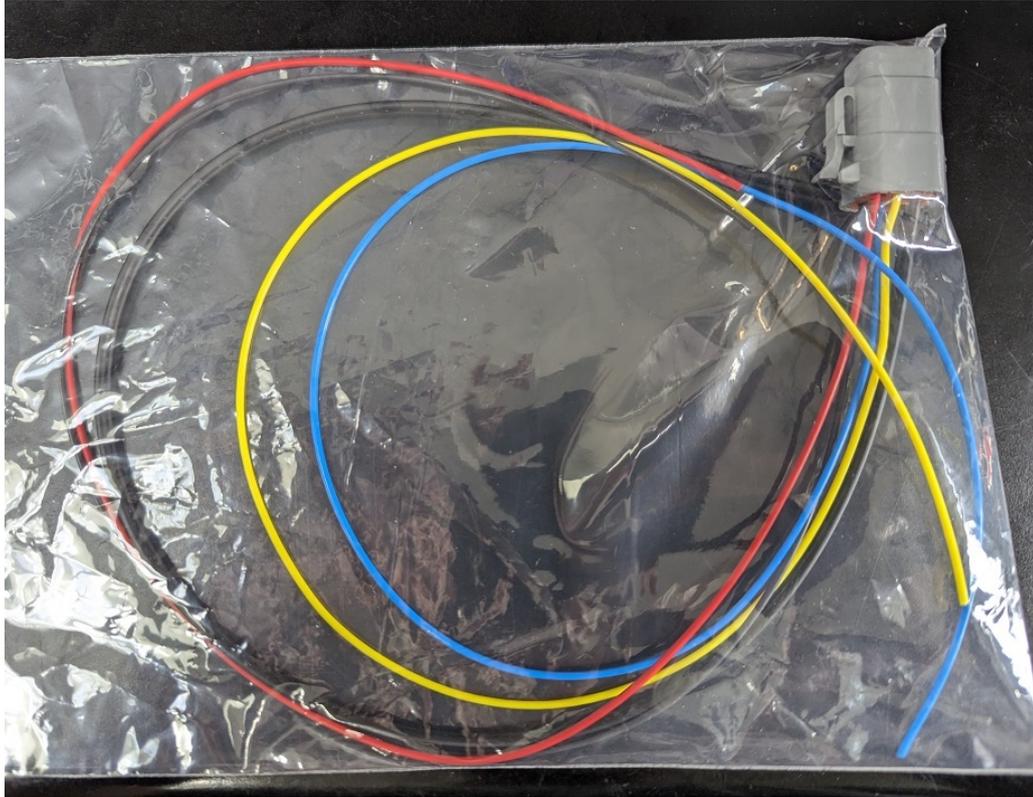


## 1.5. Accessories

a. Accessory Power, M-Stop, and Data Connection

(Red: V+ | Black: GND | Yellow: MS+ | Blue: MS- | Plastic Optical Fiber Data)

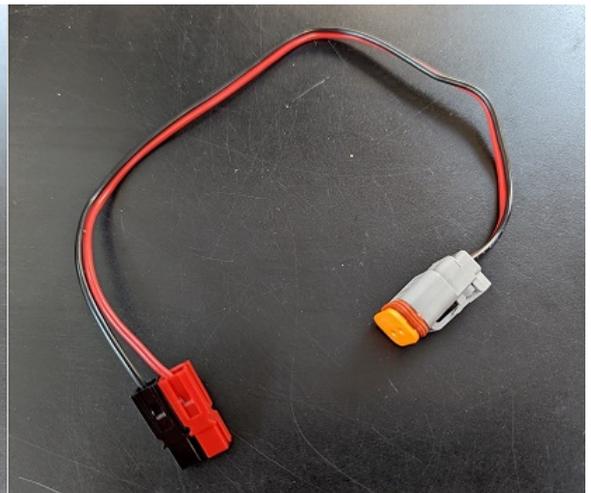
[ATM06-6S Connector Kit](#)



b. Battery charging bulkhead adapter & Charger

[DT06-2S Connector Kit](#)

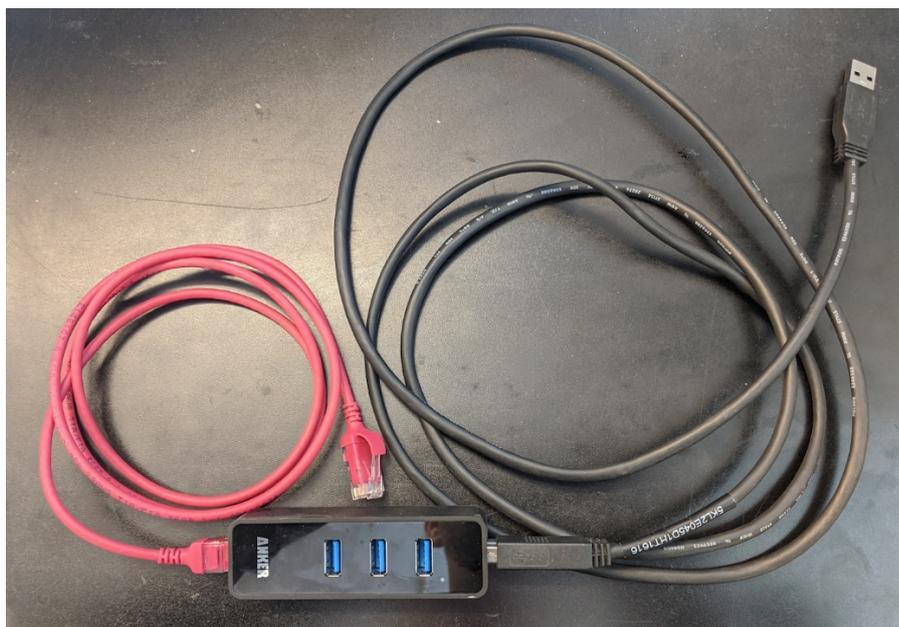
[Powerpole Connector Kit](#)



c. Track tensioning tool



d. Ethernet-to-USB Adapter and USB Hub for Network-to-Computer communications  
[3-Port USB Hub with Gigabit Ethernet Converter \(Amazon\)](#)





## 2. User Control

### 2.1. Startup

1. Before powering Tready up, make sure to remove the straps holding the side flipper tracks together as shown in the image below.

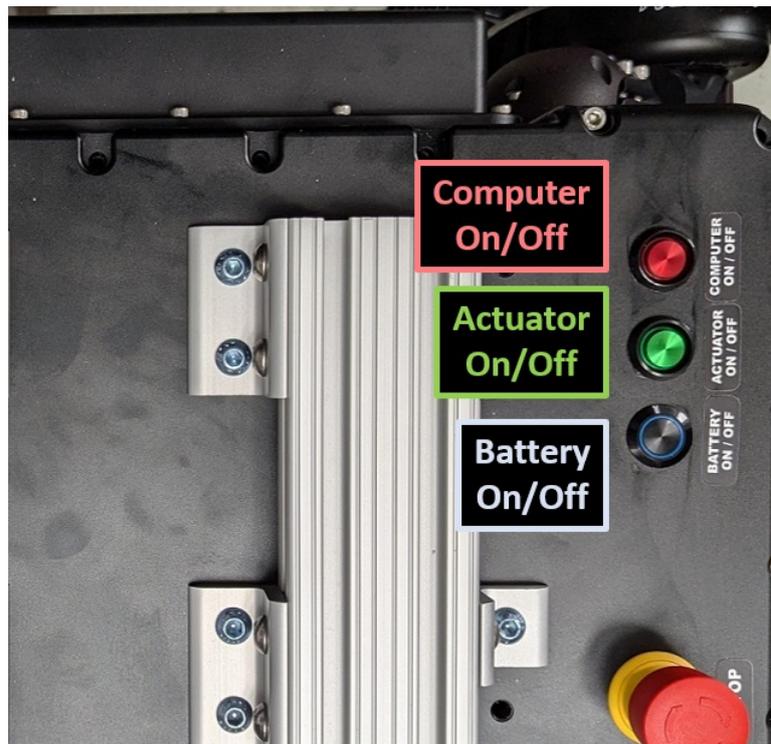
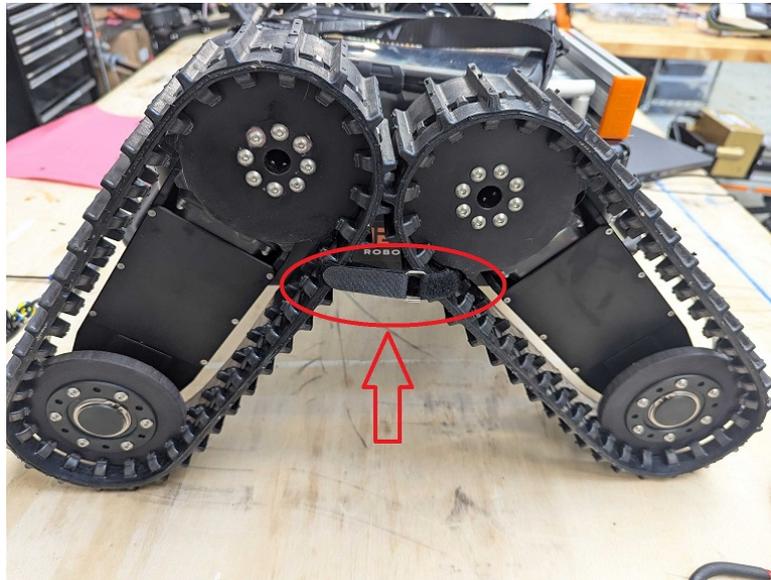
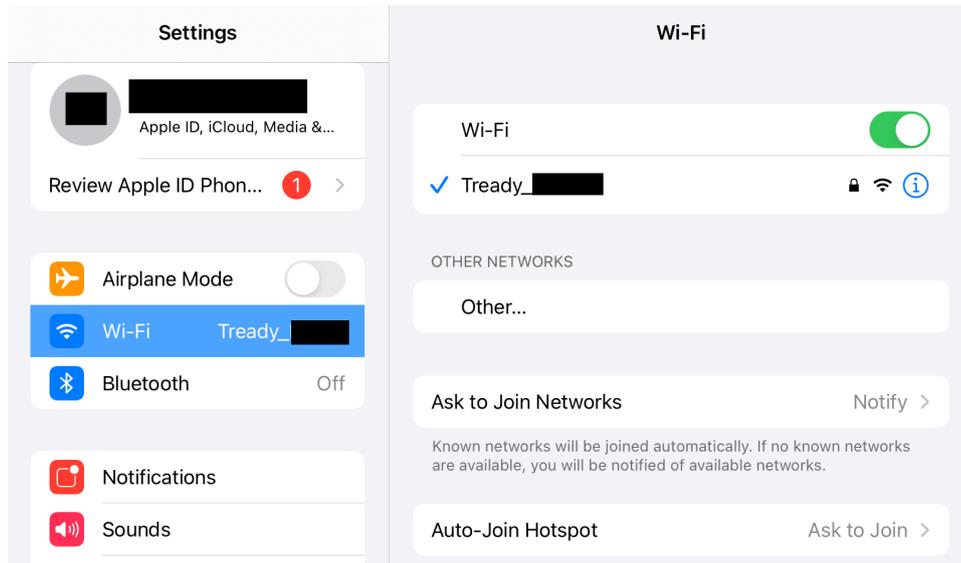


Figure 1. Tready Main Bulkhead Buttons Reference in steps below

2. Press and hold the "Battery On/Off" Button (Blue) until you hear a faint beep from the batteries and the button's LED lights up. This turns battery power on which power on the robot's networking system.
3. Wait until you hear a **single** "beep" come from inside the chassis. This means the router is turning on.

4. Wait for about 30 seconds to 1 minute for a **double** "beep" coming from inside the chassis. This means the DHCP server on the router has initialized.
5. On your mobile control device check for Tready's WiFi to appear and connect to it (**Password: hebi1234**)



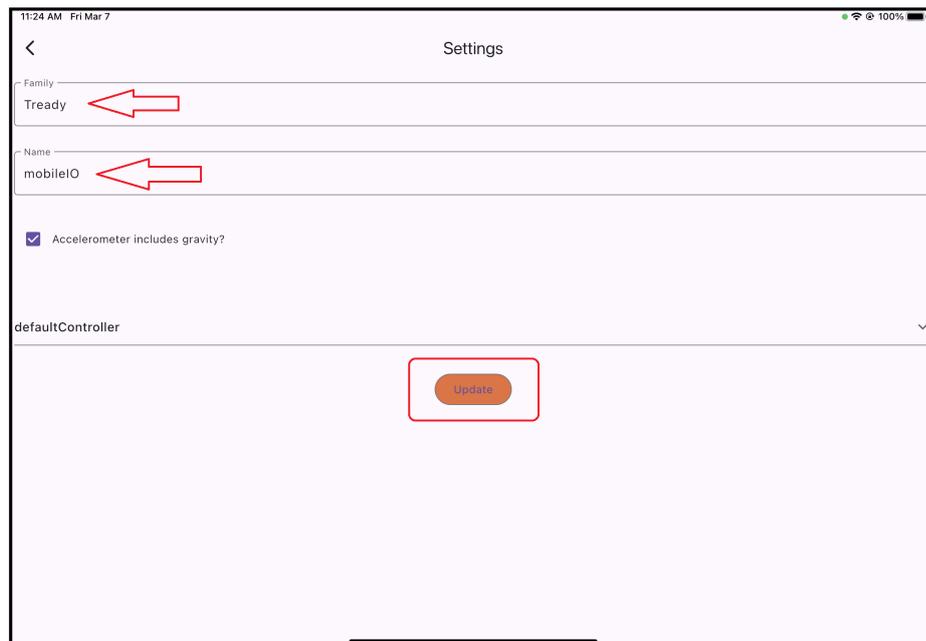
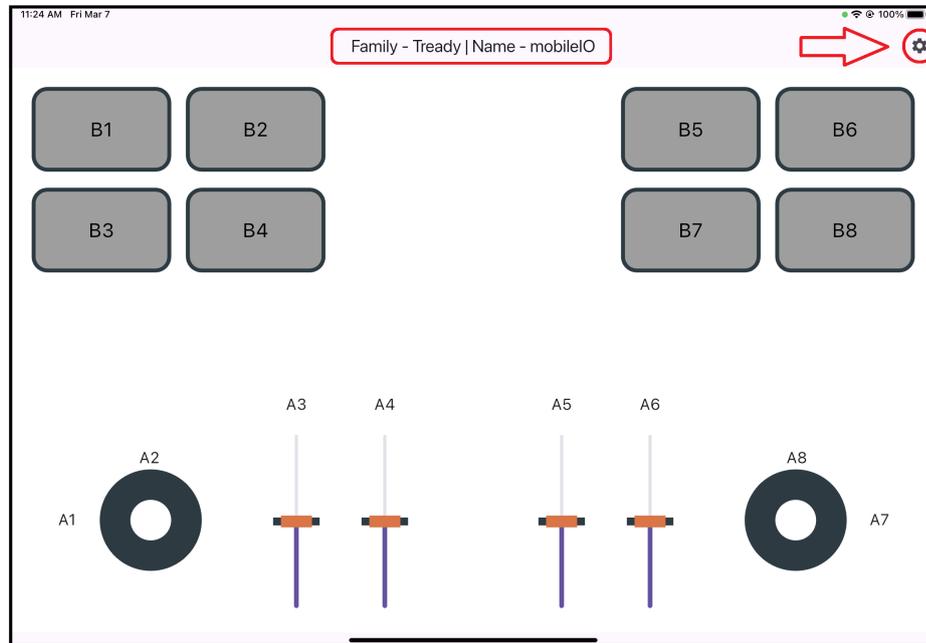
6. Once connected to the WiFi with your mobile device, press and hold the "Actuator On/Off" Button (Green) until the button's LED lights up. This sends power to the R-Series Actuators on Tready's tracks as well as the front bulkhead panel for any other accessory components.
7. Wait for the actuators to go from a LED status of green/orange blink to slow green fade. This means that they have acquired an IP Address from the robot's network.



8. During this time listen for a **triple** "beep" coming from inside the chassis. This means that the connection between the router and access point have been properly established and the computer is ready to be turned on.
9. Before turning the computer on, open the Mobile I/O (  ) Application on your mobile device.
10. Look at the top of the screen to make sure that the correct Family and Name are set. (case-

sensitive)

- a. Family should be "Tready"
- b. Name should be "mobileIO"
- c. If these need to be changed, use the gear icon in the top right of the app and change them in the "Settings" page. Make sure to click "Update" before going back to the control screen.

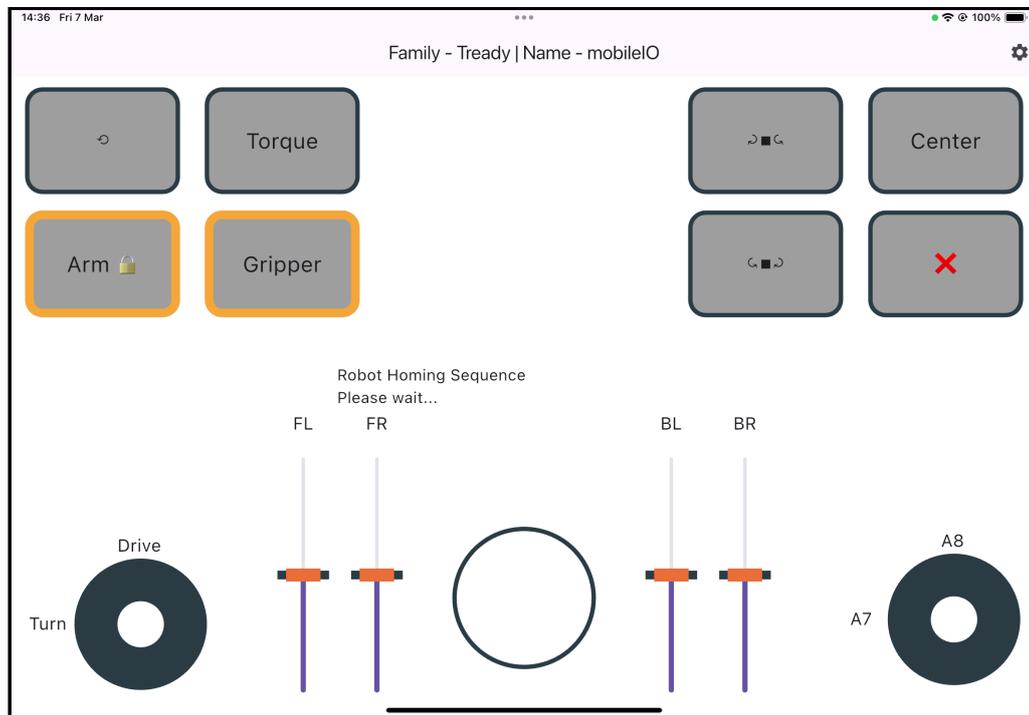


11. You are now ready to turn on the computer and startup Tready! Press and hold the "Computer On/Off" Button (Red) until the button's LED lights up. This powers on the system's internal CPU. Tready's control code will autostart as long as you have the mobile device connected to the robot's WiFi and the HEBI Mobile I/O App open.

## 2.2. Control Interface (HEBI Mobile IO App)

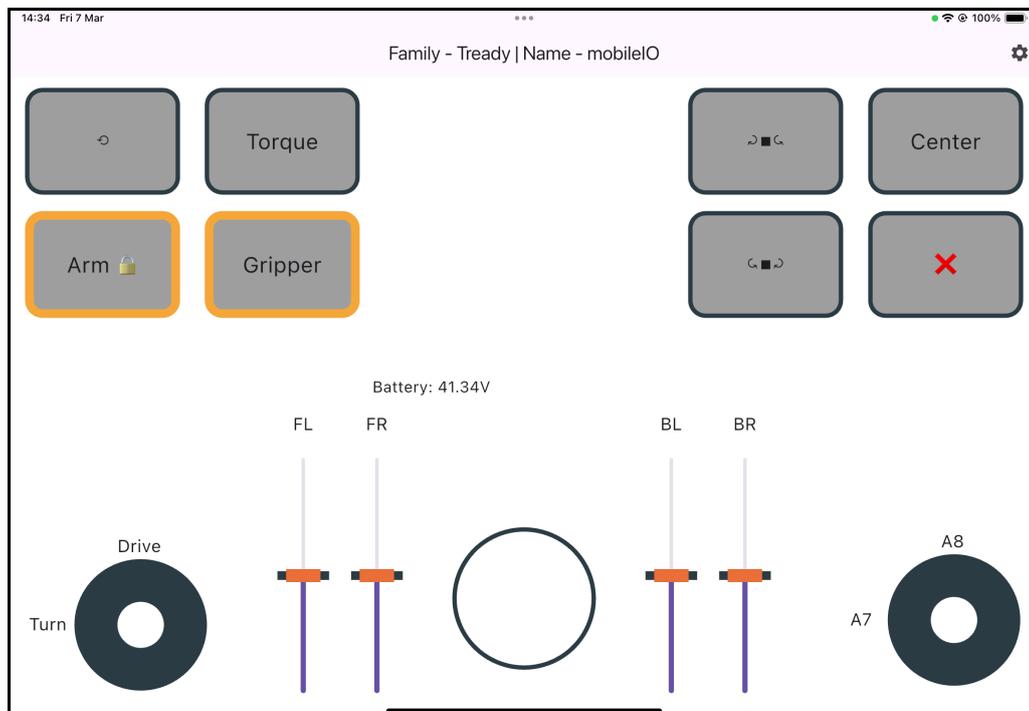
### 1. Startup Control Screen

This screen and text is shown when Tready first connects to the mobile device and Tready is moving to it's home position.



### 2. Main Control Screen (w/ Battery Voltage)

During normal control operation of Tready the Battery Voltage will be displayed in the middle of the screen. A good operating voltage for the system is between **32V-42V**.

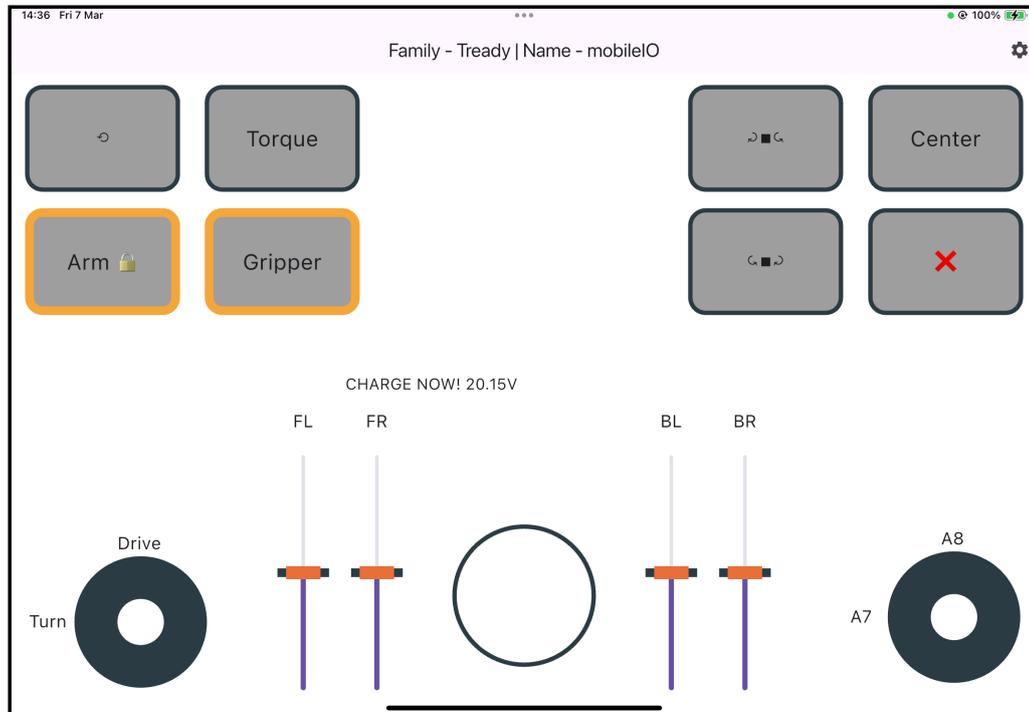


### 3. Main Control Screen (w/ Charge Required or Robot Disconnected)

If the battery voltage ever dips below roughly **32V** or if the Robot shuts down while the iPad is connected, the control screen will print a message of **CHARGE NOW!** and a reading of a low voltage.

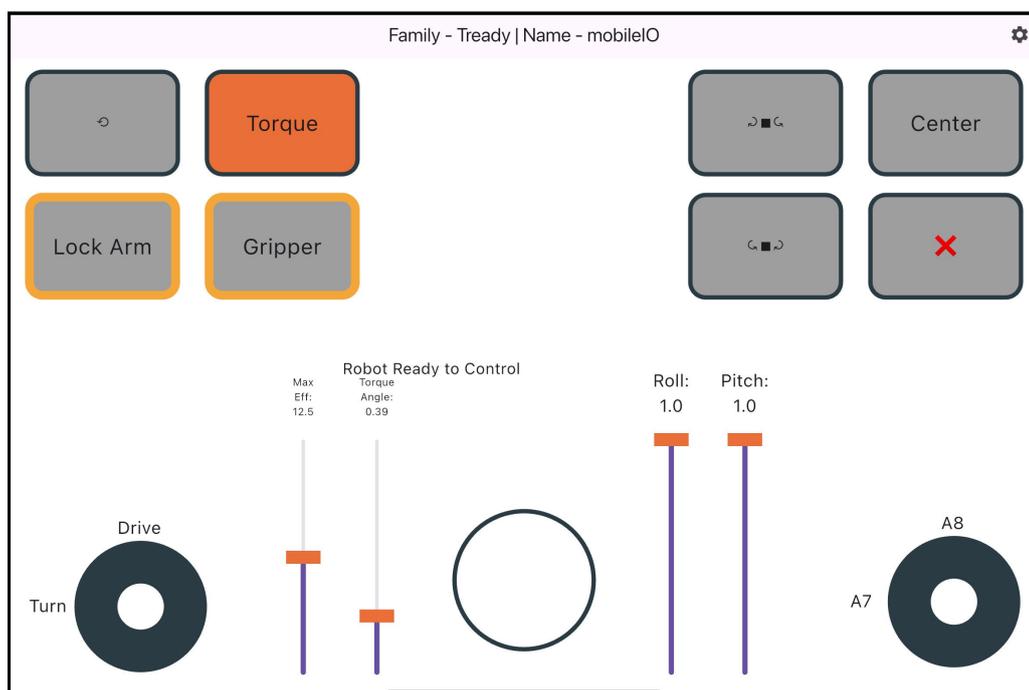


If the robot was shutdown then a very low voltage (like the ~20V shown in the image) will be shown since it was the last feedback package sent to the mobile device.



### 4. Flipper Torque Control Mode Screen.

In this mode Tready's tracks use torque control to interact with the ground in order for better base stabilization. The **Roll** and **Pitch** sliders can be used to adjust how level the chassis of the system is kept relative to gravity.



## 2.3. Shutdown

The safest way shutdown Tready is to reverse the Startup procedure by following the steps below.



It is possible to just press the Blue "Battery ON/OFF" button and power off the entire system at once. Though effective, this method is not advised.



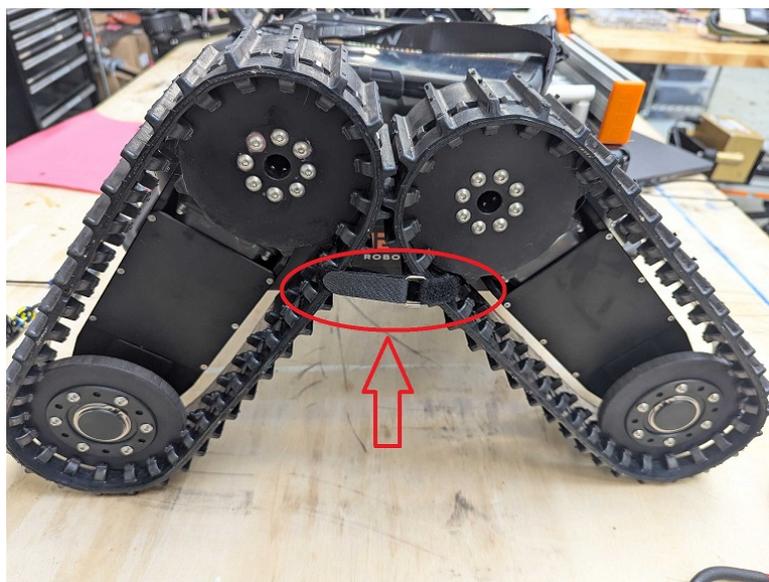
If you turn off the system all at once with a battery charger still connected the robot will appear to stay powered on because it will try to pull power from the charger. Make sure to unplug the charger before powering down in this fashion.

1. To begin a safe shutdown, first return Tready to it's home position by pressing the "↻" button.
2. Next, press the Red "Computer ON/OFF" button on the chassis to initiate the computer shutdown procedure. The track flippers will begin to sag informing you that the control code has stopped and the computer is shutting down. Once the LED on the button is off, the computer is fully shutdown.
3. Press and hold the Green "Actuator ON/OFF" button on the chassis. This will turn off power to the Actuators. Once the LED goes off on the button and you either hear the actuators go limp or you see the status LEDs on the actuators turn off you can release the button.
4. At this point only the batteries are on and powering the networking electronics. This is a good point to stop if you want to charge the batteries. If you want to completely shutdown the robot, make sure to remove any connection to a battery charger.



The batteries need to be on in order to charge!

5. Finally, press and hold the Blue "Batteery ON/OFF" button until you hear a **single** "beep" from inside the chassis, signaling that the batteries have been turned off.
6. If you are going to transport Tready, flip the tracks up into a triangle and strap them together with a velcro strap to secure them during transit and prevent unnecessary movement during transit.



## 3. Batteries

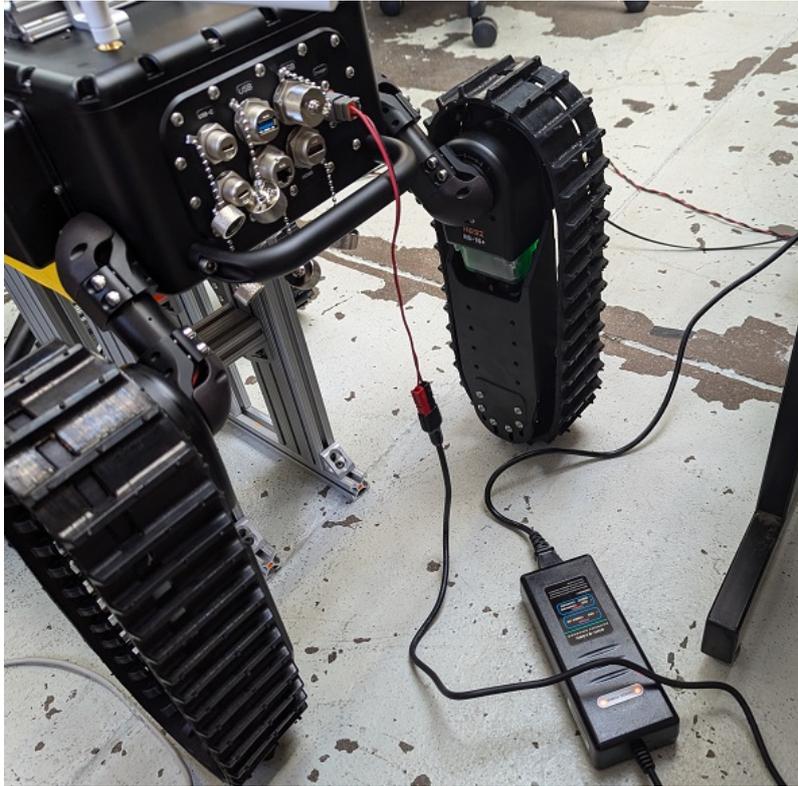
### 3.1. Charging



Chargers must be 42V and ~1-1.5A per battery.

To charge the HEBI Wattman Batteries they must be powered on.

While in Tredy's chassis Power on the batteries on Tredy using the "Battery On/Off" (Blue) Button and then plug in the Charger to the rear charger bulkhead.



To charge batteries not in Tredy's chassis use a Battery Connector Cap to turn on and connect the Wattman battery to a charger.



## 3.2. Installing / Swapping



Make sure battery power is OFF when doing an install or swap.

1. In order to install or swap out batteries in Tready unscrew the side cover from the chassis.



2. Remove the side cover and carefully take the batteries down from the side cavity in the chassis.
3. Unscrew the connector caps from the batteries and install/swap the batteries.



4. Install the batteries back into the cavity with the covers.



Be mindful of the small wires that go between the battery connectors in the Tready chassis. These are integral for controlling the batteries together with the button on the chassis lid.

# 4. Documentation

## 4.1. Datasheets and Drawings

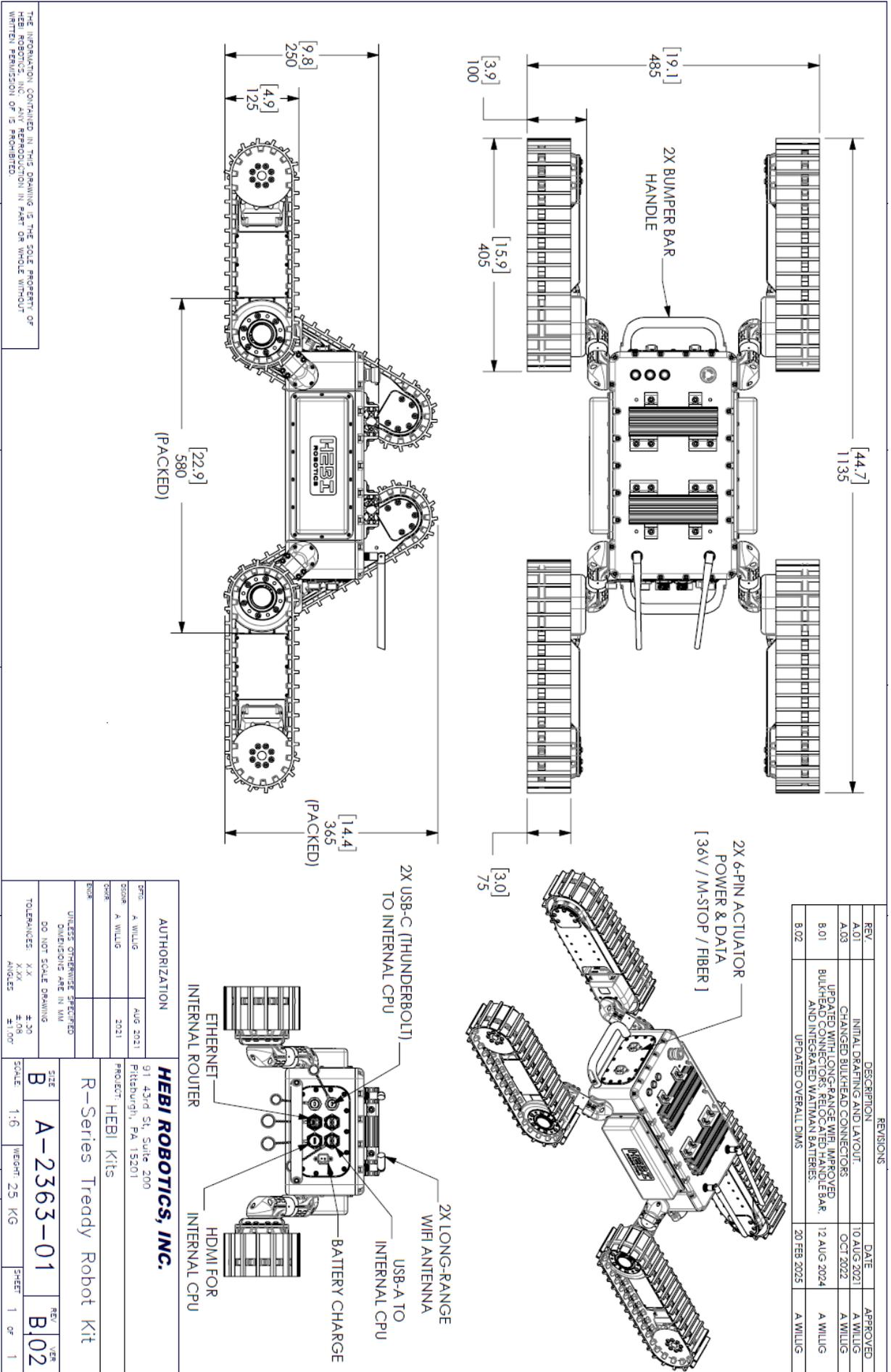
### a. R-Series Actuator Datasheet

## R-SERIES ACTUATOR – TECHNICAL SPECIFICATIONS

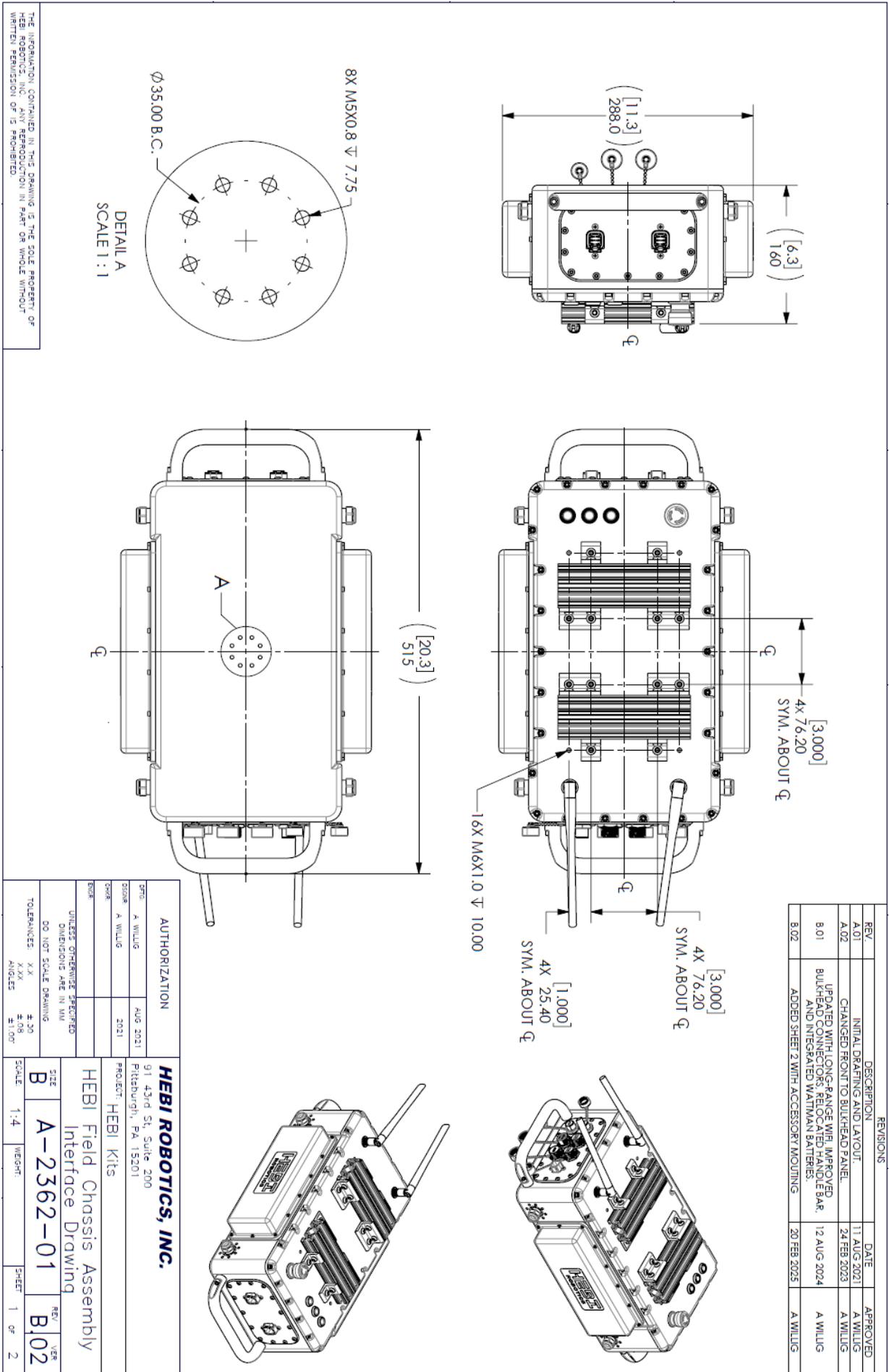
CONFIGURATION	R8-3	R8-9	R8-16
Peak Torque	7 N-m	20 N-m	38 N-m
Cont. Torque	3 N-m	8 N-m	16 N-m
Max Speed	84 RPM	30 RPM	15 RPM
Mass	670g	685 g	715 g
Dimensions	156mm x 78mm x 51mm 15mm hollow bore		
Power	24-48V DC Cont. Current: 1.3 A @ 36V Peak Current: 3.0 A @ 36V		
Environment	-10°C to 50°C Ambient / IP67		
Communication	2X 100 Mbps Plastic Optical Fiber (Optolock®)		
Angular Resolution	0.005°		
Torque Resolution	0.01 Nm		
Backlash	+/- 0.25°		
Sensing	Angular Position (multi-turn absolute, +/- 4 turns) Angular Velocity Output Torque 3-axis Accelerometer / Gyro Temperature Voltage Current Internal Pressure		
API Support	MATLAB (Windows / Linux / OS X) ROS (Linux) Python (Windows / Linux / OS X) C/C++ (Windows / Linux / OS X) C# (Windows)		

Each order of R-Series Actuator includes a standard connection kit.  
Additional technical documentation at [docs.hebi.us](https://docs.hebi.us)  
Updated on October 1, 2021. Specifications subject to change without notice.

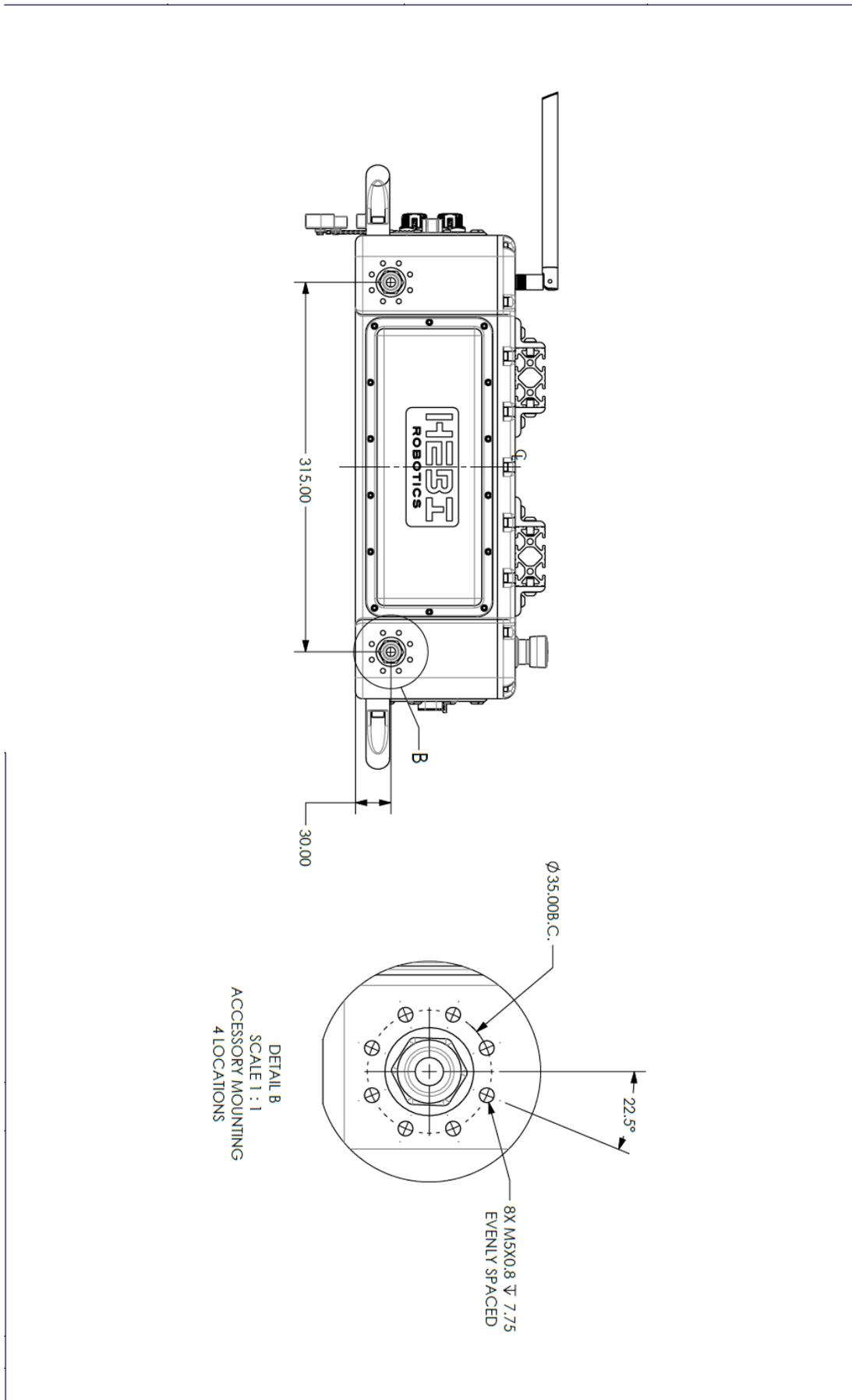
b. Tredy robot platform mechanical drawing (Sheet 1).



c. Field chassis mechanical drawing (Sheet 1).

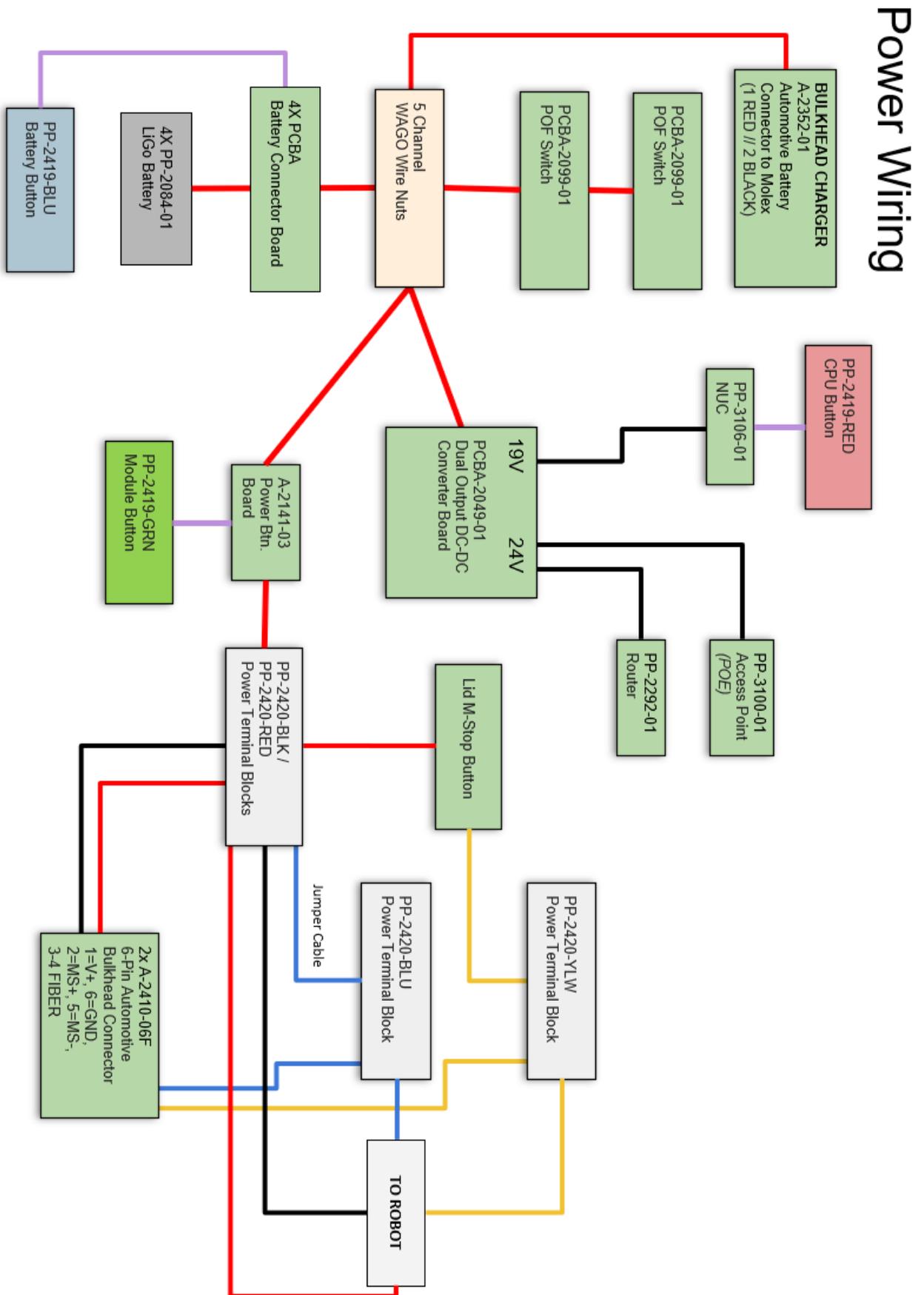


d. Field chassis mechanical drawing (Sheet 2).



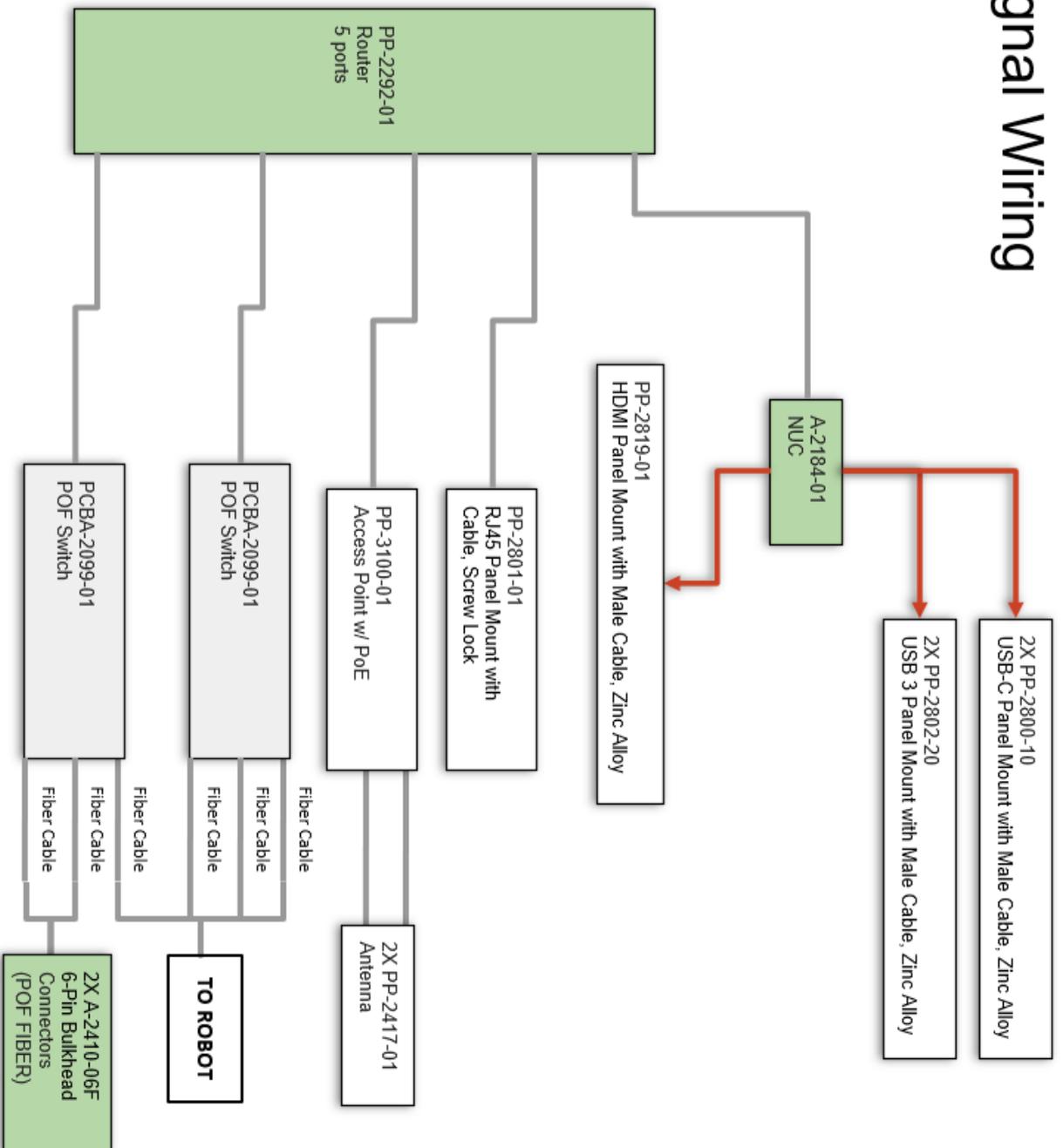
## 4.2. Wiring Diagrams

a. Power wiring schematic for Tready robot platform.



b. Signal wiring schematic for Tready robot platform.

# Signal Wiring



## 5. For More Information

### 5.1. HEBI Documentation ([docs.hebi.us](https://docs.hebi.us))

- Quick-start guides
- Core concepts background information
- Mechanical documentation
- Software walkthroughs
- Downloads

### 5.2. HEBI Community Forum ([forums.hebi.us](https://forums.hebi.us))

- Regularly monitored by HEBI Engineers
- Collaborate with fellow HEBI users
- A platform to share your successes

### 5.3. HEBI CAD Repository ([cad.hebi.us](https://cad.hebi.us))

- CAD files and drawings

### 5.4. Contact Us

HEBI Robotics  
3577 Bigelow Blvd, Floor 3  
Pittsburgh, PA 15213  
[info@hebirobotics.com](mailto:info@hebirobotics.com)